10 5/16 x 7 - grade
9 5/16 x 6 7/8

QK1
.P44
1912
AF - 9.V.7

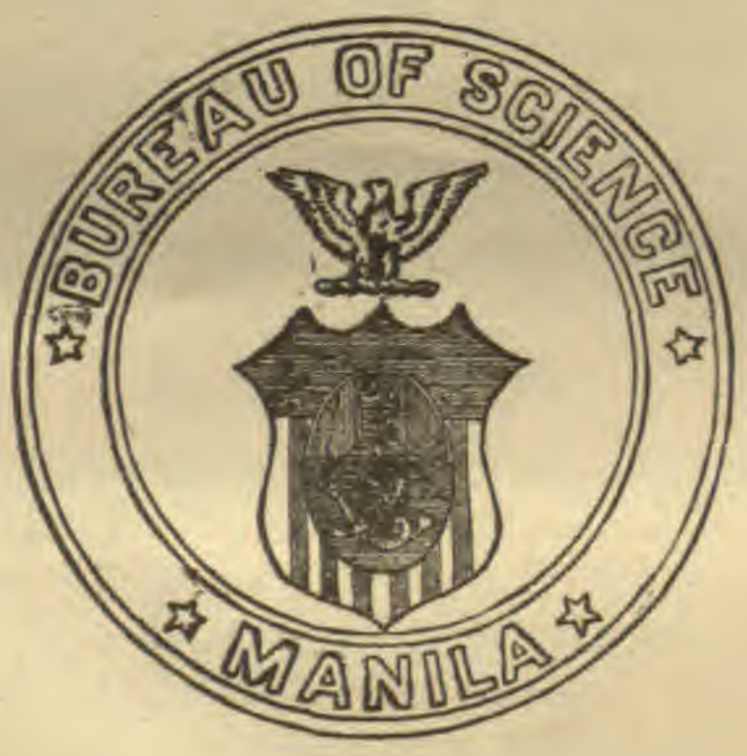
THE PHILIPPINE JOURNAL OF SCIENCE

PAUL C. FREER, M. D., PH. D.
SUCCEEDED BY
ALVIN J. COX, M. A., PH. D.
GENERAL EDITOR

SECTION C. BOTANY

E. D. MERRILL, M. S.
EDITOR
WITH THE COÖPERATION OF
P. W. GRAFF, B. S.; W. H. BROWN, PH. D.
H. N. WHITFORD, PH. D.

VOL. VII
1912
WITH 22 PLATES AND 2 TEXT FIGURES



MANILA
BUREAU OF PRINTING
1912

Phil. Bot. Bur.

DATES OF ISSUE.

No. 1, pages 1 to 46, May 14, 1912.
No. 2, pages 47 to 124, July 1, 1912.
No. 3, pages 125 to 208, September 2, 1912.
No. 4, pages 209 to 258, September 30, 1912.
No. 5, pages 259 to 362, November 15, 1912.
No. 6, pages 263 to 419, January 15, 1913.

CONTENTS.

No. 1, April (May), 1912.

Page.

Ames, O. Notes on Philippine Orchids with Descriptions of New Species, IV 1
Brandl, A. Additional Philippine Symplocaceae, II 29
Brown, W. H. The Mechanism of Curvature in the Pulvini of Mimosa pudica 37
Copeland, E. B. The Genus Thayeria 41

No. 2, June (July), 1912.

Copeland, E. B. The Origin and Relationships of Taenitis 47
Copeland, E. B. New or Interesting Philippine Ferns, VI 53
Copeland, E. B. New Sarawak Ferns 59
Copeland, E. B. New Papuan Ferns 67
Groves, H. & J. Characeae from the Philippine Islands 69
Merrill, E. D. Sertulum Bontocense: New or Interesting Plants Collected in Bontoc Subprovince, Luzon, by Father Morice Vanoverbergh 71
Wester, P. J. A Contribution to the Nomenclature of the Cultivated Anonas 109

No. 3, August (September), 1912.

Ames, O. Notes on Philippine Orchids with Descriptions of New Species, V: The Genus Bulbophyllum in the Philippine Islands.. 125
Merrill, E. D. Notes on the Flora of Manila with Special Reference to the Introduced Element 145

No. 4, September, 1912.

Brown, W. H. The Relation of Rafflesia manillana to its Host 209
Merrill, E. D. Nomenclatural and Systematic Notes on the Flora of Manila 227
Warnstorf, C. Die Sphagna der Philippinen 253

No. 5, November, 1912.

Merrill, E. D. New or Noteworthy Philippine Plants, IX 259
Review 358

No. 6, December, 1912.

Merrill, E. D. The Pineda Monument and the Probable Site of the First Botanic Garden in the Philippines 363
Merrill, E. D. On the Identity of Evodia triphylla 373
Merrill, E. D. Notes on Philippine Euphorbiaceae..... 379
Robinson, C. B. Roxburgh's Hortus Bengalensis 411
Errata 421
Index 423

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

A LIST OF THE MAMMALS OF THE PHILIPPINE ISLANDS, EXCLUSIVE OF THE CETACEA.

By NED HOLLISTER.

Order No. 418. Paper, $0.50 United States currency, postpaid.

This is the only recent attempt to enumerate the mammals of the Philippine Islands. The distribution of each species is given and the original descriptions are cited.

PRICE-LIST OF PHOTOGRAPHS.

For sale by the Bureau of Science.

Order No. 417. For free distribution.

This is a list of selected photographs from the splendidly complete collection of the Bureau of Science.

A MANUAL OF PHILIPPINE BIRDS.

By RICHARD C. MCGREGOR.

2 parts, 769 pages.

Order No. 103. Paper, $4 United States currency, postpaid.

Mr. McGregor spent some eight years in active field work, visiting many parts of the Archipelago, before beginning work on this book. Therefore, he was well prepared to undertake the preparation of the manual.

A Manual of Philippine Birds contains in compact form descriptions of all the known species of Philippine birds. The usual keys and diagnoses of orders, families, and genera help the novice in identification.

Under each species are found native, English, and scientific names, distribution by islands, descriptions of the birds and in many instances notes on nesting, migrations, and other habits.

A CHECK-LIST OF PHILIPPINE FISHES.

By DAVID STARR JORDAN and ROBERT EARLE RICHARDSON.

78 pages.

Order No. 102. Paper, $0.75 United States currency, postpaid.

This list will be found a convenient guide to the synonymy of Philippine ichthyology. The nomenclature is thoroughly revised and the distribution of each species within the Philippine Islands is given.

This check-list is uniform in size and style with McGregor and Worcester's Hand-list of Philippine Birds.

INDO-MALAYAN WOODS.

By FRED W. FOXWORTHY.

182 pages, 9 photographic plates.

Order No. 411. Paper, $0.50 United States currency, postpaid.

In Indo-Malayan Woods, Doctor Foxworthy has brought together a large amount of accurate information concerning trees yielding woods of economic value. The work is based largely upon the author's own experience in the Philippine and neighboring regions, but previous publications and information generously given by other dendrologists have been used to correlate commercial and native names of useful Indo-Malayan trees.

PHILIPPINE HATS.

By C. B. ROBINSON.

Order No. 415. Paper, $0.50 United States currency, postpaid.

This paper is a concise record of the history and present condition of hat making in the Philippine Islands. The various materials used and the different kinds of hats made in each center of production are fully described. Not of the least importance are the botanical identifications of the plants from which the hat materials are obtained.

The plates illustrate the hat materials and various kinds and grades of hats. A map of central Luzon shows the towns chiefly concerned in this industry.

THE COCONUT PALM IN THE PHILIPPINE ISLANDS.

149 pages, 30 plates.

Order No. 37. Paper, $1 United States currency, postpaid.

The reprint contains the following articles: On the Water Relations of the Coconut Palm (Cocos nucifera), by Edwin Bingham Copeland; The Coconut and its Relation to Coconut Oil, and The Keeping Qualities of Coconut Oil and the Causes of its Rancidity, by Herbert S. Walker; The Principal Insects Attacking the Coconut Palm (Parts I and II), by Charles S. Banks; with an introduction by Paul C. Freer.

A VOCABULARY OF THE IGOROT LANGUAGE AS SPOKEN BY THE BONTOK IGOROTS.

By WALTER CLAYTON CLAPP.

89 pages.

Order No. 408. Paper, $0.75 United States currency, postpaid.

The introduction to this vocabulary contains notes on pronunciation, vowels, diphthongs, consonants, verbs, conjugations, syllabication and reduplication. The vocabulary is given in Igorot-English and English-Igorot.

THE NABALOI DIALECT.

By OTTO SCHEERER.

65 pages, 29 plates.

AND

THE BATAKS OF PALAWAN.

By EDWARD Y. MILLER.

7 pages, 6 plates.

Order No. 403. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The Nabaloi Dialect and the Bataks of Palawan are bound under one cover.

THE BATÁN DIALECT AS A MEMBER OF THE PHILIPPINE GROUP OF LANGUAGES.

By OTTO SCHEERER.

AND

"F" AND "V" IN PHILIPPINE LANGUAGES.

By CARLOS EVERETT CONANT.

These two papers are issued under one cover, 141 pages.

Order No. 407. Paper, $0.80 United States currency, postpaid.

Orders for these publications may be sent to the Business Manager, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below. Please give order number.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

VOL. VII MEMORIAL NUMBER JULY, 1912

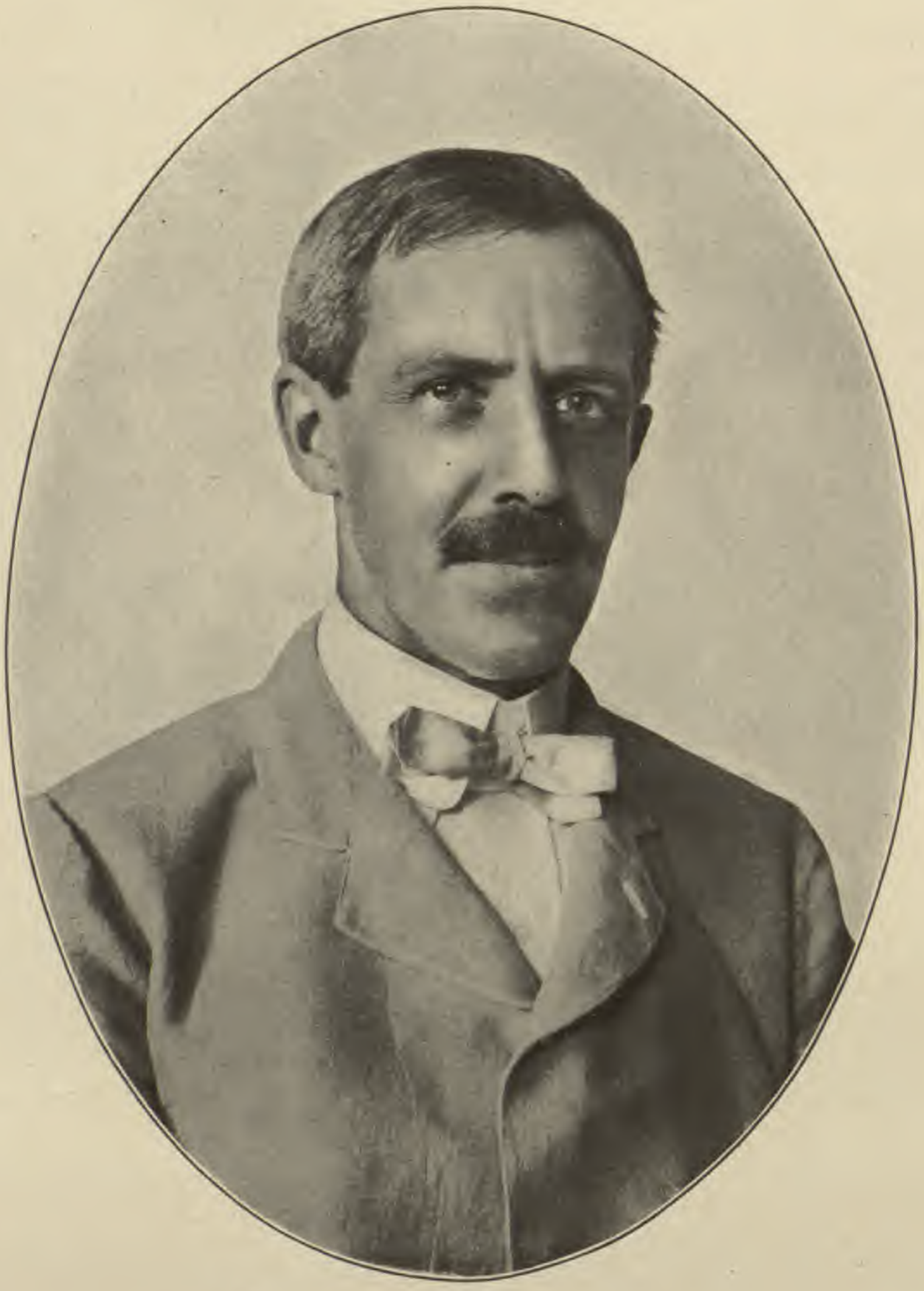
THE PHILIPPINE JOURNAL OF SCIENCE

In Memoriam

PAUL CASPAR FREER

MANILA
BUREAU OF PRINTING
1912

112897



Paul Fuller.

OBITUARY

Paul Caspar Freer

DIRECTOR OF THE BUREAU OF SCIENCE OF THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEAN OF THE COLLEGE OF MEDICINE AND SURGERY AND PROFESSOR OF
CHEMISTRY OF THE UNIVERSITY OF THE PHILIPPINES, AND
FOUNDER AND EDITOR-IN-CHIEF OF THIS JOURNAL

We are deeply grieved to announce the death of Doctor Freer at Baguio, Philippine Islands, on April the seventeenth, in his fifty-first year, from arterio-sclerosis and acute nephritis.

In an effort formally to express our sorrow and to honor his memory a memorial meeting of the members of the Staff of the Bureau of Science, the Council of the University of the Philippines, and the members of the Philippine Islands Medical Association was held on July 1, 1912. The addresses delivered at this memorial meeting are published in this number.

At a meeting of the members of the Staff of the Bureau of Science, held on the eighteenth day of April, the following resolutions were adopted:

Whereas it has pleased Almighty God in His Wise and Inscrutable Providence to remove from our midst Paul Caspar Freer, M. D., Ph. D., Director of the Bureau of Science of the Government of the Philippine Islands, since the time of its organization as the Bureau of Government Laboratories in the year 1901, Dean of the College of Medicine and Surgery, and Professor of Chemistry, University of the Philippines, and Founder and Editor-in-Chief of the "Philippine Journal of Science," who, for many years, has been our Leader, Counselor, and Friend; and

Whereas at best we can do little to indicate at this time our real appreciation of him as a man and as a worker for the general good: Therefore be it

Resolved, That we, the Members of the Staff of the Bureau of Science in Manila, Philippine Islands, do hereby express our deepest sorrow and keen feeling of personal loss in the death of Doctor Freer; and be it further

Resolved, That he holds a place of highest respect, admiration and appreciation both officially and personally in the hearts of all of us, and especially of those who were most intimately associated with him in scientific work; and be it further

Resolved, That it is the sense of the Members of this Institution that the Bureau of Science has suffered a very great loss and that the cause of Science in these Islands has been deprived of one of its most zealous and conscientious advocates; and be it further

Resolved, That we extend our sincere sympathy and condolence to his Widow in her overwhelming grief, to his Sister, Brother and other Relatives; and be it further

Resolved, That copies of these resolutions be engrossed and sent to the bereaved Widow and Brother of Doctor Freer, and that they be filed in the Archives of the Bureau of Science, transmitted to the Bureau of Civil Service, published in the forthcoming Number of each Section of the "Philippine Journal of Science," in the newspapers of Manila, in a paper in the City of Chicago, Doctor Freer's birth-place, and in "Science," the Official Organ of the American Association for the Advancement of Science, of which Doctor Freer was a Fellow.

For the Staff of the Bureau of Science:

RICHARD P. STRONG,
CHARLES S. BANKS,
E. D. MERRILL,
[L. S.] ALVIN J. COX,
OSCAR TEAGUE,
A. E. SOUTHARD,
Committee.

At Manila, Philippine Islands, this eighteenth day of April,
in the year of our Lord one thousand nine hundred and twelve.

VOL. VII MEMORIAL NUMBER JULY, 1912

THE PHILIPPINE JOURNAL OF SCIENCE

In Memoriam

PAUL CASPAR FREER



MANILA
BUREAU OF PRINTING
1912

112297

CONTENTS.

	Page.
The Life and Career of Doctor Freer ..... By MARTIN EGAN.	v
Paul Caspar Freer, his Influence upon Other Men ..... By CHARLES H. BRENT.	ix
Doctor Freer and his General Influence upon Scientific Work in the Philippine Islands ..... By RICHARD P. STRONG.	xi
Doctor Freer and the Bureau of Science ..... By DEAN C. WORCESTER.	xv
Professor Freer and the University of the Philippines ..... By WILLIAM EVERETT MUSGRAVE.	xxv
Doctor Freer as an Organizer and an Administrator..... By MURRAY BARTLETT.	xxix
Doctor Freer as a Friend of the Filipinos ..... By FERNANDO CALDERON.	xxxii
Paul C. Freer, Chemist ..... By H. D. GIBBS.	xxxv

THE LIFE AND CAREER OF DOCTOR FREER.

By MARTIN EGAN,

Editor of the Manila Times.

When Doctor Musgrave asked me to come to this memorial gathering and sketch in brief the life and career of Paul Freer, my first thought was to ask him to excuse me from a task so painful. I knew that if I did so I must bare my heart in sorrow for my friend who has gone and then I realized that we would all be here to-day with our hearts bared in sorrow, that no man need hide his heart in such a communion of friendship in grief, and so I come to take my place among those chosen to pay tribute to the memory of the good man whom we have lost from our councils, the friend passed from the narrowing circle. Paul Freer descended of a line worthy of him, its product, he worthy of his lineage. His father was a man of scientific attainments, who gave his life in that noblest aim of science, the saving of human life; his mother, a scholar, a linguist, of high culture, of rare mind, and compelling maternal love for the well-being of her children. The elder Freer, born in New York of an old family of Dutch extraction, settled in Chicago, then a scattering town of 7,000, and entered upon the practice of medicine. He quickly advanced to leadership in the growing city, and became president of Rush Medical College which he had helped to found. Overwork in a severe epidemic of typhoid fever that swept the city led to his breakdown and death, and the care and education of his children, including him whom we honor and mourn to-day, passed to the widow and mother. Mrs. Freer, his mother, was born in Württemberg and as a girl went to New Orleans to make her home with her uncle. Herself an advanced student, she devoted herself assiduously to the education of her children. It is related of the family that it was a rule to conduct table

conversation in Latin, French, or German and that good books were the first of its household gods. It was in this wholesome and stimulating atmosphere that Paul Freer received the first inspiration for study and investigation that was the compelling influence of his whole career. He was taken to Germany as a child for his rudimentary training, and he was destined to go there again to complete his education and receive from the Germanic school his chief methods and ideals in science, in education, and in general thought. Returning to Chicago, he entered the high school and when his class was graduated he stood at its head, the first student of the school. He had already determined to follow in the footsteps of his father, and from high school he entered Rush Medical College and began the study of medicine and surgery. It was at Rush that chemistry with its wonders and unsolved mysteries made its great appeal to his opening mind. He learned its rudiments at the feet of Professor Haines, well remembered as a sound scholar and instructor, and there resolved to specialize in it. He continued his medical work and graduated with the class of 1882, still a year under the age of 21. Germany was then leading the world in science and it appealed to the young student with all the forces of enthusiasm and instinct for he had the blood of the Fatherland in his veins. He determined to go to Munich and join the classes under the great von Baeyer, then the leading chemist of Europe. The choice proved a happy one for there grew a great and lasting friendship between the master and student that was deep in its influence upon the career and work of the younger man. I have recently seen a letter from Doctor Schieffelin, himself an eminent American physician, who went to Munich the year Paul Freer graduated and took his high honors, and in it he wrote:

> When I went to Munich in 1887 to study chemistry, I found that Professor von Baeyer, probably the most eminent chemist living, and the laboratory chiefs were all full of the praises of Paul Freer who had just taken the degree of doctor of philosophy, *summa cum laude*, which I believe was the first time a foreigner had achieved this distinction. And for twenty-five years I have watched with interest and pride his service to science and the government. He was an American gentleman of the highest type and of a charming personality.

Our departed friend has talked to me many times of those golden days at Munich, and I have always believed that they gave him the perfection of his ideals and logic and the soundness of his methods and thought and work. He left Munich fully equipped for work, and for a brief period labored and studied in England, first in the private laboratory of Sir William Perkin, where he devoted himself to analin dyes, and later at Owens College, Manchester, where he was an assistant instructor. But his desire was to return home, and when Tuft's College offered him a place he gladly accepted. But he was not to remain there. The faculty of the University of Michigan had heard of his ability and rising fame and offered him a larger field and scope of work. He went to Ann Arbor as lecturer in 1889 and a year later was honored with the professorship of inorganic chemistry, with a chair in the Medical School as well as in the School of Arts. It has been testified by many that Paul Freer brought to Michigan a wonderful stimulus for original work. He had the high ideals of the German university, less known and understood then in our American universities, he had the enthusiasm of youth, and he had ability as his commanding talent. He was impatient of mediocrity, and gave the best of himself to the earnest worker, the advancing student who came to him for instruction and guidance. His seriousness amounted at times to austerity, but it produced results and was in keeping with the high standard of scholarship of the members of the faculties at Michigan. In 1895 the University of Chicago sought his services, offering him a professorship of chemistry, but he declined the flattering offer, electing to stay where he was accomplishing so much good work. There he remained until 1901, when the United States Government gave him a chance for service in this field, so rich in opportunity for practical scientific work. He accepted the task, and here are written the last and greatest chapters of his life. You know them perhaps better than I. I was his personal friend and could share but little in the multiplicity of his official and professional activities, many of you were of them with him. I do know that we meet to-day in one institution and are surrounded by

others that are to a large extent monuments to his ability and service. In whole or in part they were born in his mind, shaped by his thought and plans, projected upon his knowledge, constructed with his advice, and administered by his direction and counsel. You who have shared with him in this work may well be proud for here humanity suffering is hourly served.

I have known no man better equipped for his place and part in life than Paul Freer. He was born for his profession and crowned natural equipment with the best education and training that the world can give. He was an advanced investigator. He sought the truth and he entered the house of truth with open mind, without prejudice or fear. His industry bore constant fruit. He had the rare quality of detachment. He could drop the cares and burdens of administration for the laboratory or the literature of science, in both of which he gained distinction. His talents were of wide range, his industry boundless, his service faithful. He was a true friend.

To his widow, his kinsmen, his friends there is left a rare consolation. He did a man's work, and that is the best record that any of us may hope to carry to the Master of sciences.

One copy of the Memorial Number is sent to each address on the mailing list of this Journal. This is not a regular number of Volume VII, each section of which will consist of six regular numbers as usual, but it is paged with Roman numerals so that it may be bound with any section.

112327

PAUL CASPAR FREER, HIS INFLUENCE UPON OTHER MEN.

By Charles H. Brent,
Bishop of the Philippine Islands.

There are two distinct, though not mutually exclusive, types of influence exerted by men upon their fellows: that which is let loose by conscious volition, and that which is automatically given off by inherent virility, just as perfume is exhaled by the flower. The former focuses certain powers to achieve a given end and then relaxes, like the fitful spouting of a geyser; the latter is a milder though more consistent flow, like the bubbling of a perennial spring: the former aims at, and succeeds in making, an impression; the latter naturally and simply creates an atmosphere.

Both types of influence are necessary and valuable, but of the two the most potent and constant is that unconscious pressure of the whole personality which was characteristic of Paul Caspar Freer. If, on occasions, he could effectively impress a companion in accord with definite determination, it was because he possessed the consistent background of cultured manhood.

It is chiefly men with an imperfect education who find it necessary to be vociferous and theatrical in their efforts to influence others. They fret and scheme, and are never wholly themselves. But the man who is highly educated, that is to say, who, like Doctor Freer, has established many points of contact with nature, animate and inanimate, enjoys a repose which in itself is power. His composure was, doubtless, sometimes disturbed, else he would have been less than a man, but ordinarily he left you with the feeling that life was too good to allow of haste, too safe to justify panic, too sacred to tolerate scheming.

His versatility was such as to make a pleasant companion, full of surprises. Now it was some detail of scientific knowledge which slipped out of his well-stored mind, not as instruction pedantically imparted, but as the unpremeditated expression of his thought; now a reminiscence of the Tyrol, or an anecdote of Chopin, called up by some strain of classical music to which he was devoted.

Almost the last glimpse I had of him was on the golf course. His lank form was striding over the links with that abandon and freedom which denote complete absorption in a pursuit. It was indicative of his entire life. He traveled hopefully, joyously, whether in the quiet retreat of the laboratory, or through the mountainous home of Igorot and Calinga, or in the valley of the shadow of death.

Strong personalities never seem more alive than in that gloaming which succeeds life's sunset. They refuse to die. Their littlenesses drop out of sight, and the full force of their true character influences us. That Paul Caspar Freer lives yonder with God in the conscious enjoyment of manhood not quenched but vivified through the discipline of death, who dare doubt? But he also lives as an influence rather than a memory among us men whose hands are still busied for a short while with the affairs of here and now. Personality can not die even if it would.

DOCTOR FREER AND HIS GENERAL INFLUENCE UPON SCIENTIFIC WORK IN THE PHILIPPINE ISLANDS.

By Richard P. Strong,

Chief of the Biological Laboratory, Bureau of Science.

We are here to honor the memory of a faithful and able worker, an earnest teacher, a loyal son of this Government, and a good and kindly friend. Paul C. Freer has left behind him a record of work well performed and, to those of us who knew him, the memory of a well-spent life. Although the real achievement of every great man of science lies particularly in his original contributions to science, and Doctor Freer's publications will be told of by others who are here to-day, for those who have formed their image of him largely through his writings I shall try to relate a few of the details of his scientific career and of how he moved among his fellow workers in his daily life; for, since he came to these Islands, I have, perhaps, been more closely associated with him in his work than any one else.

To him belongs the great merit of having been the pioneer in the general scientific work of the Government of these Islands. For more than ten years he has encouraged in every way at his command the cultivation of these scientific branches, and, since the establishment of the Bureau of Science and of the College of Medicine and Surgery, has unselfishly devoted his time to the best interests of these institutions. Indeed, there has been practically no scientific movement of value in these Islands since his arrival in which he has not been interested or has not taken an active part. Though, when he first began his work among us, chemistry was the branch of knowledge to which his mind most distinctly inclined and the one in which he took

the greatest interest, nevertheless, on assuming the directorship of the Bureau of Science, he threw himself into the work of its organization and development with an energy, industry, and ability that could not fail to bring success to his efforts. In this Bureau, with its various divisions, biology (including medicine, general biology, botany, and entomology), chemistry, mining, ethnology, ornithology, and fisheries, there was not one division in the work and development of which he did not take a deep interest, and, more than this, he knew what work was being carried on in each division and much of its value. Moreover, he planned and followed with great interest and attention, born of a clear insight and knowledge of chemical problems, practically all of the investigations carried on in the chemical laboratory. In this remarkable breadth of interest and in the comprehensiveness of his knowledge he will always hold a unique position in the history of scientific work. It is not too much to say that no bureau chief in these Islands ever had the welfare of his bureau more at heart than Paul C. Freer and none have fought harder and with a greater persistence than he did to secure the annual appropriation from the Government, necessary to carry on the scientific work here. With all this, and apart from his natural ability, he brought to the Bureau and maintained there an exalted professional standard. Nevertheless, his directorship in this institution has been arduous and complex and has required the exercise of the very highest qualities of the mind.

One of his early aims was the establishment of a scientific journal to be published by the Bureau of Science, and this was accomplished as soon as the necessary legislation was enacted by the Government. In this journal (The Philippine Journal of Science), of which he was the editor, he took a remarkable pride and interest. He was an editor in every sense of the word, and but few realize the number of hours he spent at this work, preparing manuscript for the printer. Often have I found him at home on his holidays with a large pile of articles by his side, and sometimes he would spend many hours of the day correcting and rewriting poorly prepared manuscript with a

patience and good nature that was truly remarkable. However, the ripeness of his critical judgment and the facility of his literary taste made most of this work easy for him, and not infrequently he earned the gratitude of some young author by having caught the spirit of his clumsily and illy-expressed ideas and transcribed them for him into terse and lucid language. His work of this nature was ever done with the conscientious desire to benefit the writer to the greatest degree. By the majority of the scientific staff of his Bureau he was particularly admired not only for the things which he had done in science, and not only for his intellect and for the wide grasp of his mind, but also for his fairness of judgment in all scientific matters and for his love and appreciation of scientific truth. In all the little disputes in his laboratory, he evidently endeavored never to let himself be led away by his personal feelings, but to give his decision in an impartial manner. His attitude finally inspired, among many of his colleagues, a confidence that he would judge their differences calmly and impartially, and there existed an intellectual bond between him and many of his laboratory workers. In the latter years of his life, his personal judgment of men and things was extensively sought after and his advice cheerfully and unselfishly given. I never knew him so busy with his own work that he would not willingly be interrupted by a colleague who wished to discuss with him some scientific problem or who sought his aid or advice. At such times it ever seemed to be his earnest desire to give the most efficient assistance to those who so came to him.

If we attempt to analyze his success, if we ask ourselves what were the qualities of his mind and character (for the two can not be separated in an investigator) by which he stood above many of his colleagues, we shall find as conspicuous traits, his comprehensive knowledge of scientific problems in general, his diligence and accuracy in the details of daily life, and his wholly upright and open character in all scientific matters. These traits were certainly powerful factors in contributing to his successful career.

However, my effort to-day is not only to pay a deserved

tribute to the memory of one in whom energy and industry were prominent traits of character and who was always so loyal a friend to his colleagues in their scientific work, but also to point out the importance of his labors in an educational way and to emphasize the importance of his establishment of a scientific institution in which the criteria of the true spirit of inquiry were always insisted upon.

Finally, his life must ever serve as a beacon to those of us who strive to emulate faithful devotion to duty.

DOCTOR FREER AND THE BUREAU OF SCIENCE.

By Dean C. Worcester,

Secretary of the Interior of the Government of the Philippine Islands.

At the time civil government was established in the Philippine Islands, there fell to my lot the drafting of legislation which had for its object the establishment of scientific work upon a firm and lasting foundation.

As a member of the zoölogical staff of the University of Michigan, I had had abundant opportunity to learn by practical observation how such work should *not* be carried on. This institution supported a zoölogical department and a medical college. In the zoölogical department we taught among other things the zoölogical half of a beginner's course in general biology, the anatomy of the cat, comparative anatomy, the embryology of the chick, and comparative embryology. In connection with these courses we operated the necessary laboratories, and for purposes of reference we had a very incomplete library.

In the medical college there were a histological laboratory, a pathological laboratory, a so-called hygienic laboratory which was in reality a bacteriological laboratory, and an anatomical laboratory.

The pathologist maintained that it was necessary for him to teach his students normal histology because the histologist did not know his business and students could not appreciate pathological conditions of tissues until thoroughly familiar with such tissues in their normal state. Similarly the histologist felt called upon to teach his students pathology because of the supposed incompetence of the pathologist. Each had trouble with bacteriologists over questions as to where histology and pathology left off and bacteriology began. At the outset only

human anatomy was taught in the anatomical laboratory, but later the anatomist in charge felt called upon to inaugurate other work in mammalian anatomy and in comparative anatomy as well. The histologist ultimately branched off into the embryology of the chick and began to talk about giving courses in comparative embryology.

Here then, within the limits of a single institution, I had observed no less than five different laboratories, each with its staff of instructors, its library, its expensive instruments, apparatus, and reagents; each more or less undermanned and inadequately equipped; each duplicating or striving to duplicate work carried on in one or more of the others. The result was needless expense, lack of readily obtainable efficiency, and constant bickering.

Furthermore, there had come to my attention rather startling instances of the duplication of scientific work in the departments at Washington.

While the complete lack of adequate facilities for carrying on imperatively necessary biological and chemical work which confronted us when civil government was organized in the Philippine Islands was appalling, I was nevertheless inclined to derive comfort from the old saying "Blessed be nothing," for we had at least the opportunity to *start* right, unhampered by costly but antiquated equipment, by worthy but incompetent investigators, or by quarrels as to who should do what needed to be done.

The materials with which to concoct a muddle worse than any of those with which I was already familiar lay ready to hand. At one time or another the Bureau of Customs has wished to establish a chemical laboratory and a so-called "microscopic laboratory." The Bureau of Forestry has thought that it needed laboratories for chemical, botanical, and entomological work. The Bureau of Agriculture has urged precisely similar needs and has desired to take up bacteriological and pathological work as well. The original Board of Health and its successor, the Bureau of Health, have been disposed to demand laboratories in which to conduct both routine work and original investiga-

tions in chemistry and biology. And so on to the end of the chapter.

I early decided to make a determined effort to centralize the laboratory work of the Insular Government under the control of one man, to the end that unnecessary and wasteful duplication of staff and equipment might be avoided and that maximum efficiency might be attained at minimum cost. With these ends in view, I drafted, and on July 1, 1901, secured the passage of "An Act providing for the establishment of Government Laboratories for the Philippine Islands." The passage of this Act laid a reasonably broad foundation, but did nothing more. It was necessary to plan and construct a modern laboratory building which should afford adequate facilities to meet the then existing, and probably future, needs of the Government; to list, buy, house, and properly catalogue a fairly complete scientific library; to purchase and install costly and complicated scientific apparatus; to provide seasonably a formidable array of expendable reagents and supplies; and most important of all, to secure the services of a large staff of well-trained scientists, capable not only of performing necessary routine examinations with unfailing accuracy, but also of grappling with some of the many scientific problems whose early solution was then imperatively needed. To the end that the best possible results should be obtained, it was necessary that the work of the members of the staff should be coördinated and directed by a master mind.

It was obvious that the man who could undertake such a task with hope of success must combine an unusually broad knowledge of the different branches of laboratory work with a wide acquaintance among scientific investigators, familiarity with cost and sources of supply of books, apparatus, and reagents, sound business judgment, good administrative ability, and hard common sense.

I chose for this important and difficult position Dr. Paul Caspar Freer, then professor of inorganic chemistry in the University of Michigan, and never was man more fortunate in his choice.

Doctor Freer's preliminary scientific training, begun in the United States and completed in Europe, had been exceptionally thorough and broad. He had displayed very distinguished ability as an original investigator and had always been most successful in directing the investigations of others. He had placed his own laboratory at the University of Michigan on a sound basis and had made numerous helpful suggestions calculated to promote efficiency and economy in the work of others of the university laboratories. Incidentally he was the youngest man ever appointed to a full professorship in the University of Michigan. I, myself, had been a student there at the time of his appointment.

Later, when both of us were members of the University faculty, we had repeatedly discussed the possible reorganization and centralization of the laboratory work of the university and had agreed that greatly increased economy and efficiency might readily be secured were some one competent person put in charge with power to act.

When the opportunity came to make a clean start in the Philippines, I felt that Doctor Freer was just the man whom I needed, and having first secured due authority, I offered to him the newly created position of Superintendent of Government Laboratories, at the same time outlining my plans for the future. The opportunity for creative work appealed to Doctor Freer, and to my very great satisfaction he accepted the position. We have profited by his mature knowledge, amazing in its breadth and accuracy.

At the outset he had no thought of permanently abandoning his university career, but requested and obtained a year's leave of absence in order to help us get started. At the end of that year his work was only begun. Mr. Taft, then Civil Governor, secured an extension of his leave for another year, and at the end of this second period successfully urged upon the university regents the almost unprecedented act of granting to a member of the faculty a third consecutive year's leave.

Meanwhile things had been happening here. At the outset Doctor Freer had found himself in the embarrassing situation of

being compelled to plan the future buildings, equipment, and personnel of the Bureau of Government Laboratories, and at the same time immediately to provide for the carrying on of urgently necessary routine examinations and original researches.

The new bureau had had small beginnings in a little building, which might without serious inaccuracy be called a shack, situated to the rear of the private residence in which the Civil Hospital had been established. In the cramped, inadequate, and unbearably hot quarters which it afforded, there were inaugurated and carried out scientific investigations of far-reaching practical importance in connection with amœbic dysentery, Asiatic cholera, and bubonic plague. More than one comparatively unknown worker here laid the foundation of an international reputation.

The preparation of plans and estimates for the permanent laboratory building, the completion of lists of necessary scientific books, apparatus, and supplies, and the figuring out of an adequate laboratory staff occupied much of Doctor Freer's time during a period of two years. I speak whereof I know when I say that plans and estimates so complete and accurate as those which he ultimately furnished were never before nor since presented to the legislative body of these Islands.

The aggregate sum of money involved was so large as to make its appropriation at one time inexpedient if not impracticable. Furthermore, it would have been worse than useless to have books and apparatus arriving without a proper place in which to house them, or to employ scientific workers prior to the provision of adequate laboratory accommodations for them. Doctor Freer was, therefore, compelled to give most careful consideration to a scheme for spreading the necessary expenditures over a period of years.

His elaborate plans and estimates proved adequate and final. They were never departed from in any essential particular, so far at least as concerns the work then under contemplation. The only changes which have proved necessary were incident to providing for a large amount of additional scientific work when the scope of the original Bureau of Government Laboratories

was added to and its designation was changed to "The Bureau of Science."

After all plans and estimates had been perfected, it was necessary to persuade a legislative body, including in its membership only one lone scientist, to provide the necessary funds. Doctor Freer was naturally required to state why he wanted what he wanted, with the result that he got it.

The work speedily outgrew the little one-story building in which it started. The biological laboratory was transferred to a much larger building on a distant street, and administration was thus complicated.

There was endless delay in the completion of the new building. Grossly exaggerated rumors as to its cost led to the charge that its erection had involved needless and wasteful expenditure. Salaries were necessarily small.

The underpaid members of the Bureau staff were publicly attacked, collectively and in some cases individually, as impracticable and visionary beings, who were devoting their energies to wasting the funds of a poverty-striken government in useless abstract investigations.

One member of the Philippine Commission who had conceived the idea that scientific books were intended only for filing in imposing ranks on the wall, as is done with formidable looking tomes by lawyers of a certain class, for years bitterly assailed every appropriation requested for the Bureau. Through good report and ill Doctor Freer held on his course with clear foresight and unwavering tenacity of purpose, convinced that he should win in the end because he was right. He lived to see this belief abundantly justified!

As the end of his third year of leave approached, he received an ultimatum from the Michigan University authorities to the effect that he must again take up his university work or sever his connection with that institution. An immediate reply by cable was necessary. I asked him to state to me the conditions under which he would be willing to remain in the Insular service, and he did so. No quorum of the Commission was present on that day and, as immediate action was imperative, I stated the

facts to four of my colleagues, with a view to obtaining their prior approval. Doctor Freer's proposition was perfectly clear to me and I thought that I made it clear to them. They agreed to accept his offer as they understood it. With a majority of the Commission thus pledged to its acceptance, I informed him that it would *be* accepted, and he then immediately severed his connection with the University of Michigan by cable. A few days later when I requested definite official action by the Commission, I found to my consternation that two of the members with whom I had consulted had failed clearly to understand the terms on which Doctor Freer was willing to remain. When the matter came to a vote my action was not confirmed. I was, therefore, compelled to inform him that he would not be given the salary for which he had stipulated and that the fault of this unfortunate blunder lay entirely with me for the reason that I had failed to submit his proposition to my colleagues in writing and to secure on the face of the document their written approval.

He immediately cabled to ascertain whether he could withdraw his resignation from the faculty of the University of Michigan, but before his message was received his place had been filled.

It is a significant commentary on his character that, although he felt, rightly, that a grave injustice had been done him, he remained loyal both to the man who was primarily responsible for it and to the Government which he served.

With the lapse of time the work conducted under his wise guidance rapidly and steadily developed. The Bureau of Government Laboratories absorbed the Bureau of Mines, took up botany, ornithology, entomology, fisheries, cement testing, and other new lines of investigation, and thus became the Bureau of Science. It furnished its own light, power, steam, and gas so economically that it was required to perform these functions for the College of Medicine and Surgery and for the Philippine General Hospital. These changes meant larger working quarters and a material addition to the power plant, which were provided under Doctor Freer's always competent and efficient direction.

As the volume of research work grew and the necessity for the prompt publication of its results became urgent, the Bureau entered upon the risky venture of beginning the publication of a scientific journal, which must depend for its subject matter upon the results of the work of a limited number of investigators, much of whose time was necessarily occupied by routine examinations. To-day the Philippine Journal of Science is one of the world's standard scientific publications. In it have been published the results of scientific investigations of far-reaching importance. In my opinion, it has done more than any other one thing to spread throughout the world knowledge of work being done in the Philippines for the uplifting of a people and to spread that knowledge among men whose opinion really counts.

The business affairs of the Bureau of Science have been exceptionally involved. It has often been necessary to order apparatus a year or more in advance in order to be sure of having it ready when required. Important book orders have sometimes remained unfilled for years and have had to be repeatedly canceled and re-placed. The Bureau has been dependent in part upon its receipts for money with which to operate and the annual total of such receipts could not be accurately foreseen. It was known to Doctor Freer that deficits would not be approved by the Secretary of the Interior. There have been none.

Scientists of established reputation have strenuously objected to taking civil service examinations and have had to be reasoned with. After arrival at Manila some of them have even more strenuously objected to accounting for their time and have in many ways displayed a desire to be considered in a class by themselves. It has been necessary for Doctor Freer to teach them that they were very much like other people, and would be so considered.

New men have not infrequently desired to reserve for themselves certain fields of investigation which they were not ready immediately to enter and have needed to be inspired with a broader and more truly scientific spirit. Doctor Freer has been peculiarly fortunate in dealing with this too common foible of

research men, and the unseemly brawls which so often occur over questions as to who shall do what, and as to priority of results, have been conspicuously absent.

For a long time the Bureau served as a training school for other and wealthier institutions which could afford to buy our employees away from us and did not hesitate to do so. The fight for more adequate salaries was a long and tedious one, but it has achieved important results.

In another particular he has deserved well of the Government. My original plan contemplated a close and helpful relationship between the Bureau of Government Laboratories, a medical college, and a great general hospital. I was told that my scheme was chimerical because three such institutions would never work together harmoniously. This prophecy has proved false. Doctor Freer thoroughly understood the meaning of the word *coöperation*, and on more than one occasion taught it to others, both by precept and example. Under his direction the Bureau of Government Laboratories and its successor, the Bureau of Science, have maintained a helpful relationship with the Bureau of Health and the University of the Philippines.

Doctor Freer may most truly be said to have lived for his work. While he sometimes shortened his afternoon hours sufficiently to make possible the taking of sorely needed exercise, he habitually labored far into the night and on holidays as well. During his last year he had repeated and prolonged attacks of acute suffering. In each such instance he resumed his work before he could rise from his bed. In the course of the last day of his life his thoughts turned again and again to the work and the needs of the Bureau of Science. His relationship to that Bureau may be very briefly summarized. *I* dreamed a dream. *He* made that dream come true. It is not too much to say that he created the Bureau. It will be a lasting monument to his unquestioned scientific and business ability, his clear foresight, his sane judgment, and his unwavering perseverance.

There have not been lacking prophets of evil who have felt that the success of the work of the Bureau of Science was so

intimately associated with the peculiar abilities of its director that the Bureau would go to pieces now that his guiding hand has been palsied by death.

It is not to be expected that anyone else could, at the outset, run so complicated a machine with the capable and peculiarly sympathetic touch of the man who built it, but ability to produce a machine which *can* be operated successfully by others determines the value of the builder's work. As the years go by, it will be realized that the constructive work of Doctor Freer for the Bureau of Science has successfully met this, the final test.

PROFESSOR FREER AND THE UNIVERSITY OF THE PHILIPPINES.

By WILLIAM EVERETT MUSGRAVE,
Chief of Clinics, Philippine General Hospital.

History records no more complete and unselfish devotion to science than is exemplified in the life of Paul Freer.

He was essentially an investigator and teacher, combining these virtues in such a manner as to make every man who became closely associated with him his pupil. In personality, in the character of his researches, in versatility of mind, in the utilitarian aim of all his work, in his generous attitude of help to all who applied for assistance and advice, and in many other points Professor Freer very closely resembled the illustrious Pasteur.

Pasteur was the father of bacteriology and lived to guide this great science from uncertainty to the road to success. Paul Freer was the father of modern science in the Philippine Islands and he lived to see and guide the developments of his creation to success.

Starting with nothing but a fertile soil and a legislature whose friendly interest was secured and maintained by the untiring activities of the Honorable Dean C. Worcester, he built up a great research institution that to-day is classed with the best in other countries.

During the early years of our residence in this country, he watched the development of elementary education with much interest, and his counsel during these years was a potent influence upon the policy of the Government in educational development.

Educational progress was so satisfactory that in 1905, at its annual meeting, the Philippine Islands Medical Association rec-

ommended the establishment of a Medical School. Doctor Freer was chairman of the committee which, with the active co-operation of Mr. Worcester, succeeded in securing satisfactory legislation. "The Philippine Medical School" opened its courses of instruction in 1907, and was merged with the University of the Philippines as the College of Medicine and Surgery in 1909. Doctor Freer was dean and, also, professor of chemistry from the organization of the school until his death, which occurred just five years after the opening of the school and shortly after graduation of the first class of physicians who had taken their entire course of instruction in this institution.

He always stood for high standards in educational work, and it was due largely to his efforts that the College of Medicine and Surgery was able to establish and maintain rigid entrance requirements, a five years' course of instruction, and to secure a faculty of research workers who are paid for teaching. This was no easy task. The public demand for more physicians, the small number of thoroughly prepared students, the limited resources of the Government, and the political exigencies were such that the pressure brought to bear for lower requirements for admission with larger classes, shorter courses of instruction, and less expensive teachers and methods was very strong. Doctor Freer very correctly considered that the stand taken by the Philippine Medical School would determine, for a long time to come, the policy of higher educational methods, and in winning this fight for high standards he not only gained world-wide recognition for our school from the first, but a precedent was established that made a similar policy practicable for other colleges and prepared the way for a University before one was created.

During the first years of our work, while searching the world for suitable teachers for the Medical School, Doctor Freer crippled the efficiency of his own Bureau by furnishing a large proportion of the faculty from the members of the staff of the Bureau of Science. Not only this, but he gave freely of his own time and even diverted funds, as far as practicable within the law, in order to insure the success of the school.

The methods of successful men are always interesting and instructive. Professor Freer's methods were very simple. In dealing with his superiors he usually made a direct request and reënforced this request by a presentation of all the facts bearing upon the subject. If the first effort failed, he would repeat the request until he secured what was wanted or was ordered to desist. In dealing with his colleagues and assistants, his watchword was *efficiency* and all men were judged upon this basis, a very satisfactory method for a man of his broad learning and experience, but a hazardous one for a less experienced leader.

Something of Doctor Freer's conception of the function of a medical school is shown in his Commencement Address to the graduating class in 1910 in which he said:

> The exact training which the graduate of a modern medical school obtains from his work in the various laboratories; the development of his powers of observation by a study of physics, chemistry, bacteriology, pathology; by his contact with the methods of diagnosis and clinical reasoning in the hospital and by the broad phases of hospital discipline which surround him during the final years of his course of study, will have been without meaning if they have not shown him one fundamental fact, that all of this hard work will have been valueless, if he has not had introduced within his being the divine spark of independent thought * * *. If he has not this ambition, his future will be first one of stagnation, then of retrogression. It has been one of the chief missions of the Faculty to cultivate this spirit among the students, and the members of the latter body themselves must be constantly extending their view-points and developing the various special branches to which they are devoting their attention. What is true of the individual members holds good of any institution of learning, a condition of dependence on what is already known and a tendency to look backward into the past is in reality retrogression; and intellectually such an institution must die, no matter how magnificent its buildings, how extensive its equipment, or how generous its means. The teaching force must itself not only be capable of advancing new thought and of developing new methods, but it must utilize these capabilities to the best advantage, continually and restlessly pressing forward to higher ground. Otherwise, the teacher is not capable of inspiring his pupils, he becomes a mere repeater or reciter of text-books, a monitor or supervisor of method which of itself is cast into fixed molds and is already passing toward its end.

Continuing in this same address, our dearly beloved friend and teacher has left us the following advice for the future policy and guidance of the school:

> We must therefore, in the future as in the past, strive to obtain and retain men in the school of the best capability for advancing their own technical specialties. Mere teaching will not do, it lacks that peculiar force which renders the pupils in after life capable of independent development. Mere study on the part of the expectant graduate will also not do. He must continue his scientific growth by observation, thought, study and reasoning from the facts as he finds them to those lying in the higher realms of advance beyond. Faculty and students form the institution as a whole, and it is for them to see that, through the many years of its existence, it continues to play its part in the great advance of human thought as a vigorous entity in the community of schools of learning.

In this last quotation we are given a duty that is made sacred by the martyrdom of him who gave it. The duty is a hard one; no one realized more fully than did Doctor Freer that our greatest difficulty would be to inculcate the spirit of independent thought in our students. Five years of experience has shown that there are local causes, intrinsic and acquired, that make this the greatest problem of our institutions of advanced learning, and the ultimate success of our work depends upon our being able to surmount these difficulties which only may be done by constant effort and the revolutionizing of the customs and practices of centuries.

This is the one phase of our educational development that had not been satisfactory to Doctor Freer, and I bespeak the coöperation of the members of the Faculty to make the appeal contained in his last public utterance to us our watchword for success; and may our efforts not cease until the Paul Caspar Freer Professorship of Chemistry in the University of the Philippines is freely recognized as one of the positions of honor in the scientific world.

DOCTOR FREER AS AN ORGANIZER AND AN ADMINISTRATOR.

By Murray Bartlett,

President of the University of the Philippines.

It is a rare thing when the creative and executive faculties are united in one mind. Rarer even is the combination of scientific genius and business ability.

To see deeply into the laws underlying the mystery of nature, to follow the trace of unknown promise to a successful conclusion, then to apply the practical methods of efficient life to the results of scientific research is seldom achieved by one mind and will. It is this combination of human powers that has made possible the fame of an Edison, a Bell, a Westinghouse. In most cases, men, such as these, use their ability to capitalize for material value the fruits of their scientific investigation.

Doctor Freer was one of these rare men. Undoubtedly he could have devoted his extraordinary ability to amassing a large fortune. Indeed, he had more than one opportunity so to do. He might have erected upon the foundation of his genius for seeing nature's hidden powers a great business organization in his own land for his own enrichment. Instead, he built up about his research and the research of others a great institution for the practical benefit of humanity in a strange and far-away land. The Bureau of Science is, perhaps, not so much a monument to Freer, the Scientist, as to Freer, the Organizer. Truly could one of his friends say, "The Bureau of Science is Freer."

This is why there has been universal testimony to-day that his place can not be filled. If such a statement can be true of any man, it is certainly true of Doctor Freer, for where can be found one, not only preëminent in his own line of study,

but familiar with the details of every other phase of scientific investigation; possessing the practical ability of a captain of industry and inspired by a spirit of service for country and for humanity? To say, however, that Doctor Freer's place can not be filled is not to declare that the work of the Bureau of Science can not go on. His task was so well done, so completely organized that, with careful guidance, its many activities may continue unimpaired through the years.

Doctor Freer had all the qualities of a great organizer; untiring industry which keeps no office hours, knowledge of affairs in the broad sense which kept him in touch with the practical needs of the world of trade and commerce, and ability in choosing his assistants. Of these qualities, it is needless to speak. The organization he left behind speaks for him. In treating the subject of Doctor Freer as an organizer and an administrator, I wish to mention the characteristics which were peculiarly his own.

First, he was capable of rare unselfishness where an ideal was to be gained. All the way through, he sacrificed his own time and desire for investigation in order to guide the investigation of others for the good of his Bureau. It was to him a real deprivation to give up his own personal research in a field in which he had few peers and no superiors, yet there was no hesitation on his part in giving freely the results and the credit of his experience to men who were just beginning their scientific investigation.

Nowhere does this unselfishness appear more clearly than in Doctor Freer's relations with the College of which he was the executive head. The Philippine Medical School was very largely the creation of Paul Freer. Its thoroughness of instruction and its high as well as practical standards were made possible by his thorough acquaintance with medical instruction and his extraordinary knowledge of university affairs. He was thoroughly imbued with the idea of founding here, in these Islands, a great Medical College; to provide for the Filipino people a succession of competent physicians and surgeons who should protect and safeguard the health of their race. He had the

right to take pride in the success of this institution and to look upon it as his own. When, however, by operation of law the Philippine Medical School ceased to be an independent institution and became a constituent part of the University of the Philippines, he gave the same care, enthusiasm, and loyalty to the College of Medicine and Surgery, although he occupied, what might appear to be, a subordinate position. I sometimes think that I saw the biggest side of Paul Freer—the older man and the younger man, the man of long and rich experience and the man with little. If in future years any credit is given to the work of laying the foundation of this University in its early days, the larger part should be his.

This spirit of unselfishness enabled him to administer his trust, not for the benefit of his own Bureau, but for the larger cause of the Government as a whole, and for its work in these Islands. His outlook was broad and his vision clear. With him the Bureau of Science was simply one means of rendering a service to the Philippine people. His real aim was to make that service as perfect as possible. A favorite phrase with him was "we must play the game." To him, the game was not an opportunity for individual play, but for team work.

In our own relations, the unusual facilities of his Bureau were freely offered to the University, and I believe that in his dealings with other departments of the Government, his attitude was marked by the spirit of true coöperation. Thus he has left behind him a great lesson in administration to those of us who are administrators in this Government. His example entreats us to work not for the conspicuous success of our own Bureaus but for rendering a complete and perfect service by the whole Government.

The University of the Philippines will always revere the memory of Paul Caspar Freer; great as a scientist—greater, perhaps, as an administrator—but greatest of all as a man.

DOCTOR FREER AS A FRIEND OF THE FILIPINOS.

By Fernando Calderon,

Professor of Obstetrics, University of the Philippines.

There are three classes of Americans according to their feelings toward the Filipinos with whom they are in daily contact. First, there are those who maintain an attitude of *absolute indifference* with respect to the future of the Filipino people, when both races should thoroughly know and gladly help each other. These Americans, after spending some time in the Islands, return to the United States without having in any manner coöperated in the improvement of their brothers, the inhabitants of this beautiful Archipelago. Then, here are those who are absorbed by a feeling of *utter selfishness*, and whose sole desire is that this country be converted into a fit place for the satisfaction of their personal ambitions, thus forgetting entirely the economic welfare of the Filipino people. Lastly, there are those noble Americans who have come to the Philippines imbued with a kindly spirit toward the Filipino, whom they treat as brother and friend.

The object of these Americans, who are, after all, the real and proper representatives of the great American nation in the Far East, in coming to these shores, is neither to further their private interest nor to satisfy their greed for wealth, but to fulfil their sacred mission of service and usefulness and to set an example of righteousness to their fellow-countrymen here, so that we may justly call them the standard-bearers of a civilization which is based on the ethical and immutable principles of democracy and on that great ideal of history: the universal brotherhood of man. These are the Americans whose beneficent influence will infuse new ideas and new energies into our insti-

tutions and inculcate into the minds of the rising generation that wholesome spirit of democracy which will make the Philippines the most prosperous and progressive country which the world ever beheld in these far-away regions of the extreme Orient. To this group of worthy and self-denying citizens of America the late Dr. Paul C. Freer belongs, whose memory will ever be cherished by those Filipinos who have had opportunity to realize his untiring efforts for the advancement of science in the Philippine Islands.

I need not remind you, of course, to prove my assertion, that Doctor Freer was the one who created and established the Bureau of Science on a scientific basis, helped a great deal in the foundation of the Philippine Medical School and planned this beautiful building, and that he was, perhaps, the principal factor in the construction of that magnificent General Hospital where the College of Medicine and Surgery has its clinics. All of these institutions are admired by visitors and constitute a perennial fountain of blessings upon the Filipino people.

But there is still another feature of his work which deserves notice. Paul Caspar Freer was a solicitous protector of the Filipino youth. It was his desire that young Filipinos should participate directly in the scientific movement which, since the establishment of American government, has been initiated here. For this reason, both government and private students, upon their return from abroad, found the Bureau of Science an adequate field for their studies and the Director, Doctor Freer, a generous adviser who knew how to encourage the spirit of personal initiative and original research.

Paul Caspar Freer also entertained the salutary idea of putting as many Filipinos as possible in his Bureau. On account of this policy, the division of mechanics of the Bureau of Science is at present completely entrusted to Filipinos; and, in the majority of the other divisions, the work of young Filipino graduates is by no means small. Two of them, Messrs. Timoteo Dar Juan and José del Rosario, in the division of chemistry, after graduating in pharmacy from private schools in this city, were asked by Doctor Freer to practise in his office. Later on, Doctor

Freer recommended their being sent to the United States as government students, and now they are instructors in the College of Medicine and Surgery.

This true friendship on Doctor Freer's part toward the Filipinos also manifested itself in the College of Medicine and Surgery, of which he was the Dean. It was a real source of pleasure for him to work with so many Filipino members of the faculty.

In rendering my humble tribute to the memory of that great friend of the Filipinos, allow me to suggest that we, his fellow-workers and admirers, especially his Filipino friends, place a votive tablet on one of the walls of this building, as a sincere token of our enduring appreciation of his disinterested service and as an outward expression of our unswerving admiration of his ideals as a man and a scholar.

PAUL C. FREER, CHEMIST.

By H. D. GIBBS,

Chief of the Division of Organic Chemistry, Bureau of Science, and Associate Professor of Chemistry, University of the Philippines.

In 1887 Paul C. Freer received the degree of doctor of philosophy in Munich. It is astonishing to note the number of great chemists who have received their first inspiration in chemical research in Professor Adolf von Baeyer's laboratory in Munich, and who have absorbed and later radiated the teachings of this great master. This period in v. Baeyer's work was largely devoted to the study of the structure of ring compounds and very soon afterward he published his classic series of articles on the structure of the benzene ring and the reduction of terephthalic acid.[1]

For some years before Doctor Freer received his degree, W. H. Perkin, jr., son of the Perkin who founded the industry of the manufacture of coal tar dyes, had been working in v. Baeyer's laboratory on the synthesis of ring compounds. In 1885 the first part of the article "On the Synthetical Formation of Closed Carbon-Chains" [2] was published. The continuation of this article [3] was published by the joint authorship of Freer and Perkin and was a further study of the construction of the ring compounds from open chains. Parts II and III were published by Perkin alone and in Parts IV and V Freer [4] again appears as

[1] *Ann. d. Chem.* (Liebig) (1888), 245, 103; (1889), 251, 257; (1890), 256, 1.

[2] *Journ. Chem. Soc. London* (1885) 47, 801, Part I. On some derivatives of trimethylene.

[3] The synthetical formation of closed carbon-chains, part I (continued). The action of ethylene bromide on the sodium-derivatives of ethylic aceto-acetate, benzoyl-acetate and acetone-dicarboxylate, by P. C. Freer, Ph. D. and W. H. Perkin, jr., Ph. D., *ibid.* (1887), 51, 820.

[4] The synthetical formation of closed carbon-chains, part IV. Some derivatives of hexamethylene, by Paul C. Freer, Ph. D. and W. H. Perkin, jr., Ph. D., *ibid.* (1888), 53, 202; Part V. Experiments on the synthesis of heptamethylene derivatives, by Paul C. Freer, Ph. D. and W. H. Perkin, jr., Ph. D., *ibid.*, 215.

the senior author. The work commenced in v. Baeyer's laboratory was later carried on in the laboratory of Professor Dixon, Owens College, Manchester, England.

This research with Perkin is a valuable contribution to the knowledge of the tetra, penta, and hexamethylene rings and the derivatives of tetrone, pentone, and hexone. Efforts to synthesize the heptamethylene ring determined that the methods attempted were not feasible.

About this time Doctor Freer was offered a commercial position in the dye manufacturing industry and it became necessary for him to choose between this and an academic career. He chose the latter and, although knowing that the former meant greater financial reward, I know he never regretted his decision.

To my intimate knowledge there are two things which Doctor Freer carried through life as a result of his association in Munich. The first was his intense interest in the discussions of the structure and behavior of the benzene ring. Less than ten days before his death, we were at the Country Club in Baguio discussing some phases of the work described in an article which I had just presented to him for publication in the Philippine Journal of Science, when he enthusiastically said: "This throws more light on the benzene ring. We must further elucidate the structure of the benzene ring." The second was his generosity with his ideas and assistance to the younger chemists. Only we chemists of the Bureau of Science know how much of Doctor Freer's keen mind, inspiration, and editorial ability there is in the chemical articles originating in the Bureau, for his name seldom appears. We know that a person of less lofty ideals, less ability, and more self aggrandizement would have felt himself privileged, at least, to take the credit of a joint authorship in a large proportion of the published chemical research.

The next period of his research, extending from 1887 to 1902 during his residence in America, principally at Ann Arbor, Michigan, was largely concerned with the sodium derivatives of various ketones and aldehydes, their formation and behavior. In 1890 Doctor Freer contributed an important piece of research which did much to settle the mooted question of the constitution

of aceto-acetic ether, when he found that acetone, a substance containing no methylene group, was capable of forming a sodium derivative, the reactions of which were similar in nearly every respect to those of sodium aceto-acetic ether. This reaction proved to be a general one shown by other ketones as well as acetic aldehyde.

In 1898 he completed a most interesting piece of work on the constitution of phenylhydrazones. Some of the compounds prepared were very difficult to handle and were made in Michigan during the winter when the thermometer was about 20° below zero. The oxidation of acetone p-bromphenylhydrazone to p-brombenzene azo-isopropylene was especially troublesome, requiring careful handling even at this low temperature, and on several different occasions when our laboratories in the Bureau of Science were unusually warm, Doctor Freer brought up this subject with me and took delight in discussing the difficulties we would experience in trying to produce this reaction in Manila.

During this period, before his arrival in Manila, in addition to the 14 articles on ketones and aldehydes referred to, Doctor Freer also published papers on "The Saponification of Substituted Acetic Ester, Tetrinic Acid, The Constitution of Some Derivatives of Formic Acid, Distillation in Vacuum, Formamide, Jamaica Dogwood, Organic Peroxides, the Action of Acids on Metals, and Halogen Substitution Products of Aliphatic Acids," and two textbooks, one The Elements of Chemistry and the other Descriptive Inorganic General Chemistry. These books are very highly regarded both from a chemical and literary standpoint.

From 1901 to 1912, a period of a little over ten years spent in the Philippines, Doctor Freer found that, on account of his administrative duties in connection with the Bureau of Science and the Medical School, and his editorial work on the Philippine Journal of Science, his personal application to research was impossible, a fact which he regretted deeply. Nevertheless he found time to write a number of articles descriptive of the work of these institutions, and his address given at the commencement exercises of the Philippine Medical School, Feb-

ruary 27, 1909, and later published in the Philippine Journal of Science, is an inspiration to all workers in science. His editorial work was most conscientiously performed and I have known him to read many articles three times before the final appearance in print. During the last four years of his life, he developed the keenest interest in the studies of sunlight and sunlight reactions carried on in the Bureau of Science, and through his wide acquaintance and scientific reputation, he obtained the coöperation of various colleagues in America, Europe, Africa, Asia, Australia, and some of the most important islands outside of the Philippine Archipelago. This work was beginning to bear fruit at the time of his death, and he had already published two articles summarizing the results. It promises to throw much light upon several mooted questions concerning sunlight and its effects upon man, and in a few years would have resulted, I believe, in such an indisputable mass of valuable evidence that Doctor Freer and his friends would have regarded it as his crowning achievement.

LIST OF PUBLICATIONS.

Ueber den Acetyltrimethylencarbonsäureäther, by W. H. Perkin, jr., and P. C. Freer. *Ber. d. deutschen chem. Ges.* (1886), 19, 2561–2569.

The synthetical formation of closed carbon-chains. Part I (continued). The action of ethylene bromide on the sodium-derivatives of ethylic acetoacetate, benzoyl-acetate, and acetone-dicarboxylate, by Paul C. Freer and W. H. Perkin, jr. *Trans. Journ. Chem. Soc.* (1887), 51, 820–853.

On the action of ethylene bromide on the sodium derivatives of the ethers of acetoacetic, benzoyl-acetic and acetone-dicarboxylic acids, by Paul C. Freer and W. H. Perkin, jr. *Am. Chem. Journ.* (1888), 40, 446–457.

Synthese von Hexamethylenderivaten, by Paul C. Freer and W. H. Perkin, jr. *Ber. d. deutschen chem. Ges.* (1888), 12, 735–737.

The synthetical formation of closed carbon-chains. Part IV. Some derivatives of hexamethylene, by Paul C. Freer and W. H. Perkin, jr. *Trans. Journ. Chem. Soc.* (1888), 53, 202–215.

The synthetical formation of closed carbon-chains. Part V. Experiments on the synthesis of heptamethylene derivatives, by Paul C. Freer and W. H. Perkin, jr. *Trans. Journ. Chem. Soc.* (1888), 53, 215–222.

Zur Kenntniss des Heptamethylenringes, by Paul C. Freer and W. H. Perkin, jr. *Ber. d. deutschen chem. Ges.* (1888), 21, 738–739.

Uber die Einwirkung von Jodwasserstoffsäure auf die Krotonsäuren, by Arthur Michael and Paul C. Freer. *Journ. f. prak. Chem.* (1889), 40, 95–96.

The action of sodium on acetone. *Am. Chem. Journ.* (1890), 12, 355–357.

Ueber die Einwirkung von Natrium auf Aceton. *Journ. f. prak. Chem.* (1890), 42, 470–472.

The action of chlor-carbonic ether on acetone-sodium, by Paul C. Freer and George O. Higley. *Am. Chem. Journ.* (1891), 13, 322–326.

The constitution of aliphatic ketones, and the action of sodium on acetone. *Am. Chem. Journ.* (1891), 13, 308–322.

On the saponification of the substituted acetic esters, by Paul C. Freer and F. L. Dunlap. *Am. Chem. Journ.* (1892), 14, 366–376.

Some reactions with acetoacetic ether and with salicylic ether. *Am. Chem. Journ.* (1892), 14, 407–422.

Ein Vorlesungsversuch, die Effusion der Gase betreffend. *Ztschr. f. phys. Chem.* (1892), 9, 669–670.

Zur Kenntniss des Acetessigesters. *Journ. f. prak. Chem.* (1892), 45, 414–416.

The action of metals on nitric acid, I. The reduction of nitric acid by copper, by Paul C. Freer and George O. Higley. *Am. Chem. Journ.* (1893), 15, 71–81.

2. The reduction of nitric acid by copper and by lead, by George O. Higley. *Am. Chem. Journ.* (1895), 17, 18–26.

3. The reduction of nitric acid by silver, by George O. Higley and W. E. Davis. *Am. Chem. Journ.* (1896), 18, 587–590.

4. The reduction of nitric acid by silver, by Paul C. Freer and George O. Higley. *Am. Chem. Journ.* (1899), 21, 377–392.

On the action of sodium on acetone. *Am. Chem. Journ.* (1893), 15, 582.

Descriptive inorganic general chemistry. Boston (1894), 550 pp.

Ueber die Einwirkung von Natrium auf Aceton. *Ann. d. Chem.* (Liebig) (1894), 278, 116–140.

Zur Kenntniss des Acetone. Ueber die Einwirkung von Chlorkohlensäure-äthylester auf Natriumaceton. *Ann. d. Chem.* (Liebig) (1894), 283, 380–391.

Derivatives of tetrinic acid. Experimental work by E. R. Miller. *Am. Chem. Journ.* (1905), 17, 792–796.

The elements of chemistry. Boston (1895), 289 pp.

On the action of chlorcarbonic ester on sodium acetone. *Am. Chem. Journ.* (1895), 17, 1–18.

On the action of sodium on the esters of aconitic and nitric acids. Preliminary notice. *Am. Chem. Journ.* (1895), 17, 31–33.

Tetrinic acid. *Am. Chem. Journ.* (1895), 17, 779–792.

The action of sodium on aldehyde. *Am. Chem. Journ.* (1896), 18, 552–562.

Notes on new apparatus. 2. Distillation in a vacuum. *Am. Chem. Journ.* (1896), 18, 585–586.

3. The demonstration that two volumes of hydrogen and one volume of oxygen form two volumes water vapor. *Am. Chem. Journ.* (1896), 18, 562–584.

On the constitution of some derivatives of formic acid. First paper, by Paul C. Freer and P. L. Sherman, jr. *Am. Chem. Journ.* (1896), 18, 562–584.

The action of sodium upon methylpropylketone and acetophenone, by Paul C. Freer and Arthur Lackman. *Am. Chem. Journ.* (1897), 19, 878–890.

Die Einwirkung von Natrium auf Aldehyd. *Ber. d. deutschen chem. Ges.* (1897), **29**, 1147.

Ueber die Constitution einiger Derivate der Ameisensäure, by Paul C. Freer and P. L. Sherman, jr. *Ber. d. deutschen chem. Ges.* (1897), **29**, 1148.

Ueber die Constitution einiger Hydrazone. *Ber. d. deutschen chem. Ges.* (1897), **30**, 736–738.

Formamide and its sodium and silver salts, by Paul C. Freer and P. L. Sherman, jr. *Am. Chem. Journ.* (1898), **20**, 223–228.

The action of benzoyl chloride on the phenylhydrazones of benzoin. *Am. Chem. Journ.* (1899), **22**, 396–402.

On the constitution of the phenylhydrazones. *Am. Chem. Journ.* (1899), **21**, 14–64.

On the constituents of Jamaica dogwood, by Paul C. Freer and A. M. Clover. *Am. Chem. Journ.* (1901), **25**, 390–413.

Ueber halogensubstituirte aliphatische Säuren. *Ann. d. Chem.* (Liebig) (1901), **319**, 345–357.

On the formation, decomposition and germicidal action of benzoyl acetyl and diacetyl peroxides, by Paul C. Freer and Frederick G. Novy. *Am. Chem. Journ.* (1902), **27**, 161–192.

The preparation of benzoyl-acetyl peroxide, and its use as an intestinal antiseptic in cholera and dysentery. Preliminary notes. *Pub. Bur. Gov. Labs.* (1902), **No. 2**, (Second printing, 1904).

On the organic peroxides, by Paul C. Freer and Frederick G. Novy. *Contrib. Med. Research* (Vaughan), Ann Arbor, Mich. (1903), 63–127.

The spirit of organic chemistry by Arthur Lachman, with an introduction on the growth of the science of organic chemistry by Paul C. Freer, 6 pp. New York (1904).

The work of the Bureau of Government Laboratories of the Philippine Islands. *Science* (1904), n. s. **20**, 105–109.

I. Description of the new buildings of the Bureau of Government Laboratories by Paul C. Freer. II. A Catalogue of the Library of the Bureau of Government Laboratories by Mary Polk. *Pub. Bur. Gov. Labs.* (1905), **No. 22**, 320 pp., 28 pls.

Plague and late cholera epidemic in the Philippine Islands. *Ill. Med. Journ.* (1905), **7**, 346.

Accidental inoculation with the virus of plague. *Journ. Am. Med. Assoc.* (1907), **48**, 1264–1265.

The action of sodium on acetone, by Raymond Foss Bacon and Paul C. Freer. *Phil. Journ. Sci., Sec. A* (1907), **2**, 67–76.

A consideration of some of the modern theories in relation to immunity. *Phil. Journ. Sci., Sec. B* (1907), **2**, 71–81.

The new Philippine Medical School established by the Government of the Philippine Islands. *Science* (1907), **26**, 600–602.

The free dispensary of the Philippine Medical School. Editorial. *Phil. Journ. Sci., Sec. B* (1908) **3**, 352–353.

The Philippine Islands Medical Association. Editorial. *Phil. Journ. Sci., Sec. B* (1908), **3**, 183.

Address at the commencement exercises of the Philippine Medical School. *Phil. Journ. Sci., Sec. B* (1909), **4**, 71–75.

The Philippine Medical School. *Journ. Am. Med. Assoc.* (1909), **52**, 271–272.

Commencement address, Philippine Medical School. *Bull. Manila Medical Society* (1910), 2, 72–73.
Interesting things to see and do in the Philippines. *The Manila Times.* First annual edition (1910), 22, 23.
Threading the Archipelago. *Philippine Resources* (1910), 1, 17–21.
The study of Manila copal. *Phil. Journ. Sci., Sec. A* (1910), 5, 171–172.
The tropical sunlight. *Phil. Journ. Sci., Sec. B* (1910), 5, 1–20.
The Bureau of Science. *Merchants' Asso. Rev.* (1911), 1, No. 5, 1–5.
Medical education in the Philippines. *Manila Times.* Second annual edition (1911), 30–31.
The result of the past two years' work in the study of tropical sunlight. *Phil. Journ. Sci., Sec. B* (1912), 7, 1–28. [Abstract in *Med. Rec.* (1912), 81, 682.]
Tropical sunlight. *Pop. Sci. Month.* (1912), 80, 521–529.



BUREAU OF SCIENCE, MAIN BUILDING.

VOL. VII, SEC. C, NO. 1 APRIL, 1912

THE PHILIPPINE JOURNAL OF SCIENCE

PAUL C. FREER, M. D., PH. D.
GENERAL EDITOR

SECTION C. BOTANY

E. D. MERRILL, M. S.
EDITOR

WITH THE COÖPERATION OF

P. W. GRAFF, B. S.; W. H. BROWN, PH. D.
H. N. WHITFORD, PH. D.



MANILA
BUREAU OF PRINTING
1912

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS.

REPORT OF THE INTERNATIONAL PLAGUE CONFERENCE.

Held at Mukden, April, 1911, under the auspices of the Chinese Government.

Edited by RICHARD P. STRONG.

483 pages, 13 plates (2 colored, 4 half-tones, 12 charts and maps).

Order No. 416. Cloth, $3.50; paper, $2.50 United States currency, postpaid.

The proceedings of this International Conference and information gained therefrom, together with the results of certain bacteriological investigations, constitute the present report.

Nothing hitherto has been published which gives such a complete and comprehensive account of the entire subject of pneumonic plague.

Delegates from America (United States of), Austria-Hungary, France, Germany, Great Britain, Italy, Japan, Mexico, the Netherlands, Russia, and China attended the Conference.

The Bureau of Science of the Government of the Philippine Islands has been appointed sole agent for the distribution of the printed proceedings of the International Plague Conference.

THE SUGAR INDUSTRY IN THE ISLAND OF NEGROS.

By HERBERT S. WALKER.

145 pages, 10 plates, 1 map.

Order No. 412. Paper, $1.25 United States currency, postpaid.

Considered from the viewpoint of practical utility, Mr. Walker's Sugar Industry in the Island of Negros is one of the most important papers published by the Bureau of Science. This volume is a real contribution to the subject; it is not a mere compilation, for the author was in the field and understands the conditions of which he writes. The following is a brief synopsis of the contents:

Tables of soil analyses, both chemical and physical; analyses of the cane, juice and bagasse; estimates based on actual information as to the costs of production and of cultivation; and estimates of the cost and location of possible central factories. The island is considered by sugar-producing districts; the area of cultivation and the production per hectare are given, and the possibility for future expansion discussed.

The plates illustrate various phases of sugar industry from the cultivation of the field to the transportation of sugar in native sailboats.

A MANUAL OF PHILIPPINE SILK CULTURE.

By CHARLES S. BANKS.

53 pages, 20 plates.

Order No. 413. Paper, $0.75 United States currency, postpaid.

The silk industry is particularly adapted to be undertaken by persons with small capital, and like the making of hats in the Philippine Islands it should thrive with a little encouragement.

In A Manual of Philippine Silk Culture we have presented the results of several years' actual work with silk-producing larvæ together with a description of the new Philippine race. Half-tone plates illustrate in natural size silkworms in different stages of development, pupæ, adult moths, samples of cloth made from eri silk, hand reel, and silk house. Other plates illustrate the various appliances used in raising silkworms and in spinning silk; hand and power reels are illustrated; working drawings are given for a silk house and for a hand reel.

THE PHILIPPINE
JOURNAL OF SCIENCE
C. BOTANY

VOL. VII APRIL, 1912 No. 1

NOTES ON PHILIPPINE ORCHIDS WITH DESCRIPTIONS OF NEW SPECIES, IV.

By OAKES AMES.

(*From the Ames Botanical Laboratory, North Easton, Mass., U. S. A.*)

The following paper contains descriptions of twenty-seven new species from the Philippine Islands, one genus, heretofore unrecorded as a native of the Philippines, and one species, namely *Dendrobium angustifolium* Blume, a native of Java, Sumatra, and the Malay Peninsula, which is an addition to the list of Philippine plants.

Cestichis Cumingii (Ridley) Ames is here included as a distinct species. In Orchidaceae 1:13, doubts were expressed as to its distinctness from *C. compressa*. From careful studies of *C. compressa*, as represented by Javan material, and of *C. Cumingii*, as represented by the specimens collected by Weber on Mount Mariveles, I am convinced that two species are before us. What is true of *C. Cumingii* is true of numerous other Philippine orchids which have close allies in Java and the Malay Peninsula. A general similarity undoubtedly exists, but comparative studies of each individual case show differences, the sum of which indicate clearly that there are constant differentiating traits of specific value. This fact becomes more and more apparent with each case studied and makes it seem highly probable that many Philippine plants which have been referred to extra-limital species will be found, after critical examination, to be distinct

and endemic. An interesting example of this is offered by the genus *Dendrochilum* in the Philippines, which is composed entirely of endemic species, if we exclude one or two which have been ascribed to the Philippines conjecturally on evidence too slight for recognition.

HABENARIA Willd.

Habenaria Curranii sp. nov.

Planta 6 dm alta, foliis paulum infra medium partem caulis congestis, lanceolatis, acuminatis. *Sepala lateralia* lanceolata, vel lineari-lanceolata, aristata, *sepalum superius* simile, lanceolatum, acuminatum, cucullatum. *Petala* bipartita, *lacinia* posterior linearia, *lacinia anterior* posteriori similis sed longior, 4.5 cm longa. *Labellum* usque ad basim tripartitum; *laciniae laterales* media longiores, filiformes; *lacinia media* 1.7 cm longa. *Calcar* prope apicem subdilatatum, *processus stigmatis* prominentes.

Plant tall, slender throughout, *leaves* five or more, narrowly lanceolate, acuminate, acute, 7.5 to 11 cm long, 1 to 2 cm wide, clustered near the middle of the stem or lower, about 2 dm above the roots. *Bracts* of the stem sheathing, those above the leaves acuminate, aristate, about 2 cm long. *Raceme* slender, elongated, smooth, many-flowered (about 20), flowers greenish. *Bracts of the inflorescence* aristate, about equaling the flowers, ovary and pedicel about 2 cm long, smooth. *Lateral sepals* spreading, narrowly lanceolate, 3-nerved, acuminate, aristate, about 1 cm long, 2 mm wide. *Upper sepal* similar to but shorter than the laterals, 7.5 mm long. *Petals* bipartite, *posterior division* (free from the dorsal sepal?) linear, 1 cm long, *anterior division* filiform, 4.5 cm long. *Labellum* tripartite, *lateral divisions* much longer than the middle one, filiform, about *4 cm long* (!), *middle division* broader than the laterals, about 0.5 mm wide, 1.7 cm long. *Stigmatic processes* elongated, tapering, longer than the anther-canals. *Spur* stout, somewhat inflated near the tip, about 2.4 cm long.

LUZON, Province of Cagayan, Lalloc, H. M. Curran, *For. Bur. 17138*, February 22, 1909: Benguet Subprovince, Sablan, E. Fénix, *Bur. Sci. 12578*, December 6, 1910.

Similar in habit to *H. ponerostachys* Reichb. f., but unlike that species in the size and structure of the flowers. It is also like *H. aristulifera* Reichb. f., but the floral divisions are conspicuously longer in *H. Curranii*.

Habenaria Delessertiana Kränzl. Gen. et Sp. Orch. 1: 233.

Kränzlin cites Cuming's 2086 as the type of this species, but under *Habenaria muricata* Vidal (*H. hystrix* Ames) he also cites this number of

the same collection without any allusion to a mixture having been made in the distribution of Cuming's specimens. In my studies of the material collected for the Bureau of Science I have examined two series of specimens which are clearly referable to *H. Delessertiana*, being chiefly characterized by the linear petals, protuberant in part at the base, by the aristate sepals, and by the middle lobe of the labellum being about one-fourth longer than the lateral lobes. Another characteristic is the crowding of the oblong-lanceolate leaves near the middle of the stem.

All of the material distributed as 2086 of Cuming's collections which I have examined is referable to *Habenaria hystrix*, and as *H. muricata* Vidal this number is listed in "Phanerogamae Cumingianae Philippinarum." (*H. muricata* is a synonym of *H. hystrix*).

Kränzlin cites "Calananz?" as the habitat of *H. Delessertiana*. The material from Luzon which I have examined was collected at Calauan (written on the field label as Calauang). May not the localities in question be identical, Kränzlin's "Calananz?" being the same as Calauang?[1]

LUZON, Province of Laguna, Calauan, R. C. McGregor, *Bur. Sci. 12407*, November 30, 1910. MINDANAO, Lake Lanao, Camp Keithley, *Mary Strong Clemens 865*, November, 1906.

Habenaria Mearnsii sp. nov.

Habitu *H. clavellatae* (Michx.) Spreng. haud dissimilis. *Folia* oblongi-elliptica et lineari-lanceolata. *Bracteae inflorescentiae* ovariis longiores, excedentes flores infimos. *Sepala lateralia* lanceolata vel ovato-lanceolata, subfalcata. *Sepalum superius* ellipticum, obtusum. *Petala* simplicia, oblonga, obtusa. *Labellum* simplex, linearis; prope basim labelli *tuberculum*. *Calcar* ovario brevius.

Tuberoids fleshy (3 ?). *Plants* 1.4 to 3.6 dm tall, strict, few-leaved, in leafage somewhat resembling *H. clavellata* (Michx.) Spreng. *Lowermost leaf* elliptic-oblong, obtuse, 4 to 7 cm long, 1.3 to 2 cm wide, much longer than those above it, which are bract-like and about 4 in number. *Upper leaves* linear, acute, the uppermost one about 1 cm long, linear, acute. *Floral bracts* linear-lanceolate, acute, lower ones exceeding the flowers. *Raceme* 4.7 cm long, many-flowered, flowers pale-green. *Lateral sepals* lanceolate or ovate-lanceolate, subfalcate, obtuse, 3.5 mm long, about 2 mm wide near the base. *Upper sepal* elliptic, obtuse, 3 mm long. *Petals* simple, oblong, obtuse, 3 mm long, 1.25 mm wide. *Labellum* 4 mm long, 1 mm wide, simple, fleshy, linear, tapering toward the tip, with a fleshy retrorse callus or

[1] "Calananz" is unquestionably a misprint for Calauan, or Calauang as it is frequently spelled. Cuming collected in Calauan from the end of September to the 15th of December, 1836, according to a letter written by him from Manila Dec. 24, 1836, to Sir W. J. Hooker, now preserved in Hooker's correspondence at Kew. There is no town by the name of Calananz in the Philippines. E. D. M.

protuberance near the base. *Spur* 5 to 6 mm long, slender, not at all inflated. *Stigmatic processes* wanting or very much reduced.

LUZON, Subprovince of Benguet, Pauai, Major E. A. Mearns, *Bur. Sci. 4313*, July, 1907; Mount Pulog, R. C. McGregor, *Bur. Sci. 8815, 8835*, in grass lands near the summit, July 3 and 4, 1909. *H. Mearnsii* is similar in its leafage and general appearance to *H. clavellata* (Michx.) Spreng., although totally dissimilar in the details of the inflorescence. The gynostemium of the flowers examined was so pressed out of shape that it was impossible to describe it with fullness.

Habenaria ponerostachys Reichb. f. in Bonplandia 3: 213; Kränzlin in Engler's Jahrb. 16: 179; Gen. et Sp. Orch. 1: 385.

This species was described by Reichenbach in 1855 from material collected in the Philippines by Hugh Cuming (*no. 2095*). The next reference to the species was made by Kränzlin in Engler's "Jahrbücher" and subsequently in "Genera et Species Orchidacearum." In the Herbarium of the British Museum of Natural History there is one of Cuming's specimens from the Philippines (*no. 2095*) which it is reasonable to suppose represents *H. ponerostachys*, but in several details it is not in agreement with Reichenbach's description. Kränzlin's description, on the other hand, is quite satisfactory. In Engler's "Jahrbücher," Kränzlin states that Reichenbach drew up his description from a depauperate specimen preserved in the Boissier Herbarium. In April, 1910, Mr. Merrill secured specimens from the Island of Negros which are almost a perfect match for the specimen of *Cuming 2095*, preserved in the British Museum of Natural History. These, I believe, are clearly referable to *H. ponerostachys*.

DESCRIPTION: *Plant* 2 to 5 dm tall, very slender, with several sheathing, obtuse or acute bracts below the leaves. *Leaves* clustered 7 to 14 cm above the stout fleshy roots, lanceolate to ovate-lanceolate, acute, shortly aristate, 3 to 9 cm long, 1.6 to 2.7 cm wide. *Spicate raceme* 6 to 25 cm long, very slender, many-flowered. *Bracts* lanceolate, erect, acute, 5 to 10 mm long, about equaling the matured capsules. *Lateral sepals* elliptic, 2.5 to 3 mm long, about 1.5 mm wide. *Upper sepal* ovate, about equal to the laterals. *Petals* asymmetrically ovate, blunt, 1–nerved, 3 mm long, 2 mm wide, simple. *Labellum* 3-lobed, similar to that of *Peristylus tentaculatus* J. J. Smith, 3 mm long to tip of middle lobe. *Lateral lobes* linear, longer than the middle one, abruptly curved at the tip, 2 mm long. *Middle lobe* gradually tapering to the obtuse tip, 1.5 mm long, about 1 mm wide. *Spur* longer than the lip, slender at base, dilated toward the tip, about 5 mm long.

NEGROS, Canlaon Volcano, *Elmer D. Merrill 7022*, April, 1910. Terrestrial, on forested ridges, about 1500 m above sea level, flowers greenish-white.

Habenaria Robinsonii sp. nov.

Folia linearia, acuta. *Bracteae* aristatae. *Pedunculus* glabratus. *Flores* albi, 1 ad 4. *Bracteae inflorescentiae* aristatae. *Sepala lateralia* oblongi-ovata, subacuta, 3-nervia. *Sepalum superius* cucullatum, obtusum. *Petala* spathulata, obtusa, 1-nervia. *Labellum* 4-lobatum; lobi laterales cuneati, truncati, lobi terminales rotundati. *Calcar* 4.7 cm longum.

Whole plant from 10 to 27 cm high (including the inflorescence). *Bulbs* elongated, roots fleshy. *Leaves* linear, acuminate, 5 to 13 cm long, 4 to 9 mm wide (average about 6 mm), slightly contracted at the base, sheathing, passing rather abruptly into the sheathing, aristate bracts. *Bracts* 3 or more, 2 to 3.5 cm long, long-aristate. *Raceme* glabrous, slender, flowers 1 to 4 (rarely 4). *Floral bracts* 2 to 3 cm long, aristate, sheathing. *Pedicel,* together with the *ovary,* about 2 cm long, glabrous. *Flowers* large, white (in general aspect recalling *H. militaris*). *Lateral sepals* deflexed, oblong-ovate, subacute, 3-nerved, about 7 mm long, 4 mm wide. *Upper sepal* cucullate, obtuse, about 8 mm long. *Petals* simple, spathulate, rounded at the apex, 1-nerved, 8 mm long, 2 mm wide near tip. *Labellum* very large in comparison with the other perianth-organs, about 2 cm long, 2.5 cm wide, four-lobed, *basal lobes* cuneate, the free end obliquely truncated, 12 mm long, 9 mm wide at the tip, many-nerved. *Front lobes* separated from the basal ones by a narrow isthmus 3 mm long, 2.5 mm wide, semi-rotund, margin slightly crenulate. (The front lobes might be more properly designated as the bifid or cleft middle lobe of the lip.) *Stigmatic processes* prominent, tapering, somewhat decurved, 2.5 mm long. *Spur* slender, longer than the ovary, 4.7 cm long.

Luzon, Province of Laguna, Molauin River, C. B. Robinson, *Bur. Sci. 9666,* Feb. 2, 1910, on rocks in the river, 50 to 150 m above sea level; *Elmer D. Merrill 6306,* Feb. 9, on mossy boulders in stream bed.

This very beautiful species bears a striking similarity to *H. militaris* from which it is readily distinguished by its very different leaves, long-aristate bracts, and white flowers.

Habenaria rosulata sp. nov.

Folia rosulata, linearia, acuta. *Bracteae* aristatae. *Flores* 3 vel 4, albi. *Bracteae inflorescentiae* acutae, ovariis breviores. *Sepala lateralia* ovata vel ovato-lanceolata, subacuta. *Sepalum superius* ovatum. *Petala* linearia, 1-nervia, obtusa, simplicia. *Labellum tripartitum,* laciniae laterales media longiores. *Calcar* inflatum, processus stigmatis hippocrepiformes.

Plant 1 to 2 dm tall, slender. *Roots* fleshy. *Leaves* rosulate, about 5, linear, acute, suberect or spreading, 2 to 4.5 cm long,

2 to 5 mm wide, acuminate, acute. *Bracts* sheathing, 3 or 4, aristate, 5 to 10 mm long. *Flowers* few, 2 to 4, white. *Floral bracts* about 5 mm long, about one-third as long as the pedicel and ovary, aristate. *Lateral sepals* narrowly ovate, subacute, larger than the dorsal one, about 7 mm long, by 3 mm wide. *Upper sepal* ovate, cucullate, about 5 mm long. *Petals* simple, linear, 1-nerved, obtuse, 6 mm long, 1 mm wide. *Labellum* tripartite nearly to the base, *divisions* filiform, about equally wide, the laterals longer than the middle one, laterals about 1.3 cm long, middle division 7 mm long, 0.5 mm wide. *Spur* about 13 mm long, slender near the opening, dilated from about the middle, resembling the abdomen of an ichneumon fly. *Anther canals* about equaling the stigmatic processes. *Stigmatic processes* cylindric, hippocrepiform.

LUZON, Province of Tayabas, Quinatacutan, Foxworthy & Ramos, *Bur. Sci. 13203*, on rocks at the edge of the stream, 75 m above sea level. Described in collector's note as "tuber-bearing or with fleshy roots."

This species, which I have been unable to refer to any described *Habenaria*, belongs, in my opinion, to the § *Diphyllae*. The flowers resemble those of *H. falcigera*, *H. diphylla*, etc., but the foliage is quite characteristic.

GASTRODIA R. Br.

Gastrodia javanica (Bl.) Lindl.

PALAWAN, Napsahan, on the west coast, *Elmer D. Merrill 7233*, Sptember 19, 1910. "About rotten stumps along trail in dense forest. Petals yellowish, whole plant brownish, with purplish tinge; a very brittle, succulent, leafless saprophyte."

The genus *Gastrodia* has not, heretofore, been recorded as a native of the Philippines.

KUHLHASSELTIA J. J. Smith.

Kuhlhasseltia Merrillii Schlechter in Fedde Repert. 9 (1911) 437.

Haemaria Merrillii Ames in Philip. Journ. Sci. 2 (1907) Bot. 315; Orchidaceae 3 (1908) 21, *pl. 30*.

Doctor Schlechter, *loc. cit.*, refers to J. J. Smith's recently established genus *Kuhlhasseltia* (1910) the species which, with hesitation, I described under the genus *Haemaria*, in my paper on the orchids collected on Mount Halcon. As stated in "Orchidaceae"[2] the genera which constitute the group to which *Haemaria* belongs are differentiated by means of characters which are not only of questionable value, in my opinion, but which are extremely perplexing when it is attempted to place in its proper position a new species of the *Neottiinae-Physureae*. As defined by J. J. Smith the genus *Kuhlhasseltia* includes *Haemaria Merrillii* and Doctor Schlechter is undoubtedly correct in his views expressed in Fedde's "Repertorium." But what do we gain at the present time by multiplying the genera of this puzzling section of the Orchidaceae ? It would seem that an exhaustive monograph of the *Neottiinae-Physureae* should be produced before the number of genera is inordinately increased.

[2] 3: 21.

TROPIDIA Lindl.

Tropidia calcarata sp. nov.

Folia 1 (-2), ovato-lanceolata, acuminata, acuta. *Bracteae inflorescentiae* lineares. *Flores* albi in racemo laxo. *Sepala lateralia* connata, scrotum conspicuum efficientia, basim labelli includens, partes terminales liberae, 3 mm longae, acutae. *Sepalum superius* anguste lineari-lanceolatum. *Petala* lanceolata, subacuta vel obtusa. *Labellum* integerrimum, lanceolatum, carinatum, calcar breve ad apicem obtusum.

Related to *T. angulosa* Bl. *Terrestrial,* 2 to 3 dm high. *Stems* slender, about 2 mm thick, sheathed with obtuse, tubular bracts, 1.5 to 3.4 cm long. *Leaves* 1 or 2 (only one bifoliate specimen among the three examined) sheathing at the base, ovate-lanceolate, acuminate, acute, many-nerved, when mature about 1 dm long, about 5 cm wide. *Peduncles* terminal, shorter than the leaves, erect, 5 to 9 cm long, slender; *floral bracts* linear about 1 cm long. *Racemes* 3 to 5 cm long. *Flowers* white, 1.3 to 1.8 cm long. *Lateral sepals* connate beyond the middle, at the base forming a conical spur 3 mm long which encloses the spur of the labellum, free portion about 3 mm long, acute. *Upper sepal* linear, acute, about 1 cm long. *Petals* lanceolate, subacute or obtuse, 1 cm long, 2.5 mm wide near the base, mid-nerve prominent. *Labellum* slightly sigmoid, *calcarate,* lamina lanceolate, the apex very slightly cucullate. Just below the middle, near the margin, two inconspicuous longitudinally extended keels are situated. Main nerves three in number, slightly prominent. *Spur* obtuse, about 2 mm long, curving slightly toward the ovary, blunt. *Gynostemium* 7 mm long, *rostellum* bifid, exceeding the acuminate anther.

LUZON, Province of Laguna, Mount Maquiling, *Elmer D. Merrill 7144,* September 2, 1910. "Rare, only three plants seen."

Tropidia calcarata is very near *T. angulosa* Blume, but distinguishable from it by the leafage and by the carinae of the lip.

Unfortunately I have seen very little material of *T. angulosa* and my knowledge of it is chiefly based on descriptions and plates. The material from which the above description was taken consists of three specimens. The unifoliate character appears to be normal. In the single case where two leaves terminate the stem, one of them is very small and bract-like.

CESTICHIS Pfitzer.

Cestichis Cumingii (Ridley) Ames Orchidaceae 1: 13.

Liparis Cumingii Ridley Journ. Linn. Soc. Bot. 22: 292.

What I blieve to be this species is well represented by specimens from Mount Mariveles, recently collected by C. M. Weber. The suborbicular lip with a minute tooth at the obscurely retuse tip, the very characteristic inflorescence, and the broad, somewhat oblanceolate leaves, agree very well

with the specimen collected by Cuming (*no. 2141*) preserved in the Herbarium of the British Museum of Natural History. This species should not be confused with *Cestichis compressa* which is a much larger plant with a larger lip. That *C. compressa* is very closely allied to *C. Cumingii* can not be denied, but for the present it seems wise to regard them specifically distinct.

LUZON, Province of Bataan, Mount Mariveles, *C. M. Weber 26*, February 9, 1911. On trees in mossy forest, about 800 m above sea level.

OBERONIA Lindl.

Oberonia benguetensis sp. nov.

Folia ensiformia, acuta, ad basim imbricata. *Pedunculus* elongatus, multo folia excedens, multibracteatus. *Bracteae* circiter 2 mm longae, setaceae. *Racemus* gracilis. *Flores* flavidi, minuti, circiter 1 mm longi. *Sepala lateralia* ovato-lanceolata. *Sepalum superius* triangulum. *Petala* linearia, attenuata. *Labellum* ad basim rotundatum, oblongum, ad apicem bilobum; lobi minuti, valde separati.

Roots fibrous. *Plants* diminutive, about 4 cm high to the tip of the tallest leaf, stem very short. *Leaves* ensiform or somewhat falcate, acute, the largest about 3 cm long and 4 mm across from edge to edge, fleshy. *Peduncle* up to 1 dm long, much longer than the leaves, beset with numerous, spreading, setaceous bracts 2 mm long. *Raceme* somewhat drooping, about 5 cm long, 5 mm in diameter at the base when in flower. *Flowers* yellowish, irregularly verticellate, minute, exceeding the bracts. *Floral bracts* linear-acute, about 2 mm long, margin minutely denticulate. *Pedicel* and *ovary* 2 mm long, smooth. *Lateral sepals* ovate-lanceolate, concave, about 1 mm long. *Upper sepal* triangular, subacute (half lanceolate). *Petals* linear-lanceolate, tapering gradually from the base to the subacute tip. *Labellum* rounded at the base, 1 mm long, from about the middle to the tip oblong, each distal angle produced into a diminutive blunt lobe, recalling, although vaguely, *Oberonia similis* Lindl. (which is, however, lobed at the base), lobes about 0.5 mm apart. *Column* minute.

LUZON, Benguet Subprovince, Suyoc to Pauai, *Elmer D. Merrill 4855*, November 7, 1905. Epiphytic in mossy forest about 2,200 m above sea level.

Oberonia hispidula sp. nov.

Aff. *O. mindorensi* speciei quam habitu et structura haec species conspicus simulat. *Folia* imbricata, ensiformia. *Pedunculus* elongatus, gracilis. *Racemus* densiflorus. *Bracteae* aristatae. *Sepala lateralia* ovata. *Sepalum superius* simile. *Petala* ovata,

integerrima. *Labellum* pandurata, ad apicem bilobum, lobi rotundi. *Ovarium* hispidulum.

Plants caulescent, similar to *Oberonia mindorensis* Ames, but different in the lobing of the lip, different petals and shorter pedicels. From base to tip of uppermost leaf, between 1 and 2 dm tall. *Leaves* imbricating, ensiform, about 4 cm long, free portion spreading, somewhat recurved, 1 to 4 cm long, about 1 cm deep where it forms an angle with the stem. *Peduncle* long, slender, about 1 dm long, about 4 mm through when the flowers are expanding. *Bracts* linear-lanceolate, aristate, equaling or slightly exceeding the flowers. *Flowers* greenish, approximate. *Lateral sepals* ovate, 0.75 mm long. *Upper sepal* similar to the laterals and about equal to them in size. *Petals* entire, ovate, obtuse, about 0.5 mm long. *Labellum* pandurate, 1 mm long, nearly 1 mm wide across the tip, margin entire, deeply retuse at the apex, or cleft into two, rounded, terminal, slightly divaricate lobes. *Pedicel* and *ovary* 1.5 mm long. *Ovary* hispidulous.

LUZON, Benguet Subprovince, H. M. Curran, *For. Bur. 5124*, August 20, 1906.

Oberonia Merrillii sp. nov.

Planta parvula. *Folia* ensiformia, acuta. *Pedunculus* gracilis. *Racemus* elongatus. *Flores* verticellati. *Bracteae* angustatae, acutae. *Bracteae inflorescentiae* lanceolatae prope apicem, 2-dentatae. *Sepala lateralia* rotundata. *Sepalum superius* ovato-oblongum. *Petala* orbiculata, denticulata. *Labellum* 3-lobatum. *Lobi laterales* minuti, rotundati, *lobus medius* subquadratus. *Columna* minuta.

Plant up to 9 cm tall from copious fibrous roots, acaulescent or with the stem very short, less than one quarter as long as the leaves. *Leaves* fleshy, equitant, ensiform, acute, 2.5 to 7 cm long, about 5 mm wide seen from the side, shorter than the inflorescence. *Peduncle* slender, 7 to 12 cm long, spike 4 to 9 cm long, about 4 mm in diameter when the flowers are fully expanded, below the spike beset with numerous, linear, spreading bracts 2 mm long; *floral bracts* lanceolate, acute, near the tip angled or 1-toothed on each side. *Flowers* minute, reddish, verticellate, or subverticellate, verticels 2 to 3 mm apart. *Pedicel* and ovary about 1.5 mm long, slender. *Lateral sepals* rotundate or round-ovate, obtuse, 0.75 mm long. *Upper sepal* ovate-oblong, obtuse, about 1 mm long. *Petals* rotund, 0.75 mm long, 0.75 mm wide, margin minutely denticulate. *Labellum* 3-lobed, 0.75 mm long. *Lateral lobes* minute, smaller than the middle lobe,

roundish, margin irregular; *middle lobe* subquadrate, 0.75 mm long, 0.75 mm wide. *Column* minute, clinandrium entire (?).

[1] LUZON, Manila and vicinity (Masambong), *Elmer D. Merrill 7348*, November 6, 1910, on trees, 6 to 8 m above sea level: Province of Nueva Ecija, Cabanatuan, R. C. McGregor, *Bur. Sci. 5298*, September, 1908.

Oberonia setigera sp. nov.

Planta parvula. *Folia* ensiformia vel subfalcata, obtusa vel acuta. *Pedunculus* elongatus. *Bracteae* setiformes. *Sepala lateralia* ovato-lanceolata. *Sepalum superius* lanceolatum, acuminatum. *Petala* serrulata. *Labellum* 3-lobatum; *lobi laterales* majores valde dentati; *lobus medius* subquadratus, integer.

Roots fibrous. *Plants* caulescent, 6 cm tall to tip of uppermost leaf. *Leaves* equitant, ensiform or somewhat falcate, obtuse or acute, 2 to 4.5 cm long, 5 to 7 mm wide. *Peduncle* 12 cm long, thickly beset below the raceme with *setiform bracts* nearly 1 cm long. *Raceme* densely many-flowered, about 7 mm in diameter when in fruit. *Floral* bracts very long, setiform, longer than the flowers, clustered at intervals. *Flowers* lavender, minute, clustered at intervals, but the clusters approximate. *Lateral sepals* ovate-lanceolate, about 1 mm long, 0.5 mm wide. *Upper sepal* lanceolate, acuminate, slightly exceeding 1 mm in width. *Petals* fimbriate, oblanceolate, obtuse, 1 mm long. *Labellum* about 1 mm long, 3-lobed, *lateral lobes* much larger than the middle one, each with the margin broken up into about 7 finger-like divisions. *Middle lobe* minute, subquadrate. *Column* minute, clinandrium entire.

LUZON, Province of Bataan, Lamao River, Mount Mariveles, *H. N. Whitford 1122*, March 3, 1905.

The flowers of *Oberonia setigera* are similar to those of *O. Griffithiana* Lindl., but the middle lobe of the labellum is quite distinct and the setiform bracts constitute an unmistakable differentiating character.

PHAIUS Lour.

Phaius linearifolius sp. nov.

Folia 5, linearia, elongata, acuta. *Scapus* erectus, bracteis tubularibus vestitus. *Bracteae inflorescentiae* persistentes. *Flores* flavi. *Sepala lateralia* oblonga, falcata. *Sepalum superius* oblongi-lanceolatum, obtusum. *Petala* ovato-lanceolata. *Labellum* 3-lobatum; *lobi laterales* rotundati, obtusi, *lobus medius* crenulatus, retusus. *Discus* tricarinatus. *Gynostemium* arcuato-ascendens, clavatum, antice canaliculatum, dorso gibbum, facie anteriore concaviusculum et dense villosum.

Stem thickened at the base, somewhat rounded, tapering upward. *Leaves* about 5 in number, the lowermost one about 2

dm above the ground, sheathing at the base, about 55 cm long, 1.5 to 3 cm wide, linear, acuminate, acute, prominently 5-nerved. *Scape* erect, smooth, about 6 dm long, with four, closely appressed, sheathing, acute bracts about 4 cm long. *Floral bracts* persistent, smooth, lanceolate, acute, 1.5 to 2.5 cm long. *Flowers* 5.5 cm in diameter when spread out, 6 to 15 in a loose raceme, the lowermost 4 cm apart. *Pedicel* and *ovary* 3 cm long, slender. *Lateral sepals* oblong, subacute, broadly falcate, 3 cm long, 1 to 2 cm wide. *Upper sepal* lanceolate-oblong, obtuse, 3.5 cm long, 11 mm wide. *Petals* ovate-lanceolate, subfalcate, obtuse, 3.2 cm long, 1.4 cm wide. *Labellum* obscurely three-lobed, excluding the short spur, about 2.5 cm long. *Lateral lobes* slightly shorter than the middle lobe, rounded, obtuse, obscurely crenulate, smooth. *Middle lobe* irregularly dentate, the margin crumpled or ruffled, deeply retuse at the rounded tip. *Disk* smooth, the three central nerves carinate above the middle, somewhat wavy, diminishing as they approach the tip. *Spur* cylindric, round-pointed, 7 mm long. *Column* comparatively stout, 1.5 cm long, hairy on the anterior surface. *Pollinia* 8. *Flowers* yellow, the ruffled margin of the middle lobe brownish.

LUZON, Bontoc Subprovince, *Father M. Vanoverbergh 1288*, June 28, 1911, growing in brooks, 1,650 m above sea level.

Phaius linearifolius belongs to the groups of which *Phaius flavus* is the best known species. I have refrained from identifying it with *P. flavus* as I find many points of dissimilarity between my material and the specimens of *P. flavus* examined, and also as none of the numerous diagnoses in literature describe my plants adequately, and as the illustrations of *P. flavus* fall far short of depicting them.

CALANTHE R. Br.

Calanthe lacerata sp. nov.

Radices lanatae. *Caules* abbreviati. *Folia* anguste lanceolata, acuminata, acuta, plicata. *Petiolus* ad basim vaginans. *Scapus* foliis longior, gracilis, erectus, elongatus, tomentosus, *bracteis* bene appressis, vaginantibus. *Bracteae inflorescentiae* lanceolatae, pedicellis breviores. *Sepala lateralia* elliptico-lanceolata vel elliptica, acuta. *Sepalum superius* simile. *Petala* oblonga ad medium satis dilatata, ad apicem truncatum, apiculatum. *Labellum* 4-lobatum, *lobi inferiores* oblongi, subfalcati, obtusi. *Lobi anteriores* divaricati, cuneati, flabellati, lacerati, papillosi. In disco ultra columnam utroque *calli* complanati. *Calcar* gracilis.

Roots stout, lanate. *Stem* very short. *Leaves* about 4, about 2 dm long, up to 2 cm wide, narrowly lanceolate, acute, plicate,

shorter than the scape, sheathing at base. *Petiole* narrow, sulcate. *Scape* slender, tomentose, up to 4 dm long. *Bracts* closely appressed, sheathing, 1 to 2 cm long, acute, the lower ones subacute or rounded at the tip, sparsely pubescent. *Raceme* 4 to 9 cm long, densely many-flowered, bracts of the raceme lanceolate, 6 to 10 mm long. *Pedicel* and *ovary* about 1.5 cm long, slender, exceeding the bracts. *Flowers* 1 to 1.5 cm across, odorless, white, labellum purplish. *Lateral sepals* elliptic-lanceolate, acute, 6 to 8 mm long, 3 to 5 mm wide. *Petals* oblong, slightly dilated near the middle, truncate, apiculate, 3-nerved, 5 to 8 mm long, 2.5 to 3.5 mm wide. *Labellum* 1 cm long, 4-lobed. *Basal lobes* oblong, subfalcate, rounded at the tip, 4 mm long, about 2 mm wide, toothed in front, or almost entire, apical lobes 3 mm long, 3 mm wide across the tip, divaricate, cuneate, flabellate, margin lacerate-dentate, papillate. In front of the column on the disk two rows of flattened, elongated *calli* are situated. *Column* about 3 mm long, fleshy; *ovary* pubescent. *Spur* cylindric, or subscrotiform, 4 to 5 mm long. *Pollinia* 8 (4 large, 4 small).

LUZON, Benguet Subprovince, Pauai, *Elmer D. Merrill 4756*, November 8, 1905, terrestrial in mossy forest along the trail, about 2,050 m above sea level: Province of Tayabas, Mount Banahao, *H. N. Whitford 960*, at 1,700 m above sea level: Lepanto Subprovince, Mount Data, *Elmer D. Merrill 4582*, November 4, 1905, in damp shaded ravine, mossy forest, about 2,100 m above sea level.

The specimen collected on Mount Banahao, by Whitford, has broader leaves than the type (5 cm), but appears to be similar in the details of the flower.

Calanthe Ramosii sp. nov.

Planta foliosa. *Folia* oblongi-lanceolata, acuminata, acuta, nervosa, in petiolum vaginantem angustata. *Scapus* tomentosus, elongatus, *bracteis* bene appressis, obtusis, vaginantibus, tubularibus. *Bracteae inflorescentiae* deciduae. *Racemus* laxus, *pedicellus* cum *ovario* pubescens. *Sepala lateralia* extus pubescentia, anguste lanceolata, acuminata. *Sepalum dorsale* simile. *Petala* lineari-lanceolata, acuta. *Labellum* 3-lobatum. *Lobi laterales* acuti. *Lobus medius* valde emarginatus, apiculatus, crenulatus. In disco ultra columna utroque *callus* carinatus. *Calcar* o.

Plant leafy, from stout elongated roots. *Stem* thickened at base, attenuated, about 15 cm long, terminated by 3 to 5 leaves. *Leaves* oblong-lanceolate, acuminate, acute, about 2 dm long, up to 3 cm wide, plicate, sheathing, conspicuously 5-nerved, with numerous less conspicuous nerves. *Scape* longer than the leaves,

finely pubescent above, with several, tubular, obtuse, sheathing, closely appressed bracts about 2 cm long. *Raceme* loosely flowered, *bracts* deciduous. *Pedicels* slender, finely pubescent, 1 cm long. *Ovary* pubescent, about 8 mm long. *Color* of the flowers not noted. *Lateral sepals* 11 mm long, 3 mm wide, narrowly lanceolate, acuminate, pubescent. *Upper sepal* similar to the laterals and about equal to them. *Petals* 8 mm long, 2 mm wide, linear-lanceolate, acute, smooth. *Labellum* 7 mm long, 3-lobed. *Lateral lobes* directed forward, 3 mm long, acuminate, acute, margin slightly crenulate. *Middle lobe* flabellate, deeply emarginate, apiculate, margin crenulate or blunt-toothed. Disk smooth with two semi-elliptic *carinae* one on each lateral nerve in front of the column, fleshy, pubescent. *Spur* none.

Luzon, Province of Zambales, Maximo Ramos, *Bur. Sci. 4987*, December 14, 1907.

EULOPHIA R. Br.

Eulophia Vanoverberghii sp. nov.

Planta gracilis. *Folia* ? *Racemus* laxus, *bracteae* lineares. *Pedicelli* graciles. *Sepala lateralia* ligulato-oblonga, obtusa. *Sepalum* superius simile. *Petala* anguste elliptica. *Labellum* 3-lobatum; *lobi laterales* haud conspicui, minuti, obtusi, *lobus medius* oblongus, obtusus. *Discus* papillosus, ultra columnam utroque callus carinatus.

Plants slender, 2 to 4 dm tall from a large corm. *Scape* sheathed at the base by several, nervose, tubular, imbricating *bracts*, near the middle 1- or 2-bracteate. (*Leaves* absent at flowering time, not seen.) *Raceme* loosely flowered, 10 to 15 cm long. *Bracts of the raceme* linear, about 1 cm long, about equaling the pedicellate ovary, erect or slightly spreading. *Pedicels* slender, smooth, about 7 mm long; *ovary* smooth, about 5 mm long at the period of anthesis. *Flowers* about 1 cm long, erect. *Lateral sepals* 1.4 cm long, 3.5 mm wide, ligulate-oblong, obtuse, green. *Upper sepal* similar to the laterals, slightly shorter. *Petals* 1 cm long, about 5 mm wide, narrowly elliptic, rounded at the tip, green. *Labellum* 1.3 cm long, 7 mm wide at the tip, oblong, very obscurely 3-lobed, the lateral lobes minute and inconspicuous, margin wavy or fluted, nerves *papillose*, *disk* bilamellate at base. *Sac* obtuse, 1 mm long. *Column* about 11 mm long. *Pollinia* 2. The labellum is described by the collector as being yellow and all the perianth organs as being marked with red lines.

Luzon, Bontoc Subprovince, *Father M. Vanoverbergh 336*, April 2, 1910. "Root edible;" found 1,350 meters above sea level on hillocks.

DENDROBIUM Sw.

Dendrobium albayense sp. nov. (§ *Aporum, Hemiphylla*).

Cum *D. cuneato* Schltr. comparandum videtur, a quo tamen foliis differt. *Caulis* ad basim teres, foliosus, compressus, anceps. *Folia* disticha, lanceolata a latere visa. *Sepala lateralia* triangulari-ovata, obtusa. *Sepalum superius* oblongum obtusum, subquadratum. *Petala* ligulata, obtusa. *Labellum* cuneatum ad apicem 3-lobatum. *Lobi laterales* divaricati, obtusi. *Lobus medius* obtusus. Prope apicem labelli *callus* bilobus. *Mentum* brevem, obtusum, rotundatum.

Plants up to 3 dm in length, simple or with a few branches, *leafy* to about the middle, floriferous portion of the stem leafless. *Leaves* distichous, lanceolate, acute, when viewed from the side, 1.5 to 3 cm long from tip to point of insertion; at the middle of the leafy part of the stem 1.5 cm long from tip to inner angle formed with the stem; free portion up to 1 cm wide. *Lateral sepals* fleshy, broad, triangular-ovate, subacute or obtuse, about 3.5 mm long, 2.5 mm wide. *Upper sepal* fleshy, 3 mm long, 2.5 mm wide, rounded at the tip. *Petals* ligulate, obtuse, 3 mm long, 1.5 mm wide. *Labellum* equaling the lateral sepals, 3.5 mm wide at the tip, obscurely 3-lobed in front, *lateral lobes* divaricate, obtuse, about 1 mm long to the angle formed with middle lobe, *middle lobe* shorter than the laterals, obtuse, forming with the cuneate-bilobed callus above it a shallow pocket. *Mentum* rounded, about 1.5 mm long. *Column* 1 mm long.

LUZON, Province of Albay, *A. Loher 6018*, June 26, 1905, plant flowering in Manila. "Flowers odorless, petals with purple lines."

Dendrobium angustifolium (Blume) Lindl. Gen. et Sp. Orch. 76.

Desmotrichum angustifolium Blume Bijdr. 330; Kränzlin in Engl. Pflanzenreich 45 (1910) 350.

The material which I refer to this species exhibits several slight variations from authentic specimens of *D. angustifolium*. These slight variations seem to me unimportant. I have examined living material collected by Elmer D. Merrill on Mount Mariveles in 1905.

LUZON, Bontoc Subprovince, *Father M. Vanoverbergh 708, 709*, July 23, 1910: Province of Bataan, Lamao River, Mount Mariveles, *R. S. Williams 674*: Province of Rizal, San Isidro, M. Ramos, *Bur. Sci. 12123*, June 24, 1910.

Dendrobium basilanense sp. nov.

Caulis compressus, anceps. *Folia* disticha, lanceolata, acuta. *Flores* albi, terminales. *Sepala lateralia*, oblonga, acuta. *Sep-*

alum superius lanceolatum. *Petala* lineari-lanceolata. *Labellum* lineari-oblongum, ad apicem *bilobum.*

In *leafage* and in the bilobed tip of the *labellum* similar to *Dendrobium aloifolium* Reichb. f. *Stems* simple or branching, 1 to 4 dm tall or even taller. *Leaves* distichous, extending along the stem from the base to the summit, gradually diminishing in size, from the point of insertion of the sheathing base to the tip 1 to 2 cm long (average somewhat exceeding 1.5 cm), free portion of the leaf lanceolate, acute, about 1 cm long from inner angle to tip. *Inflorescence* terminal, floriferous part of the stem up to 2 cm long. *Pedicels* arising from small heads of minute bracts. Pedicel and ovary 3 mm long. *Lateral sepals* 3 mm long, oblong, acute. *Upper sepal* 2.75 mm long, lanceolate. *Petals* linear-lanceolate, 3-nerved, obtuse or subacute, 2.25 mm long, slightly less than 1 mm wide. Labellum 3 mm long, 1 mm wide at base, linear-oblong, slightly dilated below the middle, above the middle contracted, the tip deeply retuse, or cleft, the lobes 1 mm long, obtuse. At the point where the lip is contracted, a transversely situated fleshy *callus* occurs. *Mentum* obtuse, about 2 mm long. *Column* 1 mm long.

BASILAN, W. I. Hutchinson, *For. Bur. 3968*, January 23, 1906.

Dendrobium basilanense is nearly allied to *D. aloifolium*, from which it is to be distinguished by the linear-oblong labellum, scarcely, if at all, broader near the middle than at the tip.

In his monograph of the *Dendrobiinae*[3] Doctor Kränzlin cites *D. Merrillii* Ames Orch. 2: 181, as a synonym of *D. aloifolium.* I believe this is clearly the result of an error in judgment. *D. Merrillii* is unlike *D. aloifolium* in leafage and has an entire or obscurely retuse middle lobe of the labellum. With the original description of *D. Merrillii* mention was made of two collections, one *Merrill 3357*, and one *Loher 6017.* On the sheet of Loher's specimen in my herbarium I find in A. A. Eaton's handwriting "Not *aloifolium.*" This note was made when Eaton and I were comparing the Philippine species of § *Aporum* with the specimens preserved at the British Museum of Natural History and at Kew. Doctor Kränzlin refers to *Merrill 3357* in the geographical notes under *D. aloifolium* and from the exclamation mark after the number it would seem that he had examined the type. Yet, he makes no revision in the description of *D. aloifolium* which accounts for the inclusion of material which has a three-lobed labellum with the apical lobe oblong, and inconspicuously, if at all, retuse at the tip. *D. merrillii* Ames is also given by Kränzlin[4] under his "Species *Dendrobii* imperfecte notae."

Dendrobium Brongniartii Kränzl. in Engl. Pflanzenreich 45 (1910) 210.

This is a robust species of § *Aporum.* The flowers are described by collectors some as white, some as yellow, others as

[3] Engl. Pflanzenreich 45 (1910) 206. [4] l. c. 299.

reddish, but these differences are very likely the result of difference in age of the flower; the color turning from white to brown as it matures. In all cases I have been unable to identify the material at hand by an analysis of a flower, but where an examination has been possible the perianth organs agree with Kränzlin's description. In a specimen collected by W. S. Lyon I was able to find perfect pollen masses. These are *four* in number.

LUZON, Province of Zambales, Mount Pinatubo, F. W. Foxworthy, *Bur. Sci. 3029*, June 13, 1907, on stunted trees in small rocky desert, flowers white and fragrant, bracts yellow; *Bur. Sci. 2617*, April 26, 1907, on plain of coarse sand on trees: Province of Rizal, Ahern's collector, *For. Bur. 3304*, September, 1905; Bosoboso, M. Ramos, *Bur. Sci. 5639*, November 30, 1909, fls. pure white, bracts yellow; Montalban, W. Schultze, *Bur. Sci. 5620*, May 25, 1908, flower white, fragrant, basal bracts yellow: Province of Cagayan, H. M. Curran, *For. Bur. 16844*, March 9, 1909: Province of Tayabas, H. M. Curran, *For. Bur. 9651*, March 22, 1908: Province of Camarines, H. M. Curran, *For. Bur. 11345*, May 10, 1908. MINDANAO, Province of Surigao, *F. H. Bolster 378*, August 15, 1906, epiphyte on trees, flowers yellow: District of Davao, Malalag, *E. B. Copeland 692*, March 28, 1904, ephiphyte, and on rocks over the sea: District of Zamboanga, H. N. Whitford and W. I. Hutchinson, *For. Bur. 9207*, January, 1908, altitude above the sea 150 meters, flowers white. BASILAN, W. I. Hutchinson, *For. Bur. 4018*, February 10, 1906, growing on tree near beach, flower brownish-yellow.

Dendrobium Clemensiae sp. nov.

Caules uniarticulati, monophylli. *Folium* oblongum. *Sepala petalaque* ad basim triangularia in caudas longas producta. *Labellum* 3-lobatum costis 2 usque ad basim lobi medii percurrentibus. *Lobi laterales* obtusi, parvi. *Lobus medius* linearis ad apicem dilatatus, acutus, medio papillosus.

Stem uniarticulate, somewhat stouter at the base than at the tip, rugose when dry, 7 to 14 cm long, monophyllous. Leaf narrowly oblong, fleshy, rigid, unequally bilobed at the tip, 11 to 15 cm long, 11 to 14 mm wide. *Peduncle* slender, weak, about 5 cm long, 1-flowered, from the summit of the stem, terminal, sheathed by an elongated spathe 3.5 to 4 cm long. *Lateral sepals* about 5 cm long, triangular at the base, prolonged into a long, slender, filiform tail. *Upper sepal* similar to the laterals, about 5 cm long. *Petals* similar to the sepals, but shorter and more slender, about 4.5 cm long. *Labellum* up to 1.8 cm long, 3-lobed, suborbicular at base, abruptly continued from between the small, obtuse, lateral lobes into a linear, papillose limb which terminates in a lanceolate, membranaceous

lamina; orbicular base about 5 mm long, 6 to 7 mm wide, with a membranaceous, sulcate lamina on each side of the middle nerve which extends beyond the lateral lobes, the linear papillose portion about 1 cm long, lamina about 4 mm long, 1.5 mm wide. Foot of the *column* 4 mm long.

MINDANAO, Lake Lanao, Camp Keithley, *Mary Strong Clemens 508*, April, 1906: NEGROS, *W. S. Lyon 40*, December, 1907, "epiphyte, pedicel green, base of perianth pure white, prolongations of sepals and petals lemon-yellow."

This species, which is closely allied to *Dendrobium filiforme* J. J. Smith, belongs to the section which, in his recent monograph, Doctor Kränzlin has established as the genus *Diplocaulobium*, characterized by a uniarticulate stem, 3-lobed crested labellum, and ephemeral flowers. *Dendrobium longicolle* Lindl., another species of this section, has been reported from the Philippines, but without sufficient authority.

Dendrobium lunatum Lindl. in Journ. Linn. Soc. Bot. 3 (1859) 4.

In my preceding paper,[8] I referred *Dendrobium lunatum* Lindl. to the synonymy of *D. indivisum* Miquel. Further studies have convinced me that this proceeding was a matter of mistaken judgment. From the material referred by me to *D. indivisum*, *D. lunatum* differs slightly in foliage and also slightly in the labellum. The leaves are not so spreading as in *D. indivisum*, their tips pointing more exactly in the same direction as the stem. The labellum of *D. lunatum* is not 3-lobed, although in my specimens it is hardly so reniform or lunate as shown in the sketch preserved with the Cuming specimen from the Philippines in Lindley's Herbarium. The flowers of both species are whitish or yellowish with purple streaks.

According to Kränzlin's recent monograph *Dendrobium indivisum* Miquel (not Bl.) and *D. distichum* (Presl) Reichb. f., are conspecific. The specimens previously referred by me to *D. indivisum* Miquel belong to *D. distichum* (Presl) Reichb. f.

The specimens of *D. lunatum* which I have examined come from Palawan, F. W. Foxworthy, *Bur. Sci. 907*, May 6, 1906.

Dendrobium MacGregorii sp. nov. (§ *Aporum, Hemiphylla*).

Caulis ad basim teres, foliosus, compressus, anceps. *Folia* disticha, lanceolata, a latere visa lanceolata. *Sepala lateralia* triangulari-lanceolata, subacuta. *Sepalum superius* oblongi-ovatum, obtusum. *Petala* lineari-oblonga, obtusa. *Labellum* cuneato-spathulatum, ad apicem trilobatum, *lobi* rotundati, obtusi, laterales obscuri, medius obtusus. *Mentum* obtusum.

Plants (somewhat resembling *D. teloense* J. J. Smith, but with very different leaves) leafy to about the middle, slender and nearly terete at the base, about 5 dm tall. Leaves about 3.5 cm long from the tip to point of insertion, 1.5 to 2 cm long from tip to angle formed by the inner edge of the leaf and

[8] This Journal 6 (1911) Bot. 52.

the stem, free portion lanceolate, acute, about 1 cm wide measured perpendicularly. At about the middle of the stem the leaves suddenly decrease in size and give place to bract-like leaves 5 to 10 mm long, where they are free, which are closely appressed, their tips erect and nearly touching the stem. From the bases of these bracts, at intervals, the flowers break through. *Flowers* pale-yellowish-white with two lines of dark-carmine on the lip. *Lateral sepals* 3 mm long, triangular-lanceolate, subacute. *Upper sepal* oblong-ovate, obtuse, 3 mm long. *Petals* linear-oblong, obtuse, about 3 mm long, slightly less than 1 mm wide. *Labellum* cuneate-spathulate, 3-lobed in front, the side lobes rounded, the middle lobe half-elliptic, obtuse, rounded (in dried specimens the margin of each lateral lobe appears to have been stained with carmine). In general outline the lip resembles that of *D. Merrillii*, and appears to be minutely *papillose* on the disk near the base of the middle lobe. *Mentum* obtuse, 2 mm long. *Column* 2 mm long.

POLILLO, R. C. McGregor, *Bur. Sci. 10457*, epiphytic in mangrove swamp, October 12, 1909.

Dendrobium parciflorum Reichb. f. ex Lindl. in Journ. Linn. Soc. Bot. 3 (1859) 4.

D. Jenkensii Griff. in Calcutta Journ. Nat. Hist. (1854) 367, *t 25.*

D. kentrophyllum Hook. f. Fl. Brit. Ind. 5 (1890) 725; Icon. Plant. *t. 2021.*

D. marivelense Ames Orchidaceae 2 (1908) 180.

The above is the bibliographical history of the species which in my second volume of "Orchidaceae" I described as a novelty under the name *D. marivelense.* In his monograph of the "*Dendrobiinae*" Doctor Kränzlin concluded that *D. parciflorum* and *D. marivelense* should be regarded as conspecific.

In addition to the locality given in Orchidaceae 2: 180, the following is of interest: MINDANAO, Lake Lanao, Camp Keithley, *Mary Strong Clemens 611*, June, 1906.

Dendrobium Ramosii sp. nov.

Caules gracilis, gerentes folia circiter 13. *Folia* linearia, acuta in anthesi decidua. *Flores* pallide rosei vel purpurei, in pedunculis brevibus. *Sepala lateralia* oblonga, obtusa, ad apicem cucullata. *Sepalum superius* oblongum, obtusum. *Petala* ovato-oblonga, denticulata. *Labellum* cuneato-obovatum, unguiculatum, prope basin callus hippocrepiformis. *Caules* foliosi et florigeri simul exstant.

Plant very slender, about 3 dm tall, leafy, about 2 mm thick near the base. *Leaves* distichous, linear, acute, about 7 cm

long, about 6 mm wide, base sheathing. Sheathing bases of the leaves tubular, in dried specimens tinged with purple, about 1 cm long. *Flowers* pale-purplish, in short lateral racemes. *Peduncle* 1 cm long. *Bracts* lanceolate, purplish, 2 mm long. *Pedicellate ovary* about 1 cm long, pedicel very slender. *Flowers* about 5, about 1 cm long, with a sharply curved mentum. *Lateral sepals* oblong, obtuse, somewhat cucullate at the tip, 3 mm wide. *Upper sepal* cucullate, lanceolate, 6 mm long. *Petals* ovate-oblong, rounded at the tip, 6 mm long, 3 mm wide, margin minutely denticulate. *Labellum* 12 mm long, 6 mm wide near the tip, simple, cuneate-obovate, sharply bent at the base to conform to the curved (genuflected) mentum, finely denticulate along the margin of the rounded, broad tip. In front of the column-foot the lip is dilated (nearly orbicular), then contracted at the point where a hippocrepiform membranaceous callus is situated, beyond the callus the limb is cuneate obovate, with three prominent longitudinal central nerves. In some flowers the mentum is so much curved that the blunt apex points in the same direction as the sepals and petals.

LUZON, Lepanto Subprovince, Maximo Ramos, *Bur. Sci. 7049*, January, 1909.

Dendrobium Ramosii belongs in the same section with *D. O'Brienianum* Kränzl., and *D. Epidendropsis* Kränzl., two Philippine species which are characterized by the sharply bent mentum. From both it is very distinct in foliage and in the color and size of the flowers.

I have seen two other collections from the Philippines which appear to be referable to this species. The leaves and stems are longer than in the specimens gathered by Ramos, but the flowers are very similar, the lip varying slightly in outline.

LUZON, Bontoc Subprovince, Bauco, *Father M. Vanoverbergh 9*, 1,300 meters above sea level, January 8, 1910: Benguet Subprovince, Bugias, *Elmer D. Merrill 4682*, October 28, 1905.

Dendrobium ventricosum Kränzl. in Engl. Pflanzenreich 45 (1910) 209.

LUZON, Province of Zambales, *A. Loher 6004*, June 11, 1905, flowers greenish-yellow, with purple lines. MINDANAO, Butuan Subprovince, Agusan River, Talacogon, *C. M. Weber 176*, epiphyte, flower light-green, July 20, 1911: District of Davao, *Rev. R. F. Black*, August, 1906, "flowers white, blue-veined inside;" from same locality, *Black*, 1909

Apparently a very variable species. The material which I have examined would seem to indicate that the labellum varies considerably in the condition of the anterior margin which may be minutely and inconspicuously denticulate or almost fringed. In the specimen collected by Rev. R. F. Black the margin of the lateral and middle lobes is lacerate-denticulate.

My understanding of Doctor Kränzlin's *D. ventricosum* is based on his original description; I have not seen the type.

ERIA Lindl.

Eria (Mycaranthes) Vanoverberghii sp. nov.

Planta robusta, erecta, foliosa. *Folia* ligulata, coriacea, acuta, disticha. *Pedunculi* terminale, circiter 6 bracteae imbricatae. *Bracteae inflorescentiae* lineari-lanceolatae, acutae, circiter 1.5 cm longae. *Pedunculus* rhachisque sericeo-pubescens. *Pedicellus* et *ovarium* pubescentia. *Sepala* externe pubescentia. *Sepala lateralia* oblonga, 5-nervia. *Sepalum dorsale* oblongi-lanceolatum. *Petala* oblonga, obtusa. *Labellum* 3-lobatum. *Lobi laterales* obtusi; *lobus medius* quadratus, apiculatus, callus parvus ad basim labelli; prope apicem labelli *tuberculum* permagnum; utroque in disco *callus* carinatus lobis lateralibus parallelus.

Plant robust, erect, probably 10 dm high (only upper part seen), leafy. *Leaves* ligulate, coriaceous, acute, sheathing, distichous, about 20 cm long, up to 22 mm wide. *Inflorescences* several (as many as 6) sheathed by large, imbricating bracts. *Peduncles* rather stout, about 2 dm long, whitish-pubescent. *Floral bracts* linear-lanceolate, acute, crowded, reflexed, the lowermost exceeding 2 cm in length, about 5 mm wide, longer than the densely pubescent flowers. *Lateral sepals* oblong, acute, 5-nerved, densely pubescent on the exterior surface, 7 mm long, 3.5 mm wide. *Upper sepal* oblong-lanceolate, 7 mm long, 3 mm wide, 5-nerved. *Petals* oblong, or nearly elliptical, obtuse, 5 mm long, about 2 mm wide. *Labellum* 3-lobed, 6 mm long. *Lateral* lobes triangular, obtuse, from the tip to base of sinus formed with middle lobe 1.5 mm long, *middle lobe* subquadrate, apiculate, 3 mm long, 4.5 mm wide. *Calli* 4, one in the middle of the base, one on each side near the sinus formed by the middle and lateral lobes, each continued from the free forward protruding apex to near the base of the lip, passing into a gradually diminishing keel, one at the apex, a large triangular, obtuse, erect tooth-like callus, 2 mm high, laterally flattened with the apex slightly reflexed. *Column* very short, free portion almost none.

LUZON, Bontoc Subprovince, *Father M. Vanoverbergh 789*, August 27, 1910, 1,550 meters above sea level.

Eria Vanoverberghii **is near** ***Eria longibracteata*** **Leavitt, but is unlike it in the dense inflorescence, large flowers, and very different calli.**

PHREATIA Lindl.

Phreatia (§ Euphreatia) infundibuliformis sp. nov.

Folia linearia. *Pedunculus* valde elongatus, prope basim fractiflexus, *bracteae* infundibuliformes, magnae. *Racemus* elongatus, gracilis. *Bracteae inflorescentiae* lineari-lanceolatae, acutae, *ovarium pedicellum* aequantes. *Sepala lateralia* ovato-

lanceolata. *Sepalum superius* oblongi-lanceolatum. *Petala* oblonga, angustata, obtusa. *Labellum* breviter unguiculatum; lamina *cordatum,* breviter apiculata. *Columna* minuta.

Leaves linear, much shorter than the peduncle, about 9 cm long, 5 to 7 mm wide, asymmetrical at the tip. *Peduncles* elongated, somewhat zig-zag below the raceme, the angles marked by the large infundibuliform bracts, 4 or 5 in number. *Bracts* about 1 cm long. *Peduncle* 14 to 27 cm long. *Raceme* 8 to 14 cm long, 5 to 7 mm through in fruiting specimens. *Bracts* of the raceme linear-lanceolate, 3 to 7 mm long, the lowermost ones equaling or exceeding the flowers on fruiting specimens. *Flowers* diminutive, white. *Lateral sepals* ovate-lanceolate, 1 mm long. *Upper sepal* oblong-lanceolate, about 1 mm long *Petals* narrowly oblong, obtuse, 1 mm long, 0.5 mm wide. *Labellum* 0.75 mm long, cordate, shortly apiculate, 3-nerved, very shortly and inconspicuously unguiculate. *Mentum* minute. *Column* diminutive.

MINDANAO, Province of Misamis Mount Malindang, Major E. A. Mearns & W. I. Hutchinson, *For. Bur. 4611*, May, 1906. Plants abundant at an altitude of 1,700 meters above sea level.

From nearly related Philippine species readily distinguished by the large infundibuliform bracts below the raceme. In habit closely resembling *P. myosurus* (Forst.) Ames.

Phreatia (§ Euphreatia) Mearnsii sp. nov.

Habitu *P. densiflorae* haud dissimilis. *Folia* ligulata. *Racemus* densiflorus. *Bracteae inflorescentiae* lanceolatae, acuminatae. *Sepala lateralia* triangulari-ovata. *Sepalum superius* simile. *Petala* oblongi-ovata, obtusa. *Labellum* trapezoideum.

In habit similar to *P. Vanoverberghii* and *P. densiflora.* *Leaves* ligulate, asymmetrical at the tip, up to 25 cm long, 1.6 to 2.5 cm wide, coriaceous. *Peduncle* up to 4 dm long, exceeding the leaves, with several lanceolate sheathing bracts below the raceme. *Bracts* about 2 cm long, the upper ones about 1 cm long. Raceme about 1 dm long (1 cm through when the capsules are nearly ripe). *Floral bracts* lanceolate, long-acuminate, 3.5 cm long, spreading, subrigid. *Flowers* yellow, numerous, crowded. *Lateral sepals* triangular-ovate, 1.5 mm long, subacute. *Mentum* 0.5 mm long. *Upper sepal* 1 mm long. *Petals* oblong-ovate, obtuse, 1.5 to 2 mm long, 1.5 mm wide at about the middle. *Capsule* ellipsoid, 3 mm long. *Pedicel* and *ovary* in fruiting specimens about 5 mm long.

MINDANAO, Province of Misamis, Mount Malindang, E. A. Mearns & W. I. Hutchinson, *For. Bur. 4592*, May, 1906. LUZON, Province of Pampanga, H. M. Curran, *For. Bur. 19313*, March, 1910.

Phreatia Mearnsii is nearly related to *P. aristulifera* Ames and *P. Vanoverberghii* Ames, but differs from them in details of the flowers. The petals of *P. Mearnsii* are not unguiculate nor in any sense rhombic in outline.

Phreatia (§ Euphreatia) Ramosii sp. nov.

Planta parvula. *Folia* linearia. *Pedunculus* folio longitudine fere aequalis vel longior. *Flores* albi. *Sepala lateralia* triangulari-lanceolata, obtusa. *Sepalum superius* ovatum, obtusum. *Petala* ovata, ad apicem rotundata. *Labellum* oblanceolatum vel obovatum. *Mentum* obtusum.

In habit similar to *Phreatia myosurus* (Forst.) Ames. *Plants* about 1 dm tall. *Leaves* linear, asymmetrical at the tip, 4 to 9 cm long, up to 5 mm wide, spreading, equaling the peduncle or slightly shorter. *Peduncle* slender, 5 to 10 cm long, bracts sheathing, about 5 mm long, acuminate, aristate. *Raceme* 2 to 4 cm long, about 7 mm through when the flowers are open. *Flowers* white, diminutive, about 1 mm apart. *Floral bracts* rounded, prolonged at the tip, aristate, 3 mm long, aristate tip 1.5 mm long. *Pedicel* and ovary 3 mm long. *Lateral sepals* about 2 mm long (forming a blunt *mentum* 0.5 mm long), triangular-lanceolate, obtuse. *Upper sepal* 1.75 mm long, broadly ovate, obtuse. *Petals* ovate, rounded at the tip, 1.5 mm long, about 1 mm wide. *Labellum* 2.5 mm long, oblanceolate or obovate, about 1 mm wide at the middle. *Column* simple.

LUZON, Province of Abra, Maximo Ramos, *Bur. Sci. 7140*, February 8, 1909. Epiphyte, found on small trees in forests.

Phreatia sulcata J. J. Smith.

In a preceding paper [6] I described a new species from the Philippines as *P. bracteata*. An examination of additional material from Luzon convinces me that the specimens cited under *P. bracteata* are conspecific with *P. sulcata* J. J. Smith. A series of specimens from Bontoc Subprovince, Luzon, collected in June, 1911, by Father M. Vanoverbergh, *No. 1289*, are most certainly referable to *Phreatia sulcata* and compare well with specimens from Sumatra.

Phreatia (§ Euphreatia) Vanoverberghii sp. nov.

Habitu *P. densiflorae* (Bl.) Lindl. haud dissimilis sed in foliis angustior et in racemo gracilior. *Folia* linearia. *Racemus* densiflorus. *Bracteae inflorescentiae* aristatae. *Sepala lateralia* ovata. *Sepalum superius* ovatum, obtusum, concavum. *Petala* unguiculata, rhombico-spathulata. *Labellum* unguiculatum, ad basim cuneatum, super medium dilatatum, ad apicem in laminam subrhombicum dilatatum.

[6] This Journal 4 (1909) Bot. 674.

Leaves linear, asymmetrical at the tip, 20 to 26 cm long, 1.5 to 1.7 mm wide. *Peduncle* up to 24 cm long, with several closely appressed bracts below the inflorescence. *Raceme* slender, about 1 cm long, very densely flowered, about 6 mm through prior to development of the capsules. *Floral bracts* equaling the flowers, 2.5 mm long, cuneate at the base, rounded, prolonged into a conspicuous aristate tip (cf. *P. aristulifera* Ames). *Pedicel* and ovary of expanding flowers 2 mm long. *Lateral sepals* about 1 mm long, ovate, forming a *mentum* 0.5 mm long. *Upper sepal* ovate from a broad base, 1 mm long, obtuse, about 1 mm wide. *Petals* cuneate at the base, roundish, obtuse, or rhombic above the base, 1.5 mm long, 0.75 mm wide near the tip. *Labellum* slightly less than 2 mm long, unguiculate, cuneate, dilated, above the middle elliptical or subrhombic, rounded, margin entire, about 1 mm wide near the tip. *Column* 1 mm long. *Pollinia* 8.

LUZON, Bontoc Subprovince, *Father M. Vanoverbergh 1115*, on trees, altitude 1,650 meters, February 21, 1911.

Here also belongs a series of specimens with leaves 3 dm long by 13 mm wide collected in Luzon, Province of Abra, by Maximo Ramos, *Bur. Sci. 7145*, altitude about 600 m, February 8, 1909.

In habit similar, in a very general way, to *P. densiflora* (Bl.) Lindl., from which it differs in the aristate floral bracts and very slender raceme.

BULBOPHYLLUM Thou.

Bulbophyllum lancipetalum sp. nov.

Pseudobulbi minuti. *Folia* elliptico-lanceolata, coriacea, acuta, prominente 1-nervia. *Scapus* foliis brevior. *Racemus* strictus. *Bracteae inflorescentiae* ovariis longiores lanceolatae, acuminatae, acutae. *Sepala lateralia* triangulari-lanceolata, ad apicem aristata. *Sepalum dorsale* simile, cymbiforme, acuminatum, acutum. *Petala* lineari-lanceolata, obtusa, pubescentia in margine. *Labellum* lingulatum ciliolatum. *Columna* stelidiis 2.

Rhizome stout, about 5 mm in diameter. *Pseudobulbs* small, about 1 cm long, pyriform. *Leaf* elliptic-lanceolate, 12 cm long, about 2.5 cm wide, coriaceous, acute, prominently nerved along the middle, tapering at base into an elongated petiole. *Petiole* 5 to 10 cm long, sulcate, rigid. *Scape* shorter than the leaves, up to 17 cm tall, sheathed by about five, loose, acute bracts 9 to 13 mm long. *Raceme* strict, spicate, 6 to 7 cm long, about 20-flowered. *Bracts* of the raceme surpassing the ovaries, lanceolate, acuminate, acute, the largest one about 5 mm long.

Lateral sepals triangular-lanceolate from a broad base, 7 mm long, tapering into a slender bristle-like tip, at base, in front protuberant, forming a rounded *mentum*. *Upper sepal* shorter than the laterals, about 6 mm long, cymbiform, acuminate, acute. *Petals* linear-lanceolate, obtuse, 4 mm long, 1-nerved, somewhat thickened at the tip, very finely pubescent. *Labellum* lingulate, about 4 mm long, margin ciliolate, strongly deflexed near the middle, base rotund when spread flat. *Column* minute with two erect stelidia.

MINDANAO, Province of Misamis, Mount Malindang, Major E. A. Mearns & W. I. Hutchinson, *For. Bur. 4608*, flower yellow-white, 2,400 m above sea level, June 4, 1906.

In general habit similar to *B. dasypetalum*, but very distinct from that species in the details of the inflorescence.

The specimen from Mindanao, Mearns & Hutchinson, *For. Bur. 4601*, referred tentatively to *B. adenopetalum* Lindl.[1] appears to belong here. From *B. adenopetalum* it differs in its larger leaves and in the absence of caudate tips to the lateral sepals. According to the brief description of *B. braccatum* given by Reichenbach f. in "Linnaea," *B. lancipetalum* appears to be distinct from that species. In the Philippines there is a puzzling group of Bulbophyllums, all so closely allied that for proper interpretation a careful study of many specimens will be necessary. To this group belong *B. adenopetalum* and *B. Ramosii* characterized by caudate-tipped lateral sepals, *B. dasypetalum* and *B. lancipetalum* characterized by triangular-lanceolate lateral sepals, shortly if at all caudate, and *B. braccatum* which is said to have apiculate petals. At the present time, from material at hand, a thorough study of this group is being made which will be published in the near future.

Bulbophyllum nutans (Lindl.) Reichb. f. in Walper's Ann. 6: 260; Lindley in Bot. Reg. (1839) Misc. 118; Bot. Mag. *t. 4418*.

This interesting species of the § *Cirrhopetalum* has come to hand from the Island of Polillo. The leaves are very thick, elliptic or nearly orbicular, 3 cm long by 17 mm wide or thereabouts, very shortly petioled, arising from diminutive, rugose, pyriform pseudobulbs, 1 cm long. Scape 1.5 to 2 dm tall, slender, with several minute, closely appressed, acute bracts. Umbel many-flowered, nodding. Bracts of the umbel linear, about 3 mm long, crowded. Pedicel slender, together with the ovary 5 mm long. Lateral sepals ligulate, 2 cm long. Upper sepal 5 mm long, lanceolate, prolonged into a slender, bristle-like tip, 3-nerved. Petals lanceolate, acuminate, acute, 3-nerved, about 3.5 mm long, margin of the upper half entire, margin of

[1] Orchidaceae 2: 206.

the lower half ciliated or serrulated. Labellum diminutive, lingulate, about 2 mm long, obtuse, fleshy, bicristate.

POLILLO, C. B. Robinson, *Bur. Sci. 9077*, August 9, 1909, growing on *Heritiera littoralis*, buds deep-yellow, flowers somewhat paler.

The plants figured in the "Botanical Magazine" have longer leaves, and larger pseudobulbs than the specimens from Polillo.

Bulbophyllum Ramosii sp. nov.

Folia oblonga, ad apicem rotundata. *Scapus* gracilis, *bracteis* tubularibus. *Flores* albi. *Bracteae inflorescentiae* lineares. *Sepala lateralia* triangularia, caudata. *Sepalum superius* concavum, lanceolatum, caudatum. *Petala* lineari-lanceolata, acuta, 1-nervia. *Labellum* lingulatum, ciliatum. *Columna* bifurcata.

Plant small, to the tip of the leaf not exceeding 1 dm. Rhizome comparatively slender, rooting freely. *Pseudobulbs* wanting, the leaves arising directly from the creeping rhizome. *Leaves* rigid, leathery, oblong, rounded at the tip, tapering gradually at the base, *lamina* up to 7 cm long, 11 mm wide, with a prominent mid-nerve. *Scape* weak, slender, longer than the leaves, up to 8 cm long, with several tubular bracts about 5 mm long below the raceme. *Raceme* lax, about 7-flowered. *Flowers* white. *Bracts* of the raceme linear, exceeding the pedicellate ovary, about 4 mm long. *Lateral sepals* triangular, prolonged into a slender caudate tip, triangular base about 3 mm long, caudate tip 5 mm long. *Upper sepal* shorter than the laterals, concave, lanceolate, caudate-tipped, 7 mm long. *Petals* linear-lanceolate, acute, 1-nerved, about 3 mm long. *Labellum* lingulate, strongly bent at the middle, apical half nearly 2 mm long, oblong, rounded at the tip, margin coarsely hairy, basal half sulcate, when spread out orbicular. *Column* at the tip bifurcate.

LUZON, Province of Laguna, San Antonio, Maximo Ramos, *Bur. Sci. 12091*, August 26, 1910.

This is a smaller species than *Bulbophyllum adenopetalum* Lindl., to which it is closely allied. The flowers resemble the sketch of *B. adenopetalum*, by Lindley, preserved at Kew. The leaves are much shorter than in Lindley's material and much broader in relation to their length. Both species are different from *B. dasypetalum* Rolfe, in their caudate-tipped lateral sepals, and ciliolate lips. *B. braccatum*, a Philippine species described by Reichenbach f., belongs in the same group. Of this species, unfortunately, I have seen no material; no type is designated by its author. The description is vague, no details regarding the foliage being given, and, in view of the fact that there is a group of species in the Philippines closely allied with *B. adenopetalum* and *B. dasypetalum*, wholly inadequate for purpose of identification and useless for comparative studies.

DENDROCHILUM Blume.

Dendrochilum (§ Acoridium) longibulbum sp. nov.

Pseudobulbi graciles, fusiformes, elongati. *Folia* linearia, obtusa. *Pedunculus* gracilis, filiformis, folio longior. *Racemus* 4 ad 5 cm longus. *Bracteae inflorescentiae* distichae. *Sepala lateralia* lanceolata, acuta. *Sepalum superius* lateralibus simile. *Petala* cuneato-ovata. *Labellum* crassum, 3-lobatum; *lobi* laterales semicrescentiformes; *lobus medius* subquadratus, apiculatus, prope basim *bicallosus*, et callo medio vel mammilla instructus.

Pseudobulbs densely clustered, elongated, cylindric, rugose, 2.5 to 4 cm long, 2 to 4 mm in diameter when dry. *Leaf* shortly petioled, linear, obtuse, 7 to 14 cm long, 5 to 7 mm wide, midnerve prominent. *Peduncle* filiform, slightly exceeding the leaf, up to 1 dm long. *Raceme* 4 to 5 cm long, loosely many-flowered (fls. about 15), subtended by 2 or 3, glumaceous, scarious, imbricating, *empty bracts;* flowers white, 2 to 3 mm apart, distichous, *floral bracts* exceeding and concealing the ovary. *Lateral sepals* lanceolate, acute, about 3.5 mm long, 1.5 mm wide, 3-nerved. *Upper sepal* similar, 3.5 mm long. *Petals* cuneate-ovate, acute, 3 mm long, about 1.5 mm wide, 3-nerved. *Labellum* fleshy, 3-lobed, 1.5 mm long; *lateral lobes* half crescent form, obtuse, shorter than the middle lobe; middle lobe 0.75 mm long, subquadrate with a triangular tooth in front. On the disk of the lip there are three *calli*, one in the middle at the bottom of the depressed or subsaccate base and one on each side near the base of each lateral lobe. *Column* typical of the section.

LUZON, Bontoc Subprovince, *Father M. Vanoverbergh 782*, altitude 1,550 m, August 23, 1910.

Dendrochilum longibulbum might readily be mistaken for a narrow-leaved form of *D. pumilum*, but its smaller flowers and very different petals are differentiating characters.

Of the sixty or more species of this genus which have been described from Philippine material all are endemic; I have been unable to discover a single exception. Of the described Philippine species I have examined every one except *D. convallariaeforme* Schauer (which is supposed to include *D. Copelandii* Ames) and *D. maleolens* Kränzl., the latter a recently described species which is said to be close to *D. oliganthum* (Ames) Pfitzer.

Dendrochilum microchilum (Schlechter) Ames Orchidaceae 2 (1908) 87.

Platyclinis microchila Schlechter in Bull. Herb. Boiss. II 6 (March, 1906) 302.

Acoridium venustulum Ames in Proc. Biol. Soc. Wash. 19 (Sept., 1906) 147.

Dendrochilum venustulum (Ames) Pfitzer in Engl. Pflanzenreich 32 (1907) 116.

In my second volume of "Orchidaceae," having no material and judging wholly from the original description, I referred to *Platyclinis microchila* as a near affinity of *Dendrochilum tenue* Pfitzer. In a letter dated November 7, 1910, Doctor Schlechter states that *Dendrochilum microchilum* and *D. venustulum* Pfitzer are identical.

Dendrochilum (§ Acoridium) Vanoverberghii sp. nov.

Pseudobulbi pyriformes in sicco rugosi. *Folia* linearia, acuta. *Pedunculus* folio longior. *Inflorescentia* laxiflora. *Bracteae* glumaceae, ovario longiores. *Sepala lateralia* ovato-lanceolata, acuta. *Sepalum superius* oblongi-lanceolatum, acutum. *Petala* lanceolata, acuta. *Labellum* crassum, 3-lobatum, *lobi laterales* obtusi, *lobus medius* apiculatus.

Whole plant, including the peduncle, up to 24.5 cm high, as shown by the type. Pseudobulbs elongated pyriform, 1.5 cm long, about 5 mm in diameter at the base, rugose in dried specimens, clothed with the fibrous remains of sheathing bracts. *Leaves* linear, acute, 4.5 to 7.5 cm long, about 2.5 mm wide, grass-like when dry. *Peduncle* free, from the summit of the pseudobulb, slender, graceful, about twice longer than the leaf, about 1 dm high, not exceeding 13.5 cm in the type. *Inflorescence* loosely flowered, subtended by two imbricating, scarious bracts; flowers about 3 mm apart, distichously arranged. *Pedicel* and *ovary* 2 mm long, concealed by a glumaceous bract. When fresh the flowers are white with a "red" lip, in dried specimens they are brownish. *Lateral sepals* ovate-lanceolate, acute, 3-nerved, 2.5 mm long, 2 mm wide near the base. *Upper sepal* oblong-lanceolate, acute, 2.5 mm long, 1 mm wide, middle nerve conspicuous (in dried specimens). *Petals* lanceolate, acute, 3-nerved, 2 mm long, 1 mm wide. *Labellum* fleshy, 1.5 mm long, somewhat saccate near the base, 3-lobed; lobes subequal, *laterals* rounded, obtuse in front; *middle lobe* longer than the laterals, subquadrate, apiculate, broader than long. *Column* minute, characteristic of the Section *Acoridium*.

LUZON, Bontoc Subprovince, *Father M. Vanoverbergh*, November–December, 1910.

Dendrochilum Vanoverberghii appears to be a near relative of *D. exile*,[1] but differs from it in the details of the flower, and in general habit, the leaves and peduncle of *D. exile* being about subequal, while in *D. Vanoverberghii* the peduncle exceeds the leaf to a conspicuous extent. *D. MacGregorii* is also a near relative but the lip-characters of that species and the dense inflorescence are conspicuous differentiating peculiarities.

[1] Orchidaceae 2: 85 *fig.*

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 1, April, 1912.

ADDITIONAL PHILIPPINE SYMPLOCACEAE, II.

By A. BRAND.
(Sorau, Germany.)

Since the publication of my first paper under the above title [1] a considerable number of specimens of *Symplocos* have been collected in the Philippines, and in addition to the material secured through the medium of recent exploration, there is now preserved in the herbarium of the Bureau of Science, a set of specimens collected by Mr. A. Loher in Luzon in the year 1906, distributed from the Kew Herbarium. This accumulated material has been submitted to me by Mr. Merrill for study, and I have fortunately been able to examine the Philippine specimens distributed by Mr. A. D. E. Elmer, preserved in the Delessert Herbarium.

Three new species of *Symplocos* described by Mr. Elmer [2] which were previously known to me only by description, are represented in the Delessert Herbarium by cotypes. I consider that two of his proposed species are valid, but the third, *S. angularis* Elm., I must consider to be a synonym of *S. Cumingiana*. It is not surprising that Mr. Elmer considered *Symplocos angularis* to be a distinct species, for *Symplocos Cumingiana* has exceedingly variable leaves, and specimens with small, somewhat coriaceous leaves look quite different from those with large chartaceous ones. Having now a large series of specimens of *S. Cumingiana*, a species previously rather imperfectly known to me, I must confess that I erred in referring to it *For. Bur. 8254 Curran & Merritt* [3]; I now consider that this number represents a distinct species, readily distinguished from *S. Cumingiana* by its bright leaves and purplish midribs.

In the material examined two additional new species were discovered, so that the total number now known from the Archipelago has been increased to twenty-six. The new species

[1] This Journal 4 (1909) Botany 107–110.
[2] Leafl. Philip. Bot. 2 (1908) 508–510.
[3] L. c.

all belong to the section *Bobua*, and accordingly the key to the species given in my previous paper must be changed as follows:

1. Inflorescentiae compositae.
   2. Folia ramos adpressa, imbricata ..... 3. *S. imbricata*
   2. Folia patentia haud imbricata.
      3. Corolla extus sericea.
         4. Stamina ca. 100; folia basi valde angustata ..... 4. *S. patens*
         4. Stamina ca. 60; folia basi plerumque rotundata.... 5. *S. floridissima*
      3. Corolla extus glabra.
         4. Stamina ca. 100..... 6. *S. polyandra*
         4. Stamina 25 ad 50.
            5. Inflorescentiae glabrae ..... 7. *S. Hutchinsonii*
            5. Inflorescentiae pilosae.
               6. Fructus globosus.
                  7. Inflorescentiae axillares ..... 8. *S. ferruginea*
                  7. Inflorescentiae terminales ..... 9. *S. Ahernii*
               6. Fructus ellipsoideus ..... 10. *S. adenophylla*
1. Inflorescentiae simplices.
   2. Flores sub foliis prominentes ..... 11. *S. oblongifolia*
   2. Flores in axillis foliorum.
      3. Inflorescentiae terminales ..... 12. *S. imperialis*
      3. Inflorescentiae axillares.
         4. Ramuli glabri.
            5. Flores in axillis foliorum sessiles, fasciculati..... 13. *S. Loheri*
            5. Flores spicati vel racemosi.
               6. Flores racemosi.
                  7. Folia 1.5 ad 2.5 cm. lata..... 14. *S. fragrans*
                  7. Folia 3 ad 3.5 cm lata ..... 15. *S. peninsularis*
               6. Flores spicati.
                  7. Folia minus quam 3 cm (vel raro 3 cm) lata.
                     8. Inflorescentiae multo longiores quam petioli.
                        9. Folia chartacea ..... 16. *S. betula*
                        9. Folia coriacea.
                           10. Nervus intermedius in facie inferiore foliorum flavidus ..... 17. *S. Whitfordii*
                           10. Nervus intermedius in facie inferiore foliorum purpurascens ..... 18. *S. purpurascens*
                     8. Inflorescentiae vix longiores quam petioli. 19. *S. curtiflora*
                  7. Folia plus quam 3 cm lata ..... 20. *S. Cumingiana*
4. Ramuli ferruginei vel pilosi.
   5. Fructus inconspicuus, vix 2.5 mm in diametro. 21. *S. inconspicua*
   5. Fructus 4 ad 5 mm longus.
      6. Folia pleraque plus quam 4 cm longa.
         7. Fructus cylindricus, pilosus ..... 29. *S. cagayanensis*
         7. Fructus ovoideus vel ovoideo-globosus, glaber.
            8. Folia subtus ad costam dense rufo-setosa. 23. *S. luzoniensis*
            8. Folia subtus ad costam glabra vel parce ciliata. 24. *S. Merrilliana*

6. Folia pleraque minus quam 4 cm longa.
   7. Folia utrinque glaberrima ..... 25. *S. palawanensis*
   7. Folia plus minus pilosa ..... 26. *S. depauperata*

1. **Symplocos confusa** Brand in Pflanzenreich 6 (1901) 88.

Additional material: NEGROS, Province of Negros Oriental, Dumaguete, Cuernos Mountains, *Elmer 9532*, May, 1908; Canlaon Volcano, mossy forest on ridges, *Merrill 6990*, April, 1910.

In these specimen the corolla is somewhat more hairy, than is usually the case. The species is now known from the Islands of Luzon, Negros, and Mindanao.

3. **S. imbricata** Brand in Philip. Journ. Sci. 4 (1909) Bot. 108.

Descriptio aucta:

Frutex vel arbor 3 ad 9 m alta, ramulis purpureis vel atro-purpureis, glabris. Folia crasse coriacea, ramulis adpressa et imbricata, 5 ad 6 cm longa, 2.5 ad 4 cm lata, ovata vel late ovata, serrato-dentata, utrinque glaberrima, in apicem brevem subito producta, basi leviter cuneata vel truncata, costa supra impressa; petiolus 5 ad 10 mm longus. Spicae terminales et subterminales, compositae, glabriusculae, juniores densae, vetustiores laxiflores, petiolo multo longiores, fructiferae incrassatae et elongatae; bractae 3, ovato-rotundatae, sericae, calycem occultantes; calycis tubus brevissimus, glaber, lobi rotundati, obtusi, sericei, tubo multo longiores, post defloration em supra ovarium glabrum convergentes; corolla alba vel lutea, glabra; stamina 50 ad 60; stylus glaber, calyce duplo longior. Fructus niger, ovato-ampulliformis, 10 ad 12 mm longus, valde rugosus, glaber, trilocularis, sed loculis binis plus minus abortientibus; lobi calycini discum comose superantes.

Additional material: LUZON, Benguet Subprovince, Mount Pulog, altitude 2500 m above sea level, *Merrill 6584*, May, 1909, with mature fruit, *For. Bur. 18091 Curran, Merritt, & Zschokke*, January, 1909; Mount Ugo, *Bur. Sci. 5715 Maximo Ramos*, December, 1908, in flower: Bontoc Subprovince, Bauco, in forests, 1650 m above sea level *Father M. Vanoverbergh 1004*, Feb.-Mar., 1911.

4. **S. patens** C. Presl Rel. Haenk. 2 (1831) 61, forma 1 **eupatens** Brand in Philip. Journ. Sci. 3 (1908) Bot. 5.

Additional material: LUZON, Province of Abra, *For. Bur. 14574 Darling*, February, 1909; Baco, 10 m above sea level, *For. Bur. 14668a Darling*, February, 1909.

The specimen first cited has flowers less silky than is usual, and is a connecting form between *S. patens* and *S. polyandra*.

Forma 2 **ciliata** (C. Presl) Brand in Philip. Journ. Sci. 3 (1908) Bot. 5 (*S. ciliata* C. Presl l. c.)

Ramuli glabri. Petiolus ca. 3 cm longus.

LUZON, Bontoc Subprovince, Bauco, in forests, altitude 1650 m above sea level, *Father M. Vanoverbergh 1300*, June-July, 1911.

A tree, 6 m high, now discovered by the American botanists for the first time.

5. **S. floridissima** Brand in Pflanzenreich 6 (1901) 35, var. **serrata** Brand in Philip. Journ. Sci. 4 (1909) Bot. 108.

Descriptio aucta:

Arbor 10 m altus, ramulis atropurpureis glabris. Folia tenuiter coriacea, 10 ad 13 cm longa, 4 ad 7 cm lata, ovalia vel elliptica, grosse serrata, utrinque glabra, in apicem brevem subito producta, basi nunc rotundata, nunc cuneata; petiolis ca. 2 cm longus. Paniculae puberulae, petiolo 4- ad 6-plo longiores, pedicellis calycem acquantibus vel superantibus; bracteae minimae; calyx dense ferrugineus, lobis rotundato-triangularibus tubum aequantibus; corolla calyce duplo longior, 5-partita, extus sericea; stamina ca. 60; stylus glaber, calyce triplo longior; ovarium dense sericeum. Fructus nigro-brunneus ca. 10 mm longus, ampulliformis.

Additional material: LUZON, Province of Laguna, San Antonio, *Bur. Sci. 12015 Ramos*, August, 1910.

The leaves are less serrate than in the type; a form connecting typical *S. floridissima* with the variety.

5. **S. polyandra** Brand in Pflanzenreich 6 (1901) 36.

Additional material: LUZON, Province of Pangasinan, *For. Bur. 13480 Medina*, February, 1909, the timber used in house construction.

8. **S. ferruginea** Roxb. var. **philippinensis** Brand in Philip. Journ. Sci. 3 (1908) Bot. 6.

Additional material: LUZON, Benguet Subprovince, Baguio, *Elmer 8761*, March, 1907: Province of Laguna, Cavinti, *Loher 6231;* San Antonio, *Bur. Sci. 10995 Ramos*, August, 1910 (a tree 12 m high, with white flowers): Province of Nueva Ecija, *For. Bur. 22194 Alvarez*, December, 1910. MARINDUQUE, Mount Tayubao, altitude 600 m above sea level, *For. Bur. 12168 Rosenbluth*, April, 1908, tree 8 m high, diameter 15 cm, common name *bocboc*.

This is the first *Symplocos* to be found on Marinduque Island. Known otherwise from Luzon and from Dinagat.

9. **S. Ahernii** Brand in Philip. Journ. Sci. 3 (1908) Bot. 6.

Additional material: LUZON, Benguet Subprovince, Sablan, *Bur. Sci. 12717 Fénix*, November-December, 1910, in flower, common name *chaniusiu:* Province of Tayabas, Lucban, *Elmer 7908*, May, 1907.

13. **S. Loheri** Brand sp. nov.

Arbor (?) glaberrima. Folia ad apices ramulorum congesta, subcoriacea, oblonga vel oblongo-lanceolata, 6 ad 7 cm longa, 1.5

ad 2 cm lata, integerrima, breviter et sensim apiculata, basi in petiolum vix 1 cm longum, flavidum, subalatum, sensim et valde attenuata, costa supra impressa et caniculata, subtus prominula, flavida. Flores ignoti, in axillis foliorum sessiles, ad 5 fasciculati (ex fructibus junioribus). Fructus oblongo-cylindricus, laete brunneus, ca. 10 mm longus, lobis calycinis flavescentibus discum occulantibus.

LUZON, Province of Rizal, Angilog, *Loher 6192*, March, 1906.

This is the first *Symplocos* with fasciculate flowers to be found in the Philippines. Its closest ally seems to be *Symplocos congesta* Benth., of southern China. The number of *Symplocos* species with fasciculate flowers is not great.

14. **S. fragrans** Elmer, Leafl. Philip. Bot. 2 (1908) 508.

Ramuli glabri purpurascentes. Folia juniora chartacea, vetustiora subcoriacea, elliptica vel oblonga, 4.5 ad 6.5 cm longa, 1.5 ad 2.5 cm lata, integerrima, utrinque glaberrima, in apicem longiusculum subito producta, basi cuneata, costa supra impressa, subtus prominula, flavida, petiolus 5 ad 8 mm longus, purpurascens, haud alatus. Inflorescentiae minutissime et adpresse hirtellae, petiolo multo longiores, laxiflorae; pedicelli calyce multo longiores; bracteae lanceolatae, hirtellae; calyx minimus hirtellus, lobis ovatis tubo subbrevioribus; corolla glabra calyce duplo longior; stamina ca. 50; stylus claviformis, crassiusculis, cum ovario hirtellus. Fructus mihi non visus.

NEGROS, Dumaguete, Cuernos Mountains, *Elmer 9875*, April, 1908.

The description is taken from the specimen preserved in the Delessert Herbarium.

17. **S. Whitfordii** Brand in Philip. Journ. Sci. 3 (1908) Bot. 8.

Additional material: LUZON, without locality, *Loher 6199:* Province of Laguna, Mount Banajao, *Loher 6201, 6207:* Province of Tayabas, Lucban, *Elmer 7487*, May, 1906, distributed as *S. lancifolia;* same locality, *Elmer 7850, 9103:* Benguet Subprovince, Mount Tonglon, altitude 1800 m above sea level, *Merrill 8005*, May, 1911, a tree 6 to 8 m high. NEGROS, Canlaon Volcano, *Merrill 7031, Phil. Pl. 239 Merrill*, April, 1910, growing at an altitude of 2100 m above sea level.

18. **S. purpurascens** Brand sp. nov.

Symplos Cumingiana Brand in Philip. Journ. Sci. 4 (1909) Bot. 110, non Brand in Pflanzenreich 6 (1901) 58.

Glaberrima. Ramuli teretes purpurascentes. Folia coriacea, elliptica vel oblonga, 4.5 ad 6 cm longa, 2 ad 2.5 cm lata, breviter et obtuse apiculata, basi sensim in petiolum subalatam, purpurascentem, 5 ad 10 mm longum attenuata, integerrima, utrinque

nitida, costa utrinque purpurascens, supra impressa, subtus prominula, nervi secundarii in foliis junioribus purpurascentes, in vetustioribus flavidi. Inflorescentia spicatae, petiolo 2- ad 4-plo longiores, pauci- et laxiflorae; bracteae minimae, ovato-triangulares; calyx glaber, lobis rotundatis tubo subbrevioribus; corolla glabra, calyce triplo longior; stamina (ex unico flore) 45; stylus crassiusculus, claviformis; ovarium glabrum. Fructus mihi non visus.

LUZON, Province of Zambales, Mount Tapulao, *For. Bur. 8254 Curran & Merritt*, December, 1907, altitude 1500 m.

19. **S. curtiflora** Elmer Leafl. Philip. Bot. 2 (1908) 509.

Frutex glaber, ramulis purpurascentibus, apice viridescentibus. Folia chartacea, 5 ad 7 cm longa, 2 ad 3 cm lata, oblonga vel elliptica, integerrima, in apicem longiusculum subito producta, basi cuneata, costa subtus prominula, flavida, petiolus ca. 1 cm longus. Inflorescentiae spicatae, breves, petiolo haud vel vix longiores, densiflorae, sericeae; calyx glaber, lobis rotundatis tubum aequantibus; corolla (alabastra tantum vidi) videtur calyce triplo longior, glabra; stamina ca. 35 (?); stylus glaber. Fructus viridis globosus, glaber, ca. 4 mm in diametro; lobis calycinis brevissimis coronatus.

NEGROS, Dumaguete, Cuernos Mountains, *Elmer 9802*, April, 1908; Mount Marapara, altitude 1200 m above sea level, *For. Bur. 13624 Curran & Foxworthy*, September, 1909.

20. **S. Cumingiana** Brand in Pflanzenreich 6 (1901) 58.
S. angularis Elmer Leafl. Philip. Bot. 2 (1908) 510.

Frutex 2 m altus, ramulis glabris. Folia 6 ad 17 cm longa, 2.5 ad 6.5 cm lata, valde variabilia, elliptica vel oblonga, leviter undulata vel serrata, utrinque glaberrima, breviter apiculata in petiolum nunc brevissimum nunc longiorem flavidum sensim attenuata. Spicae puberulae, 5- ad 10-florae; bracteae sericeae, lanceolato-acutae; calycis tubus subglaber, lobi rotundati sericei; corolla alba, calyce duplo longior; stamina ca. 25; ovarium glabrum. Fructus 9 ad 11 mm longus, dilute brunneus vel atroviridis, glaber, rugosus, cylindricus, trilocularis, exocarpio tenui.

Additional material: LUZON, Benguet Subprovince, Baguio, *Williams 1308*, August, 1904, *Elmer 8736, 8554, 8695*, March, 1907, *For. Bur. 13497 Ramos*, May, 1911; *Bur. Sci. 2521 Mearns*, April, 1907. NEGROS, Cuernos Mountains, *Elmer 10324*, June, 1908, distributed as *S. ferruginea;* Canlaon Volcano, *Phil. Pl. 244 Merrill*, April, 1910, distributed as *S. curtiflora.*

22. **S. cagayanensis** Brand sp. nov.

Frutex vel arbor parva ca. 4 m alta, ramulis sordide villosis. Folia chartacea vel subcoriacea, elliptica vel oblonga, 4 ad 6.5 cm longa, 1.5 ad 3 cm lata, repanda vel subtiliter denticulata, juniora dense pilosa, vetustiora praeter costam glabrata, breviter apiculata, basi cuneata costa subtus valde prominula, petiolus 4 ad 8 mm longus, sordide hirtus. Spicae villosae, laxi- et pauciflorae, petiolo ca. triplo longiores; fructus juniores et flores vetustiores brevissime pedicellati, flores juniores sessiles; bracteae ovato-triangulares, bracteolae lanceolatae, pilosae; calyx pilosus, lobis lanceolatis tubum aequantibus; corolla lutea, glabra, lobis calycinis duplo longior; stamina ca. 25, corolla sublongiora; ovarium glabrum, stylus glaber, elongatus, in fructu juniore persistens. Fructus viridis, pilosus, oblongis, 9 ad 10 mm longus, lobis calycinis brevissimis coronatus.

LUZON, Province of Cagayan, Mission River, *For. Bur. 16725 Curran*, March, 1909 (type); Mount Ababaca, altitude 300 m, *For. Bur. 18469 Alvarez*, Feb.-March, 1909: Province of Rizal, Angilog, *Loher 6190*, March, 1906; without locality, ex Herb. Ateneo de Manila, collector unknown (fruiting specimen).

With some hesitation I refer also to this species a specimen collected by Maximo Ramos in 1909 on Mount Bagagan, Province of Abra (*Bur. Sci. 7207*). It differs from the species as described in its larger leaves (up to 8 cm long) and denser pubescence. The specimen *Vidal 2141*, Province of Nueva Ecija, referred previously to *S. luzoniensis*[4] may be *S. cagayanensis*, judging from the pilose fruits.

23. **S. luzoniensis** Rolfe in Journ. Bot. 24 (1886) 348.

Frutex ramulis rufo-setosis. Folia chartacea vel fere subcoriacea, 4 ad 7 cm longa, 1.5 ad 2.5 cm lata, lanceolata vel oblongo-lanceolata, crenato-serrata vel serrata, praeter nervum medium setosum glabra; spicae villosae, 4- ad 12-florae, petiolo 2- vel 3-plo longiores; bracteae lanceolatae, villosae; calycis lobi lanceolati; corolla calyce duplo longior; stamina ca. 25 corolla sublongiora; stylus glaber; ovarium breviter pilosum. Fructus junior ovoideus, calyce coronatus, glaber, rugosus.

LUZON, Province of Rizal, Angilog, *Loher 6194*, March, 1906.

This specimen agrees fully with the original description, the type specimen from Mount Banajao, being unknown to me, except that the ovary is called glabrous, while in my specimen it is slightly hairy. I think, however, the pubescence of the ovary may be easily overlooked, if only superficially examined.

[4] This Journal 3 (1908) Bot. 9.

24. S. Merrilliana Brand in Philip. Journ. Sci. 3 (1908) Bot. 9.

Additional material: LUZON, Province of Laguna, Mount Banajao, *Bur. Sci. 6081, 6547, 9803 Robinson, Loher, 5696, 6179*, February, 1906: Benguet Subprovince, *For. Bur. 10839 Curran*, December, 1908; Baguio and vicinity, *Bur. Sci. 11978 Robinson*, May, 1911; Mount Tonglon, *Bur. Sci. 5387 Ramos*, December, 1908.

One of the specimens collected by Dr. Robinson (*Bur. Sci. 6547*) grows at an altitude of only 1250 m above sea level and has broader leaves than the others. The specimen collected by Mr. Curran is from a larger tree than is usual; it is 7 m high.

26. S. depauperata Merrill in Govt. Lab. Publ. (Philip) 29 (1905) 45.

Additional material: LUZON, Province of Benguet, Baguio, *Elmer 8546, 8594, 8805*, March, 1907, *For. Bur. 14149 Merritt*, December, 1908, *For. Bur. 18301 Alvarez*, December, 1908; Mount Pulog, *For. Bur. 18059, 18075, 18107, Curran, Merritt, & Zschokke*, January, 1909; Mount Tonglon, *For. Bur. 14166 Merritt*, December, 1908; Mount Ugo, *Bur. Sci. 5833 Ramos*, December, 1908: Province of Rizal, Mountains back of San Mateo, *L. Guerrero*, 1910.

The specimens collected on Mount Pulog are of peculiar interest. *No. 18107* has inflorescences longer than the leaves, *No. 18075* is a shrub 4 m high, and *No. 18059* grows at the extreme altitude of 2900 m above sea level.

Var. angustissima Brand var. nov.

Folia lanceolata, 9 ad 11 mm lata (in speciminibus ceteris 13 ad 24 mm lata).

LUZON, Bontoc Subprovince, Bauco, *Father M. Vanoverbergh 1095*, January, 1911.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 1, April, 1912.

THE MECHANISM OF CURVATURE IN THE PULVINI OF MIMOSA PUDICA.

By WILLIAM H. BROWN.

(From the Botanical Section of the Biological Laboratory, Bureau of Science, Manila, P. I.)

According to Pfeffer [1] the curvature resulting from the stimulation of the pulvini of the petioles of *Mimosa pudica* L., is due to a fall in the turgor of the cells of the lower or reacting half of the pulvini, which cells are compressed by the expansion of those of the upper turgid half. The decrease in turgor is shown by the stimulated pulvini becoming more flaccid and less rigid than the unstimulated ones, and by the passage of water from the cells, of the lower half, to the intercellular spaces. Pfeffer states that from the load required to prevent curvature it can be calculated that the energy necessary for movement is from two to five atmospheres and that hence the curvature can not be due to an active contraction of the protoplasm as was claimed by Vines [2] and by Gardener.[3]

A reduction in turgor might be produced by a change in the permeability of the plasma membranes, as claimed by Lepeschkin,[4] although as pointed out by Pfeffer this would necessitate a passage of dissolved substances from the cells. It seems more likely, as is thought by Pfeffer, that the reduction in the turgor of the cells of the pulvini is due to a decrease in the osmotic pressure of the cell-sap, which would allow an exosmosis of water without the dissolved substances. In either case, however, there should be a decrease in the number of osmotically active molecules in the cells, and if this were the cause of the curvature in the living pulvini, it seemed likely

[1] Pfeffer, W., Physiology of Plants, translated by A. J. Ewart, Oxford, 1906.
[2] Vines, Arb. Bot. Inst. Wurzburg 2 (1878) 146.
[3] Gardener, Annals of Botany 1 (1887–8) 366.
[4] Lepeschkin, W. W. Ber. Deutsch. Bot. Gesell. 26 (1908) 724.

that a similar curvature might be produced in dead pulvini if the proteids of the cells could be coagulated around the osmotically active substances thus forming osmotic cells. A reduction in the pressure within the cells could then be obtained by replacing the water in them with some liquid in which the osmotically active substances would not dissolve.

In order to test this hypothesis a large number of leaves were killed in boiling water. The pulvini used were those of the leaflets as these could be killed more quickly than the larger ones of the petiole. When leaves were killed after the production of curvature in the pulvini the pulvini remained curved; but attempts to kill the pulvini, before bending had taken place, were only partially successful as they were always stimulated, to some extent, by the treatment before losing the power of responding. However, thirty-eight leaves were obtained in which the curvature of the pulvini was only about half as much as it would have been if completed. In order to remove the water from the cells of the pulvini the leaves were run up through several grades of alcohol to absolute alcohol after which they were transferred to xylene. Since sugars are practically insoluble in this it would seem probable that there could be little or no osmotic pressure in the cells of the pulvini after they had been placed in it. Those pulvini which had been killed after complete curvature showed no change in shape, while in those in which the curvature was only partial, it had been completed. Since in these later cases the effect of replacing the water with xylene was to reduce the pressure in all the cells of the pulvini, it would seem that the completion of curvature could have been caused only by a reduction in the osmotic pressure in the cells of the concave or reacting half of the pulvini, without the aid of pressure due to the expansion of the cells of the convex half. Concave is used here to designate the half of the pulvinus toward which bending takes place, and convex the opposite half. These terms are substituted for upper and lower as applied to the pulvini of the petioles, since physiologically the upper half of the pulvini of the leaflets, with which we are dealing, corresponds to the lower half of the pulvini of the petioles. The production of curvature in the pulvini placed in xylene would indicate that the cell walls of the convex half were less elastic or more rigidly placed than those of the concave half, for an equal contraction of both halves would not produce curvature; and the osmotic pressure must have been largely removed from both. In this connection it is interesting to note that a longitudinal section of a pulvinus shows that on the concave half

there are several deep wrinkles running perpendicular to the longitudinal axis of the pulvinus. Any decrease in the pressure in the cells should cause a deepening of the wrinkles and consequently a curvature of the pulvinus. In living leaves the turgor of the cells of the concave half is probably not entirely removed when curvature is produced so that the pressure exerted on these by the turgid ones of the opposite side may at least increase the rapidity of movement.

After taking observations on the leaves in xylene they were transferred back to alcohol and run down through several grades of water. Those pulvini which had been killed after curvature was complete remained as before while those with only a partial curvature, which had been completed in xylene, straightened out to the same extent as when first killed. It would seem that this could have been due only to the restoration of the osmotic pressure in the cells of the concave or reacting half of the pulvini by the redissolving in the water of the osmotically active substances in the cells. In no case did the pulvini straighten out to a greater extent than when killed. The phenomena exhibited by these dead pulvini would seem to show that stimulation produces a relatively permanent reduction in the number of osmotically active molecules in the cells and that the extent of the movement which can be produced in the dead pulvini stands in some inverse ratio to the extent of this reduction. The reduction in the number of osmotically active molecules in the cells might be brought about by a chemical change in the contents of the cells or by a change in the permeability of the plasma membranes which would allow an exosmosis of some of the osmotically active substances dissolved in the water of the cells. While, in the case of *Mimosa*, the last possibility is not excluded the first would seem more probable, for if the loss in turgor is due to a change in the permeability of the membranes which allows the passage into the intercellular spaces of dissolved substances, a reverse change in permeability would not restore these lost substances to the cells, and turgidity could be restored only after the manufacture of additional osmotically active substances. If, however, the fall in turgor is due to a chemical change in the contents of the cells, a reverse change would restore turgidity. The closure of the leaf of *Dionaea*, which will be discussed more fully in a later paper, also appears to be due to a change in osmotic pressure. When the leaves close there is a passage of water from the cells of the inner or concave surface to those of the outer or convex, which causes the latter to become greatly

stretched. If the leaves are killed soon after closure and transferred from water to xylene, so that the osmotic pressure in the cells of the convex side is removed, the leaves open. A change in the permeability of the membranes might cause the passage of water from the cells of the inner surface but could hardly explain its entrance into those of the opposite side. In both *Mimosa* and *Dionaea* there appears to be a reduction in the osmotic pressure in the cells of the side toward which bending takes place. In *Mimosa* the water which passes from the cells goes largely into the intercellular spaces, while in *Dionaea* it is taken up by the cells of the opposite surface. In *Mimosa* movement is due to a fall in the turgor of the cells of the concave half of the pulvinus while in *Dionaea* it is due to the stretching of the cells of the convex surface.

The experiments with the dead pulvini of *Mimosa* show that changes in the osmotic pressure in the cells of the reacting half can cause movement without the aid of any vital phenomena and may therefore be taken as a confirmation of Pfeffer's conclusion that the movement of the living pulvini is due to changes in the osmotic pressure of the cells of the reacting half. Since the experiments with the pulvini of the leaflets and Pfeffer's with those of the petioles lead to similar conclusions it would seem that the reactions in the two cases are similar.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 1, April, 1912.

THE GENUS THAYERIA.

By EDWIN BINGHAM COPELAND.

(From the College of Agriculture, University of the Philippines, Los Baños, P. I.)

The genus *Thayeria* was described by myself about six years ago,[1] from sterile specimens collected in the mountains north of Zamboanga. The type species was given the name *T. Cornucopia.* It was found on a ridge above the source of the Sax River, a hurried visit to the place requiring three days of hard travel. I made the trip twice in 1905, the second time for the special purpose of finding fruiting fronds of this fern, but without success. In the same year I collected sterile specimens in Lepanto-Bontoc, but could find none fertile. Baker had described a New Guinea plant collected by Beccari, with essentially identical vegetative structures, as *Polypodium nectariferum;*[2] and these structures are so peculiar that it seemed probable that the fertile fronds were also alike. As far as my specimens showed, the identity was so perfect that I ascribed my Luzon plant to Baker's species, as *Thayeria nectarifera.*

Thayeria is a fern of the *Drynaria* group, as shown unmistakably by the very stout, fleshy rhizome, with a dense coat of brown scales, the structure and venation of the leaf, and very characteristic splitting off of the segments from the midrib, the humus-gathering habit, and various minor details. Its essential peculiarity is the specialization of branches of the rhizome, as phyllopodia. Each of these branches bears a single large leaf, the lower part of which is very broad, with the sides rolled together so as to form a broad cup like a cornucopia. The end of the branch is in the bottom of this cup, where it bears a dense cluster of roots. In the cup falling leaves and twigs collect and decay. Each branch makes therefore a sort of com-

[1] This Journal 1 (1906) Supplement 165, *Plate 28.*
[2] Malesia 2: 247, *Plate 65.*

plete physiological unit, the leaf and roots working together—so close together that the stem is hardly in evidence. The main rhizome produces these successive units and serves as their point of attachment, and also as a place of storage, at least of water. Except presumably in every young plants, which have not been seen, the rhizome bears no roots except numerous short ones confined to the side against the tree on which the fern grows. Their main function is certainly clinging; but they doubtless absorb some water, and very little food. In each sinus between the segments of the leaf is an evident gland, but I have seen no ants around these. For its mineral food the plant probably depends practically altogether on the detritus collected by the leaves.

In the perfection of the humus-gathering apparatus, and in the extension of the specialization to all parts of the plant, *Thayeria* has gone so far beyond any other ferns, or any other plants whatever, that I believed, and believe, that its recognition as a distinct genus is justified and advisable, though on vegetative characters alone.

Diels [3] reduced Baker's *Polypodium nectariferum* to *Drynaria*, and van Alderwerelt [4] did the same with *Thayeria Cornucopia*. Both authors seem to have failed to grasp the characteristics of the plants of which they were treating; and their placing these plants in *Drynaria* is unjustified even with such light as they had, while both of them place *Aglaomorpha meyeniana*, which they knew to agree in fructification with *Polypodium nectariferum*, in *Polypodium*, and maintain *Dryostachyum* as a distinct genus. *Aglaomorpha* is decidedly nearer *Dynaria* than is *Thayeria*. Van Alderwerelt has even included in his Section *Thayeria* a real *Drynaria*.

Thayeria was first collected fertile in the Philippines by Ramos, *Bureau of Science 7192*, in Abra, in northern Luzon. In 1910, I collected copious fruiting specimens on Mount Santo Tomas, in Benguet. These showed that the Luzon plant was distinct from that of New Guinea, with which it had been identified.[5] As the Zamboanga plant had been made the type of the genus, I immediately made another attempt to find its fruit but was again unsuccessful. Accompanied by Mr. Merrill, I went for it a fourth time in November, 1910. After we had hunted along the entire ridge where it is common sterile, and had

[3] Natürlichen Pflanzenfamilien 1⁴: 330.
[4] Bull. Dept. Agr. Indes Néerland. 21 (1908) 8.
[5] This Journal 6 (1911) Botany 140.

given it up, fertile fronds were detected in a single tree at a greater altitude. Fifteen fertile fronds were obtained by felling the tree.

With the ample material now in hand from Mindanao and Luzon, I conclude that the differences formerly found between them are not constant, but that all are one species. This differs from *Thayeria nectarifera* in not being dimorphous. As the accompanying plate shows, the sori are born, as in *Aglaomorpha*, on the constricted upper part of otherwise normal fronds; while the sterile lower part of the fertile frond of *Thayeria nectarifera* is pinnate, this frond being stipitate and not humus-collecting. The fertile pinnae of *Thayeria nectarifera* are also more constricted. The figure in "Malesia" shows no lamina between the sori, as is typical of *Aglaomorpha* § *Psygmium;* while *Thayeria Cornucopia* has more or less lamina everywhere, as the plate shows, but the amount of development of this wing is variable.

The known species of *Thayeria*, then, are two:

T. Cornucopia Copel., of Mindanao and Luzon.
T. nectarifera (Baker) Copel., of New Guinea.

ILLUSTRATION.

PLATE I. **Thayeria Cornucopia.** Herbarium specimen from the type locality. Photograph by Martin.



PLATE I. THAYERIA CORNUCOPIA Copel.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

A LIST OF THE MAMMALS OF THE PHILIPPINE ISLANDS, EXCLUSIVE OF THE CETACEA.

By NED HOLLISTER.

Order No. 418. Paper, $0.50 United States currency, postpaid.

This is the only recent attempt to enumerate the mammals of the Philippine Islands. The distribution of each species is given and the original descriptions are cited.

PRICE-LIST OF PHOTOGRAPHS.

For sale by the Bureau of Science.

Order No. 417. For free distribution.

This is a list of selected photographs from the splendidly complete collection of the Bureau of Science.

A MANUAL OF PHILIPPINE BIRDS.

By RICHARD C. MCGREGOR.

2 parts, 769 pages.

Order No. 103. Paper, $4 United States currency, postpaid.

Mr. McGregor spent some eight years in active field work, visiting many parts of the Archipelago, before beginning work on this book. Therefore, he was well prepared to undertake the preparation of the manual.

A Manual of Philippine Birds contains in compact form descriptions of all the known species of Philippine birds. The usual keys and diagnoses of orders, families, and genera help the novice in identification.

Under each species are found native, English, and scientific names, distribution by islands, descriptions of the birds and in many instances notes on nesting, migrations, and other habits.

A CHECK-LIST OF PHILIPPINE FISHES.

By DAVID STARR JORDAN and ROBERT EARLE RICHARDSON.

78 pages.

Order No. 102. Paper, $0.75 United States currency, postpaid.

This list will be found a convenient guide to the synonymy of Philippine ichthyology. The nomenclature is thoroughly revised and the distribution of each species within the Philippine Islands is given.

This check-list is uniform in size and style with McGregor and Worcester's Hand-list of Philippine Birds.

INDO-MALAYAN WOODS.

By FRED W. FOXWORTHY.

182 pages, 9 photographic plates.

Order No. 411. Paper, $0.50 United States currency, postpaid.

In Indo-Malayan Woods, Doctor Foxworthy has brought together a large amount of accurate information concerning trees yielding woods of economic value. The work is based largely upon the author's own experience in the Philippine and neighboring regions, but previous publications and information generously given by other dendrologists have been used to correlate commercial and native names of useful Indo-Malayan trees.

PHILIPPINE HATS.

By C. B. Robinson.

Order No. 415. Paper, $0.50 United States currency, postpaid.

This paper is a concise record of the history and present condition of hat making in the Philippine Islands. The various materials used and the different kinds of hats made in each center of production are fully described. Not of the least importance are the botanical identifications of the plants from which the hat materials are obtained.

The plates illustrate the hat materials and various kinds and grades of hats. A map of central Luzon shows the towns chiefly concerned in this industry.

THE COCONUT PALM IN THE PHILIPPINE ISLANDS.

149 pages, 30 plates.

Order No. 37. Paper, $1 United States currency, postpaid.

The reprint contains the following articles: On the Water Relations of the Coconut Palm (Cocos nucifera), by Edwin Bingham Copeland; The Coconut and its Relation to Coconut Oil, and The Keeping Qualities of Coconut Oil and the Causes of its Rancidity, by Herbert S. Walker; The Principal Insects Attacking the Coconut Palm (Parts I and II), by Charles S. Banks; with an introduction by Paul C. Freer.

A VOCABULARY OF THE IGOROT LANGUAGE AS SPOKEN BY THE BONTOK IGOROTS.

By Walter Clayton Clapp.

89 pages.

Order No. 408. Paper, $0.75 United States currency, postpaid.

The introduction to this vocabulary contains notes on pronunciation, vowels, diphthongs, consonants, verbs, conjugations, syllabication and reduplication. The vocabulary is given in Igorot-English and English-Igorot.

THE NABALOI DIALECT.

By Otto Scheerer.

65 pages, 29 plates.

AND

THE BATAKS OF PALAWAN.

By Edward Y. Miller.

7 pages, 6 plates.

Order No. 403. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The Nabaloi Dialect and the Bataks of Palawan are bound under one cover.

THE BATÁN DIALECT AS A MEMBER OF THE PHILIPPINE GROUP OF LANGUAGES.

By Otto Scheerer.

AND

"F" AND "V" IN PHILIPPINE LANGUAGES.

By Carlos Everett Conant.

These two papers are issued under one cover, 141 pages.

Order No. 407. Paper, $0.80 United States currency, postpaid.

Orders for these publications may be sent to the Business Manager, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below. Place give order number.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

THE SUBANUNS OF SINDANGAN BAY.

By EDGERTON B. CHRISTIE.

121 pages, 1 map, 29 plates.

Order No. 410. Paper, $1.25 United States currency, postpaid.

Sindangan Bay is situated on the northern coast of Zamboanga Peninsula. The Subanuns of this region were studied by Mr. Christie during two periods of five and six weeks, respectively.

The following is an abstract from the contents of Mr. Christie's report on the Subanuns: Habitat and history; relations with the Moros; material culture; houses; industries; trade; agriculture; family life; social customs; administration of justice; religion; the medicine man; ceremonies; tales; word-lists; physical measurements.

The 29 plates illustrate the Subanuns at work and at play; their industries, houses, altars, and implements; and the people themselves.

THE HISTORY OF SULU.

By NAJEEB M. SALEEBY.

275 pages, 4 maps, 2 diagrams.

Order No. 406. Paper, $0.75 United States currency, postpaid.

In the preparation of his manuscript for The History of Sulu Doctor Saleeby spent much time and effort in gaining access to documents in the possession of the Sultan of Sulu. It is fortunate that these records have now been translated and preserved in permanent form. This book is a history of the Moros in the Philippines from the earliest times to the American occupation.

STUDIES IN MORO HISTORY, LAW, AND RELIGION.

By NAJEEB M. SALEEBY.

107 pages, 16 plates, 5 diagrams.

Order No. 405. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

This volume deals with the earliest written records of the Moros in Mindanao. Doctor Saleeby was fortunately able to obtain exact copies of carefully preserved early records written in the Maguindanao dialect with Arabic characters. The author presents translations of these as well as 16 half-tone illustrations of certain pages from the originals. The names of the rulers of Maguindanao are recorded in five folding diagrams.

NEGRITOS OF ZAMBALES.

By WILLIAM ALLAN REED.

83 pages, 62 plates.

Order No. 402. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The introductory chapter deals with the general distribution of Negritos and with the distribution of the Philippine branch of the race. The succeeding chapters deal with the various industries, amusements, and social relations of these little men.

Plates from photographs, the greater part of which was taken for this publication, show ornaments, houses, men making fire with bamboo, bows and arrows, dances, and various types of the people themselves.

CONTENTS.

	Page
AMES, OAKES. Notes on Philippine Orchids with Descriptions of New Species, IV	1
BRAND, A. Additional Philippine Symplocaceae, II	29
BROWN, W. H. The Mechanism of Curvature in the Pulvini of Mimosa pudica	37
COPELAND, E. B. The Genus Thayeria	41

The "Philippine Journal of Science" is issued as follows:	U. S. currency.
Section A. Chemical and Geological Sciences and the Industries	$2.00
Section B. The Philippine Journal of Tropical Medicine	3.00
Section C. Botany	2.00
Section D. General Biology, Ethnology and Anthropology (Section D began with Volume V)	2.00
Entire Journal, Volume II, III, IV, or V	5.00
Entire Journal, beginning with Volume VI	7.00
Single numbers	.50
Volume I, 1906 (not divided into sections)	10.00
Supplement to Volume I (botany)	3.50
Volume I (without supplement)	6.50

Each section is separately paged and indexed.

Publications sent in exchange for the Philippine Journal of Science should be addressed: Library, Bureau of Science, Manila, P. I.

Subscriptions may be sent to the BUSINESS MANAGER, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below:

AGENTS.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

Entered at the post-office at Manila, P. I., as second-class matter.

VOL. VII, SEC. C, NO. 2 JUNE, 1912

THE PHILIPPINE JOURNAL OF SCIENCE

PAUL C. FREER, M. D., PH. D.
GENERAL EDITOR

SECTION C. BOTANY

E. D. MERRILL, M. S.
EDITOR

WITH THE COÖPERATION OF

F. W. GRAFF, B. S.; W. H. BROWN, PH. D.
S. N. WHITFORD, PH. D.



MANILA
BUREAU OF PRINTING
1912

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

REPORT OF THE INTERNATIONAL PLAGUE CONFERENCE.

Held at Mukden, April, 1911, under the auspices of the Chinese Government.

Edited by Ernest Marchoux, G. F. Petrie, Arthur Stanley, and Richard P. Strong.

483 pages, 18 plates (2 colored, 4 half-tones, 12 charts and maps).

Order No. 416. Cloth, $3.50; paper, $2.50 United States currency, postpaid.

The proceedings of this International Conference and information gained therefrom, together with the results of certain bacteriological investigations, constitute the present report.

Nothing hitherto has been published which gives such a complete and comprehensive account of the entire subject of pneumonic plague.

Delegates from America (United States of), Austria-Hungary, France, Germany, Great Britain, Italy, Japan, Mexico, the Netherlands, Russia, and China attended the Conference.

The Bureau of Science of the Government of the Philippine Islands has been appointed sole agent for the distribution of the printed proceedings of the International Plague Conference.

THE SUGAR INDUSTRY IN THE ISLAND OF NEGROS.

By Herbert S. Walker.

145 pages, 10 plates, 1 map.

Order No. 412. Paper, $1.25 United States currency, postpaid.

Considered from the viewpoint of practical utility, Mr. Walker's Sugar Industry in the Island of Negros is one of the most important papers published by the Bureau of Science. This volume is a real contribution to the subject; it is not a mere compilation, for the author was in the field and understands the conditions of which he writes. The following is a brief synopsis of the contents:

Tables of soil analyses, both chemical and physical; analyses of the cane, juice and bagasse; estimates based on actual information as to the costs of production and of cultivation; and estimates of the cost and location of possible central factories. The island is considered by sugar-producing districts; the area of cultivation and the production per hectare are given, and the possibility for future expansion discussed.

The plates illustrate various phases of sugar industry from the cultivation of the field to the transportation of sugar in native sailboats.

A MANUAL OF PHILIPPINE SILK CULTURE.

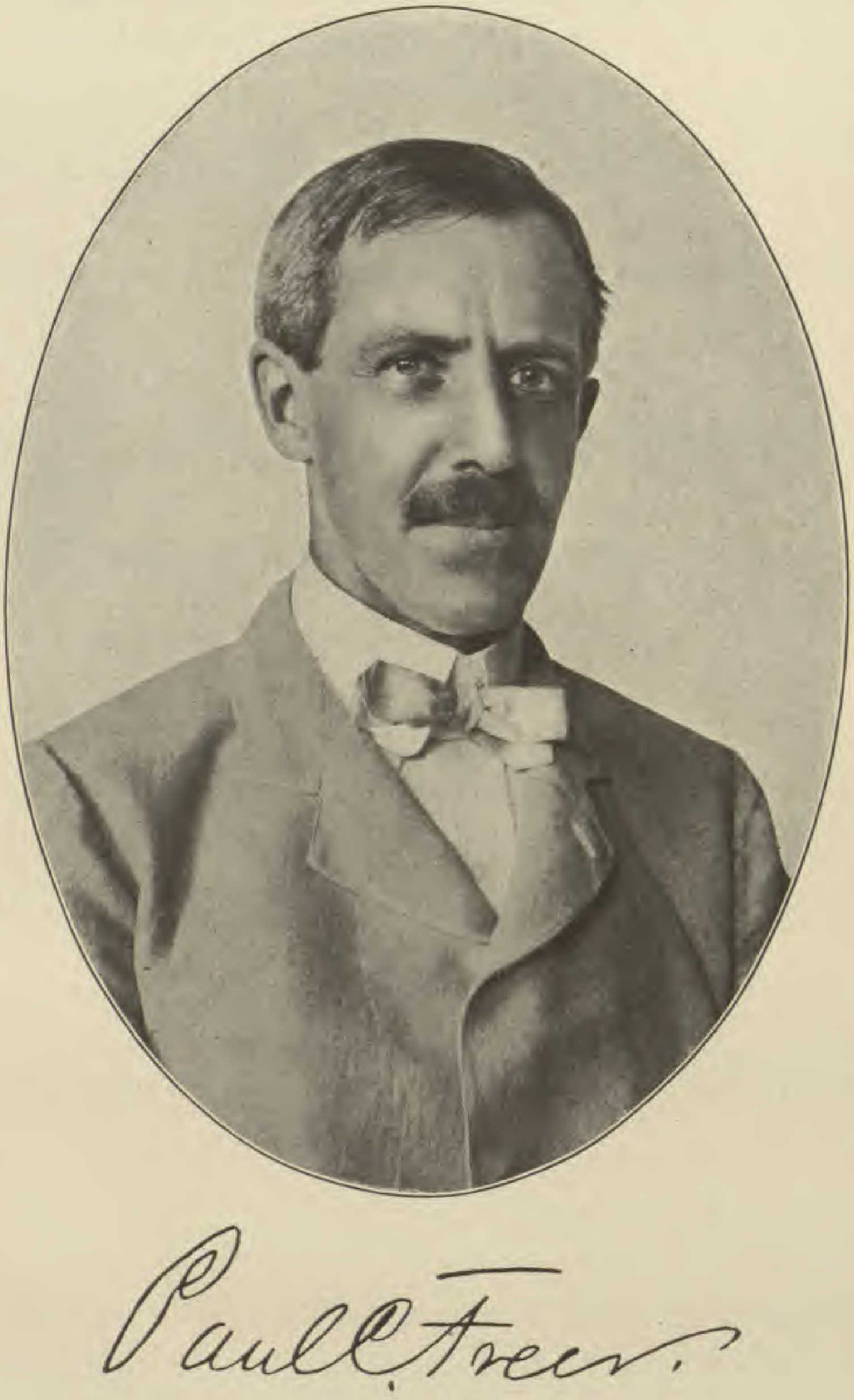
By Charles S. Banks.

55 pages, 20 plates.

Order No. 423. Paper, $0.75 United States currency, postpaid.

The silk industry is particularly adapted to be undertaken by persons with small capital, and like the making of hats in the Philippine Islands it should thrive with a little encouragement.

In A Manual of Philippine Silk Culture we have presented the results of several years' actual work with silk-producing larva together with a description of the new Philippine race. Half-tone plates illustrate in natural size silkworms in different stages of development, pupæ, adult moths, samples of cloth made from the silk, hand reel, and silk house. Other plates illustrate the various appliances used in raising silkworms and in winding silk; hand and power reels are illustrated; working drawings are given for a silk house and for a hand reel.



Paul C. Freer.

OBITUARY

Paul Caspar Freer

DIRECTOR OF THE BUREAU OF SCIENCE OF THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEAN OF THE COLLEGE OF MEDICINE AND SURGERY AND PROFESSOR OF
CHEMISTRY OF THE UNIVERSITY OF THE PHILIPPINES, AND
FOUNDER AND EDITOR-IN-CHIEF OF THIS JOURNAL

We are deeply grieved to announce the death of Doctor Freer at Baguio, Philippine Islands, on April the seventeenth, in his fifty-first year, from arterio-sclerosis and acute nephritis.

In an effort formally to express our sorrow and to honor his memory a memorial meeting of the members of the Staff of the Bureau of Science, the Council of the University of the Philippines, and the members of the Philippine Islands Medical Association will be held on July 1, 1912. The proceedings of this memorial meeting will be published in a future number of this Journal.

At a meeting of the members of the Staff of the Bureau of Science, held on the eighteenth day of April, the following resolutions were adopted:

Whereas it has pleased Almighty God in His Wise and Inscrutable Providence to remove from our midst Paul Caspar Freer, M. D., Ph. D., Director of the Bureau of Science of the Government of the Philippine Islands, since the time of its organization as the Bureau of Government Laboratories in the year 1901, Dean of the College of Medicine and Surgery, and Professor of Chemistry, University of the Philippines, and Founder and Editor-in-Chief of the "Philippine Journal of Science," who, for many years, has been our Leader, Counselor, and Friend; and

Whereas at best we can do little to indicate at this time our real appreciation of him as a man and as a worker for the general good: Therefore be it

Resolved, That we, the Members of the Staff of the Bureau of Science in Manila, Philippine Islands, do hereby express our deepest sorrow and keen feeling of personal loss in the death of Doctor Freer; and be it further

Resolved, That he holds a place of highest respect, admiration and appreciation both officially and personally in the hearts of all of us, and especially of those who were most intimately associated with him in scientific work; and be it further

Resolved, That it is the sense of the Members of this Institution that the Bureau of Science has suffered a very great loss and that the cause of Science in these Islands has been deprived of one of its most zealous and conscientious advocates; and be it further

Resolved, That we extend our sincere sympathy and condolence to his Widow in her overwhelming grief, to his Sister, Brother and other Relatives; and be it further

Resolved, That copies of these resolutions be engrossed and sent to the bereaved Widow and Brother of Doctor Freer, and that they be filed in the Archives of the Bureau of Science, transmitted to the Bureau of Civil Service, published in the forthcoming Number of each Section of the "Philippine Journal of Science," in the newspapers of Manila, in a paper in the City of Chicago, Doctor Freer's birth-place, and in "Science," the Official Organ of the American Association for the Advancement of Science, of which Doctor Freer was a Fellow.

For the Staff of the Bureau of Science:

[L. S.]

RICHARD P. STRONG,
CHARLES S. BANKS,
E. D. MERRILL,
ALVIN J. COX,
OSCAR TEAGUE,
A. E. SOUTHARD,
Committee.

At Manila, Philippine Islands, this eighteenth day of April,
in the year of our Lord one thousand nine hundred and twelve.

THE PHILIPPINE
JOURNAL OF SCIENCE
C. BOTANY

VOL. VII JUNE, 1912 NO. 2

THE ORIGIN AND RELATIONSHIPS OF TAENITIS.

By EDWIN BINGHAM COPELAND.
(From the College of Agriculture, University of the Philippines, Los Baños.)

Taenitis is one of the ferns which, up to this time, has eluded very successfully all attempts at natural classification. It has been in such a tribe as the *Grammitideae* of Hooker and Baker's "Synopsis," in company with *Notholaena, Brainea, Meniscium, Vittaria, Hemionitis* and *Drymoglossum,* that it has seemed least out of place, as this tribe has no semblance of naturalness to be disturbed by it. A tribe named for this genus was proposed by Presl,[1] and is maintained with changed composition, as a subfamily of *Polypodieae,* by Diels [2] and Christensen.[3] Some of the other genera included in the group, *Drymoglossum* for instance, are obviously related to the real *Polypodieae,* and the group must have been given its position on their account, for *Taenitis* itself offers hardly a suggestion of such an affinity, except in the naked sorus, which it shares with the various genera named above, and with many others.

Taenitis has a hairy rather than scaly rhizome, of very characteristic reddish color, non-articulate stipe, and altogether non-polypodioid venation. What slight superficial resemblance it has to any plants called *Polypodium* is to certain species of *Selliguea* (*Phymatodes*), but its remoteness from these is attested by the absence of their very characteristic foliar endodermis. In

[1] Tent. Pterid. (1836) 222.
[2] Engler und Prantl, Nat. Pflanzenfam. 1 [4]: 302.
[3] Index Filicum (1906) 46.

my work on the Polypodiaceae of San Ramon,[4] in which I carried the natural arrangement of the family farther than had before been attempted, I was confronted by the unnaturalness of the supposed near relationship of this fern to *Polypodium,* and, not knowing what its real affinities might be, did not include it at all in the "family tree" of the *Polypodiaceae.*

It has since become clear that *Taenitis* belongs in the only large and nearly natural tribe not represented among its companions in the standard works, the *Davallieae.* In the family tree just cited, *Microlepia* represents the central group in this tribe. By removing *Davallodes,* I have since made it possible to constitute a really natural genus, including *Microlepia* in *Dennstaedtia. Dennstaedtia* and its nearer relatives are unfailingly characterized by hard, creeping, reddish rhizomes clothed with small, harsh, reddish hairs which are pluricellular at the base but narrowed above to a single row of cells. The color and form of a negro's hair do not testify to blood relationship more certainly than do the color and form of the pubescence of *Dennstaedtia, Saccoloma, Leptolepia, Odontosoria, Tapeinidium, Saccoloma,* and *Taenitis.* Trichomes enough like these to betray relationships are found not only in various *Davallieae,* but also, as we shall presently see, in various ferns which have apparently not been suspected of such affinity.

Of ferns known to me, the most like *Taenitis blechnoides* (Willd.) Sw. in superficial aspect is *Schizoloma ensifolium* (Sw.) J. Sm. This fern is extremely variable in its venation, the veins being sometimes almost free, sometimes anastomosing very similarly to those of *Taenitis,* whose venation is likewise far from uniform. *Taenitis* sometimes, though not usually, has the peculiar form of leaflet, broadest near the base, characteristic of *Schizoloma ensifolium.* The rhizomes and the bases of the stipes are so alike in the two ferns that these parts are often practically indistinguishable. A young plant of either is likely to be mistaken for the other. The difference in the position and protection of the sorus is hardly greater than that found in *Vittaria,* between *V. scolopendrina* and *V. elongata,* where it is not usually regarded as constituting a generic distinction. *Taenitis* itself is variable in the position of the sorus, as the accompanying photograph shows (Plate II). And there are species of *Schizoloma* whose sori are by no means marginal.

However, internal structure affords in general a better clue to affinity than does external; and the steles in the rhizome of

[4] This Journal 2 (1907) Bot. 74.

Taenitis and *Schizoloma* are unlike. *Schizoloma ensifolium*, and other species of the genus, have the peculiar solid steles of the *Lindsayae*.[5] But *Dennstaedtia* seems to have in all species a solenostele with very short foliar gaps. As Gwynne-Vaughan states, *Taenitis* has a dictyostele very near in nature to a solenostele; it is so near in fact that in a rhizome with internodes 16 mm long the foliar gaps may overlap by less than 1 mm.

The only plant usually recognized as a very near relative of *Dennstaedtia*, in which I have found a dictyostele, is *Saccoloma moluccanum*, in which this structure is derived from a solenostele by the shortening of the internodes. *Davallodes*, which contemporary pteridologists have treated as a *Microlepia*, has a complicated dictyostele; but my appreciation of its distinctness from *Microlepia* has strengthened since I raised it to generic rank, and I now group it with the other epiphytic *Davalliae*,—*Leucostegia*, *Davallia*, *Humata*, *Oleandra*, etc.,—in which open dictyosteles are the rule.

Drymoglossum has a real dictyostele, as have its polypodioid relatives, *Goniophlebium*, and the numerous related groups, and *Hymenolepis*, *Eschatogramme*, and *Paltonium lanceolatum*. While technically bearing the same name, the stele of *Taenitis* is very much less like that of *Drymoglossum* than like any solenostele of the *Dennstaedtia* group.

There are other characters of more or less interest which might be considered; but I believe that enough has been said so that nobody, having the plants in hand, will question the conclusion that *Taenitis* is a reasonably near derivative of *Dennstaedtia*, and not at all a near relative of *Polypodium*. We will now see that *Taenitis* is one of a very natural group of ferns, but a group as different as possible in composition from those which have borne its name.

[5] Gwynne-Vaughan, Annals of Botany, 17 (1903) 689, *Plate XXXIV, fig. 23*, representing the stele of "*Davallia*" *repens*, might have been drawn from *Schizoloma ensifolium*. The data in this paper are of great taxonomic value, in spite of the statement that the "Anatomical characteristics do not, for the most part run parallel to . . . . systematic position." The trouble is with the systematic position; thus, the author finds true solenosteles in *Dicksonia*, *Davallia*, *Lindsaya*, *Pteris* and *Polypodium;* but the situation clears up when it develops that the *Davalliae* are all *Microlepia* or *Leptolepia;* the *Dicksoniae*, all *Dennstaedtia;* the *Lindsaya*, *Odontosoria;* the three species of *Pteris*, severally, *Paesia*, *Histiopteris* and *Doryopteris;* and the *Polypodium*, probably *Hypolepis*. When one recognizes genera which in a proper sense are genera, all of the apparently very diverse plants just named present themselves as near relatives. Contradicting the statement quoted above, Gwynne-Vaughan later suggests such a conclusion.

Mo. Bot. Gar.
1913

Platytaenia requiniara (Gaudich.) Kuhn is treated by Diels as the nearest relative of *Taenitis*. This fern is accredited to the Philippines, but is known to me only by leaf fragments *ex herb*. Kunth, collected in Waighiou in 1825, and kindly sent me from the Berlin Botanic Garden. So far as can be judged from these fragments, it is altogether like *Taenitis* except for the acrostichoid fructification and a correlated narrowing of the fertile pinnae; the close affinity of the two is not doubtful. *Lomagramma* is like *Platytaenia* in fructification, and fairly similar in venation, but does not seem to be a member of this group.

Genera with the *Gymnogramme* type of fructification are usually found in the groups with acrostichoid genera, and may be regarded as intermediate between the latter and the more primitive forms with definite sori. In the *Taenitis* group, this position is occupied very exactly by *Syngramma pinnata* J. Sm. The stele and trichome characters are perfectly typical of the group; and I have fronds from New Guinea which would be determined without hesitation as *Taenitis*, if they were sterile. *Syngramma* is a natural genus, whether or not its separation into several genera can be justified. The simple-leaved sections have modified types of venation, but are alike in the important structural characters, including the natural type of stele. Examining a small number of individuals, I have found solenosteles in *Syngramma alismifolia* J. Sm., *S. cartilagidens* (Baker) Diels, and *S. borneensis* (Hooker) J. Sm.; overlapping foliar gaps in *S. Wallichii* Hooker and *S. angusta* Copel.; and in *S. Hookeri* C. Chr., gaps usually but not always overlapping, this character varying along a single rhizome.

Because of its affinity to *Taenitis* and *Platytaenia*, and especially to the more primitive genera, *Schizoloma* and *Dennstaedtia*, *Syngramma* may with reason be regarded as the most primitive member of one or perhaps two other groups, embracing a considerable part of the genera included in the *Pterideae* of Diels. These include first the genera with fructification of the same type, as *Craspedodictyum*,[6] *Coniogramme* and *Hemionitis;* and second such genera as *Doryopteris*, with the sori of *Pteris*. These all preserve the ancestral stelar characters, and the fronds of most of the species have the same structural peculiarities. The paleae of all except the first-named are less abruptly narrowed, and in some cases less pigmented and with thinner walls.

[6] This Journal 6 (1911) Bot. 84.

ILLUSTRATION.

PLATE II. *Taenitis blechnoides* (Willd.) Sw. Two pinnae showing the difference in arrangement of the sori.



PLATE II. TAENITIS BLECHNOIDES (Willd.) Sw.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 2. June, 1912.

NEW OR INTERESTING PHILIPPINE FERNS, VI.

By EDWIN BINGHAM COPELAND.

(From the College of Agriculture, University of the Philippines, Los Baños.)

Pleurogramme minor (Fée) Copel. comb. nov.

Vittaria minor Fée 3rd. Mém. (1851–52) 23, *pl. IV, f. 2.*

Pleurogramme loheriana Christ in Bull. Herb. Boiss. II 6 (1906) 1006.

Christ[1] distinguishes his *Pleurogramme loheriana* from *P. pusilla* (Blume) Christ by its "having the soriferous line sunk in an exactly marginal grove." Fée states of his species "sporotheciis . . . . *exacte marginalibus.*" Comparison of absolutely authentic specimens leaves no doubt as to the identity of the two species.

Trichomanes craspedoneurum Copel. sp. nov.

Rhizomate filiforme repente; stipitibus brevibus vel subnullis, minute pilosis; fronde 1 ad 1.5 cm longa, oblanceolata, integra vel saepius paucilobata, deorsum angustata et pilifera, sursum glabra; venatione pinnata, venis spuriis obliquis sat conspicuis, cum vena submarginale anastomosantibus; soro solitario apicale, tubo cylindrico omnino immerso, limbo dilatato, cum margine anastomosante et deinde bilabiato.

LUZON, Province of Tayabas, Infanta, alt. 100 m, *J. B. Leiberg,* sheet No. 593183, U. S. Nat. Herb.

Distinguished from *T. sublimbatum* K. Müll, and *T. henzaianum* Hooker by the evident submarginal vein. Near *T. Petersii* A. Gray of Alabama.

Pteris Taenitis Copel. sp. nov. (Plate III.)

Stipitibus densissime confertis, 3 ad 10 cm altis, fulvo-castaneis, deorsum paleis fulvis crinitis vestitis, sursum rhachique praecipue in sulco puberulis glabrescentibus; fronde 25 ad 35 cm alta, pinnata; pinnis 20 ad 30 cm longis, 4 ad 6 mm latis, 1 ad 3 paribus, fere erectis, utrinque sensim angustatis, decurrentibus et plerumque ala angustissima connexis, integris, coriaceis,

[1] This Journal 2 (1907) Bot. 175.

opacis, mox glabrescentibus, fertilibus haud diversis; margine reflexo sat lato.

MINDANAO, Agusan Subprovince, Mount Hilonghilong, alt. 115 m, *C. M. Weber 1143*, March, 1911.

A relative of *Pteris opaca* J. Sm. but much smaller; easily distinguished from all forms of *Pteris cretica* by the simple and entire, decurrent, coriaceous pinnae.

Dryopteris dichrotricha Copel. sp. nov.

Thelypteris, D. (Nephrodio) adenophorae affinis; rhizomate erecto, paleis angustis castaneis vestito; stipite 30 cm alto, brevissime hirsuto, sursum pinnis in auriculas minutas reductis donato; fronde 35 cm alta, 12 ad 15 cm lata, acuminata, ubique densissime minute albido-setosa; pinnis utroque latere ca. 20, sessilibus, acuminatis, 10 ad 15 mm latis, $\frac{3}{4}$ ad costam pinnatifidis; utroque facie ad costa venasque setis majoribus vestitis; venis simplicibus, utroque latere 6 ad 9; soris medialibus, indusio persistente, setoso.

MINDANAO, Agusan Subprovince, Mount Hilonghilong, alt. 120 m, *C. M. Weber 1173*, March 1911. Nearer to *D. adenophora* than to any species with free veins.

Dryopteris mesodon Copel. sp. nov.

Species gregis D. dissectae, stipite ad basin paleis linearibus castaneis 15 mm longis vestito, supra sparse spinuloso; fronde 35 ad 40 cm alta et lata, rhachibus castaneis, supra costisque velutinis; pinnis infimis oppositis multo maximis, stipitatis, deltoideis, valde acuminatis; earum pinnulis[I] infimis stipitatis, acuminatis; harum pinnulis[II] brevistipitatis, cordatis, acutis, ad basin pinnatis; pinnulis[III] adnatis, obtusis, grosse serratis, utroque latere una; pinnulis ordinum omnium superioribus decurrenti-connexis, et ala decursa saepe dente uno ornata; segmentis penultimis acute grosse serratis, acutis, oblanceolatis; soris a costa remotis, parvis; indusio persistente, minute praecipue ad insertionem puberulo.

MINDANAO, Agusan Subprovince, Mount Hilonghilong, alt. 120 m, *C. M. Weber 1176*, March, 1911.

This bears the same relation to *Dryopteris dissecta* that *D. purpurascens* does to *D. sparsa*. Its nearest relative is *D. balabacensis* Christ.

Tectaria Weberi Copel. sp. nov.

Sagenia, rhizomate ca. 1 cm crasso, suberecto, apice paleis angustis atrocastaneis 4 mm longis dense vestito; stipite 20 ad 25 cm alta, 15 ad 20 cm lata, breviter decurrente, ad alam 2 ad 5 mm latam pinnatifida; segmentis plerumque 5, sat remotis, late lanceolatis, sinuatis, obtusis, versus costam angustatis, herbaceis, lamina glabra; venis minute glanduloso-piliferis, venis primariis remotis, fere ad marginem protensis, areolis primariis

unisoriferis; soris utroque latere venarum uniseriatis; indusio orbiculare cum sinu minuto, 2 mm lato, insertione lineare glanduloso-pilifero, aliter glabram, tenue sed persistente.

MINDANAO, Agusan Subprovince, Mount Hilonghilong, alt. 425 m, *C. M. Weber 1148*, March, 1911.

Nearest to *Tectaria decurrens*, but in appearance approaching *T. Menyanthidis;* distinguished from the former by the few segments, slightly decurrent base, and conspicuously remote main veins.

Humata microsora Copel. sp. nov. (Plate IV.)

Rhizomate 2 mm crasso, paleis castaneis apice acicularibus vestito, ad truncos arborum late repente; stipitibus remotis, 4 ad 7 cm altis, sparse paleaceis; fronde usque ad 18 cm alta, a basi truncata 15 ad 18 mm lata, sensim sursum angustata, deorsum fere ad costam latam pinnatifida, segmentis 1 cm latis, truncatis vel rotundatis, integris, rigide coriacea, glabra; venis conspicuis, furcatis; soris in lobo quoque usque ad 12 submarginalibus 0.6 ad 0.8 mm latis.

MINDANAO, Agusan Subprovince, Mount Hilonghilong, alt. 180 m, *C. M. Weber 1146*, March, 1911.

A very distinct species in the group of *Humata angustata* J. Sm.

Adiantum scabripes Copel. sp. nov. (Plate V.)

Adiantellum rhizomate setis parvis saturate atropurpureis dense vestito; stipite nitido, atrocastaneo, 20 ad 40 cm alto, deorsum paleis angustis 3 mm vestito vel ob baseos illarum scabro, sursum rhachibusque ubique glabris; fronde deltoidea, 15 ad 20 cm alta et lata, bi- vel tripinnata, pinnis paucis, acutis; pinnulis stipitatis, dimidiatis, oblongis, apice rotundatis, 10 ad 13 mm longis, marginibus superioribus et exterioribus ubi sterilibus cartilagineo-denticulatis, coriaceis, non opacis, supra nitidissimis, infra luce directa pallidis luce oblique incidente subcupreis sed oblique versus obscuritatem visi fere albis; soro plerumque uno, usque ad 5 mm longo, interdum interrupto; indusio brunneo, coriaceo, 0.7 ad 1 mm lato.

MINDANAO, Agusan Subprovince, Mount Hilonghilong, alt. 175 m, *C. M. Weber 1174*, March, 1911.

A relative of *Adiantum opacum* and *A. cupreum*, and like these a very promising fern for cultivation.

Adiantum flabellulatum L. Sp. Pl. (1753) 1095.

LUZON, Province of Ilocos Sur, Mount Dagat, *Bur. Sci. 7760 Ramos.*

New to the Philippines. Tropical Asia, China, and Japan.

Athyrium lanceum (Thunb.) Milde Bot. Zeit. (1870) 354.

Asplenium lanceum Thunb. Fl. Jap. (1784) 333.

LUZON, Province of Ilocos Norte, *Bur. Sci. 7761 Ramos.*

New to the Philippines. Ceylon and India through China to Japan.

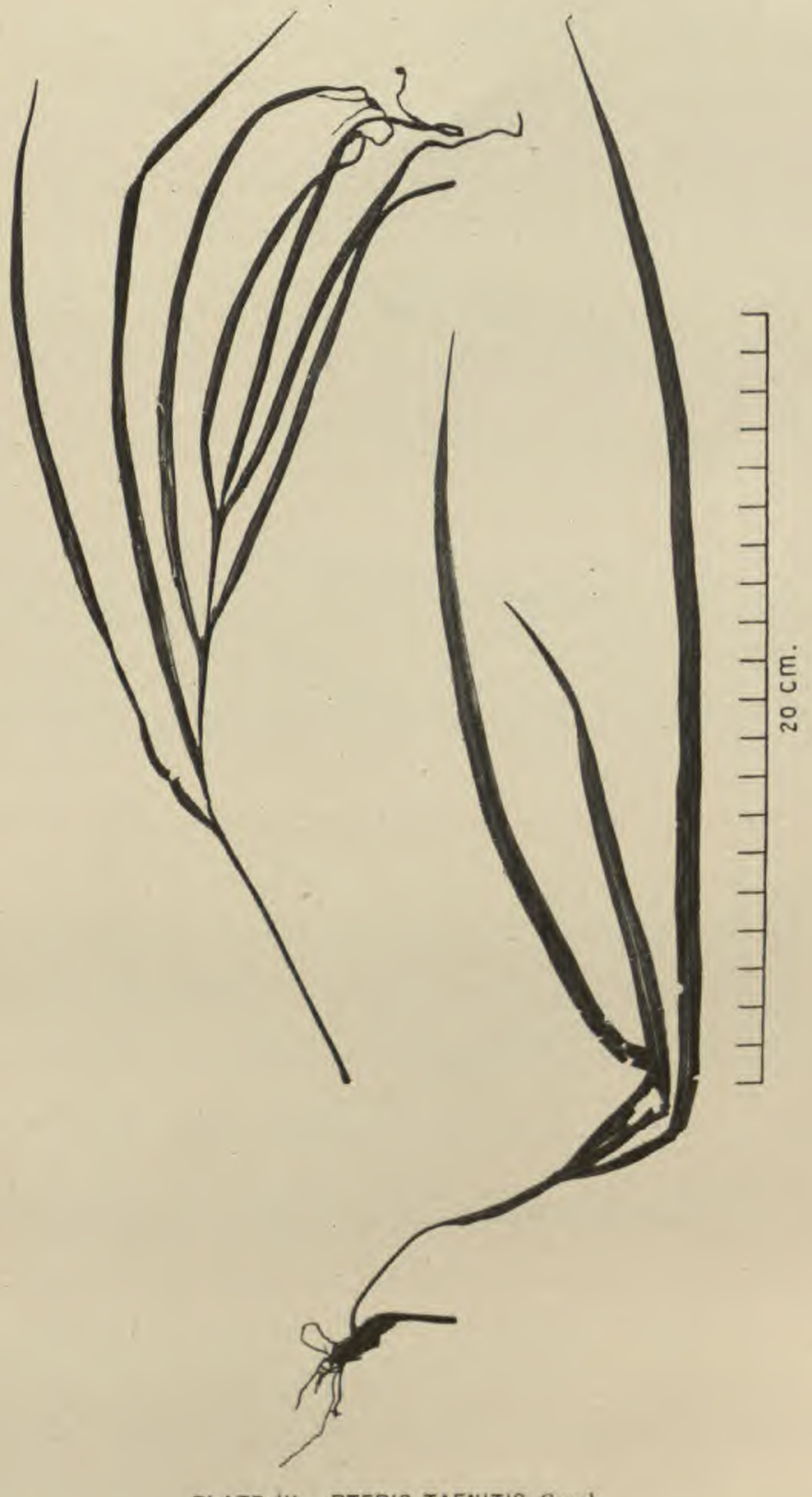


PLATE III. PTERIS TAENITIS Copel.

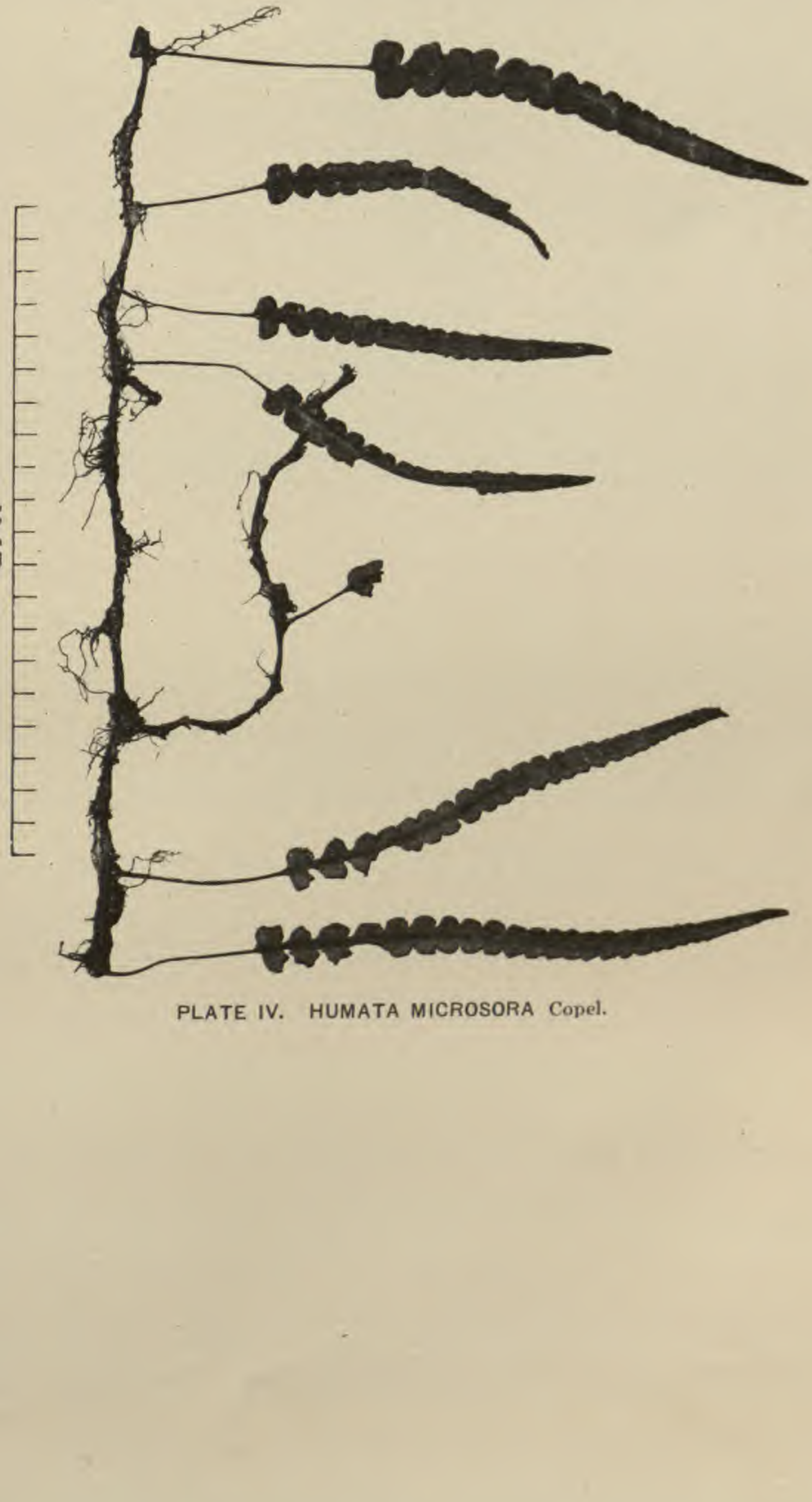


PLATE IV. HUMATA MICROSORA Copel.

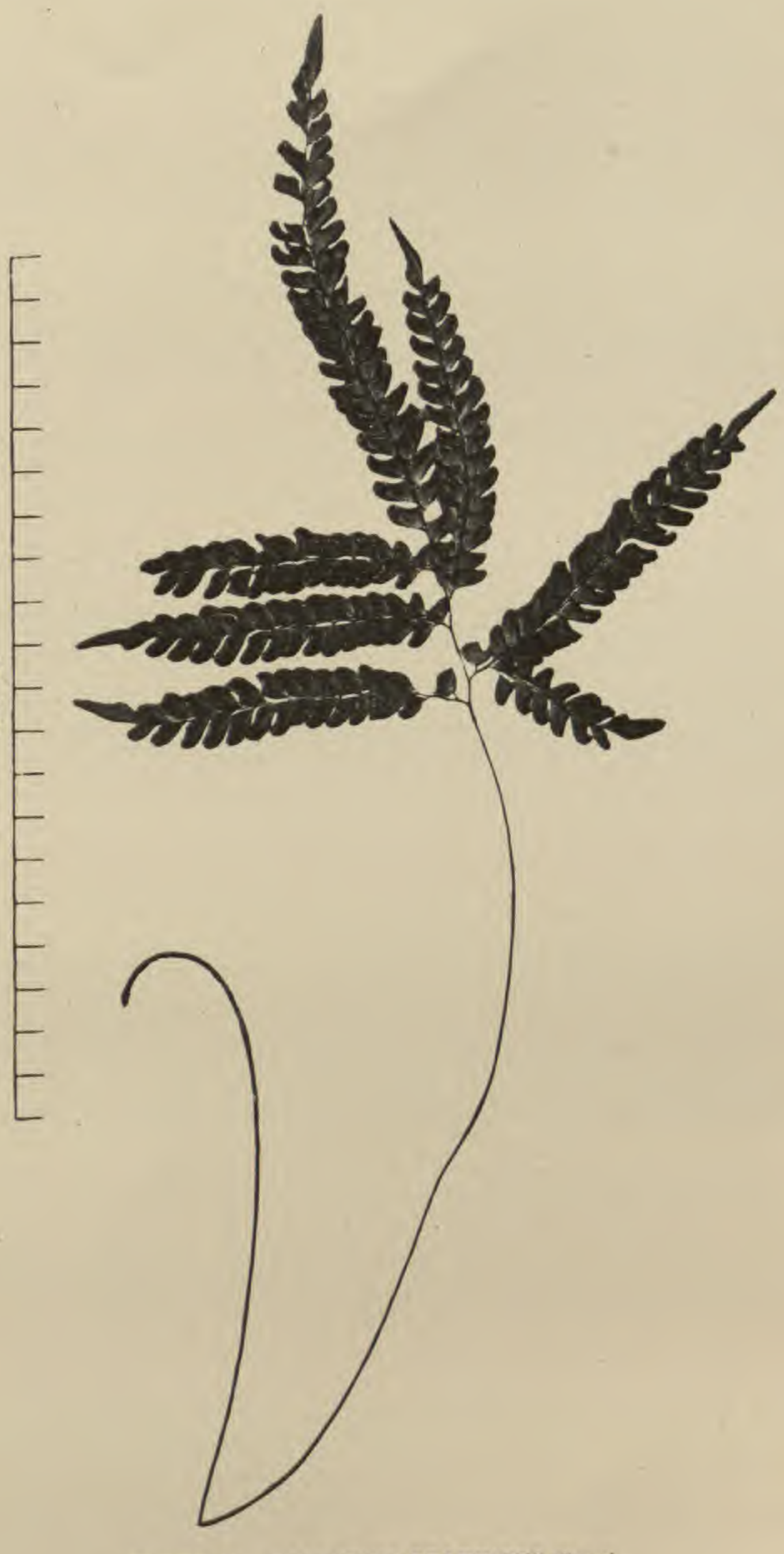


PLATE V. ADIANTUM SCABRIPES Copel.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 2. June, 1912.

NEW SARAWAK FERNS.

By EDWIN BINGHAM COPELAND.

(*From the College of Agriculture, University of the Philippines, Los Baños.*)

Marattia Brooksi Copel. sp. nov.

Stipulis 25 mm longis latisque; stipite sicco 7 mm crasso, deorsum paleis parvis castaneis vestito, sursum rhachique ob emergencias carnosas insigniter transversaliter pseudorugosis; fronde tripinnata; pinnis longistipitatis; pinnis[II] brevistipitatis, ca. 3-paribus; pinnulis utroque latere ca. 5, infimis solumodo stipitatis, late cuneatis, argute serratis, acutis vel saepius acuminatis, subcoriaceis, pallidis, superioribus majoribus 5 cm longis, 12 mm latis; venis simplicibus, sub lente hyalinis; soris a margine remotis, 3- ad 7-locularibus; indusio conspicuo.

Sarawak, Mt. Poe, alt. 900 m, in damp valley district, *Brooks 138*.
Remarkable for the contorted transverse thickenings on the main axis.

Dryopteris aquatiloides Copel. sp. nov.

Nephrodium D. salicifoliae subsimile et cum ea confuso; rhizomate 2 mm crasso, breviter repente; stipite frondis sterilis 10 ad 15 fertilis 20 ad 25 cm alto, stramineo, sursum minutissime pubescente, valido, rhachi costique densius pubescentibus; fronde 15 ad 25 cm alta, 12 ad 17 cm lata, pinna apicale aliis simile; pinnis utroque latere ca 6, infimis haud diminutis, stipitatis, praecipue superioribus unilateraliter subauriculatis, usque ad 9 cm longis et 1 cm latis, obtusis, inferioribus vel omnibus utrinque angustatis, integris vel crenulatis, papyraceo-coriaceis, lamina glabrescente; venulis utroque latere 2 vel 3; soris parvis, medialibus, interdum coalescentibus, indusio rudimentario.

Sarawak, Bungo Range, *Brooks 9*.
This is the plant referred to as *Dryopteris salicifolia* in my description of the Papuan *D. aquatilis*.[1] Mr. Brooks has corrected my mistake, which was not a very reasonable one.

[1] This Journal 6 (1911) Bot. 75.

Dryopteris porphyricola Copel. sp. nov.

Nephrodium, rhizomate erecto; stipite ca. 10 cm alto sparse ferrugineo-paleato; fronde 80 cm alta, 27 cm lata; pinnis infimis abrupte in auriculas auriculatas integras reductis, parte deinde angusta 25 cm alta; pinnis sequentibus deflexis non reductis, basi truncatis, 14 cm longis, 22 mm latis, $\frac{1}{3}$ ad $\frac{1}{2}$ ad costam pinnatifidis, supra appresso-sericeis, infra minute pilosis et dense glandulosis, membranaceo-papyraceis; lobis ca. 3.5 mm latis, falcatis; venis utroque latere ca. 7 quarum 2 vel 3 anastomosantibus; soris parvis, medialibus; indusio glanduloso et breviter piloso, persistente.

Sarawak, Bau, Jebong Valley, on porphyry dyke, *Brooks 112*.

In the same general group as the following. More like *Dryopteris jaculosa* (Christ) C. Chr. than any other species known to me.

Dryopteris angustipes Copel. sp. nov.

Nephrodium, rhizomate breve et crasso, paleis brunneis 5 mm longis vestito; stipite 1 ad 2 cm alto, valido, paleaceo; fronde 80 cm alta, 20 cm lata, rhachi straminea, nisi in sulco glabrescente; pinnis inferioribus subabrupte in auriculas multas pinnatifidas utroque latere ca. 15 reductis, parte indeque angusta 15 ad 20 cm alta; pinnis medialibus horizontalibus, proximis, sessilibus, acuminatis, supra basin acroscopice auriculatum 13 ad 15 mm latis, $\frac{1}{2}$ ad costam pinnatifidis, costa costulis et venis infra minute appresso-pilosis, costa glabrescente, lamina infra minute glandulosa supra sparse albo-pilosa, membranacea; lobis 2 ad 2.5 mm latis, subfalcatis; venis utroque latere ca. 7 quarum 1 vel 2 anastomosantibus; soris medialibus, parvis; indusio in centro glanduloso, alibi sparse piloso vel glabro, persistente.

Sarawak, Singie, in swamp near foot of mountain, *Brooks 110*.

This keys out with van Alderwerelt's "Malayan Ferns" as his *Dyropteris sumatrana* (*Nephrodium molle* var. *major* Bedd.) which he seems not to have seen and which has never had an adequate specific diagnosis, and may be suspected of being *D. stipellata* (Bl.) O. Ktze. J. Smith, in a marginal note in his copy of Blume's "Enumeratio," construed *Aspidium stipellatum* as *A. molle*. *Dryopteris angustipes* is not merely exceedingly distinct in appearance from *D. parasitica* but differs in the character of the pubescence from that species to such an extent that Beddome could not have placed them together.

Lomagramma Brooksii Copel.

Mr. Brooks has sent me a very complete specimen, collected at Bau. It has the fertile and sterile fronds distinct, as in other species of the genus. The frond of a juvenile plant "which germinates on the limestone and may grow in large masses before reaching a trunk, and becoming scandent", has membranaceous, serrate, and very oblique pinnae. Fronds of adult

plants are as described, except in size. The sterile fronds are a meter or more long and 30 cm wide. The fertile frond is still wider, its pinnae 2 to 4 mm wide, and straight or curved.

The species is nearest to *Lomagramma perakensis* Bedd., differing conspicuously in the very short stipes and persistent scaliness.

Athyrium sorsogonense (Presl) Milde, var. **poense** Copel. var. nov.

Forma laxa et grandis, pinnis remotis infimis usque ad 25 cm longis, 2.5 ad 3.5 cm latis, rhachi mox glabrescente.

Sarawak, Mount Poe, alt. 900 m, *Brooks 143*.

Athyrium carnosum Copel. sp. nov.

Species gregis A. maximi vel A. pinnati, fronde pinnata, 45 cm alta, fere 30 cm lata, rhachi furco excepto glabra vel mox glabrescente; pinnis liberis utroque latere ca. 10, subsessilibus vel sursum adnatis, horizontalibus, falcato-acuminatis, basi late cuneatis, 3.5 cm latis, $\frac{1}{3}$ ad $\frac{1}{2}$ ad costam pinnatifidis, glabris, carnoso-subcoriaceis, viridibus; lobis 9 mm latis, rotundatis; venis ca. 9, angulo acuto distantibus, simplicibus; soris linearibus, usque ad 10 mm longis, paginam totam complentibus, indusio angusto mox sporangiis occulto.

Sarawak, Matang, collected by native collector of the Sarawak Museum. The pinnae look like pinnules of *Athyrium maximum*, but are remarkably large and coarsely cut and peculiar also in the clear but deep-green color and almost fleshy texture.

Athyrium (Diplazium) polycarpum Copel. sp. nov.

Stipite teste Brooks 60 cm alto et paleis paucis brunneis ovatis vestito; fronde 75 cm alta, 45 cm lata, sulcis axium exceptis glabra, deorsum haud angustata, sub apice pinnatifido bulbifera, rhachi brunnea, deorsum sparsissime argute spinosa; pinnis stipitatis, subacuminatis, basi inaequaliter truncatis, infimis 25 cm longis, 45 mm latis, praecipue deorsum fere ad costa pinnatifidis cum segmentis ibidem solumodo remotis; segmentis ca. 2 cm longis, 1 cm vel ultra latis, rotundatis vel truncatis, obscure serrulatis, supra punctis albis marginalibus donatis, coriaceis; venis utroque latere ca. 11, simplicibus vel furcatis, omnibus soriferis; indusio lineare, atro.

Sarawak, Mount Penrissen, alt. 1,050 m, *Brooks 151*. Also Bidi, *Brooks*, Aug., 1908. Intermediate between the groups of *Athyrium sorsogonense* and *A. maximum*.

Athyrium muricatum Copel. sp. nov.

Species gregis polymorphae *A. maximi* (Don) Copel., rhizomate 12 mm crasso; stipite 30 cm alto, 4 mm crasso, spinoso, basin versus paleis lanceolato-ovatis incurvatis sordide brunneis 5 mm longis vestito; pinnis infimis 20 ad 25 cm longis, 5 cm

latis, stipitatis, acuminatis, ad basin vix ad costam pinnatis, sursum sensim leviter pinnatifidis, segmentis oblongis, 10 mm latis, obtusis vel subacutis, plerisque apices versus serratis, glabris, coriaceis, infra pallidioribus; venulis utroque latere ca. 12, furcatis, segmentis infimis reductis; parte apicale frondis sensim per pinnas sessiles lobatas et adnatas serratas ad apicem grosse pinnatifidum angustata; soris a costula remotis, 1 ad 2 mm longis, indusio mox evanescente.

Sarawak, *No. 35* of the Sarawak Museum collection.

Distinguished from most others of its group by the scattered spines on the stipe, and from all by the short sori near the apices of the veinlets, and the transient indusia.

Athyrium Hewitti Copel. sp. nov.

Species gregis A. cyatheifolii Milde, fronde 75 cm alta, 30 cm vel paullo ultra lata, rhachi nisi in sulco glabra, castanea; pinnis pinnatis utroque latere ca 8, pinnatifidis, ca. 13, brevistipitatis, infimis 23 cm longis, 5 cm latis, oppositis, acuminatis, pinnulis horizontalibus et rectis, subsessilibus, basi truncatis plerisque sursum vel utroque latere subhastatis, subacutis, supra basin 1 cm latis, $\frac{1}{3}$ ad costam incisis, sursum integrioribus, glabris, papyraceis; lobis 2 mm latis; venis furcatis, obliquis; soris 2 ad 4 mm longis, linearibus, indusio laete brunneo.

Sarawak, Matang, collected by *J. Hewitt,* the former curator of the Sarawak Museum, to whom the species is dedicated.

Athyrium sarawakense Copel. sp. nov.

Species gregis A. cyatheifolii Milde, stipite 3 mm crasso, sparse spinuloso, glabro; fronde 45 cm lata, ut videtur 75 cm alta, bipinnata, rhachi, sulco et alis exceptis, glabra, laete castanea; pinnis brevistipitatis, 25 cm longis in caudam argute serratum protractis, pinnis liberis paucis, sessilibus, acutis, usque ad 5 cm longis, 1 cm latis, serratis, basi truncatis, subhastatis, glabris, subcoriaceis; venis furcatis, obliquis; soris 2 ad 3 cm longis, costalibus, indusio laete brunneo.

Sarawak, Mount Matang, *J. Hewitt,* April, 1908.

Athyrium confertum (Baker) Copel.

Asplenium confertum Baker. Ann. Bot. 8 (1898) 125.

Sarawak, Mount Bongo *Brooks & Hewitt,* 1908. Previously known only from Sumatra.

Athyrium Christii (C. Chr.) Copel.

Diplazium Christii C. Chr. Index Fil. (1905) 299.

Beside the synonym given by Christensen (*D. acuminatum* Bl.), I believe there should also be included here *Asplenium ambiguum* Schkuhr. Kr. Gew. (1809) *pl. 75* (non Swtz.), and *Diplazium Schkuhrii* J. Sm. The latter

name was used without description for *Cuming 389*, from Malacca. Presl, Epimeliae p. 86, described *Diplazium malaccense* from the same number, stating explicitly that it included his plant and also *D. Schkuhrii* = *Asplenium ambiguum* Schkuhr, *pl. 75*. Then came Mettenius, *Asplenium No. 208*, giving the first diagnosis in connection with the name, *Asplenium Schkuhrii*, ignoring Presl's statement that the Cuming number 389 was mixed, citing *D. malaccense* as a synonym, and making a diagnosis which fits the latter. *Diplazium Schkuhrii* J. Sm. is therefore a *nomen nudum*, and *Asplenium Schkuhrii* Mett. a synonym of *Diplazium malaccense*, which I construe as a form of *Athyrium pinnatum* (Blanco) Copel. I have in hand also a specimen from Mount Penrissen, Sarawak, alt. 1050 m., *Brooks 141*, sent as *D. acuminatum* Bl. The determination is probably correct although the fern's appearance just suggests *D. petiolare* Presl, which I have also reduced to *Athyrium pinnatum*. Mr. Brooks has also sent a fern collected at Bidi in 1908 which is *Diplazium petiolare*, differing from the type only in having a more naked rachis.

Athyrium elatum (Fée) Copel.

Diplazium elatum Fée Genera (1850–52) 44.

Many as are the forms which I construe as *Athyrium pinnatum* (*A. silvaticum* Milde 1870), this seems decidedly distinct. I have a fragment from Kuhn's herbarium which agrees with Mettnius' description (*Asplenium No. 203*) so perfectly that it seems probable that it is a part of the specimen he had in hand; and he and Fée cite the same single collection.

Athyrium Cumingii (Presl) Milde. (?)

Mount Poe, alt. 900 m, *Brooks 145*.

From Luzon to Celebes; new to Borneo. The specimen is not typical and may be a distinct species; but this is its nearest affinity.

Athyrium subserratum (Bl.) Milde.

Sarawak, Mount Poe, alt. 900 m, *Brooks 144*.

Previously known from Java and Penang.

Dennstaedtia cuneata (J. Sm.) Moore, var. **obtusa** Copel. var. nov.

Pinnulis obtusis, haud alter forma typicale diversa.

Sarawak, Paku Bater, collection of the Sarawak Museum.

New to Borneo; the type from Luzon. Hooker describes the pinnules of typical *D. cuneata* as very obtuse, but is very evidently referring to the secondary pinnules, as the primary ones are acute, or often acuminate.

Histiopteris integrifolia Copel. sp. nov.

Segmentis stipularibus carentibus vel minutis orbicularibus; pinnulis linearibus, longis, acuminatis, subcordatis, sessilibus vel infimis subpedicellatis; areolis parvis; soris ad apicem non approximatis.

Sarawak, Matang Road *Native collector 768*, Bureau of Science.

This may well be the *Litobrochia incisa* var. *integrifolia* Bedd. Supplement (1892) 25, from Perak, which, however, is described as without "stipules," and as having the sorus almost reach the apex. *H. stiplacea* (Hooker) Copel. has large "stipules" and broad pinnules.

Oleandra oblanceolata Copel. sp. nov.

Species gregis O. colubrinae (Blanco) Copel; frondibus oblanceolatis, ca. 18 cm longis 3.4 cm latis, apice abrupte in caudam tenuissimam contractis, deorsum usque ad basin truncatum sensim angustatis, coriaceis, glabris; soris stricte costalibus.

Sarawak, Bungo Range, alt. 600 m, *Brooks 115*.

Quite distinct in frond form from its relatives. The younger paleae are ciliate but not cobwebby, and in my specimens have the apices appressed. The pedicels are very short, and the fronds sessile on them. As in related species, there are sometimes stunted branches with clusters of small fronds which do not present diagnostic characters.

Humata puberula Copel. sp. nov.

Rhizomate vix 2 mm crasso, late repente infra paleas castaneas calcareo; stipite frondis sterilis 7 cm frondis fertilis 10 cm alta paleis deciduis sparse vestito; fronde sterile 7 cm alta, 5 cm lata, bipinnatifida, lobis oblongis, integris; fertile 10 cm alta, 5 cm lata, bipinnatifido, lobis crenato-serratis, dentibus haud acutis; lamina coriacea, pilis brevissimis obsetis et praecipue ciliatis; soris in sinubus submarginalibus, permultis, indusio lato, coriaceo.

Sarawak, Mount Penrissen, alt. 750 m and upward, common, *Brooks 135*.

Narrower and less dimorphous than most of its relatives and distinguishable from all by its pubescence.

Humata Brooksii Copel. sp. nov.

Rhizomate 15 mm crasso, calcareo, dense paleaceo; stipitibus 7 ad 10 cm altis, gracilibus, paleis caducis sparse vestitis; frondibus uniformibus, 10 ad 12 cm altis, 4.5 cm latis, bipinnatifidis, rhachi crassa, sparse paleacea; pinnis lanceolatis, acutis, coriaceis, glabris, infimis plerumque brevioribus, brevistipitatis, interdum quam sequentibus sessilibus paullo latioribus; lobis oblongis, integris, sursum in dentes breves obtusos reductis; soris in sinubus dentium marginalibus; indusio lato, coriaceo.

Sarawak, Mount Poe, alt. 900 m and upward, common, *Brooks 134*.

Most easily recognizable by the form of the frond but otherwise quite distinct from any related species.

Scyphularia simplicifolia Copel. sp. nov.

Frondibus simplicibus, 15 ad 25 cm altis, 35 ad 45 mm latis, fertilibus obscure crenulatis, sterilibus integerrimis, venulis haud crassis, soris 2 ad 3 mm longis, linearibus, aliter ut S. triphyllae Fée.

Sarawak, Santubong Mountain, alt. 600 m, scandent, *Brooks 133*, Oct., 1909.

Fée's genus *Scyphularia* is so homogeneous a group and so sharply distinguished in various ways from *Davallia*, that I see no reason whatever

for forcing its species into that genus. The two older species, *S. pentaphylla* (Bl.) Fée and *S. triphylla* (Hooker) Fée, are very distinct, quite aside from the division of the frond.

Polypodium Merrittii Copel. var. **poense** Copel. var. nov.

Fronde gracillima, 6 ad 12 cm alta, 4 ad 6 mm lata, pinnis majoribus potius digitato quam pinnatim lobatis, soris pinnulae quaeque 1 vel 2.

Sarawak, Mount Poe, alt. 900 m, *Brooks 118*.

As noted in the description of *Polypodium Merrittii*, the stipes are not articulate.

Polypodium taeniophyllum Copel. sp. nov.

Lepisorus (?) rhizomate repente, 1 mm crasso, paleis anguste setaceis 5 mm longis rufo-ferrugineis basi 0.3 mm longis squarrosis dense vestito; stipitibus inter se 3 ad 6 mm distantibus, vix 1 cm altis, glabris; fronde 7 ad 15 (plerumque ca. 10) cm longa, 3 ad 4 mm lata, obtusa vel subacuta, basi sensim angustata, coriacea, glaberrima, hyalina; costa infra prominente, supra leviter sulcata; venis paucis, omnino inconspicuis, seriem unam areolarum angustarum includentibus, venulis liberis non visis; soris paucis medialibus, leviter immersis, vix oblongis.

Sarawak, *Native Collector 769*, Bureau of Science.

In some respects like a very narrow *Polypodium lineare*, but sharply distinguished by the rhizome, translucent texture, and almost invisible veins.

Polypodium Wrayi Baker.

Sarawak, Mount Poe, alt. 1,050 m, on base of trunk, *Brooks 117*.

Malaca and Sumatra; new to Borneo.

Polypodium (Selliguea) loxogrammoides Copel. sp. nov.

Rhizomate 1.5 ad 2.5 mm crasso, paleis cinereo-brunneis versus apicem densissime vestito; frondibus 5 ad 8 cm distantibus, sessilibus, oblanceolatis, acuminatis, integris, coriaceis, glabris; costa carinata, venis fere occultis; fronde fertile minore.

Sarawak, Limbang, April, 1910, *No. 17* of Sarawak Museum collection.

Near *Polypodium macrophylla* (Bl.) Reinw., from which it differs chiefly in texture and in the inconspicuous veins.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 2. June, 1912.

NEW PAPUAN FERNS.

By EDWIN BINGHAM COPELAND.

(*From the College of Agriculture, University of the Philippines, Los Baños.*)

Stenochlaena intermedia Copel. sp. nov.

Rhizomate ca. 1 cm crasso, basique stipitis paleis atrocastaneis 15 mm longis, 1.5 mm latis sat dense vestito et deinde ob baseos duras spiniformes earum horrida; stipite 40 cm vel alto, valido, sursum rhachique paleis latioribus vestitis et haud spinescentibus; fronde 60 ad 70 cm alta, pinnata, pinnis ad rhachin articulatis; pinnis utroque latere ca. 8, frondis sterilis subsessilibus, basi plus minus obliquis, rotundato-truncatis, apice abrupte breviter caudatis, 20 ad 22 cm longis, 45 ad 55 mm latis, integris, papyraceo-coriaceis, glabris, venis liberis; frondis fertilis pinnulis stipitatis (stipitibus 4 ad 8 mm longis), 15 ad 20 cm longis, 2 mm latis, sursum sensim angustatis.

Papua, Ambasi, *King 370*.

This fern has the deciduous pinnae of *S. aculeata* (Bl.) Kunze, but otherwise is rather suggestive of *Lomariopsis*. In general appearance it suggests *Lomagramma* rather than any *Stenochlaena*.

Humata tenuis Copel. sp. nov.

Rhizomate 2 ad 3 mm crasso, paleis brunneis dense vestito; stipitibus frondium sterilium ca. 3 fertilium ca. 7 cm altis, paleaceis; fronde sterile 5 ad 8 cm alta, deltoidea, tripinnatifida, pinnulis oblongo-linearibus, coriaceis, glabris, rhachibus paleaceis; fronde fertile 10 ad 13 cm alta, deltoidea, acuminata, quadripinnatifida; pinnulis II infimis oblongo-linearibus, in segmentis angustissimis pinnatifidis; soris apud baseos segmentarum, indusio grande.

Papua, Gira Track, *King 367*.

Near *H. vestita*, but much more finely cut than is this species or *H. introrsa* Christ. This is possibly *Davallia Chaerophylla* Ces. but that name was used earlier.

Humata dimorpha Copel. sp. nov.

Rhizomate 2 mm crasso, paleis castaneis lanceolatis 6 mm longis vestito; stipitibus glabris, gracilibus, frondis sterilis 5 cm fertilis 7 cm altis; fronde sterile 5 cm alta, 4 cm lata rhachi sordide squamulosa, pinnis utroque latere sub apice late crenulata ca. 4, fere 2 cm longis, infimis 1 cm latis, subintegris, basi anguste adnatis, truncatis, obtusis, sequentibus paullo minoribus glabris rigide coriaceis; fronde fertile 13 cm alta, 8 cm lata, valde acuminata; pinnis inferioribus 3-paribus aequalibus, 4 ad 4.5 cm longis, usque ad 12 mm latis, stipitatis, rigide coriaceis; pinnulis remotis, infimis solummodo liberis, vix quam sequentibus majoribus, 2 ad 3 mm latis, utroque latere in dentes 2 ad 4 triangulares pinnatifidis, soro quoque dentem complente, indusio lato, interdum quam alto duplo latiore, centro nigro.

Papua, Lakekamu, *King 326*. A very distinct species.

Davallodes viscidulum (Mett.) v. A. v. R.

Davallia viscidula Mett. (1869)

This species has the indusial characters of *D. gymnocarpum*, but the frond is more lax and finer cut, with the pinnules next to the rhachis dilated.

Lindsaya papuana Copel. sp. nov.

Synaphlebium gregis L. decompositae Willd. pinnis vel pinnulis integris soro continuo; fronde pinnata pinnis usque ad 3 cm longis vel tripartito et pinnulis ca. 2 cm longis; pinnulis brevistipitatis, apice obtusis, integris, maximis rarius inconspicue incisis; soro fere marginale, lamina ultra venam soriferam bullata.

Papua, Lakekamu, *King 358*.

Lindsaya azurea Christ is a plant with much smaller and truncate pinnules. *L. nitida* Copel., of Borneo, has pinnules of quite different shape, the base hardly truncate and apex broadly rounded, with the sorus at the end. The pinnules of *L. papuana* are broadest at the base and abruptly truncate, and the apex is obtuse rather than rounded. The sorus extends from the point next to the rhachis to the apex, almost always without a break.

Polypodium linguaeforme Mett.

King 368, 190, and *21* in part, are *P. linguaeforme*, judging by diagnosis only: I have not seen what I could feel sure was this species. These specimens fall well within the range of variation of *Polypodium musifolium* Bl.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 2. June, 1912.

CHARACEAE FROM THE PHILIPPINE ISLANDS.

By H. and J. GROVES.
(*London, England.*)

1. NITELLA Agardh.

1. **Nitella acuminata** Braun in Hook. Journ. Bot. 1 (1849) 292.

LUZON, Benguet Subprovince, Trinidad, in a roadside ditch, altitude about 1,200 m, *Bur. Sci. 14108 Robinson*, May, 1911. MINDANAO, District of Zamboanga, "im Graben bei Sambanga" (Zamboanga), *Wichura 2005*, 1862, *fide* Braun Fragmente 37.

This species is widely distributed especially in the Tropics. It occurs in southern Asia from India eastwards, in Borneo and in several of the other Islands of the Malay Archipelago, also in Africa and in North and South America. Like the other widely distributed species it is variable. Braun has described two varieties from this region, *Belangeri* from India, characterized by its large size, stout stem, and short end-segments to the branchlets, and *indica* from Java and the Philippine Islands, being more slender and having longer end-segments. The Trinidad plant is a stout form of the latter.

2. **Nitella Roxburghii** Braun in Hook. Journ. Bot. 1 (1849) 292.
N. polyglochin Braun Monatsb. Berl. Akad. (1867) 816.

LUZON, Benguet Subprovince, in a streamlet, Daklen to Kabayan, *Merrill 4867* (young), October, 1905; Baguio, *Merrill 4868*, November, 1905, altitude about 1,500 m, *Merrill 7928*, May, 1911, in small still streams: Province of Bataan, Lamao River, Mount Mariveles, *Elmer 6760*, November, 1904, *Merrill 7625*, March, 1911, Limay, *For. Bur. 19160 Curran*, December, 1909. MINDORO, Binabay River, in stagnant pools, border of forests, altitude about 10 m, *Merrill 5686*, November, 1906.

Fairly normal forms of this species, which occurs also in Ceylon, southern India, lower Burma, Nicobar Islands, Borneo, Java, Celebes, Sumbawa, new Guinea, and Australia (Endeavour River). The closely allied *Nitella Mauritiana* is found in Mauritius. Braun in his later writings applied to this species the name of *Nitella polyglochin*, which he had previously used in a wider sense, but there is no valid reason for discarding the earlier name.

2. CHARA Linn.

3. **Chara corallina** Willd. in Mém. Acad. Berol. 1803 (1805) 89, *t. II*, *f. 2*.

PHILIPPINES, *Llanos*, 1853, in Herb. DeCandolle, *fide* Braun Fragmente 108.

Braun described this plant as var.? *basilaris* on account of the fruits being produced at the base only, and not also at the nodes of the branchlets,

as in the type, and quotes for it *Chara congesta* Spreng. var. P. Fr. Ant. Llanos, Fragm. de algunas Plantas de Filipinas (1851) 112.

4. **Chara Braunii** Gmelin Flora Badens. Alsat. 4 (1826) Suppl. 646. (*Chara coronata* Auct.)

LUZON, Bontoc Subprovince, Lessep, *Father M. Vanoverbergh 590*, June, 1910, in still water, altitude 1,100 m.

A specimen from Benguet Subprovince, collected by Major E. A. Mearns, *Bur. Sci. 2825*, probably also belongs to this species, but may possibly be a very small form of *Chara corallina*. Being old and without fruit, it cannot be determined with certainty. *Chara Braunii* is almost world-wide in its distribution, occurring in all the continents. The specimen from Bontoc may be characterized as *f. meiocarpa microptila unilateralis*.

5. **Chara Benthami** Braun in Monatsb. Berl. Akad. (1867) 799.

A specimen from stagnant fresh water from near sea-level, Bucas Island, a small island northeast of Mindanao, *Merrill 5265*, October, 1906, is, we think, best referred to this species. Braun separated *Chara Benthami* from *C. gymnopitys*, to which it is closely allied, by its having one stipulode to each branchlet instead of two as in the latter species, but in the original specimen from Hongkong in the Kew Herbarium, this character is not constant.

6. **Chara gymnopitys** Braun in Linnaea 25 (1852) 708.

SIBUYAN, Magallanes, *Elmer 12382*, April, 1910.

This species has been found in Socotra, India, Ceylon, Straits Settlements, Tonkin, China, New Guinea, Australia, New Zealand, and Tasmania, also in the United States of America.

The plant from the Philippines may be characterized as *f. tylacantha macracantha meiocarpa*.

7. **C. flaccida** Braun in Hook. Journ. Bot. 1 (1849) 296.

LUZON, Manila, in shallow pools (about 20 cm), *W. R. Shaw 1173*, February, 1912.

In describing *Chara flaccida*, Braun separated it from *C. Hydropitys* by the yellow oospores and the always uncoated branchlets. *C. gymnopitys* was subsequently described with black or nearly black oospores, but it is so very similar in other respects to *C. flaccida* that we think a more extended knowledge of its various forms may prove that it should be regarded as a subspecies.

8. **Chara brachypus** Braun in Hook. Journ. Bot. 1 (1849) 298.

LUZON, Province of Rizal, in rather swift water of the Maraquina River, near the Manila waterworks dam at the Montalban Gorge, *Merrill 5098*, March, 1906.

A fairly typical form of this rare species which occurs in India and New Guinea, also in Africa and in Australia.

9. **Chara zeylanica** Willd. in Mém. Acad. Berol. 1803 (1805) 86, *t. II, f. 1.*
C. gymnopus Braun, *sens. lat.*

LUZON, Province of Rizal, Maricaban, near Manila, *Merrill 7462*, February, 1911, in shallow muddy pools of fresh water at sea level; Pasay, *Merrill 7586*, April, 1911, in stagnant pools of fresh water at sea level.

The commonest of the tropical species of *Characeae*, occurring in India, Ceylon, Burma, and Java, as well as in Africa, North and South America, and Australia. The plants from Luzon come under Braun's variety *ceylonica*.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 2. June, 1912.

SERTULUM BONTOCENSE.

NEW OR INTERESTING PLANTS COLLECTED IN BONTOC SUBPROVINCE, LUZON, BY FATHER MORICE VANOVERBERGH.

By E. D. MERRILL.

(*From the Botanical Section of the Biological Laboratory, Bureau of Science, Manila, P. I.*)

In the year 1909 Father Morice Vanoverbergh, who had recently come to the Philippines from Belgium, was assigned to the mission station at Bauco, Bontoc Subprovince, Luzon, and shortly after his arrival there entered into correspondence with the writer in regard to botanical matters. Father Vanoverbergh having expressed his deep interest in the study of botany, and a desire to become acquainted with the flora of the region in which he was located, an offer was made to determine, so far as possible, whatever he might submit for identification; and a small collecting outfit was sent to him. He commenced his botanical exploration of Bauco and vicinity in January, 1910, and continued it during his leisure hours until August, 1911. In this time he collected and transmitted to the Bureau of Science for determination about 1,400 numbers of plants, representing approximately 1,300 different species. The material was identified from time to time as it was received, and lists of names were sent to the collector, with special reference to those forms of which additional or more complete material was desired. In general collections received here, there is always a certain percentage of species represented which for lack of complete material can not be accurately determined, especially in those families having dioicious flowers, and in those groups where our classification is based on a combination of flower and fruit characters. Father Vanoverbergh has assiduously searched for the additional material required and accordingly I have been able to determine with a reasonable degree of accuracy a high percentage of the material collected by him.

The present paper is based primarily on specimens collected by Father Vanoverbergh; but in a number of cases I have been able, with aid of his material, to complete the determinations of specimens previously secured by other collectors and which for the most part had been determined only to the genus or family, or in some cases erroneously identified. From a study of his material I have been able to record, in the present paper, three genera, *Microcarpaea, Trachelospermum,* and *Teucrium,* previously unknown from the Archipelago, and two, *Microchloa* and *Blyxa,* which were included by Fathers Villar and Naves in the "Novissima Appendix" to the third edition of Blanco's "Flora de Filipinas," and whose records have not previously been verified. An apparently undescribed genus, *Vanoverberghia,* has been discovered in the collection, and I have been able to reduce one genus, *Cleistoloranthus,* previously proposed by me, so that the number of genera definitely known from the Archipelago has been increased by five. As to species originally described from extra-Philippine material but previously not definitely known from the Archipelago, I have been able to record the following eleven: *Blyxa octandra* Planch., *Microchloa setacea* (L.) Merr., *Scleria pergracilis* Kunth, *Cocculus laurifolius* DC., *Rhynchosia volubilis* Lour., *Lysimachia capillipes* Hemsl., *L. decurrens* Forst., *Microcarpaea minima* (Koenig) Merr., *Acrocephalus indicus* O. Ktze, *Utricularia exoleta* R. Br., and *Campanumoea truncata* Endl. Thirty-one species are described as new. I have previously described one new species of *Begonia* from Father Vanoverbergh's material, *B. vanoverberghii* Merr. Dr. C. B. Robinson has indicated two new species of *Elatostema,* *E. scapigerum* C. B. Rob., and *E. variabile* C. B. Rob., in the same collection. Several new species of orchids have been described by Mr. Ames,[1] while additional ones have been indicated for future publication. A study of Father Vanoverbergh's material has therefore increased our knowledge of the Philippine flora by six genera and over sixty species. I have dedicated the new genus *Vanoverberghia,* described below, to its discoverer and collector, and as its specific name I have associated with it the appellation *sepulchrei* in honor of the late Father Jules Sépulchre, Father Vanoverbergh's colleague and companion at Bauco, and the founder of the mission station at that place. Father Vanoverbergh informs me that Father Sépulchre took a lively interest in the botanical work and was of much assistance to

[1] Supra 1–27.

him in his botanical labors. Father Sépulchre died very suddenly in Bontoc on February 13th, 1912, and was buried in the church erected by himself. It is but a very slight acknowledgement of Father Vanoverbergh's services to Philippine botany to fulfill his request and to associate with the genus dedicated to him the name of his regretted friend, colleague, and companion.

In the year 1909 I described a new genus of the *Loranthaceae*, *Cleistoloranthus*,[2] which on reëxamination and comparison with excellent material representing the same species, secured by Father Vanoverbergh, I am now able to reduce to *Loranthus*. The type of the genus and species proves to have been a specimen with immature flowers. *Cleistoloranthus* may still be worthy of sectional rank on account of the peculiar appendages to the petals, but it can hardly be retained as a distinct genus if we follow the limits of genera generally accepted in this family.

The types of the new species indicated in the present paper are preserved in the Herbarium of the Bureau of Science, which also contains a complete or nearly complete set of all the botanical material collected in Bontoc by Father Vanoverbergh. He has also sent some material to the University of Louvain, Belgium, and many duplicate orchids have been supplied to Mr. Ames. Some duplicate material still remains to be distributed by the Bureau of Science.

Father Vanoverbergh's botanical work in Bontoc was interrupted in August, 1911 by his transfer to a new station in Union Province, but on the death of Father Sépulchre he was reassigned to the Bauco station, where he plans to continue his botanical explorations.

HYDROCHARITACEAE.

BLYXA Thouars.

Blyxa octandra (Roxb.) Planch. ex Thwaites Enum. Pl. Zeyl. (1859–64) 332.
Vallisneria octandra Roxb. Pl. Corom. 2 (1798) *t. 165.*
Blyxa roxburghii Rich. in Mém. Inst. Fr. (1811) 77, *t. 5;* Hook. f. Fl. Brit. Ind. 5 (1888) 660; Naves Novis. App. (1880) 214.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 664*, July, 1910, in rice paddies, altitude about 1,250 m.

Naves' record for this species as a Philippine one has not previously been verified. Tropical Asia through Malaya to Australia, and the Caroline Islands.

[2] This Journal 4 (1909) Bot. 150.

GRAMINEAE.

MICROCHLOA R. Br.

Microchloa indica (Linn. f.) comb. nov.

Nardus indica Linn. f. Suppl. (1781) 105.

Rottboellia setacea Roxb. Pl. Coromandel 2 (1798) 18, *t. 132.*

Microchloa setacea R. Br. Prodr. (1810) 208; Hook. f. Fl. Brit. Ind. 7 (1897) 283; F.-Vill. Novis. App. (1883) 319.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 764*, August, 1910, altitude about 1,300 m: Rizal Province, Novaliches, *Loher 7179*, June, 1904.

A species widely distributed in the Tropics, previously reported from the Philippines by Fernandez-Villar, but his record not before verified. The earliest valid specific name is here adopted.

CYPERACEAE.

CLADIUM P. Br.

Cladium cyperoides sp. nov.

Planta tenuis, perennis, plus minusve pilosa, foliis omnibus radicalibus, tenuibus, subrigidis, 4 ad 8 cm longis, circiter 1 mm latis; inflorescentiis longe et tenuiter pedunculatis, umbellatis, simplicibus vel compositis more Fimbristylis diphyllae; spiculis compressis, 5 ad 8 cm longis, oblongis, glumis puberulis, omnibus vel inferioribus exceptis distichis.

A slender, tufted, erect, perennial plant, the leaves and culms slightly ciliate-pubescent with white hairs, the leaves slender, all basal, flat or involute, rather rigid, 4 to 8 cm long, usually less than 1 mm wide, acute, the sheaths inflated, purple, enclosing the base of the stems. Inflorescence long-exserted, the slender leafless peduncle 10 to 30 cm long, deeply sulcate, about 0.5 mm thick. Inflorescence a simple or compound umbel, similar to that of *Fimbristylis diphylla* and allied species, rather dense, or lax, the spikelets fascicled or solitary, some sessile, others pedicelled, 5 to 20 in each inflorescence, the inflorescence subtended by 1 to several narrow, rigid, 0.5 to 2 cm long, leaf-like bracts which are inflated below and pubescent; rays few, up to 5 cm in length, usually much shorter. Spikelets brown, oblong, compressed, 5 to 8 mm long. Glumes all distichous, or the lower one or two spiral, puberulent, acute or acuminate; first glume empty, broadly ovate, 2.5 to 3 mm long, apiculate-acuminate, the apiculus 0.6 mm long; second glume 4 mm long, about 2 mm wide, acuminate, somewhat keeled, apiculate, 1-nerved, containing a perfect flower. Anthers 3, 1.8 mm long; style thickened at the base, jointed with the nut, about 3 mm long, with three 2 mm long arms; hypogynous bristles none. Nut white, obovoid, 3-angled, minutely verrucose, about 1 mm long; style deciduous.

Succeeding glumes similar to the second one, all subtending perfect flowers, usually 6 or 7 flowering glumes in each spikelet.

LUZON, Bontoc Subprovince Bauco, *Vanoverbergh 273*, hillsides, altitude about 1,320 m, first collected in March, 1910, again in May or June, 1910, and more abundant and representative material in May, 1911.

A curious species which may possibly be referable to some other genus than *Cladium*. It has very much the habit of various species of *Fimbristylis* of the *F. diphylla* group, but is at once distinguished from that and allied genera by its glumes being distichous, not spiral, or only the lower one or two spiral, very strongly resembling the spikelets of *Cyperus* in this character. It is anomalous in *Cladium* in its habit, its very slender, slightly pilose leaves, which are all basal, in its *Fimbristylis*-like inflorescence, its spikelets with mostly perfect flowers, and its glumes mostly distichously arranged.

When first received I could not refer it to its proper genus, and specimens were accordingly sent to Rev. G. Kükenthal, who reported it as probably referable to *Cladium;* in the meantime the second collection, having been received, I had also tentatively placed the material in *Cladium*. The description has been drawn up with reference to all three collections.

SCLERIA Berg.

Scleria pergracilis (Nees) Kunth Enum. 2 (1837) 354; Clarke in Hook. f. Fl. Brit. Ind. 6 (1884) 685.

Hypophorum pergracile Nees in Edinb. Phil. Journ. 17 (1834) 267.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 889*, October 5, 1910, on hillocks, altitude about 1,400 m. MINDANAO, District of Cotabato, near Makar, *Copeland*, December, 1911.

Not previously reported from the Philippines; Tropical Africa, through India and Ceylon to Yunnan. Remarkable for its lemon-scented leaves.

ZINGIBERACEAE.

ALPINIA L.

Alpinia vanoverberghii sp. nov. § *Probolocalyx*.

Herba erecta circiter 2 m alta, subtus foliis minute puberulis, inflorescentiis terminalibus pubescentibus; foliis oblongis, breviter petiolatis, usque ad 30 cm longis, 11 cm latis; racemis simplicibus quam folia longioribus, multifloris, bracteis bracteolisque nullis, pedicellis inter se remotis, solitariis vel binis, vix 2 cm longis; floribus pro genere magnis, albis, 5 ad 6 cm longis, connectivo vix appendiculato.

An erect herb about 2 m high. Leaves alternate, distichous, the sheaths of the uppermost ones frequently 30 cm long, rather loose, glabrous, the ligule chartaceous or subcoriaceous, 1.5 cm long or less, usually inequilaterally 2-lobed, the petioles 1.5 cm long or less; leaf-blades oblong, subcoriaceous, up to 30 cm long, 11 cm wide, glabrous and somewhat shining above, beneath slightly paler, shining, more or less puberulent, the base broadly

rounded or somewhat acute, the apex with a slender acumen. Racemes simple, terminal, as long as or longer than the leaves, the rachis and pedicels rather densely cinereous-pubescent, the pedicels 1.8 cm long or less, solitary, rarely in pairs, mostly 1.5 to 2 cm apart. Flowers white, 5 to 6 cm long. Calyx in bud cylindric, in anthesis spathaceous, split to the base down one side, 3 to 3.5 cm long, when spread 2.2 cm wide at the base, about 1 cm wide near the apex, the apex with three subequal, oblong-ovate teeth 3.5 to 5 mm long, densely pubescent on the back, the remainder of the calyx slightly pubescent on the back, obscurely about 17-nerved. Corolla exserted from the base of the calyx and at right-angles to it, the tube about 1.5 cm long, somewhat enlarged upwards, and nearly 1.5 cm wide at the apex. Corolla-lobes subequal, narrowly oblong, about 4 cm long, 1 cm wide, blunt, wrinkled when dry. Lip as long as the petals, about 2 cm wide above, apparently more or less cucullate, very much wrinkled when dry. Stamen-filament stout, broad at the base, when spread nearly 1 cm wide, narrowed upwards, 3 cm long; anther oblong, 2.2 cm long, nearly 5 mm in diameter, the connective not crested; staminodes linear, 1.5 cm long. Ovary pubescent, ovoid or obovoid, 3-celled, 5 to 8 mm long.

LUZON, Bontoc Subprovince, Bauco, on hillsides, altitude about 1,250 m, *Vanoverbergh 573*, June 11, 1910, locally known to the Igorot as *calawin*.

A species manifestly belonging in the subgenus *Probolocalyx*, the first one of this group to be found in the Philippines. It is well characterized by its large flowers, crestless anthers, rather lax, racemose inflorescence, and in the entire absence of bracts and bracteoles.

VANOVERBERGHIA gen. nov.

Calyx in alabastro cylindraceus, demum spathaceo-fissus, apice latus, planus, 3-dentatus. Corollae tubus calyce brevior, lobi anguste oblongi, subaequales, 2 antici alte ($\frac{1}{3}$ ad $\frac{1}{2}$) connati. Staminodia lateralia, linearia vel filiformia, elongata. Labellum petalis anterioribus alte adnatum, bifidum, lobi anguste lineares. Filamentum elongatum, concavum; antherae loculi discreti, connectivo sublatiusculo, concavo, non producto. Ovarium 3-loculare, loculis ∞-ovulatis; stylus filiformis, stigmate subovoideo, ciliolato; nectaria bina, crassa, compressa, erecta. Herba altissima, aromatica, e rhizomate crasso. Inflorescentia terminalis, racemosa, suberecta vel nutans. Flores in quaque bractea solitarii, bracteolis nullis.

Vanoverberghia sepulchrei sp. nov.

Planta erecta, robusta, usque ad 4 m alta, glabra, aromatica; foliis oblongis, usque ad 40 cm longis, longe caudato-acuminatis,

breviter petiolatis, vaginis superioribus inflatis; racemis terminalibus, suberectis vel nutantibus, bracteis calycibus subaequilongis, persistentibus, bracteolis nullis; floribus roseis, 4 ad 4.5 cm longis, petalis anterioribus alte connatis; labellum bifidum, membranaceum, lobis albidis, linearibus.

A tall, erect, glabrous, coarse plant, with a strong anise-like odor, reaching a height of 4 m, the rhizome 5 cm in diameter, red outside, the stem green, 5 cm in diameter below, higher up 2 cm in diameter, and at the apex 1 to 1.5 cm thick. Leaves alternate, distichous, oblong, subcoriaceous, the lower ones rather short, gradually increasing in length upwards, the longest ones at the top of the stem, up to 40 cm long and 10 cm wide, the apex slenderly caudate-acuminate, the acumen about 5 cm long, the base acute or somewhat rounded and shortly decurrent-acuminate, the petiole short, 1 cm long or less; nerves very numerous, slender, ascending, densely arranged; upper sheaths inflated, coriaceous, up to 20 cm long, when spread up to 6 cm wide, longitudinally striate, the upper ones tipped with much reduced leaves, or the uppermost one subtending the inflorescence acuminate and with no vestige of a leaf. Inflorescence terminal, racemose, peduncled, at length nodding, the flower-bearing part up to 20 cm long. Flowers very numerous, about 4.5 cm long, pink outside, white within, densely disposed, one to each bract, the bracts brown, oblong, persistent, somewhat boat-shaped, 2.5 to 3 cm long, 8 to 10 mm wide, much wrinkled when old; bracteoles wanting. Pedicels stout, 5 to 10 mm long, often twisted. Calyx in bud cylindric, in flower spathaceous, split down one side nearly to the base, above flattened and about 8 mm wide, about 10-nerved, the apex with 3 oblong-ovate, obtuse, 3 mm long teeth. Corolla-tube about 1.7 cm long, the posterior lobe narrowly oblong, 3 cm long, 6 to 7 mm wide, about 7-nerved, obtuse, slightly cucullate at the apex, flat below, the base boat-shaped, inclosing the stamen, the upper one-half ultimately reflexed or spreading; anterior lobes about as long as the posterior one and similar to it, united for one-third to one-half their length, keeled below the union, the free parts flat, 5- to 7-nerved, apex obtuse and slightly cucullate. Lip sessile, membranaceous, adnate to the anterior petals as high as the cleft along the middle, the margins free, narrow, cleft above the part united to the petals into two linear, thin, flexuous lobes about 1.8 cm long, 2 mm wide below, narrowed upwards, the lobes about as long as the free parts of the anterior petals. Stamen somewhat curved, the filament stout, cylindric, about 2 cm long and 2.5 mm thick,

channeled on the inside and inclosing the style; anther about 12 mm long, 3 mm thick, somewhat curved, the connective rather broad, but semi-cylindric, so that the lateral anther-cells are contiguous, not produced, truncate or retuse at the apex. Staminodes linear, 1 to 1.5 cm long, thin, flexuous, 1 mm wide or less from a somewhat broader base, attached at the angle between the lip and the posterior petal. Ovary 3 to 4 mm long, 3-celled; ovules many, spreading, attached along the inner angles of the cells; style slender, surrounded by the hollowed filament below, emerging above, nearly as long as the stamen; stigma obovate, about 2 mm long, somewhat oblique, truncate or hollowed, minutely ciliate. Nectaries 2, suborbicular, compressed, about 2 mm in diameter, one on each side of the style at the base but free from it. Fruit edible, subellipsoid, 2 to 2.5 cm long, the pericarp coriaceous, very tardily dehiscent. Seeds numerous, about 3 mm long.

LUZON, Bontoc Subprovince, Malamey (Pinggat), *Vanoverbergh 956*, October 19, 1910, and mature fruits August 17, 1911, along streams at an altitude of about 1,500 meters, locally known to the Igorots as *agbab*.

This genus is closely allied to *Riedelia* Oliver, and appears to be somewhat intermediate between that genus and *Alpinia*. It differs from *Riedelia* in its rather large floral bracts, and especially in its two anterior petals being united for one-third to one-half their length, its narrow and membranaceous lip being adherent to the two anterior petals as high as the cleft between them, the lip there split into two linear lobes as long as the free parts of the anterior petals.

The genus is dedicated to Father Morice Vanoverbergh, by whom it was discovered, in appreciation of his intensive and enthusiastic botanical exploration of the region in and about Bauco where his mission station is located. The species is dedicated to his colleague, Father Jules Sépulchre who came to the Philippines in November, 1907, and whose untimely death occurred in Bontoc February 13, 1912. Father Sépulchre established the Bauco mission, and rendered much assistance to Father Vanoverbergh, who was associated with him in the missonary work, in the latter's botanical explorations.

LORANTHACEAE.

LORANTHUS L.

Loranthus appendiculatus nom. nov.

Cleistoloranthus verticillatus Merr. in Philip. Journ. Sci. 4 (1909) Bot. 150, 5 (1910) Bot. 345, non *Loranthus verticillatus* Ruiz & Pav.

This was originally described by me as a new genus and species, on the basis of a single collection from Mount Pulog, Benguet Province, Luzon. The original material was taken to represent mature or nearly mature specimens, but a recent collection of the same species shows that the type was quite immature, the flowers being in young bud only. In the original specimens the corolla was considered to be composed of four almost entirely

united petals, forming a cylindric tube quite closed at the apex by an appendage from each corolla-lobe uniting to form a conical body at the mouth, the four free spreading lobes being broad and very short. This description is true of the original specimens, but quite mature flowers on recently collected material shows them not to be cleistogamous, and the corolla to be composed of four entirely free petals, and hence the species being referable to *Loranthus*, § *Heteranthus*.

Specimens from Malamey, Bontoc Subprovince, Luzon, collected by Father Vanoverbergh, in June, 1911, (*no. 1293*) match the type of *Cleistoloranthus verticillatus* in all respects except that some of the flowers are quite mature and open. The original description of the species must be emended as follows:

Inflorescence solitary or fascicled at the nodes, the flowers in umbellately disposed triads, or by reduction, in diads. Calyx 2.5 to 2.8 mm long. Petals 4, free, valvate, 1.6 cm long, about 1.7 mm wide, the reflexed part above the insertion of the stamen narrowly oblong, 5 mm long, about 2 mm wide, each petal with a somewhat triangular, thick appendage on the inner surface near the apex, the four appendages forming a conical body that closes the corolla in bud, the petals in bud with a spreading, 2 to 2.3 mm broad, short, truncate tip. Stamens 4 mm long, erect; filaments 2.5 mm long; anthers 1.5 mm long, continuous with the filaments and of the same diameter.

In spite of the reduction of *Cleistoloranthus* to *Loranthus* the species is a very distinct one in the latter genus, characterized by the peculiarly appendaged petals. In the generally accepted interpretations of the genera of *Loranthaceae*, *Cleistoloranthus* cannot be considered to be generically distinct from *Loranthus*, but with any treatment of genera approaching that proposed by Van Tieghem, it would probably rank as distinct as most of the genera indicated by that author.

Unfortunately the specific name originally used by me is not valid in *Loranthus*, hence the necessity of coining a new specific name under the latter genus.

Loranthus tetranthus sp. nov. § *Lepiostegeres.*

Glaber; foliis oppositis, coriaceis, oblongo-ellipticis ad lanceolatis, usque ad 6 cm longis, obtusis vel acutis, rariter leviter acuminatis, basi acutis, nervis obsoletis; capitulis axillaribus, solitariis, 4-floris, in alabastro oblongo-lanceolatis, acuminatis, bracteis numerosis, ovatis ad lanceolatis, interioribus gradatim longioribus; floribus 4-meris, sessilibus, corolla circiter 2 cm longa.

Glabrous throughout, 0.5 m high, the branches terete, dark-colored when dry, the internodes rather short. Leaves opposite, oblong-elliptic to lanceolate, 4 to 6 cm long, 1 to 2.5 cm wide, coriaceous, dull, of about the same color on both surfaces, the base acute, the apex blunt, acute, or rarely somewhat acuminate;

petioles 4 to 8 mm long; midrib prominent, the lateral nerves obsolete. Flowers in axillary, solitary, 4-flowered, sessile heads, surrounded by numerous, grayish-brown, chartaceous, imbricate bracts, the outer bracts broadly ovate, acute or acuminate, 3 to 4 mm long, the inner ones gradually longer, ovate-lanceolate, prominently acuminate, the innermost up to 1 cm long, the ultimate two or three strongly imbricate forming a beaked 1 cm long calyptra that falls as a whole. Flowers pink and greenish, sessile. Calyx 3.5 to 4 mm long, somewhat angled by contact with those of the other flowers in the same receptacle, slightly and irregularly 3- or 4-toothed, the limb slightly produced. Corolla about 2 cm long, 4-lobed, the lobes united for the lower 3 to 4 mm forming a short tube about 2.5 mm in diameter, the part above the insertion of the stamens linear-oblong, 6 mm long, about 0.6 mm wide. Filaments 1.5 mm long; anthers continuous, linear-lanceolate, acuminate, 3 mm long. Style slender, 2 cm long.

LUZON, Bontoc Subprovince, Malamey, *Vanoverbergh 1294*, June 28, 1911, parasitic on trees, altitude about 1,890 m.

A very distinct species of the section *Lepiostegeres*, entirely different from the few other species of the section known from the Philippines.

Loranthus pentagonus sp. nov. § *Dendrophthoë.*

Frutex glaber, ramulis crassis, acute pentagonis; foliis alternis, coriaceis, oblongis vel oblongo-ellipticis, usque ad 12 cm longis, petiolatis, obtusis vel acutis, basi acutis vel leviter acuminatis, nervis utrinque vix distinctis, 5 vel 6; inflorescentiis in axillis superioribus; floribus 6-meris, circiter 5 cm longis, sessilibus, solitariis, in diadibus, vel in triadibus dispositis.

A glabrous parasitic shrub, the branchlets stout, 5 to 8 mm in diameter, brown when dry, distinctly and sharply 5-angled. Leaves alternate, thickly coriaceous, oblong to oblong-elliptic, 7 to 12 cm long, 3 to 5.5 cm wide, brownish-olivaceous when dry, the lower surface slightly paler than the upper one, slightly shining, apex acute or obtuse, base more or less narrowed, acute or somewhat decurrent-acuminate, rarely subrounded; nerves 5 or 6 on each side of the midrib, not prominent, the reticulations obsolete or nearly so; petioles 1 to 1.5 cm long. Inflorescence in the uppermost axils, the rachis stout, 4 to 6 cm long, bearing alternate stout branchlets 1 cm long or less, each branchlet bearing at its apex from 1 to 3 sessile flowers, the bracteole subtending the flowers broadly triangular-ovate, concave, obtuse, about 4 mm long. Flowers 6-merous, yellowish, stout. Calyx cylindric, about 8 mm long, 4.5 mm in diameter, truncate, or very slightly and obscurely toothed. Corolla 4.5 cm long, the

tube slightly gibbous at the base and 5 mm in diameter, the lobes 3 mm wide below, narrowed above, the reflexed part above the insertion of the stamens about 1.5 cm long, thickened, 2 mm wide, the margins incurved. Filaments 3 to 4 mm long; anthers continuous, erect, linear-lanceolate, about 1 cm long.

LUZON, Bontoc Subprovince, Bauco, in forests, altitude about 1,650 m, *Vanoverbergh 1254*, June 13, and August 17, 1911.

A characteristic species, its distinctive features being its stout, 5-angled branchlets, and its comparatively large flowers, the corolla being somewhat gibbous at the base.

MENISPERMACEAE.

COCCULUS DC.

Cocculus laurifolius DC. Syst. 1 (1818) 530, Prodr. 1 (1824) 100; Diels in Engl. Pflanzenreich 46 (1910) 239.

LUZON, Bontoc Subprovince, Daoait, *Vanoverbergh 1237*, June, 1911, along trails, altitude about 1,200 m.

Not previously reported from the Philippines, the third species of the genus to be found in the Archipelago. India to Japan, southern China, Formosa, and Java.

The specimen is a fairly close match for *Wallich 4965*, a specimen of which is in our herbarium, as well as several specimens from plants cultivated in the Botanic Garden at Buitenzorg, Java.

MAGNOLIACEAE.

ILLICIUM Linn.

Illicium montanum sp. nov.

Arbor parva, glabra, aromatica; foliis oblongo-ellipticis, utrinque acutis vel leviter acuminatis, coriaceis, usque ad 8 cm longis, nervis utrinque circiter 7, obscuris vel subobsoletis; floribus axillaribus, fasciculatis, circiter 3 cm diametro; folliculis circiter 12, radiatis, 1.5 ad 2 cm longis, acuminatis.

A small, glabrous, aromatic tree about 4 m high. Branches olivaceous when dry. Leaves coriaceous, dark-brown when dry, slightly shining, oblong-elliptic, narrowed about equally at both ends and acute or slightly acuminate, 5 to 8 cm long, 2 to 3.3 cm wide, the midrib very stout and prominent; lateral nerves about 7 on each side of the midrib, very faint, often nearly obsolete, the reticulations obsolete; petioles about 1 cm long. Flowers white, axillary, somewhat fascicled, the buds ovoid, sessile, soon becoming short-pedicelled. Sepals and petals about 20, the outer ones in bud ovate, apiculate, their margins ciliate, deciduous or persisting until anthesis and elongated, the outer sepals in flower oblong, about 15 mm long, 6 mm wide, obtuse, the inner ones gradually shorter and narrower, the innermost petals lanceolate, long-acuminate, about 10 mm long. Stamens

about 20, in two rows, 3 to 4 mm long. Carpels about 12, acuminate, 5 mm long, in fruit radiately arranged, laterally compressed, lanceolate, 1.5 to 2 cm long, about 5 mm deep.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 1048*, January, 1911, in forests, altitude about 1,650 m.

The second species of the genus to be found in the Philippines, differing from *Illicium philippinense* Merr., to which it is closely allied, in its larger flowers, more numerous perianth-segments, and larger and more numerous mature carpels.

LEGUMINOSAE.

RHYNCHOSIA Lour.

Rhynchosia volubilis Lour. Fl. Cochinch. (1790) 460; DC. Prodr. 2 (1825) 385; Hemsley in Journ. Linn. Soc. Bot. 23 (1887) 196.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 654*, July, 1910, altitude about 1,400 m.

Not previously reported from the Philippines; China to Formosa and Japan.

The specimen seems to be referable to Loureiro's species, as that is at present interpreted; it differs from it, as described, in having the leaflets shortly acuminate, not obtuse. The Luzon plant is matched in all respects by one from Formosa, *Nakahara 195*, July, 1905.

DERRIS Lour.

Derris oblongifolia sp. nov. § *Paraderris.*

Frutex erectus vel scandens, partibus junioribus plus minusve ferrugineo-pubescentibus vetustioribus glaber vel subglaber; foliis pinnatis, circiter 20 cm longis, foliolis 13, oblongis vel anguste oblongo-obovatis, acuminatis, 3 ad 7 cm longis; racemis axillaribus, ferrugineis, quam folia multo brevioribus; floribus fasciculatis, albidis vel roseis, circiter 1.7 cm longis, vexillo piloso, basi subcalloso; leguminibus oblongis, 5 ad 8 cm longis, 1.5 ad 2 cm latis, subglabris.

A scandent woody vine, or suberect and about 1 m high, the younger parts more or less ferruginous-pubescent, in age becoming glabrous or nearly so. Branches dark-brown, lenticellate, slightly pubescent, the younger parts very densely ferruginous-pubescent. Leaves alternate, about 20 cm long, pubescent with scattered, short hairs, becoming nearly glabrous; leaflets 13, oblong to narrowly oblong-obovate, when young membranaceous, becoming firmly chartaceous, 3 to 7 cm long, 1.5 to 2 cm wide, base rounded or subacute, the apex shortly and rather abruptly acuminate, the lower surface slightly paler than the upper, in age becoming quite glabrous except for scattered hairs along the midrib; lateral nerves about 10 pairs, slender but distinct; petiolules 2 to 3 mm long. Racemes in the upper axils, solitary,

appearing with the leaves, forming a terminal leafy inflorescence, rather densely ferruginous-pubescent. Flowers fascicled at the nodes, white or pink, their pedicels pubescent, 6 to 7 mm long. Calyx ferruginous-pubescent, cup-shaped, subtruncate, 5 to 6 mm deep and wide, faintly and broadly toothed. Standard about 17 mm long, the claw 3 to 4 mm long, the lamina suborbicular, retuse, pubescent on the back, reflexed in anthesis, the base with thickened but not projecting callosities. Wings adherent to the keel, their claws slender, about 6 mm long, their blades narrowly oblong, about 4 mm wide, similar to those forming the keel. Vexillary filament free at the base, united with the others above. Ovary somewhat pubescent. Fruit very thin, oblong, 5 to 8 cm long, 1.5 to 2 cm wide, acuminate, when young with very few scattered short hairs, apparently when mature glabrous or nearly so, one wing about 2.5 mm wide, the other less than one-half as wide.

LUZON, Bontoc Subprovince, Bauco, on hillsides, altitude about 1,325 m, *Vanoverbergh 280*, in flower April, 1910, in fruit May, 1911.

A species apparently undescribed, and quite different from any of the Philippine forms previously known. Although the callosities of the standard do not project as in *Derris elliptica* Benth., still they are sufficiently evident as thickenings of the tissue, and apparently refer the present species to the section *Paraderris*.

TERAMNUS Sw.

Teramnus angustifolius sp. nov.

Herba scandens omnibus partibus plus minusve ferrugineo-pubescens; foliolis lanceolatis usque ad 7 cm longis, vix 1 cm latis; calycis dentibus lanceolatis, acuminatis, aequalibus, 2 mm longis.

A scandent, slender, herbaceous vine reaching 1 m in length. Stems 4-angled, 1.5 mm in diameter or less, rather densely pubescent with somewhat spreading ferruginous hairs. Leaves trifoliolate, the petioles, petiolules and lower surfaces of the leaflets more or less appressed-pubescent with ferruginous hairs, the stipels pubescent, acicular, about 1 mm long; petioles 1.5 to 3 cm long; petiolules of the lateral leaflets usually about 2 mm long, that of the terminal one longer. Leaflets lanceolate, 4 to 7 cm long, 5 to 9 mm wide, chartaceous, base rounded or acute, narrowed upwards to the apiculate apex. Racemes pubescent, axillary, solitary, few-flowered, 2 to 9 cm long, slender. Calyx 4.5 mm long, appressed-pubescent, the 5 lobes subequal, lanceolate, acuminate, 2 mm long. Corolla almost included in the calyx, blue and white; standard 5.5 mm long, the limb orbicular-elliptic, retuse, not auricled at the base, 4 mm long, 3 mm wide,

the claw about 1.5 mm long; wings and keel nearly as long as the limb, clawed, narrow. Stamens monadelphous, the vexillary one united with the others at the base, then free for about 0.5 mm, then united with the others again, forming a closed tube, five of the filaments bearing fertile anthers about 0.4 mm long, the other five without anthers. Ovary cylindric, somewhat pubescent, bearded at the apex, the style short, curved; ovules about 10. Young pods somewhat flattened, slightly pubescent, 4 cm long, 3 mm wide.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 716*, July 28, 1910, in cultivated lands, altitude 1,300 m.

A very distinct species, at once recognizable by its lanceolate, comparatively very narrow leaflets.

RUTACEAE.

EVODIA Forst.

Evodia villosa sp. nov.

Frutex circiter 1.5 m altus, ramulis, subtus foliis inflorescentiisque dense fulvo-villosus; foliis unifoliolatis, foliolis ellipticis vel oblongo-ellipticis, breviter acuminatis vel acutis, 10 ad 15 cm longis, nervis prominentibus, utrinque 7 ad 10; inflorescentiis axillaribus, brevibus, in alabastro densissimis; floribus 4-meris, calycis villosis.

A shrub about 1.5 m high, the branchlets, petioles, lower surfaces of the leaves and inflorescence densely fulvous-villous, the indumentum rather pale. Leaves opposite, 1-foliolate, the petiole stout, about 2 cm long. Leaflets elliptic to oblong-elliptic, coriaceous, 10 to 15 cm long, 3 to 6.5 cm wide, rather pale when dry, shining, the apex shortly acuminate or merely acute, the base acute, rarely somewhat rounded, the upper surface fulvous-villous, densely so on the midrib and nerves; lateral nerves 7 to 10 on each side of the midrib, prominent, arched-anastomosing, the reticulations distinct. Inflorescence in the upper axils, in bud dense, not exceeding the petioles, many-flowered. Flowers 4-merous, yellowish-green. Sepals obtuse, oblong, densely villous outside, 2 mm long. Petals (in nearly mature bud) oblong-elliptic, obtuse, punctate, 2 mm long. Ovary ovoid, densely villous, about 1.3 mm long; style subquadrangular, subsessile, about 0.6 mm in diameter. Stamens 4, short. Fruit unknown.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 1002*, November 15, 1910, in forests, altitude about 1,650 m.

A species not closely allied to any other known Philippine form, well characterized by its villous, pale-fulvous indumentum.

VITACEAE.

TETRASTIGMA Planch.

Tetrastigma brunneum sp. nov.

Frutex scandens, glaber, ramulis teretibus; foliis palmato 3- ad 5-foliolatis, foliolis coriaceis, in siccitate brunneis, ovatis, oblongo-ovatis, vel subellipticis, basi acutis vel rotundatis, apice abrupte subtenuiter acute acuminatis apiculatisque, margine distanter crenato-serratis; inflorescentiis axillaribus, laxis, corymboso-paniculatis; floribus 4-meris, subumbellato dispositis, circiter 1.5 mm longis, numerosis; fructibus obovoideis vel oblongo-obovoideis, 8 mm longis; seminibus 2, plano-convexis, rugosis, haud sulcatis.

A woody vine 5 to 6 m in length, glabrous throughout. Stems and branches terete, light-brown, striate, the branchlets usually smooth, black or dark-colored when dry. Tendrils leaf-opposed, forked, up to 18 cm in length. Leaves palmately 3- to 5-foliolate, their petioles 1.5 to 5 cm in length. Leaflets ovate, oblong-ovate, or subelliptic, firmly coriaceous, always brown when dry, the lower surface a little paler than the upper one, slightly shining, 5 to 10 cm long, 2 to 5 cm wide, the middle leaflet larger than the lateral ones, abruptly and rather slenderly acutely acuminate, the acumen apiculate, the base rounded or acute, the margin distantly crenate-serrate, the teeth usually rather prominent, often apiculate; nerves 5 or 6 on each side of the midrib, not prominent, anastomosing, the reticulations lax, obscure; petiolules of the lateral leaflets 4 to 8 mm long, that of the middle one about 1.5 cm in length. Inflorescence axillary, rather lax, corymbose-paniculate, many-flowered, peduncled, about 8 cm long, enlarged in fruit and often forming terminal or subterminal more or less leafy panicles. Male flowers: Calyx shallowly cup-shaped, truncate, about 1 mm in diameter. Petals 4, free, oblong, 1.8 to 2 mm long, obtuse, cucullate at the apex inside. Filaments about 1 mm long, inserted under the broad disk; anthers 0.5 mm long, broader than long. Disk prominent, obscurely 4-angled or lobed. Female flowers: Calyx somewhat funnel-shaped, truncate, 1.2 mm in diameter. Petals as in the males. Staminodes slender, 1 mm long, slightly dilated at the apex. Ovary cylindric-ovoid, truncate, glabrous, 1.2 mm long; stigma sessile, disk-like, not at all or very obscurely lobed, 0.7 mm in diameter. Fruit obovoid to oblong-obovoid, about 8 mm long, apparently somewhat fleshy, each containing two plano-convex seeds, or the

inner face slightly concave, not sulcate, somewhat rugose, brown, the albumen ruminate.

LUZON, Bontoc Subprovince, Malamey, *Vanoverbergh 795* (type), August, 1910, in forests, altitude about 1,550 m, with ♂ flowers, a second collection in December, 1910, with immature fruits: Benguet Subprovince, Pauai, *Bur. Sci. 8410 McGregor*, June, 1909, with very immature flowers, altitude about 2250 m; Mount Tonglong, *Bur. Sci. 5125 Ramos*, December, 1908, with immature fruits, altitude about 2,100 m, *Williams 1336*, October, 1904: Province of Tayabas, Mount Binuang, *Bur. Sci. 9434 Robinson*, August, 1909, with ♀ flowers; Lucban, Mount Banajao, *Elmer 7796*, May, 1907, with mature fruits, distributed as *Tetrastigma lanceolarium* Planch.: Province of Bataan, Mount Mariveles, *Bur. Sci. 1560 Foxworthy*. Probably also should be referred here *Elmer 10867* from Mount Apo, Mindanao, distributed as *Tetrastigma pergamaceum* Blume.

Apparently allied to *Tetrastigma pergamaceum* Blume, but differing from that species, as described, in its terete stems, its 3– to 5–foliolate leaves, never 1–foliolate as is usually the case in Blume's species, and in its axillary, not leaf-opposed cymes. The species is not typical of *Tetrastigma*, as the stigmas are perfectly circular in outline, not at all lobed, but has been placed in the genus as it agrees in other details, especially in its 4–merous flowers, and in its fruit and seed characters.

Tetrastigma philippinense sp. nov.

Species T. loheri similimis et ut videtur valde affinis differt petalis extus distincte pubescentibus.

A tendril-bearing dioecious vine reaching a height of 10 m, and the trunk a diameter of 2 cm, glabrous except the inflorescence. Branches terete, brownish, smooth, slender. Leaves 3-foliolate, their petioles 1 to 2.5 cm long; leaflets lanceolate, submembranaceous to coriaceous, dull or slightly shining, of about the same color on both surfaces, the middle one longer than the lateral ones, equilateral, obtuse, rounded, or subacute at the base, the lateral ones somewhat falcate, inequilateral at the usually rounded base, all acuminate at the apex, margins often slightly undulate, distantly serrulate-crenate, the teeth usually mucronulate, 6 to 16 cm long, 1.5 to 4.5 cm wide; lateral nerves 7 to 10 on each side of the midrib, not prominent, the reticulations lax, obsolete or indistinct; petiolules of the middle leaflets 1 to 2 cm long, of the lateral ones 5 mm or less. Tendrils simple, 10 to 15 cm long or more. Inflorescence axillary, pubescent, about as long as the petioles, compound, umbellately corymbose, the flowers subumbellately arranged on the ultimate branchlets. Female flowers: Calyx obscurely 4-toothed, about 1.5 mm in diameter. Petals 4, oblong, pubescent externally, obtuse, somewhat cucullate at the apex, 2 to 2.2 mm long. Ovary ovoid, glabrous, 1.5 mm long, slightly contracted upwards; stigma

sessile, distinctly but shallowly 4-lobed. Staminodes slender, spatulate, 1 to 1.2 mm long. Male flowers similar to the female ones in size. Filaments 1.5 mm long; anthers broadly ovoid or ellipsoid, 0.6 mm long. Disk prominent. Fruit oblong-obovoid, red, turning dark-purple or black, the pericarp more or less fleshy when fresh, apparently thin. Seeds solitary, with a shallow longitudinal groove along each side, obscurely sulcate, the albumen ruminate.

Type specimen *R. S. Williams 1025*, Antamok, Benguet Subprovince, Luzon, October 22, 1904, with ♀ flowers, altitude about 1,000 m.

This species is common and widely distributed in the Philippines, and most of the material below referred to it has been determined here as *Tetrastigma lanceolarium* Planch., a few specimens as *T. angustifolium* Planch., and very recently a number have been referred to *Tetrastigma loheri* Gagnep., the latter determinations being based on a specimen of *Whitford 19*, referred by Gagnepain to his species.[3] However, Whitford's specimen is with fruit only, and its determination as *Tetrastigma loheri* Gagnep., must have been based on strong vegetative resemblances between it and the type of the species, *Loher 371*. According to Gagnepain's description, and according to the characters used by him in his key to the Asiatic species,[4] all the material cited below must belong to a different species than *T. loheri*, for that species has glabrous petals, while all our material of *T. philippinense* has pubescent petals. As to *Whitford 19* it is impossible to say whether or not the petals were glabrous or pubescent, but abundant material from the same locality in flower, which matches it in all respects, so far as the material in different stages is comparable, has pubescent petals. I have no hesitation in referring to *Tetrastigma philippinense* the following material:

LUZON, Province of Ilocos Norte, *For. Bur. 12489 Merritt & Darling*, November, 1908: Bontoc Subprovince, Bauco, *Vanoverbergh 646*, June, October, 1910, ♀ flowers: Benguet Subprovince, lower slopes of Mount Pulog, *Merrill 6394*, May, 1909, ♀ flowers; Sablang, *Bur. Sci. 12730 Fénix*, November, 1910, with young fruits: Province of Bataan, Lamao River, Mount Mariveles, *Williams 349, 792*, December, 1903, January, 1904, the former with ♂ Flowers, the latter with immature fruits, *For. Bur. 2310 Meyer*, December, 1904, ♀ flowers, *Bur. Sci. 1872 Foxworthy*, December, 1906, ♂ flowers, *Whitford 19*, April, 1904, with mature fruits; Dinalupijan, *Merrill 1590*, December, 1902, with ♂ flowers: Province of Pampanga, Arayat, *Merrill 1419*, March, 1903, with mature fruits: Province of Laguna, Cavinti, *Loher 5837*, February, 1906, with immature fruits: Province of Rizal, Montalban, *Loher 5824*, January, 1905, with ♀ flowers; Caytimon, *Bur. Sci. 10897 Ramos*, October, 1909: Province of Tayabas, *Bur. Sci. 13277 Ramos*, March, 1911, in fruit, *Bur. Sci. 12325 Foxworthy*, with very young fruits. MINDORO, Baco River, *McGregor 261*, April, 1905, in fruit, *Merrill 1240*, January, 1903, in fruit. PALAWAN, *Merrill 846*, February, 1903, with ♂ flowers and with fruits. MINDANAO, Butuan Subprovince,

[3] Not. Syst. 1 (1910) 265.
[4] L. c. 312.

Weber s. n., March 15, 1911, with fruits: District of Davao, *Copeland 533*, March, 1904, with ♂ flowers and with fruits.

Native names: *Chanon* (Igorot, Benguet); *Ayo*, *Ayu* (Tagalog, Bataan, Rizal, Pampanga, etc.).

Tetrastigma sepulchrei sp. nov.

Frutex scandens, inflorescentiis exceptis glaber, ramulis teretibus, striatis, vix tuberculatis; foliis 3-foliolatis vel pedato-5-foliolatis, foliolis coriaceis, nitidis, oblongis, usque ad 12 cm longis, acuminatis, distanter crenato-denticulatis; inflorescentiis axillaribus vel oppositifoliis, 2- vel 3-pinnatim umbellato-corymbosis, petiolo aequantibus vel longioribus; floribus umbellato-dispositis, extus leviter pubescentibus, petalis oblongis, 3 mm longis, supra glanduloso-corniculatis; ovario piloso.

A scandent vine about 3 m high, glabrous except the inflorescence, the branches terete, striate, smooth, olivaceous when dry. Tendrils leaf-opposed, stout. Leaves palmately 3-foliolate or more commonly pedately 5-foliolate, their petioles 3 to 5 cm long. Leaflets oblong, coriaceous, shining, of about the same color on both surfaces when dry, the lower surface duller than the upper one, 9 to 12 cm long, 3 to 4.5 cm wide, acuminate, base acute or somewhat rounded, of the lateral ones usually inequilateral, the margins more or less recurved, distantly crenate-denticulate; primary lateral nerves 7 to 9 on each side of the midrib, distant, anastomosing, the reticulations obsolete or nearly so; petiolule of the middle leaflet about 2 cm long, the common one of the two lateral leaflets about one-half as long, their petiolules proper 3 to 5 mm in length. Inflorescence leaf-opposed and axillary, 5 to 10 cm long, slightly pubescent or nearly glabrous, rather lax, 2- or 3-pinnately umbellate-corymbose, the primary branches opposite or umbellately arranged, each bearing 4 or 5 or more umbellately arranged secondary branches, these in turn bearing few to many umbellately arranged flowers. Flowers 4-merous (very rarely 5-merous), dioecious, their pedicels 3 to 5 mm in length. Pistillate flowers: Calyx disk-like, truncate, 1.5 mm in diameter, glabrous. Petals 4 (rarely 5), uniformly but sparingly pubescent externally oblong or oblong-ovate, somewhat narrowed upwards, obtuse or acute, distinctly hooded at the apex and some or all with an apical dorsal gland with a short, stout, reflexed process at its base. Staminodes very slender, 1 mm long. Ovary 2 mm long, narrowed upwards, glabrous. Stigma sessile, truncate, obscurely 4-lobed.

LUZON, Bontoc Subprovince, Bauco, in forests, altitude about 1,650 m, *Vanoverbergh 1215*, May 18, 1911.

According to Gagnepain's recent treatment of this genus the species above described is allied to *Tetrastigma crassipes* Planch., and to *T. pedunculare* Planch., although apparently not very close to either. It is dedicated to Father Jules Sépulchre, Father Vanoverbergh's colleague and companion at Bauco and founder of the mission at that place whose recent sudden death is greatly deplored.

TILIACEAE.

GREWIA L.

Grewia setacea sp. nov. § *Eugrewia.*

Arbor parva, omnibus partibus plus minusve simpliciter vel admodum stellato-pilosis, partibus junioribus ferrugineis; foliis oblongis vel oblongo-ovatis, acutis vel breviter acuminatis, basi obtusis vel rotundatis, aequilateralibus, trinerviis, margine crenato-denticulatis; stipulis setaceis; inflorescentiis axillaribus, solitariis, umbellatis; floribus bracteatis, circiter 9 mm longis, petalis 2 mm longis, ciliatis.

A small tree, all parts more or less pilose or pubescent with simple or somewhat stellately-arranged hairs, the young shoots and leaves rather densely ferruginous-pilose, the older parts with scattered hairs. Branches terete, dark-colored, somewhat pubescent. Leaves oblong to oblong-ovate, firmly chartaceous or subcoriaceous, 5 to 8 cm long, 2 to 3.5 cm wide, equilateral, somewhat shining when dry, slightly paler beneath, the apex acute or shortly acuminate, the base obtuse or rounded, margins rather finely and uniformly crenate-serrate, the upper surface pubescent on the midrib and nerves, the lower surface with simple or stellate, more or less scattered, pilose hairs on the nerves and reticulations; basal nerves extending above the middle of the leaf, the lateral ones above the basal pair about 4 on each side of the midrib, ascending, prominent beneath; petioles densely pubescent, 5 to 8 mm long; stipules setaceous, somewhat pubescent, about 1 cm long. Inflorescence of axillary umbels, solitary or in pairs, stellate-pubescent, the flowers few, usually about three, their pedicels subtended by a whorl of linear-lanceolate, acuminate, 5 to 7 mm long, slightly pubescent bracteoles, the pedicels 4 to 7 mm long, the peduncles usually about 1.5 cm in length. Sepals oblong, obtuse, pubescent, about 9 mm long, 2 to 2.2 mm wide. Petals elliptic-oblong or ovate-elliptic, distinctly ciliate-pilose, about 2 mm long, 1.5 mm wide. Stamens 1 mm long or less; anthers subglobose (perfect?), 0.2 mm long. Ovary villous; style glabrous, 3 mm long, cleft above. Drupe black when dry, somewhat pubescent, ultimately nearly glabrous,

2-lobed, the lobes ovoid, about 7 mm long, each lobe 1- or 2-celled, each cell containing a single seed.

LUZON, Benguet Subprovince, Mount Tonglon, *For. Bur. 5022 Curran* (type), August, 1906, a small tree with white flowers near the summit of the mountain, altitude probably about 2,000 m: Bontoc Subprovince, Bauco, *Vanoverbergh 1372*, August, 1911, altitude 1,250 m.

A species with somewhat the aspect of *Grewia multiflora* Juss., and *G. laevigata* Vahl, but quite different from both in its pubescence.

MALVACEAE.

SIDA L.

Sida puberula sp. nov.

Species S. corylifoliæ Wall. affinis, differt omnibus partibus plus minusve cinereo-stellato-puberulis, aristis carpellorum brevioribus, pubescentibus, non reflexo-villosis.

An erect branched shrub about 3 m high (*fide* Vanoverbergh). Branches terete, cinereous-puberulent. Leaves oblong-ovate, firmly chartaceous, base somewhat cordate, apex acute or slightly acuminate, the margins crenate-denticulate, 3 to 8 cm long, 2 to 4.5 cm wide, the upper surface stellate-puberulent with scattered hairs, the lower surface much paler and densely cinerous-stellate-puberulent; basal nerves 2 pairs, the outer pair much shorter than the inner, the inner pair reaching to about the middle of the leaf, the lateral nerves above the basal ones about 4 on each side of the midrib, the reticulations few, lax; petioles densely cinereous-stellate-puberulent, 1.5 to 2.5 cm long; stipules setaceous, about 4 mm long. Flowers orange-yellow, rather large, axillary, solitary, mostly somewhat crowded near the ends of the branches, the peduncles stellate-puberulent, reaching a length of 5 cm, somewhat geniculate near the apex. Calyx about 1.5 cm long, 2 cm in diameter, the lobes ovate, acuminate, 8 to 9 mm long, outside stellate-puberulent, inside puberulent with simple hairs. Petals obliquely and very broadly obovate, about 2 cm long, 2.5 cm wide, each with from 15 to 20 slender nerves. Staminal-tube cylindric, densely pubescent, about 8 mm long, 3 mm in diameter; stamens very numerous, the anthers about 1 mm long, 2 mm wide. Styles 9, united for the lower 7 mm, the free portions exserted, about 1.5 cm long. Carpels 9, including the awns about 7 cm long, slightly reticulate on all three faces, glabrous except for the two, pubescent, terminal, 1.5 to 2 mm long awns.

LUZON, Bontoc Subprovince, Bauco, wet hillsides, altitude about 1,350 m, *Vanoverbergh 853*, September 14, 1910.

A species allied to and with much the general appearance of *Sida corylifolia* Wall., differing not only in its much larger size (3 m high), but also in being more or less densely stellate-puberulent throughout, and especially in its carpels having much shorter awns which are not supplied with reflexed bristles.

DILLENIACEAE.

SAURAUIA Willd.

Saurauia vanoverberghii sp. nov.

Arbor parva circiter 6 m alta, ramulis subtus foliis inflorescentiisque dense brunneo-setosis; foliis coriaceis, oblongo-obovatis, usque ad 12 cm longis, denticulatis, supra nervis plus minusve setosis exceptis glabra; pedunculis axillaribus, solitariis, quam petiolo longioribus, paucifloris; floribus bracteatis, albidis, circiter 2 cm diametro; styli 5.

A small tree about 6 m high, the branches and branchlets very densely covered with brown or ferruginous, linear, acuminate setae, the setae themselves more or less furfuraceous. Leaves coriaceous, oblong-obovate, 9 to 12 cm long, 3 to 5.5 cm wide, the upper surface ultimately quite glabrous, or the nerves more or less setose, much darker than the lower surface which is rather densely covered with brown setae which like those of the branches and inflorescence are more or less furfuraceous, base rounded, apex acute or slightly acuminate, margins denticulate, the teeth rather irregular, not very close; petioles densely brown-setaceous, 1 to 2.5 cm long; lateral nerves 9 to 11 on each side of the midrib, prominent on the lower surface, curved-ascending, anastomosing, the reticulations distinct. Inflorescence in the axils, solitary, 5 cm long or less, long-peduncled, few-flowered, all parts brown-setose, the peduncle 3 to 4 cm long, the leaf-like bracts subtending the flowers 1.5 cm long or less, similar to the leaves in shape and texture. Flowers white, few, 2 or 3 to several on each inflorescence, about 2 cm in diameter. Sepals ovate, about 5 mm long, setose on the back. Petals obovate, about 8 mm long, glabrous. Stamens many; anthers about 2 mm long. Styles 5, short, free nearly or quite to the base.

LUZON, Bontoc Subprovince, Malamey, *Vanoverbergh 1014*, December 3, 1910, in forests, altitude about 1,500 m.

A species, while similar in vegetative characters to other forms, well characterized by the furfuraceous setae, all of the other Philippine forms having glabrous setae.

GUTTIFERAE.

CALOPHYLLUM L.

Calophyllum glabrum sp. nov. § *Inophyllum.*

Arbor parva, 5 ad 6 m alta, glabra; foliis coriaceis, nitidis, oblongo-ellipticis, usque ad 8 cm longis, basi angustatis, acutis, apice breviter obtuse acuminatis; racemis terminalibus et in axillis superioribus, folia aequantibus vel longioribus; floribus 2.5 ad 3 cm diametro, sepalis decussatis, exterioribus parvis, orbicularis, interioribus multo majoribus; petalis 5 vel 6, anguste oblongis, circiter 13 mm longis.

A small tree, 5 to 6 m high, glabrous in all parts even including the buds. Branches reddish-brown, smooth, slightly wrinkled when dry. Leaves oblong-elliptic, rarely narrowly obovate-oblong, 6 to 8 cm long, 2.5 to 3.5 cm wide, coriaceous, shining, base narrowed, slightly decurrent, acute, apex shortly and obtusely acuminate; midrib prominent on the lower surface, impressed on the upper surface; lateral nerves very fine and dense; petioles 7 to 10 mm long. Racemes terminal and in the uppermost axils, glabrous, simple, equaling or a little longer than the leaves. Flowers 2.5 to 3 cm in diameter, their pedicels 1 to 1.5 cm long, the petals white, the stamens yellow. Sepals 4, concave, in two pairs, the outer two orbicular, 5 to 6 mm in diameter, the inner two oblong-elliptic, about 11 mm long. Petals 5 or 6, white, narrowly oblong, obtuse, about 13 mm long, 4 mm wide. Stamens indefinite; filaments 4 mm long; anthers oblong, 1 to 1.8 mm long. Fruit ovoid, about 1 cm long when young, crowned by the style.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 1251*, June 13, 1911, in forests, altitude about 1,650 m, with immature fruits, August, 1911.

A species allied to *Calophyllum blancoanum* Pl. & Tr., differing in its smaller leaves and especially in its quite glabrous racemes.

THYMELAEACEAE.

WIKSTROEMIA Endl.

Wikstroemia angustissima sp. nov.

Frutex erectus circiter 1 m altus ramulis inflorescentiisque exceptis glaber; foliis anguste lanceolatis, usque ad 7.5 cm longis, 8 mm latis rectis vel leviter falcatis, acuminatis, breviter petiolatis; floribus subcapitato-dispositis, pallide viridibus, circiter 8 mm longis.

An erect, much branched shrub about 1 m high. Branches slender, terete, smooth, reddish-brown, the ultimate branchlets somewhat appressed-pubescent. Leaves narrowly lanceolate,

chartaceous, glabrous, 4 to 7.5 cm long, 4 to 8 mm wide, straight or slightly falcate, the base acute, the apex acuminate; lateral nerves obscure, ascending, irregular; petioles 1 to 1.5 mm long. Flowers pale-green, subcapitately racemose at the tips of the branches, the peduncles and rachis appressed-pubescent, 5 to 6 mm long, the pedicels pubescent, about 0.5 mm long. Perianth cylindric, in anthesis about 8 mm long, 1.5 mm in diameter, slightly appressed-pubescent externally, 4-lobed, the lobes orbicular-ovate, rounded, about 1 mm long. Stamens eight, 2-seriate, arranged in the upper part of the perianth-tube, the anthers 0.8 to 1 mm long. Ovary oblong; style very short; stigma capitate, 0.5 mm in diameter. Fruit fleshy, red, ovoid, about 7 mm long.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 430* (type), April 26, 1910, altitude about 1,260 m, locally known to the Ilocanos as *suca;* also represented by *Bur. Sci. 5831 Ramos*, Sablan River, Benguet, December, 1908.

A species well characterized by its very narrow, elongated leaves. It is allied to *Wikstroemia lanceolata* Merr., but is distinguished by its relatively longer and narrower leaves.

PRIMULACEAE.

LYSIMACHIA L.

Lysimachia capillipes Hemsl. in Journ. Linn. Soc. Bot. 26 (1889) 48; Pax & Knuth in Engl. Pflanzenreich 22 (1905) 270.

LUZON, Benguet Subprovince, Baguio, in thickets, limestone ravines, altitude about 1,500 m, *Williams 1153*, June, 1904, *Phil. Pl. 845 Merrill*, May, 1911: Bontoc Subprovince, Gaddac, in forests, altitude 1,300 m, *Vanoverbergh 723*, August, 1910.

This species has previously been known only from China, and is with some doubt recorded from the Philippines under Hemsley's name. The specimen collected by Williams was so identified by Dr. C. B. Robinson, but not recorded as it did not agree in all characters with the description of *Lysimachia capillipes* Hemsl. The petioles of the Philippine specimens are 5 to 10 mm long, the leaves are distinctly acuminate, and the pedicels in fruit attain a length of 3 cm. Comparison of Philippine material with authentic specimens of Hemsley's species is desirable, but for the present it is considered advisable to refer our material to *L. capillipes*, pending such comparison.

China.

Lysimachia decurrens Forst. f. Prodr. (1786) 12; Pax & Knuth in Engl. Pflanzenreich 22 (1905) 296.

LUZON, Benguet Subprovince, Mount Tonglon, *Williams 1289*, 1904, *Phil. Pl. 738 Merrill*, May, 1911, altitude about 1,900 m: Bontoc Subprovince, Cuayo, *Vanoverbergh 596*, June, 1910, altitude 1,200 m; Bauco *Vanoverbergh 1189*, April, 1911, altitude about 1,250 m.

Not common and of local occurrence, apparently in the Philippines confined to the Mountain Province, Luzon. India to China and Formosa southward to Java, Timor, and New Caledonia.

MELASTOMATACEAE.

MEDINILLA Gaudich.

Medinilla subsessilis sp. nov.

Frutex 3 ad 4 m altus, glaber; ramis teretibus, nodis setosis; foliis oppositis, oblongo-ellipticis vel oblongo-ovatis, acuminatis, usque ad 16 cm longis, sessilibus vel subsessilibus, 5-plinerviis; paniculis terminalibus, quam folia longioribus, ramis ramulisque verticillatis, bracteis parvis; floribus 4-meris.

An erect glabrous shrub 3 to 4 m high. Branches terete; nodes densely setose. Leaves firmly chartaceous or subcoriaceous, opposite, sessile or subsessile, oblong-elliptic or oblong-ovate, 11 to 16 cm long, 5 to 6 cm wide, somewhat shining, of about the same color on both surfaces, brownish-olivaceous when dry, the apex rather slenderly acuminate, the base acute; nerves 2 pairs, the lower pair leaving the midrib near the base, the upper pair at above 2 cm above the base. Panicles terminal, about 20 cm long, the primary branches in distant whorls of fours, more or less spreading, 4 to 7 cm long, the subtending bracts ovate-lanceolate, 8 mm long or less, the secondary branches 1 cm long or less, verticillate at the ends of the primary ones, the subtending bracts small. Flowers apparently pink, 4-merous. Calyx urceolate, 4 mm long, the limb somewhat produced and with 4 shallow, rounded teeth. Petals oblong-obovate, about 8 mm long, 6 to 7 mm wide. Stamens subequal; filaments 4 mm long; anthers lanceolate, acuminate, 5 mm long, the anterior appendages auriculate, less than 1 mm long, the posterior spur about 0.8 mm long.

LUZON, Bontoc Subprovince, Malamey, *Vanoverbergh 792*, August 23, 1910, in forests, altitude about 1,550 m. Igorot *gubangbangtitao*.

A species closely allied to *Medinilla intermedia* Blume, but with differently shaped, acuminate leaves, and larger flowers. Among the Philippine species it is closely allied to *Medinilla myriantha* Merr., and to *M. confusa* Merr., but is quite distinct from both.

Medinilla vanoverberghii sp. nov.

Frutex scandens, nodis setaceo-barbatis exceptis glaber; ramulis crassis, griseis, teretibus vel angulatis; foliis oppositis, petiolatis, ellipticis vel obovato-ellipticis, apice rotundatis, basi acutis vel leviter acuminatis, 5-plinerviis; paniculis axillaribus, multifloris, pendulis, usque ad 40 cm longis; floribus parvis, 4-meris, staminibus aequalibus.

A scandent shrubby plant, glabrous except the prominently setose-barbate nodes. Branchlets light-gray, smooth, terete or somewhat angled. Leaves opposite, elliptic or obovate-elliptic,

16 to 20 cm long, 10 to 13 cm wide, coriaceous, glabrous, shining, the apex broadly rounded, the base slightly acuminate or acute; nerves 5, prominent, the two lateral pairs leaving the midrib shortly above the base; reticulations very lax, or usually entirely obsolete; petioles stout, about 2 cm long. Panicles solitary, axillary, pendulous, about 40 cm long, the branches more or less spreading, in whorls of four branches each, the whorls scattered, the primary branches 5 cm long or less, bearing at their apices usually four, secondary, umbellately disposed branches, these again bearing from two to four shorter tertiary ones. Flowers pink, 4-merous, two to four on the ultimate branchlets, the pedicels 2 to 3 mm long. Calyx 3 mm long, the limb slightly produced. Petals 4, 6 to 7 mm long, 5 to 6 mm wide, very prominently obliquely obovate, base narrowed. Stamens 8, equal, the filaments 3.5 mm long; anthers about 4 mm long, the dorsal spur about 0.5 mm long, the anterior appendages short, curved. Bracts and bracteoles none or very small.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 448*, May, 1910.

A species well characterized by its opposite, broadly obovate-elliptic or elliptic, rounded, 5-plinerved leaves, and especially by its long, pendulous, axillary inflorescence. Among the Philippine species it is probably most closely allied to *Medinilla multiflora* Merr., but differs from that species especially in its larger, quite differently-shaped leaves, more numerous nerves, longer petioles, and other characters.

ARALIACEAE.

SCHEFFLERA Forst.

Schefflera albida sp. nov. § *Cephalosche*ffl*era.*

Arbor 4 ad 5 m alta; foliis circiter 13-foliolatis, foliolis oblongis, coriaceis, supra glabris, subtus densissime et minute stellato-pubescentibus, indumento albido vel subflavido, basi rotundatis, apice breviter acuminatis; capitulis racemoso-dispositis, numerosis, circiter 1.5 cm diametro, globosis; fructibus 6-locellatis.

A tree 4 to 5 m high. Leaflets about 13, their petiolules 4 to 8 cm long, the blades oblong, coriaceous, 16 to 25 cm long, 6 to 9 cm wide, the upper surface glabrous, somewhat shining, dark-brown when dry, the lower surface very densely covered with white or pale-yellowish, very short, stellate hairs. Inflorescence terminal, the racemes racemosely arranged up to 20 cm in length, the heads numerous, in fruit globose, about 1.5 cm in diameter, their peduncles 1 to 1.5 cm long, the inflorescence somewhat furfuraceous, becoming nearly glabrous. Flowers unknown.

Fruits numerous in each head, densely disposed, somewhat obovoid, angled, the apex conical, 6-celled, 6-seeded.

LUZON, Bontoc Subprovince, Malamey, *Vanoverbergh 958*, October 19, 1910, in forests, altitude, 1,550 m. Father Vanoverbergh notes that the whole tree is white, and that the heads of fruits are brown, with the odor of carrots.

A very characteristic species, distinguished from the other three known Philippine species of the section by the dense, pale, stellate indumentum on the lower surfaces of its leaflets.

ERICACEAE.

VACCINIUM L.

Vaccinium indutum Vid. Rev. Pl. Vasc. Filip. (1886) 169.

This apparently rare species is known only from Bontoc, and has previously been known only by the type collection, *Vidal 1831*. It is also represented by *Vanoverbergh 1013*, from Malamey, Bontoc, growing in forests at an altitude of about 1,500 m. Vidal gives *banuay* as the local name of the species.

GENTIANACEAE.

EXACUM Linn.

Exacum parviflorum sp. nov.

Herba erecta, glabra, haud ramosa, circiter 30 cm alta, caule quadrangulare; foliis anguste lanceolatis, sessilibus, obscure trinerviis, 1 ad 3 cm longis; floribus 4-meris, circiter 1.5 cm longis.

An erect, rather slender, unbranched herb, the stems 4-angled, about 2 mm in diameter. Leaves sessile, narrowly lanceolate, 1 to 3 cm long, less than 5 mm wide, obscurely 3-nerved, obtuse or subacute. Inflorescence terminal, few-flowered, racemose, the pedicels 2 cm long or less. Flowers 4-merous, blue, about 1.5 cm long. Calyx-lobes lanceolate, long-acuminate, keeled but not winged on the back, 6 to 7 mm long, 2.5 mm wide. Corolla-tube 4 to 5 mm long, somewhat contracted at the throat, the lobes 10 to 11 mm long, 5 mm wide, elliptic-lanceolate, long-acuminate. Filaments 2 mm long; anthers straight, 5 mm long, obtuse. Ovary ovoid; style 2 mm long.

LUZON, Bontoc Subprovince, Vila, *Vanoverbergh 758*, August 15, 1910, hillsides, altitude about 1,220 m.

The second species of the genus to be found in the Philippines, differing from *Exacum tetragonum* Roxb., to which it does not appear to be very closely allied, by its more slender, unbranched stems, smaller leaves, and especially in its much smaller flowers.

APOCYNACEAE.

TRACHELOSPERMUM Lemaire.

Trachelospermum vanoverberghii sp. nov.

Frutex scandens, glaber; foliis oblongo-ellipticis ad oblongo-lanceolatis, nitidis, utrinque angustatis, basi acutis, apice acuminatis, usque ad 7 cm longis; cymis axillaribus terminalibusque, longe pedunculatis, paucifloris; floribus circiter 18 mm diametro.

A slender, glabrous, woody vine 2 to 3 m high, or (?) longer, the branches slender, brown or reddish-brown. Leaves oblong-elliptic to oblong-lanceolate, 3 to 7 cm long, 1 to 2.5 cm wide, narrowed at both ends, base acute, apex shortly and obtusely acuminate, shining, the lower surface a little paler than the upper, when young membranaceous, soon becoming chartaceous or somewhat coriaceous; nerves 7 to 10 on each side of the midrib, rather distant, slender, straight, anastomosing, the reticulations lax; petioles about 3 mm long. Cymes mostly terminal, sometimes axillary, solitary, few-flowered; peduncles slender, 1.5 to 3.5 cm long, trichotomous and 3-flowered, or the branches themselves again trichotomous, each branchlet bearing 3 flowers, the pedicels slender, 5 to 10 mm long. Sepals oblong-ovate, acute, about 2.5 mm long. Corolla-tube about 5 mm long, about 3 mm in diameter in the more or less inflated middle, glabrous inside and outside, the lobes spreading, strongly obliquely obovate, about 9 mm long, 6 to 7 mm wide, throat naked, not villous. Anthers inserted near the middle of the tube, included, lanceolate, acuminate, 3 mm long, cells produced at the base, adherent to the stigma; style slender, 1 to 1.5 mm long. Follicles unknown. Flowers white and pink.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 432, 1230* (type), April, 1910, and June, 1911, altitude 1,450 to 1,650 m, in forests and on hillsides: Benguet Subprovince, Baguio, *Williams 1160*, June 22, 1904, *Bur. Sci. 14084 Robinson*, May, 1911. I suspect also that *Loher 3880*, from Mount Arayat, Province of Pampanga, Luzon, is also referable here, of which a small fragment is in our herbarium. It was determined at Kew as *Trachelospermum fragrans* Hook. f.

The species above described is allied to *Trachelospermum fragrans* Hook. f., differing from that species especially in its corolla-tube and throat being quite glabrous; it is also manifestly allied to *T. jasminoides* Lemaire of China, but seems to be sufficiently distinct from that species.

The only representative of the genus for the Philippines, one species previously described, *T. philippinense* Elm., being a synonym of *Micrechites schrieckii* Rolfe.

VERBENACEAE.

CLERODENDRON L.

Clerodendron vanoverberghii sp. nov. *Euclerodendron, § Paniculata.*

Frutex circiter 4 m altus, pubescens; foliis ovatis, integris, circiter 13 cm longis, basi late rotundatis, subtruncatis, vel leviter cordatis, apice acuminatis, subtus glandulosis; paniculis terminalibus subdiffusis, bracteis paucis, parvis; calycis lobis ovatis, acutis; corolla circiter 2 cm longa.

An erect shrub about 4 m high, all parts more or less densely pubescent with rather soft, spreading, brownish hairs. Younger stems somewhat 4-angled, densely pubescent. Leaves ovate, 10 to 14 cm long, 10 cm wide or less, chartaceous, entire, the base broad, rounded, subtruncate, or slightly cordate, the apex sharply acuminate, the upper surface pubescent with scattered hairs, more densely pubescent on the nerves and midrib, the lower surface more densely pubescent than the upper, and with numerous, minute, shining, yellowish glands; nerves about 7 on each side of the midrib; petioles densely pubescent, 4 to 5 cm long. Panicles terminal, about 15 cm long and nearly as wide, the primary branches spreading, the lower ones subtended by reduced leaves, all parts pubescent. Bracts scattered, narrowly oblong-obovate, 5 to 6 mm long, pubescent, the bracteoles similar but smaller and somewhat spatulate. Flowers white, red in the center. Calyx pubescent, funnel-shaped, about 9 mm long, persistent and loosely enclosing the fruit, the lobes ovate, acute, 3 to 4 mm long. Corolla-tube straight, cylindric, 1.8 to 2 cm long, 2 mm in diameter, somewhat pubescent, the lobes oblong, 7 to 8 mm long, 3 mm wide, obtuse or acute, spreading or recurved. Filaments as long as the corolla-tube, exserted, slightly falcate, straight. Fruit (immature), globose, 5 mm in diameter, loosely enclosed in the persistent calyx.

LUZON, Bontoc Subprovince, Bauco, in forests, altitude about 1,650 m, *Vanoverbergh 838*, September 9, 1910.

A species manifestly allied to *Clerodendron infortunatum* L., *C. villosum* Bl., *C. cumingianum* Schauer, and *C. brachyanthum* Schauer, differing from all in its rather broad, acute, not slenderly acuminate calyx-lobes. It is, perhaps, most closely allied to *C. brachyanthum* Schauer, but has a very much longer corolla than has that species.

Clerodendron multibracteatum sp. nov. *Euclerodendron, § Densiflora.*

Arbor 4 ad 9 m alta, ramulis, foliis ad nervos, paniculisque plus minusve pubescentibus; foliis oblongis vel oblongo-ovatis,

integris vel subintegris, acuminatis, basi acutis vel subrotundatis, usque ad 13 cm longis, subtus dense minuteque glandulosopunctatis; paniculis terminalibus, bracteis bracteolisque confertis, albidis vel purpureis, ovatis, 1 ad 2.5 cm longis, diu persistentibus; corollae tubo circiter 7 mm longo.

A tree 4 to 9 m high. Branches terete, brownish, lenticellate, the branchlets rather densely pubescent with short appressed hairs. Leaves oblong to oblong-ovate, subcoriaceous, entire, or rarely with few, scattered, irregular teeth, 8 to 13 cm long, 4 to 5.5 cm wide, base acute or somewhat rounded, the apex acuminate, the acumen often rather slender, blunt, the upper surface glabrous except for the somewhat pubescent midrib and nerves, the lower surface with numerous, minute, shining glands, also pubescent on the midrib and nerves; lateral nerves 6 to 8 on each side of the midrib, prominent, the reticulations rather lax; petioles pubescent, 1.5 to 2.5 cm long. Panicles terminal, 10 to 15 cm long, the branches somewhat spreading, pubescent, naked below, each subtended by large bracts, the flowers crowded at the apices of the branches, surrounded by numerous bracts and bracteoles. Lower bracts 2.5 cm long, the upper ones and the bracteoles narrowly ovate or ovate, acuminate, thin, sparingly pubescent and glandular, base narrowed, 1 to 1.5 cm long, in anthesis white, persistent and pink or purplish in fruit. Flowers white. Calyx somewhat longitudinally plicate, the lobes broadly ovate, acuminate, 5 to 6 mm long. Corolla-tube cylindric, 7 mm long, 2 mm in diameter, nearly glabrous, the lobes narrowly elliptic-ovate, obtuse or acute, recurved, 5 to 6 mm long, 2.5 mm wide, slightly pubescent. Filaments long-exserted, recurved; anthers 1.5 mm long. Style 1.5 cm long. Fruit globose, about 6 mm in diameter, loosely enclosed by the persistent calyx, the bracts and bracteoles also persistent in fruit.

LUZON, Bontoc Subprovince, Malamey, *Vanoverbergh 777*, August 23, 1910, in forests, altitude 1,550 m, in flower (type): Lepanto Subprovince, trail to Balbalasan, *For. Bur. 5713 Klemme*, November 19, 1906, in fruit, altitude 1,600 m, locally known as *palutan*. MINDORO, Mount Halcon, in forests, altitude about 1,800 m, *Merrill 5516*, November, 1906, fruits fallen.

A species probably as near *Clerodendron macrostegium* Schauer as to any other species, but entirely different from that form, and not closely allied to it. It is well characterized by its rather large, numerous, crowded, white or colored bracts and bracteoles which persist until after the fruit is matured, its oblong leaves, and its short flowers.

SCROPHULARIACEAE.

MICROCARPAEA R. Br.

Microcarpaea minima (Koenig) comb. nov.

Paederota minima Koenig in Retz. Obs. 5 (1789) 10.

Microcarpaea muscosa R. Br. Prodr. (1810) 436; Benth. in DC. Prodr. 10 (1846) 433; Hook. f. Fl. Brit. Ind. 4 (1884) 287.

Microcarpaea alterniflora Blume Bijdr. (1826) 744.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 939*, October, 1910, in rice paddies, altitude about 1,250 m.

This genus has previously not been reported from the Philippines, although the species is of wide distribution, extending from India and Ceylon to southern China, Malaya, and tropical Australia. The earliest specific name is here adopted.

LABIATAE.

TEUCRIUM L.

Teucrium philippinense sp. nov. § *Scorodonium* Benth.

Herba annua, 30 ad 60 cm alta, ramosa, leviter ciliato-pilosa; foliis longe petiolatis, membranaceis, oblongo-ovatis, acuminatis, basi rotundatis vel subacutis, usque ad 7 cm longis, margine prominente crenato-serratis; racemis terminalibus axillaribusque, usque ad 10 cm longis, verticillatris 2-floris; floribus circiter 9 mm longis, calycibus ciliatis, 4 mm longis.

An annual, erect or ascending, branched herb 30 to 60 cm high, all parts somewhat ciliate-pilose. Stems slender, 4-angled, sulcate. Leaves opposite, oblong-ovate, membranaceous, 3.5 to 7 cm long, 2 to 3 cm wide, the apex acuminate or merely acute, the base subacute or rounded, the margins, except near the base, prominently crenate-serrate, both surfaces with scattered, weak, white hairs, especially on the nerves, the lower surface a little paler than the upper one; lateral nerves slender, 4 or 5 on each side of the midrib; petioles slender, 1.5 to 3 cm long. Racemes terminal and axillary, simple, ciliate, when young 2 to 3 cm long, in maturity up to 10 cm long, the flowers opposite, their pedicels 2 to 3 mm long; bracteoles ciliate, lanceolate, 3 to 5 mm long. Calyx ciliate, somewhat cup-shaped in anthesis, 4 mm long, obscurely 2-lipped, the lower two teeth lanceolate, acuminate, narrower than the upper three which are ovate, obtuse or acute, and the middle one twice as large as the lateral ones; tube somewhat inflated in fruit. Corolla exserted, slender, pink, 9 mm long, the tube 3 to 4 mm in length; lower lateral lobes of the lip spreading, oblong-ovate, about 1.5 mm long, the

upper lateral lobes oblong, obtuse, ascending, shorter than the lower ones, the terminal lobe orbicular-ovate, rounded, concave, 3 mm in diameter. Nutlets globose, brown, smooth, slightly glandular, about 1.2 mm in diameter.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 1374* (type), August 17, 1911, in forests, altitude about 1,650 m. Benguet Subprovince, Baguio, *For. Bur. 4935 Curran*, August, 1906, at base of limestone rocks.

The first species of the genus to be reported from the Philippines, apparently allied to the Indian *Teucrium tomentosum* Heyne, judging from the description of that species. The specimens collected by Curran were distributed as *Pogostemon*, probably as *Pogostemon nepetoides* Stapf. Later, doubting the correctness of my determination, a duplicate was sent to Kew for comparison with Stapf's type. The comparison was made by Mr. N. E. Brown, who reported that Curran's specimen was totally different from any *Pogostemon* in the Kew Herbarium. As there were no flowers on my retained specimen, no further attempt was made to determine it until it was rediscovered by Father Vanoverbergh. The two specimens cited manifestly represent the same species even though there are no flowers on Curran's specimen for comparison.

ACROCEPHALUS Benth.

Acrocephalus indicus (Burm.) O. Ktze. Rev. Gen. Pl. (1891) 511.

Prunella indica Burm. Fl. Ind. (1768) 130.
Ocimum capitellatum L. f. Suppl. (1781) 276.
Acrocephalus capitatus Benth. in Wall. Pl. As. Rar. 2 (1831) 18; Hook. f. Fl. Brit. Ind. 4 (1885) 611; F.-Vill. Novis. App. (1880) 163.

LUZON, Bontoc Subprovince, Abuling, *Vanoverbergh 923*, October, 1910: Benguet Subprovince, Ambuklao to Daklan, *Merrill 4384*, October, 1905: Province of Tarlac, Concepcion, *Merrill 3622*, November, 1903: Province of Rizal, *Bur. Sci. 10899 Ramos*, *Phil. Pl. 448 Ramos:* Province of Bulacan, Norzagaray, *Yoder 128*, December, 1906: Province of Laguna, Los Baños, *Hallier s. n.*, December, 1903.

Father Villar's record for this species as a Philippine plant has not previously been verified. India to Burma, Indo-China, China (*fide* Willdenow), Java, Sumatra, and Borneo.

MESONA Blume.

Mesona philippinensis sp. nov.

Herba erecta, vix ramosa, usque ad 50 cm alta, omnibus partibus plus minusve pallide fulvo-pubescens; foliis subsessilibus, oblongo-ellipticis vel anguste obovato-ellipticis, usque ad 5 cm longis, acutis, margine crenato-denticulatis; inflorescentiis densis, verticillastris circiter 20-floris; calycibus 2-labiatis, labio inferiori integro, superiori 3-lobato; corolla 5 mm longa.

An erect, unbranched, aromatic herb 50 cm high or less, the stems, leaves, and inflorescence more or less clothed with weak,

jointed, pale-fulvous hairs that are more or less crisped when dry. Stems rather slender, obscurely angled, usually somewhat sulcate when dry, pale-brown or reddish-brown. Leaves oblong-elliptic or narrowly obovate-elliptic, membranaceous or chartaceous, brownish when dry, 3 to 5 cm long, 1.5 to 2 cm wide, the apex acute, the base narrowed, acute, the margins distinctly crenate-denticulate; petioles 2.5 mm long or less, often obsolete and the leaves sessile or subsessile; lateral nerves ascending, about 7 on each side of the midrib. Inflorescence rather dense, 8 to 12 cm long, about 1.5 cm in diameter, the whorls close or somewhat distant, 20 or more flowers in each, the bracts subtending each whorl ovate, 7 to 10 mm long, 5 to 6 mm wide, narrowed at both ends, acuminate, more or less hairy, ultimately deciduous; pedicels densely hairy, 6 mm long or less. Calyx somewhat hairy, in anthesis about 3 mm long, 2-lipped, the lower lip oblong, rounded, entire, the other with a large central lobe and two smaller lateral ones, in fruit somewhat accrescent, cylindric, slightly inflated below, about 5 mm long. Corolla nearly white, glabrous, 5 mm long, the lower lip oblong, 2.5 to 3 mm long, the upper rhomboid, inflated, nearly 2 mm square, entire or obscurely toothed. Stamens four, exserted, the lower two 6 mm long, the upper two 5 mm in length and with an oblong, obtuse, thin, 1 mm long appendage near the base. Style slender, 6 mm long. Nutlet oblong, dark-brown or black, about 1.5 mm long, surrounded by a transparent, gelatinous coating.

LUZON, Lepanto Subprovince, *Merrill 4500*, October 29, 1905, on open grassy slopes, altitude about 2,000 m (type): Bontoc Subprovince, *Father M. Vanoverbergh 601*, *903*, June, October, 1910, altitude about 1,150 m. *Loher 4201*, in the Kew Herbarium, is probably the same.

No species of the genus previously has been reported from the Philippines, there being at present known *Mesona wallichiana* Benth., of the Himalayan region, *M. chinensis* Benth., *M. procumbens* Hemsl., and *M. prunelloides* Hemsl., from China, and *H. palustris* Bl., of Java, Celebes and Borneo.

LENTIBULARIACEAE.

UTRICULARIA L.

Utricularia exoleta R. Br. Prodr. (1810) 430; Clarke in Hook. f. Fl. Brit. Ind. 4 (1884) 329; Prain in Journ. As. Soc. Beng. 74 [2] (1905) Extra Number 368.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 663*, July and September, 1910, in rice paddies, altitude about 1,250 m.

Not previously reported from the Philippines. India to Hongkong through Malaya to northern Australia.

ACANTHACEAE.

LEPIDAGATHIS Willd.

Lepidagathis subglabra sp. nov.

Suffruticosa, erecta, ramosa, circiter 1 m alta, subglabra, bracteis parce ciliatis; foliis majoribus lanceolatis, late lanceolatis, vel oblongis, usque ad 4 cm longis, subtus ad costa nervisque parce puberulis, foliis minoribus oppositis; spicis axillaribus terminalibusque, solitariis, 1 ad 2.5 cm longis; bracteis oblongo-lanceolatis, acuminatis, margine obscure ciliatis; floribus 4-meris; corolla 8 mm longa.

A suffrutescent, much-branched plant about 1 m high, the branches slender, terete, olivaceous, glabrous, the ultimate branchlets slightly 4-angled. Leaves opposite, of each pair one always much larger than the other, the larger leaves lanceolate, broadly lanceolate, or oblong, chartaceous, 2 to 4 cm long, 0.8 to 1.7 cm wide, entire, the base acute, the apex acuminate, glabrous, shining and rather dark-colored above when dry, beneath slightly paler and puberulent on the midrib and nerves; nerves 3 or 4 on each side of the midrib; petioles about 5 mm long; the smaller leaves of each pair similar to the larger ones but subsessile and mostly less than 5 mm long. Spikes terminal and in the upper axils, solitary, 1 to 2.5 cm long, 5 to 8 mm in diameter, rather dense, sessile or subsessile, the bracts oblong-lanceolate, acuminate, about 6 mm long, 1.7 to 2 mm wide, keeled, greenish when dry, the margins obscurely ciliate, otherwise glabrous. Calyx-lobes subequal in length, 6 to 7 mm long, all acuminate, slightly ciliate on the margins with short hairs, one oblong, about 2 mm wide, 3-nerved, two linear, less than 1 mm wide, 1-nerved, and the fourth deeply cleft, the lobes about 1 mm wide. Corolla white, glabrous, 8 mm long, the tube constricted below the anthers, the upper lobe subentire or minutely retuse, about 3 mm long, 2 mm wide, the lower lobe 3-cleft, the resulting lobes as long as the upper lobe but narrower. Anthers about 1 mm long, one cell slightly higher than the other, the cells parallel, contiguous. Ovary ovoid, glabrous, 1.5 mm long; style 2.5 mm long.

LUZON, Bontoc Subprovince, Malamey, *Vanoverbergh 507*, May 10, 1910, in forests, altitude about 1,600 m.

A species apparently well characterized among the Philippine forms by its subglabrous inflorescence, the bracts and calyx-segments being only slightly ciliate on the margins with rather short hairs. It resembles somewhat *Lepidagathis psilantha* Nees., but differs from that species in its larger, solitary, not clustered spikes. It differs from *L. dispar* C. B. Clarke in the same characters, although resembling that species in its unequal leaves.

CUCURBITACEAE.

MELOTHRIA L.

Melothria lobata sp. nov. § *Solena*.

Species M. mucronatae valde affinis, differt foliis profunde palmato-lobatis.

A slender, herbaceous, dioecious vine reaching a length of 2 m or more, the stems slender, sulcate, glabrous or with very few scattered hairs. Leaves ovate in outline, deeply palmately 5-lobed, 3.5 to 6 cm long, 3 to 5 cm wide, membranaceous, dark-colored when dry, both surfaces punctate-scabrid with small protuberances, slightly hispid on the nerves, the lobes extending two-thirds to three-fourths to the base, oblong, obovate, or oblong-obovate, acute or obtuse, usually mucronate, sparingly and irregularly toothed, the sinuses narrower or about as broad as the lobes, rounded or subacute; nerves 5, palmate; petioles 1.5 to 3 cm long, glabrous or with few scattered hairs; tendrils slender, simple, 5 to 15 cm long. Male flowers not seen. Female flowers in axillary, short-peduncled, few-flowered umbels, whitish, the peduncles 5 mm long or less, the pedicels usually about 5, 2 to 2.5 mm long. Ovary oblong-elliptic, about 3 mm long, constricted below the limb, the calyx above the ovary 2.5 to 3 mm long. Calyx teeth 5, narrow, short, less than 1 mm long. Corolla villous inside, the lobes oblong, acute or obtuse, 2.5 to 3 mm long. Disk fleshy. Style 3 mm long, 3-lobed at the apex; stigmas flattened, cleft. Fruit not seen.

LUZON, Bontoc Subprovince, Bauco, along trails, *Vanoverbergh 1241*, June 11, 1911, altitude about 1,300 m.

CAMPANULACEAE.

CAMPANUMOEA Blume.

Campanumoea truncata (Wall.) Endl. Gen. Pl. 1 (1836) 515.

Codonopsis truncata Wall. Cat. (1829) no. 1301, nomen; A. DC. Monogr. Camp. (1830) 122, Prodr. 7 (1839) 423.

Campanumoea axillaris Oliv. in Hook. Ic. III 8 (1888) *pl. 1775;* Hemsl. in Journ. Linn. Soc. Bot. 26 (1889) 7.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 965*, October 27, 1910, altitude about 1,450 m, growing in wet places, flowers red.

Burma and southern China; not previously reported from the Philippines. The second species of the genus for the Archipelago, and of special interest as it adds another species to the long list of continental types found in northern Luzon.

I can see no valid reason why Wallich's specific name should not be accepted for this plant, as Hemsley states, l. c., that Wallich's plant is

certainly the same as the Chinese one. Whether or not *Cyclodon distans* Griff., is the same or not has no bearing on the case, as it was not published until 1851.

LOBELIA L.

Lobelia bialata sp. nov. § *Isolobus.*

Planta parva, glabra, erecta vel suberecta, circiter 10 cm alta, ramosa; caulibus tenuiter bialatis; foliis elliptico-ovatis, acuminatis, basi angustatis, sessilibus vel subsessilibus, usque ad 2 cm longis et 1 cm latis, superioribus minoribus, margine distincte serratis; pedunculis axillaribus, solitariis, folia subaequantibus; floribus roseis, circiter 5 mm longis.

A small, erect or suberect, branched, glabrous, annual herb about 10 cm high, the lower parts of the stem sometimes decumbent but scarcely rooting at the nodes. Stems slender, narrowly 2-winged. Leaves thin, elliptic-ovate, up to 2 cm long and 1 cm wide, the upper ones smaller, margins rather distantly and distinctly sharply serrate, base narrowed, acute, sessile or subsessile, apex shortly acuminate or acute. Pedicels axillary, slender, solitary, about as long as the leaves, 1-flowered. Calyx-tube broadly ovoid, nearly 2 mm long and thick, green, the teeth 5, linear, erect, 2 to 2.5 mm long. Corolla about 4 mm long, pink, the lower lip violet, subequally 3-lobed, the lobes oblong-ovate, pointed, about 1.5 mm long, the upper lip with two linear-lanceolate, acuminate, 1.5 mm long teeth. Filaments united; 3 fertile anthers glabrous, two sterile ones ciliate at the apex. Stigma slightly cleft. Fruit somewhat ovoid, narrowed at both base and apex, half-superior, about 3 mm long, the part above the calyx 2-valved. Seeds numerous, brown, ellipsoid, smooth, about 0.3 mm long.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 902*, October 5, 1910, in wet places, altitude about 1,350 m.

This species is closely allied to *Lobelia radicans* Thunb., but differs in a number of characters, in its broader, differently-shaped leaves, its stems not prostrate and rooting, its smaller flowers, and its two lower filaments glabrous, not hairy. It is even more distinct from *Lobelia filiformis* Lam., both as originally described by Lamarck from the Isle of France material, and as later figured and described by Cavanilles from Luzon material.

COMPOSITAE.

BLUMEA DC.

Blumea vanoverberghii sp. nov.

Herba erecta, circiter 1 m alta, ramulis, subtus foliis inflorescentiisque pilosis; foliis oblongo-obovatis ad oblanceolatis, 7 ad 12 cm longis, plus minusve lyrato-lobatis, sessilibus, supra

scabridis; inflorescentiis angustatis, ramulis distantibus, 1 ad 3 cm longis; capitulis circiter 10 mm longis, sessilibus vel breviter pedunculatis, subfasciculatis; floribus flavidis; disco piloso.

An erect herb about 1 m high, the stems striate, pubescent, about 4 mm in diameter. Leaves oblong-obovate to oblong-oblanceolate, 7 to 12 cm long, 2 to 4.5 cm wide, the upper ones gradually smaller, sessile, rather prominently lyrately lobed, acute or acuminate, base narrowed, not decurrent, the lower surface rather softly pilose, the upper surface scabrid, slightly hairy. Inflorescence a terminal, slender, interrupted, pubescent, leafy panicle, 15 to 30 cm long, the branches 1 to 3 cm long in the axils of reduced leaves. Heads about 1 cm long, somewhat crowded on the branchlets, sessile or shortly peduncled. Bracts several-seriate, pubescent, the outer ones 1.5 to 2 mm long, oblong-ovate, the innermost about 7 mm long and 0.8 mm wide. Achenes 1 mm long, hispid; pappus white, scabrid, about 5 mm long. Disk-flowers perfect, about 12 in each head, yellow, the corolla-tube enlarged above, about 7 mm long, 1.5 mm in diameter, 5-toothed. Female flowers marginal, many, slender, 5 to 5.5 mm long, about 0.3 mm in diameter, 3-toothed. Disk somewhat pilose.

LUZON, Bontoc Subprovince, Bauco, *Vanoverbergh 1063*, February 9, 1911, altitude about 1,300 m.

A species characterized by its narrow, elongated, leafy panicles, and its lyrately lobed, coriaceous leaves which are pilose beneath and scabrid on the upper surface. It is somewhat anomalous in *Blumea* on account of its distinctly pilose, not glabrous disk, in this character approaching the very closely allied genus *Merrittia*.

VERNONIA Schreb.

Vernonia phanerophlebia sp. nov. § *Strobocalyx.*

Frutex erectus circiter 2 m altus; foliis oblongo-obovatis, breviter obtuse acuminatis, usque ad 7 cm longis, crassissime coriaceis, nitidis, pagina inferiore prominente glanduloso-punctatis, nervis utrinque 7 ad 10, prominentibus; corymbis terminalibus, parvis, congestis, capitulis 7- vel 8-floris, squamis imbricatis, distincte pubescentibus; achaenio 2.5 mm longo, glanduloso.

An erect shrub about 2 m high. Branches terete, striate when dry, somewhat lenticellate, glabrous, the branchlets distinctly appressed-pubescent. Leaves very thickly coriaceous, oblong-obovate, entire, 3.5 to 7 cm long, 1 to 2.5 cm wide, shining when dry, of about the same color on both surfaces or slightly paler beneath, the upper surface glabrous, the lower appressed-

pubescent on the midrib, prominently glandular-punctate, the apex shortly and bluntly acuminate, the base narrowed, cuneate; lateral nerves 7 to 10 on each side of the midrib, prominent, distant, anastomosing, the reticulations prominent, rather dense, distinct on both surfaces; petioles 5 to 8 mm long, pubescent. Corymbs terminal, appressed-pubescent, rather dense, about 3 cm long, 3 to 5 cm wide. Heads, including the pappus, 8 to 10 mm long, the flowers white and pink. Involucral-bracts several-seriate, imbricate, all distinctly pubescent, the outer ones less than 1 mm long, the inner gradually longer, the innermost oblong, 4.5 to 5 mm long, 1 to 1.2 mm wide, margins prominently ciliate-pubescent. Achenes 7 or 8 in each head, somewhat curved, 2.5 mm long, 4-angled, prominently glandular; pappus pale-straw-colored, rather copious, 5 to 6 mm long.

LUZON, Bontoc Subprovince, Malamey (Piñggat), *Vanoverbergh 688*, July 23, 1910 (type), in forests, altitude about 1,450 m: Benguet Subprovince, Losod, *Bur. Sci. 5574 Ramos*, December, 1908.

A species manifestly allied to *Vernonia acrophila* Merr., differing in its somewhat larger, more coriaceous leaves, the nerves more numerous, and also in its more numerous achenes.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 2. June, 1912.

A CONTRIBUTION TO THE HISTORY AND VERNACULAR NOMENCLATURE OF THE CULTIVATED ANONAS.

By P. J. WESTER.

(*From the Bureau of Agriculture, Manila, P. I.*)

Ordinarily the vernacular name of a plant refers only to a single species; in fact homonymy in horticultural literature is rare, far more so than synonymy. An example of homonymy is the name grape which includes most species of the genus *Vitis*, but this causes few, if any, misconceptions. The word "nut," employed to designate the seeds of many very dissimilar species, is usually prefixed with a word that clearly identifies the species in question. Synonymy is well illustrated in *Persea gratissima* Gaertn., which has been referred to as Avocado, Alligator pear, Midshipman's butter, Vegetable marrow, etc.

Perhaps the most remarkable recorded instance of homonymy and synonymy in the vernacular nomenclature of plants, with its attendant confusion, is found among the cultivated Anonas, the Cherimoya, *Anona cherimolia* Miller; the Sugarapple, *Anona squamosa* L.; the Custardapple, *Anona reticulata* L.; the Soursop, *Anona muricata* L.; and the Mamon, *Anona glabra* L. The same vernacular names, in a given language, have been used continually for two or more of these species ever since they were first described by botanists. As these species have come to be better known and more frequently mentioned in literature the practice of applying the same name to different species has increased rather than decreased. This has rendered their identification, by the layman, most difficult, as two authors frequently refer to the same fruit by totally different names.

It is very evident that much of the hononymy and synonymy of these species has originated by the misspelling of the vernacular names given by the natives to travellers and botanists. The latter, frequently, did not remain in the various countries long enough to become thoroughly familiar with the native names of

the plants to write them correctly. Some names are evidently only typographical errors and never existed except on paper. This, however, does not render the confusion of names less serious. The deplorable practice of some authors such as Don(20) in referring to all species of anonas as "custard apples," or of Lamarck(42) who speaks of them as "Corossol" or "Corossolier," has done much toward bringing about the confusion in nomenclature under discussion.

Now that the anonaceous fruits are beginning to attract attention among the fruit growers, in many parts of the tropics, the time is perhaps more than ever opportune to call attention to the errors of the past in order that they may be avoided in the future. The following pages, prepared after a study of much of the botanical literature containing references to anonaceous plants, will indicate the extent of the confusion in the vernacular nomenclature of the cultivated Anonas, and will, it is hoped, serve to clear away the prevalent misconceptions in regard to the popular names of these species.

In Mexico Texaltzapotl is one popular name for *Anona cherimolia*(63) and also for *A. squamosa*(25). In the same country both of these species are also called Anono and Cherimoyo(28). Chirimoya is used for *Anona cherimolia* in Cuba(72), and elsewhere(15), and for *A. squamosa* in Porto Rico(12). Cherimolia is the name of *A. cherimolia* in Peru(40), and of *A. squamosa* in Porto Rico(12). Anona is, in Mexico, the vernacular for *A. reticulata* and *A. glabra*(29); Pinha in Brazil for *A. reticulata*(83) and *A. squamosa*(19, 75, 45); Cachiman morveaux for *A. reticulata*(17) and *A. muricata*(2). Cachiman has been applied to *A. muricata*(39) and *A. reticulata*(73, 27), while both *A. muricata*(39) and *A. squamosa*(45) have been called Pomme de Canelle. The latter species is also referred to as Pomme Canelle(2, 6, 71), Caneel-appel(45) and Pommier de Canelle(21, 68). In one work(6) it is named Undulated custard apple and in the same publication *A. cherimolia* is referred to as Broad-leaved custard apple(7). *A. squamosa* is called Custard apple(16, 25) by two authors. This is, otherwise, the accepted vernacular for *A. reticulata*(46, 65, 11, 67, 36, 78), although De Candolle(16) says that, in America, it is the name of *A. muricata*. The names Fruto de Conde(19), Fruta de Conde(24, 76) and Fructa de Conde(83) appear under *A. reticulata*, but have also been applied to *A. squamosa*(9) and *A. reticulata*(8). *A. squamosa* is called Fructa do Conde(31) and Frutta de Condessa(45). *A. reticulata* is in one publication named Condessa(76) and in another Condissa(19). In some

publications the name Cœur de Bœuf is applied to *A. reticulata*(40, 67, 3), and then again to *A. squamosa*(21, 6). In Mexico the name Quauhtzapotl is applied to the three species, *A. reticulata*(62), *A. cherimolia*, and *A. squamosa*(63). In Cuba Mamon is the vernacular name for both *A. reticulata* and *A. glabra*(73).

The synonymys that are used to designate a single species are many. In Brazil, from whence *Anona muricata* was first described as Araticu ponhe(54), the species is still called Araticu(31). In Spanish-speaking countries it is known as Guanabana(69), Guanabo(22), Guanabano(11), Guanabena(24), Catuche(33), Catucho, Cabeza de negro, and Anona amarilla(26). Vulgar Mexican names are Polvox and Zapote de viega(63). In the French colonies Corossolier and Cachiman épineux, or derivatives from these, are the common names for this species(26). The name Sapadille, given by Descourtilz for *A. muricata*(18), is very probably an error which crept in when he collected his notes, as this is the vernacular name of *Achras sapota* L. Carib names of *A. muricata* are Alacalyona and Guanavana(83). The English name Soursop is undoubtedly a corruption of the Dutch name Soort-sack, which appears to have been applied to this species in the latter part of the seventeenth century(30), or Suursak, used eighteen years later(47). The early English spellings of the name were Sower Sop(64), Sowre-sop tree(65), Sowr-sop(32), and Sowrsoptree(77). One early English writer refers to it as Prickled apple(70). The vernacular name for the species in Dutch Guiana is now Zuurzak(60), and derivatives from it are Suirsaak and Susakka(24).

The first appearance of the name Custardapple was apparently in 1691(56) and referred to *Anona reticulata*. This name has descended to us without alteration. Aside from this name and those previously discussed, which the species has had in common with others of the same genus it is called Bullock's heart(24) in English. In Mexico it is known by several names, Anona, Anona colorada, Ananhtzapotl, and Ilama(27). In Porto Rico it is known as Corazon(11). In addition to the names already mentioned as current in Brazil, it is referred to as Coracao do boi(31). The name Mamillier(73) is very probably due to a confusion of the common names of *Anona reticulata* and *Mammea americana* L., the Mammee apple. Corossol and Cachiman, and their derivatives, are frequently found in publications discussing *Anona reticulata*(35). The names enumerated have all originated in the Western Hemisphere where the species is indigenous. *Anona reticulata* was, however, early introduced in the tropics

of the Old World, as references to the fruit, by travelers of the seventeenth and eighteenth centuries, bear witness. Anona-maram, Parangi-jaca, Tsina-panosou(67), Noona and Ramphu!(52) are Indian vernacular names. In Malaysia the plant, among others, is known as Anona Mamoa(68), Vlaade-Appel(46), and Anoneira(58).

Anona squamosa, in common with its congener, carries a multiplicity of names, some of which have already been mentioned. Sugarapple, the now commonly accepted English name, and the less frequent Sweetsop(57) were both applied to this species as early as 1691. This species has, to some extent, been known in the West Indies as Marie Baise(21), and in Brazil is called Araticu pitaya(84), Pinha, Ata(75), and Atta(31). In addition to the Mexican names, which it has in common with related species, *Anona squamosa* is called Saramuyo and Anona blanca(25). By the Dutch it is known as Kaneelappel in Guiana(61), and Steenappelboom in Java(21), while in the latter Island its native name is Siri Kaya(21). In other parts of Malaysia the fruit is known as Boa, Atis(21), Ateira, Ata, Zimmet apfel(59), and Manoa papuwa(68). Vernacular names in India are Atoa, Manil-panosou, Manil-jaca, Jona-jaca, Atas, Atocira(21), Auza, Loona, Meba, and Sita-pullum(52). In Arabia the sugarapple is called S'ferdjel; in Egypt, Keschta(52); and in Zanzibar, Mstaphele(23). Vulgar names in the Philippines are Ates and Yates(4).

Anona cherimolia is less widely cultivated than the preceding species and its vernacular names are fewer in number. In English-speaking countries its popular names are Cherimoya, Cherimoyer, Chirimoya, and Jamaica apple(24, 82). In Mexico it is known as Chirimollo and Matzapotl in addition to the names, previously discussed, which it has in common with the sugarapple and custardapple. In one of the earliest descriptions of the fruit, from Peru, its vulgar name is said to be Cherimolia(40). Chilimoya is given as a vernacular name in Columbia(34).

For the sake of convenience the numerous names and synonyms of the five species of cultivated Anonas have been alphabetically arranged in the following list:

Anona cherimolia Miller — CHERIMOYA.

Anona, Broad-leaved custard apple, Cherimolia, Cherimoyer, Chilimoya, Chirimollo, Chirimoya, Chirimoyo, Corossol, Corossolier, Custard apple, Jamaica apple, Matzapotl, Quauhtzapotl, Texaltzapotl.

Anona squamosa L. SUGARAPPLE.

Ahate de Panucho, Anona blanca, Anono, Araticu pitaya, Ata, Atas, Ateira, Ate Pannicensis, Ates, Atis, Atoa, Atocira, Atta, Auza, Boa, Caneel-appel, Cherimolia, Chirimoya, Chirimoyo, Corossol, Corossolier, Cœur de Bœuf, Custard apple, Fructa do Conde, Fructa de Conde, Frutta de Condessa, Hanon, Jona-jaca, Kaneel appel, Keschta, Loona, Manil-jaca, Manil-Panosou, Manoa Papuwa, Marie Baise, Meba, Mstaphele, Pinha, Pomme Canelle, Pomme de Canelle, Pommier de Canelle, Quauhtzapotl, Saramuyo, S'ferdjel, Siri Kaya, Sita-pullum, Steenappelboom, Sweetsop, Texaltzapotl, Tzypipatlis, Undulated custard apple, Yates, Zimmet apfel.

Anona reticulata L. CUSTARDAPPLE.

Ananhtzapotl, Anona, Anona colorada, Anona manoa, Anona-maram, Anoneira, Bullocks heart, Cachiman, Cachiman morveaux, Cœur de Bœuf, Condessa, Condissa, Coracao de boi, Corazon, Corossol, Corossolier, Fructa de Conde, Fruta de Conde, Fruto de Conde, Ilama, Mamillier, Mamon, Noona, Parangi-jaca, Pinha, Quauhtzapotl, Ramphul, Tsina-Panosou, Vlaade-appel.

Anona muricata L. SOURSOP.

Alacalyona, Anona amarilla, Araticu, Araticu ponhe, Cabeza de negro, Cachiman, Cachiman épineux, Cachiman morveaux, Catuche, Catucho, Corossol, Corossolier, Custard-apple, Fructa de Conde, Guanabana, Guanabanis, Guanabano, Guanabena, Guanabo, Guanavana, Polvox, Pomme de Canelle, Prickled apple, Sappadille, Soortsack, Sower Sop, Sowresoptree, Sowr-soptree, Sowrsoptree, Sowr-sop, Suirsak, Susakka, Suursak, Zapote de viegas, Zuurzak.

Anona glabra L. MAMON.

Alligator apple, Anona, Araticu pana, Bunya, Corkwood, Corossol, Corossolier, Custard-apple, Monkey apple, Pond apple.

Four of the species considered, the cherimoya, *Anona cherimolia* Mill., the sugarapple, *Anona squamosa* L., the custardapple, *Anona raticulata* L., and the soursop, *Anona muricata* L., have been cultivated for their fruits for many centuries, and were all domesticated before the discovery of America. They are all natives of the American tropics as is conclusively shown by De-Candolle(13) in his able discussion of the subject. A description of the five species discussed, in the present paper, with some account of their origin and their dissemination is given below.

Anona cherimolia Mill. (§ *Attae*) Pl. VIII.

A tall shrub or tree of spreading habit, 4.5 to 10 meters high; young growth ferruginous-tomentose; leaves usually ovate-oblong, 7.5 to 18 cm long, variable, base rounded, apex obtuse, scarcely acute, sparsely hairy above, velvety beneath, pale-greenish or glaucescent; midrib and veins ferruginous-tomentose; petioles 10 to 14 mm long. Flowers usually solitary, opposite

the leaves, nodding, fragrant; pedicel 17 to 20 mm long; calyx tripartite with small sepals; petals six, arranged in two series, the three exterior being linear-oblong, 27 mm long or more, blunt, sometimes acuminate, ferruginous-tomentose, velvety outside, whitish inside, keeled, with a maroon-colored blotch at the concave base; interior petals rudimentary; stamens indefinite; carpids one-seeded, united in a fleshy syncarp. The fruit is variable in size, from that of a large apple to 5,000 grams in weight, irregularly heart-shaped, surface greenish or yellowish, ferruginous-tomentose, areoles frequently indistinct, carpids depressed, equal or raised, sometimes so much so as to make a distinctly "knobby" fruit; flesh whitish and in good varieties, sweet, with a slight trace of acidity, aromatic, rich and melting, with scarcely noticeable fiber; seeds brown and variable in size, shape and color, about 18 mm long and 9 mm broad.

The cherimoya is more famed although perhaps less generally cultivated than any of its congeners. It is indigenous to Ecuador, Colombia, Central America, and perhaps Mexico, whence it was introduced into other parts of the world. In 1629 Cobo sent seed from Guatemala to Peru(10). This is the earliest record, of its introduction into a country outside of its native habitat, which has come to the attention of the writer. From Peru its cultivation has extended to Chili, and it is now one of the most esteemed fruits in both countries. The cherimoya was introduced into southern Spain as early as 1757, whence it probably found its way into Italy and Madeira. It thrives on the northern coast of Africa and fruits well in southern France, although no superior varieties have, as yet, been introduced into that country. It was cultivated in greenhouses in England in 1739(1). The cherimoya has long been cultivated in Jamaica and Hawaii, and has become naturalized in certain sections of these Islands; but it is a remarkable fact that a species so easily disseminated, has not, until recently, been introduced into some of the old English colonies in the Lesser Antilles. Woodrow[1] fails to mention the cherimoya, in connection with the other cultivated species as occurring in India. This would indicate that even at this late date it was not introduced into India, or if so, that it was very uncommon in that country. According to MacMillan[2] it was introduced into Ceylon about the year 1880, and is now cultivated in many up-country gardens in that Island. It is to be noted that the cherimoya was

[1] Gardening in India (1899).
[2] Handbook of Tropical Gardening and Planting (1910) 172.

apparently not introduced, by the Spaniards, into the Philippines, where its inferior congeners were established centuries ago and where they are perfectly at home. It is true that Kamel's reference in his "Herbarium aliarumque in insula Luzone Philippinarum primaria nascentium,"[3] to "Cherimoia," may refer to this species, but his use of the name does not of necessity apply to *Anona cherimolia,* as he may have referred to some other member of the genus. Granting that the species was introduced into the Philippines by the early Spanish colonists, it, like the avocado, certainly was never widely distributed in the Archipelago, and failed to persist. The probable explanation of the absence of the cherimoya, in many tropical countries, is not that it has never been introduced, but that it is unadapted to certain climatic conditions, such as are prevalent at low altitudes in the Philippines, in Ceylon, and in similar situations elsewhere in the tropics. It would seem that it is adapted to subtropical rather than to tropical conditions. The species is well established in Australia, where its cultivation is very successful in Queensland. The cherimoya was introduced into California about forty years ago, and into Florida in 1895. An excellent representation of twig, leaves and flowers in natural size and colors, and of a fruit much reduced, is given by Ehret and Trevv, in their "Plantae Selectae," plate 49, published in 1750.

Anona squamosa L. (§ *Attae*) Pl. VI, IX, fig. a.

A tall shrub, three or more meters high, less diffuse in habit than the cherimoya; young growth finely pubescent; leaves oblong-ovate, 6 to 12 cm long, base rounded, apex acute or obtuse, sparsely hairy on both sides, beneath paler green than above, thin, malodorous when bruised, petiole 18 mm or more in length. Flowers 1 to 3, opposite the leaves, fragrant, although less so than those of the cherimoya, pedicel slender, 17 to 52 mm long; sepals small; the three exterior petals linear-oblong, 25 to 30 mm long, blunt, greenish and sparsely pubescent on the outside, whitish inside, keeled, concave, with a purplish blotch at the base; inner petals inconspicuous; the androecium and gynaecium in this and the following species are similar to those organs in the cherimoya. The fruit is irregularly heart-shaped, 7.5 to 10 cm in diameter, tuberculate, each carpid forming a green protuberance, yellowish at base, sometimes shaded with pink or purple and covered with a whitish bloom; flesh whitish, sweet and delicately flavored, with a slight trace of fiber; seeds dark-brown, 15 mm long, 6 to 8 mm broad, smooth.

[3] Ray Hist. Pl. 3 (1704) App. 51.

The sugarapple is more widely dispersed throughout the tropics and sub-tropics and more generally cultivated than any species of the genus. Some authors have argued that it is indigenous to the tropics of the Old World, but it is now generally conceded that the species is native of the Western Hemisphere, more especially of the West Indies(14).

There seems to but little doubt that the Quauhtzapotl or Anona described by Hernandez is the sugarapple. The woodcuts, of Ahate de Panucho and Ate Pannicensis in his "Nova Plantarum Mexicanorum Historia," pages 348 and 454, one a reproduction of the other, evidently represent this species although Martius thinks that they represent the cherimoya. It is mentioned by Oviedo(51) under the name of Hanon. The sugarapple is described from Jamaica by Sloane(80), who gives a very good illustration of the fruit. Aublet(2) describes it from Guiana, and Tussac figures the plant in his "Flore des Antilles," 1808. In the colored plate in the latter work the gynaecium is represented as red. If this is not an error of the artist the model was certainly anomalous as, according to the observation of the writer,[4] this part of the flower is usually white.

St. Hilaire, who records the species from Brazil(74), argued that it was indigenous in Asia and brought to Brazil by the Portuguese. Unquestionably, however, DeCandolle is correct in concluding that it is a native of tropical America. That the sugarapple was transported to tropical Asia soon after the discovery of the New World is evident from the reference to the fruit in Malabar by Rheede(66), and the East Indian Archipelago by Rumphius(68). It is recorded from the Philippines in the last third of the 17th century, by Mercado[5] and by Kamel,[6] and is later considered by Blanco(4). It is probable that it was brought to the Philippines direct from Mexico by the Spaniards, who maintained communication between the latter country and the Archipelago for nearly 300 years. Two of its vernacular names in India, Manil-panosou and Manil-jaca seem to indicate its introduction into India from Manila. It was introduced into greenhouse culture in England in 1731(48). In southern France it has not proved to be hardy.

The sugarapple was introduced into Florida in 1833 by Dr.

[4] In the Philippines one tree of *Anona reticulata* was noted in San Isidro, Nueva Ecija, with the androecium and gynaecium colored a reddish-purple and the exterior petals purplish and quite hairy.

[5] Declaración de las virtudes de los árboles y plantas que están en esta tierra. Fl. Filip. ed. 3, 4 (1880) 59.

[6] Ray Hist. Pl. 3 (1704) App. 51.

Henry Perrine(81), and is now practically naturalized on several of the Florida Keys. It is said to have fruited well above the twentieth parallel in Norwalk, Putnam County, before the freeze of 1886(82). So far it has failed to thrive in California.

Anona reticulata L. (§ *Attae*) Pl. IX, fig. b.

A small tree, 4.5 to 7.5 meters tall; young growth finely pubescent, the full grown leaves becoming glabrous; leaves 12 to 30 cm in length or more, lanceolate, papery, malodorous when bruised, base rounded or acute, apex acuminate, veins prominent, petioles 11 to 25 mm long. Flowers 2 to several; pedicel 18 to 25 mm long; the three exterior petals, 16 to 33 mm in length, linear-oblong, blunt, greenish, whitish inside, keeled, concave, with a maroon-colored blotch in the cavity at the base; interior petals inconspicuous. The fruit attains a size of 7.5 to 15 cm in diameter, heart-shaped, the surface fairly smooth, greenish or yellowish with reddish reticulations, and covered with a whitish bloom; flesh yellowish-white, rich, melting, sweet, with a trace of acidity; seeds imbedded in the pulp, slightly smaller than those of the sugarapple, dark-brown and smooth.

In the West Indies the custardapple is commonly less esteemed than the other cultivated Anonas, although it is a close second to the sugarapple in wide distribution. It is a native of the American tropics. Its early introduction into the tropics of the Old World is shown by the reference to this fruit by Rumphius(69) and Rheede(67), and also a mention of it, in the last third of the 17th century, by Mercado and by Kamel as occurring in the Philippines. The former states definitely that it was brought to the Archipelago from Nueva España. It is now naturalized in British India and in tropical Africa(14) and has long been cultivated in the Philippines, Blanco(5).

As far as the author knows the name custardapple appeared first in 1657; but, as the writer of the work referred to failed to describe the plant, the species he had in mind can only be conjectured(48, 42). Thirty-four years later it is referred to as the vulgar name for *Anona indica*, a prelinnean synonym of *Anona reticulata*(56). In Plukenet's drawing the specific characteristics of the custardapple are readily recognizable although the author confounded the species with the sugarapple, the Ahate, the Panucho and Ate Pannicensis of Hernandes, and the Hanon of Oviedo. The custardapple was mentioned by Ray in 1704(65). Sloane described it from Jamaica as *Anona maxima* and accompanied the description by a drawing of the leaves and fruit(78). It was later figured by Jacquin(38), for his drawing in "Obser-

vationum Botanicarum," illustrating a twig with leaves and flowers, said to be *Anona squamosa,* is evidently the custardapple. (Vol. I, *t. 6, f. 1.*)

Anona muricata L. (§ *Guanabani*) Pl. VII, X.

A small tree, 4 to 6 meters in height, the young growth ferruginous-tomentose; leaves oblong-ovate or obovate, 8 to 18 cm long, acute at the base, scarcely obtuse, the apex shortly acuminate, dark-green above, shining, pale-green beneath, exhaling, when bruised, an odor similar to that of the black currant,[7] lateral veins not prominent, petioles 6 to 8 mm long. Flowers one to three, nodding; calyx small, tripartite; petals six, arranged in two series, the exterior ones 35 to 40 mm long, greenish-yellow and granular outside, smooth inside, ovate, concave, acute or acuminate, exceeding the interior ones; fruit ovate-oblong or conical, irregular, attaining a weight of 450 to 3,500 grams, frequently exceeding this size, greenish, and covered with soft spines corresponding to the carpids; flesh white, rather fibrous, subacid with a suggestion of turpentine, juicy and of good flavor; seeds brownish, smooth, about the same size as those of the cherimoya, embedded in the pulp.

The soursop is indigenous to the West Indies from whence it has spread to all parts of the tropics. It would appear that this fruit was first known to Oviedo who describes it under the name Guanabano(50), referring to its refreshing quality. Nieremberg 100 years later speaks of the soursop under the name Guanabanis(49). It is pictured by Piso and Marcgrav, in "Historia Naturalis Brasilia," published in 1648, this being the earliest illustration of the species that has come to the attention of the author. It is described in this work under the name Araticu ponhe. After this date references to the soursop become more frequent.

It is evident that some authors confounded this species with other Anonas. Sloane has a very good plate of the soursop, the fruit being particularly true to nature. It is also well illustrated by Jacquin(37), and Merian(47). The species was introduced into greenhouse culture in England in 1656, earlier than any other species of the genus(1). The soursop was introduced into Florida by Dr. Henry Perrine in 1833(81); but it is doubtful if this introduction was successful. It had, however, fruited

[7] Swartz, O. Observationes botanicae (1791) 221, speaks of a variety in Jamaica having inodorous leaves; it does not appear that latter travellers in the island have verified this fact.

previous to the freeze of 1886, in Manatee. Only a few isolated specimens have been grown and these in the extreme south of the peninsula and on the Keys.

Martius[8] describes a new species from Brazil under the name *Anona marcgravii*, to which he refers Araticu ponhe; but admits that the difference between this species and *Anona muricata* is exceedingly slight. There is probably little doubt that this species is merely a variety of *Anona muricata* as later botanists do not appear to have collected any specimens of *Anona marcgravii*.

Anona glabra L. (§ *Guanabani*) Pl. XI. (*Anona palustris* L., *A. laurifolia* Dunal.)

A shrub or tree, sometimes exceeding 7.5 meters in height, of spreading habit; leaves oblong, oval, or obovate, 10 to 18 cm long, glabrous, coriaceous, obtuse or abruptly narrowed at the base, apex acute or shortly acuminate, dark-green above, paler beneath, petioles 1 to 2 cm long, flowers solitary, nodding, petals six, in two series, yellowish-white outside, glabrous, concave, fleshy, the exterior 2.5 to 4 cm long, exceeding the interior ones, acute, scarcely obtuse, marked with red near the base inside, the interior petals, except a narrow, transverse, yellowish band near the base, red within. The fruit is heart-shaped, 6 to 12 cm long, regular, moderately smooth, undulate, yellowish or brownish; flesh yellowish, scarcely edible containing numerous pale-brown seeds.

The mamon, recently used as a stock for the cherimoya, custardapple, and soursop, was first described by Piso and Marcgrav from Brazil under the name Araticu pana(55), and has since been mentioned by many travelers and botanists. It has a wider natural distribution than any other species in the genus, as it extends throughout the American tropics to southern Florida, and is also found in a large part of tropical Africa.

The mamon, like its cultivated congeners excepting the cherimoya, was known to prelinnean botanists, and the specific characters distinguishing the species have long been well known, but although St. Hilaire has pointed out the similarity between *Anona palustris* L. and *Anona glabra* L., the synonymy of these species is not yet recognized by all writers on anonaceous plants.

From personal observations and by comparisons between the species known as *Anona glabra* in Florida and introduced plants of *Anona palustris* from the West Indies, the writer is of the

[8] Fl. Brasil. 13:6.

opinion that the two species are identical although there are varietal differences. This view has been further strengthened by an examination of the herbarium specimens of the two alleged species in the United States National Herbarium, Washington, D. C.

The writer wishes to acknowledge his indebtedness to Doctor Audrey Goss for the translation of many passages of works in foreign languages which were consulted in the preparation of this paper. Plates VI, VII and VIII are from photographs by Mr. Crandall of the Bureau of Plant Industry, U. S. Department of Agriculture, the others from photographs made by the writer. All are published through the courtesy of Mr. David Fairchild of the same institution.

BIBLIOGRAPHY.

(1) AITON, W. Hortus Kewensis 2 (1789) 252.
(2) AUBLET, F. Histoire des Plantes de la Guiane française 1 (1775) 617.
(3) ———. Ibid. 618.
(4) BLANCO, M. Flora de Filipinas (1837) 470.
(5) ———. Ibid. 471.
(6) BOTANICAL MAGAZINE (1831) *pl. 3095.*
(7) ———. Ibid. *pl. 2011.*
(8) BUL. SOC. BOTANIQUE DE FRANCE 52 (1905) mém. 3: 13.
(9) ———. Ibid. 14.
(10) COBO, P. Historia del Nuevo Mundo 2 (1891) 18.
(11) CONTRIBUTIONS FROM THE U. S. NAT. HERB. 8 (1903) 81.
(12) ——— ———. Ibid. 82.
(13) DE CANDOLLE, A. Origin of Cultivated Plants (1886).
(14) ———. Ibid. 168.
(15) ———. Ibid. 173.
(16) ———. Ibid. 174.
(17) DE CANDOLLE, P. Systema Naturae 1 (1818) 474.
(18) DESCOURTILZ, E. Flore des Antilles 2 (1833) 57, *t. 81.*
(19) DON, G. A. General History of Dichlamydeous Plants 1 (1831) 89.
(20) ———. Ibid.
(21) DUNAL, F. Monographie de la famille des Anonacées (1817) 70.
(22) ENGLER, A. and DIELS, L. Monogr. Afr. Pfl. 6 (1901) 77.
(23) ———. Ibid. 81.
(24) CYCLOP. AM. HORTICULTURE 1 (1904) 69.
(25) FOEX, F. Estacion Agricola Central Bul. 9 (1908) 17.
(26) ———. Ibid. 19.
(27) ———. Ibid. 21.
(28) ———. Ibid. 17, 12.
(29) ———. Ibid. 21, 23.
(30) HERMANN, P. Horti Academici Lugduno Batavi Catalogus (1687) 645.
(31) HUBER, J. Arvores Fructiferas do Para (1904) 380.
(32) HUGHES, W. The American Physitian (1672) 60.

(33) HUMBOLDT, A., BONPLAND, A., and KUNTH, C. S. Nova Genera et Species Plantarum 5 (1821) 55.
(34) ———. Ibid. 57.
(35) JACQUIN, N. J. Observationum Botanicarum 1 (1764) 14.
(36) ———. Ibid. 16.
(37) ———. Ibid. *t. 5.*
(38) ———. Ibid. *t. 6, fig. 2.*
(39) LAMARCK, A. M. DE. Encyclopédie méthodique Botanique 2 (1786) 123.
(40) ———. Ibid. 124.
(41) ———. Ibid. 2 (1786).
(42) LIGON, R. History of the Island of Barbadoes (1657) 14.
(43) ———. Ibid. 70.
(44) ———. Ibid. 71.
(45) MARTIUS, K. F. P. Flora Brasiliensis 13 [1] (1872) 14.
(46) ———. Ibid. 15.
(47) MERIAN, M. S. DE. Histoire Générale de Surinam 1 (1771) 14, *t. 14.* (First ed. 1705.)
(48) MILLER, P. Gardener's Dictionary (1807).
(49) NIEREMBERG, J. E. Historia Naturae (1635) 331.
(50) OVIEDO Y VALDES, G. F. DE. Historia de las Indies (1851) 303. (First ed. 1535.)
(51) ———. Ibid. 304.
(52) PICKERING, C. Chronological History of Plants (1879) 867.
(53) ———. Ibid. 754.
(54) PISO, G., and MARCGRAV, G. Historia Naturalis Brasilia (1648) 93.
(55) ———. Ibid. 94, 48.
(56) PLUKENET, L. Phytographia 1 (1691) *t. 134, fig. 4.*
(57) ———. Ibid. *t. 134, fig. 3.*
(58) PREVOST EXILES, A. F. Reisebeschreibungen 22 (1754) 658, *t. 18, fig. 4, 5.*
(59) ———. Ibid. 659, *t. 19, fig. 2, 3.*
(60) PULLE, A. A. Enumeration of the Vascular Plants of Surinam (1906) 177.
(61) ———. Ibid. 178.
(62) RAMIREZ, J. Plantas Mexicanas (1902) 81.
(63) ———. Ibid. 145.
(64) RAY, J. Historia Plantarum (1686) 165.
(65) ———. Ibid. 3 (1704) Dendrologiae 77.
(66) RHEEDE, H. VAN. Hortus Malabaricus 3 (1682) 21, *t. 29.*
(67) ———. Ibid. 23, *t. 30, 31.*
(68) RUMPHIUS, G. E. Herbarium Amboinense 1 (1741) 138, *t. 46.*
(69) ———. Ibid. 136, *t. 45.*
(70) SAGRA, RAMON DE LA. Historia de la Isla de Cuba 10 (1845) 12.
(71) ———. Ibid. 13.
(72) ———. Ibid. 14.
(73) ———. Ibid. 15.
(74) ST. HILAIRE, A. Histoire des plantes les plus remarquables du Brésil et du Paraguay (1824).
(75) ST. HILAIRE, A. Flora Brasiliae Meridionalis 1 (1825) 31.
(76) ———. Ibid. 32.

(77) SLOANE, H. Natural History of Jamaica 2 (1707) *t. 225.*
(78) ———. Ibid. *t. 226.*
(79) ———. Ibid. *t. 225, 226.*
(80) ———. Ibid. 168, *t. 227.*
(81) TWENTY-FIFTH CONGRESS, 2nd Session, Rep. (1838) 564.
(82) U. S. DEPARTMENT OF AGRICULTURE, Division of Pomology, Bul. 1 (1887) 16.
(83) VELLOZO, J. M. Florae Fluminensis (1880) 226.
(84) ———. Ibid. 225.

ILLUSTRATIONS.

PLATE VI.

The sugarapple, *Anona squamosa* L., as illustrated by Hernandez in "Nova Plantarum Animalium et Mineralium Mexicanorum Historia," published in 1651.

PLATE VII.

The soursop, *Anona muricata* L., as illustrated by Piso and Marcgrav in "Historia Naturalis Brasilia," published in 1648.

PLATE VIII.

The cherimoya, *Anona Cherimolia* Miller.

PLATE IX.

FIG. *a*. The sugarapple, *Anona squamosa* L.
b. The custardapple, *Anona reticulata* L.

PLATE X.

The soursop, *Anona muricata* L.

PLATE XI.

The mamon, *Anona glabra* L.

Vol. VII, No. 1, including pages 1 to 46, was issued May 14, 1912.



PLATE VI. THE SUGARAPPLE, *Anona squamosa* L., AS ILLUSTRATED BY HERNANDEZ IN 1651.



PLATE VII. THE SOURSOP, *Anona muricata* L., AS ILLUSTRATED BY PISO AND MARCGRAV IN 1648.



PLATE VIII. THE CHERIMOYA, *Anona Cherimolia* Miller.



PLATE IX, Fig. a. THE SUGARAPPLE, *Anona squamosa* L.



PLATE IX, Fig. b. THE CUSTARDAPPLE, *Anona reticulata* L.



PLATE X. THE SOURSOP, *Anona muricata* L.



PLATE XI. THE MAMON, *Anona glabra* L.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

A LIST OF THE MAMMALS OF THE PHILIPPINE ISLANDS, EXCLUSIVE OF THE CETACEA.

By NED HOLLISTER.

Order No. 418. Paper, $0.50 United States currency, postpaid.

This is the only recent attempt to enumerate the mammals of the Philippine Islands. The distribution of each species is given and the original descriptions are cited.

PRICE-LIST OF PHOTOGRAPHS.

For sale by the Bureau of Science.

Order No. 417. For free distribution.

This is a list of selected photographs from the splendidly complete collection of the Bureau of Science.

A MANUAL OF PHILIPPINE BIRDS.

By RICHARD C. MCGREGOR.

2 parts, 769 pages.

Order No. 103. Paper, $4 United States currency, postpaid.

Mr. McGregor spent some eight years in active field work, visiting many parts of the Archipelago, before beginning work on this book. Therefore, he was well prepared to undertake the preparation of the manual.

A Manual of Philippine Birds contains in compact form descriptions of all the known species of Philippine birds. The usual keys and diagnoses of orders, families, and genera help the novice in identification.

Under each species are found native, English, and scientific names, distribution by islands, descriptions of the birds and in many instances notes on nesting, migrations, and other habits.

A CHECK-LIST OF PHILIPPINE FISHES.

By DAVID STARR JORDAN and ROBERT EARLE RICHARDSON.

78 pages.

Order No. 102. Paper, $0.75 United States currency, postpaid.

This list will be found a convenient guide to the synonymy of Philippine ichthyology. The nomenclature is thoroughly revised and the distribution of each species within the Philippine Islands is given.

This check-list is uniform in size and style with McGregor and Worcester's Hand-list of Philippine Birds.

INDO-MALAYAN WOODS.

By FRED W. FOXWORTHY.

182 pages, 9 photographic plates.

Order No. 411. Paper, $0.50 United States currency, postpaid.

In Indo-Malayan Woods, Doctor Foxworthy has brought together a large amount of accurate information concerning trees yielding woods of economic value. The work is based largely upon the author's own experience in the Philippine and neighboring regions, but previous publications and information generously given by other dendrologists have been used to correlate commercial and native names of useful Indo-Malayan trees.

PHILIPPINE HATS.

By C. B. Robinson.

Order No. 415. Paper, $0.50 United States currency, postpaid.

This paper is a concise record of the history and present condition of hat making in the Philippine Islands. The various materials used and the different kinds of hats made in each center of production are fully described. Not of the least importance are the botanical identifications of the plants from which the hat materials are obtained.

The plates illustrate the hat materials and various kinds and grades of hats. A map of central Luzon shows the towns chiefly concerned in this industry.

THE COCONUT PALM IN THE PHILIPPINE ISLANDS.

149 pages, 30 plates.

Order No. 37. Paper, $1 United States currency, postpaid.

The reprint contains the following articles: On the Water Relations of the Coconut Palm (Cocos nucifera), by Edwin Bingham Copeland; The Coconut and its Relation to Coconut Oil, and The Keeping Qualities of Coconut Oil and the Causes of its Rancidity, by Herbert S. Walker; The Principal Insects Attacking the Coconut Palm (Parts I and II), by Charles S. Banks; with an introduction by Paul C. Freer.

A VOCABULARY OF THE IGOROT LANGUAGE AS SPOKEN BY THE BONTOK IGOROTS.

By Walter Clayton Clapp.

89 pages.

Order No. 408. Paper, $0.75 United States currency, postpaid.

The introduction to this vocabulary contains notes on pronunciation, vowels, diphthongs, consonants, verbs, conjugations, syllabication and reduplication. The vocabulary is given in Igorot-English and English-Igorot.

THE NABALOI DIALECT.

By Otto Scheerer.

65 pages, 29 plates.

AND

THE BATAKS OF PALAWAN.

By Edward Y. Miller.

7 pages, 6 plates.

Order No. 403. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The Nabaloi Dialect and the Bataks of Palawan are bound under one cover.

THE BATÁN DIALECT AS A MEMBER OF THE PHILIPPINE GROUP OF LANGUAGES.

By Otto Scheerer.

AND

"F" AND "V" IN PHILIPPINE LANGUAGES.

By Carlos Everett Conant.

These two papers are issued under one cover, 141 pages.

Order No. 407. Paper, $0.80 United States currency, postpaid.

Orders for these publications may be sent to the Business Manager, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below. Please give order number.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

THE SUBANUNS OF SINDANGAN BAY.

By Emerson B. Christie.

121 pages, 1 map, 29 plates.

Order No. 410. Paper, $1.25 United States currency, postpaid.

Sindangan Bay is situated on the northern coast of Zamboanga Peninsula. The Subanuns of this region were studied by Mr. Christie during two periods of five and six weeks, respectively.

The following is an abstract from the contents of Mr. Christie's report on the Subanuns: Habitat and history; relations with the Moros; material culture; houses; industries; trade; agriculture; family life; social customs; administration of justice; religion; the medicine man; ceremonies; tales; word-lists; physical measurements.

The 29 plates illustrate the Subanuns at work and at play; their industries, houses, altars, and implements; and the people themselves.

THE HISTORY OF SULU.

By Najeeb M. Saleeby.

275 pages, 4 maps, 2 diagrams.

Order No. 406. Paper, $0.75 United States currency, postpaid.

In the preparation of his manuscript for The History of Sulu Doctor Saleeby spent much time and effort in gaining access to documents in the possession of the Sultan of Sulu. It is fortunate that these records have now been translated and preserved in permanent form. This book is a history of the Moros in the Philippines from the earliest times to the American occupation.

STUDIES IN MORO HISTORY, LAW, AND RELIGION.

By Najeeb M. Saleeby.

167 pages, 16 plates, 5 diagrams.

Order No. 405. Paper, $0.75; half morocco, $0.75 United States currency, postpaid.

This volume deals with the earliest written records of the Moros in Mindanao. Doctor Saleeby was fortunately able to obtain exact copies of carefully preserved early records written in the Maguindanao dialect with Arabic characters. The author presents translations of these as well as 16 half-tone illustrations of certain pages from the originals. The names of the rulers of Maguindanao are recorded in five interesting diagrams.

NEGRITOS OF ZAMBALES.

By William Allan Reed.

82 pages, 62 plates.

Order No. 402. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The introductory chapter deals with the general distribution of Negritos and with the distribution of the Philippine branch of the race. The succeeding chapters deal with the various industries, amusements, and social relations of these little men.

Plates from photographs, the greater part of which was taken for this publication, show implements, houses, men making fire with bamboo, bows and arrows, dances, and various types of the people themselves.

CONTENTS.

	Page.
COPELAND, EDWIN BINGHAM. The Origin and Relationships of Taenitis	47
COPELAND, EDWIN BINGHAM. New or Interesting Philippine Ferns, VI	53
COPELAND, EDWIN BINGHAM. New Sarawak Ferns	59
COPELAND, EDWIN BINGHAM. New Papuan Ferns	67
GROVES, H. and J. Characeae from the Philippine Islands	69
MERRILL, E. D. Sertulum Bontocense: New or Interesting Plants Collected in Bontoc Subprovince, Luzon, by Father Morice Vanoverbergh	71
WESTER, P. J. A Contribution to the Nomenclature of the Cultivated Anonas	109

The "Philippine Journal of Science" is issued as follows:	U. S. currency.
Section A. Chemical and Geological Sciences and the Industries	$2.00
Section B. The Philippine Journal of Tropical Medicine	3.00
Section C. Botany	2.00
Section D. General Biology, Ethnology and Anthropology (Section D began with Volume V)	2.00
Entire Journal, Volume II, III, IV, or V	5.00
Entire Journal, beginning with Volume VI	7.00
Single numbers	.50
Volume I, 1906 (not divided into sections)	10.00
Supplement to Volume I (botany)	2.50
Volume I (without supplement)	6.50

Each section is separately paged and indexed.

Publications sent in exchange for the Philippine Journal of Science should be addressed: Library, Bureau of Science, Manila, P. I.

Subscriptions may be sent to the BUSINESS MANAGER, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below:

AGENTS.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

Entered at the post-office at Manila, P. I., as second-class matter.

VOL. VII, SEC. C, NO. 3 AUGUST, 1912

THE PHILIPPINE JOURNAL OF SCIENCE

ALVIN J. COX, M. A., PH. D.
GENERAL EDITOR

SECTION C. BOTANY

E. D. MERRILL, M. S.
EDITOR

WITH THE COÖPERATION OF

P. W. GRAFF, B. S.; W. H. BROWN, PH. D.
H. N. WHITFORD, PH. D.



MANILA
BUREAU OF PRINTING
1912

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

REPORT OF THE INTERNATIONAL PLAGUE CONFERENCE.

Held at Mukden, April, 1911, under the auspices of the Chinese Government.

Edited by Eroi Martini, G. F. Petrie, Arthur Stanley, and Richard P. Strong.

483 pages, 18 plates (2 colored, 4 half-tones, 12 charts and maps).

Order No. 416. Cloth, $3.50; paper, $2.50 United States currency, postpaid.

The proceedings of this International Conference and information gained therefrom, together with the results of certain bacteriological investigations, constitute the present report.

Nothing hitherto has been published which gives such a complete and comprehensive account of the entire subject of pneumonic plague.

Delegates from America (United States of), Austria-Hungary, France, Germany, Great Britain, Italy, Japan, Mexico, the Netherlands, Russia, and China attended the Conference.

The Bureau of Science of the Government of the Philippine Islands has been appointed sole agent for the distribution of the printed proceedings of the International Plague Conference.

THE SUGAR INDUSTRY IN THE ISLAND OF NEGROS.

By Herbert S. Walker.

145 pages, 10 plates, 1 map.

Order No. 412. Paper, $1.25 United States currency, postpaid.

Considered from the viewpoint of practical utility, Mr. Walker's Sugar Industry in the Island of Negros is one of the most important papers published by the Bureau of Science. This volume is a real contribution to the subject; it is not a mere compilation, for the author was in the field and understands the conditions of which he writes. The following is a brief synopsis of the contents:

Tables of soil analyses, both chemical and physical; analyses of the cane, juice and bagasse; estimates based on actual information as to the costs of production and of cultivation; and estimates of the cost and location of possible central factories. The island is considered by sugar-producing districts; the area of cultivation and the production per hectare are given, and the possibility for future expansion discussed.

The plates illustrate various phases of sugar industry from the cultivation of the field to the transportation of sugar in native sailboats.

A MANUAL OF PHILIPPINE SILK CULTURE.

By Charles S. Banks.

53 pages, 20 plates.

Order No. 413. Paper, $0.75 United States currency, postpaid.

The silk industry is particularly adapted to be undertaken by persons with small capital, and like the making of hats in the Philippine Islands it should thrive with a little encouragement.

In *A Manual of Philippine Silk Culture* we have presented the results of several years' actual work with silkworms, together with a description of the new Philippine race. Half-tone plates illustrate in natural size silkworms in different stages of development, cocoons, adult moths, samples of cloth made from raw silk, hand reel, and silk hanks. Other plates illustrate the various appliances used in raising silkworms and in spinning silk; hand and power reels are illustrated; working drawings are given for a silk house and for a hand reel.

THE PHILIPPINE
JOURNAL OF SCIENCE
C. BOTANY

VOL. VII AUGUST, 1912 No. 3

NOTES ON PHILIPPINE ORCHIDS WITH DESCRIPTIONS OF NEW SPECIES, V: THE GENUS BULBOPHYLLUM IN THE PHILIPPINE ISLANDS.[1]

By OAKES AMES.

(From the Ames Botanical Laboratory, North Easton, Mass., U. S. A.)

The following paper contains descriptions of nineteen new species of the genus *Bulbophyllum* together with a list of the species heretofore ascribed to the Philippine Islands. Those which belong to the § *Racemosae* are closely related to one another, although distinguishable by characters which I have set forth in a provisional key. I am convinced that we have in the Philippines a puzzling group of species, closely allied to *Bulbophyllum adenopetalum* Lindl., and to *B. dasypetalum* Rolfe, which cannot be rightly understood until a great deal more material than I have seen has been assembled and thoroughly studied. In this group we find plants which bear flowers so similar in detail that they seem to belong to the same species, although they are easily distinguishable and specifically unlike in their foliage. Around *Bulbophyllum dasypetalum* there is grouped a number of species which have triangular-lanceolate lateral sepals, and around *B. adenopetalum* there is grouped

[1] Proof read by E. D. Merrill.

a number of species which have caudate-tipped lateral sepals. Aside from this conspicuous floral distinction, one easily recognized, the species of each group are perplexingly similar. Often the points of dissimilarity are difficult to make clear in a description and stand out distinctly only when actual comparisons are made.

The general habit and the characteristic flowers of this group may be seen in *Bulbophyllum dasypetalum* Rolfe, which is figured in Orchidaceae 1:99. The flowers of the species with caudate-tipped sepals are for the most part similar to those of *Bulbophyllum flavescens* Lindl. A figure of this species is given by J. J. Smith in his "Orchideen von Java," Atlas, *fig. CCCIV*.

A LIST OF THE PHILIPPINE SPECIES OF BULBOPHYLLUM.

The following species of *Bulbophyllum* have been reported as natives of the Philippine Islands. Those species marked with an asterisk have been verified by an examination of material from the Archipelago; those marked with a double asterisk are doubtfully natives of the Philippines.

*1. **Bulbophyllum adenopetalum** Lindl. Bot. Reg. 28 (1842) Misc. 85.

*2. **B. alagense** Ames in Philip. Journ. Sci. 2 (1907) Bot. 233, Orchidaceae 3 (1908) 54.

*3. **B. antenniferum** Reichb. f. in Walp. Ann. Bot. Syst. 6 (1860) 248.
Cirrhopetalum antenniferum Lindl. Bot. Reg. 29 (1843) sub *t. 49*.
In Lindley's herbarium at Kew this species is represented by a single flower collected in the Philippines by Cuming.

*4. **B. auratum** Reichb. f. in Walp. Ann. Bot. Syst. 6 (1860) 261.
Cirrhopetalum auratum Lindl. Bot. Reg. 26 (1840) Misc. 50.

5. **B. balaeniceps Reichb. f. in Hamb. Gartenz. 19 (1863) 280.
In "Index Kewensis" this species is given as an equivalent of *B. Napelli* Lindl., a native of Brazil. The original description of *B. balaeniceps* appears to have been drawn entirely from a flower. It was not stated positively by Reichenbach that *B. balaeniceps* came from the Philippines; its origin was obscure. Pfitzer[1] gives *Balaenoidea* as a section of the genus and refers to it a single species, "*B. balaeniceps* Rchb. f. von den Philippinen."

*6. **B. bataanense** Ames Orchidaceae 1 (1905) 96.
Probably conspecific with *B. Cheiri* Lindl.

*7. **B. Bolsteri** Ames. See below.

*8. **B. bontocense** Ames. See below.

9. **B. braccatum** Reichb. f. in Linnaea 41 (1877) 117.

*10. **B. canlaonense** Ames. See below.

11. **B. careyanum Spreng. Syst. Veg. 3 (1826) 732.

*12. **B. carinatum** Ames. See below.

[1] Engl. & Prantl, Nat. Pflanzenfam. 2[4] (1889) 179.

*13. **B. Cheiri** Lindl. Bot. Reg. 30 (1844) Misc. 44.
14. **B. chryseum** (Kränzl.) Ames in Philip. Journ. Sci. 6 (1911) Bot. 54.
Cirrhopetalum chryseum Kränzl. in Fedde Repert. 8 (1910) 97.
*15. **B. Clemensiae** Ames. See below.
*16. **B. Copelandii** Ames Orchidaceae 1 (1905) 97.
*17. **B. Cumingii** Reichb. f. in Walp. Ann. Bot. Syst. 6 (1860) 261.
Cirrhopetalum Cumingii Lindl. Bot. Reg. 29 (1843) sub. *t. 49.*
For a colored plate see Bot. Mag. *t. 4996.*
*18. **B. cuneatum** Rolfe in Ames Orchidaceae 1 (1905) 98.
*19. **B. Curranii** Ames. See below.
20. **B. Blumei J. J. Smith Orch. Jav. (1905) 459.
B. cuspidilingue Reichb. f. in Walp. Ann. Bot. Syst. 6 (1860) 264.
Philippines given as a habitat in Index Kewensis. Java, Singapore, New Guinea.
*21. **B. dasypetalum** Rolfe in Ames Orchidaceae 1 (1905) 98, *fig.*
*22. **B. Dearei** Reichb. f. in Flora 71 (1888) 156.
Sarcopodium Dearei Reichb. f. in Gard. Chron. (1883) 108, *fig. 17.*
*23. **B. Elmeri** Ames. See below.
*24. **B. exile** Ames Orchidaceae 2 (1908) 208, *fig.*
*25. **B. gimagaanense** Ames. See below.
*26. **B. gnomoniferum** Ames Orchidaceae 2 (1908) 209, *fig.*
*27. **B. halconense** Ames in Philip. Journ. Sci. 2 (1907) Bot. 334.
*28. **B. lancipetalum** Ames supra 23.
29. **B. lasianthum Lindl. in Gard. Chron. (1855) 53.
"The first knowledge we had of this remarkable plant was from a coloured drawing, from Sumatra, shown us by our learned friend Prof. de Vriese. It has now been examined in a living state, a specimen said to have come from Manila having flowered with Messrs. Loddiges." etc., Lindley l. c.
*30. **B. lasioglossum** Rolfe in Ames Orchidaceae 1 (1905) 100, 2 (1908) 3, *pl. 18.*
*31. **B. lepantense** Ames. See below.
32. **B. longiflorum** Thouars Orch. Afr. (1822) *t. 97.*
Cirrhopetalum Thouarsii Lindl. Gen. and Sp. Orch. (1830) 58.
This species has been referred to the Philippines by Lindley and by other authors (cf. Bot. Mag. sub. *t. 7214;* Gard. Chron. 2 (1891) 69). I have not seen *B. longiflorum* from the Philippines and probably the species referred by various authors to the Archipelago under this name is *B. Weberi* Ames, described below.
*33. **B. luzonense** Ames. See below.
*34. **B. Makoyanum** Reichb. f. in Gard. Chron. 1 (1879) 234, in note; Ames in Philip. Journ. Sci. 6 (1911) Bot. 55.
*35. **B. marivelense** Ames. See below.
*36. **B. maxillare** Reichb. f. in Walp. Ann. Bot. Syst. 6 (1860) 248.
Cirrhopetalum maxillare Lindl. Bot. Reg. 29 (1843) sub. *t. 49.*
In Lindley's herbarium at Kew this species is represented by a flower and leaf collected in the Philippines by Cuming.
*37. **B. MacGregorii** Ames. See below.
*38. **B. Merrittii** Ames in Philip. Journ. Sci. 2 (1907) Bot. 334.
*39. **B. mindorense** Ames l. c. 334, Orchidaceae 3 (1908) 56, *pl. 45.*

*40. **B. nutans** Reichb. f. in Walp. Ann. Bot. Syst. 6 (1860) 260; Ames Supra 24.

Cirrhopetalum nutans Lindl. Bot. Reg. 25 (1839) Misc. 71; Bot. Mag. *t. 4418.*

41. **B. orthoglossum Wendl. & Kränzl. in Gard. Chron. (1896) 326.

This species was collected by W. Micholitz in "Sarangui insula," according to its authors. If by "Sarangui insula" Sarangani Island is intended, then *B. orthoglossum* is a native of the Philippines.[1]

*42. **B. pauciflorum** Ames. See below.

43. **B. penicillium** Par. & Reichb. f. in Trans. Linn. Soc. 30 (1874) 151; King & Pantl. Orch. Sikkim Himalaya *t. 108.*

Rolfe in both Vidal's Phanerogamae Cumingianae Philippinarum (1885) 80, 149, and in the Journal of Botany 23: 215 cites *Cuming 2076,* from the Philippines, as *Bulbophyllum penicillium* Par. & Reichb. f.

*44. **B. pleurothallioides** Ames in Philip. Journ. Sci. 2 (1907) Bot. 335, Orchidaceae 3 (1908) 55, *pl. 44.*

*45. **B. profusum** Ames. See below.

*46. **B. Ramosii** Ames supra 25.

47. **B. saurocephalum** Reichb. f. in Gard. Chron. 2 (1886) 262.

*48. **B. stellatum** Ames. See below.

*49. **B. trisetum** Ames. See below.

*50. **B. vagans** Ames & Rolfe in Orchidaceae 2 (1908) 210, *fig.* *Var. **angustum** Ames in Philip. Journ. Sci. 2 (1907) Bot. 335.

*51. **B. Vanoverberghii** Ames. See below.

*52. **B. Weberi** Ames. See below.

*53. **B. Whitfordii** Rolfe in Ames Orchidaceae 1 (1905) 100.

*54. **B. zambalense** Ames. See below.

BULBOPHYLLUM Thouars.

The following key represents a provisional effort to differentiate the group of the racemose Bulbophyllums which are closely allied to *B. adenopetalum* and *B. dasypetalum.* In order to make it more serviceable several other racemose species, clearly separable from all other Philippine species of the genus, are included. The key is based on characters which may exhibit a wide range of variation when more material is available for comparison. Unfortunately very few duplicates of the new species described in this paper have been received so that it has been impossible to arrive at a clear conception of those characters which will, in a key, make positive identification possible.

Bulbophyllum lasianthum Lindl. has been ascribed to the Philippines from whence it was supposed to have been imported into England by Loddiges, but I have seen no material referable

[1] Sarangani Island is known to several professional orchid collectors, Micholitz and others, as the home of certain species of commercial value, and has been visited at various times by different collectors. It is a small island off the south coast of Mindanao.

E. D. M.

to *B. lasianthum* among the Philippine specimens I have examined.

A. Raceme sharply decurved ..... *B. cuneatum*
B. Raceme erect or simply flexuose.
  a. Labellum or sepals hairy.
    b. Labellum hairy ..... *B. lasioglossum*
    (*b.* Sepals hairy ..... *B. lasianthum*)
  a. Labellum ciliolate; sepals smooth.
    b. Lateral sepals caudate-tipped.
      c. Leaves 7.5 to 15 cm long..... *B. adenopetalum*
      c. Leaves 5 to 6 cm long..... *B. Ramosii*
    b. Lateral sepals triangular-lanceolate, not caudate-tipped.
      c. Leaves about 15 cm long..... *B. lancipetalum*
      c. Leaves 3.5 to 5.5 cm long..... *B. gimagaanense*
      c. Leaves 8 to 10 cm long..... *B. Clemensiae*
a. Labellum smooth on the margin.
  b. Plants caespitose.
    c. Pseudobulbs 1 cm long; flowers several..... *B. Merrittii*
    c. Pseudobulbs wanting or minute.
      d. Flowers several ..... *B. lepantense*
      d. Flowers two ..... *B. pauciflorum*
  b. Rhizome creeping; leaves distant.
    c. Flowers 7 mm long..... *B. vagans*
    c. Flowers less than 7 mm long.
      d. Raceme erect, many-flowered, longer than the leaves.
        e. Petiole's 3 to 10 cm long.
          f. Leaves elliptic-oblong ..... *B. Vanoverberghii*
          f. Leaves narrowly lanceolate ..... *B. dasypetalum*
        e. Petioles about 1 cm long..... *B. zambalense*
      d. Raceme weak, few-flowered, shorter than the leaves; petals spathulate ..... *B. marivelense*
      d. Raceme 2-flowered ..... *B. Curranii*
(Insufficiently known) ..... *B. braccatum*

§ RACEMOSAE.

Bulbophyllum Clemensiae sp. nov.

Aff. *B. adenopetalo* et *B. dasypetalo. Rhizoma crassum. Pseudobulbi* 0. *Folia* oblanceolata, coriacea, petiolata. Scapus gracilis flexuosus, bracteis tubularibus prope basim. *Racemus* elongatus, bracteis inflorescentiae glabris, lanceolatis, ovarium aequantibus. *Sepala lateralia* triangulari-lanceolata, acuminata. *Sepalum superius* lineari-lanceolatum, acutum, concavum. *Petala* linearia, acuta, 1-nervia, margine cellulari-ciliato. *Labellum* ad basim rotundatum, lingulatum ab medio, vel lingulatum, pars inferior explanata suborbicularis; ad basim bicallosum. *Columna* brevis, ad apicem bifurcata.

Rhizome comparatively stout, copiously rooted. Pseudobulbs 0. Leaves long petiolate, oblanceolate, coriaceous, tapering abruptly

at the tip, lamina 8 to 10 cm long, 1.6 to 2.3 cm wide. Petiole 2 to 4 cm long. Scape weak, flexuouse, sheathed at the base with several tubular bracts, shorter than the leaves or equaling them. Raceme loose, 10- to 20-flowered. Bracts subtending the flowers about equaling the pedicellate ovary, scarious, lanceolate, concave, acute. Flowers in dried specimens appear to have been yellowish or whitish when fresh. Lateral sepals triangular-lanceolate, acute, broadly caudate-tipped, 5 mm long, 2 mm wide. Upper sepal linear-lanceolate, concave, acute, 4.5 mm long. Labellum 3.75 mm long, lingulate, margin of the apical half minutely ciliate, somewhat deflexed, margin of the basal half erect; basal half rotundate when spread out; bicallose. Column bifurcate at the tip.

MINDANAO, Lake Lanao, Camp Keithley, March, 1906, *Mary Strong Clemens 440*.

Bulbophyllum Curranii sp. nov.

Rhizoma gracile, ad nodos radicans. *Pseudobulbi* nulli. *Folia* oblongi-lanceolata vel oblonga, coriacea, acuta, in sicco rugosa, erecta, distantes, vix petiolata. *Scapus* brevis, biflorus, bracteis tubularibus obtectus, prope apicem bractea tubulari adornatus. *Bracteae inflorescentiae* flores subtendentes, pedicellis longiores, lanceolatae, acutae, in sicco scariosae. *Flores* flavidi. *Sepala lateralia* triangulari-lanceolata, acuminata, acuta, 3-nervia. *Sepalum superius* simile, lanceolatum, acutum, 3-nervium. *Petala* lineari-oblonga, 1-nervia, acuta. *Labellum* subhastatum vel subquadratum, ad apicem rotundatum, obtusum, 3-nervium. *Columna* breviter bicuspidata.

Rhizome elongated, very slender, in dried specimens less than 1 mm thick. Pseudobulbs, scarcely if at all developed, mere thickenings of the rhizome at the base of each leaf. Leaves 2 to 3 cm distant, elliptic-oblong, or oblong-lanceolate, acute, coriaceous, 1 to 2 cm long, up to 5 mm wide. Scape very short, scarcely exceeding 6 mm in length, concealed by sheathing bracts. Flowers in pairs, yellow, small, subtended by lanceolate bracts 2 to 3 mm long. Lateral sepals triangular-lanceolate, 5 mm long, 2 mm wide. Upper sepal 4.5 mm long. Petals much shorter than the sepals, about 2 mm long, less than 1 mm wide, 1-nerved. Labellum 2 mm long, about 1 mm wide, smooth.

LUZON, Benguet Subprovince, summit of Mount Tonglon, August 8, 1906, H. M. Curran, *For. Bur. 4953*. "Epiphytic vine."

Bulbophyllum gimagaanense sp. nov.

Aff. *B. adenopetalo* sed foliis minor et sepalis lateralibus non caudatis. *Rhizoma* elongatum, repens, gracile. *Pseudobulbi* 0.

Folia lineari-oblonga, obtusa, coriacea, in petalos graciles contracta. *Scapus* flexuosus, folio longitudine fere aequalis, vel brevior, bracteis 2, laxe vaginantibus, acutis. *Racemus* laxiflorus, pauciflorus (flores ± 3). *Bracteae* lanceolatae. *Sepala lateralia* triangulari-lanceolata, acuta. *Sepalum superius* oblongi-lanceolatum, acutum, concavum. *Petala* spathulata, 1-nervia, margine papilloso vel cellulari-ciliato. *Labellum* lingulatum, ad basim bituberculatum, 3-nervium, margine ciliato. *Columna* bifurcata.

Rhizome slender, elongated, creeping, copiously rooted. Pseudobulbs 0. Leaves coriaceous, linear-oblong, 3.5 to 5 cm long, 5 to 8 mm wide, contracted into slender petioles. Scape very slender, sheathed at the base by several, tubular, acute bracts. Raceme loose, few-flowered, flowers 5 to 10 mm apart. Bracts about 2 mm long, lanceolate, acute, exceeding the ovaries. From dried specimens the flowers appear to have been yellowish or whitish when fresh. Lateral sepals triangular or triangular-lanceolate, acute, hardly caudate-tipped, 5 mm long, about 2.5 mm wide. Upper sepal oblong-lanceolate, acute, about 4.5 mm long, concave. Petals spathulate, 3 mm long, ciliolate on the margin, 1-nerved. Labellum 3.5 mm long, lingulate, obtuse, margin ciliate, base bituberculate. Column minute.

NEGROS, Province of Occidental Negros, May 26, 1906, *H. N. Whitford 1610*. On tall trees, 65 m above sea-level.

B. gimagaanense differs from *B. adenopetalum* Lindl. and *B. Ramosii* Ames in the form of the lateral sepals. In habit it resembles *B. Ramosii* rather closely but is readily distinguishable from that species by means of its elongated rhizome and widely separated leaves. It is also similar to *B. vermiculare* Hook. f. but in the details of the flowers is quite distinct.

Bulbophyllum lepantense sp. nov.

Pseudobulbi minuti, caespitosi, globosi, rugosi, 3.5 mm alti. *Folia* crassa, in sicco rugosa, oblongi-elliptica, subacuta, breviter petiolata. *Scapus* foliis longior, bracteis carinatis tubularibus infra medium. *Racemus* sublaxiflorus. *Bracteae* ovato-lanceolatae, acutae. *Sepala lateralia* triangulari-lanceolata, 3-nervia, acuta. *Sepalum superius* ligulatum, acutum, concavum, 3-nervium. *Petala* rhombica vel rhombico-spathulata, obtusa, 1-nervia. *Labellum* lingulatum, obtusum, ad basim bituberculatum.

Pseudobulbs minute, approximate, rugose, globose, about 3.5 mm in diameter. Leaves fleshy, 3.5 to 5.5 cm long, 1 to 1.6 cm wide, deeply wrinkled in the dried state. Petals comparatively short, stout, 3.5 mm long. Scape at least twice longer than the leaves, ±10 cm tall, sheathed below the raceme with

about three, carinate, tubular bracts 1 to 1.5 cm long. Raceme loosely flowered. Bracts subtending the flowers ovate-lanceolate, about 3 mm long. Perianth about 5 mm long, the divisions scarcely spreading, yellowish-white. Lateral sepals triangular-lanceolate, acute, not caudate-tipped, 3-nerved, about 5 mm long. Upper sepal 5 mm long, ligulate, acute, 3-nerved, concave. Petals rhombic or rhombic-spathulate, obtuse, 1-nerved, about 3 mm long, the margin minutely cellular-ciliate. Labellum lingulate, about 3 mm long, fleshy, bituberculate at the base. Column minute, bifurcate at the tip.

LUZON, Lepanto Subprovince, October 29, 1905, *Elmer D. Merrill 4586*. Epiphyte in mossy forests, 2,200 m above sea-level.

Bulbophyllum marivelense sp. nov.

Aff. *B dasypetalo,* a quo tamen foliis differt. *Rhizoma* repens. *Pseudobulbi* nulli. *Folia* oblongi-lanceolata, obtusa, coriacea, petiolata. *Scapus* folio brevior, flexuosus, pauciflorus. *Flores* flavidi. *Sepala lateralia* triangulari-lanceolata, 3-nervia, acuta. *Sepalum superius* oblongum, acutum. *Petala* spathulata, 1-nervia. *Labellum* lingulatum, ad basim bicarinatum. *Columna* breviter bicuspidata.

Rhizome creeping, 2 mm thick. Pseudobulbs wanting. Leaves 1 cm apart, petiolate, coriaceous, oblong-lanceolate, obtuse, lamina 10 to 12 cm long, 12 to 13 mm wide, in general outline similar to that of *B. adenopetalum.* Petioles 3 to 4 cm long, slender, shorter in relation to the length of the lamina than those of *B. dasypetalum* to which species this one bears a close resemblance in the details of the flowers. Scape erect, bracteate, shorter than the leaves, 8.5 to 10 cm tall. Bracts subtending the flowers ovate-lanceolate, acute, about 1 mm long, equaling the ovaries, hyaline in dried specimens. Raceme loosely flowered, flowers about 10, yellow. Lateral sepals triangular-lanceolate, acute, 3-nerved, 4.5 mm long. Upper sepal oblong or oblong-lanceolate, acute, concave, 4 mm long. Petals spathulate, 1-nerved, obtuse, 2.5 mm long. Labellum lingulate, margin smooth, about 2.5 mm long, bicarinate at the base. Column minute, bicuspidate.

LUZON, Province of Bataan, Mount Mariveles, January 1, 1904, *Elmer D. Merrill 3738*. On exposed ridges, epiphytic, at 1,100 meters above the sea.

Bulbophyllum pauciflorum sp. nov.

Planta parvula, caespitosa, pseudobulbi minuti vel nulli. *Folia* conferta, coriacea, elliptica vel oblanceolata, breviter petiolata. *Scapus* foliis breviores, flores duos gerentes. *Flores* flavidi.

Sepala lateralia, triangulari-lanceolata, 3-nervia. *Sepalum* superius concavum, oblongi-lanceolatum, 3-nervium. *Petala* spathulata, 1-nervia. *Labellum* ovato-lanceolatum, 3-nervium, acutum. *Columna* breviter bicuspidata.

Plants small, copiously rooted, caespitose, leaves crowded. Pseudobulbs practically wanting. Leaves fleshy, coriaceous, rugose when dry, elliptic or oblanceolate, rounded at the retuse tip, 1 to 2 cm long, 6 to 8 mm wide. Petiole very short, causing the leaves to appear sessile. Scape shorter than the leaves or barely equaling them, up to 2 cm long, bearing, in the specimens studied, only two yellowish flowers. Bracts of the inflorescence about half as long as the shortly pedicellate ovary. Lateral sepals triangular-lanceolate, acute, 4.5 mm long. Upper sepal about 4 mm long, concave, oblong-lanceolate, acute. Petals much smaller than the sepals, about 2 mm long, spathulate, 1-nerved. Labellum comparatively large, ovate-lanceolate, acute, 3-nerved, 3 mm long, 2 mm wide. Column minute, bicuspidate.

LUZON, Bontoc Subprovince, August 17, 1911, *Father M. Vanoverbergh 1381.* Epiphytic, altitude 1,650 meters above sea level.

Bulbophyllum Vanoverberghii sp. nov.

Pseudobulbi 0. *Folia* petiolata, coriacea, oblongi-elliptica. *Scapus* gracilis, erectus, folio longior, bracteis tubularibus prope basim. *Racemus* gracilis, multiflorus. *Bracteae* ovariis longiores, anguste lanceolatae. *Sepala* lateralia triangulari-lanceolata, acuminata, acuta, subcaudata. *Sepalum* superius lanceolatum, acutum ad basim concavum. *Petala* lineari-oblonga, obtusa, 1-nervia. *Labellum* crassum, 3-nervium, lingulatum, obtusum, ad basim bituberculatum, bicarinatum prope medium. *Columna* bifurcata.

Rhizome creeping, about 5 mm in diameter, copiously rooted. Pseudobulbs 0. Leaves petiolate, very thick, coriaceous, yellowish when dry, rugose. Petiole 2.5 to 5 cm long, sulcate, about 3 mm thick, rigid. Lamina elliptic-oblong, obtuse, bilobed at the tip, abruptly or gradually contracted at the base, margin revolute, average length about 15 cm, average width 4 cm. Scape erect, sheathed up to the lowermost flower by about four, loose, acute, vaginate bracts. Raceme slender, many-flowered, 12 to 22 cm long. Bracts exceeding the ovaries, linear-lanceolate, acuminate, acute, diaphanous in dried specimens, about 7 mm long. Flowers yellowish or whitish, up to 8 mm long, segments of the perianth hardly spreading. Lateral sepals triangular-lanceolate, acuminate, subcaudate-tipped, acute, smooth,

6 to 8 mm long. Upper sepal lanceolate, acute, about 5 mm long. Petals linear-oblong, obtuse, 1-nerved, 3 mm long, about 1 mm wide. Labellum 4.5 mm long, lingulate, obtuse, fleshy, 3-nerved, bituberculate at the base, bicarinate or furnished with two fleshy marginal ridges on the apical half below the middle, strongly deflexed at about the middle, obscurely if at all 3-lobed, margin of the basal half erect, margin of the apical half deflexed, slightly revolute. Column bifurcate.

LUZON, Bontoc Subprovince, July-August, 1911, *Father M. Vanoverbergh 1367.*

To this species I refer the following collections:

LUZON, Province of Nueva Vizcaya, December 22, 1908, M. L. Merritt, *For. Bur. 15861,* altitude above sea-level 1,600 meters: Benguet Subprovince, August 8, 1906, H. M. Curran, *For. Bur. 5062;* Subaan trail, January, 1909, W. Schultze, *Bur. Sci. 5629:* Bontoc Subprovince, July 23, 1910, *Father M. Vanoverbergh 712:* Province of Tayabas, November 3, 1907, Curran and Merritt, *For. Bur. 7835:* Province of Zambales, December 10, 1907, Maximo Ramos, *Bur. Sci. 4995:* Province of Rizal, Bosoboso (San Isidro), January, 1909, Maximo Ramos, *Bur. Sci. 2025:* Province of Laguna, Mount Banajao, November, 1907, Curran and Merritt, *For. Bur. 8025.*

Bulbophyllum Vanoverberghii belongs to a small group of Philippine species of which *B. dasypetalum* Rolfe and *B. adenopetalum* Lindley are representatives. It appears to be closely allied to *B. braccatum* Reichb. f. a species which is known to me only through the brief and incomplete description published by Reichenbach f.[4] Up to the present time I have been unable to assign with certainty any Philippine specimens to *B. braccatum. B. Vanoverberghii* is distinguishable from *B. dasypetalum* Rolfe chiefly by the very dissimilar foliage. The flowers of these species are very similar in detail.

Bulbophyllum zambalense sp. nov.

Rhizoma elongatum. *Pseudobulbi* nulli vel minuti. *Folia* oblanceolata, coriacea, petiolata. *Scapus* folio longitudine fere aequalis vel longior, ad basim bracteis imbricatis. *Racemus* laxus. *Flores* flavidi. *Sepala lateralia* triangulari-lanceolata, subcaudata, acuta. *Sepalum superius* lanceolatum, acutum, concavum. *Petala* spathulata, obtusa, 1-nervia. *Labellum* lingulatum, 3-nervium. *Columna* breviter bicuspidata.

Rhizome creeping, elongated, bearing at intervals of 3 to 5 cm, coriaceous, oblanceolate leaves. Pseudobulbs reduced to small thickenings on the rhizome. Leaves petiolate, lamina about 5 cm long, 6 mm wide. Petiole about 1 cm long. Scape equaling or somewhat longer than the leaves, clothed at the base by several, scarious, imbricating bracts. Raceme loosely few-flowered, bracts 2 mm long, linear-lanceolate, acute. Flowers

[4] Linnaea 41: 117.

yellow. Lateral sepals triangular-lanceolate, subcaudate, 7 mm long. Upper sepal lanceolate, about 5 mm long, concave. Petals spathulate, obtuse, 1-nerved, 2.5 mm long. Labellum lingulate, 3-nerved, 2.5 mm long. Column minute, shortly bicuspidate.

LUZON, Province of Zambales, December 13, 1907, Maximo Ramos, *Bur. Sci. 4996.*

The type of this species is composed of a single specimen in the Herbarium of the Bureau of Science and of a fragment preserved in my own herbarium. The elongated rhizome is very characteristic. The labellum of the flowers examined lacked the conspicuous tubercles or callosities at the base, which are usual in flowers of this group.

§ MONANTHAPARVA.

Bulbophyllum bontocense sp. nov.

Rhizoma elongatum, repens, gracile, ad nodos radicans. *Radices* crassae. *Pseudobulbi* pyriformi, rugosi, parvi. *Folia* brevissime petiolata, coriacea, elliptica vel ovata, ad apicem aristata. *Scapus* foliis longior ortus a basi pseudobulbi vel a rhizomate; ad basim vaginis tubularibus bracteiformibus; sub *florem* solitarium bractea tubularis. *Sepala lateralia* triangulari-lanceolata, longe caudata, 3-nervia. *Sepalum superius* simile. *Petala* variabilis, 1-nervia, oblonga, ad apicem irregulariter retusa, mucronata vel marginibus inaequaliter dentatis. *Labellum* 3-lobatum, unguiculatum, 3-nervium, lobis lateralibus erectis, lanceolatum ab medio, obtusum vel subacutum, pars inferior explanata orbicularis, pars anterior crassa.

Rhizome creeping, elongated, slender. Pseudobulbs 2 to 3 cm apart, pyriform, rugose, monophyllous, 4 to 6 mm long. Leaves coriaceous, elliptic or ovate, setigerous at the tip, 7 to 12 mm long, 5 to 7 mm wide. Scape slender, longer than the leaves, 1 to 3 cm long, arising from the base of the pseudobulbs and from the rhizome about midway between the pseudobulbs, bracteate at base, unibracteate at the base of the solitary white flower, persistent. Lateral sepals triangular-lanceolate, acuminate, caudate-tipped, 3-nerved, up to 8 mm long. Upper sepal similar to the laterals. Petals variable, 1-nerved, 3 mm long, 1 mm wide, oblong, somewhat cuneate at the base, apex mucronate or irregularly dentate, the apex exhibiting both conditions in the same flower. Labellum 3-lobed, 2 mm long. Lateral lobes semiorbicular, erect, when spread out giving to the basal portion of the labellum an orbicular aspect, middle lobe lanceolate, fleshy, acute, 1.5 mm long. Column 1.5 mm long.

LUZON, Bontoc Subprovince, August 17, 1911, *Father M. Vanoverbergh 1382.* Growing on trees, altitude 1,650 meters above sea-level.

Bulbophyllum canlaonense sp. nov.

Cum *B. halconensi* comparandum videtur, a quo tamen sepalis differt. *Rhizoma* longe repens, gracile, elongatum, ad nodos radicans. *Pseudobulbi* pyriformi, 3 mm alti, in sicco rugosi, distantes. *Folia* 1 ad 3 cm longa, 4 ad 9 mm lata, elliptico-oblonga, acuta, coriacea, petiolata. *Scapus* usque ad 4.5 cm longus, foliis longior, 1-florus, a basi pseudobulbi vel a rhizomate in medio inter pseudobulbos ortus. *Flores* atropurpurei, usque ad 12 mm longi. *Sepala lateralis* ovato-lanceolata, acuta. *Sepalum superius* simile. *Petala* 6 mm longa, 3 mm lata, elliptica, ad apicem rotundata, acuta. *Labellum* 4.5 mm longum, cordato-lanceolatum, acutum. *Columna* brevis, in medio columnae dens vel papilla.

NEGROS, Canlaon Volcano, April 10, 1910, *Elmer D. Merrill 7015.* Epiphyte, rather abundant, altitude above sea-level 1,200 to 1,700 m, flower dull-purple.

A near ally of *Bulbophyllum halconense* from which it differs mainly in the entire absence of caudate tips to the sepals (cf. Orchidaceae 3: 54, *pl. 44, fig. 3 C. c.*)

Bulbophyllum Elmeri sp. nov.

Rhizoma repens, gracile, elongatum. *Pseudobulbi* pyriformes, rugosi, distantes, monophylli. *Folia* vix petiolata, lanceolata, acuta, breviter apiculata. *Scapi* filiformes, ad basim bractea tubulari vaginati, a basi pseudobulbi vel a rhizomate in medio inter pseudobulbos ortus, interdum scapi orti a pseudobulbo uno. *Sepala lateralia* triangulari-linearia, acuminata, valde acuta, 3-nervia. *Sepalum superius* simile. *Petala* elongata sepalis vix breviora, linearia, acuminata, longe aristata, 1-nervia. *Labellum* 3-lobum, lobi laterales parvi, rotundati, lobus medius subcordatus, crassus, apex erectus vel recurvatus, incrassatus, ad basim labellum carina brevis, gnomoni solari similis. *Columna* brevis, antice utroque ad apicem processus setiformis.

Rhizome about 1 mm thick. Pseudobulbs about 1 mm apart, 5 mm tall. Leaves 1 to 2.5 cm long, up to 5 mm wide. Scape equaling the leaves in length or shorter. Lateral sepals about 4 mm long, about 1 mm wide; upper sepal similar to the laterals. Petals very slender, prolonged into a thread-like or aristate tip, 4 mm long. Labellum 1.5 cm long, 3-lobed, cuneate at the base, middle lobe 0.5 mm long.

LUZON, Benguet Subprovince, Baguio, March 8, 1904, *A. D. E. Elmer 6618.*

Bulbophyllum MacGregorii sp. nov.

Aff. *B. mindorensi*, specei quam habitu et structora haec species conspicue simulat. In cortice arborum depressum, decumbens. *Rhizoma* elongatum omnino pseudobulbis obtectum. *Pseudobulbi* cylindracei, depressi, rugosi, 1-foliati. *Folia* elliptica vel oblanceolata, coriacea, breviter petiolata, erecta. *Scapus* 1-florus, a basi pseudobulbi ortus. Ovarium hystricosum vel papillosum. *Flos* flavidus in sicco [5] a bractea tubulari subtensus. *Sepala lateralia* oblonga, acuta, 3-nervia, margine prope apicem cellulari-dentato. *Sepalum* superius oblongi-lanceolatum, 3-nervium. *Petala* abbreviata, 1-nervia, spathulata, ad apicem incrassata. *Labellum* crassum, oblongum, obtusum, integerrimum, ad apice valde incrassatum, ad basim concaviusculum; apex saepe deflexus. *Columna* gracilis, bicuspidata. *Petalis* brevior.

Pseudobulbs 6 mm long. Leaves shortly petiolate, 8 to 13 mm long, 2 to 3.5 mm wide. Scape slender, filiform, about 1 cm tall. Bract subtending the flower up to 2 mm long. Lateral sepals 4 to 7 mm long, up to 2 mm wide, conspicuously 3-nerved when dry. Upper sepal similar to the laterals. Petals 2 to 2.5 mm long, about 0.75 mm wide, thickened at the tip. Labellum 3 mm long, 1 mm wide. Column 2 mm long.

LUZON, Benguet Subprovince, Pauai, June, 1909, R. C. McGregor, *Bur. Sci. 8322*, altitude above sea-level about 2,100 meters; same locality, *Elmer D. Merrill 6624*, May, 1909, epiphyte in mossy forest, "flowers dull-red," altitude 2,250 m above sea-level.

B. MacGregorii is nearly allied to *B. mindorense* and to the Bornean species, *B. corticicola*, recently described by Doctor Schlechter. From the former it differs in the sepals, petals and lip, and from the latter it is readily distinguishable by its 3-nerved sepals, *B. corticicola* having 5-nerved sepals in the specimens I have examined.

Bulbophyllum profusum sp. nov.

Rhizoma ramosum, elongatum, diffusum, bracteis imbricatis, arcte vaginantibus, dense vestitum; *scapis* e vaginis rhizomatis a pseudobulbis longe remotis erumpentibus. *Pseudobulbi* parvuli, cylindracei, in sicco rugosi. *Folium* coriaceum, elliptico-oblongum, breviter petiolatum. *Scapus* abbreviatus, uniflorus. *Flores* flavidi, sub florum solitarium bractea infundibuliformis. *Sepala lateralia* elongata, caudata, lineari-triangularia, 3-nervia, glabra. *Sepalum* dorsale simile. *Petala* elliptica vel ovata,

[5] In dried specimens the flowers are yellowish or orange-yellow. McGregor made no remarks regarding the flowers of his specimens. Merrill describes the flowers of his specimen as dull-red.

obtusa, 1-nervia. *Labellum* lanceolatum, obtusum, 3-nervium. *Columna* minuta.

Rhizome much branched, clothed with imbricating, scarious bracts from among which the numerous 1-flowered scapes arise, crowding the space between the widely separated pseudobulbs. Pseudobulbs about 2 cm apart, 5 mm long, 2 mm thick, closely appressed to the rhizome, rugose and angled when dry, cylindraceous, truncate, bearing at the summit a solitary, fleshy, elliptic-oblong leaf. Leaves shortly petiolate, 2.2 to 5 cm long, about 1 cm wide, yellowish-green in dried specimens, retuse at the rounded tip. Flowers about 6 mm long, yellowish, borne singly on very short, slender scapes, the scapes almost entirely concealed by the bracts of the rhizome. Subtending each flower there is an infundibuliform, acuminate-tipped, hyaline bract which partly conceals the ovary. Lateral sepals linear-triangular, caudate-tipped, 6 mm long. Upper sepal similar to the laterals. Petals elliptic or ovate, obtuse, much shorter than the sepals, 1.75 to 2 mm long, 0.75 mm wide. Labellum lanceolate, more fleshy than the other perianth divisions, about 1.5 mm long, 3-nerved, smooth.

LUZON, Province of Rizal, Mount Canumay, October 15, 1911, Maximo Ramos, *Bur. Sci. 13785*, epiphytic: Province of Cagayan, April 20, 1909, Ramos, *Bur. Sci. 7971*.

B. profusum resembles the Celebesian *B. myrianthum* Schltr. so closely that the slight differences between them, observable when specimens are laid side by side, may be considered too trivial for recognition as valid specific characters. In *B. myrianthum* the leaves are ovate or suborbicular and, in the specimens I have examined, do not exceed 2.5 cm in length. In *B. profusum*, however, the leaves average more than 2.5 cm in length and are rather oblong-elliptic than ovate or suborbicular. In *B. profusum* the labellum is broader than in *B. myrianthum*, very obtuse, and broader in proportion to its length. The sepals of *B. profusum* are narrower in proportion to their length than those of *B. myrianthum*. Both species are near relatives of the Javan *B. sessile* J. J. Smith (*B. clandestinum* Lindl.) which is rather widely distributed, having been reported from Borneo, the Malay Peninsula, Singapore, and Tenasserim. An examination of additional material may show that *B. myrianthum* and *B. profusum* are referable to *B. sessile* and that the differences now relied on for differentiation are of slight importance.

§ CIRRHOPETALUM.

Bulbophyllum antenniferum (Lindl.) Reichb. f. in Walp. Ann. Bot. Syst. 6 (1860) 245.

Cirrhopetalum antenniferum Lindl. Bot. Reg. 29 (1843) sub. *t. 49*.

The type specimen of *Cirrhopetalum antenniferum* in Lindley's Herbarium at Kew consists of a solitary flower. There are no leaves and no pseudobulbs. Lindley's description of the flower is incomplete, no

reference being made to the labellum. The nearest approach to Lindley's type, among the Philippine specimens I have examined, is a *Bulbophyllum* from Mindanao collected at Camp Keithley on Lake Lanao by Mary Strong Clemens, *no. 445*. The leaves of this specimen are about 10 cm long by 2.5 cm wide, from pseudobulbs 2 cm long. The lateral sepals are 5 cm long, about equaling the upper sepal. The petals are minute, prolonged into setiform tips. The lip is missing.

Bulbophyllum auratum (Lindl.) Reichb. f. in Walp. Ann. Bot. Syst. 6 (1860) 261.

Cirrhopetalum auratum Lindl. Bot. Reg. 26 (1840) Misc. 107; 29 (1843) *t. 61*.

To this species I refer two series of specimens from Mindanao. The flowers suggest those of *B. Cumingii*, but are considerably smaller with a much broader upper sepal, abruptly terminating in a filiform appendage, and with the yellow-fringed petals broader in relation to their length. The foliage of the two species is very similar but in *B. auratum* the pseudobulbs are much smaller than in *B. Cumingii*. *Plate 61* in the "Botanical Register" represents, with reasonable closeness to details, the specimens here referred to *B. auratum*. In *B. Cumingii* the lateral sepals are about 2.6 cm long. In *B. auratum* they are 1.6 cm long. *B. Cumingii* the upper sepal is 7 mm long including the filiform appendage, and in *B. auratum* it is about 4 mm long.

MINDANAO, Butuan Subprovince, San Vicente, Agusan River, *C. M. Weber 137*, June 2, 1911, epiphyte, flowers pink; near Butuan, A. Celestino, *Bur. Sci. 12128*, October, 1910.

Bulbophyllum Bolsteri sp. nov.

Aff. *B. chryseo* sed in floribus major. *Rhizoma* repens. *Internodia* 2.3 cm longa. *Pseudobulbi* 1.5 ad 2 cm longi, cylindracei, ad apicem fastigiati, in sicco rugosi, monophylli. *Folia* breviter petiolata, elliptico-lanceolata, acuta, coriacea, 3.3 ad 5.2 cm longa, usque ad 1.7 cm lata. *Petiolus* 2 mm longus, sulcatus. *Scapus* filiformis, 8 ad 12 cm longus, uniflorus, bracteis tubularibus 2. Bractea 1 in basi pedicelli unici. *Pedicellus* cum ovariis 1.5 cm longus, filiformis. *Sepala lateralia* leviter conglutinata, lineari-lanceolata, acuta, 1.6 cm longa, 3.5 mm lata prope basim. *Sepalum superius* simile valde concavum. *Petala* lanceolata, 1-nervia, 6.5 mm longa, 2.5 lata, diaphana, glabra. *Labellum* petalis longior, lineari-lanceolatum, obtusum, 9 mm longum, 1.5 mm latum, ad basim biauriculatum, auriculi rotundati, erecti. Columna minuta, stelidia subulata, gracilia, 1 mm longa, glabra.

MINDANAO, Province of Surigao, *F. H. Bolster 349*, May, June, 1906. Epiphyte, flowers yellowish with purple markings. Here should be referred *Bur. Sci. 3076 Ramos*, collected in Rizal Province, Luzon, a plant previously confused with *B. chryseum*.[6]

[6] This Journal 6 (1911) Bot. 54.

B. Bolsteri and *B. chryseum* (Kränzl.) Ames are very near allies, differing mainly in the more rambling habit of *B. Bolsteri* and in the proportions of the flowers, *B. Bolsteri* being a larger flowered species with smooth petals, the median nerve unbranched. Unfortunately, I have not seen the type of *B. chryseum*, but among the Philippine plants in my herbarium there is one collected by *W. S. Lyon 152*, which answers so closely to Kränzlin's description in Fedde's "Repertorium" that I feel sure it must be that species.

B. Bolsteri is suffused with purple in dried specimens, conspicuously so at the base, while *B. chryseum* is light-yellow.

Bulbophyllum carinatum sp. nov.

Pseudobulbi cylindracei, rugosi, 3 cm longi, juniores vaginis mox in fibras solutis inclusi, monophylli. *Folia* permagna, petiolata, oblongi-elliptica, coriacea, in petiolum attenuata, in sicco rugosa. *Scapus* elongatus, bracteis tubularibus vestitus, univel pauciflorus. *Flores* aurantiaci. *Pedicellus* gracilis. *Sepala lateralia* elongata, subfalcata, sulcata, valdi carinata, ad basim connata et pedi columnae adnata, mentum breve formantia, superne libera. *Sepalum superius* sepalis lateralibus multo brevior, ovato-lanceolatum, acuminatum, valde acutum. *Petala* ovato-lanceolata, acuta. *Labellum* crassum, inferne sulcatum, margo partis dimidiae basilaris erectus; pars dimidia superior, conduplicata, margine copiosi pilis instructis. Columna bipartita, laciniae bipartitae.

Leaves, including the sulcate petiole, 21 to 30 cm long, 3.5 to 5.5 cm wide. Petiole about 5 cm long. Scape 17 to 26 cm long. Bracts about 1 cm long, infundibuliform. Pedicel and ovary 2 cm long. Flowers 1 or 2, mottled, yellow-red. Lateral sepals 4 cm long, 5 mm wide, conspicuously carinate, sulcate above, triquetrous. Upper sepal 3 cm long, about 1 cm wide. Petals strongly reflexed, 1.5 cm long, 6 to 7 mm wide. Labellum 1.4 cm long, conduplicate for the most part, the basal portion cordate when spread out, with setiform, marginal teeth near the point of insertion, the margin otherwise, to about the middle of the lip, irregularly and shortly dentate. The lip, just beyond the middle is conduplicate, the upper margin long-papillose, papillae fleshy; on the under side it is longitudinally sulcate. Column about 1 cm long, divided at about the middle into two spreading lateral arms or wings, each wing deeply unequally cleft, the anterior division terminating in a setiform tip.

MINDANAO, Province of Misamis, Mount Malindang, Mearns and Hutchinson, *For. Bur. 4593*, May, 1906, found at an altitude of about 900 m above sea-level.

B. carinatum suggests *B. Leysianum* Burbidge Journ. Roy. Hort. Soc.

134 (1894) *fig. 19*, from which, in detail, it is clearly distinct. The carinate lateral sepals, the fleshy labellum, sulcate beneath, with its papillose apex, are marked peculiarities which distinguish *B. carinatum* from all other Philippine species of the genus heretofore described.

Bulbophyllum luzonense sp. nov.

Rhizoma repens. *Pseudobulbi* approximati, cylindracei. *Folia* oblonga, coriacea, ad apicem attenuata, breviter petiolata. *Petiolus* sulcata. *Scapus* folia brevior, bracteatus, suberectus. *Bracteae inflorescentiae* numerosae, confertae. *Pedicelli* graciles, divaricata. *Flores* albidi, racemo in umbellam constricto. *Sepala lateralia* longe triangulari-lanceolata, acuta, 3-nervia, libera, patentia. *Sepalum* superius simile. *Petala* triangulari-lanceolata, angustata, acuminata, acuta, glabra, 1-nervia. *Labellum* minutum, lingulatum, glabrum, obtusum. *Columna* parvula.

Pseudobulbs 2 to 2.7 cm long. Leaves about 8 cm long, 1.2 to 1.8 cm wide. Petiole 3 mm long. Scape about 8 cm long, in fruiting specimens 10 cm long. Bracts subtending the umbel linear, about 5 mm long. Pedicel and ovary about 1.5 cm long. Flowers about 8 in each umbel. Lateral sepals 7 to 9 mm long, about 1.5 mm wide near the base. Petals about 4 mm long, less than 1 mm wide near the base. Labellum about 2 mm long, obtuse.

LUZON, Province of Cagayan, H. M. Curran, *For. Bur. 16787*, March, 1909.

This is an interesting species of § *Cirrhopetalum* easily distinguished from all other Philippine species of the same section by its loose umbels and long, narrowly triangular petals which are smooth and similar in form to the sepals. The upper sepal is remarkable because of its similarity to the lateral sepals.

Bulbophyllum stellatum sp. nov.

Rhizoma repens, crassum. *Pseudobulbi* cylindracei, ad basim tumidi, prope apicem paulatim fastigati, rugosi, 2.5 ad 3 cm longi in sicco, ad basim 8 mm in diametro, monophylli. *Folia* coriacea, oblongi-elliptica, breviter petolata, 8.5 ad 9 cm longa, usque ad 3 cm lata. *Petiolus* 5 mm longus, sulcatus, rigidus. *Scapus* folio brevior, usque ad 11 cm longus, bracteis 3 vaginantibus. *Bracteae inflorescentiae* confertae, circiter 2 mm longae, lineari-lanceolatae. *Pedicellus* cum *ovario* 1 cm longus, gracilis. *Flores* albidi et rubidi, racemo in umbellam constricto. *Sepala lateralia* subpatentia, 5 mm longa, prope basim 2 mm lata, 3-nervia, lanceolata, acuta. *Sepalum superius* valde concavum, 6 mm longum. *Petala* lanceolata, acuminata, acuta, prope basim

3-nervia, 5 mm longa, 1.5 mm lata prope basim. *Labellum* parvulum circiter 2 mm longum, anguste lingulatum, obtusum. *Columna* brevis, stelidia longe aristata, filiformia.

LUZON, Bontoc Subprovince, *Father M. Vanoverbergh 1360*, August 3, 1911. Found on trees, altitude 1,650 m above sea-level. The flowers are described by the collector as yellowish-white and red.

Among the Philippine species of § *Cirrhopetalum, B. stellatum* is most closely allied to *B. luzonense* Ames, from which it differs in its larger leaves, shorter pedicels and smaller flowers.

Bulbophyllum trisetum sp. nov.

Aff. *B. longifloro* Thou. *Rhizoma* crassum, repens. *Pseudobulbi* pyriformes, plus minus tetragoni, remoti. *Folia* coriacea, petiolata. *Lamina* elliptico-oblonga. *Petiolus* sulcatus. *Scapus* elongatus, erectus, bracteatus, gracilis. *Flores* albi et purpurei, racemo in umbellam contracto. *Bracteae inflorescentiae* lanceolatae, acutae. *Pedicelli* graciles. *Sepala lateralia* supra basim fere ad apicem cohaerentia, glabra, oblonga vel ligulata. *Sepalum superius* cucullatum, in caudam filiformem, constrictum, ad apicem dilatatum, margo dentatus. *Petala* triangularia, purpurea, in caudam elongatam, integerrimam, abrupte attenuata, ciliata. *Labellum* crassum, lingulatum, glabrum, obtusum, convexum. *Columna* erecta, basi in pedem producta, superne 2-alata, alis utrinque in brachium erectum productis.

Pseudobulbs 3 to 4 cm long, about 1.5 cm thick. Leaves about 12 cm long, up to 3.5 cm wide. Petiole 1.6 cm long. Scape about 15 cm long. Umbels few-flowered. Lateral sepals 2.7 cm long, each one about 3 mm wide. Upper sepal from base to end of setiform or filiform tip 2.3 cm long, filiform tip 1.5 cm long, slightly dilatated at the end. Petals 1.2 cm long to end of the setiform tip, setiform tip 5 to 6 mm long. Labellum 7 mm long. Column wings 4-toothed at the tip; anterior tooth prolonged into a setiform appendage 2 mm long.

LUZON, Benguet Suprovince, Itogan to Baguio, E. S. Bacani, *For. Bur. 15899*, December 24, 1908, found on trees.

Bulbophyllum trisetum is closely allied to *B. longiflorum* Thou., from which it differs in the color of the flowers, the longer appendages of the sepals, and in the different toothing of the wings of the column. It is also near *Cirrhopetalum Koordersii* Rolfe, a Celebes species. The collector described the flowers as being white, but in dried specimens the petals and upper sepal are of a rich deep-madder color.

Bulbophyllum Weberi sp. nov.

Pseudobulbi plus minus tetragoni, 2 ad 3 cm longi, paulatim fastigiati ad apicem, juniores vaginis mox in fibras solutis inclusi. *Folium* late oblongi-ellipticum, coriaceum, petiolatum, 9.5 ad 13.5

cm longum, 2.5 ad 4.4 cm latum. *Petiolus* circiter 2 cm longus, sulcatus, rigidus. *Scapus* folio longior, gracilis, bracteis circa 3 vaginantibus. *Bracteae inflorescentiae* lineari-lanceolatae, 3 mm longae, valde acutae. Flores circiter 8, flavidi et rubidi, 2.5 cm longi, speciosi, racemo in umbellam contracto. *Pedicelli* graciles, bracteas excedentes. *Pedicellus* cum ovario 1.5 cm longus. *Sepala* lateralia 2.7 cm longa, supra basim fere ad apicem connata in lamina cohaerentia; *lamina* oblongi-elliptica, 11 mm lata, flavida. *Sepalum superius*, 6 mm longum, valde concavum, suborbiculare, non ciliatum, ad apicem in caudam filiformem constrictum; cauda 4 mm longa. Petala 5 mm longa, ciliata, 3-nervia, in caudam filiformem, 1.5 mm longam, constricta. *Labellum* valde arcuatum, circiter 5 mm longum, lingulatum, obtusum, glabrum. *Columna* superne 2-alata, alis in brachium erectum producta. *Anthera* denticulata.

LUZON, Province of Rizal, Mount Canumay, *C. M. Weber 8*, found on mossy trees, 700 m above sea-level.

The affinity of this species seems to be with *B. Cumingii* Reichb. f. and with *B. longiflorum* Thouars. From the former it is readily separated by the color of the flowers, the smooth margin of the dorsal sepal, and by the arms of the column. The column-arms are similar to those of *B. longiflorum* as shown in the figure of *Cirrhopetalum Thouarsii* in the "Botanical Magazine" *plate 7214*. The denticulate margin of the anthers is another distinguishing character in the comparison of *B. Weberi* and *B. Cumingii*. From *B. longiflorum* it is not so easy to distinguish *B. Weberi*. Here we have a striking similarity in the structure of the column, the erect wings and the denticulate anther-cap in both species. The plate formed by the union of the lateral sepals is rather more elliptic in *B. Weberi* than in *B. longiflorum*, and the leaves are broader in relation to their length. From the *Cirrhopetalum Thouarsii* of the Botanical Register (1838) *t. 11* and of the Botanical Magazine, *t. 4239*, a plant which appears to be different from the *C. Thouarsii* of Lindley, *B. Weberi* is hardly distinct.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 3, August, 1912.

NOTES ON THE FLORA OF MANILA WITH SPECIAL REFERENCE TO THE INTRODUCED ELEMENT.

By E. D. MERRILL.

(*From the Botanical Section of the Biological Laboratory, Bureau of Science, and the Department of Botany, University of the Philippines, Manila, P. I.*)

In compiling data and in making explorations of Manila and its vicinity with the ultimate object of the preparation of a flora of the region, which is now in press,[1] much information other than that of a purely systematic nature has been secured. It has not been considered advisable to include this, however, in the forthcoming publication. An opportunity has been taken in the present paper for some discussion of the climatic conditions, the different types of vegetation, and the geologic and geographic features of the region under consideration. In connection with the above there are also included some facts and conclusions regarding the vegetation of Manila and its vicinity, the introduced element and its origin, the pantropic species and their dissemination, and other matters that cannot properly be considered in a short preface or introduction. Most of the present paper is devoted to a consideration of the introduced element, which is a very large one in the vicinity of Manila, and, on the whole, the most interesting botanical feature of the area covered.

The area under consideration comprises approximately 100 square kilometers, roughly a triangle with its base on Manila Bay, and its apex at the town of Pasig. Its limits are as follows: From the town of Malabon on Manila Bay, north of the City of Manila, in a southeasterly direction through Masambong, San Francisco del Monte, San Juan del Monte, etc., to Pasig, thence

[1] Merrill, E. D. A Flora of Manila. Bureau of Science Publication (1912).

in a southwesterly direction to the town of Parañaque on Manila Bay south of Manila.

Practically the entire area occupied by the city of Manila consists of an alluvial plain, for the most part located but little above the limits of high tide. This plain is divided by the Pasig River and some of its tributaries, the smaller tidal streams being locally known as *esteros*. Undoubtedly the greater part of the area now occupied by the city was originally a mangrove swamp; but with the extension of the town the low places have been graded, and the original mangrove vegetation destroyed. Vestiges of this original vegetation still remain along some of the *esteros;* and at Malabon, just north of the city, the mangrove vegetation is rather conspicuous in places.

The word Manila itself is generally assumed to have been derived from *nilad* or *nilar*, one of the Tagalog names for a mangrove tree, *Scyphyphora hydrophyllacea* Gaertn. (*Rubiaceae*). The prefix *ma* means "where is," so that the word Manila signifies the place where *nilar* grows. Whether or not this theory is correct the species is no longer to be found in or near Manila, although it is sufficiently abundant in other parts of the Archipelago.

Within the area covered by the "Flora of Manila," and the region on which the present paper is based, there are a number of low hills, none of which exceed an altitude of 50 meters. They consist of water-laid tuff, with usually a thin covering of poor clayey or gravelly soil. These hills occur in limited areas within the city limits, but are much more numerous inland.

There are, then, only two geological formations, the alluvial plain and the low hills of water-laid tuff with their thin covering of poor soil. By far the greater part of the area under consideration consists of waste places, cultivated and fallow fields, and thickets. In restricted areas we have the strand formation occurring along the sandy shores of Manila Bay; the vestiges of mangrove swamps along tidal streams and muddy shores; and swampy areas with fresh water, brackish water, and salt water.

The entire area under consideration, so far as its vegetation is concerned, has been profoundly altered by the presence of man, and at no place near the city do conditions at all approaching primeval ones exist. The original vegetation has been almost entirely destroyed, for presumably the present location of the City of Manila was for the most part covered with mangrove forests, as noted above, while the dry hills undoubtedly sup-

ported a low and more or less scrubby forest. Comparatively few of the original forest types exist in the area at the present time.

From a consideration of the above notes it will readily be seen that the soil and topographical conditions in the vicinity of Manila are not favorable to a diversified flora. In connection with these matters the question of rainfall must be considered, and here again the local conditions militate against a multiplicity of species. From June to November, the period of the southwest monsoon, there are heavy rains and typhoons. This season is followed by several months of comparatively dry weather, with only scattered showers. February to May, the period of the north-east monsoon, is very dry, with almost no rain, making the conditions on the dry hills almost desert ones during these months. In those parts of the Philippines, where the rains are fairly continuous throughout the year, one finds at low altitudes a great number of species that are not found near Manila. These species, moreover, are not encountered at low altitudes in those parts of the provinces contiguous to the city and having a rainfall similar to it. Epiphytes, always abundant in continuously humid regions in the tropics, are represented by very few species in the vicinity of Manila.

From the standpoint of the collector or the systematist, the vegetation in the vicinity of Manila is a disappointing one, especially in consideration of the tropical habitat. Most of the species found are common and well known ones of very wide distribution. Including all the more commonly cultivated forms, there are 1,007 species, of which about 225 are never found outside of cultivation, leaving 782 that are indigenous or naturalized.

Undoubtedly the original flora of the country in and about Manila was a comparatively poor one, so far as the number of species was concerned, and at the present time it is certain that in species the flora is much richer that it was in primeval times. With the destruction of the original forests, and subsequent cultivation of the soil, the proper habitats were provided for species adapted to conditions of growth in the open. Since the advent of man in the Philippines, some thousands of years ago, the process of introduction of exotic, light-loving species, purposely and accidentally, has been going on, and is still being continued at the present day. Then, too, the proper habitats were provided for the rice-paddy, and other small-seeded weeds of cultivation, which were thus enabled to persist and to extend

their range after once being introduced. Some of these were undoubtedly introduced in dirty grain, but for the most part probably by natural causes; by winds, and especially by the transmission of their small seeds in mud on the feet or feathers of migratory birds. Thus directly and indirectly, through the agency of man, many species have been added to the flora of the Archipelago. Likewise through the agency of man, especially in the destruction of the original vegetation over vast areas, it is very probable that many local indigenous species have been exterminated.

When, then, we consider the nature of the geological formation in and about Manila, the alluvial plain, the dry hills of water-laid tuff covered with a thin poor soil, the lack of altitude, the uneven distribution of rainfall through the year, causing a protracted very dry season, the entire lack of forests, and the fact that primeval conditions as to vegetation are not to be found in the entire area, a flora of approximately 1,000 different species, or, excluding the cultivated ones, 780 indigenous or naturalized ones in an area not exceeding 100 square kilometers, cannot be considered a poor one so far as individual species are concerned.

In fact, as to the number of species, the flora of Manila compares very favorably with that of like areas in the Archipelago supporting a primeval vegetation. Mount Mariveles, just across the bay from Manila, is densely covered with unbroken forests, and its vegetation, except for a narrow coastal strip, has not been disturbed by man. In contrast to the 1,007 species known from Manila and vicinity, or excluding the cultivated forms, 782 native or naturalized ones, only about 1,114 are known from Mount Mariveles, although the latter has the climatic advantage of 1,400 meters of altitude, is densely forested, and supports several types of vegetation that are quite absent in and about Manila.

Properly to understand the local conditions as to vegetation, the fundamental differences between the flora of the settled and cultivated areas in contrast to that of the undisturbed regions supporting a primeval vegetation, and the enormous influence man has had on the present condition of the vegetation of the Archipelago, it is necessary to take into consideration the probable nature of the vegetation before the advent of man.

Considering the Philippine Archipelago as a whole, at the present time approximately thirty-three and one-third per cent of the entire land area is covered with virgin forest, sixteen and

two-thirds per cent by second-growth forest, forty per cent is grass land, and ten per cent cultivated land.[2] It is practically certain that before the advent of man in the Philippines, the entire country was covered with unbroken forest, of one kind or another, from sea-level to the tops of the highest mountains, except, perhaps, where the vegetation had been temporarily destroyed by natural causes, such as volcanic eruptions. Such types of vegetation as the extensive grass-covered hills, mountain sides, and plains, and the open cultivated areas, now such prominent features in the landscape, did not originally exist, so that the whole aspect of many localities must have been quite different from what it is to-day and from what has been its condition within historic times. When we consider that about two-thirds of the entire land surface of the Archipelago consists of cultivated areas, open grass lands, thickets, and second-growth forests, and that all these types of vegetation are due directly or indirectly to the presence of man, some idea can be obtained of the profound changes that have been wrought in the vegetation of the country in past centuries.

The first agricultural method employed in the Archipelago, whether by the supposedly aboriginal Negritos, or by later Malay invaders, was certainly the "caiñgin" system, still very extensively practiced. This primitive system of agriculture consists simply in clearing a selected area by felling the trees, burning the débris, and raising some simple crop on the area thus cleared. Such a clearing is, in general practice, utilized but one or two years, rarely longer; and is abandoned as coarse grasses, weeds, shrubs, etc., commence to gain an ascendency over the cultivated plants. With only most primitive agricultural instruments, the average native to-day, as in centuries past, finds it much easier to fell and burn the trees, thus clearing a new area, than to combat the encroachment of weeds, and especially grasses such as the cogon (*Imperata cylindrica* Beauv.) with deep-seated perennial rhizomes. Moreover in each new clearing that he makes he has the advantage of virgin soil, although this last factor is in most cases doubtless a secondary consideration. A clearing once abandoned, may, depending on local conditions, revert to a forested condition through a succession of coarse annual weeds, shrubs, and various quick-growing trees, or it may become covered with coarse grasses, especially the cogon (*Imperata cylindrica* Beauv.), or sometimes other species, such

[2] Whitford, H. N., Bull. Bureau Forest. (Philip.) 10[1] (1911) 12.

as *Saccharum, Rottboellia, Themeda,* etc. The primitive agriculturist selects another forested area, usually contiguous to the one just abandoned or about to be abandoned, fells the trees, burns the débris, and plants his crop. If the abandoned clearing becomes reforested, then it is only a question of time when the land will again be cleared for cultivation by the "caiñgin" system. If, however, as is most often the case, it becomes covered with coarse grasses, the chances are that the area will not become reforested. Annually recurring grass fires are purposely started either for improving grazing conditions, or to make the country more easily traversed. These prevent the reproduction of forest conditions by killing the young trees, seedlings, etc., which may have become established among the grasses, and, in fact, all the plants except those which, like the coarse grasses, are provided with deep-seated perennial rhizomes. As the grass-covered areas become more extended, the fires often gradually push back the edges of the forest by the destruction of the young and the mature trees along the edges of the clearing, even when not aided by man. As a result in many hilly areas in the Philippines one finds the continuous slopes covered with grasses, the forest persisting only in the ravines, where, perhaps, the original clearings made by man were of comparatively limited extent.

Forest fires, as such, are practically unknown in the Philippines, except perhaps in some very limited areas. The average high humidity, the very rapid decay of fallen leaves, branches, trees, etc., and the nature of the undergrowth militate against them. To permit the ravages of forest fires in the Philippines, climatic conditions in ages past must have been very different from what they are to-day, and any great difference in this respect, especially in decreased humidity, is exceedingly unlikely. Forest fires as a factor in the establishment of the open grass-covered areas can hence be ignored.

In grass-covered areas, protected against fire, it is however, only a question of time when forest conditions will again prevail, the original vegetation of the country claiming its own. It is, therefore, due to the presence of man that the open grass country exists here, and to his continued presence that this type of vegetation persists and still continues to extend itself at the expense of the forested area. Man is directly responsible for nearly all of the annually recurring grass fires in all parts of the Archipelago, very few being started from natural causes.

Assuming, then, that the original vegetation of the Philippines was practically unbroken forest, it becomes manifest that a very high percentage of the species now dominant in the settled areas, that is, in waste places in and about towns, fallow fields, cultivated areas and thickets, and in the open grass country, must have been introduced into the Archipelago after the advent of man and after sufficient time had elapsed for man to have provided the habitats to which these species are adapted. The great bulk of these plants are those requiring abundant light, adapted to growth in the open, and which cannot persist under forest conditions. They are for a large part species of very wide distribution that certainly have not originated in the Archipelago, but which must have developed their characteristics as to habitat in non-forested, or at least very thinly forested countries.

On the assumption that the great majority of the species now found at low altitudes in the settled areas of the Philippines have reached the Archipelago by one means or another since the advent of man, it is manifest that should any large area become depopulated for a long term of years, and the vegetation thus become protected against fires and other disturbing factors due to the presence of man, the original vegetation of the Archipelago would again occupy the entire area. The absolute or nearly absolute extermination of the introduced forms which depend for their existence on an open habitat, and which cannot thrive in forests, would follow. This would mean that the great majority of the species now found in the settled areas would become either extinct, or of rare and very local occurrence in the limited areas where conditions for their growth and reproduction might persist. In addition to the herbs, undershrubs, and other plants of the country, now so common and widely distributed, which would in all probability be exterminated with the reversion of the country to primeval conditions, it is exceedingly probable that very many of the introduced trees, including the naturalized ones, would eventually become extinct, from their inability to withstand forest conditions, that is, their inability to compete with the native trees and vines in the struggle for light.

In Table I, following, is given a summary of the species considered in the "Flora of Manila," a total of 1,007 distributed into 595 genera and 136 families. Of these 1,007 species it is estimated that about 550 are indigenous, that is, true natives of the Archipelago or those that have reached the Islands through

natural agencies, and that 457 have purposely or inadvertently been introduced by man. Of the introduced species somewhat over one-half, or 232, are spontaneous, while about 225 are never or but very rarely met with outside of cultivation. One hundred and seventy-eight of these introduced forms are considered to have originated in tropical America, the remainder for the most part in the tropical parts of the Old World. Four hundred and twenty-five species are found in the tropics of both hemispheres, but less than 90 of these are considered as being possible or probable natives of both; 334 are considered as having been manifestly distributed by man, and chiefly within historical times. Of the total of 1,007 species found in and about Manila 812 extend to the Malay Archipelago, 789 to tropical Asia, 425 to tropical Australia, 355 to Polynesia, and 402 to tropical Africa.

TABLE I.—*Summary of the families, genera, and species, found in and about Manila, with indications of the origin and range of the various forms.*

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pan tropic: Distributed-		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
POLYPODIACEAE:														
Dryopteris	5	5	----	----	2	----	----	1	----	3	3	2	3	2
Nephrolepis	5	3	----	2	----	----	----	2	1	3	3	3	3	4
Davallia	1	1	----	----	----	----	----	----	----	1	1	1	1	1
Athyrium	1	1	----	----	----	----	----	----	----	1	1	----	1	----
Asplenium	2	2	----	----	----	----	----	----	----	2	2	----	2	1
Hemionitis	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Ceropteris	1	----	1	----	----	1	----	----	1	1	1	----	----	1
Notholaena	1	1	----	----	----	----	----	----	----	1	1	1	1	----
Cheilanthes	1	1	----	----	----	----	----	----	----	1	1	1	1	----
Onychium	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Adiantum	5	2	----	3	----	----	3	2	3	5	5	2	2	2
Pteris	5	5	----	----	----	----	----	3	----	5	5	5	5	4
Polypodium	1	1	----	----	----	----	----	----	----	1	1	1	1	1
Cyclophorus	1	1	----	----	----	----	----	----	----	1	1	1	----	----
Drynaria	2	2	----	----	1	----	----	----	----	1	1	1	1	----
Acrostichum	1	1	----	----	----	----	----	1	----	1	1	1	1	1
PARKERIACEAE:														
Ceratopteris	1	1	----	----	----	----	----	1	----	1	1	1	1	1
SCHIZAEACEAE:														
Lygodium	2	2	----	----	----	----	----	----	----	2	2	2	----	----
MARSILEACEAE:														
Marsilea	1	1	----	----	1	----	----	----	----	----	----	----	----	----

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed—		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
LYCOPODIACEAE:														
Lycopodium	4	4								4	4		3	1
SELAGINELLACEAE:														
Selaginella	3	3			2					1	1			1
CYCADACEAE:														
Cycas	2	1		1						1	1		1	
TYPHACEAE:														
Typha	1	1						1		1	1	1	1	1
PANDANACEAE:														
Pandanus	1	1								1	1	1	1	
POTAMOGETONACEAE:														
Potamogeton	1	1						1		1	1		1	
Ruppia	1	1						1		1	1	1	1	1
NAJADACEAE:														
Najas	1	1								1	1	1	1	1
HYDROCHARITACEAE:														
Hydrilla	1	1								1	1	1		
Vallisneria	1	1						1		1	1	1	1	1
Ottelia	1	1								1	1	1		
Halophila	2	2									1		1	
Thalassia	1	1								1	1		1	
GRAMINEAE:														
Zea	1			1			1		1	1	1	1	1	1
Coix	1		1						1	1	1	1	1	1
Dimeria	1	1								1	1	1		
Imperata	1	1						1		1	1	1	1	1
Pogonatherum	1	1								1	1	1		
Polytrias	1		1						1		1			
Arthraxon	1	1								1				
Pollinia	1	1								1	1	1		
Saccharum	2	1		1					1	2	2	2	1	1
Rottboellia	1	1								1	1	1		1
Manisuris	1		1						1	1	1	1	1	1
Ophiurus	1	1								1				
Apluda	1	1								1	1	1	1	
Ischaemum	3	3								2	2		1	
Themeda	1	1								1	1	1	1	
Andropogon	11	6	3	2					3	9	10	5	3	3
Zoisia	1	1								1	1	1	1	1
Eriochloa	1	1						17		1	1	1	1	1
Arundinella	1	1								1				
Paspalum	4	3	1					2	1	4	4	3	3	3
Digitaria	6	4	2					2?		5	4	4	1	2
Isachne	1	1								1	1		1	
Panicum	17	11	5	1	1			4?	1	15	16	6	6	6
Oplismenus	2	2						1?		2	2	2	2	2
Cenchrus	1		1			1			1	1				1

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed-		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
GRAMINEAE—Contd.														
Setaria	3	2	1					1?	1	2	3	2	2	2
Chamaeraphis	1	1								1	1	1		
Thuarea	1	1								1	1	1	1	
Spinifex	1	1								1	1			
Oryza	2	1		1	1				1	1	1	1	1	1
Leersia	1	1						1		1	1	1	1	1
Sporobolus	2	2						2?		2	2	2	2	2
Aristida	1	1								1				1
Diplachne	1	1								1	1	1	1	
Centotheca	1	1								1	1	1	1	1
Phragmites	1	1						1		1	1	1	1	1
Eragrostis	9	5	4		2			2	1	7	6	3	1	5
Cynodon	2	2			1			1?		1	1	1	1	1
Chloris	1		1			1			1	1	1	1		1
Eleusine	1		1						1	1	1	1	1	1
Dactyloctenium	1		1						1	1	1	1	1	1
Leptochloa	1	1								1	1	1		
Bambusa	3			3				1?		3	3			1
Schizostachyum	1	1			1									
CYPERACEAE:														
Kyllinga	2	2						2		2	2	2	2	2
Pycreus	3	3						1		3	3	3	3	3
Juncellus	1	1						1		1	1	1	1	1
Cyperus	12	11		1				7?	1	12	12	8	7	12
Mariscus	4	4						1		4	4	1	2	
Torulinium	1	1						1?		1	1	1	1	1
Eleocharis	3	3						1		3	3	2	3	1
Fimbristylis	11	11			1			5?		10	10	9	7	8
Scirpus	5	5						2?		5	5	4	2	4
Fuirena	1	1								1	1	1		1
Lipocarpha	1	1								1	1	1		
Rhynchospora	1	1								1	1	1		
Scleria	4	4						1		4	4	2		
Diplacrum	1	1								1	1	1		
PALMAE:														
Livistona	1	1								1				
Corypha	1	1								1	1			
Caryota	2	2			1					1				
Calamus	1	1			1									
Nipa	1	1								1	1	1		
Cocos	1			1			1		1	1	1	1	1	1
Elaeis	1			1					1	1	1			1
Arenga	1		1							1	1			
Oreodoxa	1			1			1		1	1	1			1
Normanbya	1	1			1									
Areca	1			1					1	1	1		1	1

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed-						
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.	To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
ARACEAE:														
Rhaphidophora	1	1			1									
Scindapsus	1			1						1	1		1	
Pistia	1	1						1		1	1			1
Acorus	1			1					1	1	1			1
Amorphaphallus	1	1								1	1		1	
Caladium	1		1				1		1	1	1	1		1
Typhonium	1	1								1	1			
Alocasia	5	5			4					1	1			
Colocasia	1			1					1	1	1	1	1	1
LEMNACEAE:														
Lemna	1	1						1		1	1			1
Spirodela	1	1						1		1	1			1
XYRIDACEAE:														
Xyris	1	1								1	1	1		
ERIOCAULACEAE:														
Eriocaulon	3	3			1					2	1	1	1	1
BROMELIACEAE:														
Ananas	1			1			1		1	1	1	1	1	1
COMMELINACEAE:														
Commelina	2	2						1?		2	2		2	2
Aneilema	2	2								2	1	1		
Rhoeo	1			1			1		1					
Cyanotis	3	3								3	2	1		1
Zebrina	1		1			1			1					
PONTEDERIACEAE:														
Monochoria	2	2								2	2			
LILIACEAE:														
Smilax	1	1			1									
Asparagus	3			3					3	3	3			
Allium	2			2					2	2	2	2	2	2
Sansevieria	1		1						1	1	1		1	1
Cordyline	1			1					1	1	1		1	
Yucca	1			1			1		1					
AMARYLLIDACEAE:														
Agave	1			1			1			1	1		1	1
Polianthes	1			1			1		1	1	1	1	1	1
Zephyranthes	1			1			1		1	1	1		1	
Crinum	3	1		2						1	3		1	
Pancratium	1			1						1	1			
Hymenocallis	1			1			1		1	1	1			
Eurycles	1	1								1	1	1		
Eucharis	1			1			1		1					
TACCACEAE:														
Tacca	2	2								2	1	1	1	1
DIOSCOREACEAE:														
Dioscorea	5	4		1	1					3	4		2	

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed—		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
IRIDACEAE:														
Belamcanda	1		1						1	1	1			
Eleutherine	1		1			1			1					
MUSACEAE:														
Musa	1	(?)		1				1?		1	1	1	1	1
Ravenala	1			1					1	1	1			1
ZINGIBERACEAE:														
Globba	1		1								1			
Hedychium	1		1						1	1	1			
Kaempferia	1		1							1	1			
Curcuma	1		1						1	1	1			1
Zingiber	2		1	1					1	2	2		2	1
Kolowratia	1	1			1									
Costus	1	1								1	1			
CANNACEAE:														
Canna	6		2	4		2	4		6	6	6	1	1	2
MARANTACEAE:														
Maranta	1			1			1		1	1	1		1	1
ORCHIDACEAE:														
Didymoplexis	1	1								1	1			
Geodorum	1	1												
Habenaria	3	3			1					2	2			
Cleisostoma	1	1			1									
Dendrobium	1	1								1	1			
Oberonia	1	1			1									
CASUARINACEAE:														
Casuarina	1	1							1	1	1	1	1	1
PIPERACEAE:														
Peperomia	2		1	1		1	1		1?	1	1			
Piper	3	2	1		1				2	2	2			1
ULMACEAE:														
Trema	1	1								1	1	1	1	
MORACEAE:														
Ficus	11	10		1	8				1	3	3		2	
Artocarpus	2		1	1					1	2	2		1	2
Streblus	1	1								1	1			
Castilloa	1			1			1		1	1	1			1
Morus	1		1						1	1	1			1
Malaisia	1	1								1	1	1	1	
Cudrania	1	1								1	1	1		1
Fatoua	1	1								1	1	1	1	
URTICACEAE:														
Pipturus	1	1			1					1				
Laportea	1	1												
Boehmeria	1			1					1	1	1	1	1	1
Fleurya	1		1							1	1	1	1	

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed—		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
URTICACEAE—Contd.														
Pilea	1		1			1			1	1	1	1		1
Elatostema	1	1			1									
Pouzolzia	1	1								1	1	1		
LORANTHACEAE:														
Loranthus	2	2			2									
OPILIACEAE:														
Champereia	1	1			1					1?	1?			
OLACACEAE:														
Olax	1	1								1	1			
ARISTOLOCHIACEAE:														
Aristolochia	2	1		1			1		1	1	1			
POLYGONACEAE:														
Polygonum	2	2								2	2	1		2
Antigonon	1			1			1		1	1	1		1	1
Muehelenbeckia	1			1					1	1	1	1	1	1
CHENOPODIACEAE:														
Chenopodium	1		1			1			1	1	1	1	1	1
AMARANTHACEAE:														
Deeringia	1	1								1	1	1		
Celosia	1		1				1		1	1	1	1	1	1
Gomphrena	1			1			1		1	1	1	1	1	1
Alternanthera	3		2	1		1	1		3	2	2	1	1	1
Amaranthus	4		2	2					4	4	4	4	4	2
Pupalia	1		1							1	1			1
Cyathula	1		1						1	1	1	1	1	1
Aerua	1		1							1	1			1
Achyranthes	1		1						1	1	1	1	1	1
NYCTAGINACEAE:														
Pisonia	2	1		1				1		2	2	1		1
Bougainvillea	1			1			1			1	1	1	1	1
Mirabilis	1		1			1			1	1	1	1	1	1
Boerhaavia	1		1			1			1	1	1	1	1	1
AIZOACEAE:														
Sesuvium	1	1						1		1	1	1	1	1
Trianthema	1		1						1	1	1	1	1	1
Mollugo	2		2						2	2	2	2		
PORTULACACEAE:														
Portulaca	3	1	2			1		1?	1	2	2	1	1	2
BASELLACEAE:														
Basella	1		1						1	1	1	1	1	1
Anredera	1		1			1			1					
NYMPHÆACEAE:														
Castalia	1		1							1	1			1

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed—		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
CERATOPHYLLACEAE:														
Ceratophyllum	1	1						1		1	1	1	1	1
RANUNCULACEAE:														
Naravelia	1	1			1									
MENISPERMACEAE:														
Pycnarrhena	1	1			1									
Tinospora	1	1			1									
Cissampelos	1	1						1?		1	1	1	1	1
MAGNOLIACEAE:														
Michelia	2			2					1	2	1			
ANONACEAE:														
Uvaria	1	1								1	1			
Anona	3			3			3		3	3	3		1	3
Artabotrys	1			1						1	1			
Canangium	1	1								1	1		1	
Unona	1			1						1	1			
Polyalthia	1	1									1			
LAURACEAE:														
Cinnamomum	1			1					1	1	1			
Litsea	2	2			1					1	1			
Persea	1			1			1		1	1	1		1	1
Cassytha	1	1						1		1	1	1	1	1
HERNANDIACEAE:														
Illigera	1	1			1									
PAPAVERACEAE:														
Argemone	1		1			1			1	1	1	1	1	1
CRUCIFERAE:														
Nasturtium	1		1							1	1			
Brassica	1		1						1	1	1	1	1	1
Raphanus	1			1					1	1	1	1	1	1
CAPPARIDACEAE:														
Capparis	4	3		1						4	3		1	
Cleome	1		1					1?		1	1	1	1	1
Gynandropsis	1		1					1?		1	1	1	1	1
MORINGACEAE:														
Moringa	1			1					1	1	1	1	1	1
CRASSULACEAE:														
Bryophyllum	1		1						1	1	1	1	1	1
Kalanchoe	1			1						1	1			1
PITTOSPORACEAE:														
Pittosporum	1	1			1									
CONNARACEAE:														
Rourea	1	1			1									
Connarus	1	1			1									

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed—		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
LEGUMINOSAE:														
Pithecolobium	1		1			1			1	1	1			
Enterolobium	1			1			1		1	1	1			1
Albizzia	4	3		1	1				1	3	3	2		1
Acacia	2	1	1			1			1	2	2	1	1	1
Leucaena	1		1			1			1	1	1	1	1	1
Mimosa	1		1			1			1	1	1	1	1	1
Prosopis	1		1			1			1					
Adenanthera	1	1			1									
Parkia	1	1								1				
Mezoneurum	1	1								1				
Bauhinia	3		1	2			1		1	3	3	2	1	1
Delonix	1			1					1	1	1	1	1	1
Caesalpinia	4	2	2			1		2	1	4	4	2	2	2
Peltophorum	1	1								1	1			
Cassia	5		4	1		4			5	5	5	3	3	3
Tamarindus	1			1					1	1	1	1	1	1
Intsia	1	1								1	1	1	1	1
Pahudia	1	1			1									
Cynometra	1	1			1									
Aeschynomene	1		1							1	1	1	1	1
Arachis	1			1			1		1	1	1	1	1	1
Zornia	1		1			1?			1	1	1	1	1	1
Desmodium	11	3	8		1	2		1?	3	8	8	3	4	5
Alyscicarpus	3	3							1	3	3	1	3	
Uraria	1	1								1	1	1	1	
Lourea	1			1						1	1			
Indigofera	3		3			1			3	3	3	2	1	3
Tephrosia	1	1			1									
Millettia	1	1			1									
Gliricidia	1		1			1			1					
Clitorea	1		1			1?			1	1	1	1	1	1
Parosela	1		1			1			1					
Pterocarpus	2	2								2	1		1	
Dalbergia	1	1								1				
Pongamia	1	1								1	1	1	1	
Derris	3	3								3	2	2	2	1
Pisum	1			1					1	1	1	1		1
Abrus	2	2							1	2	2	1	1	2
Sesbania	3		3						1	3	3	2	2	3
Crotalaria	6	2	4			1			2	5	5	5	2	4
Flemingia	2	1	1		1				1	1	1	1	1	1
Medicago	1		1						1	1	1	1		1
Pueraria	2	1	1							2	2			
Dunbaria	1	1								1	1	1		
Cantharospermum	2	2								2	3	1	1	

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.			Endemic.	American origin.		Pantropic: Distributed—		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.			Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
LEGUMINOSAE—Contd.															
Cajanus	1		1							1	1	1	1	1	1
Erythrina	3	3									3	3	1	2	
Teramnus	1	1?								1?	1	1			1
Canavalia	4	3		1			2?	1	2	4	4	2	2	2	
Centrosema	1			1			1		1	1	1				
Mucuna	2	2?			1?						1	1	1	1	1
Galactia	1	1									1	1	1		
Phaseolus	7	3	1	3		1	2	1?	4	6	7	4	4	4	
Vigna	3	2		1				1	1	2	3	2	2	2	
Pachyrrhizus	1		1			1			1	1	1	1	1	1	1
Dolichos	2	1	1				1		1	1	1	1	1	1	1
Psophocarpus	1			1					1	1	1				1
OXALIDACEAE:															
Oxalis	2	1		1			1		1	1	1	1	1	1	1
Biophytum	1	1							1	1	1				1
Averrhoa	2			2			2		2	2	2				2
ERYTHROXYLACEAE:															
Erythroxylum	1			1			1		1	1	1				1
ZYGOPHYLLACEAE:															
Tribulus	1		1							1	1	1	1	1	1
RUTACEAE:															
Glycosmis	1	1									1	1	1		
Murraya	1	1								1	1	1	1		
Clausena	1	1			1										
Triphasia	1		1							1	1	1	1	1	1
Citrus	3			3	1?					2	2	2		2	2
Aegle	1	1			1										
SIMARUBACEAE:															
Harrisonia	1	1									1	1			
Quassia	1			1			1		1						
BURSERACEAE:															
Canarium	1	1			1										
MELIACEAE:															
Turraea	1	1									1				
Sandoricum	1		1								1	1			
Aglaia	1			1					1	1	1				
Lansium	1			1						1	1				
Dysoxylum	1	1									1				
Melia	2	1		1					1	2	1				1
MALPIGHIACEAE:															
Galphimia	1			1			1		1						
Tristellateia	1	1									1	1	1		
POLYGALACEAE:															
Polygala	1		1								1	1	1		
Salomonia	1		1								1	1	1		

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed—		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
EUPHORBIACEAE:														
Euphorbia	10	2	6	2	----	2	1	2?	5	10	9	3	3	2
Bridelia	1	1	----	----	----	----	----	----	----	1	1	----	----	1
Phyllanthus	4	2	2	----	----	----	----	2?	----	4	4	1	2	2
Glochidion	1	1	----	----	----	----	----	----	----	1	----	----	----	----
Breynia	2	2	----	----	----	----	----	----	----	2	1	1	----	----
Fluggea	1	1	----	----	----	----	----	----	----	1	1	1	----	1
Antidesma	3	2	1	----	1	----	----	----	----	2	2	2	----	----
Cicca	1	----	----	1	----	----	----	----	1	1	1	----	1	1
Bischofia	1	1	----	----	----	----	----	----	----	1	1	1	1	----
Jatropha	4	----	2	2	----	2	2	----	4	4	3	2	3	----
Aleurites	2	2	----	----	1	----	----	----	1	1	1	1	1	1
Codiaeum	1	----	----	1	----	----	----	----	1	1	1	1	1	1
Sumbava	1	1	----	----	----	----	----	----	----	1	----	----	----	----
Acalypha	5	1	2	2	----	----	----	----	2	5	5	1	5	1
Hevea	1	----	----	1	----	----	1	----	1	1	1	----	----	1
Mallotus	3	3	----	----	1	----	----	----	----	2	2	2	----	----
Macaranga	2	2	----	----	1	----	----	----	----	1	1	1	----	----
Homonoia	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Ricinus	1	----	1	----	----	----	----	----	1	1	1	1	1	1
Manihot	2	----	----	2	----	----	2	----	2	2	2	1	1	2
Alchornea	1	1	----	----	1	----	----	----	----	----	----	----	----	----
Excoecaria	1	1	----	----	----	----	----	----	----	1	1	1	1	1
ANACARDIACEAE:														
Anacardium	1	----	----	1	----	----	1	----	1	1	1	1	1	1
Semecarpus	1	1	----	----	1	----	----	----	----	----	----	----	----	----
Mangifera	1	----	----	1	----	----	----	----	1	1	1	1	1	1
Buchanania	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Spondias	1	----	----	1	----	----	1	----	----	1	1	----	----	----
CELASTRACEAE:														
Celastrus	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Gymnosporia	1	1	----	----	1	----	----	----	----	----	----	----	----	----
Siphonodon	1	1	----	----	----	----	----	----	----	1	1	----	----	----
HIPPOCRATEACEAE:														
Salacia	1	1	----	----	----	----	----	----	----	1	1	----	----	----
SAPINDACEAE:														
Cardiospermum	1	----	1	----	----	----	----	----	1	1	1	1	1	1
Allophylus	1	1	----	----	1	----	----	----	----	----	----	----	----	----
Otophora	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Euphoria	1	----	----	1	----	----	----	----	----	1	1	----	----	----
Guioa	1	1	----	----	1	----	----	----	----	----	----	----	----	----
Arytera	1	1	----	----	----	----	----	----	----	1	1	----	----	----
BALSAMINACEAE:														
Impatiens	1	----	----	1	----	----	----	----	1	1	1	1	1	1

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.			American origin.		Pantropic: Distributed—						
			Spontaneous.	Cultivated only.	Endemic.	Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.	To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
RHAMNACEAE:														
Zizyphus	3	2	----	1	2	----	----	----	----	1	1	1	----	1
Gouania	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Colubrina	1	1	----	----	----	----	----	----	----	1	1	1	1	1
VITACEAE:														
Tetrastigma	1	1	----	----	----	----	----	----	----	----	1	----	----	----
Cissus	3	2	1	----	----	----	----	----	----	3	3	2	----	1
Leea	1	1	----	----	1	----	----	----	----	----	----	----	----	----
TILIACEAE:														
Grewia	1	1	----	----	----	----	----	----	----	1	1	1	----	1
Columbia	1	1	----	----	----	----	----	----	----	1	----	----	----	----
Muntingia	1	----	1	----	----	1	----	----	1	----	1	----	----	----
Triumfetta	2	----	2	----	----	2	----	----	2	2	2	1	1	2
Corchorus	3	----	3	----	----	----	----	----	3	3	3	1	----	3
MALVACEAE:														
Malvastrum	1	----	1	----	----	1	----	----	1	1	1	1	1	----
Sida	6	----	6	----	----	----	----	----	4	6	6	4	3	5
Abutilon	1	----	1	----	----	----	----	----	1	1	1	1	----	1
Malachra	2	----	2	----	----	2	----	----	2	1	1	----	----	----
Urena	1	----	1	----	----	----	----	----	1	1	1	1	1	1
Malvaviscus	1	----	----	1	----	----	1	----	1	----	----	----	----	----
Kosteletzkya	1	1?	----	----	1?	----	----	----	----	----	----	----	----	----
Abelmoschus	2	----	1	1	----	----	----	----	2	2	2	2	2	2
Hibiscus	5	1	----	4	----	----	----	1	4	5	5	1	2	3
Thespesia	2	2	----	----	----	----	----	----	----	2	2	1	1	1
Gossypium	2	----	----	2	----	----	2	----	2	2	2	1	----	1
BOMBACACEAE:														
Bombax	1	1	----	----	----	----	----	----	----	1	1	1	----	----
Ceiba	1	----	1	----	----	1?	----	----	1	1	1	----	1	1
STERCULIACEAE:														
Sterculia	4	4	----	----	3	----	----	----	----	1	1	1	----	1
Heritiera	1	1	----	----	----	----	----	----	----	1	1	1	1	1
Theobroma	1	----	----	1	----	----	1	----	1	1	1	----	1	1
Kleinhofia	1	1	----	----	----	----	----	----	----	1	1	1	1	1
Helicteres	1	1	----	----	----	----	----	----	----	1	1	1	----	----
Pterospermum	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Melochia	1	----	1	----	----	----	----	----	1	1	1	1	----	1
Waltheria	1	----	1	----	----	1?	----	----	1	1	1	1	1	1
DILLENIACEAE:														
Tetracera	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Dillenia	1	1	----	----	1	----	----	----	----	----	----	----	----	----
GUTTIFERAE:														
Calophyllum	1	1	----	----	----	----	----	----	----	1	1	1	1	1
ELATINACEAE:														
Bergia	1	1	----	----	----	----	----	----	----	----	----	----	----	----
BIXACEAE:														
Bixa	1	----	----	1	----	----	1	----	1	1	1	----	1	1

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed—		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
VIOLACEAE:														
Viola	1	----	----	1	----	----	----	----	1	1	1	----	----	----
FLACOURTIACEAE:														
Flacourtia	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Casearia	1	1	----	----	1	----	----	----	----	----	----	----	----	----
PASSIFLORACEAE:														
Passiflora	3	----	1	2	----	1	2	----	3	3	3	1	1	1
Adenia	1	1	----	----	1	----	----	----	----	----	----	----	----	----
CARICACEAE:														
Carica	1	----	----	1	----	----	1	----	1	1	1	1	1	1
BEGONIACEAE:														
Begonia	1	1	----	----	1	----	----	----	----	----	----	----	----	----
CACTACEAE:														
Cereus	2	----	----	2	----	----	2	----	2	1	1	----	----	----
Nopalea	1	----	1	----	----	1	----	----	1	1	1	----	----	----
LYTHRACEAE:														
Lawsonia	1	----	----	1	----	----	----	----	1	1	1	----	----	1
Lagerstroemia	2	1	----	1	----	----	----	----	1	2	2	2	----	1
Rotala	3	2	1	----	----	1	----	1?	1	2	2	2	----	----
Ammannia	1	1	----	----	----	----	----	----	----	1	1	----	----	1
SONNERATIACEAE:														
Sonneratia	2	2	----	----	----	----	----	----	----	2	2	1	----	1
PUNICACEAE:														
Punica	1	----	----	1	----	----	----	----	1	1	1	----	----	1
LECYTHIDACEAE:														
Barringtonia	3	3	----	----	1	----	----	----	----	2	2	2	2	1
RHIZOPHORACEAE:														
Rhizophora	2	2	----	----	----	----	----	----	----	2	2	1	1	1
Bruguiera	2	2	----	----	----	----	----	----	----	2	2	1	----	----
COMBRETACEAE:														
Terminalia	1	1	----	----	----	----	----	----	----	1	1	1	1	1
Quisqualis	1	1	----	----	----	----	----	----	----	1	1	----	----	----
Lumnitzera	1	1	----	----	----	----	----	----	----	1	1	1	1	1
Combretum	1	1	----	----	----	----	----	----	----	1	1	----	----	----
MYRTACEAE:														
Eucalyptus	1	----	----	1	----	----	----	----	1	----	----	1	----	----
Eugenia	5	1	1	3	1	----	----	----	----	4	4	1	2	2
Psidium	1	----	1	----	----	1	----	----	1	1	1	1	1	1
MELASTOMATACEAE:														
Memecylon	1	1	----	----	----	----	----	----	----	1	1	1	----	----
OENOTHERACEAE:														
Ludwigia	2	----	2	----	----	----	----	----	----	2	2	2	----	2
Jussiaea	3	2	1	----	----	1?	----	2?	1?	3	2	2	1	3
ARALIACEAE:														
Nothopanax	5	----	----	5	----	----	----	----	2	5	5	(?)	(?)	(?)
Schefflera	1	1	----	----	1	----	----	----	----	----	----	----	----	----

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed-		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
UMBELLIFERAE:														
Foeniculum	1			1					1	1	1	1		1
Hydrocotyle	1		1					1?		1	1			
Centella	1		1						1	1	1	1	1	1
MYRSINACEAE:														
Aegiceras	1	1								1	1	1		
PLUMBAGINACEAE:														
Plumbago	3		1	2						3	3	1	1	2
SAPOTACEAE:														
Mimusops	1			1						1	1	?		
Achras	1			1			1		1	1	1			1
EBENACEAE:														
Diospyros	2	1		1	1		1		1					
OLEACEAE:														
Jasminum	4	1		3	1				1	3	3		1	1
SALVADORACEAE:														
Azima	1	1								1	1			
LOGANIACEAE:														
Buddleia	1	1								1	1			
GENTIANACEAE:														
Canscora	1	1								1	1	1		1
APOCYNACEAE:														
Plumeria	1			1			1		1	1	1		1	1
Cerbera	1	1								1	1	1	1	
Thevetia	1			1			1		1	1	1		1	
Lochnera	1		1			1			1	1	1	1	1	1
Tabernaemontana	4	3		1	3				1	1	1			1
Alstonia	1	1								1	1	1		
Allamanda	2			2			2		2	2	2		1	
Wrightia	1	1			1									
Nerium	1			1					1	1	1			1
Strophanthus	1	1			1									
Parsonsia	1	1			1									
Aganosma	1	1								1	1			
Ichnocarpus	1	1								1	1			
ASCLEPIADACEAE:														
Cryptostegia	1			1					1	1	1			1
Streptocaulon	1	1			1									
Asclepias	1		1			1			1	1	1	1	1	1
Ischnostemma	1	1								1		1		
Gymnema	1	1								1	1			
Tylophora	1	1			1									
Conchophyllum	1	1			1									
Telosma	2	1		1	1					1	1		1	
Hoya	1	1			1									
Dischidia	1	1			1									

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed-		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
CONVOLVULACEAE:														
Evolvulus	1	1?						1?		1	1	1		1
Lepistemon	1	1								1	1			
Quamoclit	2		2			2			2	2	2	2	2	2
Calonictyon	2		2			2			2	2	2	1	1	1
Operculina	2	1?		1			1		1	1	1	1	1	
Stictocardia	1	1								1	1			
Rivea	1		1			1			1					
Argyreia	2	1		1					1	2	1			
Hewittia	1	1?							1	1	1	1		1
Merremia	6	5?	1					1?		6	6	3		2
Ipomoea	10	4	4	2		2	2	2?	4	10	9	6	5	4
HYDROPHYLLACEAE:														
Hydrolea	1	1								1	1	1	1	
BORAGINACEAE:														
Cordia	1	1			1									
Ehretia	2	2			1					1	1			
Tournefortia	1	1								1		1		
Heliotropium	1		1						1	1	1	1	1	1
Trichodesma	2		2							1	2	1		1
Coldenia	1		1						1	1	1	1		
VERBENACEAE:														
Avicennia	1	1								1	1	1	1	1
Lantana	1		1			1			1	1	1	1	1	1
Lippia	1		1			1			1	1	1	1		1
Stachytarpheta	1		1			1			1	1	1	1	1	1
Duranta	1			1			1		1	1	1		1	
Petraea	1			1			1		1	1	1			
Symphorema	1	1			1									
Callicarpa	2	2			1					1	1			
Clerodendron	7	4		3	2				1	5	4		1	1
Vitex	3	3								3	2	1	1	1
Premna	4	4			3					1	1			
Gmelina	1	1									1			
LABIATAE:														
Rosmarinus	1			1										
Ocimum	2		2							2	2	1	2	2
Moschosma	1		1							1	1	1		1
Hyptis	4		4			4			4	1	1			
Coleus	2	1		1	1				1	1	1	1	1	1
Pogostemon	1	1								1	1			
Mentha	1			1					1					
Anisomeles	1		1							1	1			
Leucas	2		2							2	1		1	
Leonurus	1		1						1	1	1	1	1	1

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed—		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
SOLANACEAE:														
Datura	1		1							1	1		1	
Brunfelsia	2			2			2		2					
Cestrum	1			1			1		1					
Nicotiana	1			1			1		1	1	1	1	1	1
Solanum	7	1	3	3	1	1	1		4	5	5	3	2	3
Physalis	2		2			2			2	2	2	1	1	1
Lycopersicum	1		1			1			1	1	1	1	1	1
Capsicum	2		1	1		1	1		2	2	2	2	2	2
SCROPHULARIACEAE:														
Scoparia	1		1			1			1	1	1	1	1	1
Centranthera	1	1								1	1	1		
Russelia	1			1			1		1	1	1		1	
Bacopa	2	2						1		2	2	2	1	1
Lindenbergia	1	1								1	1			
Limnophila	2	2			1					1		1	1	
Mazus	1	2								1	1			
Vandellia	4	7							1	4	4	1	1	1
Torenia	1			1						1	1			
Bonnaya	2	2								2	2	2		
Dopatrium	1	1								1	1	1		
BIGNONIACEAE:														
Jacaranda	1			1			1		1	1	1	1		
Oroxylum	1	1								1	1			
Tecoma	1			1			1		1	1	1		1	
Dolichandrone	1	1								1	1			
Spathodea	1			1						1	1			1
Kigelia	1			1						1	1			1
Crescentia	2			2			2		2					
PEDALIACEAE:														
Sesamum	1		1						1	1	1	1	1	1
GESNERIACEAE:														
Rhynchoglossum	1	1								1	1			
LENTIBULARIACEAE:														
Utricularia	4	4								3	4	2		
ACANTHACEAE:														
Dicliptera	1	1									1			
Elytraria	1		1			1			1					
Justicia	2	2								2	2	1		1
Barleria	3		1	2					1	3	3			1
Odontonema	1			1			1		1	1	1			
Pseuderanthemum	1	1								1				
Rhinacanthus	1		1							1	1			1
Graptophyllum	1			1					1	1	1	1	1	1
Thunbergia	4	1	1	2					2	4	4	2	1	2

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed—						
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.	To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
ACANTHACEAE—Contd.														
Staurogyne	1	1			1									
Acanthus	1	1								1	1	1		
Lepidagathis	1	1			1									
Hygrophila	2	2								1	2	1		
Ruellia	1	1								1	1			
Hemigraphis	2	1		1	1					1				
Blechum	1		1			1			1					
PLANTAGINACEAE:														
Plantago	1		1						1	1	1	1	1	1
RUBIACEAE:														
Sarcocephalus	1	1								1	1	1		
Mitragyna	1	1									1			
Dentella	1	1								1	1	1	1	
Oldenlandia	5	5			1				1	4	4	2	1	2
Mussaenda	1	1			1									
Gardenia	1			1					1	1	1	1		
Randia	2	1		1	1					1	1			
Hypobatherum	1	1			1									
Coffea	1			1					1	1	1	1	1	1
Ixora	4	1		3	1				1	3	3			
Pavetta	1	1								1	1	1		
Morinda	2	2								2	2	2	2	
Psychotria	1	1			1									
Plectronia	2	2			1					2	2			
Paederia	1	1								1	1		1	
Spermacoce	2	2								2	2			1
CUCURBITACEAE:														
Melothria	1	1								1	1			
Cucurbita	1			2			1?		1	1	1	1	1	1
Trichosanthes	2	2			1					1	1	1		
Lagenaria	1			1					1	1	1	1	1	1
Luffa	2		1	1					1	2	2	1	2	2
Benincasa	1			1					1	1	1	1	1	1
Citrullus	1			1					1	1	1	1	1	1
Cucumis	2			2					2	2	2	2	1	2
Momordica	2	1		1					1	2	2	1	1	1
CAMPANULACEAE:														
Sphenoclea	1	1								1	1	1	1	1
Isotoma	1			1			1		1	1	1			1
GOODENOVIACEAE:														
Calogyne	1	1										1		
STYLIDIACEAE:														
Stylidium	1	1										1		

TABLE I.—*Summary of the families, genera, species, etc.*—Continued.

Families and genera.	Total species.	Indigenous.	Introduced.		Endemic.	American origin.		Pantropic: Distributed-		To Malaya.	To tropical Asia.	To Australia.	To Polynesia.	To Africa.
			Spontaneous.	Cultivated only.		Spontaneous.	Cultivated only.	By natural agencies.	Through agency of man.					
COMPOSITAE:														
Vernonia	2		2							2	2	1	1	1
Eupatorium	1			1			1		1	1	1			1
Ageratum	1		1			1			1	1	1	1	1	1
Emilia	1		1						1	1	1	1	1	1
Elephantopus	3		3			3			3	1	1	1	2	1
Sphaeranthus	1		1							1	1	1		1
Blumea	4	2	2		1					3	3	1		1
Pluchea	1	1								1	1	1		
Grangea	1	1								1	1			1
Crossostephium	1			1							1			
Synedrella	1		1			1			1	1	1	1	1	1
Artemisia	1		1						1	1	1	1		1
Epaltes	1	1								1	1	1		
Centipeda	1		1							1	1	1	1	
Erigeron	1		1						1	1	1	1		1
Tagetes	1			1			1		1	1	1	1	1	1
Chrysanthemum	3			3						3	3	2	1	2
Enhydra	1	1								1	1			
Eclipta	2		2						1	2	1	1	1	1
Helianthus	1			1			1		1	1	1	1		1
Wedelia	2	1	1							2	1	1	1	
Cosmos	1		1				1		1	1	1			1
Bidens	1		1						1	1	1	1	1	1
Lactuca	1			1					1	1	1	1	1	1
Sonchus	1		1						1	1	1	1		1
Crepis	1		1							1	1	1		
Totals	1,007	550	232	225	124	83	95	89	223	812	789	425	355	402

The introduced element in a flora is not frequently treated as such, although the subject is a fascinating one in many respects. Investigation of the subject involves not only an extensive knowledge of the flora of the region under discussion, but also detailed information as to the nature of the plants, their relative abundance or rarity, their habitats, their native names, special methods by which their seeds may have been disseminated, ancient and modern trade routes, and other factors. In the case of a species suspected of having been introduced it is desirable that its original home be determined as nearly as possible. This involves a study not only of the plant itself, but of its allied forms and their recorded ranges, and especially a study

of botanical literature, and floras of different regions. A knowledge of the properties of the various species is essential, for very many plants, some of which in the case of the Philippines are so thoroughly naturalized as to appear truly indigenous, have purposely been introduced for definite reasons, for food, for medicinal purposes, for dyes, for fibers, and for ornamental uses. In many cases it can be determined with a reasonable degree of certainty whether a certain species has been purposely or inadvertently introduced. Finally there must be taken into consideration the communication with various other countries both in ancient and in modern times, the origins of peoples in archipelagos like the Philippines, and their intercourse with other peoples.

Manifestly the aboriginal inhabitants of the Philippines must have reached the Archipelago from some other country, and it is certain that in the thousands of years that have elapsed since man first reached the Islands, very many plants have been introduced, some purposely, some inadvertently, by the early invaders and their later successors from Malaya. If we exclude the abacá plant (*Musa textilis* Née) and the various trees yielding timbers, gums, and resins, a few palms, some bamboos, the rattans, etc., it will be found that practically all the species now found in the Archipelago that are of the greatest importance in the economy of the native, whether for food, for condiments, for clothing, for dyes, for ornamental purposes, and very many for medicinal purposes, have originated outside of the Philippines, and have purposely been introduced at one time or another. Not a single important food plant or fruit tree has originated in the Archipelago, but all have been introduced.

While prehistoric trade routes by which plants have been brought to the Philippines are not definitely known, still from the geographic location of the Archipelago, it would seem that communication must have been mostly with other Islands of the Malay Archipelago, and to a lesser degree with the Asiatic continent. A great many plants of economic importance were introduced in prehistoric times, and certainly at the same time a considerable number of weeds of cultivation. It is possible to determine, with at least a reasonable degree of certainty, most of the introduced species that were established or cultivated in the Archipelago before the advent of the Europeans.

With the advent of the Europeans and the consequent increased communication between the Philippines and neighboring

countries, and especially with tropical America, a great impetus was given to the dissemination of plants, and the flora of this Archipelago, like that of many other regions has been greatly enriched by species introduced within historical times. While many of the introduced forms have proved to be of the greatest economic importance, still many undesirable citizens were represented among the numerous aliens. With the advent of the Spaniards came a considerable number of European species, both weeds and plants of economic value, and very many forms from other parts of the Orient. A very large number were introduced from tropical America through the medium of the galleons on the old Acapulco-Manila trade route, which will later be given a more detailed consideration.

The Philippine Archipelago, as geologists reckon time, is of comparatively recent formation, and the logical conclusion regarding the origin of its flora is that the original vegetation of the group, like its human inhabitants, reached the Archipelago from older neighboring countries of the Indo-Malayan region. Much of this original vegetation may have reached the group through previously existing land connections, but ocean currents, winds, migratory birds, and lastly, and perhaps not least, man must be considered, for species have been introduced by all these factors, and all have hence had their influence on the present character of the rich and varied flora. It is not my intention at this time to discuss the probable origins of the flora as a whole, it being primarily the same as that of the Malay Archipelago. We have, however, in the high lands of northern Luzon a very pronounced continental, that is, Asiatic element, where the Himalayan types are more numerous than in any other part of the Malay Archipelago; there is also a decided Polynesian, and a decided Australian element in the flora, and I have previously advanced the theory[3] that our dominant Malayan element has been introduced chiefly from southeastern Malaya, rather than from western Malaya, that is, the Malay Peninsula and the Sunda Islands.

Whatever may have been the geological history of the Archipelago, and whatever the source of its flora, it is manifest from a study of the present flora that the Islands as such have been separated from neighboring countries for a very long period of time, sufficient, in fact, to develop a very marked endemism. While the percentage of endemism as to genera is comparatively

[3] Ann. Jard. Bot. Buitenz. Suppl. 3 (1909) 277–306.

small, for species it averages approximately 40 per cent, and the indications are that as botanical exploration progresses this percentage will be increased rather than diminished.

As noted above the average percentage of endemism for the entire Archipelago is about 40. In many families it runs to 90 per cent, or even higher, but in others it is much lower than the average. Wherever primeval conditions exist, that is, wherever the original forests have been undisturbed by man, the percentage of endemism is always high but wherever the country is thickly settled, the destruction of the original forests and the large introduced element, cultivated plants, weeds, etc., correspondingly decrease the percentage of endemism, so that we find in Manila a percentage of endemism of only 8.7, or including *cultivated* endemic species, only 12 per cent. This great difference in endemism emphasizes the radical differences between the vegetation of the settled areas and that of the forested regions, and is one strong reason for considering a high percentage of the species found in the settled areas as introduced.

In support of the theory that very many of the species now common and widely distributed in the settled areas in the Philippines have been introduced into the Archipelago since the advent of man, and in many cases have been spread in the Archipelago by his agency, the present vegetation of many of the smaller islands can be cited. On very many of such islands which are not inhabited, and only visited at irregular intervals by fishermen, or by collectors of turtles, turtle's eggs, or bird's eggs, it is exceedingly rare that one finds a single species that has presumably been introduced by man, although the conditions for their growth and reproduction are frequently present. I have personally visited a number of small and isolated islands in the Sulu Sea, and while many of these support a fairly rich flora, the species, without exception, are those that have been distributed by natural causes, that is, by water, winds, or migratory birds. The characteristic species of the open country on the larger islands are practically wanting, although as noted above, favorable conditions for their growth on these small islands are sometimes present. However, as small islands invariably support a flora poor in species as compared with larger land masses, the evidence from this source alone cannot be of great value.

The case of the Island of Polillo is of interest in this connection, for it ranks about sixteenth in size among the islands of the

Archipelago, having an area of somewhat over 850 square kilometers. This island is situated off the eastern coast of Luzon, in about the same latitude as Manila, the channel separating it from Luzon being about 32 kilometers wide in its narrowest part; its highest point, Mount Malulud, is about 340 meters above sea level. This island was brought under control by the Spaniards at an early date, for the town of Polillo was fortified for protection against Moro raids in early colonial days. While much of its area is covered with virgin forest, still a strip along the coast has been cleared and settled, and the island supports a population of about 3,000 people. It was presumably inhabited before the Spanish conquest.

In the botanical collections made on this Island by Doctor C. B. Robinson, and Mr. R. C. McGregor, in four months, August to November, 1909, about 515 species of flowering plants and vascular cryptogams are represented,[4] most of them of wide distribution in the Philippines and in the Indo-Malayan region generally; but 15 of them being known only from Polillo. In studying the *Leguminosæ* of this collection my attention was called to the paucity of the unquestionably introduced forms in the Polillo flora,[5] and an examination of the entire list of species collected or observed shows that what was true of the *Leguminosæ* applies to the other families as well. For instance, of the 178 species of plants of American origin that are now found in and about Manila, and have reached the Philippines since the advent of the Spaniards in 1521, but about 25 or 30 have reached Polillo, so far as our material shows. Of the 136 introduced species of presumably oriental origin, apparently not more than 35 or 40 are found on the island; and of the 109 species of cosmopolitan distribution, but whose original homes are uncertain, more than one-half of which in all probability have been distributed by man, only about 15 are found on Polillo.

Now the conditions for the growth and reproduction of our numerous introduced species are excellent in Polillo, but from our present data regarding the flora of the island, it is estimated that less than 100 of the total 457 undoubtedly introduced species that are found in and about Manila, have as yet reached that island. This is due to the somewhat isolated position of the island, and to the comparatively slight communication between it and the more densely populated parts of Luzon. The very

[4] Robinson, C. B. This Journal 6 (1911) Botany 185–228.
[5] This Journal 5 (1910) Botany 5.

fact that so few species of American origin have reached Polillo in the past 375 years, leads us to infer that very many of the species of oriental or of unknown origin that for the most part are now cosmopolitan in the tropics, which like those of known American origin are comparatively few in Polillo, have reached the Philippines since the advent of the Europeans.

Not only does the vegetation of the small and medium-sized islands bear out the theory that very many of our characteristic open country species are of recent introduction, but the conditions in some parts of the larger islands are practically the same. In the Province of Bataan, just across the bay from Manila, and only about 35 kilometers distant, a fairly intensive study has been made of a strip of land extending from the seashore to the summit of Mount Mariveles, attaining an altitude of about 1,400 meters.[6] While most of the area is covered with primeval forest, still a strip along the coast, several kilometers in width, consists of open lands, low thickets, etc., with climatic conditions closely approximating those in Manila. This coastal strip has at one time or another been entirely deforested, but is now, except for small cultivated areas and open grass lands, covered with second growth forest, thickets, etc. This region yielded 1,114 species of flowering plants and vascular cryptogams, and of this number only 90 are supposed to have been introduced by man.[7] Practically all of these introduced forms are found only in the coastal region, in the open lands and thickets, almost none of them being found in the forests. In contrast to these figures, Manila, with its vegetative conditions entirely changed by the destruction of the original vegetation, presents a total of 1,007 species, including the cultivated plants, of which 457 have presumably been introduced by man, either purposely or accidentally. The percentage of endemism for the Lamao flora is about 40, the general average for that of the Archipelago as a whole, while for Manila it is only about 12. If we exclude 36 endemic species which are included in the "Flora of Manila," but which are not true natives of the area covered, then the endemism for Manila is only about 8.7 per cent.

Much has been published on the origin of cultivated species, and the subject has been admirably summarized by A. DeCandolle in his work on the "Origin of Cultivated Plants." While this

[6] Merrill, E. D. The Flora of the Lamao Forest Reserve. This Journal 1 (1906) Suppl. 1–141.

[7] The original estimate was fifty-four, Merrill *l. c.* 9.

phase of the subject has been given considerable attention, comparatively little has been written regarding the origin of various pantropic weedy plants that unquestionably have been distributed by man. Manifestly the question is a very complicated one, and in the case of very many species it is exceedingly doubtful if definite proof as to whether certain forms have originated in the Tropics of the Eastern or the Western Hemisphere can be compiled. In many cases we can at most indicate that a certain species is a native of tropical America, and another a native of tropical Asia.

To illustrate some of the reasons for considering certain species as having been introduced, and as natives of the Eastern or of the Western Hemisphere, it is well, perhaps, to cite and discuss some specific cases, for in a limited space it is impossible to give for each species the various reasons for considering it as having been introduced, and the reasons why, with a reasonable degree of certainty, it may be assumed to be a native of this or that region.

The evidence from botanical literature is important, but is by no means always to be taken as definite proof that a species is a native of a certain country. It has not infrequently happened that species that are natives of tropical America have first been described in botanical literature from material collected in the Eastern Hemisphere, this simply showing that such species were introduced into India and other countries at an early date in colonial history. For example, *Waltheria indica* L. (=*W. americana* L.) was first described, in part, from specimens collected in Ceylon by Hermann before the year 1679. The species is of world-wide distribution in tropical countries, but in looking up the generic range it is found that there are approximately 30 species in the genus, all confined to tropical America, with the exception of *W. americana* L. (*W. indica* L.). This species in the Philippines, and in other countries in the Orient, occurs as a weed in the settled areas, and is a manifestly introduced one. All evidence points to its American origin, and it can safely be assumed to be a native of some part of tropical America. It was probably among the first of the numerous species inadvertently introduced into the Orient by the early European explorers or colonists.

Sometimes it has happened that a species originating in America has been described from specimens grown in Asia, but with indications as to its origin. For instance Roxburgh[8] published

[8] Plants of the Coast of Coromandel 1 (1795) 67, *t. 99*.

the first description of *Pithecolobium dulce* Benth. (as *Mimosa dulcis*), from specimens grown in India, but definitely states that it was introduced from the Philippine Islands, his inference being that it was a native of this Archipelago. However, the species is of wide distribution in tropical America, and although no definite record as to the date of its introduction into the Philippines has been found, still we know from its usual habitat here and from its native names that it is not an indigenous plant. It is locally kown as *camanchile, camonsil, camatchile,* and variations of these names, manifestly corruptions of its old Mexican name, *quamochitl,* the name having been introduced by the Spaniards with the plant.

The genus *Rotala* of the *Lythraceae* contains about 38 species, and has representatives in most warm countries, some confined to one hemisphere, some to the other. *Rotala ramosior* (L.) Koehne extends from the northern United States southward through Mexico and Central America to Brazil, and is also of wide distribution in the Philippines, occurring here as a rice-paddy weed. It is unknown from any other part of the Orient. It is certainly not an indigenous species with us, and undoubtedly was accidentally introduced at an early date through the medium of the Acapulco–Manila galleons, and finding favorable local conditions, became established.

Elephantopus, a genus of the *Compositae,* has about 16 species, mostly confined to tropical America, but we have in the Philippines three manifestly introduced ones. One of these, *E. scaber* L., is now distributed to most tropical countries, but *E. spicatus* Aubl. and *E. mollis* HBK. are unknown outside of tropical America, except in the Philippines and Guam; in the Philippines all three are common and widely distributed. Unquestionably they have all been introduced from tropical America, and through the medium of the Acapulco–Manila galleons.

Acacia farnesiana Willd. is a species of very wide distribution in tropical and subtropical countries, and most authors are content with indicating its range as cosmopolitan in the tropics without attempting to determine its origin. In some countries it is thoroughly naturalized and is very abundant, as in some parts of the Philippines, while in others it is cultivated only. It was originally described from American material and there is every reason to believe that it is of American origin, and that it has been purposely distributed for the sake of its fragrant flowers. In the Philippines it is now never cultivated, and is so very

common in open places, thickets, in and about towns, and on dry hillsides, etc., that the casual observer would certainly consider it to be an indigenous species. It is, however, primarilly a species of the open country, and one that cannot exist in forests, unless possibly such as are composed of small and scrubby trees. Hence it would be excluded from the Philippines as an indigenous species, assuming the theory that the country was originally covered with forest. The genus is of world-wide distribution, so that there is no evidence to be secured from the generic distribution, except that its closest allies are all American and African; of the 14 given by Bentham in the series *Gummifereae,* 10 being American, including the cosmopolitan *A. farnesiana* Willd., and 4 African. Bentham [9] considered it probable that it was indigenous in western America from Chili northward to Texas, also in tropical Australia, and possibly in South Africa. As to the Philippines, it is certainly introduced, and, so far as this Archipelago is concerned, is undoubtedly of American origin, for it is universally known among the natives by its Spanish name *aroma,* no other name being recorded for it in the Philippines, and no variations of its Spanish name. It was undoubtedly introduced by the Spaniards from Mexico at an early date, and presumably is a native of that country.

Cassia alata L., given by Baker[10] as "Cosmopolitan in the Tropics," with no indication as to its probable origin; other authors more definitely state it to be a native of tropical America. From its habitat in the Philippines it is manifestly not an indigenous species, although it is widely distributed here, spontaneous, and thoroughly naturalized. While it has several native names that are purely Malayan in origin, still it is not uncommonly known here as *acapulco,* or *capurco,* a name at once pointing to its origin so far as the Philippines are concerned; that is, it was brought to the Philippines in early colonial days on the galleons sailing from Acapulco. It must be considered a purposely introduced plant on account of its medicinal properties. All evidence points to its American origin and it can be safely assumed to have originated there.

The genus *Hyptis* has about 350 known species, practically all of which are confined to tropical America. We have in the Philippines as common and widely distributed plants of the settled regions four species, *H. capitata* Jacq., *H. brevipes* Poir.,

[9] Trans. Linn. Soc. 30 (1875) 502.
[10] Hook. f. Fl. Brit. Ind. 2 (1878) 264.

H. suaveolens Poir., and *H. spicigera* Lam., all of wide American distribution. Of these four species two, *H. suaveolens* Poir. and *H. brevipes* Poir., are now of wide distribution in the tropics of both hemispheres, but *H. spicigera* Lam. is known in the Eastern Hemisphere only from the Philippines and Guam, and *H. capitata* Jacq. only from the Philippines, Guam, and Java, although in the latter place it presumably is of comparatively recent introduction, as it is apparently not of wide distribution there, although common in places.[11] In confirmation of the American origin of these four species, if such were necessary, all are known from Guam, a small island in the Marianne group, at which the Spanish galleons stopped en route from Acapulco to Manila; unquestionably all reached the Philippines through this trade route. None of them, although all are common in the Philippines, have any well-defined native names.

Gomphrena globosa L. is a commonly cultivated plant in the Philippines, and is not infrequently found subspontaneous about dwellings, etc. It is by some authors given as of American origin, and by others Asiatic. It is certainly not a native of the Philippines, and it is equally certain that it was purposely introduced by the Spaniards, for it is usually known only by names of Spanish origin, or corruptions of such names, *botón* (button), *botoncillo*, etc. In looking up the generic range it is found that of the 90 known species, nearly all are American and confined to tropical America, hence it is only reasonable to suppose that *Gomphrena globosa* L. originated in the same part of the world.

In Table II, following, is given a summary of the species of pantropic distribution that are found in and about Manila, a total of 425, distributed into 296 genera and 86 families. Of these at least 334 owe their present wide distribution directly or indirectly to man, and have, for the most part at least, been distributed from the Eastern Hemisphere to the Western or vice versa within historical times, that is, since the first circumnavigation of the globe. About 90 are assumed to have been of natural distribution, but in at least one-half of the cases so considered, there is some doubt as to whether they may not have been distributed by man. In very many of the cases man has undoubtedly been instrumental in their dissemination whether or not he was instrumental in distributing them from one hemisphere to the other. Purposely introduced species, including those of prehistoric distribution, aggregate 242, and inadvertently distributed ones, 92.

[11] Backer in Ann. Jard. Bot. Buitenz. Suppl. 3 (1909) 404.

Again, so far as the Philippines are concerned, 197 species are found only in cultivation, while 227 are spontaneous and more or less thoroughly naturalized. As to their origins, 177 have, for most part at least, originated in tropical America, and 138 in the tropical or subtropical parts of the Old World. In 109 cases it has been impossible to determine, with any degree of certainty, where they may have originated.

In my consideration of the Manila flora I have assumed that about 550 species, considerably more than one-half of the total, are indigenous, that is, true natives of the Philippines, or plants that have reached the Archipelago by natural causes and without the direct aid of man. It must be admitted, however, if we assume as correct the theory that the original vegetation of the Archipelago was a practically unbroken forest, that very many of these species must have reached the Philippines since the advent of man. In contrast to the 550 species that are presumably indigenous, about 457 have certainly been introduced by man, either purposely or accidentally, some in prehistoric times, and others at more recent dates. A very considerable percentage of these introduced species must have reached the Archipelago in recent times, that is, since the Spanish conquest or after the year 1521. Of the manifestly introduced species, about 225 are cultivated only, or at least spontaneous to but a small degree, and could not persist without the aid of man.

Taking into consideration only those species included in my "Flora of Manila" I am of the opinion that my estimate of 457 species introduced by man directly or indirectly, in the thousands of years that have elapsed since the group was first inhabited, is a very conservative one. For many centuries before the Europeans reached the East the commerce between the Philippines and surrounding countries was by no means inconsiderable. The early Spaniards found here Chinese, Japanese, and Indian merchants and traders, and there must from very early times have existed intercommunication between the Philippines and Malaya. Since the Spanish conquest, that is, in the 390 years that have elapsed since the Spaniards first came to the Archipelago, no less than 178 species, manifestly of American origin, and over one-third of my estimated total of introduced forms, have been introduced into the Philippines, purposely or inadvertently, by man. More than 100 of these were brought to the Philippines between the years 1521 and 1815, for at the latter date regular communication between the Philippines and the west coast of Mexico ceased. As the communication between the Philippines and

Mexico was chiefly by annual galleons, it is certainly safe to assume that there was more communication between the Philippines and the neighboring countries in the Orient than between the Philippines and America, so that if in that time more than 100 species were introduced from America, we might reasonably expect that as many more of Oriental origin would be introduced during the same period. In this connection it is curious to note that many of our common weeds, both of American and of Oriental origin, have no standard names in the local dialects, but that many of them are known by Spanish names, or by corruptions of Spanish names.

The great majority of the species found in and about Manila are the characteristic ones of the open country, weeds of cultivation, etc., that are dominant in the settled areas at low altitudes throughout the Archipelago, few being rare or of local occurrence. Very many of these plants, considerably over one-half, must have originated in treeless countries, or at least in regions where only scattered trees existed, for they cannot persist in a thickly forested region. Many have doubtless originated in regions that have been more or less under cultivation from very ancient times, and have thus become adapted to the environment of cultivation.

TABLE II.—*Summary of species represented in the Manila flora that are of pantropic distribution, with indications of their condition of growth here, and their origin.*

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
POLYPODIACEAE:								
Dryopteris parasitica O. Ktze.	×				×			×
Nephrolepis cordifolia Presl	×				×			×
Nephrolepis floccigera Moore		×		×			×	
Nephrolepis hirsutula Presl	×				×			×
Ceropteris calomelanos Und.		×			×	×		
Adiantum macrophyllum Sw.		×		×		×		
Adiantum tenerum Sw.		×		×		×		
Adiantum trapeziforme L.		×		×		×		
Adiantum philippense L.	×				×			×
Adiantum caudatum L.	×				×			×
Acrostichum aureum L.	×				×			×
Pteris longifolia L.	×				×			×
Pteris quadriaurita L.	×				×			×
Pteris biaurita L.	×				×			×
PARKERIACEAE:								
Ceratopteris thalictroides Brongn.	×				×			×

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
TYPHACEAE:								
Typha angustifolia L.	×				×			×
POTAMOGETONACEAE:								
Potamogeton malainus Miq.	×				×			×
Ruppia maritima L.	×				×			×
HYDROCHARITACEAE:								
Vallisneria spiralis L.	×				×			×
GRAMINEAE:								
Zea mays L.		×		×		×		
Coix lachryma-jobi L.		×		×			×	
Imperata cylindrica Beauv.	×				×			×
Saccharum officinarum L.		×		×			×	
Manisuris granularis L. f.			×?		×			×
Polytrias diversiflora Nash			×		×		×	
Andropogon contortus L.			×		×			×
Andropogon zizanioides Urb.		×			×		×	
Andropogon sorghum L.		×		×			×	
Eriochloa ramosa OK.	×?				×			×
Paspalum scrobiculatum L.	×?				×			×
Paspalum distichum L.	×				×			×
Paspalum conjugatum Berg.			×		×	×		
Digitaria sanguinalis Scop.	×?				×			×
Digitaria violascens Link	×?				×			×
Panicum colonum L.	×?				×			×
Panicum crus-galli L.	×?				×			×
Panicum amplexicaule Rudge	×				×			×
Panicum maximum Jacq.		×		×			×	
Panicum repens L.	×				×			×
Oplismenus compositus Beauv.	×?				×			×
Cenchrus echinatus L.			×		×	×		
Setaria viridis Beauv.			×		×		×	
Setaria flava Kunth	×?				×			×
Oryza sativa L.		×		×			×	
Leersia hexandra Sw.	×				×			×
Sporobolus indicus R. Br.	×?				×			×
Sporobolus virginicus Kth.	×							×
Phragmites vulgaris Trin.	×				×			×
Eragrostis interrupta Doell.	×?				×			×
Eragrostis unioloides Nees		×			×		×	
Eragrostis pilosa Beauv.	×?				×			×
Cynodon dactylon Pers.	×?				×			×
Chloris barbata Sw.			×		×	×		
Eleusine indica Gaertn.			×		×		×	
Dactyloctenium aegyptium Willd.			×		×		×	
Bambusa vulgaris Schrad.	×?				×			×
CYPERACEAE:								
Kyllinga brevifolia Rottb.	×?				×			×
Kyllinga monocephala Rottb.	×?				×			×
Pycreus odoratus Urb.	×				×			×

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
CYPERACEAE—Continued.								
Juncellus pygmaeus Clarke	X?				X			X
Cyperus difformis L.	X?				X			X
Cyperus haspan L.	X?				X			X
Cyperus flabelliformis Rottb.		X		X			X	
Cyperus diffusus Vahl	X?				X			X
Cyperus compressus L.	X?				X			X
Cyperus distans L.	X?				X			X
Cyperus rotundus L.	X				X			X
Cyperus radiatus Vahl	X?				X			X
Mariscus flabelliformis HBK	X				X			X
Torulinium ferax Ham.	X?				X			X
Eleocharis capitata R. Br.	X				X			X
Fimbristylis diphylla Vahl	X				X			X
Fimbristylis ferruginea Vahl	X?				X			X
Fimbristylis barbata Benth.	X?				X			X
Fimbristylis miliacea Vahl	X?				X			X
Fimbristylis monostachya Hassk.	X?				X			X
Scirpus supinus L.	X?				X			X
Scirpus erectus Poir.	X?				X			X
Scleria lithosperma Sw.	X				X			X
PALMAE:								
Cocos nucifera L.		X		X		X		
Elaeis guineensis Jacq.		X		X			X	
Oreodoxa regia HBK.		X		X		X		
Areca catechu L.		X		X			X	
ARACEAE:								
Pistia stratiotes L.	X				X			X
Acorus calamus L.		X		X			X	
Caladium bicolor Vent.		X		X		X		
Colocasia esculentum Schott		X		X			X?	
LEMNACEAE:								
Lemna paucicostata Hegelm.	X				X			X
Spirodela polyrrhiza Schl.	X				X			X
BROMELIACEAE:								
Ananas sativus Schultes		X		X		X		
COMMELINACEAE:								
Commelina nudiflora L.	X?				X			X
Rhoeo discolor Hance		X		X		X		
Zebrina pendula Schnizl.		X		X		X		
LILIACEAE:								
Asparagus sprengeri Regel.		X		X			X	
Asparagus officinalis L.		X		X			X	
Asparagus plumosus Baker		X		X			X	
Allium cepa L.		X		X			X	
Allium porrum L.		X		X			X	
Sansevieria zeylanica		X		X			X	
Yucca aloifolia L.		X		X		X		
Cordyline terminalis Kth.		X		X			X	

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
AMARYLLIDACEAE:								
Agave cantula Roxb.	-----	×	-----	×	-----	×	-----	-----
Hymenocallis tenuiflora Herb.	-----	×	-----	×	-----	×	-----	-----
Polianthes tuberosa L.	-----	×	-----	×	-----	×	-----	-----
Eucharis grandiflora Planch.	-----	×	-----	×	-----	×	-----	-----
Zephyranthes rosea Lindl.	-----	×	-----	×	-----	×	-----	-----
IRIDACEAE:								
Belamcanda chinensis Lem.	-----	×	-----	×	-----	-----	×	-----
Eleutherine palmaefolia Merr.	-----	×	-----	×	-----	×	-----	-----
MUSACEAE:								
Musa paradisiaca L.	×?	-----	-----	-----	×	-----	×	-----
Ravenala madagascariensis Sonn.	-----	×	-----	×	-----	-----	×	-----
ZINGIBERACEAE:								
Hedychium coronarium Koenig	-----	×	-----	×	-----	-----	×	-----
Zingiber officinale Rosc.	-----	×	-----	×	-----	-----	×	-----
Curcuma longa L.	-----	×	-----	×	-----	-----	×	-----
CANNACEAE:								
Canna indica L.	-----	×	-----	-----	×	×	-----	-----
Canna edulis Sims	-----	×	-----	×	-----	×	-----	-----
Canna coccinea Mill.	-----	×	-----	×	-----	×	-----	-----
Canna warscewiczii Dietr.	-----	×	-----	×	-----	×	-----	-----
Canna glauca L.	-----	×	-----	×	-----	×	-----	-----
Canna flaccida	-----	×	-----	×	-----	×	-----	-----
MARANTACEAE:								
Maranta arundinacea L.	-----	×	-----	×	-----	×	-----	-----
PIPERACEAE:								
Peperomia pellucida HBK.	-----	-----	×	-----	×	×	-----	-----
Peperomia argyreia Morr.	-----	×	-----	×	-----	×	-----	-----
Piper betle L.	-----	×	-----	×	-----	-----	×	-----
Piper retrofractum Vahl	-----	×	-----	×	-----	-----	×	-----
MORACEAE:								
Ficus elastica L.	-----	×	-----	×	-----	-----	×	-----
Artocarpus communis Forst.	-----	×	-----	×	-----	-----	×	-----
Castilloa ellastica Cerv.	-----	×	-----	×	-----	×	-----	-----
Morus alba L.	-----	×	-----	×	-----	-----	×	-----
URTICACEAE:								
Boehmeria nivea Gaudich.	-----	×	-----	×	-----	-----	×	-----
Pilea microphylla	-----	-----	×	-----	×	×	-----	-----
ARISTOLOCHIACEAE:								
Aristolochia elegans Mast.	-----	×	-----	×	-----	×	-----	-----
POLYGONACEAE:								
Antigonon leptopus H. & A.	-----	×	-----	×	-----	×	-----	-----
Muehelenbeckia platyclada Meissn.	-----	×	-----	×	-----	-----	×	-----
CHENOPODIACEAE:								
Chenopodium ambrosioides L.	-----	×	-----	-----	×	×	-----	-----
AMARANTHACEAE:								
Celosia argentea L.	-----	×	-----	-----	×	×	-----	-----
Gomphrena globosa L.	-----	×	-----	×	-----	×	-----	-----
Alternanthera sessilis R. Br.	-----	-----	×	-----	×	-----	-----	×

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
AMARANTHACEAE—Continued.								
Alternanthera versicolor Regel.	------	×	------	×	------	×	------	------
Alternanthera frutescens R. Br.	------	------	×	------	×	×	------	------
Amaranthus spinosus L.	------	------	×	------	×	------	------	×
Amaranthus caudatus L.	------	×	------	------	×	------	×	------
Amaranthus gangeticus L.	------	×	------	------	×	------	×	------
Amaranthus viridis L.	------	------	×	------	×	------	------	×
Cyathula prostrata Blume	------	------	×	------	×	------	×	------
Achyranthes aspera L.	------	------	×	------	×	------	×	------
NYCTAGINACEAE:								
Pisonia aculeata L.	×	------	------	------	×	------	------	×
Bougainvillea spectabilis Willd.	------	×	------	×	------	×	------	------
Miribilis japala L.	------	×	------	×	------	×	------	------
Boerhaavia diffusa L.	------	------	×	------	×	×?	------	------
AIZOACEAE:								
Sesuvium portulacastrum L.	×	------	------	------	×	------	------	×
Trianthema portulacastrum L.	------	------	×	------	×	------	------	×
Mollugo lotoides O. Ktze.	------	------	×	------	×	------	------	×
Mollugo oppositifolia L.	------	------	×	------	×	------	------	×
PORTULACACEAE:								
Portulaca pilosa L.	------	×	------	------	×	×	------	------
Portulaca oleracea L.	×	------	------	------	×	------	------	×
BASELLACEAE:								
Basella rubra L.	------	×	------	------	×	------	×?	------
Anredera scandens Moq.	------	×	------	------	×	×	------	------
CERATOPHYLLACEAE:								
Ceratophyllum demersum L.	×	------	------	------	×	------	------	×
MENISPERMACEAE:								
Cissampelos pareira L.	×?	------	------	------	×	------	------	×
MAGNOLIACEAE:								
Michelia champaca L.	------	×	------	×	------	------	×	------
ANONACEAE:								
Anona muricata L.	------	×	------	×	------	×	------	------
Anona reticulata L.	------	×	------	×	------	×	------	------
Anona squamosa L.	------	×	------	×	------	×	------	------
LAURACEAE:								
Cinnamomum zeylanicum L.	------	×	------	×	------	------	×	------
Persea americana Mill.	------	×	------	×	------	×	------	------
Cassytha filiformis L.	×	------	------	------	×	------	------	×
PAPAVERACEAE:								
Argemone mexicana L.	------	×	------	------	×	×	------	------
CRUCIFERAE:								
Brassica juncea L.	------	×	------	------	×	------	×	------
Raphanus sativus L.	------	×	------	×	------	------	×	------
CAPPARIDACEAE:								
Cleome viscosa L.	×?	------	------	------	×	------	------	×
Gynandropsis pentaphylla DC.	×?	------	------	------	×	------	------	×
MORINGACEAE:								
Moringa oleifera Lam.	------	×	------	×	------	------	×	------

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
CRASSULACEAE:								
Bryophyllum pinnatum Kurz	------	×	------	------	×	------	×	------
LEGUMINOSAE:								
Enterolobium saman Prain	------	×	------	------	×	×	------	------
Pithecolobium dulce Benth.	------	×	------	------	×	×	------	------
Albizzia lebbeck Benth.	------	×	------	×	------	------	×	------
Acacia farnesiana Willd.	------	×	------	------	×	×	------	------
Leucaena glauca Benth.	------	×	------	------	×	×	------	------
Mimosa pudica L.	------	×	------	------	×	×	------	------
Prosopis vidaliana Naves	------	×?	------	------	×	×	------	------
Bauhinia tomentosa L.	------	×	------	×	------	------	×	------
Bauhinia monandra Kurz	------	×	------	×	------	×	------	------
Delonix regia Raf.	------	×	------	×	------	------	×	------
Caesalpinia crista L.	×	------	------	------	×	------	------	×
Caesalpinia pulcherrima Sw.	------	×	------	------	×	×	------	------
Caesalpinia nuga Ait.	×	------	------	------	×	------	------	×
Cassia siamea Lam.	------	×	------	×	------	------	×	------
Cassia tora L.	------	------	×	------	×	×	------	------
Cassia occidentalis L.	------	------	×	------	×	×	------	------
Cassia hirsuta L.	------	------	×	------	×	×	------	------
Cassia alata L.	------	×	------	------	×	×	------	------
Tamarindus indica L.	------	×	------	×	------	------	×	------
Arachis hypogaea L.	------	×	------	×	------	×	------	------
Zornia diphylla Pers.	------	------	×	------	×	×?	------	------
Desmodium scorpiurus Desv.	------	------	×	------	×	×	------	------
Desmodium procumbens Hitchc.	------	------	×	------	×	×	------	------
Desmodium triflorum DC.	×?	------	------	------	×	------	------	×
Desmodium lasiocarpum DC.	------	------	×	------	×	------	×	------
Alyscicarpus vaginalis DC.	------	------	×	------	×	------	×	------
Indigofera hirsuta L.	------	------	×	------	×	------	×	------
Indigofera suffruticosa Mill.	------	×	------	------	×	×	------	------
Indigofera tinctoria L.	------	×	------	------	×	------	×	------
Gliricidia sepium Steud.	------	×	------	------	×	×	------	------
Clitorea ternatea L.	------	×	------	------	×	×?	------	------
Parosela glandulosa Merr.	------	------	×	------	×	×	------	------
Pisum sativum L.	------	×	------	×	------	------	×	------
Abrus precatorius L.	------	×	------	------	×	------	×	------
Sesbania grandiflora Pers.	------	------	×	------	×	------	------	×
Crotalaria verrucosa L.	------	------	×	------	×	------	------	×
Crotalaria incana L.	------	------	×	------	×	×	------	------
Flemingia strobilifera R. Br.	------	------	×	------	×	------	×	------
Medicago denticulata Willd.	------	------	×	------	×	------	×	------
Cajanus cajan Merr.	------	×	------	------	×	------	------	×
Teramnus labialis Spreng.	------	------	×	------	×	------	------	×
Canavalia lineata DC.	×	------	------	------	×	------	------	×
Canavalia ensiformis DC.	------	×	------	------	×	×?	------	------
Canavalia gladiata DC.	------	×	------	×	------	×	------	------
Centrosema plumieri Benth.	------	×	------	×	------	×	------	------
Phaseolus lunatus L.	------	×	------	×	------	×	------	------

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
LEGUMINOSAE—Continued.								
Phaseolus semierectus L.			×		×	×		
Phaseolus vulgaris DC.			×	×		×		
Phaseolus adenanthus Mey.	×?				×			×
Phaseolus radiatus L.			×	×			×	
Vigna sesquipedalis L.		×		×			×	
Vigna lutea A. Gray	×				×			×
Pachyrrhizus erosus Urb.		×			×	×		
Dolichos lablab L.		×		×		×		
Psophocarpus tetragonolobus DC.		×		×			×	
OXALIDACEAE:								
Oxalis repens Thunb.	×?				×			×
Oxalis martiana Zucc.		×		×		×		
Biophytum sensitivum DC.			×		×		×?	
Averrhoa carambola L.		×		×		×		
Averrhoa bilimbi L.		×		×		×		
ERYTHROXYLACEAE:								
Erythroxylum coca L.		×		×		×		
ZYGOPHYLLACEAE:								
Tribulus cistoides L.			×		×			×
RUTACEAE:								
Murraya exotica L.		×		×			×	
Triphasia trifoliata DC.		×		×			×	
Citrus lima Lun.		×		×			×	
Citrus decumana Murr.		×		×			×	
SIMARUBACEAE:								
Quassia amara L.		×		×		×		
MELIACEAE:								
Aglaia odorata Lour.		×		×			×	
Melia azedarach L.		×		×			×	
MALPIGHIACEAE:								
Galphimia glauca Cav.		×		×		×		
EUPHORBIACEAE:								
Euphorbia splendens Boj.		×		×			×	
Euphorbia heterophylla L.		×		×		×		
Euphorbia pulcherrima Willd.		×		×		×		
Euphorbia hypericifolia L.			×		×		×?	
Euphorbia hirta L.	×?				×			×
Euphorbia thymifolia Burm.	×?				×			×
Euphorbia prostrata Ait.			×		×	×		×
Phyllanthus urinaria L.	×?				×			×
Phyllanthus niruri L.	×?				×			×
Jatropha podagrica Hook.		×		×		×		
Jatropha multifida L.		×		×		×		
Jatropha curcas L.		×			×	×		
Jatropha gossypifolia L.		×		×		×		
Aleurites moluccana Willd.		×		×			×	
Codiaeum variegatum Blume.		×		×			×	
Acalypha hispida Burm.		×		×			×	

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
EUPHORBIACEAE—Continued.								
Acalypha wilkesiana Muell.		×		×			×	
Hevea braziliensis HBK.		×		×		×		
Ricinus communis L.		×			×		×	
Manihot utilissima Pohl		×		×		×		
Manihot glaziovii Muell.		×		×		×		
ANACARDIACEAE:								
Anacardium occidentale L.		×		×		×		
Mangifera indica L.		×		×			×	
Spondias purpurea L.		×		×		×		
SAPINDACEAE:								
Cardiospermum halicacabum L.		×			×		×?	
BALSAMINACEAE:								
Impatiens balsamina L.		×		×			×	
TILIACEAE:								
Muntingia calabura L.		×		×		×		
Triumfetta bartramia L.			×		×	×		
Triumfetta semitriloba Jacq.			×		×	×		
Corchorus capsularis L.		×			×		×	
Corchorus olitorius L.		×			×		×	
Corchorus acutangulus Lam.			×		×		×	
MALVACEAE:								
Malvastrum coromandelinum Garcke			×		×	×		
Sida cordifolia L.			×		×			×
Sida acuta Burm.			×		×			×
Sida rhombifolia L.			×		×			×
Sida retusa L.			×		×			×
Abutilon indicum Don.			×		×		×	
Malachra capitata L.			×		×	×		
Malachra fasciata Jacq.			×		×	×		
Urena lobata L.			×		×		×	
Malaviscus pilosus DC.		×		×		×		
Abelmoschus moschatus Moench.		×?			×			×
Abelmoschus esculentus Moench.		×		×			×	
Hibiscus sabdariffa L.		×		×			×	
Hibiscus mutabilis L.		×		×			×	
Hibiscus tiliaceus L.	×			×				×
Hibiscus rosa-sinensis L.		×		×			×	
Hibiscus schizopetalus Hook. f.		×		×			×	
Gossypium hirsutum L.		×		×		×		
Gossypium brasiliense Macf.		×		×		×		
BOMBACACEAE:								
Ceiba pentandra Gaertn.		×		×		×?		
STERCULICACEAE:								
Theobroma cacao L.		×		×		×		
Melochia corchorifolia L.			×		×			×
Waltheria americana L.			×		×	×?		
BIXACEAE:								
Bixa orellana L.		×		×		×		

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
VIOLACEAE:								
Viola odorata L.	------	×	------	×	------	------	×	------
PASSIFLORACEAE:								
Passiflora quadrangularis L.	------	×	------	×	------	×	------	------
Passiflora edulis Sims.	------	×	------	×	------	×	------	------
Passiflora foetida L.	------	×	------	------	×	×	------	------
CARICACEAE:								
Carica papaya L.	------	×	------	×	------	×	------	------
CACTACEAE:								
Cereus triangularis Mill.	------	×	------	×	------	×	------	------
Cereus lepidota Salm-Dyck	------	×	------	×	------	×	------	------
Nopalea cochinelifera Salm-Dyck	------	×	------	×	------	×	------	------
LYTHRACEAE:								
Lawsonia inermis L.	------	×	------	×	------	------	×	------
Lagerstroemia indica L.	------	×	------	×	------	------	×	------
Rotala mexicana C. & S.	×?	------	------	------	×	------	------	×
Rotala ramosior Koehne	------	------	×	------	×	×	------	------
PUNICACEAE:								
Punica granatum L.	------	×	------	×	------	------	×	------
MYRTACEAE:								
Eucalyptus tereticornis Sm.	------	×	------	×	------	------	×	------
Psidium guajava L.	------	×	------	------	×	×	------	------
OENOTHERACEAE:								
Jussiaea repens L.	×	------	------	------	×	------	------	------
Jussiaea suffruticosa L.	×	------	------	------	×	------	------	------
Jussiaea linifolia Vahl.	------	------	×	------	×	×?	------	------
ARALIACEAE:								
Nothopanax cochleatum Miq.	------	×	------	×	------	------	×	------
Nothopanax fruticosum Miq.	------	×	------	×	------	------	×	------
UMBELLIFERAE:								
Foeniculum vulgare Gaertn.	------	×	------	×	------	------	×	------
Hydrocotyle rotundifolia Roxb.	------	------	×	------	×	------	×	------
Centella asiatica Urb.	×?	------	------	×	×	------	×	------
SAPOTACEAE:								
Achras sapota L.	------	×	------	×	------	×	------	------
EBENACEAE:								
Diospyros ebenaster Retz.	------	×	------	×	------	×	------	------
OLEACEAE:								
Jasminum sambac Ait.	------	×	------	×	------	------	×	------
APOCYNACEAE:								
Plumeria acutifolia Poir.	------	×	------	×	------	×	------	------
Thevetia neriifolia Juss.	------	×	------	×	------	×	------	------
Lochnera rosea Reichb.	------	×	------	------	×	×	------	------
Tabernaemontana divaricata R. Br.	------	×	------	×	------	------	×	------
Allamanda cathartica L.	------	×	------	×	------	×	------	------
Allamanda hendersonii Bull.	------	×	------	×	------	×	------	------
Nerium indicum Mill.	------	×	------	×	------	------	×	------

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
ASCLEPIADACEAE:								
Cryptostegia grandiflora R. Br.	------	×	------	×	------	------	×	------
Asclepias curassavica L.	------	×	------	------	×	×	------	------
CONVOLVULACEAE:								
Evolvulus alsinoides L.	×?	------	------	------	×	------	------	×
Quamoclit phoenicea Choisy	------	×	------	------	×	×	------	------
Quamoclit pinnata Boj.	------	×	------	------	×	×	------	------
Brunfelsia acuminata Benth.	------	×	------	×	------	×	------	------
Brunfelsia americana L.	------	×	------	×	------	×	------	------
Cestrum nocturnum L.	------	×	------	×	------	×	------	------
Nicotiana tabacum L.	------	×	------	×	------	×	------	------
Lycopersicum esculentum Mill.	------	×	------	×	------	×	------	------
Capsicum frutescens L.	------	×	------	×	------	×	------	------
Capsicum anuum L.	------	×	------	×	------	×	------	------
Physalis angulata L.	------	------	×	------	×	×	------	------
Physalis minima L.	------	------	×	------	×	×	------	------
SCROPHULARIACEAE:								
Scoparia dulcis L.	------	------	×	------	×	×	------	------
Russelia juncea Zucc.	------	×	------	×	------	×	------	------
Bacopa monniera Wettst.	×	------	------	------	×	------	------	×
Vandellia crustacea Benth.	------	------	×	------	×	------	×	------
BIGNONIACEAE:								
Jacaranda ovalifolia R. Br.	------	×	------	×	------	×	------	------
Tecoma stans Juss.	------	×	------	×	------	×	------	------
Crescentia cajute L.	------	×	------	×	------	×	------	------
Crescentia alata HBK.	------	×	------	×	------	×	------	------
PEDALIACEAE:								
Sesamum orientale L.	------	×	------	×	------	------	×	------
ACANTHACEAE:								
Elytraria tridentata Vahl	------	------	×	------	×	×	------	------
Barleria lupulina Lindl.	------	×	------	×	------	------	×	------
Odontonema nitidum O. Ktze.	------	×	------	×	------	×	------	------
Thunbergia alata Boj.	------	×	------	×	------	------	×	------
Thunbergia grandiflora Roxb.	------	×	------	×	------	------	×	------
Graptophyllum pictum Griff.	------	×	------	×	------	------	×	------
Blechnum brownei Juss.	------	------	×	------	×	×	------	------
PLANTAGINACEAE:								
Plantago major L.	------	------	×	------	×	------	×	------
RUBIACEAE:								
Coffea arabica L.	------	×	------	×	------	------	×	------
Oldenlandia corymbosa L.	------	------	×	------	×	------	×?	------
Ixora finlaysoniana Wall	------	×	------	×	------	×	------	------
Gardenia florida L.	------	×	------	×	------	------	×	------

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
CUCURBITACEAE:								
Cucurbita maxima Duch.		×		×			×	
Lagenaria leucantha Rusby		×		×			×	
Luffa cylindrica Roem.		×		×			×	
Operculina tuberosa choisy		×		×		×		
Calonictyon aculeatum House		×			×	×		
Calonictyon album House		×			×	×		
Rivea corymbosa Hallier f.		×			×	×		
Argyreia nervosa Boj.		×		×			×	
Hewittia sublobata O. Ktze.			×?		×			×
Merremia umbellata Hallier f.	×?				×			×
Ipomoea nil Roth		×			×	×		
Ipomoea purpurea Lam.		×		×		×		
Ipomoea digitata L.	×?				×			×
Ipomoea pes-caprae Roth	×				×			×
Ipomoea triloba L.			×		×	×		
Ipomoea batatas Poir.		×		×		×		
BORAGINACEAE:								
Heliotropium indicum L.			×		×		×?	
VERBENACEAE:								
Lantana camara L.		×			×	×		
Lippia nodiflora L.			×		×	×		
Stachytarpheta jamaicensis Vahl			×		×	×		
Duranta repens L.		×		×		×		
Petraea volubilis Jacq.		×		×		×		
Clerodendron thompsonae Balf.		×		×			×	
LABIATAE:								
Hyptis capitata Jacq.			×		×	×		
Hyptis brevipes Poir.			×		×	×		
Hyptis suaveolens Poir.			×		×	×		
Hyptis spicigera Lam.			×		×	×		
Coleus blumei Benth.		×		×			×	
Leonurus sibiricus L.			×		×		×	
Mentha arvensis L.		×		×			×	
SOLANACEAE:								
Solanum nigrum L.			×		×			×
Solanum melongena L.		×		×			×?	
Solanum torvum Sw.			×		×	×?		
Solanum wendlandii Hook. f.		×		×		×		
Benincasa hispida Cogn.		×		×			×	
Citrullus vulgaris Schrad.		×		×			×	
Cucumis melo L.		×		×			×	
Cucumis sativus L.		×		×			×	
Momordica charantia L.		×		×			×	
CAMPANULACEAE:								
Sphenoclea zeylanica Gaertn.			×		×		×?	
Isotoma longiflora Presl.		×		×		×		

TABLE II.—*Summary of species, etc.*—Continued.

Families, genera, and species.	Natural distribution.	Purposely introduced.	Accidentally introduced.	Cultivated.	Spontaneous.	American origin.	Oriental or European origin.	Origin doubtful or unknown.
COMPOSITAE:								
Eupatorium triplinerve Vahl.	------	×	------	×	------	×	------	------
Ageratum conyzoides L.	------	------	×	------	×	×	------	------
Emilia sonchifolia DC.	------	------	×	------	×	------	×?	------
Elephantopus scaber L.	------	------	×	------	×	×	------	------
Elephantopus mollis HBK.	------	------	×	------	×	×	------	------
Elephantopus spicatus Aubl.	------	------	×	------	×	×	------	------
Synedrella nodiflora Gaertn.	------	------	×	------	×	×	------	------
Artemisia vulgaris L.	------	×	------	------	×	------	×	------
Erigeron linifolius Willd.	------	------	×	------	×	------	×	------
Tagetes erecta L.	------	×	------	×	------	×	------	------
Eclipta alba Hassk.	------	------	×	------	×	------	------	×
Helianthus annuus L.	------	×	------	×	------	×	------	------
Cosmos caudatus HBK.	------	×	------	------	×	×	------	------
Bidens pilosa L.	------	------	×	------	×	------	------	×
Lactuca sativa L.	------	×	------	×	------	------	×	------
Sonchus oleraceus L.	------	------	×	------	×	------	×	------
Chrysanthemum indicum L.	------	×	------	×	------	------	×	------
Totals	90	242	92	197	227	177	138	109

Very many of our species are to be found in practically all tropical countries in both hemispheres; in fact, of the 1007 included in the Manila flora, about 425 are now found in tropical America and in the tropics of the Orient, although not all of these are of general distribution. Some of these are manifestly of natural distribution, but the greater number have unquestionably been distributed by man, either purposely or accidentally, and within the past 390 years. I consider it very probable that not more than 92 of the 425 pantropic species under consideration are of natural distribution, that is, those species that have extended to the tropics of both hemispheres, and sometimes also to more temperate regions, without the direct or indirect aid of man. In at least one-half of these 92 cases which I have considered as presumably of natural distribution, there is a reasonable doubt as to whether they may not have been distributed from one hemisphere to the other by man.

Among the species that are unquestionably of natural distribution in the tropics of both hemispheres may be mentioned the following: *Dryopteris parasitica* O. Ktze., *Nephrolepis cordifolia* Presl, *N. hirsutula* Presl, *Adiantum philippense* L., *A. caudatum* L., *Pteris longifolia* L., *P. quadriaurita* Retz., *P. biaurita* L.,

Acrostichum aureum L., *Ceratopteris thalictroides* Brongn., *Vallisneria spiralis* L., *Ruppia maritima* L., *Typha angustifolia* L., *Imperata cylindrica* Beauv., and doubtless other grasses and sedges, *Pistia stratiotes* L., *Lemna paucicostata* Hegelm., *Spirodela polyrrhiza* Schl., *Sesuvium portulacastrum* L., *Portulaca oleracea* L., *Ceratophyllum demersum* L., *Cassytha filiformis* L., *Caesalpinia nuga* L., *C. crista* L., *Canavalia lineata* L., *Vigna lutea* A. Gray, *Jussiaea suffruticosa* L., *J. repens* L., *Hisbiscus tiliaceus* L., *Bacopa monniera* Wettst., and *Ipomoea pes-caprae* Roth.

It will be noted that a considerable number of the forms enumerated above are aquatic species or those that grow in swampy places, having minute seeds that might readily be transported by adhering in mud to the feet or feathers of migratory wading or swimming birds. Such plants are *Ceratopteris, Acrostichum, Lemma, Spirodela, Pistia, Ceratophyllum, Vallisneria, Bacopa, Jussiaea,* etc., although the wind may have been the agency of dispersal in some cases. Others are characteristic species of the strand, such as *Hisbiscus tiliaceus* L., *Canavalia lineata* DC., *Cassytha filiformis* L., *Caesalpinia nuga* Ait., *C. crista* L., *Vigna lutea* A. Gray, and *Ipomoea pes-caprae* Roth, and are undoubtedly ocean-distributed plants.

While it is comparatively easy to explain the probable methods by which species like the above have been distributed, it is, excluding the theory of their distribution by man, impossible to explain the wide distribution of many grasses and sedges and other weedy plants which in most tropical countries are found in waste places in and about towns, in fallow lands, and as weeds in cultivated fields. While many of these might be distributed by winds, by water, or by their comparatively small seeds adhering in mud to the feet or feathers of migratory birds, still it is more probable that most of them have been disseminated by man, for most part inadvertently, in packing material, in earth transported for one purpose or another, in ballast, and by other means. From the habitats and distribution of such species as the following, it is only reasonable to suppose that most or all of them have been distributed by man, although their original homes are unknown or uncertain; wherever else they may have originated they are certainly not natives of the Philippines: Various grasses and sedges, *Commelina nudiflora* L., *Alternanthera sessilis* R. Br., *Amaranthus spinosus* L., *A. viridis* L., *Trianthema portulacastrum* L., *Mollugo lotoides* O. Ktze., *M. oppositifolia* L., *Cissampelos pareira* L., *Cleome viscosa* L., *Gynandropsis pentaphylla*

DC., *Desmodium triflorum* DC., *Crotalaria verrucosa* L., *Teramnus labialis* Spr., *Oxalis repens* Thunb., *Biophytum sensitivum* DC., *Euphorbia hirta* L., *E. thymifolia* Burm., *E. hypericifolia* L., *Phyllanthus niruri* L., *P. urinaria* L., *Sida cordifolia* L., *S. acuta* Burm., *S. rhombifolia* L., *S. retusa* L., *Melochia corchorifolia* L., *Centella asiatica* Urb., *Evolvulus alsinoides* L., *Solanum nigrum* L., *Emilia sonchifolia* DC., *Eclipta alba* Hassk., and *Bidens pilosa* L.

In most treatments of tropical floras, whether of the eastern or of the western hemisphere, such species as the above are usually listed and discussed as native ones. It is far more probable that some have originated in one hemisphere and some in another, and that, for the most part at least, they have been accidentally distributed by man within the past 400 years. Certainly many of them were widely disseminated at an early date in colonial history, and in most cases it is probable that their original homes will never definitely be known.

Purposely introduced species comprise those of various other tropical countries that, for reason of their economic importance, have been introduced either in prehistoric or within historic times. Naturally the first plants introduced were those of the Malayan region that were familiar to the original invaders or their successors in western Malaya, and these include such species as Job's tears (*Coix lachryma-jobi* L.), the more common form of use for ornamental purposes, another form cultivated for food; sugar cane (*Saccharum officinarum* L.), as a source of sugar; lemon grass (*Andropogon citratus* DC.), used as a condiment; vetiver (*Andropogon zizanioides* Urb.), for its aromatic root; sorghum (*Andropogon sorghum* L.), for food; Italian millet (*Setaria italica* Beauv.), for food; rice (*Oryza sativa* L.), for food; bamboos (*Bambusa vulgaris* Schrad., and B. *blumeana* Schultes), for purposes of construction; coconut (*Cocos nucifera* L.[12]), for food; betel-nut palm (*Areca catechu* L.), for its stimulating properties; sweet flag (*Acorus calamus* L.), medicinal; taro (*Colocasia esculentum* Schott), food; yam, "ubi" (*Dioscorea alata* L.), for food; garlic (*Allium sativum* L.), for food; various varieties of the banana (*Musa paradisiaca* L.), for food; various zingiberaceous plants (*Kaempferia galanga* L., *Curcuma zedoaria* L., *C. longa* L., *Zingiber zerumbet* Sm., and Z. *officinale* Rosc.), for condiments, etc.; betel-pepper (*Piper betel* L.) for use with the betel-nut for

[12] This species is unquestionably of American origin, but reached the Orient long before the advent of Europeans.

chewing; bread fruit (*Artocarpus communis* Forst.), and the jak fruit (*A. integrifolia* L. f.), for food; amaranths (*Amaranthus gangeticus* L., *A. caudatus* L.), for ornamental purposes and food; "libato" (*Basella rubra* L.), for food; champaca (*Michelia champaca* L.[18]), for its fragrant flowers; *siempre viva* (*Bryophyllum pinnatum* Kurz), for medical purposes; horse radish tree (*Moringa oleifera* Lam.), for food and medicine; sappan (*Caesalpinia* sappan L.), for dyeing; the tamarind (*Tamarindus indica* L.), for food; indigo (*Indigofera tinctoria* L.), for dye; "caturay" (*Sesbania grandiflora* Pers.), for its edible flowers and its resinous exudation; the pigeon pea (*Cajanus cajan* Merr.), for food; the cow pea (*Vigna sesquipedalis* L.), for food; the asparagus pea (*Psophocarpus tetragonolobus* DC.), for food; "batao" (*Dolichos lablab* L.), for food; the mungo (*Phaseolus radiatus* L.), for food; various citrus fruits, such as the pomelo (*Citrus decumana* Murr.), the lime (*C. lima* Lunan.), and varieties of the orange (*C. aurantium* L.), for food; the santol (*Sandoricum koetjape* Merr.), for food; the lansone (*Lansium domesticum* Jack), for food; some euphorbias (*E. tirucalli* L.), for medicine; "iba" (*Cicca disticha* L.), for food; crotons (*Codiaeum variegatum* Blume), for ornamental purposes; castor oil plant (*Ricinus communis* L.), for medicine; croton oil plant (*Croton tiglium* L.), for medicine and for poisoning fish; balsam (*Impatiens balsamina* L.), for medicine and for ornamental purposes; cotton (*Gossypium* sp.), for textile purposes; silk cotton tree (*Ceiba pentandra* Gaertn.) for its fibrous floss; various Eugenias (*E. jambolana* Lam., *E. malaccensis* L., *E. jambos* L., and *E. javanica* L.), for food; "papua" (*Nothopanax fruticosum* Miq.), for medicine and for ornamental purposes; jasmine (*Sasminum sambac* Ait.), for its fragrant flowers; "solasi" (*Ocimum basilicum* L., and *O. sanctum* L.), for condiments; sesame (*Sesamum orientale* L.) for its oily seed; the bottle gourd (*Lagenaria leucantha* Rusby), for food; the sponge gourd (*Luffa cylindrica* Roem. and *L. acutangula* Roxb.), for food; the "condol" (*Benincasa hispida* Cogn.), for food; and the "ampalaya" (*Momordica charantia* L.) for food.

From an examination of the above list it will readily be seen that a great number of species were purposely introduced in prehistoric times from various parts of the East, chiefly through Malaya, for one reason or another, usually for their food value or for other reasons of economic importance. It is quite certain that none of the species enumerated above are natives of the

[18] This may have been introduced later by the Spaniards.

Philippines, and it is equally certain that none of them reached the Archipelago without the aid of man. Again it is equally certain that, with possibly very few exceptions, all these species were introduced by the early Malay invaders, by their successors, or by peoples of various other nationalities with whom they came in contact, long before the advent of the Europeans in the Orient.

In addition to the species above mentioned, for the most part undoubtedly of prehistoric introduction, there is still another source to be considered, and that is those species introduced by the Spaniards from Europe, or from various neighboring countries in the East. A brief summary of such plants follows: *Elaeis guineensis* Jacq., the oil palm; *Asparagus* spp.; *Sansevieria zeylanica* Willd., for its fiber and for ornamental purposes; *Cordyline terminalis* Kunth, for ornamental purposes, although this may have been of prehistoric introduction; the onion (*Allium cepa* L.), for food; *Crinum zeylanicum* L. and *C. latifolium* L., for ornamental purposes; *Pancration zeylanicum* L., for ornamental purposes; *Belamcanda chinensis* Lem., for ornamental purposes; *Ravenala madagascariensis* Sonn., for ornamental purposes; *Ficus elastica* L., a shade tree; *Morus alba* L., for feeding silk-worms; *Muehelenbeckia platyclada* Meissn., for ornamental purposes; *Boehmeria nivea* Gaudich, for its fiber; *Artabotrys uncinatus* Merr., for its fragrant flowers; *Unona chinensis* DC., for its fragant flowers; *Cinnamomum zeylanicum* L., one of the sources of cinnamon; *Brassica juncea* Coss., for food; *Raphanus sativus* L., for food; *Capparis cordifolia* Lam., from the Marianne Islands, used as a condiment; *Albizzia lebbeck* Benth., a shade tree; *Bauhinia tomentosa* L., an ornamental shrub; *Cassia siamea* Lam., a shade tree; *Lourea vespertilionis* Desv., for ornamental purposes; *Pisum sativum* L., for food; *Phaseolus vulgaris* L., for food; *Mangifera indica* L., for its edible fruit; *Aglaia odorata* Lour., a shade tree with fragant flowers; *Melia azedarach* L., for ornamental purposes; *Euphorbia splendens* Boj., for ornamental purposes; various forms of *Codiaeum variegatum* Blume, for ornamental purposes; *Acapypha hispida* Burm., and *A. wilkesiana* Muell-Arg., ornamentals; *Euphoria longana* Lam., for its edible fruit; *Zyzyphus jujuba* Mill., for its edible fruit; *Hibiscus sabdariffa* L. *H. mutabilis* L., *H. rosa-sinensis* L., *H. schizopetalus* Hook. f., all ornamentals; *Viola odorata* L., for its fragrant flowers; *Lagerstroemia indica* L., an ornamental; *Lawsonia inermis* L., for its fragrant flowers; *Punica granatum* L., for its edible fruit;

Eucalyptus tereticormis Sm., a shade tree; *Fœniculum vulgare* Gaertn., a condiment; *Plumbago auriculata* Lam., *P. zeylanica* L., and *P. rosea L.*, ornamentals; *Mimusops elengi* L., for its fragrant flowers; *Jasminum grandiflorum* L., and *J. multiflorum* Roth, for their fragrant flowers; *Tabernaemontana divaricata* R. Br., an ornamental shrub; *Nerium indicum* Mill., for its flowers; *Cryptostegia grandiflora* R. Br., for its flowers; *Telosma odoratissima* Coville, for its fragrant flowers; *Argyreia nervosa* Boj., *Ipomoea cairica* Sweet, vines; *Clerodendron thomsonae* Balf., *C. fragrans* Vent., and *C. calamatosum* L., ornamentals; *Rosmarinus officinalis* L., for medicinal purposes; *Mentha arvensis* L., mint; *Spathodea campanulata* Beauv., an ornamental tree; *Kigelia africana* Benth., a tree; *Graptophyllum pictum* Griff., an ornamental shrub; *Thunbergia glandiflora* Roxb., *T. alata* Boj., and *T. erecta* And., ornamentals; *Plantago major* L., for medicinal purposes; *Gardenia florida* L., for its fragrant flowers; *Coffea arabica* L., the source of coffee; *Ixora finlaysoniana* Wall., *I. coccinea* L., and *I. chinensis* Lam., ornamental shrubs; *Cucumis sativus* L., for its edible fruit; *Artemisia vulgaris* L., for medicinal purposes; and *Lactuca sativa* L. for food.

Comparatively few of the above species have become naturalized in the Philippines, and for the most part their continued existence here is dependent directly on the presence of man. *Sanseviera zeylanica* Willd. is at least subspontaneous, and also, in some localities, *Belamcanda chinensis* Lam., and *Muehelenbeckia platyclada* Meissn. *Brassica juncea* Coss., is an occasional weed, and some species of *Plumbago* are naturalized, as well as *Thunbergia alata* Boj., *Plantago major* L., and *Artemisia vulgaris* L.

More than 50 of the species above enumerated have almost certainly been introduced within the past fifty or sixty years, if one can judge by their non-inclusion in Blanco's "Flora de Filipinas" (1845). Blanco included in his work chiefly cultivated plants and the species found in the settled areas, giving comparatively little attention to the forest flora; and, from lack of material, entirely ignoring the rich mountain flora of the Archipelago. He seems, however, to have included most of the species found in and about towns, except the grasses and sedges, and especially the cultivated and economic plants.

The species purposely introduced within historical times from various parts of the Old World aggregate a considerable number, as will be noted from an examination of the above list. In addition to those enumerated above, there are still found in

the Archipelago a great number of plants of wide distribution in the Indo-Malayan region, which from their distribution and occurrence in the Philippines are certainly not indigenous species. Manifestly they must have originated in some other part of the Orient, and have been introduced into the Philippines, either within historic times, or at a still earlier date. It is only reasonable to assume that many of them have reached the Archipelago within the past 400 years. It is, however, practically impossible definitely to determine whether many of them have been introduced inadvertently by man, or by natural causes. Excluding the purposely introduced species enumerated above, and for the present ignoring those species of oriental origin having minute seeds, which in all probability have reached the Philippines through natural causes, there still remains a considerable list of weedy plants that presumably have been accidentally introduced, such as various grasses, *Rottboellia exaltata* L. f., *Apluda nutica* L., *Andropogon aciculatus* Retz., *Panicum flavidum* Retz., *Panicum distachyum* L., *Centotheca latifolia* Trin., *Eragrostis* spp., certain sedges, and representatives of other families, such as *Fleurya interrupta* Gaudich., *Cyathula prostrata* Bl., *Aerua lanata* Juss., *Achyranthes aspera* L., *Portulaca quadrifida* L., *Nasturtium indicum* DC., *Aeschynomene indica* L., *Desmodium pulchellum* Benth., *D. triquetrum* DC., *D. gangeticum* DC., *D. lasiocarpum* DC., *Sesbania cannbina* Pers., *Crotalaria quinquefolia* L., *C. linifolia* L. f., *Flemingia strobilifera* R. Br., *Pueraria phaseoloides* Benth., *Euphorbia* spp., *Phyllanthus* spp., *Sida* spp., *Abutilon indicum* Don, *Urena lobata* L., *Abelmoschus moschatus* Moench, *Merremia* spp., *Coldenia procumbens* L., *Moschosma tenuiflorum* Heynh., *Anisomeles indica* O. Ktze., *Leucas* spp., *Leonurus sibirica* L., *Datura alba* Nees, *Vernonia patula* Merr., *Emilia sonchifolia* DC., *Sphaeranthus africanus* L., *Grangea maderaspatana* Poir., *Erigeron linifolius* Willd., *Wedelia prostrata* Hemsl., *Sonchus oleraceus* L., and *Crepis japonica* Benth.

While some of the above species may have been introduced by natural causes, by birds, or by winds, it is only reasonable to suspect that most of them, especially those species in genera having special adaptations for the dispersal of seeds by sticking to clothing, to the hair of animals, etc., have been introduced by man. In contrast to this, a large number of genera undoubtedly owe their presence in the Archipelago to natural causes, their small seeds having been transported in one method or another by migratory birds, by winds, etc., as, for example, cer-

tain grasses and sedges, especially the rice paddy forms, and such genera as *Eriocaulon, Commelina, Aneilema, Cyanotis, Monochoria, Mollugo, Sesuvium, Trianthema, Polygala, Salomania, Rotala, Ammannia, Ludwigia, Jussiaea, Canscora, Hydrolea, Centranthera, Lindenbergia, Bacopa, Mazus, Vandellia, Torenia, Bonnaya, Dopatrium, Utricularia, Sphenoclea, Calogyne, Stylidium,* and doubtless, so far as the flora of the whole Archipelago is concerned, many other genera. In this connection the distribution of two characteristic Australian types, both found near Manila, is of interest, *Calogyne pilosa* R. Br., of the *Goodenoviaceae,* and *Stylidium alsinoides* R. Br., of the *Stylidiaceae.* Both of these are rice paddy weeds with us, and there is every reason to believe that they have been present in the Philippines for a very long time. There appears to be no doubt whatever as to the Australian origin of both. The former species is also found in southeastern China, but the latter is unknown north of Australia except in Luzon. It is believed that the most reasonable explanation of their occurrence in such widely-separated regions is that they have been disseminated by their minute seeds adhering in mud to the feet or feathers of migratory wading birds, such as the snipe, and it is confidently expected that eventually both will be found in intermediate localities in Gilolo, Celebes, and New Guinea, when those islands are botanically better known. It is possible, however, that they may have existed in one or all of these islands in the past, and that they may have become exterminated by adverse conditions. It is certainly unreasonable to suppose that their seeds have been transported directly from tropical Australia to Luzon, a distance of approximately 4,000 kilometers.

Having considered the species of presumably oriental and those of unknown origin and the agencies by which they have reached the Philippines, there still remains to be discussed the great number of forms that have originated in tropical America, and which have been purposely or accidentally introduced here within the past 390 years; that is, since the discovery of the Archipelago by Magellan in 1521, and its subsequent conquest by the Spaniards. To a greater or lesser extent in the early colonial days, the Philippines were a distributing center of American species to the neighboring countries, not only of those purposely distributed for their economic value, but also many weeds and other useless plants inadvertently disseminated. Previous to the arrival of the Spaniards in the Orient the Portuguese had doubtless introduced various American species into

their possessions in tropical Asia and Malaya, and later the Dutch continued the work, so that it is now quite impossible, in many cases, to determine by whom the various economic plants and many weeds were first brought to the East; doubtless many were distributed by representatives of all three nationalities. The Spaniards and the Portuguese were, however, unquestionably the pioneers in this respect, and the interchange of species between the tropics of the two hemispheres initiated by these pioneer explorers and colonists still continues.

The American element in the Philippine flora is of peculiar interest as showing the effect of commerce on the vegetation of a country. Even with the limited communication between the Philippines and Mexico, it is surprising to consider the number of American forms introduced here through the medium of the galleons in the years when all communication between Spain and the Philippines was *via* Mexico. From the time of the Spanish conquest up to the year 1815, a period of nearly 300 years, the government galleons sailed annually for Manila, first from Navidad and later from Acapulco, on the western coast of Mexico. These galleons carried not only the civil, military, and ecclesiastical authorities between Spain and the Philippines *via* Mexico, but also other travellers, merchants, etc., as well as large quantities of merchandise.

At an early date various Spanish officials, but, apparently, chiefly the priests, introduced here the various species of economic value, food plants, medicinal plants, fruits, etc., that were familiar to their countrymen in tropical America, most often bringing seeds, but in some cases most certainly living plants. Undoubtedly many species were introduced at that time that failed to become established here. Among the American species purposely introduced from Mexico may be mentioned the following: Maize (*Zea mays* L.), introduced for food; the pineapple (*Ananas sativus* Schultes), for its edible fruit and its fiber; maguey (*Agave cantula* Roxb.), for its fiber; the tuberose (*Polianthes tuberosa* L.), for its fragrant flowers; the spider lily (*Hymenocallis tenuiflora* Herb.), for ornamental purposes; the canna (*Canna indica* L.), for ornamental purposes; arrowroot (*Maranta arundinacea* L.), for food; "aposotis" (*Chenopodium ambrosioides* L.), for medical purposes; four o'clock (*Mirabilis jalapa* L.), for ornamental purposes; "libato" (*Anredera scandens* Moq.); various species of *Anona* (*A. muricata* L., *A. reticulata* L., and *A. squamosa* L.), for their edible fruits; the avocado (*Persea americana* Mill.), for its edible fruit; the Mexican

poppy (*Argemone mexicana* L.), for ornamental purposes or for medicine; "camanchile" (*Pithecolobium dulce* Benth.), for its tanbark and its edible fruit; "aroma" (*Acacia farnesiana* Willd.) for its fragrant flowers; "ipel-ipel" (*Leucaena glauca* Benth.), as a hedge plant; the sensitive plant (*Mimosa pudica* L.), for ornamental purposes; "cabellero" (*Caesalpinia pulcherrima* Sw.), for ornamental purposes; "acapulco" (*Cassia alata* L.), for medicinal purposes; the peanut (*Arachis hypogaea* L.), for food; indigo (*Indigofera suffruticosa* Mill.), for dye; "madre cacao" (*Gliricidia sepium* Steud.), for hedges and for ornamental purposes; the lima bean (*Phaseolus lunatus* L.), for food; the yam bean (*Pachyrrhizus erosus* Urb.), for its edible root; the bilimbi and carambola (*Averrhoa bilimbi* L., and *A. carambola* L.), for their edible fruits; physic nut (*Jatropha curcas* L.), for medicine, as well as *J. multifida* L. for ornamental purposes; cassava (*Manihot utilissima* Pohl), for food; the cashew nut (*Anacardium occidentale* L.) for its edible fruit; "ciruelas" (*Spondias purpurea* L.) for its edible fruit; cotton (*Gossypium braziliense* Macf.), for textile purposes; cacao (*Theobroma cacao* L.), the source of chocolate and cacao; acheute (*Bixa orellana* L.), for dye; the papaya (*Carica papaya* L.), for its edible fruit; various species of cacti (*Nopalea* and *Cereus*), for ornamental purposes; the guava (*Psidium guajava* L.), for its edible fruit; the "chico" (*Achras sapota* L.), for its edible fruit; the "chico mamey" (*Lucuma mammosa* L.), for its edible fruit; the "sapote negro" (*Diospyros ebenaster* Retz.), for its edible fruit; the temple flower (*Plumeria acutifolia* Poir.), for its fragrant flowers; the periwinkle (*Lochnera rosea* Reichb.), for its ornamental flowers; "campanello" (*Thevetia neriifolia* Juss. and *Allamanda cathartica* L.), for ornamental and medicinal purposes; some species of convolvuli (*Ipomoea nil* Roth, *Quamoclit pinnata* Boj., *Colonictyon aculeatum* House), for ornamental purposes, and the sweet potato (*Ipomoea batatas* Poir.), for food; lantana (*Lantana camara* L.), for ornamental purposes; "dama de noche" (*Cestrum nocturnum* L.), for its fragrant flowers; tobacco (*Nicotiana tabacum* L.); the tomato (*Lycopersicum esculentum* Mill.); the peppers (*Capsicum frutescens* L. and *C. annuum* L.), for condiments and for food; some ornamental *Bignoniaceae* (*Crescentia alata* HBK., and *Tecoma stans* Juss.); (?) the squash (*Curcubita maxima* Duch.), for food; some ornamental *Compositae* (*Tagetes erecta* L., *Helianthus annuus* L., *Cosmos caudatus* HBK., and *C sulphureus* Cav.), and "ayapana" (*Eupatorium triplinerve* Vahl), for medicine.

The majority of the above species are found only in cultivation, but some, such as *Leucaena glauca* Benth., *Mimosa pudica* L., *Argemone mexicana* L., *Lantana camara* L., *Cosmos caudatus* HBK., *Acacia farnesiana* Willd., *Gliricidia sepium* Steud., *Psidium guajava* L., *Jatropha curcas L.*, *Pithecolobium dulce* Benth., *Ipomoea nil* Roth, and *Pachyrrhizus erosus* Urb., are so thoroughly naturalized and so common and widely distributed in the Philippines that the casual observer would consider them to be indigenous species.

In addition to the species above enumerated that were originally purposely introduced and which have become thoroughly naturalized, we must now consider a very large number of tropical weeds that have originated in America, which were inadvertently introduced here and which have now extended their range, certainly through the agency of man, to most tropical countries. Among these American aliens may be mentioned the following: *Paspalum conjugatum* Berg., *Cenchrus echinatus* L., *Chloris barbata* Sw., *Peperomia pellucida* HBK., *Pilea microphylla* Leibm., *Celosia argentea* L. (possibly introduced for ornamental purposes), *Alternanthera frutescens* R. Br., *Cassia tora* L., *C. occidentalis* L., *C. hirsuta* L., *Zornia diphylla* Pers., *Desmodium scorpiurus* Desv., *D. procumbens* Hitchc., *Parosela glandulosa* Merr., *Crotalaria incana* L., *Phaseolus semierectus* L., *Euphorbia prostrata* Ait., *Malvastrum coromandelinum* Garcke, *Malachra capitata* L., *M. fasciata* Jacq., *Triumfetta bartramia* L., (*T. rhomboidea* Jacq.), *T. semitriloba* Jacq., *Waltheria americana* L., *Passiflora foetida* L., *Rotala ramsoir* Koehne, *Jussiaea linifolia* Vahl, *Asclepias curassavica* L., *Ipomoea triloba* L., *Lippia nodiflora* Rich., *Stachytarpheta jamaicensis* Vahl, *Hyptis suaveolens* Poir., *H. brevipes* Poir., *H. capitata* Jacq., *H. spicigera* Lam., *Physalis angulata* L., *P. minima* L., *Scoparia dulcis* L., *Elytraria tridentata* Vahl, *Blechum brownei* Juss., *Ageratum conyzoides* L., *Elephantopus scaber* L., *E. mollis* HBK., *E. spicatus* Aubl., and *Synedrella nodiflora* Gaertn.

Nearly all the species in this last list of American weeds are very common and widely distributed in the Philippines. Most of them are confined to the settled areas, and are so thoroughly naturalized that they might well be considered indigenous species if nothing were known of their origin. Many are individually numerous, that is more dominant, than are native species, or those that have been introduced from the tropics of the Orient.

While most of these American weeds are now found in most tropical countries in the East having proper climatic conditions

for their reproduction and growth, it is interesting to note that a number of forms are found in none of the other countries of the Eastern Hemisphere, while others are just commencing to establish themselves in neighboring regions. Many of these American aliens in the Philippines that have not reached neighboring countries are among our most common and widely distributed species, while others are of local occurrence only. In connection with this matter the following species may be mentioned: *Alternanthera frutescens* R. Br., common in waste places; *Portulaca pilosa* L., occasional in dry localities; *Anredera scandens* Moq., very abundant in hedges and thickets along streets; *Pithecolobium dulce* Benth., very common in the Philippines, and thoroughly naturalized, thriving especially on gravel bars along many streams, now also scattered in Java and in India; *Prosopis vidaliana* Naves, described from Philippine material, and by some authors reduced to *P. juliflora* Sw., certainly of Mexican origin, and now very abundant about the shores of Manila Bay; *Desmodium scorpiuris* Desf., abundant here, also in Polynesia; *Gliricidia sepium* Steud., very abundant in the Philippines, and now just beginning to appear in neighboring countries in the Orient; *Parosela* (*Dalea*) *glandulosa* Merr., very abundant on dry grassy slopes and in waste places, first described by Blanco; *Schrankia quadrivalvis* (L.) Merr., rare, or at least very local; *Muntingia calabura* L., also in Siam, introduced there from Manila; *Malachra fasciata* Jacq., abundant in waste places, now occasional in Java, but still rare there; *Ipomoea triloba* L., very common in the Philippines and in Guam, now making its appearance in Singapore, Borneo, Java, and Mauritius; *Hyptis capitata* Jacq. and *H. spicigera* Lam., both also in Guam, the former also in Java, but still rare there; *Blechum brownei* Juss., abundant in Guam and in the Philippines, now also in Formosa; *Elytraria tridentata* Vahl, abundant locally; *Elephantopus mollis* HBK., also in Guam, and *E. spicatus* Pers., among our most common and widely distributed weeds; *Rotala ramosoir* Koehne, now a common rice paddy weed with us; *Cenchrus echinatus* L., very common, now also occasional in neighboring countries, Borneo, etc., and *Eleutherine americana* Merr., occasional in some parts of the Philippines, locally abundant.

The presence of these American weeds in the Philippines is directly due to the old Acapulco–Manila trade route, and indicates the necessity of taking into consideration the communication between different countries in working out problems regarding the introduced element in any particular region.

The direct introduction of various species from tropical America apparently ceased with the withdrawal of the galleons between Manila and Acapulco, but at a later date other plants of American origin, mostly ornamentals, have come in indirectly, chiefly from neighboring countries in the Orient. Among the comparatively recently introduced species of American origin may be mentioned *Ceropteris calomelanos* Und., *Adiantum macrophyllum* Sw., *A. tenerum* Sw. and *A. trapeziforme* L., *Panicum maximum* Jacq., *Oreodoxa regia* HBK., *Cladium bicolor* Vent., *Rhoeo discolor* Hance, *Zebrina pendula* Schinzl., *Yucca aloifolia* L., *Eucharis grandiflora* Planch., *Canna* spp., *Peperomia argyreia* Morr., *Castilloa elastica* Carv., *Aristolochia elegans* Mast., *Antigonon leptopus* H. & A., *Alternanthera versicolor* Regel, *Bougainvillea spectabilis* Willd., *Enterolobium saman* Prain, *Bauhinia monandra* Kurz, *Centrosema plumieri* Benth., *Oxalis martiana* Zucc., *Euphorbia heterophylla* L., *E. pulcherrima* Willd., *Jatropha podagrica* Hook. f., *J. gossypifolia* L., *Hevea brasiliensis* HBK., *Manihot glaziovii* Muell.-Arg., *Malvaviscus pilosus* DC., *Abelmoschus esculentus* Moench., *Gossypium hirsutum* L., *Passiflora quadrangularis* L., *P. edulis* Sims, *Allamanda hendersonii* Bull., *Ipomoea purpurea* Lam., *Operculina tuberosa* Choisy, *Duranta repens* L., *Petraea volubilis* Jacq., *Brunfelsia americana* L., *B. acuminata* Benth., *Solanum wendlandii* Hook. f., *Russelia juncea* Zucc., *Jacaranda ovalifolia* R. Br., *Crescentia cujete* L., *Odontonema nitidum* O. Ktze., *Isotoma longiflora* Presl as well as various ornamental *Compositae,* such as *Dahlia, Corepsis, Cosmos, Zinnia, Gaillardia,* etc. Very few of the above species are found outside of cultivation, but some are now becoming established, such as *Euphorbia heterophylla* L., *Enterolobium saman* Benth., *Russelia juncea* Zucc., *Ceropteris calomelanos* Und., *Cladium bicolor* Vent., and *Zebrina pendula* Schinzl.

If we can trust to the evidence afforded by local botanical literature, all of the above species have been introduced within the last 70 years, or since the publication of the second edition of Blanco's "Flora de Filipinas" in 1845. None of them are included in his work, although about one-half are mentioned by F. Villar and Naves in the "Novissima Appendix" to the third edition of the "Flora de Filipinas," 1880–83, as having been seen by them in the Archipelago.

Taking into consideration only those species found in and about Manila, we have seen that about 178 or over one-sixth of the total number have originated in tropical America, some of which have been introduced here purposely for one reason or

another, and others inadvertently. In other parts of the Archipelago additional species of American origin occur which are not now found in or near Manila, while in other neighboring countries of the Indo-Malayan region there are a certain number of other species, also of American origin, which have not as yet reached the Philippines. In the entire Indo-Malayan region it is probable that there are to-day, either in general cultivation or as weeds, more than 200 species that have originated in tropical America and which have found their way into the Eastern Hemisphere since the advent of the Europeans, that is, within the past 400 years.

In the interchange of species between the Old World and the New, those originating in tropical America and now occurring in the Indo-Malayan region are apparently much more numerous than those of oriental origin which have been introduced into tropical America. This seems to apply not only to the ubiquitous weeds of cultivation, but also the economic plants, especially those that are cultivated for food.

Without access to extensive and representative collections of tropical American plants, it is impossible properly to deal with the subject of introduced plants in the countries extending from Mexico southward to Brazil, either of oriental or other origin. That many species from the Indo-Malayan region have been introduced into tropical America is a fact, but it is impossible to form a clear conception of the number, and especially of their abundance, without some personal knowledge of the floras of the latter region. Species that are merely cultivated are as a general rule ignored by botanical collectors, and for this or for other reasons are frequently excluded from botanical works treating of restricted areas. From an examination of the literature available here I have been able to compile a list of only about 80 species of Indo-Malayan origin that have purposely been introduced into tropical America, and which are for the most part only cultivated there, although naturally some have become established where favorable conditions exist. As to how general these species are in the great area included in tropical America, I have no information, but many are doubtless of very local occurrence. As to weeds of cultivation I have found records of only about twenty species that are to a greater or less degree distributed in tropical America, and which have undoubtedly originated in the Old World, and are of inadvertent introduction into the New.

It is apparent that by far the greater part of our ubiquitous

cosmopolitan tropical weeds have originated in tropical America, and at the same time that region seems to lead in the number of plants of economic value, especially those cultivated for food. These facts may indicate a very ancient civilization in some parts of tropical America, by which the various weeds have become adapted to the environment of cultivation, and by which many of the economic plants have become domesticated. It is more probable, however, that at least the weed-flora has been developed in a region with thin forests, or with very scattered trees, or perhaps in nonforested areas. Such types of vegetation as the above have probably existed in some parts of tropical America, especially in the drier regions, from very ancient times, but in the eastern tropics with their high and continuous humidity, such as is found in the entire Malay Archipelago, and in a large part of tropical Asia, extensive areas of open country could hardly exist under primeval conditions.

In tropical countries like the Philippines in respect to anthesis there is a constant succession during all months of the year, and hence, in order thoroughly to investigate the flora of any region, explorations and observations must be continuous throughout the year. Very many species flower only during the dry season, some at its beginning, others as it progresses, and still others toward its end, while very many others flower only during some part of the rainy season. While most of the species found in and about Manila, and in other parts of the Archipelago as well, have well defined and restricted periods of anthesis, a comparatively large number flower throughout the year, some continuously, and some at intervals of greater or less duration.

With the exception of those species that flower continuously, the time of anthesis is found to be closely correlated with the distribution of the rainfall. In the Philippines where the time and duration of the rainy season is very largely modified by local conditions, the influence of the monsoons, geological and geographical features, etc., it is a well-known fact that the period of greatest precipitation in one part of the Archipelago may be and often is in the period of greatest drought in other parts. Generally speaking the western part of the Archipelago is dry while the regions bordering on the Pacific coast are wet, and vice versa, but the local distribution of mountain masses frequently modifies this general rule, and in the vicinity of some mountains the precipitation is often fairly continuous throughout the year. Manifestly then, observations as to the periods

of anthesis of any species or group of species have only a local value. That some species growing in and about Manila flower during certain months is no indication that the same species will be found in flower in other parts of the Archipelago during the same period of time. The dates of flowering for individual species are approximately the same only in those regions where the dry season and the rainy season cover similar periods.

Most of our indigenous species have well-defined and restricted periods of anthesis, especially the perennial herbs and the woody plants, sometimes lasting a few days or a few weeks, more rarely extending over several months in a homogeneous area. Judging from herbarium records alone it is not infrequent to find that certain woody species have been collected in flower in all months of the year, taking into consideration the material from all parts of the Archipelago. If, however, the material is considered by provinces it is almost always found that the specimens from one region all flower during a certain period, those from another region at another period, etc., more or less closely correlated with the distribution of the rainfall.

Annual species, being more dependent on rainfall than the perennial ones, are for the most part found in flower only during the rainy season or shortly after its close, and on the whole their period of anthesis appears to average somewhat longer than for the perennial ones. Very many of the annuals disappear with the advance of the dry season, only to make their appearance as a new generation after the rains have commenced.

Among the indigenous species the constituents of the strand flora and of the mangrove vegetation, including most of the perennials and many of the annuals, flower more or less freely throughout the year, in this respect being sharply contrasted with the inland flora. The explanation of this phenomenon is probably to be found in the soil moisture, which in the mangroves is practically the same at all seasons, and along sandy beaches and tidal streams more or less uniform throughout the year.

An examination of the indigenous and introduced elements in relation to their periods of anthesis brings out a striking and rather interesting fact. Only about 8 per cent of the indigenous species in and about Manila flower all the year, while among the introduced ones the corresponding percentage is more than 70. Very many of the species making up the 8 per cent for the indigenous element will be found in the representatives of

the strand flora and mangrove vegetation, mentioned above. Of the remaining 30 per cent of the introduced element, very many of the species, although not flowering all the year, have decidedly prolonged periods of anthesis, such as *Enterolobium saman* Prain, 7 months, from March to September, *Delonix regia* Raf., 5 months, from March to July, etc.

There are various reasons that will in part account for this enormous difference in continuous anthesis between the indigenous and the introduced elements. For instance, many of the cultivated plants are comprised in the latter group, and these are always under more or less abnormal conditions, while very many of them have been greatly altered by the process of selection in the course of domestication. In those species that are cultivated for their ornamental flowers, unquestionably the very fact of continuous anthesis has in many cases been one of the reasons for their original selection and domestication, their popularity as ornamentals, and hence their wide distribution. A considerable number of these plants locally never produce fruits, such as several species of *Hibiscus, Ixora finlaysoniana* Wall., *I. chinensis* Lam., *I. coccinea* L., *Odontonema nitidum* O. Ktz., *Graptophyllam pictum* Griff., *Thunbergia grandiflora* Roxb., *T. erecta* And., *Ipomoea cairica* Sweet, *Barleria cristata* L., *Allamanda cathartica* L., *A. hendersonii* Bull., and many others, and this very fact unquestionably has its influence on the question of continuous anthesis. The above factors, however, can explain this striking difference in anthesis only in part.

It is impracticable, if not quite impossible, to determine the nature of these plants in their native homes as to restricted or continuous anthesis. Doubtless some of them in their original habitats flower all the year, but it is most probable that the great majority of them were originally species with restricted anthesis, a character which has undergone extension or modification due to changed environment and climatic conditions in their new homes.

Whatever may have been the causes leading to the development of this character the fact remains that most of our ubiquitous tropical weeds owe their success largely to the fact that for twelve months in the year they are continuously developing and maturing seeds, giving such species an enormous advantage in the struggle for existence over those having a restricted period of anthesis. Naturally also this continuous seed production gives such plants a great advantage over native species,

which lack this character, and helps to account for the wide and rapid distribution of tropical weeds.

SUMMARY.

1. The original vegetation of the Philippine Archipelago was undoubtedly a continuous forest of one type or another. The present enormous deforested areas, cultivated and fallow lands, thickets, second growth forests, and open grass lands are directly or indirectly due to the presence of man. The original forests have been destroyed by crude methods of agriculture and recurring grass fires in abandoned clearings.

2. Most of the species found in the settled areas, that is, light-loving species adapted to growth in the open, and which cannot withstand forest conditions, must have been introduced into the Archipelago after the advent of man, and after the nature of the vegetation had been altered over greater or less areas. These species cannot persist and reproduce themselves in forests.

3. A high percentage of the species in the settled areas have been introduced into the Philippines some through natural agencies and very many purposely or inadvertently by man. Many of these species reached the Archipelago in prehistoric times, while many others have been introduced since the advent of the Europeans.

4. Practically all the useful plants in the Philippines, excluding the forest trees, the rattans, some bamboos, a few palms, and the abacá plant (*Musa textilis* Née) have been purposely introduced from other countries. These introduced economic plants include all the important species yielding food, the cereals, nearly all the früit trees, condiments, many medicinal plants, and most of the commonly cultivated ornamentals. Many were introduced in prehistoric times, chiefly from the Malayan region, but a high percentage have been introduced within the past 400 years, including a great number of American origin.

5. The percentage of endemism in regions where the original forests have not been disturbed by man is over 40; in the settled areas and in those regions where the forests have been destroyed it is but about 12.

6. Of the 1,007 species found in the vicinity of Manila, a region where the original vegetation has been largely destroyed by man, about 550 are indigenous, and 475 introduced. Of the introduced species over one-half, or 232, are spontaneous; 225 are found in cultivation only, or but sparingly spontaneous.

7. As to the ranges of these 1,007 species, 812 extend to the

Malay Archipelago, 789 to tropical Asia, 425 to tropical Australia, 424 to tropical America, 402 to tropical Africa, and 355 to Polynesia. Only 124 are endemic, including the locally introduced and cultivated species.

8. Species that are cosmopolitan in the tropics, at least those that are found in some parts of both hemispheres, aggregate 424, of the total of 1,007 considered. About 90 of these are considered to have spread from one hemisphere to the other through natural causes, although in about one-half of these cases the species may have been transmitted by man. As to the Philippines, 334 of these pantropic species have been introduced by one means or another, about 242 purposely, and about 92 inadvertently.

9. As to the origin of these pantropic species, 177 are considered to have originated in tropical America, and 138 in the tropics of the Eastern Hemisphere. In the case of 109 species it has been impossible definitely to determine where they may have originated.

10. Pantropic weeds of American origin are more dominant and more numerous in species and in individuals in the Philippines, than are those of oriental origin. This is probably due to fundamental differences in aboriginal floristic conditions. In some parts of tropical America, at least in the drier regions, open treeless or partly treeless regions have probably existed from the earliest times, thus permitting the development of a flora consisting of annual, or of small, perennial, light-loving plants. In the Philippines, the Malayan region generally, and perhaps in large parts of tropical continental Asia, the high and continuous humidity has tended to the development of continuous forests, and hence, as to the herbs and small shrubs, the development of a shade-loving flora. The destruction of forests over large areas has provided the habitats for light-loving species, an element lacking or but poorly developed in the original flora, thus permitting the growth and rapid dissemination of plants adapted to these conditions when once introduced.

11. Among the introduced element in and about Manila, more than 70 per cent of the species flower continuously, or practically continuously, during all months of the year. Of the indigenous species but about 8 per cent flower continuously, over 90 per cent having restricted periods of anthesis.

Vol. VII, No. 2, including pages 47 to 124, was issued July 1, 1912.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

A LIST OF THE MAMMALS OF THE PHILIPPINE ISLANDS, EXCLUSIVE OF THE CETACEA.

By Ned Hollister.

Order No. 418. Paper, $0.50 United States currency, postpaid.

This is the only recent attempt to enumerate the mammals of the Philippine Islands. The distribution of each species is given and the original descriptions are cited.

PRICE-LIST OF PHOTOGRAPHS.

For sale by the Bureau of Science.

Order No. 417. For free distribution.

This is a list of selected photographs from the splendidly complete collection of the Bureau of Science.

A MANUAL OF PHILIPPINE BIRDS.

By Richard C. McGregor.

2 parts, 769 pages.

Order No. 103. Paper, $4 United States currency, postpaid.

Mr. McGregor spent some eight years in active field work, visiting many parts of the Archipelago, before beginning work on this book. Therefore, he was well prepared to undertake the preparation of the manual.

A Manual of Philippine Birds contains in compact form descriptions of all the known species of Philippine birds. The usual keys and diagnoses of orders, families, and genera help the novice in identification.

Under each species are found native, English, and scientific names, distribution by islands, descriptions of the birds and in many instances notes on nesting, migrations, and other habits.

A CHECK-LIST OF PHILIPPINE FISHES.

By David Starr Jordan and Robert Earle Richardson.

78 pages.

Order No. 102. Paper, $0.75 United States currency, postpaid.

This list will be found a convenient guide to the synonymy of Philippine ichthyology. The nomenclature is thoroughly revised and the distribution of each species within the Philippine Islands is given.

This check-list is uniform in size and style with McGregor and Worcester's Hand-list of Philippine Birds.

INDO-MALAYAN WOODS.

By Fred W. Foxworthy.

182 pages, 9 photographic plates.

Order No. 411. Paper, $0.50 United States currency, postpaid.

In *Indo-Malayan Woods*, *Doctor Foxworthy* has brought together a large amount of accurate information concerning trees yielding woods of economic value. The work is based largely upon the author's own experience in the Philippine and neighboring regions, but previous publications and information generously given by other dendrologists have been used to correlate commercial and native names of useful Indo-Malayan trees.

PHILIPPINE HATS.

By C. B. ROBINSON.

Order No. 415. Paper, $0.50 United States currency, postpaid.

This paper is a concise record of the history and present condition of hat making in the Philippine Islands. The various materials used and the different kinds of hats made in each center of production are fully described. Not of the least importance are the botanical identifications of the plants from which the hat materials are obtained.

The plates illustrate the hat materials and various kinds and grades of hats. A map of central Luzon shows the towns chiefly concerned in this industry.

THE COCONUT PALM IN THE PHILIPPINE ISLANDS.

149 pages, 30 plates.

Order No. 37. Paper, $1 United States currency, postpaid.

The reprint contains the following articles: On the Water Relations of the Coconut Palm (Cocos nucifera), by Edwin Bingham Copeland; The Coconut and its Relation to Coconut Oil, and The Keeping Qualities of Coconut Oil and the Causes of its Rancidity, by Herbert S. Walker; The Principal Insects Attacking the Coconut Palm (Parts I and II), by Charles S. Banks; with an introduction by Paul C. Freer.

A VOCABULARY OF THE IGOROT LANGUAGE AS SPOKEN BY THE BONTOK IGOROTS.

By WALTER CLAYTON CLAPP.

89 pages.

Order No. 408. Paper, $0.75 United States currency, postpaid.

The introduction to this vocabulary contains notes on pronunciation, vowels, diphthongs, consonants, verbs, conjugations, syllabication and reduplication. The vocabulary is given in Igorot-English and English-Igorot.

THE NABALOI DIALECT.

By OTTO SCHEERER.

65 pages, 29 plates.

AND

THE BATAKS OF PALAWAN.

By EDWARD Y. MILLER.

7 pages, 6 plates.

Order No. 403. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The Nabaloi Dialect and the Bataks of Palawan are bound under one cover.

THE BATÁN DIALECT AS A MEMBER OF THE PHILIPPINE GROUP OF LANGUAGES.

By OTTO SCHEERER.

AND

"F" AND "V" IN PHILIPPINE LANGUAGES.

By CARLOS EVERETT CONANT.

These two papers are issued under one cover, 141 pages.

Order No. 407. Paper, $0.80 United States currency, postpaid.

Orders for these publications may be sent to the Business Manager, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below. Please give order number.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

THE SUBANUNS OF SINDANGAN BAY.

By Emerson B. Christie.

121 pages, 1 map, 29 plates.

Order No. 410. Paper, $1.25 United States currency, postpaid.

Sindangan Bay is situated on the northern coast of Zamboanga Peninsula. The Subanuns of this region were studied by Mr. Christie during two periods of five and six weeks, respectively.

The following is an abstract from the contents of Mr. Christie's report on the Subanuns: Habitat and history; relations with the Moros; material culture; dress; ornaments; industries; trade; agriculture; family life; social customs; administration of justice; religion; the medicine man; ceremonies; tales; word-lists; physical measurements.

The 29 plates illustrate the Subanuns at work and at play; their industries, houses, attire and implements; and the people themselves.

THE HISTORY OF SULU.

By Najeeb M. Saleeby.

275 pages, 4 maps, 2 diagrams.

Order No. 406. Paper, $0.75 United States currency, postpaid.

In the preparation of his manuscript for The History of Sulu Doctor Saleeby spent much time and effort in gaining access to documents in the possession of the Sultan of Sulu. It is fortunate that these records have now been translated and preserved in permanent form. This book is a history of the Moros in the Philippines from the earliest times to the American occupation.

STUDIES IN MORO HISTORY, LAW, AND RELIGION.

By Najeeb M. Saleeby.

107 pages, 16 plates, 5 diagrams.

Order No. 405. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

This volume deals with the earliest written records of the Moros of Mindanao. Doctor Saleeby was fortunately able to obtain exact copies of carefully preserved early records written in the Maguindanao dialect with Arabic characters. The author presents translations of these as well as 16 half-tone illustrations of certain pages from the originals. The names of the rulers of Maguindanao are reported in five folding diagrams.

NEGRITOS OF ZAMBALES.

By William Allan Reed.

83 pages, 32 plates.

Order No. 402. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The introductory chapter deals with the general distribution of Negritos and with the distribution of the Philippine branch of the race. The succeeding chapters deal with the various industries, amusements, and social relations of these little men.

Plates from photographs, the greater part of which was taken for this publication, show ornaments, houses, men making fire with bamboo, bows and arrows, dances, and various types of the people themselves.

CONTENTS.

	Page.
AMES, OAKES. Notes on Philippine Orchids with Descriptions of New Species, V: The Genus Bulbophyllum in the Philippine Islands	125
MERRILL, E. D. Notes on the Flora of Manila with Special Reference to the Introduced Element	145

The "Philippine Journal of Science" is issued as follows:	U. S. currency.
Section A. Chemical and Geological Sciences and the Industries	$2.00
Section B. The Philippine Journal of Tropical Medicine	3.00
Section C. Botany	2.00
Section D. General Biology, Ethnology and Anthropology (Section D began with Volume V)	
Entire Journal, Volume II, III, IV, or V	2.00
Entire Journal, beginning with Volume VI	5.00
Single numbers	7.00
Volume I, 1906 (not divided into sections)	.50
Supplement to Volume I (botany)	10.00
Volume I (without supplement)	3.50
	6.50

Each section is separately paged and indexed.

Publications sent in exchange for the Philippine Journal of Science should be addressed: Library, Bureau of Science, Manila, P. I.

Subscriptions may be sent to the BUSINESS MANAGER, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below:

AGENTS.

The Macmillan Company, 64-66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

Entered at the postoffice at Manila, P. I., as second-class matter.

VOL. VII, SEC. C, NO. 4 SEPTEMBER, 1912

THE PHILIPPINE JOURNAL OF SCIENCE

ALVIN J. COX, M. A., PH. D.
GENERAL EDITOR

SECTION C. BOTANY

E. D. MERRILL, M. S.
EDITOR

WITH THE COOPERATION OF

P. W. GRAFF, B. S.; W. H. BROWN, PH. D.
H. N. WHITFORD, PH. D.



MANILA
BUREAU OF PRINTING
1912

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

REPORT OF THE INTERNATIONAL PLAGUE CONFERENCE

Held at Mukden, April, 1911, under the auspices of the Chinese Government.

Edited by EMILE MARTINI, G. F. PETRIE, ARTHUR STANLEY, AND RICHARD P. STRONG.

483 pages, 16 plates (2 colored, 4 half-tones, 12 charts and maps).

Order No. 416. Cloth, $3.50; paper, $2.50 United States currency, postpaid.

The proceedings of this International Conference and information gained therefrom, together with the results of certain bacteriological investigations, constitute the present report.

Nothing hitherto has been published which gives such a complete and comprehensive account of the entire subject of pneumonic plague.

Delegates from America (United States of), Austria-Hungary, France, Germany, Great Britain, Italy, Japan, Mexico, the Netherlands, Russia, and China attended the Conference.

The Bureau of Science of the Government of the Philippine Islands has been appointed sole agent for the distribution of the printed proceedings of the International Prague Conference.

THE SUGAR INDUSTRY IN THE ISLAND OF NEGROS.

By HERBERT S. WALKER.

145 pages, 10 plates, 1 map.

Order No. 412. Paper, $1.25 United States currency, postpaid.

Considered from the viewpoint of practical utility, Mr. Walker's Sugar Industry in the Island of Negros is one of the most important papers published by the Bureau of Science. This volume is a real contribution to the subject; it is not a mere compilation, for the author was in the field and understands the conditions of which he writes. The following is a brief synopsis of the contents:

Studies of soil analyses, both chemical and physical; analyses of the cane, juice and bagasse; estimates based on actual information as to the costs of production and of cultivation; and estimates of the cost and location of possible central factories. The island is considered by sugar-producing districts; the area of cultivation and the production per hectare are given, and the possibility for future expansion discussed.

The plates illustrate various phases of sugar industry from the cultivation of the field to the transportation of sugar in native sailboats.

A MANUAL OF PHILIPPINE SILK CULTURE.

By CHARLES S. BANKS.

53 pages, 29 plates.

Order No. 415. Paper, $0.75 United States currency, postpaid.

The silk industry is particularly suited to be undertaken by persons with small capital, and like the making of hats in the Philippine Islands it should thrive with a little encouragement.

In A Manual of Philippine Silk Culture we have presented the results of several years' actual work with silk-producing larvæ together with a description of the new Philippine reel. Half-tone plates illustrate in natural size silkworms in different stages of development, pupæ, adult moths, samples of cloth made from eri silk, hand reel, and silk house. Other plates illustrate the various appliances used in raising silkworms and in spinning silk; hand and power reels are illustrated; working drawings are given for a silk house and for a hand reel.

THE PHILIPPINE
JOURNAL OF SCIENCE
C. BOTANY

VOL. VII. SEPTEMBER, 1912 No. 4

THE RELATION OF RAFFLESIA MANILLANA TO ITS HOST.

By WILLIAM H. BROWN.

(From the Botanical Section of the Biological Laboratory, Bureau of Science, Manila, P. I.)

The genus *Rafflesia* is particularly interesting on account of the large size of its flowers and the great reduction of its vegetative parts. A flower of *Rafflesia arnoldi* R. Br., according to a description by Arnold in a letter to Robert Brown,[1] measured a yard across and sprang from a root about the size of two fingers. Brown described the flower as parasitic on a species of *Cissus* and thought that part of the base was derived from the host. This opinion he later confirmed[2] and showed that the shoot of *Rafflesia* consisted of a short thick stalk terminating in a single large flower, around which, in its early stages, there were a number of bracts; and that the base of the shoot was embedded in a cup-shaped mass of tissue formed by the host. The general relation of the parts of the flower and host is shown in figure 3 which represents an expanded flower bud of *Rafflesia manillana*. Robert Brown's drawings show the young buds covered by the bark of the host.

[1] Brown, R. An Account of a New Genus of Plants, named Rafflesia. *Trans. Linn. Soc.* 13 (1842) 201–234.

[2] Brown, R. Description of the Female Flower and Fruit of Rafflesia Arnoldi, with Remarks on its Affinities; and an Illustration of the Structure of Hydnora Africana. *Trans. Linn. Soc.* 19 (1845) 221–239.

According to Schaar,[3] Unger,[4] in a paper which is not available to the writer, says in reference to *Rafflesia patma,* "Wir sehen den Parasiten mit der Nährpflanze in der Art vereinigt, dass derselbe unmittelbar über dem Holzkörper seines Trägers entspringt und durch sein Gefässsysten mit dem Gefässsystem der Nährpflanze anastomosirt."

Solms-Laubach [5] showed that the vegetative portion of *Pilostyles haussknechtii,* one of the *Rafflesiaceae,* consisted of simple cell strands in the pith, medullary rays, vascular elements and bark of species of *Astragalus.* These cell-strands Solms-Laubach designated as mycelium on account of their resemblance to the mycelium of a fungus. They extend into the bases of the leaves where they form cushions from which the flower buds are developed. These buds break through the tissues of the host and appear upon the basal portion of the leaves.

A similar structure of the vegetative portion of the plant has been shown by Solms-Laubach [6] and Peirce [7] for *Brugmansia zippelii,* by Solms-Laubach [8] and Pierce [7] for *Rafflesia patma* and by Schaar [9] for *Rafflesia rochussenii.*

The present study is based upon material of *Rafflesia manillana* Teschem.[10] collected during January and February, 1912, on a forested ridge of Mount Maquiling, Province of Laguna, Luzon, at an elevation of about 400 meters.

The original description of *Rafflesia manillana* by Teschemacher was based on small unopened male buds, preserved in alcohol. The only description of an expanded flower is a short and unsatisfactory one by Blanco [11] of a male flower of *R. phil-*

[3] Schaar, F. Uber den Bau des Thallus von Rafflesia Rochussenii Teysm. [und] Binn. *Siztber. Acad. Wien* 107 (1898) Abt. 1: 1039–1056.

[4] Unger, F. Beiträge zur Kenntniss der parasitischen Pflanzen. *Annalen des Wiener Museums der Naturgeschichte.* 2 (1840).

[5] Solms-Laubach, H. Graf zu, Uber den Thallus von Pilostyles haussknechtii. *Bot. Zeit.* 32 (1874) 49–59, 65–74.

[6] Solms-Laubach, H. Graf zu, Die Entwicklung der Bluten bei Brugmansia zippelii und Aristolochia clematitis. *Bot. Zeit.* 34 (1876) 449.

[7] Peirce, G. J. On the Structure of the Haustoria of some Phanerogamic Parasites. *Ann. Bot.* 7 (1893) 291–327.

[8] Solms-Laubach, H. Graf zu, Rafflesiaceae. Engler & Prantl Nat. Pflanzenfam. 3 [1] (1889).

[9] Schaar, F. Sitzber. Acad. Wien 107 (1898) Abt. 1: 1039–1056.

[10] Teschemacher, J. E. On a new species of Rafflesia from Manilla. *Boston Journ. Nat. Hist.* 4 (1844) 63–65, t. 6; *Ann. & Mag. Nat. Hist.* 9: 381–384.

[11] Blanco, M. Flora de Filipinas, ed. 2 (1845) 565.

ippinensis, which is evidently the same species as *R. manillana* Teschem. The female flower has not been previously described.

The material of *Rafflesia manillana* from Mount Maquiling was parasitic on a species of *Cissus*. The male and female flowers have the same general appearance. (A male flower is shown in fig. 1 and a female one in fig. 2.) The differences seen in the photographs are individual variations and are not characteristics of the sexes. When fully expanded the flowers are from 15 to 20 cm in breadth and from 7 to 9 cm in height. The base of the flower is embedded in a cup-shaped mass of tissue formed from the root of the host (figs. 3, 9, 10). The outer surface of this tissue is rough but not reticulate as in *R. arnoldi* R. Br.

The young buds (fig. 9) are enveloped in several series of sessile, imbricate, coriaceous, brown, broadly ovate, rounded bracts with prominent veins, the inner of which become gradually larger. When the flower is expanded the innermost bracts are about 7 cm long and 5.5 cm wide. As the bud expands these bracts become broken so that usually only the inner ones and the basal portion of the outer ones remain attached to the fully expanded flower.

When the flowers first open they have a light reddish-brown color. This color gradually grows darker until it becomes black in old flowers. The perianth (figs. 1–3) consists of a broad, somewhat turbinate tube 7 to 9 cm in diameter, bearing 5 suborbicular to subreniform lobes. The lobes are about 7 cm broad and 5 cm long, at first spreading, in age becoming recurved. The perianth-tube is crowned inside by a prominent, continuous, incurved annulus, the tube, inside, being about 2.5 cm deep. The inner surface of the tube and annulus is thickly spotted with white warty patches. These increase in length from a fraction of a mm at the base of the tube to nearly a cm at the top (figs. 1, 3). At the base of the tube these consist of rounded masses on slender stalks, but as they increase in size they become sessile. The inner surface of the lobes is spotted with smooth, white, raised patches (figs. 1, 2). In the center of the flower (figs. 1–4) there is a large column which rises from a circular, basal disk, thickly beset with stout brown hairs. The column terminates in an expanded, circular, convex disk surrounded by a raised margin. On the top of the disk there are from 10 to 30 large raised processes. The tips of these processes and the margin of the disk are densely brown-tomentose. The column is about 2 cm in height and the disk at its summit 4.5 cm broad.

All parts of the flower are very thick, fleshy and brittle. The flower has a distinctly putrid odor which is, however, not very strong.

The anthers (fig. 4) are suspended in a circular arrangement from the lower surface of the disk at the summit of the central column and are partitioned off from each other by plates of tissue. In the material examined there were from 12 to 14 anthers. According to Teschemacher there are 10. The anthers are round and open by an apical pore which connects with a number of cavities running through the anther longitudinally. The pollen, when discharged, is suspended in a liquid. This liquid, containing the pollen, hangs as a yellow drop from the lower end of the anther mass. Corresponding to each anther there is in the central column a deep groove which runs down into the basal disk. In the female flower these grooves are developed to a much less extent or may be entirely wanting. Without an examination of the lower surface of the disk at the top of the column, which necessitates the mutilation of the flower, the relative development of the grooves in the column and basal disk is the only superficial character by which the male and female flowers can be distinguished. The only parts of these grooves, which are visible in an entire flower, are the lower ends in the basal disk. The stigmatic surfaces of the female flower correspond in position to the anthers of the male (fig. 3). The ovarial cavity consists of labarynthine passages occupying a disk-shaped region below the central column (fig. 3). In the male flower this region is occupied by parenchymatous tissue (fig. 4). The ovules are small and exceedingly numerous.

Although both the condition of the pollen and the odor of the flower suggest that pollination is performed by insects, no flying insects have been seen around the plants. Old flowers are, however, always infested with insect larvæ, prominent among which are those of a species of Coleoptera. A large number of anthers were examined but in no case did the pollen appear to have been disturbed. Moreover no seed or developing embryos have been discovered. This is probably due to a scarcity of the pollinating insect as both the pollen and embryo-sacs appear to be perfectly normal.

The ovule is anatropus and has one integument. The archesporium differentiates in the apex of the nucellus as a single hypodermal cell surrounded by a single epidermal layer. The archesporial cell without further division functions as a megaspore mother cell, its nucleus undergoing the usual heterotypic

prophases. After becoming considerably enlarged the megaspore mother cell divides into a small micropylar and a larger chalazal daughter cell. The micropylar daughter cell usually divides in a plane parallel with the longitudinal axis of the nucellus. The chalazal daughter cell divides unequally into two megaspores, the chalazal or innermost one of which gives rise to the embroyo-sac. The three micropylar megaspores degenerate. The embroy-sac is formed from the megaspore by three successive divisions and is of the usual 8-nucleate type. It contains an egg, two synergids, three antipodals and two polar nuclei. At first it is somewhat elongated but as growth proceeds it becomes more nearly round. The antipodals are ephemeral and degenerate early. The polar nuclei fuse without the occurrence of fertilization. No sign of fertilization has been observed in the material examined, and in old ovules the embryo-sacs had degenerated. The rarity of *Rafflesia manillana* may well be due, in part, to the fact that its flowers are frequently not pollinated.

In the cases observed the open flowers did not increase in size. The chief changes observed were that they turned black and shriveled to some extent while the tissues gradually died. The ovules remained about the same size. There was a tendency for the tissue around them to break down into a semi-fluid mass, in which they degenerated in a few days. The flowers became infested with a number of insects and larvæ some of which bored from the outside into the cavity containing the ovules. This allowed other insects to enter the cavity, and several kinds were usually found within it. It is possible that the seeds, if formed, are disseminated by some of these insects, as the ovules are enclosed in the fleshy tissue of the flower and there is no evident means of seed dispersal.

VEGETATIVE STRUCTURE.

The vegetative structure of *Rafflesia manillana* is quite similar to that of the other species of the *Rafflesiaceae*, previously mentioned. It consists, for the most part, of rows of single cells running through the bark, cambium, medullary rays and xylem elements. In the material examined these cell-rows occurred more frequently in the tissues of the woody cylinder than in those of the bark or in the cambium. In the woody cylinder they were about equally frequent in the medullary rays and xylem elements. They were, perhaps, somewhat more numerous in the phloem and sclerenchyma than in the parenchyma of the bark. The cells composing the rows are usually fairly short, rather densely filled with protoplasm, and each contains one prominant opaque nu-

cleus. The arrangement in rows, rather than in tissues, produces an appearance not unlike the mycelium of a fungus. The character of the individual cells is, however, quite distinct from that of fungus cells, which are usually long, vacuolated, and have small inconspicuous nuclei. From the features, mentioned above, it will be seen that the vegetative cells of *Rafflesia manillana* are quite similar to embryonic cells in higher plants, and except for shape, they have an appearance which is quite like that of the embryonic cells in the flower. A row of *Rafflesia* cells in a medullary ray is shown in figure 14. In the upper and lower parts of the figure are sections of xylem rays between which there is a medullary ray. The black spots are medullary ray cells with densely staining contents. The cells of *Rafflesia* are seen as a row running transversely across the center of the figure. They have deep-gray colored contents and prominent nuclei.

The cells of *Rafflesia manillana*, which form the rows in the roots of *Cissus*, are so intimately connected with those of the host that they appear to unite with them in forming a continuous tissue. The cells of the parasite, when in the cambium, medullary rays, or the parenchyma of the bark, are frequently distinguishable from those of the host only by a difference in size and shape, and by the denser contents and more prominent nuclei of those of the parasite (fig. 14).

The cells of *Rafflesia manillana*, in the medullary rays of the woody cylinder, are usually wider, more densely filled with protoplasm, and relatively shorter than those in the xylem. Those in the region of the sieve-tubes have, in general, a greater diameter and denser contents than those in any other portion of the root. Those in the sclerenchyma usually contain large vacuoles and little protoplasm. This vacuolation of the cells, when among the dead and empty ones of the sclerenchyma, the more vigorous appearance of those in the region of the sieve-tubes, and the larger size of the ones in the medullary rays as compared with those in the xylem would indicate that there is little conduction of food material by the vegetative cells of the parasite.

The cell-rows of *Rafflesia manillana* run through the tissues of the host in all directions, but are more prominent in the longitudinal and radial planes of the root than in the tangential. Since they run in all directions in the various tissues, and are certainly continuous for very considerable distances, it is evident that the cells must grow and multiply in all parts of the root. Peirce [12] states that the cells of *Brugmansia zippelii* "grow and

[12] *Ann. Bot.* 7 (1893) 291–327.

multiply in the cambium, they grow only slowly, and do not multiply in the wood and bast." That the cells of *Rafflesia manillana* do not grow and multiply only in the cambium is shown by their presence in the primary tissues of the root. The greater development of the rows in the longitudinal and radial planes of the root than in the tangential or other planes may be due, in part, to their having been formed in embryonic tissue and then carried away from the meristematic region by the development of the tissues of the host, but it is also in the longitudinal and radial planes that the cells of the parasite could most easily push in between those of the host for it is in these planes that the latter are arranged in most regular rows. If the cells of the parasite did not grow and multiply in other than embryonic regions they would become separated by the growth of the host as in *Brugmansia zippelii*.[13] In *Rafflesia manillana*, however, the cells show little if any tendency to become broken by the growth of the host. In fairly large roots rows of cells several millimeters long may be found running radially in the wood. The appearance of the cells of the parasite would, moreover, frequently indicate that they were actively growing through the tissues of the woody cylinder and bark, and in the material examined they were certainly relatively more numerous in the woody cylinder than in the cambium region. In other cases the arrangement of the cells of the parasite in the tissues of the host would seem to be due to their having pushed in between the cells of the root after the latter had ceased growing.

The cells of *Rafflesia manillana* not only occur in the tissues of the host as rows of single cells but also, at times, as strands of tissue in the outer part of the bark of the root. Since these strands of tissue have not been seen in meristematic regions it would seem that they must have been developed in the outer part of the bark. Smaller strands (fig. 15), plates and irregular masses (fig. 16) of tissue are also frequently found in the woody cylinder. The strand of tissue shown in figure 15 is in the xylem of the root and can be distinguished from the latter by the contents and prominant nuclei in its cells. The plates of tissue usually lie in radial planes parallel to the longitudinal axis of the root.

It would appear that the cells of *Rafflesia manillana* grow and multiply in all of the tissues of the host, but that growth is more active in the tissues of the woody cylinder than in the bark. Individual sections, however, show great variations in this respect.

[13] Peirce, *Ann. Bot.* 7 (1893) 291–327.

In some cases the rows of cells of the parasite appear to be wedged in between the cells of the root, and in others they apparently replace them as by a dissolving action. In either case there is very little distortion of the cells of the root, which would indicate that the growth of the parasite through the tissues of the host is made possible by a dissolving action of the parasite rather than by pressure exerted by its cells. In the first case the dissolving action would be exerted on the middle lamella and in the second on the whole cells. The expansion of the cells of the parasite between those of the host must, however, be due in part to pressure exerted by the turgescence of the cells of the parasite.

The bulk of the vegetative cells of *Rafflesia manillana* is small compared with that of the root of *Cissus*, and since they do not cause a distortion of the root or its tissues and probably take only enough nourishment to carry on their growth, it is likely that these vegetative cells, in themselves, do comparatively little harm to the host. As will be shown later, it is not probable that the flowers are nourished by these vegetative cells to any great extent.

The flowers of *Rafflesia manillana* are not produced progressively in the direction of growth of the root of the host, but young buds are frequently found between the scars of old flowers. This would indicate that the cells in one region retain their activity for a considerable length of time, although some of the latter buds may, of course, be due to more recent infections of the root.

DEVELOPMENT OF THE FLOWER.

The flower shoots of *Rafflesia manillana* have their origin in rows of cells which usually cross the cambium of the host. When such a row is to give rise to a shoot, the cells in the region of the cambium proliferate and form a globular mass of meristematic cells (fig. 11), which is embedded partly in the woody cylinder and partly in the bark. The first proliferation may take place equally in the two regions or almost entirely in either. The cambium is destroyed by the developing parasite. These rudiments of flower shoots have been found in roots less than 2 mm in diameter. The method of the origin of the flowers of *Rafflesia manillana* is quite similar to that of *Brugmansia zippelii*.[14] The formation of the flower shoot usually begins in a medullary ray, although it would appear that they sometimes originate between

[14] Solms-Laubach, H. Graf zu, *Bot. Zeit.* 34 (1876) 449.

the xylem and phloem. The growth of the embryonic flower shoot does not, at first, cause any distortion of the tissues of the host, which is probably due in part to the absorption of the latter by the parasite. Soon, however, the embryonic shoot begins to grow more actively in the region toward the phloem, so that the rounded mass of cells becomes top-shaped (fig. 18). This is accompanied by a tendency of the xylem rays to be spread apart around the developing shoot, which process may take place to some extent even before the parasite begins to be top-shaped. The change in the shape of the parasite may take place simply by a more rapid enlargement of the portion in the phloem of the host. The top-shaped appearance is, however, frequently preceded by an irregular outgrowth of the parasite into the bark. This is usually the case when the first proliferation takes place almost entirely in the woody cylinder. At the same time that the xylem rays are becoming spread apart, the bark is pushed up in a dome-shaped projection (figs. 5, 8–11–13).

The presence of the developing parasite in the tissues of the host causes an increased activity of the cambium of the host in the region around the parasite. This, together with the tendency of the parasite to cause the spreading out of the xylem rays, results in the production of a vase-shaped mass of xylem which projects from the side of the root, and in which the base of the parasite is embedded (figs. 21, 22). This vase-shaped mass becomes more prominent as development proceeds. The increased production of xylem is accompanied by a similar increase in the phloem.

The presence of the developing shoot not only causes a greater activity in the cambium, but there is also frequently a tendency for the host to develop a phellogen-like layer around the parasite. When this layer is produced it is usually formed first in the bark and then later may extend completely around the embryonic shoot. The phellogen-like layer, when once formed, gives rise to cells which soon become empty and have an appearance entirely similar to cork. Whenever these cells completely surround the parasite the latter is cut off from its food supply and consequently dies. The time at which the phellogen-like layer is produced, as well as the extent to which it is developed, varies very greatly in different specimens. It would seem that in some cases it does not make its appearance at all, but that in the majority of cases the embryonic shoots are killed by its growth. Usually the shoots are surrounded and killed before they are large enough to cause any appreciable distortion in the tissues of the

host, but in other cases death does not occur until the swelling on the side of the root is a centimeter or more in diameter. To the host the advantage of the process just described seems to be evident, for it must cause a great reduction in the number of flowers produced by the parasite. It may also be of advantage, indirectly, to the parasite for it probably saves the host from becoming exhausted and allows the flowers of the parasite to be produced over an extended period. Why the phellogen-like layer should be produced in some cases and not in others is not evident, but this is probably connected with the relative vigor of host and parasite.

As the shoot of *Rafflesia* develops it would soon burst through the bark of the host if considerable growth did not take place in the latter. The shoot, however, does not break through until a swelling, about 3 cm in diameter, has been formed on the side of the root (fig. 6). If the shoot is formed in a small root, the diameter of the swelling may be much greater than that of the root (figs. 5, 6). The growth of the bark is accomplished by the division of cells throughout that part pushed up by the parasite. These cell divisions sometimes take the form of cambium-like layers. The result is that the cells of the bark are arranged in rows running toward the apex of the swelling (figs. 19, 21, 22). There is, however, considerable irregularity in this arrangement, as the divisions take place in a number of places, and the direction in which the phloem is cut off from the true cambium is constantly changing due to the continual spreading of the xylem. When the parasite is small, the phloem cells, formed from the cambium around it, are cut off in a plane parallel to the longitudinal axis of the root (fig. 19); but as the excessive growth and spreading apart of the xylem rays continues, the phloem cells come to be cut off in a plane which approaches more and more toward being perpendicular to this (fig. 3).

As mentioned before, the most rapidly developing part of the embryonic shoot is the rounded portion in the bark. The enlargement of this soon carries the region of most active growth of the parasite beyond the cambium of the host (figs. 18, 19). As the parasite continues to grow it becomes oval in longitudinal sections, with a pointed base (fig. 19). At this stage the vascular bundles are differentiated in a circular arrangement in the outer part of the parasite. These are shown as dark lines in figure 19. A cambium layer is formed on the outer side of each bundle. During the early stages there is also a

tendency for the cells between the bundles to divide and produce a cambium. This process, if continued, would produce a continuous ring of cambium. Soon, however, the cambium instead of forming such a ring grows around each bundle, the result being that each bundle comes to have a concentric arrangement (fig. 24), as in *Brugmansia zippelii* [15] and *Rafflesia rochussenii.*[16]

While the vascular bundles and cambium are making their appearance, an apical growing region is also in the process of differentiation. This latter is preceded by the formation of a cap over the apex (fig. 20). Since the whole surface of the parasite is joined to the host it would seem that the apex of the shoot could not become a growing region, which would cut off the bracts and floral parts, unless there were some process whereby the growing region would be separated from the host. Apparently the function of the cap is to cause this separation. The cap is formed from a layer, several cells thick, which extends over the upper surface of the parasite (fig. 20). Growth apparently ceases in these cells, after which they become stretched by the enlargement of the part of the parasite below them. A split then comes in between the cap and the underlying tissue, while the cap remains firmly attached to the bark of the host. The apex of the shoot, beneath the cap, is then organized into a growing region from which the bracts and floral parts are cut off successively (figs. 21, 22, 12, 13). The cap continues to be attached to the bark of the host for a considerable period. In figure 21 this shows as a dark streak just under the bark of the host. A large part of the short stalk of *Rafflesia manillana* is formed from the apical growing region and the parasite again becomes top-shaped (figs. 21, 22). The rapid enlargement of the bracts and floral parts causes the cells of the shoot to be arranged in rows more or less perpendicular to the axis of the shoot (figs. 21, 22).

The average bundles of *Rafflesia manillana,* which show as dark streaks in figures 19 and 22, connect with the host in the general region of the cambium. The exact point of connection varies in the same and different specimens. What is perhaps the most usual arrangement is for the cambium around the outer part of the bundles of the parasite to end in approximately the region of the cambium of the host. In other cases, however, various parts of the cambium of the parasite may be in connection with that of the host or the cambium of the parasite

[15] Peirce, C. J., *Ann. Bot.* 7 (1893) 291–327.
[16] Schaar, F., *Sitzber. Acad. Wien* 107 (1898) Abt. 1: 1039–1056.

may be entirely within that of the host. After the separation of the apical region from the host the parasite grows considerably before it breaks through the bark. This is accompanied by a considerable stretching of both host and parasite. The cambium of the parasite has comparatively little to do with the growth of the shoot. It would appear that all of the tissues, except the vascular elements, remain more or less meristematic until a very late stage and that growth and division take place in all parts of the shoot. The result is that there is a considerable enlargement of all parts, except perhaps the tip of the base. Figure 23, which is from a cross section of the central part of a young bud, shows divisions taking place in all directions.

While the above-mentioned processes are going on, a phellogen layer is differentiated in the outer layers of that part of the bark of the host which surrounds the parasite. As the parasite develops, this phellogen layer continues to produce new cells while the older ones on the outside become stretched and tend to be separated by cracks. This results in giving the bark a rough appearance, which becomes more prominent as development proceeds.

As the parasite continues to grow, the flower bud, which has become separated from the bark of the host, finally breaks through it (figs. 6–8). The bark of the host, however, remains attached to the stalk of the parasite until a very late stage when it may become separated in places by the activity of the phellogen-like layers to be described later. The first sign of the breaking through of the flower bud is the appearance of a crack in the bark of the host across the top of the swelling (fig. 6). This gradually increased in length and other intersecting ones make their appearance. The flower bud, which is continually enlarging, then grows out through the opening made by these cracks (figs. 7, 8). The formation of the cracks is evidently due to pressure exerted by the turgid, growing bud.

MacDougal,[17] while experimenting with artificially produced parasites, found that one plant could not be made to grow upon another unless the juices of the graft had a higher osmotic pressure than those of the stock. Judging from the great turgidity of the cells of *Rafflesia manillana*, it would seem that their contents must have a higher osmotic pressure than the contents of those of the root. The ability of the parasite to grow in the

[17] MacDougal, D. J., and Cannon, W. A., The Conditions of Parasitism in Plants. Carnegie Institution of Washington. Publ. 129 (1910).

root of the host and of the bud, to break through the bark is probably due, in part, to the turgor produced by this high osmotic pressure. The enlargement of the tissues of the host around the bud is, however, not a stretching caused by an increase in the size of the parasite, but an active growth which would seem to be due to a stimulus connected with its presence.

After the bud breaks through the bark of the host, that part of the bark which surrounded the flower bud becomes recurved and gradually disappears (fig. 7). The stalk, however, continues to be surrounded by the tissues of the host, which project from the side of the root as a vase-shaped mass. The base of this mass is composed of both wood and bark, while the upper part consists entirely of bark (fig. 3). The wood and bark are separated by the cambium layer. The base of the stalk of the parasite is thus in contact with xylem of the host, and the upper portion with the phloem.

After the parasite breaks through the bark all parts of the shoot continue to enlarge. This is accomplished by a proliferation of cells from the cambium of the host and also in that part of the bark which surrounds the shoot. These processes are similar to those described in the earlier stages. When the flower is mature the stalk is still surrounded by the tissues of the host. There is, however, a tendency for the tissues of the parasite and host to become separated in places. This is due to phellogen-like layers in both host and parasite. In the late stages of the growth of the shoot there is a considerable development of a phellogen-like layer in the inner layers of the bark of the host next to the parasite. This layer has an appearance which is almost identical with the one frequently produced around young shoots, and the development of the two is probably due to similar stimuli. When this phellogen-like layer is formed in the bark of the host another is sometimes developed opposite it in the outer layers of the parasite. The extent of these layers varies in different specimens. In some they are produced over the greater part of the region around the parasite, while in others they extend over only a small portion. In none of the old stages examined did they occupy the whole region and they were never entirely absent. Whenever these two layers were produced opposite each other and were developed to any considerable extent there was a tendency for the host and parasite to become separated.

When the shoot of *Rafflesia manillana* first breaks through the bark of the host only a few of the bracts which surround

the flower are visible (fig. 8). Owing, however, to the larger size of the inner bracts more and more of these become visible as growth proceeds (fig. 9). Finally the corolla appears through the bracts and the bud looses its rounded shape and becomes turbinate (fig. 10). After this the flower soon opens. The growth of the bud is very slow, a bud about the size of one shown in figure 9 taking six weeks to develop into a fully expanded flower.

Peirce [18] states that both the sieve tubes and xylem of *Brugmansia zippelii* are connected with the corresponding elements of the host. Schaar [19] describes the xylem of *Rafflesia rochussenii* as connected with that of the host but was unable to find any union between the sieve tubes of the two. The medullary rays comprise a large part of the roots of the *Cissus* on which *Rafflesia manillana* is parasitic. In consequence of this a considerable proportion of the vascular elements of the parasite end in connection with the medullary rays of the host. Both the xylem and sieve tubes of *Rafflesia* are, however, frequently in direct union with the corresponding elements of *Cissus*. Owing to the concentric arrangement of the bundles of the parasite, this is true of a larger proportion of the xylem than of the sieve tubes and in one specimen in which the bundles of the parasite appeared to end completely within the cambium of the host, there seemed to be little if any chance for a connection between the sieve tubes of host and parasite. In the latter case, however, the parasite appeared to be as vigorous as usual. An examination of figures 3 and 4 shows that a large part of the base of the shoot of *Rafflesia manillana* is surrounded by the phloem of the host. This would appear to obviate the necessity for a very close connection between the sieve tubes of host and parasite, and probably explains the vigorous condition of the parasite in the case just mentioned.

The flowers of *Rafflesia manillana,* observed, decayed soon after opening and gradually disappeared. The part of the bark of the host in contact with the shoot also disappeared. The vase-shaped mass of xylem around the base of the shoot, however, remained as a prominent scar on the root. A recent scar is shown in figure 25 and an older one in figure 26. As the flower disappears a callous is formed over the scar.

An examination of figures 27 and 28, representing a cross and longitudinal section of a root with a scar, appears to show

[18] Peirce, G. J., *Ann. Bot.* 7 (1893) 291–327.
[19] Schaar, F., *Sitzber. Acad. Wien* 107 (1898) Abt. 1 1039–1056.

that the growth of the flowers of *Rafflesia manillana* interfers with the conducting power of the xylem of the host to only a very limited extent. This is due to the excessive development of the xylem which gives the parasite a firm anchorage without its penetrating deeply into the main tissues of the root. The great reduction in the vegetative parts of *Rafflesia* and the excessive growth of the tissues of the root around the shoot would seem to be a fine adjustment between host and parasite which is of great advantage to both. The developing flowers are furnished with an abundant food supply without destroying the tissues of the host to any considerable extent. It would seem, indeed, that the taking of food from the cells of the root is the chief damage which the parasite does to the host.

SUMMARY.

Rafflesia manillana is parasitic on the roots of a species of *Cissus*. The male and female flowers are similar in shape and color, and from 15 to 20 cm in diameter. The base of the flower is embedded in a vase-shaped mass of tissue formed from the root of the host. Pollination was not observed but is probably performed by insects.

The ovules are small and exceedingly numerous. The embryo sac is of the usual 8-nucleate type.

The vegetative portion of *Rafflesia manillana* consists for the most part of rows of cells but also of strands, plates and irregular masses of tissue. The rows of cells occur in the xylem, medullary rays, cambium, phloem and schlerenchyma of the host and apparently grow and multiply in all of these tissues, except perhaps the schlerenchyma. They seem to have little power of conduction and probably do but slight damage to the tissues of the host.

The flowers originate from rows of cells which usually cross the cambium. The row of cells proliferates and forms a rounded mass of meristematic cells which becomes top-shaped by the rapid growth of the part in the bark.

Layers of cork-like cells are frequently produced in the tissues of the host around the parasite. These may cut off the food supply of the latter and cause its death.

The presence of the parasite causes an excessive growth of both the xylem and bark of the host in the region around the parasite and also a spreading apart of the xylem rays. This results in the formation of a vase-shaped mass of tissue in which

the base of the shoot is embedded, and in the early stages a dome-shaped projection of the bark which surrounds the apex of the developing shoot.

The differentiation of the growing point takes place long before the shoot breaks through the bark of the host and is preceded by the formation of a cap of tissues which becomes separated from the apex.

The vascular bundles are concentric and end in the general region of the cambium of the root. Some of the xylem and sieve tubes are connected directly with the corresponding elements of the host.

The enlargement of the parasite finally produces cracks in the bark of the host through which the parasite grows. The bark around the flower gradually disappears but the base of the shoot remains embedded in a mass of xylem and bark formed by the root of the host.

The excessive production of xylem and bark by the root gives the parasite a firm anchorage and abundant food supply while the parasite does not destroy the xylem of the host to any considerable extent. The taking of food from the cells of the root would appear to be the chief damage which the parasite does to the host.

DESCRIPTION OF THE PLATES.

Figures 1 to 13 and 25 to 28 are from fresh material and are photographs by Cortes. Wherever a scale is shown it is divided into cm. Figures 14 to 22 are microphotographs by Martin and 23, 24 by Cortes.

PLATE XII.

FIG. 1. Male flower of *Rafflesia manillana* Teschem.
2. Female flower of *Rafflesia manillana* Teschem. The differences in the shape of the flowers shown in figures 1 and 2 are individual variations and are not characteristic of the sexes.

PLATE XIII.

FIG. 3. Longitudinal section through female flower and root of host. The base of the flower is in contact with a vase-shaped mass of xylem formed by the host. The bark of the host extends around the base of the flower from the xylem half way to the corolla. The cambium between the wood and bark of the host shows plainly as a dark line. The ovarial cavity of *Rafflesia* is shown in the white spongy tissue in the center of the base.
4. Section of unopened male bud of *Rafflesia manillana*. The root of the host is shown in cross section. The bark of the host extends around the base of the flower and ends just under the bracts. Two pollen sacs are seen under the disk which terminates the central column.

PLATE XIV.

FIG. 5. A root of *Cissus* with two small swellings caused by *Rafflesia manillana*.
6. A bud of *Rafflesia manillana* breaking through the bark of *Cissus*.
7. A slightly older bud of *Rafflesia manillana*.
8. A root of *Cissus* with a bud of *Rafflesia manillana* which has, and two which have not, broken through the bark.

PLATE XV.

FIG. 9. A root of *Cissus* with a half grown bud of *Rafflesia manillana* and two swellings.
10. Bud of *Rafflesia manillana* about ready to open.
11. Cross section of root of *Cissus* containing a bud of *Rafflesia manillana*. × 1.5
12. Older stage than figure eleven. × 1.5
13. Older stage than figure twelve. ×1.5

PLATE XVI.

FIG. 14. Root of *Cissus* containing cells of *Rafflesia manillana*. In the upper and lower parts of the figure are sections of xylem rays between which there is a medullary ray. The black spots are medullary ray cells with densely staining contents. The cells of *Rafflesia* are seen as a row running transversely across the center of the figure. They have deep-gray contents and prominent nuclei. × 155

15. Strand of tissue of *Rafflesia manillana* in xylem of *Cissus*. The cells of *Rafflesia* can be distinguished by their deep-gray color and prominent nuclei. × 155

16. Large mass of tissues of *Rafflesia manillana* in central cylinder of *Cissus* root. × 115

PLATE XVII.

FIG. 17. Embryonic shoot of *Rafflesia manillana* in root of *Cissus*. × 155

18. Older shoot of *Rafflesia manillana*. Tissues still undifferentiated. × 60

PLATE XVIII.

FIG. 19. Shoot of *Rafflesia manillana* at the stage when the growing point and vascular bundles are being differentiated. The vascular bundles show as dark streaks in the light colored tissue of the parasite. × 8.5

20. Enlarged view of apex of shoot of *Rafflesia manillana* shown in figure 19. The dark tissue at the top of the figure is the bark of the host. The layer, a few cells in thickness, which is just below this, is the cap which is formed over the growing point of *Rafflesia*. × 100

PLATE XIX.

FIG. 21. Cross section of *Cissus* root containing a young bud of *Rafflesia manillana*. The cap over the apex of *Rafflesia* shows as a dark streak under the bark of the host. × 10

22. Longitudinal section of *Cissus* root containing older bud of *Rafflesia manillana*. × 7.5

PLATE XX.

FIG. 23. Cross section of parenchymatous tissue of *Rafflesia manillana* showing irregular division of cells. × 100

24. Cross section of young vascular bundle of *Rafflesia manillana*. × 100

PLATE XXI.

FIG. 25. Scar left on root of *Cissus* after the disappearance of the flower of *Rafflesia manillana*. × 1.3

26. Scar left on root of *Cissus* after the disappearance of the flower of *Rafflesia manillana*. × 1.3

27. Cross section through a scar on root of *Cissus*. × 1.3

28. Longitudinal section through a scar on root of *Cissus*. ×1.3

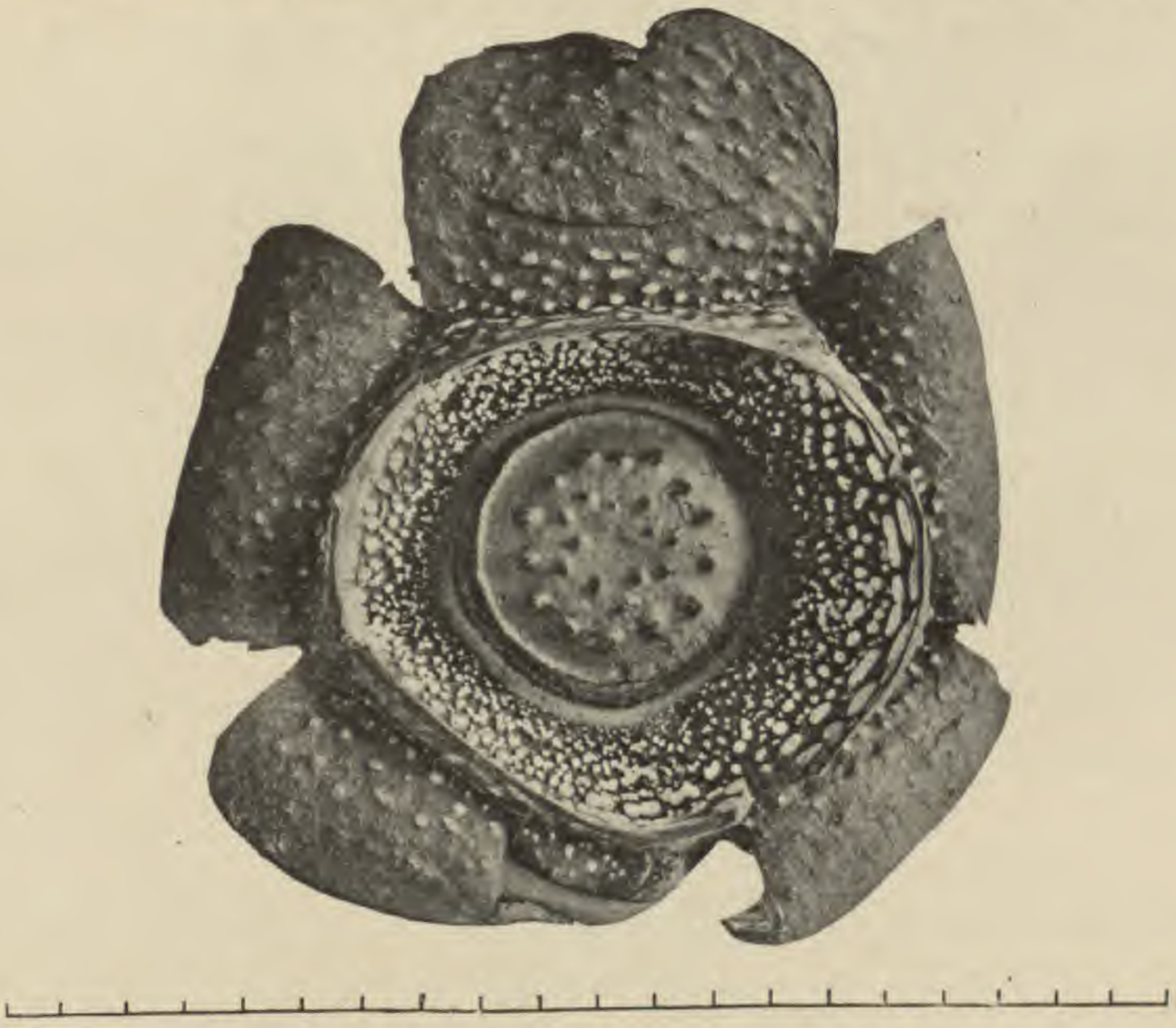


Fig. 1. Male flower of *Rafflesia manillana* Teschem.

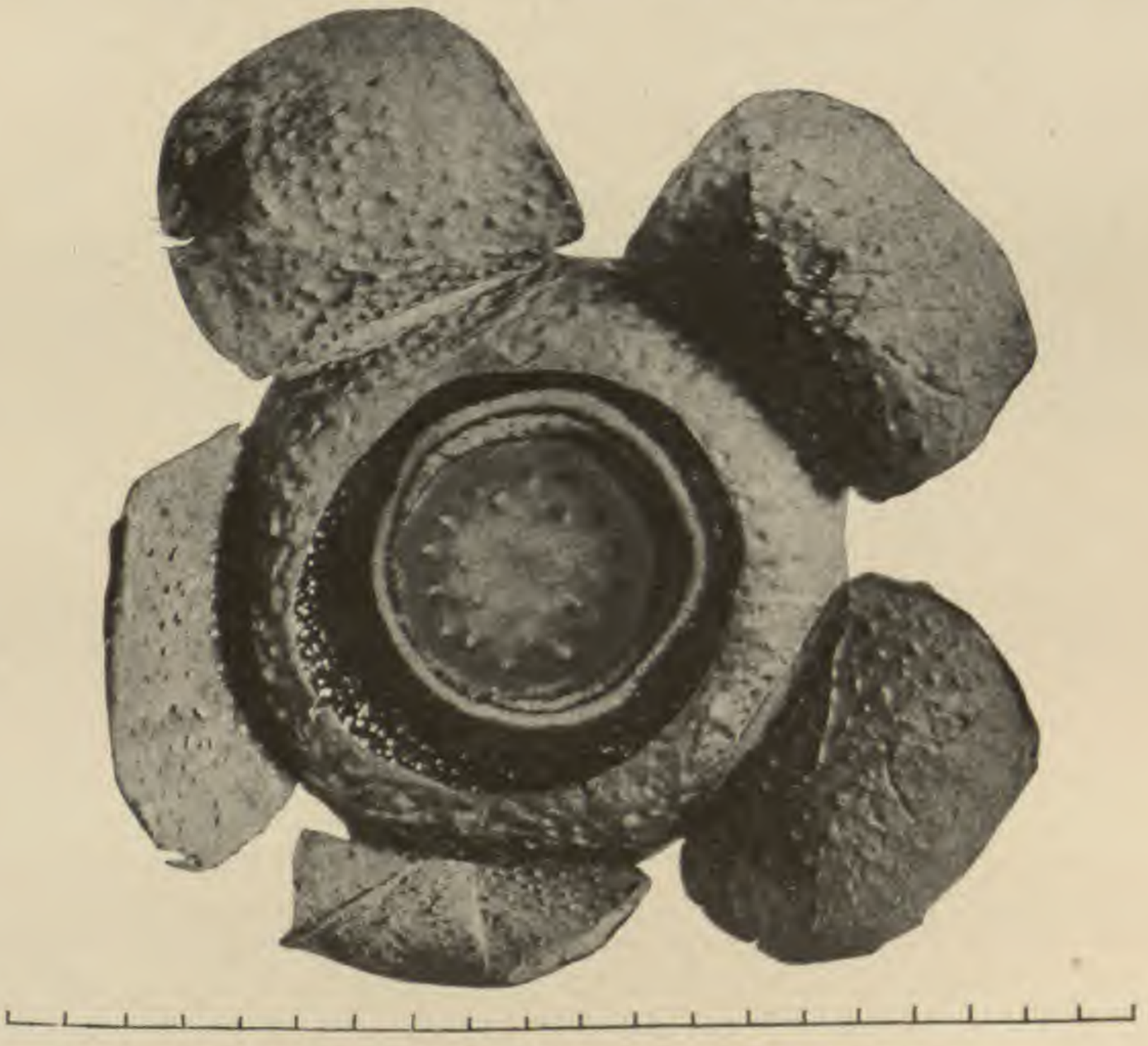


Fig. 2. Female flower of *Rafflesia manillana* Teschem.

PLATE XII.



Fig. 3. Longitudinal section through female flower and root of host.



Fig. 4. Section of unopened male bud of *Rafflesia manillana*.

PLATE XIII.



Fig. 8.



Fig. 7.



Fig. 6.

Fig. 5.

Fig. 5. A root of *Cissus* with two small swellings caused by *Rafflesia manillana*. Fig. 6. A bud of *Rafflesia manillana* breaking through the bark of *Cissus*. Fig. 7. A slightly older bud of *Rafflesia manillana*. Fig. 8. A root of *Cissus* with a bud of *Rafflesia manillana* which has, and two which have not, broken through the bark.

PLATE XIV.



Fig. 9.



Fig. 10.



Fig. 11.



Fig. 12.



Fig. 13.

Figs. 9, 10. Large buds of *Rafflesia manillana*. Figs. 11 to 13. Cross sections of roots of *Cissus* containing buds of *Rafflesia manillana*. × 1.5.

PLATE XV.



Fig. 14. Root of *Cissus* containing cells of *Rafflesia manillana*. × 155.



Fig. 15. Strand of tissue of *Rafflesia manillana* in xylem of *Cissus*. × 115.

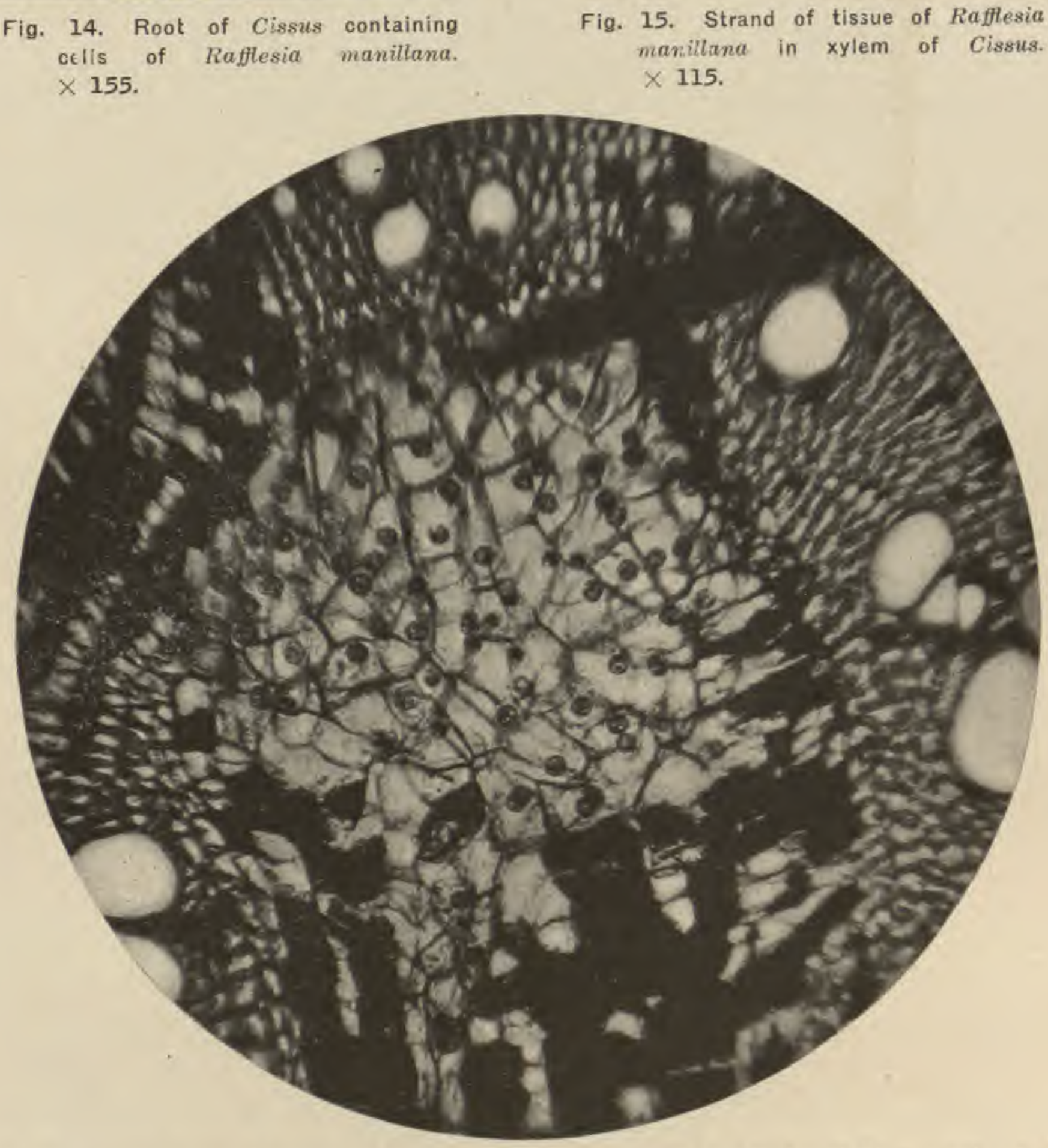


Fig. 16. Large mass of tissues of *Rafflesia manillana* in central cylinder of *Cissus* root. × 60.

PLATE XVI.



Fig. 17. Embryonic shoot of *Rafflesia manillana* in root of *Cissus*. × 155.

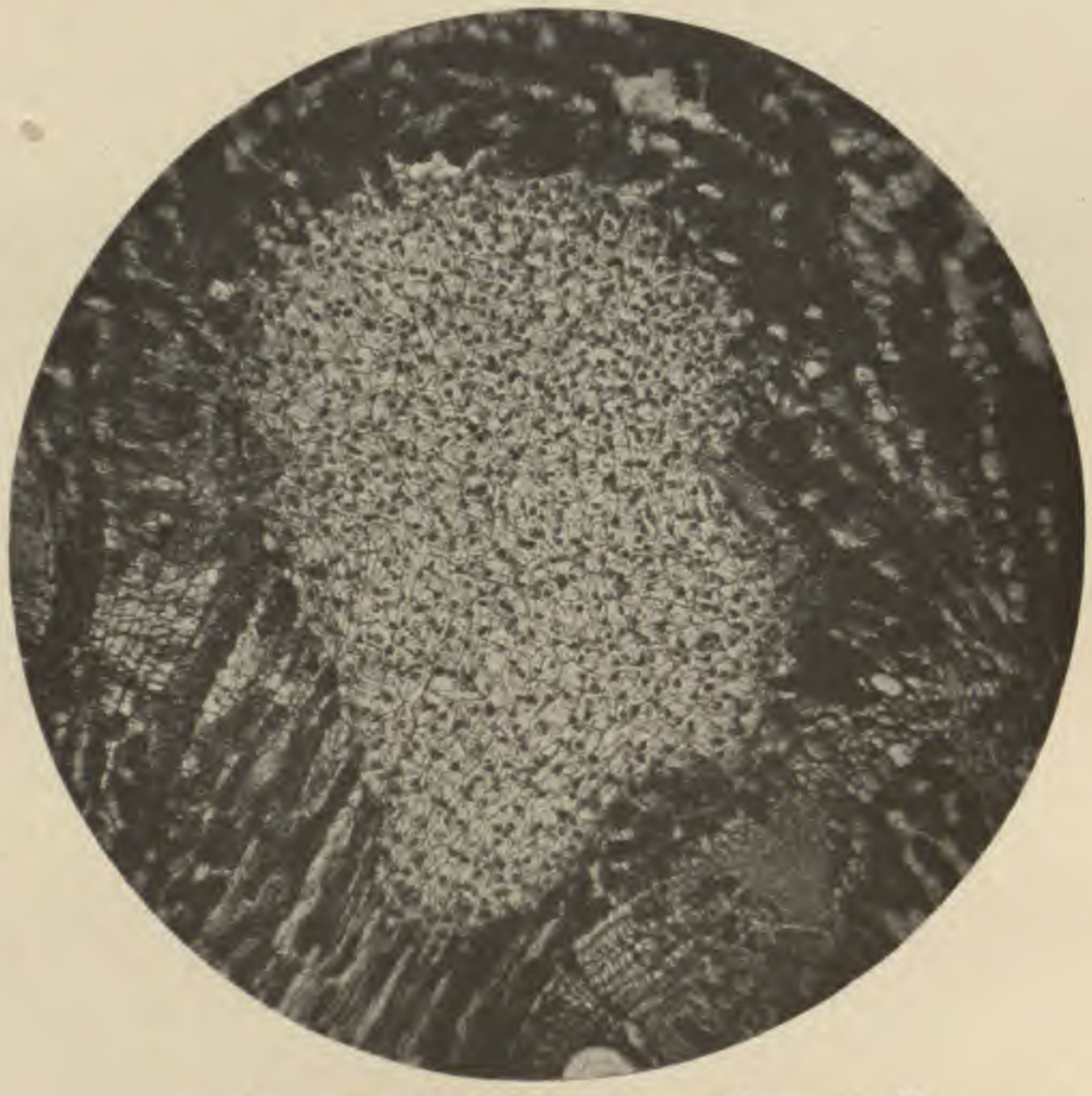


Fig. 18. Older shoot of *Rafflesia manillana*. × 60.

PLATE XVII.



Fig. 19. Shoot of *Rafflesia manillana* at the stage when the growing point and vascular bundles are being differentiated. × 8.5.



Fig. 20. Enlarged view of apex of shoot of *Rafflesia manillana* shown in figure 19. × 100.

PLATE XVIII.



Fig. 21. Cross section of *Cissus* root containing a young bud of *Rafflesia manillana*. × 10.



Fig. 22. Longitudinal section of *Cissus* root containing older bud of *Rafflesia manillana*. × 7.5.

PLATE XIX.

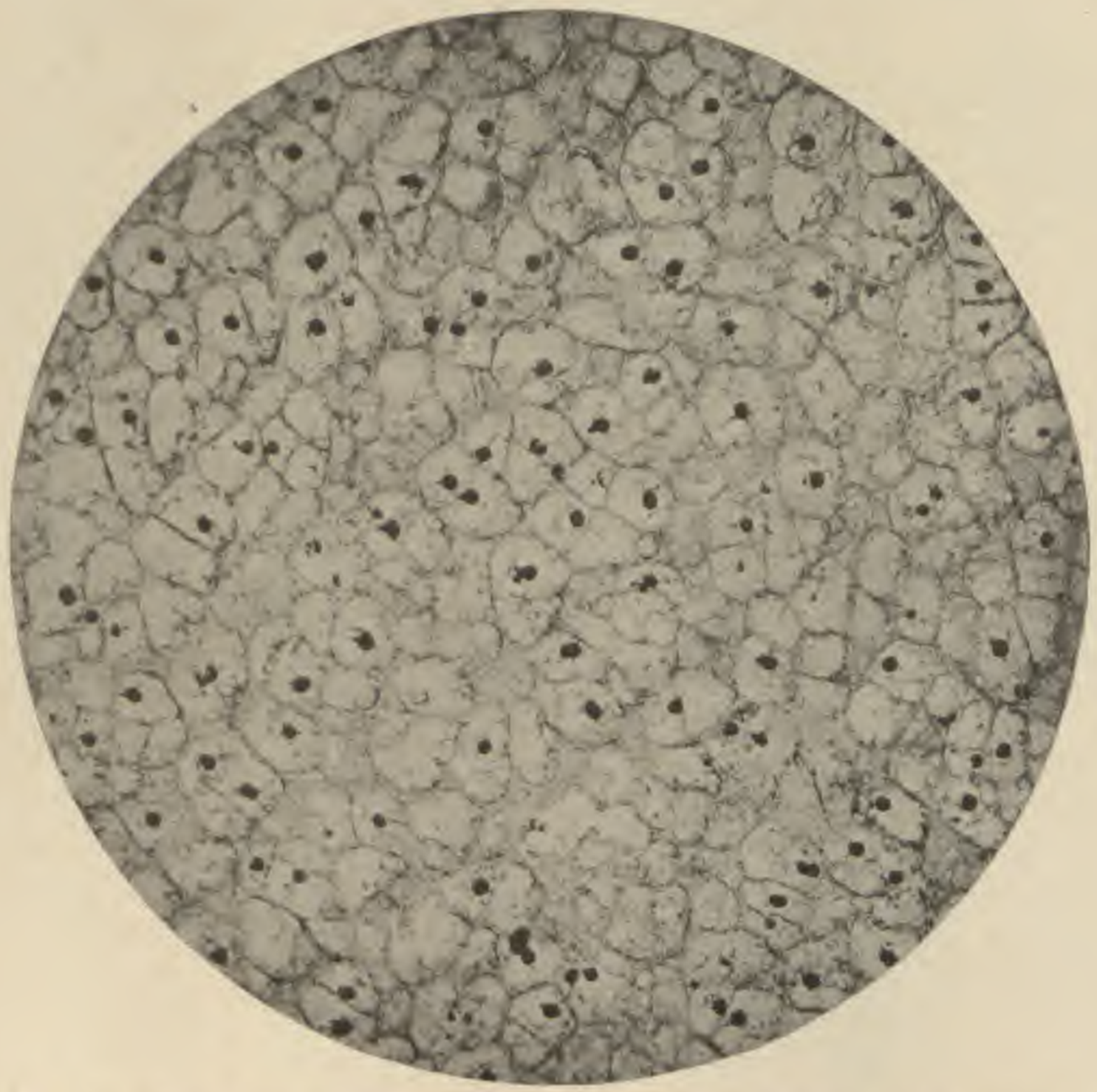


Fig. 23. Cross section of parenchymatous tissue of *Rafflesia manillana* showing irregular division of cells. × 100.

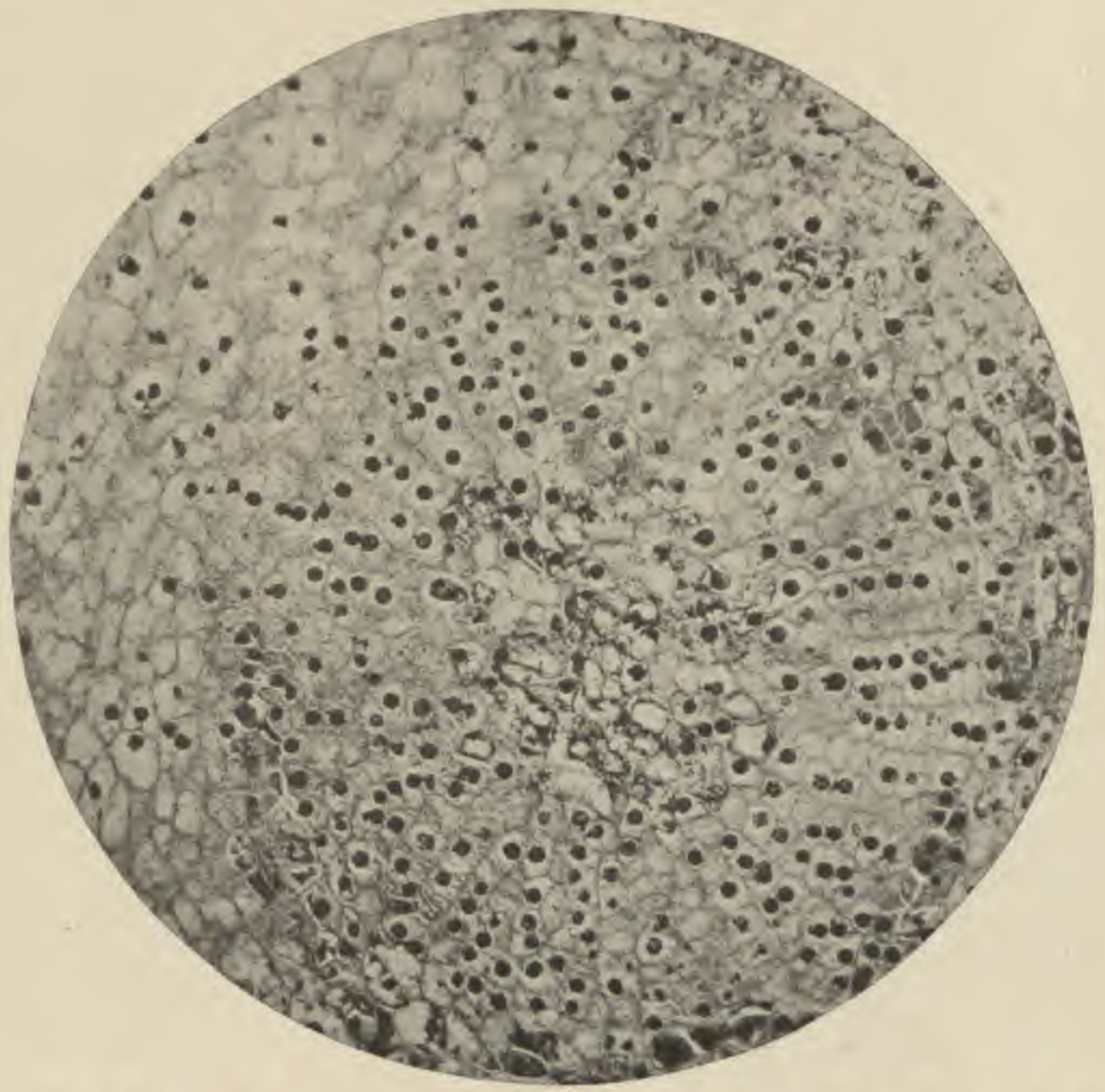


Fig. 24. Cross section of young vascular bundle of *Rafflesia manillana*. × 100.

PLATE XX.



Fig. 25.



Fig. 26.



Fig. 27.



Fig. 28.

Fig. 25. Scar left on root of *Cissus* after the disappearance of the flower of *Rafflesia manillana*. × 1.3. Fig. 26. Scar left on root of *Cissus* after the disappearance of the flower of *Rafflesia manillana*. × 1.3. Fig. 27. Cross section through a scar on root of *Cissus*. × 1.3. Fig. 28. Longitudinal section through a scar on root of *Cissus*. × 1.3.

PLATE XXI.

THE PHILIPPINE JOURNAL OF SCIENCE. C. BOTANY.
Vol. VII, No. 4, September, 1912.

NOMENCLATURAL AND SYSTEMATIC NOTES ON THE FLORA OF MANILA.

By E. D. MERRILL.

(*From the Botanical Section of the Biological Laboratory, Bureau of Science, and the Department of Botany, University of the Philippines, Manila, P. I.*)

In connection with the proximate publication of my "Flora of Manila" [1] it has been found necessary to make certain changes in nomenclature in order to bring the work into conformity with the at present generally accepted code of botanical nomenclature, that of the Vienna Botanical Congress, as modified by the additional list of *nomina conservanda* adopted by the Brussels Botanical Congress. Then too a rather intensive exploration of the region covered by the "Flora of Manila" has brought to light a few apparently undescribed species, and a number of forms, previously described from extra-Philippine material, which have never been definitely recorded as growing in the Archipelago. For the former it has become necessary to prepare diagnoses and descriptions, and for the latter it has been considered worth while to record them as Philippine species. The author does not consider that a publication of the nature of the forthcoming "Flora of Manila" is the proper place in which to describe new species, to make new combinations, to enter into extended discussions of disputed points in nomenclature, or to discuss the validity or nonvalidity of species. Accordingly such matters are considered in the present paper, so that the "Flora of Manila" will contain no descriptions of new species, no new names, and no new combinations.

The following paper contains the descriptions of five presumably new species, and the names of about 13 additional species now definitely recorded from the Archipelago for the first time.

[1] Bureau of Science Publication (1912).

One family, *Stylidiaceae*, with the genus *Stylidium*, although known as Philippine for several years, is here definitely added to the Philippine list. In nomenclatural studies it has been found necessary to publish twenty-three new combinations or new names, in strict accordance with the provisions of the Vienna Code.

POTAMOGETONACEAE.

RUPPIA L.

RUPPIA MARITIMA L. Sp. Pl. (1753) 127, subsp. **ROSTELLATA** Koch in Reichb. Ic. Pl. Crit. (1824) 66, *t. 174;* Graebner in Engl. Pflanzenreich 31 (1907) 144.

LUZON, Province of Rizal, Malabon, *Phil. Pl. 799 Merrill*, January, 1911, in brackish water of fish ponds.

Widely distributed in temperate and tropical regions of both hemispheres. *Ruppia maritima* L. has previously been reported from the Philippines by Naves,[2] but his record has not previously been verified.

HYDROCHARITACEAE.

HALOPHILA Thou.

HALOPHILA BECCARII Aschers. in Nuovo Giorn. Bot. Ital. 3 (1871) 302.

LUZON, Province of Rizal, Parañaque, *Merrill 8045* (det. C. H. Ostenfeld), July, 1911. Abundant in some of the fish ponds, in salt water, in certain ones quite covering the muddy bottom in water 1 m deep or less. A species previously known only from Ceylon and from Sarawak, Borneo, the fourth one of the genus to be found in the Philippines.

GRAMINEAE.

ANDROPOGON L.

ANDROPOGON ZIZANIOIDES (L.) Urb. Symb. Ant. 4 (1903) 79.

Phalaris zizanioides L. Mant. 2 (1771) 183.
Andropogon squarrosus L. f. Suppl. (1781) 433; Hack. in DC Monog. Phan. 6 (1889) 542.
Vetiveria zizanioides Nash in Small Fl. S. E. U. S. (1903) 67.

If *Andropogon* is to be considered in the broad sense, following Hackel's conception of the genus, then the oldest specific name for this well known species, which according to the Vienna Code must be taken up, is that indicated above. More recently the same transfer has also been made by Hochreutiner.[3] The species is widely distributed in the Philippines, but has probably been introduced within historical times.

[2] Novis. App. (1880) 297.
[3] Bull. N. Y. Bot. Gard. 6 (1910) 262.

ARTHRAXON Beauv.

ARTHRAXON QUARTINIANUS (A. Rich.) comb. nov.

Alectridia quartiniana A. Rich. Tent. Fl. Abyss. 2 (1851) 448, *t. 99.*
Arthraxon ciliaris Beauv. subsp. *quartinianus* Hack. in DC. Monog. Phan. 6 (1889) 356.

For the purposes of a local flora it is deemed expedient to consider this form as specifically distinct; it is not uncommon in northern Luzon, and has recently been found in the vicinity of Manila.

In working over the Philippine material of this genus it was noted that our two forms, placed by Hackel as subspecies of *Arthraxon ciliaris* Beauv., were really much more distinct from each other than are some generally recognized species of allied genera. It is believed that the subspecies *langsdorffii* Hack., and the subspecies *quartinianus* Hack., should be held to be distinct species, and in accordance with the Vienna Code, the following new combination is necessary:

ARTHRAXON HISPIDUS (Thunb.) comb. nov.

Phalaris hispida Thunb. Fl. Jap. (1784) 44.
Arthraxon ciliaris Beauv. Agrost. (1812) 111, *t. 11, f. 6.*
Arthraxon ciliaris Beauv. subsp. *langsdorffii* (Trin.) Hack. in DC. Monog. Phan. 6 (1889) 254.

Not uncommon in northern Luzon, but not known from the vicinity of Manila.

ERAGROSTIS Host.

ERAGROSTIS MANGALORICA Hochst. ex Steud. Syn. Gram. (1854) 265.

Eragrostis tenella, R. & S., var. *viscosa* Stapf, subvar. *contracta* Stapf in Hook. f. Fl. Brit. Ind. 7 (1897) 316.

There are two specimens in our herbarium that appear to agree sufficiently with this form, and as our Philippine specimens show no intergradations between the form with the dense, spike-like contracted panicle (*E. mangalorica* Hochst.), and the lax-panicled one (*E. viscosa* Trin.), it may, at least for local purposes, be best considered as having specific rank. The specimens are *Merrill 371,* collected in Manila, August, 1902, and *Bur. Sci. 7452 Ramos,* from Aparri, Province of Cagayan, Luzon. The former has been determined by Pilger[4] as *Eragrostis tenella* var. *viscosa* Stapf.

SPINIFEX L.

SPINIFEX LITTOREUS (Burm. f.) comb. nov.

Stipa littorea Burm. f. Fl. Ind. (1768) 29.
Stipa spinifex L. Mant. 1 (1767) 84.
Spinifex squarrosus L. Mant. 2 (1771) 300.

According to the provisions of the Vienna Code, this new combination is necessary. The oldest specific name is that supplied by *Stipa spinifex* L. (1767), but as the use of duplicate binomials is inadmissible under the Vienna Code, the next oldest specific name must be adopted, that supplied by *Stipa littorea* Burm. f. (1768).

[4] Perk. Frag. Fl. Philip. (1904) 148.

Zoisia Willd. (*Zoysia* Auct.)

ZOISIA MATRELLA (L.) comb. nov.

Agrostis matrella L. Mant. (1767) 185.

Zoisia pungens Willd. in Ges. Naturf. Fr. Neue Schrift. 3 (1801) 441; Hook. f. Fl. Brit. Ind. 7 (1897) 99 (*Zoysia*); Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 342.

Osterdamia matrella O. Kuntze Rev. Gen. Pl. (1891) 781.

This species is common and widely distributed in the Philippines especially near the seashore. The new combination is necessary according to the Vienna Code, as *Zoisia* Willd. (1801) is included in the list of *nomina conservanda* in preference to *Osterdammia* Neck. (1791), while *Agrostis matrella* L. supplies the oldest specific name.

BAMBUSA Schreb.

BAMBUSA GLAUCESCENS (Willd.) Sieb. ex Munro in Trans. Linn. Soc. 26 (1868) 89, in syn.

Ludolphia glaucescens Willd. in Ges. Naturf. Fr. Berl. Mag. 2 (1808) 320, Enum. Hort. Berol. (1809) 1035.

Panicum glaucescens "Lam." ex Roem. & Schultes Syst. 2 (1817) 846.

Arundinaria glaucescens Beauv. Agrost. (1812) 144, 152.

Bambusa nana Roxb. Hort. Beng. (1814) 25, nomen, Fl. Ind. 2 (1832) 199; Gamble in Ann. Bot. Gard. Calcutta 7 (1896) 40, *pl. 38*, Hook. f. Fl. Brit. Ind. 7 (1897) 390, Philip. Journ. Sci. 5 (1910) Bot. 268.

This species is only cultivated in Manila and is a native of China or Japan. Its synonymy is quite complicated, but what is apparently the oldest valid specific name is here adopted. *Panicum arborescens* Linn. Sp. Pl. (1753) 59 may in part be referable here, as "Index Kewensis" gives this species as in part referable to *Arundinaria glaucescens* and in part to *Panicum sparsicomun* Nees. I am unable to determine the type of the Linnean species, the first reference being to "Fl. Zeyl. 43," and the description given by Linnaeus in that work does not appear to me to be applicable to *Bambusa glaucescens;* the second reference is to "Hort. Cliff. 27," which work is not available here. The reference to "*Panicum glaucescens* Lam. Encycl. 4 (1798) 749," quoted by many authors and given in "Index Kewensis," does not appear in Lamarck's work, and Roemer and Schultes appear to have been the first authors to use the name. I am informed by the Director of the Royal Gardens at Kew that the original manuscript of "Index Kewensis" gives no additional information regarding this name, and that it was probably taken up from Roemer & Schultes "Syst. Veg.", or from Kunth's "Enumeratio" without checking the reference. *Panicum arborescens* Lam. is published on page 749 of the "Encyclopedie," and "*Panicum glaucescens*" of Roemer and Schultes was probably an error in transcribing the name. *Panicum arborescens* Lam. (non Linn.) is undoubtedly the same as *Bambusa glaucescens* (Willd.) Sieb. The specific name "*glaucescens*" undoubtedly dates from Willdenow as given in the synonymy above.

CYPERACEAE.

MARISCUS Gaertn.

MARISCUS DILUTUS (Vahl) Nees in Wight Contrib. (1834) 90.

Cyperus dilutus Vahl Enum. 2 (1806) 357.

Mariscus microcephalus Presl Rel. Haenk. 1 (1830) 182; Clarke in Hook. f. Fl. Brit. Ind. 6 (1894) 624, Philip. Journ. Sci. 2 (1907) Bot. 88.

Sphaeromariscus microcephalus Camus Not Syst. 1 (1910) 239.

Very recently E. G. Camus has proposed the new genus *Sphaeromariscus*, based on *Mariscus microcephalus* Presl. Should this proposal meet with general acceptance, Vahl's specific name will later have to be taken up under the new generic name, in accordance with the principles of the Vienna Code of Botanical Nomenclature.

FIMBRISTYLIS Vahl.

FIMBRISTYLIS CORNICULATA sp. nov. § *Trichelostylis.*

Annua, caespitosa, erecta, glabra, circiter 20 cm alta; culmis tenuibus, efoliatis; spiculis paucis, 3 ad 5, simpliciter umbellatis, pedicellatis vel centrale sessile, brunneis, 3 ad 8 mm longis; squamis oblongis; brunneo-puncticulatis, margine ciliatis, apice rotundatis vel retusis, carinatis, carina prominente, excurrente; nux obovata, verruculosa, 0.5 mm longa; stylo 3-partito.

A tufted, glabrous, apparently annual plant, the culms slender, about 20 cm high, terete, slightly striate. Basal leaves few, linear, 5 to 8 cm long, about 1 mm wide; culm-sheaths all near the base, short, leafless. Spikelets few, 3 to 5, arranged in a simple umbel, the middle one sessile, the others pedicelled, ultimately usually reflexed, brown, 3 to 8 mm long, the glumes 15 or less. Involucre at the base of the umbel of few, lanceolate, acuminate bracts 5 mm long or less. Empty glumes about 2.5 mm long, the keel very prominent, excurrent. Flowering glumes oblong, about 2 mm long, brown-puncticulate, margins ciliate-pubescent, apex rounded and cucullate, or retuse, the keel very prominent, excurrent as a distinct awn, the glumes deciduous from the base upward, leaving prominent scars on the rachis. Stamens 2 or 3. Nut obovate, black, verruculose, obscurely triquetrous, about 0.5 mm long; style slightly pubescent, 3-partite.

LUZON, La Loma, near Manila, *Merrill 7359*, December, 1910, in open grasslands, altitude about 10 m.

A species apparently well characterized by its few spikelets and especially by its glumes being rounded and cucullate or retuse, the prominent keel excurrent as a distinct awn. It seems to be allied to *F. tenera* R. & S.

ERIOCAULACEAE.

ERIOCAULON L.

ERIOCAULON ALATUM H. Lecomte in Journ. de Bot. 21 (1908) 104, *fig. 2.*

LUZON, Province of Rizal, Bosoboso, *Bur. Sci. 1831 Ramos*, January, 1907; Manila, La Loma, in old rice paddies, *Merrill 7362*, December, 1910.

The specimens agree perfectly with Lecomte's description and figure, and with a specimen in our herbarium from Cochinchina cited by Lecomte in his original description, ex herb. Pierre.

Previously known only from Indo-China.

COMMELINACEAE.

ANEILEMA R. Br.

ANEILEMA MALABARICUM (L.) comb. nov.

Tradescantia malabarica L. Sp. Pl. ed. 2 (1763) 412.
Commelina nudicaulis Burm. Fl. Ind. (1768) 17, *t. 8, f. 1.*
Aneilema nudiflorum R. Br. Prodr. (1810) 271, in nota; C. B. Clarke in DC. Monog. Phan. 3 (1881) 210.

This species is very common and widely distributed in the Philippines, the above change of name being in accordance with the provisions of the Vienna Code of Botanical Nomenclature. Robert Brown simply mentions the species in a note, basing his *Aneilema nudiflorum* on *Commelina nudiflora* Vahl, who in turn based his species on *Commelina nudiflora* L. Mant. 177. Unfortunately the original *Commelina nudiflora* L. Sp. Pl. (1753) 61, is a valid species of the genus in which it was placed by Linnaeus, but *Commelina nudiflora* L. Mant. (1767) 177 is a quite different species and is *Aneilema nudiflorum* R. Br. Even if *Commelina nudiflora* L. Mant. (1767) 177 were valid, it is antedated by the publication of *Tradescantia malabarica* L. Sp. Pl. ed. 2 (1763) 412.

ANEILEMA VERSICOLOR Dalz. in Hook. Journ. Bot. & Kew Miscel. 3 (1851) 136; Clarke in DC. Monog. Phan. 3 (1881) 208; Hook. f. Fl. Brit. Ind. 6 (1892) 378.

LUZON, Province of Rizal, Antipolo, *Bur. Sci. 10877 Ramos*, October, 1909; Caloocan, *Merrill 3644*, November, 1903; Masambong, *Phil. Pl. 763 Merrill*, November, 1910.

This species has not previously been reported from the Philippines, although it is abundant in old rice lands, etc., in the vicinity of Manila, from Caloocan to La Loma and Masambong. The flowers are russet-brown or brownish-yellow when fresh, but the petals turn dark-purple in drying. India.

ZEBRINA Schnizl.

ZEBRINA PENDULA Schnizl. in Bot. Zeit. 7 (1849) 870; C. B. Clarke in DC. Monog. Phan. 3 (1881) 318.

LUZON, Manila, *Merrill s. n.*, September, 1909, from cultivated specimens, *Baja 203*, August, 1907; Province of Laguna, Nagcarlan, *Bur. Sci. 2469 Foxworthy*, March, 1907.

This widely cultivated species is not uncommon in cultivation in Manila,

and is occasionally found as an escape; in Laguna Province it appears to be thoroughly naturalized, being found about the bases of coconut trees, along roadsides, etc. A native of Mexico.

IRIDACEAE.

ELEUTHERINE Herb.

ELEUTHERINE PALMIFOLIA (L.) comb. nov.

Sisyrinchium palmifolium L. Mant. 1 (1767) 122, saltem pro maxima parte; Naves Noviss. App. (1880) 252.
Sisyrinchium bulbosum Mill. Gard. Dict. ed. 8 (1768) no. 3.
Ixia americana Aubl. Pl. Guian. 1 (1775) 33.
Moraea plicata Sw. Fl. Ind. Occ. 1 (1797) 82.
Eleutherine plicata Herb. in Bot. Reg. 29 (1843) sub *t. 57;* Baker in Journ. Linn. Soc. Bot. 16 (1877) 100.
Antholyza meriana Blanco Fl. Filip. (1837) 24, ed. 2 (1845) 18, non L.

This American species must have been introduced into the Philippines at an early date, and at the present time is of local occurrence, occasionally cultivated, and in some places thoroughly naturalized. It was collected by Cuming (herb. Kew.), and has later been collected by Loher in Benguet Subprovince, Luzon (no. 1609), by Mr. Elmer in southern Negros, and by myself in eastern Mindanao. In accordance with the Vienna Code of Botanical Nomenclature, the above new combination seems to be necessary. The oldest generic name is *Galatea* Salisb. (1812) but *Eleutherine* is retained in the list of *nomina conservanda* of the Vienna Code.

OPILIACEAE.

CHAMPEREIA Griff.

CHAMPEREIA MANILLANA (Blume) comb. nov.

Cansjera manillana Blume Mus. Bot. Lugd.-Bat. 1 (1850) 246; Hallier f. Meded.'s Rijks Herb. 1910 (1911) 14.
Opilia cumingiana Baill. Adansonia 3 (1862) 124.
Opilia manillana Baill. l. c.
Champereia griffithiana Planch. ex Kurz in Journ. As. Soc. Beng. 44[2] (1875) 154; Hook. f. Fl. Brit. Ind. 5 (1886) 236; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26 (1894) 409.
Champereia griffithii Kurz For. Fl. Brit. Burma 2 (1877) 330; F.-Vill. Novis. App. (1880) 185; Vid. Sinopsis Atlas (1883) *t. 81, f. D.*, Phan. Cuming. Philip. (1885) 141.
Champereia cumingiana Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 50.

This common species is represented in the Herbarium of the Bureau of Science by about 50 specimens, from all parts of the Philippines, from northern Luzon to southern Mindanao. It is known from Tenasserim to the Andaman Islands, Penang, and the Malay Peninsula, Formosa, and the Philippines. So far as I have been able to determine, Blume's *Cansjera manillana* supplies the earliest specific name, which is here adopted. Hallier[5] f., who has seen the type in the Leiden Herbarium, states that

[5] Meded.'s Rijks Herbarium 1910 (1911) 14.

Cansjera manillana Blume is the same as *Champereia griffithiana* Planch.; I had previously proposed to take up the name *Champereia cumingiana*,[6] at least for the Philippine form, as it antedates Planchon's specific name. I was not sure, however, that the Philippine plant was the same as the Indian one, although at Kew the Philippine material had been referred to Planchon's species. The type of *Cansjera manillana* Blume was collected in the Philippines by Perrottet, and the type of *Opilia manillana* Baill., was also a Perrottet specimen, undoubtedly the same collection. Baillon does not cite Blume's *Cansjera manillana*, and the use of the same specific name by both authors may have been merely a coincidence, or Baillon may have neglected to cite Blume's previous publication (as *Cansjera*).

The first actual description of the plant seems to have been Blanco's *Malulucban*,[7] but this name has no standing, not being a binomial. Many authors have considered that *Malulucban*, and species similarly described by Blanco, to be of generic rank, but I believe this to be unwarranted. Blanco certainly did not intend them for genera, but simply as descriptions of species that he was unable to place in the Linnean system to his satisfaction; this is made manifest by the fact that the names both in the text and in the index are included in parentheses.

The numerous Philippine specimens have been distributed in part as *Champereia griffithii* Planch., and in part as *C. cumingiana* (Baill.) Merr. While there is some variation in vegetative characters, I am of the opinion but that a single species is represented, and that its proper name is *Champereia manillana* (Blume) Merr.

PORTULACACEAE.

PORTULACA L.

PORTULACA PILOSA L. Sp. Pl. (1753) 445.

LUZON, Province of Cavite, Mendez Nuñez, *Bur. Sci. 1453 Mangubat;* Province of Rizal, Mariquina, *For. Bur. 5207 Curran;* San Juan del Monte, *Guerrero:* Province of Pangasinan, Tayug, *Bur. Sci. 8297 Ramos.*

Not previously reported from the Philippines. Widely distributed in tropical America, introduced in the Philippines and naturalized.

ANONACEAE.

ARTABOTRYS R. Br.

ARTABOTRYS UNCINATUS (Lam.) comb. nov.

Anona uncinata Lam. Encycl. 2 (1786) 127.

Unona uncinata Dun. Monog. Anon. (1817) 105, *t. 25;* DC. Prodr. 1 (1824) 90.

Artabotrys odoratissumus R. Br. Bot. Reg. 423; Hook. f. Fl. Brit. Ind. 1 (1872) 54; King in Ann. Bot. Gard. Calcutta 4 (1893) 44, *pl. 55.*

This species occurs in the Philippines only as an introduced and cultivated plant. Sir George King expresses the opinion that it is truly wild only in southern India and in Ceylon; it is, however, much cultivated in India, and in other tropical countries.

[6] This Journal 1 (1906) Suppl. 50.

[7] Fl. Filip. (1837) 186.

CAPPARIDACEAE.

CAPPARIS L.

CAPPARIS CORDIFOLIA Lam. Encycl. 1 (1785) 609.

Capparis mariana Jacq. Hort. Schoenbr. 1 (1797) 57, *t. 109;* Blanco Fl. Filip. ed. 2 (1845) 305; F.-Vill. Noviss. App. (1880) 11; Safford in Contr. U. S. Nat. Herb. 9 (1905) 212.

Capparis baducca Blanco Fl. Filip. (1837) 438, non Linn.

Capparis spinosa var. *mariana* K. Sch. in Engl. Jahrb. 9 (1887) 201; K. Sch. & Lauterb. Deutsch Schutzgeb. Südsee (1901) 335.

Blanco knew this species only from Parañaque, where it was cultivated in his time, the seeds having been brought from the Marianne Islands; it is still cultivated in Parañaque (Guerrero, Sept., 1911), although not in great quantities, but I have seen no specimens from any other place. It is reported from the Marianne Islands, Guam, from the Caroline Islands, Kuschai and Ualan, from the Marshalls Islands, Nawodo, and from Timor. It may be only a variety of the European *Capparis spinosa* L., as considered by K. Schumann, but whatever its status, Lamarck's specific name is unquestionably the oldest one, and the type of *Capparis cordifolia* was from the Marianne Islands.

LEGUMINOSAE.

DUNBARIA W. & A.

DUNBARIA PUNCTATA (W. & A.) Benth. Pl. Jungh. (1852) 242.

Dolichos punctatus W. & A. Prodr. (1834) 247.

Dolichos conspersus Grah. in Wall. Cat. (1831–32) no. 5542, *nomen nudum.*

Dunbaria conspersa Benth. l. c. 241; Baker in Hook. f. Fl. Brit. Ind. 2 (1876) 218.

LUZON, Province of Rizal, Malapad na bato, near Manila, *Phil. Pl. 433 Ramos,* September, 1910.

What is the oldest valid name for this species is here adopted, for *Dolichos conspersus* Grah., as originally used, is only a *nomen nudum.*

Not previously reported from the Philippines. India to China, southward to northern Australia.

SESBANIA Pers.

SESBANIA SESBAN (L.) comb. nov.

Aeschynomene sesban L. Sp. Pl. (1753) 714.

Coronila sesban Willd. Sp. Pl. 3 (1806) 1147.

Sesbania aegyptiaca Poir. in Lam. Encycl. 7 (1806) 128; Pers. Syn. 2 (1807) 316; Baker in Hook. f. Fl. Brit. Ind. 2 (1876) 114; Prain in Journ. As. Soc. Beng. 66 [2] (1897) 367.

Emerus sesban O. Ktze Rev. Gen. Pl. (1891) 180.

MANILA, *Shaw,* September, 1911.

Not previously reported from the Philippines; widely distributed in the tropics of the Old World, and according to Prain l. c., the var *picta* (*Sesbania picta* Cav.), a native of tropical America, introduced in India. The Philippine specimen is without doubt the variety *typica* of Prain, its flowers uniformly yellow. The above new combination is necessary if the oldest specific name is to be used, for it scarcely forms a "duplicate binomial" excluded by the Vienna Code.

SIMARUBACEAE.

HARRISONIA R. Br.

HARRISONIA PERFORATA (Blanco) comb. nov.

Paliurus perforatus Blanco Fl. Filip. (1837) 174, ed. 2 (1845) 122.
Paliurus dubius Blanco l. c. 175, 122.
Lasiolepis paucijuga Benn. Pl. Jav. Rar. (1838) 202, *t. 42*.
Lasiolepis multijuga Benn. l. c.
Lasiolepis bennetii Planch. in Hook. Lond. Journ. Bot. 5 (1846) 570.
Harrisonia bennetii Hook. f. ex A. W. Benn. in Hook. f. Fl. Brit. Ind. 1 (1875) 519.

This species is widely distributed in the Philippines at low altitudes, extending from northern Luzon to southern Mindanao. Blanco's specific name appears to be the oldest valid one for the species, both *Paliurus perforatus* and *P. dubius* being manifestly the same species. Burma to southern China, southward to Java.

MALPIGHIACEAE.

TRISTELLATEIA Thouars.

Tristellateia australasiae A. Rich. presents an interesting case of synonymy on account of the approximately simultaneous publication of *Platynema laurifolium* Wight & Arn., which all authorities agree to be an exact synonym of Richard's species. The synonymy is as follows:

TRISTELLATEIA AUSTRALASIAE A. Rich. Sert. Astrolab. Atlas (1833) *pl. 15.* (*T. australasica* Auct.)

Gaertneria laurifolia Wall. Cat. (1832) no. 7265, *nomen.*
Tristellateia australis A. Rich. Sert. Astrolab. (text) 2 (1834) 38; Sprague in Curt. Bot. Mag. IV 6 (1910) *t. 8334.*
Platynema laurifolium Wight. & Arn. in Edinb. New Philosoph. Journ. (Apr.–July, 1833) 179; Prodr. (1834) 107.
Hiraea reclinata Blanco Fl. Filip. (1837) 378, non Jacq.
Tristellateia malintana Blanco l. c. ed. 2 (1845) 267.

As there appears to be no means of determining the relative status of the publication of Richard's and Wight & Arnott's names as to priority, the former, being in general use (as *T. australasica*) is here accepted. Authorities generally agree that the volume of plates accompanying Richard's "Sertum Astrolabianum" was published in 1833, and the text, volume one in 1832, volume two, 1834; the plate of *Tristellateia australasiae* shows a complete dissection of the flower, and is hence a valid publication.

As to *Platynema laurifolium* Wight & Arn., this was based on *Gaertneria laurifolia* Wall. (1832), and hence this name is the oldest, although unfortunately the "publication" in Wallich's "List" is only a *nomen nudum* and has no standing; in the "Edinburgh New Philosophical Journal" the genus *Platynema* is described, but the species, *P. laurifolium,* is enumerated without description; the specific description was published in the following year.

I am indebted to Prof. Isaac Bayley Balfour of the Royal Botanic Gardens at Edinburgh, and to Mr. W. Craib of the Kew Gardens for abstracts of certain articles and notes bearing on the case.

MELIACEAE.

SANDORICUM Cav.

SANDORICUM KOETJAPE (Burm. f.) comb. nov.

Melia koetjape Burm. f. Fl. Ind. (1768) 101.
Trichilia nervosa Vahl Symb. 1 (1790) 31.
Sandoricum indicum Cav. Diss. 4 (1787) 359, *t. 202, 203*.

In accordance with the rules governing priority of specific names, the above combination is necessary in the case of this common and well known species; it is unfortunate that the specific name *indicum*, long in use, must be replaced by such a barbarous one as *koetjape*.

POLYGALACEAE.

SALOMONIA Lour.

SALOMONIA CILIATA (L.) DC. Prodr. 1 (1824) 334.

Polygala ciliata L. Sp. Pl. (1753) 705.
Salomonia oblongifolia DC. l. c.; Benn. in Hook. f. Fl. Brit. Ind. 1 (1872) 207.

This species is widely distributed in the Philippines and is not uncommon. Previous authors have identified the local form with *Salomonia oblongifolia* DC., but Trimen,[8] who has examined the specimen in Hermann's herbarium on which Linnaeus based his *Fl. zeyl. 270*, and later his *Polygala ciliata*, is authority for the statement that Linnaeus' type quite corresponds with *Salomonia oblongifolia* DC. Manifestly the specific name *ciliata* should be applied to the present form, and if the species described under this name in Hooker's "Flora of British India" is really distinct, then it should receive a new name.

EUPHORBIACEAE.

EUPHORBIA L.

EUPHORBIA PROSTRATA Ait. Hort. Kew. 2 (1789) 139; Boissier in DC. Prodr. 15[1] (1862) 47.

Specimens of this species were collected in waste places about Manila by Doctor C. F. Millspaugh of the Field Museum of Natural History, in November, 1911. In habitat it is very similar to the common and widely distributed *Euphorbia thymifolia* Burm., at once distinguishible by its capsules being glabrous except for the ciliate-hispid keels of the cocci. The species is otherwise represented in our herbarium by *Wilson 228* from Cuba, and by *Ridley 123, 126* from Christmas Island (south of Java). The species is undoubtedly of American origin, and has previously not been reported from the Philippines.

[8] Journ. Linn. Soc. Bot. 24 (1888) 146.

MACARANGA Thou.

MACARANGA PORTEANA E. André in Rev. Hort. 60 (1888) 176, *f. 36;* Hook. f. in Curtiss' Bot. Mag. (1895) *t. 7407.*

Croton grandifolium Blanco Fl. Filip. (1837) 753, ed. 2 (1845) 518, non *Macaranga grandifolia* Muell.-Arg.

Macaranga mappa F.-Vill. Noviss. App. (1880) 195; Vid. Sinopsis Atlas (1883) *t. 84, f. D,* Rev. Pl. Vasc. Filip. (1886) 246; Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 80, non Muell.-Arg.

This species is fairly well distributed in Luzon, and seems to be sufficiently distinct from *Macaranga mappa* Muell.-Arg., to which Philippine material has been referred by various authors. It was first described by Blanco, but his specific name is invalid in *Macaranga.*

Endemic.

MALLOTUS Lour.

MALLOTUS PAPILLARIS (Blanco) comb. nov.

Adelia papillaris Blanco Fl. Filip. ed. 2 (1845) 562 (*pappilaris*), ed. 3, 3: 225.

Mallotus zollingeri F.-Vill. Nov. App. (1880) 195, non Muell.-Arg.

Frutex erectus 2 ad 3 m altus, omnibus partibus densissime molliter stellato-puberulis vel stellato-pubescentibus; foliis oppositis, late ovatis vel orbiculari-ovatis, basi late subtruncatis vel leviter cordatis, apice acuminatis, margine subintegris vel obscure repandis, usque ad 16 cm longis, basi triplinerviis; racemis ♂ axillaribus, solitariis, usque ad 18 cm longis; staminibus circiter 60; capsulis dense stellato-pubescentibus, processibus paucis, mollibus, brevibus instructis.

An erect shrub 2 to 3 m high, all parts more or less densely covered with a pale or somewhat yellowish indumentum composed of short, stellate hairs. Older branches terete, dark-colored, nearly glabrous. Leaves opposite, broadly ovate to orbicular-ovate, chartaceous, 5 to 16 cm long, nearly as wide, the base broad, subtruncate, sometimes slightly cordate, the apex rather abruptly and often sharply acuminate, the margins subentire or slightly repand, the lower surface with numerous, pale, waxy glands scattered through the indumentum, the indumentum on the upper surface much less dense than on the lower surface; basal nerves three, the lateral pair prominent, reaching to the middle of the leaf or above, the primary ones above the basal pair about 4 on each side of the midrib, prominent, straight or slightly curved, the reticulations distinct, subparallel; petioles 2.5 to 6 cm long. Staminate inflorescence in the upper axils, racemose, solitary, 6 to 18 cm long, densely stellate-pubescent, the flowers 5 to 10 in each fascicle, ebracteolate, their pedicels

about 5 mm long, densely stellate-pubescent. Calyx-segments four, oblong-elliptic, acute or slightly acuminate, outside densely stellate-puberulent. Stamens about 60; filaments glabrous, 2 mm long. Disk none. Capsules about 1.2 cm in diameter, of three dehiscent cocci, depressed, sulcate between the cocci, outside densely pale-stellate-puberulent, and with scattered, soft, pubescent, 2 mm long or less, spine-like processes or papillae which do not form a continuous covering.

LUZON, Province of Rizal, Malapadnabato, *Merrill 2720, Phil. Pl. 434 Ramos;* Morong, *Bur. Sci. 1417, 3324 Ramos;* San Mateo, *For. Bur. 1110 Ahern's collector:* Province of Pampanga, Arayat, *Bolster 56:* Manila, *Didrichen 3148* (Galathea Expedition).

The original description of *Adelia papillaris* (*pappilaris*) Blanco, is entirely inadequate, consisting only of the following "ADELIA PAPPILARIS, ADELIA DE PEZONES. Arbolitos dioicos con las cagillas cubiertas no de barbas sino de pezones cortos. Guadalupe." His material was from near Manila (Guadalupe, Province of Rizal), and I know of but two species of the genus to which the short description applies, the form above described and *Mallotus playfairii* Hemsl; although the latter species is widely distributed in Luzon, we have no material of it from Rizal Province. The above form needing a name, I have assumed it to be the species so inadequately described by Blanco, transferring his specific name to *Mallotus,* and written up a fairly complete description of the species. The Malapadna-bato specimens are from a locality in the vicinity of Guadalupe, the type locality of *Adelia papillaris* Blanco, and it also occurs in thickets just across the Pasig River from Guadalupe.

The species is well characterized by its dense, stellate-puberulent indumentum and by its capsules being supplied with scattered, soft, spine-like processes, similar to those of *Mallotus playfairii* Hemsl.

TILIACEAE.

TRIUMFETTA L.

TRIUMFETTA BARTRAMIA L. Syst. Nat. ed. 10 (1759) 1044, Sp. Pl. ed. 2 (1763) 638.

Bartramia indica L. Sp. Pl. (1753) 389, non *Triumfetta indica* Lam.
Triumfetta rhomboidea Jacq. Enum. Pl. Carib. (1760) 22, Stirp. Amer. Hist. (1763) 147.

The Linnean name for this common and widely distributed species is here retained, as it has manifest priority over the commonly used *T. rhomboidea* Jacq. Linnaeus may have included in *Triumfetta bartramia* more than *Triumfetta rhomboidea* Jacq., as that species in now understood, as suggested by Trimen,[9] but it seems that in most part the Linnean species is the same as Jacquin's.

[9] Fl. Ceyl. 1 (1893) 178.

MALVACEAE.

MALVASTRUM A. Gray.

MALVASTRUM COROMANDELINUM (L.) Garcke in Bonplandia 5 (1857) 297.

Malvastrum tricuspidatum A. Gray Pl. Wright. (1852) 16.

Trimen [10] states that *Malva coromandelina* L. is not, as Garcke supposed, *Malvastrum*, but is *Sida acuta*, basing this statement on an examination of Plukenet's original specimens in the Herbarium of the British Museum. From an examination of Linnaeus' description, it seems to be evident that two different species were included in his *Malva coromandelina*, and there is a chance for disagreement as to what constitutes the type of the species. The first reference, "Malva foliis ovato-oblongis acute serratis, capsulis tricuspidatis. *Hort. cliff. 346.* **Hort. ups. 201*", manifestly cannot apply to any species of *Sida*, and is undoubtedly the species named by many botanists *Malvastrum tricuspidatum* A. Gray. If the first reference be taken as the type of the species, then Garcke is correct, but if the second reference be taken as the type, and this is based on on a figure, Pluk. Mant. *10, t. 334, f. 2,* then Trimen would be correct; unfortunately, should the second reference be selected as the type of the species, this course would necessitate a new name for the very common and widely distributed *Sida acuta* Burm., which it antedates by fifteen years. I consider it best to retain the Linnean name for the *Malvastrum*.

OENOTHERACEAE.

JUSSIAEA L.

JUSSIAEA LINIFOLIA Vahl Eclog. Amer. 2 (1798) 32; DC. Prodr. 3 (1828) 55.

Jussiaea acuminata Sw. Fl. Ind. Occ. 2 (1800) 745; DC. l. c. 54; Rolfe in Journ Bot. 23 (1885) 312; Vid. Phan. Cuming. Philip. (1885) 115, Rev. Pl. Vasc. Filip. (1886) 140.

Jussiaea blumeana Presl Epim. Bot. (1851) 217, non ? DC.

Jussiaea costata Presl l. c.

This species is very common in the Philippines, extending from northern Luzon to southern Mindanao, a weed in rice-paddies, waste places, etc. It has undoubtedly been introduced from tropical America, but is now so abundant and widely distributed as to appear like an indigenous species. All the recently collected material has been distributed as *Ludwigia prostrata* Roxb., to which it has indeed a strong resemblance in superficial characters. It can readily be distinguished, however, by its 8 stamens and by its pods being cylindric, not prominently 4-angled, and the seeds scarcely or not at all visible through the walls.

As to *Jussiaea blumeana* Presl, and *J. costata* Presl, I think there can be no doubt as to their identity not only with each other but also with *J. linifolia* Vahl (*J. acuminata* Sw.). Presl cites the same number of Cuming's collection (665) under both, two specimens of which are in our herbarium; both sheets undoubtedly represent a single species, whatever

[10] Fl. Ceyl. 1 (1893) 141.

may be the case in Presl's herbarium. His descriptions appear to me to apply to a single form. It is suspected also that *Jussiaea blumeana* DC., reported by Miquel from Java, Sumatra, and Borneo, may prove to be identical.

Ludwigia prostrata Roxb., which has locally been confused with the above, appears to be a comparatively rare plant in the Philippines, being represented in our herbarium by four specimens only: LUZON, Province of Cagayan, Tuguegarao, *Bur. Sci. 7936 Ramos*, in part: Province of Rizal, Masambong, *Marave 40;* Caloocan, *Merrill 3670*, November, 1903. MINDANAO, District of Davao, *Williams 2633*.

ARALIACEAE.

NOTHOPANAX Miq.

The type of this genus is unmistakably *Panax fruticosum* L., which species most authors agree is generically distinct from *Panax quinquefolium* L., the type of the Linnean genus. However, there is great difference of opinion as to the proper place of the species and the manifestly allied forms, and the question is greatly confused by the numerous horticultural forms that have received specific names in various allied genera, and by the great variation of many of the species. There are in Manila a number of cultivated forms, all of them introduced, which are difficult to classify not only on account of their variation, but also because most of them rarely or never produce flowers. It seems to me that the logical course to follow is to recognize the genus *Nothopanax* Miq., as valid and typified by *N. fruticosum* (L.) Miq., and to refer to it certain forms that have been described in various genera.

NOTHOPANAX FRUTICOSUM (L.) Miq. Fl. Ind. Bat. 1[1] (1856) 765.

Panax fruticosum L. Sp. Pl. ed. 2 (1763) 1513.

Polyscias fruticosa Harms in Engl. & Prantl. Nat. Pflanzenfam. 3[8] (1894) 45.

Commonly cultivated in and about the larger towns throughout the Philippines, probably of prehistoric introduction. Generally known as *papua*, literally "curled," from the crisped leaves. An exceedingly variable plant, with several distinct varieties in cultivation here, which have received various horticultural names.

NOTHOPANAX COCHLEATUM (Lam.) Miq. l. c. 766.

Aralia cochleata Lam. Encycl. 1 (1783) 224.

Panax cochleatum DC. Prodr. 4 (1830) 255.

Commonly cultivated, rarely or never flowering, locally known by its Spanish name, "platitos."

NOTHOPANAX ORNATUM (Bull.) comb. nov.

Panax ornatum Bull. Cat. (1888) 9.

Commonly cultivated, exceedingly variable in foliage. Of comparatively recent introduction here, occasionally flowering.

NOTHOPANAX CRISPATUM (Bull.) comb. nov.

Panax crispatum Bull. l. c.

Commonly cultivated, rarely or never producing flowers here.

NOTHOPANAX GUILFOYLEI (Cogn. & March.) comb. nov.

Aralia guilfoylei Cogn. & March. Pl. Ornam. 2 (1874) *t. 58.*

Commonly cultivated, but of comparatively recent introduction; probably a native of Polynesia. Rarely or never producing flowers here.

APOCYNACEAE.

TABERNAEMONTANA L.

TABERNAEMONTANA SUBGLOBOSA sp. nov.

Arbuscula glabra usque ad 5 m alta; foliis chartaceis, oblongis, usque ad 18 cm longis, utrinque acuminatis, in siccitate plus minusve nitidis, subtus pallidioribus, nervis utrinque 13 ad 15, distinctis; floribus albis, corollae tubo circiter 1.4 cm longo, calycis lobis orbiculari-ovatis, late rotundatis; folliculis in vivo aurantiacis, subglobosis vel ovoideis, vix carinatis, usque ad 4 cm longis, seminibus circiter 20.

A glabrous shrub 5 m high or less. Branches terete, light-gray, rather slender, usually somewhat striate when dry, lenticellate. Leaves oblong, chartaceous, 9 to 18 cm long, 2.5 to 6.5 cm wide, the apex rather shortly blunt-acuminate, the base sharply decurrent-acuminate, the upper surface dark-colored and somewhat shining when dry, the lower surface much paler, usually somewhat brownish; nerves 13 to 15 on each side of the midrib, distinct beneath, curved upwards near the margins but not anastomosing, the reticulations rather indistinct; petioles 0.8 to 2 cm long. Cymes in the upper axils, few-flowered, 5 cm long or less, the branches few, spreading, the pedicels 12 mm long or less. Calyx about 4 mm long, narrowed below, the lobes broadly orbicular-ovate, 2 to 2.5 mm long, the apex broadly rounded. Corolla white, the tube cylindric, about 1.4 cm long, the lobes about 1 cm in length. Anthers included, 2 mm long. Follicles usually paired, when fresh subglobose to ovoid, smooth, orange-red or red, somewhat fleshy, not keeled, when dry more or less wrinkled, up to 4 cm in length, each containing about 20 seeds, the seeds irregular, oblong, about 8 mm long.

LUZON, Province of Bataan, Lamao River, *Merrill 2511* (type), *3137*, June, October, 1903; *For. Bur. 629 Borden*, with smaller flowers than in the type, April, 1904, *Whitford 370*, June, 1904, *Williams 6*, *Elmer 6783*, November, 1904, *Leiberg 6148*, July, 1904: Province of Rizal, *Phil. Pl. 333*, *340 Ramos; Merrill 1628*, with smaller leaves than in the type: Province of Bulacan, *For. Bur. 7186*, *7193 Curran:* Province of Tarlac, *For. Bur. 9607 Zschokke:* Province of Zambales, *Merrill 2076*, *For. Bur. 916 Maule.* MINDORO, *Merrill 942*, *1190*, *2234*, *For. Bur. 6743 Merritt.* MASBATE, *For. Bur. 12608 Rosenbluth*, *For. Bur. 1695 Clark.*

A species well distinguished from other Philippine forms by its subglobose fruits, but in other characters rather closely similating forms of *Tabernaemontana pandacaqui* Poir. It is probably most closely allied to *T. sphaerocarpa* Bl., but differs from that species in its smaller flowers and leaves.

ASCLEPIADACEAE.

TELOSMA Coville (*Pergularia* Auct., non L.)

The genus *Pergularia* L. has been misinterpreted by most later authors. It is the same as the genus *Daemia* (*Doemia*) R. Br. The new name *Telosma* was proposed by Coville,[11] for *Pergularia* Auct., non L., with the transfer of a single species, *Telosma odoratissima* (Lour.) Coville. Later Mr. N. E. Brown [12] proposed the new name *Prageluria*, but without the transfer of any of the species. *Prageluria* N. E. Br. is an exact synonym of *Telosma* Coville.

TELOSMA PROCUMBENS (Blanco) comb. nov.

Pergularia procumbens Blanco Fl. Filip. (1837) 201; F.-Vill. Noviss. App. (1880) 134; Vid. Sinopsis Atlas (1883) *t. 68, f. D.*

Pergularia glabra Blanco l. c. ed. 2 (1845) 141, ed. 3, 1: 254; Naves l. c. *pl. 397.*

Pergularia filipes Schltr. in Perk. Frag. Fl. Philip. (1904) 135; Merr. in Philip. Journ. Sci. 3 (1908) Bot. 329.

BABUYANES ISLANDS, Camiguin, *Bur. Sci. 4097 Fénix.* LUZON, Province of Pangasinan, Bautista, *Merrill*, July, 1903: Province of Bulacan, Malinta, *Bur. Sci. 6121 Robinson & Merritt*, July, 1908: Province of Rizal, Bosoboso, *For. Bur. 3196 Ahern's collector*, July, 1905, *Bur. Sci. 1473 Ramos*, September, 1906; Masambong, *Merrill*, August, 1910; Montalban, *Merrill*, July, 1910: Province of Bataan, Lamao River, *For. Bur. 1443 Ahern's collector*, August, 1904, *For. Bur. 2105 Borden*, November, 1904: Province of Cavite, Mendez Nuñez, *Bur. Sci. 1332 Mangubat*, August, 1906. MINDANAO, District of Zamboanga, *Merrill 5474*, October, 1906.

A widely distributed endemic species found at low altitudes. The oldest specific name is here adopted for there can be no doubt but that *Pergularia filipes* Schltr., described in 1904, is identical with *Pergularia procumbens* Blanco, described in 1837, and well figured by Naves in the third edition of the "Flora de Filipinas." The species is not uncommon in thickets in the vicinity of Manila.

TELOSMA ANGUSTILOBA (Warb.) comb. nov.

Pergularia angustiloba Warb. in Perk. Frag. Fl. Philip. (1904) 134.

Pergularia accedens Vid. Phan. Cuming Philip. (1885) 127, Rev. Pl. Vasc. Filip. (1886) 189; F.-Vill. Noviss. App. (1880) 134, non Blume.

The type of this species is *Cuming 1334*, in the Berlin Herbarium, and the specimen was collected in Cagayan Province, Luzon, according to Cuming's own list of localities. In the original description the type is cited as "(Cuming) Warburg no. 1334)"; this is an error as the number refers to Cuming's specimen, not to Warburg's. I could find no specimen of this species in the Berlin Herbarium collected by Warburg.

[11] Contr. U. S. Nat. Herb. 9 (1905) 384. [12] Kew Bull. (1907) 325.

CONVOLVULACEAE.

IPOMOEA Linn.

IPOMOEA REPTANS (Linn.) Poir. in Lam. Encycl. Suppl. 3 (1814) 460.

Convolvulus reptans Linn. Sp. Pl. (1753) 158, pro parte.

This species is very common and widely distributed in the Philippines, but there is some doubt as to its proper specific name. The question is one of an interpretation of types only. Hallier f.[13] states that the specimen of *Convolvulus reptans* in the Linnean Herbarium is *Merremia caespitosa* Hallier f. Dr. C. B. Robinson has kindly verified this for me, and confirms Hallier's opinion; he also writes that the species is listed by Linnaeus in a manuscript catalogue of his herbarium (1755), as being then in his possession, so that there is every reason to believe that the specimen was in Linnaeus' hands when he wrote the "Species Plantarum." However, he assumed that a certain plate in Rheede's "Hortus Malabaricus" was the same as the specimen in his herbarium, and in his descriptions cites the reference to Rheede first. Now *Ballel* Rheede Hort. Malabar. 11: 107, *t. 52* is unquestionably the plant usually known as *Ipomea reptans* Poir. (*I. aquatica* Forsk.), and this reference has been accepted by all botanists up to the present date as typifying the Linnean species. The sole question is, whether the specimen in the Linnean herbarium is the type of his *Convolvulus reptans*, or is the species typified by the reference to Rheede' work. The case seems to be very nearly balanced, but if an arbitrary rule be followed and the first reference to a plate be taken as typifying the species, then the reference to Rheede typifies the species; but on the other hand the specimen in the Linnean herbarium may be interpreted as the type, for Linnaeus undoubtedly possessed the specimen at the time the "Species Plantarum" was written. If the reference to Rheede be taken as the type, then no change of name is necessary, but if the specimen in the Linnean herbarium be taken as the type, then two changes are necessary, first the adoption of the binomial *Ipomea aquatica* Forsk., to designate the species now commonly known as *I. reptans* Poir., and secondly the transfer to *Convolvulus reptans* Linn. to *Merremia*, as the oldest specific name of *Merremia caespitosa* Hallier f. In order to avoid any change of name, the reference to Rheede has been accepted by me as typifying *Ipomea reptans* (Linn.) Poir. (*I. aquatica* Forsk.).

MERREMIA Dennst.

MERREMIA HIRTA (L.) comb. nov.

Convolvulus hirtus L. Sp. Pl. (1753) 159; Hallier f. Meded.s' Rijks Herb. (1910) 21.

Convolvulus caespitosus Roxb. Hort. Beng. (1814) 14, nomen, Fl. Ind. 2 (1824) 70.

Ipomoea linifolia Blume Bijdr. (1825) 721.

Skinneria caespitosa Choisy Conv. Or. (1825) 105, *t. 6*, DC. Prodr. 9 (1845) 435.

Merremia caespitosa Hallier f. in Engl. Bot. Jahrb. 16 (1893) 552.

Ipomoea philippinensis Choisy l. cc. 93, 367.

This widely distributed and variable species is common in the Philippines, what is assumed to be the earliest valid specific name being here adopted.

[13] Meded.'s Rijks Herbarium (1910) 21.

Hallier f.[14] calls attention to the fact that *Convolvulus hirtus* L. is the same as *Merremia caespitosa* (Roxb.) Hallier f., after an examination of the specimen in the Linnean herbarium. Dr. C. B. Robinson has kindly examined the Linnean material, and writes that there are two specimens in the Linnean Herbarium under *Convolvulus hirtus*, the first named by Linnaeus, the second not named, but under it Linnaeus has written "Ind."; this second specimen is the slender-leaved, glabrous form which has been described as *Ipomoea philippinensis* Choisy, and Dr. Robinson states that it might well have been a part of the specimen which Linnaeus named *Convolvulus reptans* (see above under *Ipomoea reptans* Poir.). However, it is the first specimen that Linnaeus described, and as he wrote the name on it only, it must be the type. Dr. Robinson states that Linnaeus' description is excellent, the specimen having much broader leaves than the second one, ovate to suborbicular, the inflorescence more developed, and the stems hirsute with spreading hairs. It is possible that more than one species is represented in what Hallier would call *Merremia caespitosa* and that the narrow leaved, glabrous form should be separated from the broad leaved form with hirsute stems. The evidence from specimens in this herbarium, however, seems to indicate that intergrades occur; for instance, some specimens are glabrous or nearly so, with linear leaves and 1- or 2-flowered peduncles; some have linear leaves, hirsute stems, and several-flowered peduncles; some have leaves varying from linear to oblong or oblong-ovate, with the base varying from acute to hastate; and some have mostly ovate leaves. None of the Philippine specimens agree with Linnaeus' description as to leaves "cordato-subrotunda," and none of our broader leaved forms have hirsute stems.

VERBENACEAE.

CLERODENDRON L.

CLERODENDRON COMMERSONII (Poir.) Spreng. Syst. Veg. 2 (1825) 758; Schauer in DC. Prodr. 11 (1847) 673; Miq. Fl. Ind. Bat. 2 (1856) 882.

Volkameria commersonii Poir. in Lam. Encycl. Bot. 8 (1808) 688.
Volkameria nereifolia Roxb. Fl. Ind. 3 (1832) 64.
Clerodendron neriifolium Wall. Cat. (1829) no. 1789; Schauer l. c. 660; Clarke in Hook. f. Fl. Brit. Ind. 4 (1885) 589; Gamble in Journ. As. Soc. Beng. 74 [2] (1909) Extra Number 827.
Clerodendron capsulare Blanco Fl. Filip. (1837) 509, ed. 2 (1845) 355.
Clerodendron inerme Auct. Philip., non Gaertn.

This species is common and widely distributed in the Philippines along the seashore, and is enumerated here simply to call attention to the oldest specific name, provided the species is distinct from *Clerodendron inerme* Gaertn., as Clarke and Gamble have considered it. Poiret's description most certainly applies to this form, although *Clerodendron commersonii* was considered by Schauer among the "species dubiae."

Gamble gives the range of *Clerodendron neriifolium* Wall. (*C. commersonii* Spreng.), as from the Malay Peninsula and Burma to the Philippines, China, Australia, and Polynesia. In addition to the very extensive series of Philippine specimens in this herbarium, we have also the following:

[14] L. c.

Macao, *Gaudichaud;* Formosa, *Henry, Kawakami & Nakahara 822;* Celebes, *Foxworthy 552;* Caroline Islands, Yap, *Volkens 244.*

The type of *Clerodendron commersonii* (Poir.) Spreng. was from the Philippines, Poiret stating that it was collected by Commerson; like the other Philippine plants ascribed to Commerson as collector, it was in all probability collected by Sonnerat.[15]

SCROPHULARIACEAE.

VANDELLIA L.

VANDELLIA VISCOSA (Willd.) comb. nov.

Hornemannia viscosa Willd. Enum. (1809) 654.

Vandellia hirsuta Ham. ex Benth. Scroph. Ind. (1835) 36, DC. Prodr. 10 (1844) 414; Hook. f. Fl. Brit. Ind. 4 (1884) 280.

This widely distributed species is not uncommon in the Philippines. It extends from India to southern China southward to Malaya. What is apparently its oldest valid specific name is here adopted.

VANDELLIA PUSILLA (Willd.) comb. nov.

Gratiola pusilla Willd. Sp. Pl. 1 (1797) 105.

Torenia hirta Cham. & Schlecht. in Linnaea 2 (1827) 571.

Vandellia scabra Benth. Scroph. Ind. (1835) 36, DC. Prodr. 10 (1844) 414; Hook. f. Fl. Brit. Ind. 4 (1884) 281.

This very common and widely distributed species has several specific names older than the one adopted by Bentham and generally used by most authors. *Selago pusilla* Thunb. Prodr. Pl. Cap. (1794–1800) 99, may be even earlier than Willdenow's use of the same specific name, but this I am unable to determine from the literature available here.

LIMNOPHILA R. Br.

LIMNOPHILA MANILENSIS sp. nov.

Herba annua, aromatica, erecta vel suberecta, 10 ad 50 cm alta, simplex vel paullo ramosa, leviter viscoso-hirsuta; foliis sessilibus, oppositis, oblongo-lanceolatis ad lanceolatis, acutis vel obtusis, 1.5 ad 3 cm longis, margine serratis; floribus axillaribus, pedicellatis, solitariis vel in racemis axillaribus dispositis, calycis hirsutis, 5 ad 6 mm longis, profunde 5-fidi, laciniis lanceolatis, acuminatis; corolla circiter 9 mm longa; capsulis ovoideis, 3 ad 4 mm longis.

An erect or ascending, annual, very aromatic herb 50 cm high or less, simple or sparingly branched, the branches, when present, short, all parts slightly viscid-hirsute with short scattered hairs. Stems rather weak, pale when dry, striate. Leaves opposite, sessile, oblong-lanceolate to lanceolate, 1.5 to 3 cm long, 4 to 8 mm wide, acute or obtuse, the margins distinctly serrate, the base usually more or less narrowed, both surfaces very sparingly

[15] Lamarck Encycl. 4 (1797) 387.

hirsute with short scattered hairs, the lower one prominently glandular. Flowers solitary, axillary, pedicelled, or the lower ones usually in short, few-flowered, open, axillary, leafy racemes, the floral leaves similar to the others but much smaller, the racemes 1 to 5 cm long; pedicels hirsute, shorter than the calyx. Calyx hirsute, 5 to 6 mm long, deeply 5-fid, the lobes lanceolate, acuminate. Corolla purplish, about 9 mm long. Capsule ovoid, 3 to 4 mm long.

LUZON, near Manila, *Merrill 7432* (type), January, 1911, *Phil. Pl. 464 Merrill*, December, 1910: Province of Rizal, Mariquina, *Marave 150*, January, 1895: Province of Bulacan, Norzagaray, *Yoder 16*, December, 1906.

I suspect also that *Loher 4339*, of which a mere fragment is before me is referable here, as well as *Vidal 3383* in herb. Kew., both of which have been named *Limnophila diffusa* G. Don. While in a broad conception of that species the Philippine specimens might be referred to it, still the differences are apparently sufficiently great to warrant distinguishing our local form from the Indian one. *Limnophila manilensis* is unquestionably closely allied to *L. diffusa* G. Don, but differs in its sessile, not petioled leaves, and very distinctly pedicelled flowers.

LENTIBULARIACEAE.

UTRICULARIA L.

UTRICULARIA NIVEA Vahl Enum. 1 (1805) 203; Trimen Fl. Ceyl. 3 (1895) 270.

Utricularia racemosa Wall., var. *filicaulis* (Wall.) C. B. Clarke in Hook. f. Fl. Brit. Ind. 4 (1884) 333.

In old rice lands, La Loma, near Manila, *Phil. Pl. 761 Merrill*, November, 1910.

Not previously reported from the Philippines, and here recorded under its oldest specific name. The Philippine plant, however, has pale-purplish flowers rather than white, as in the type of Vahl's species. India and Ceylon to southern China and Malaya.

UTRICULARIA TENERRIMA nom. nov.

Utricularia scandens Oliver in Journ. Linn. Soc. Bot. 3 (1859) 181; C. B. Clarke in Hook. f. Fl. Brit. Ind. 4 (1884) 332, non Benj.

LUZON, La Loma, near Manila, *Merrill 8041*, September, 1911, in open wet grass lands, scattered, twining on the stems of grasses and other plants.

Benjamin in the original diagnosis of *Utricularia scandens* described the slender twining form of *U. wallichiana* Wight, and attached the name to the corresponding specimens in Hooker's herbarium, and also so named a distinct species mounted on the same sheet, as described by Oliver, l. c. Oliver in his consideration of the Indian species of *Utricularia* discovered this fact and redescribed *Utricularia scandens* Benj., this time basing the description on the other plant, there thus being two different descriptions of *Utricularia scandens* Benj., based on two quite distinct plants. It is believed that Benjamin's diagnosis should stand for the species as described by him, not as described by Oliver, and hence the necessity for a new name for *Utricularia scandens* Oliver, non Benj.

Utricularia tenerrima Merr. (*U. scandens* Oliver, non Benj.) has previously been reported only from Madras, but the Philippine specimens appear to me to agree perfectly with the description as given by Oliver.

ACANTHACEAE.

PSEUDERANTHEMUM Radlk.

PSEUDERANTHEMUM PULCHELLUM (Hort.) comb. nov.

Eranthemum pulchellum Hort. Gartenmag. (1810) 176, *t. 17.*
Eranthemum bicolor Schrank. Hort. Monac. (1819) *t. 8;* Nees in DC. Prodr. 11 (1847) 456.
Pseuderanthumum bicolor Radlk. ex Lindau in Engl. & Prantl Nat. Pflanzenfam. 4[3a] (1895) 330, Perk. Frag. Fl. Philip. (1904) 39.
Common and widely distributed in the Philippines; Java, Timor, etc.

STAUROGYNE Wall.

STAUROGYNE RIVULARIS sp. nov.

Herba erecta, plus minusve ramosa, usque ad 20 cm alta, partibus junioribus inflorescentiisque glanduloso-pubescentibus; foliis breviter petiolatis, basi angustatis, anguste oblongo-obovatis vel oblanceolatis, 2 ad 6 cm longis, integris vel obscure undulato-crenatis: floribus brevissime pedicellatis; corolla 7 ad 9 mm longa; capsula oblonga, 5 mm longa.

An erect herb, apparently from a perennial root, usually branched from the base, 10 to 30 cm high, the stems terete, slender, brownish-purple. Younger parts and inflorescence glandular-pubescent. Leaves narrowly oblong-obovate to oblanceolate, 2 to 6 cm long, 5 to 15 mm wide, base narrowed to the short petiole, apex acute or obtuse, entire or obscurely undulate-crenate, thin. Flowers solitary in the axils of the uppermost reduced leaves, forming a terminal, somewhat leafy, spike or spike-like raceme 1 to 5 cm long. Bracteoles glandular-hairy, green, oblanceolate, acuminate or acute, about 7 mm long, 2 mm wide. Calyx green, about 7 mm long, glandular-hairy, the upper lobe lanceolate, 1.6 mm wide, the other 4 linear, about 0.5 mm wide, free nearly to the base, subequal and a little shorter than the upper one. Corolla 7 to 9 mm long, tubular, sparingly pale-purplish or nearly white, the lower lip with distinct deep-purple stripes. Lips subequal, the upper one with 2 orbicular or somewhat reniform, rounded, 1.6 mm long lobes, the lower lip with 3 similar but narrower lobes, glandular at the tip. Stamens unequal, included, the filaments white-hirsute; connective very broad, the cells diverging downward, the anther when spread about 1.5 mm wide. Ovary ellipsoid, 1.5 mm long; style 4 to 5 mm long. Capsule oblong, cylindric or slightly

compressed, sessile, 5 mm long, 2-celled, many seeded. Seeds very numerous, 0.2 mm long or less.

LUZON, Province of Rizal, Masambong, along small streams on ledges subject to overflow in high water, *Merrill 7396*, December, 1910 (type), *Phil. Pl. 755 Merrill*, January, 1911.

A rather characteristic species, quite different from the few other forms of the genus at present known from the Philippines.

STYLIDIACEAE.

In Milbraed's recent monograph of the family[16] six genera and one hundred and twenty species are recognized, with the following range: *Donatia* with two species, one in Antarctic South America to Chile and one in New Zealand and Tasmania; *Phyllachne* with four species, one in Antarctic South America and three in New Zealand; *Forsteria* with four species in New Zealand and Tasmania; *Oreostylidium* with a single species in New Zealand; *Levenhookia* with 6 species in Australia, chiefly in the western part; and *Stylidium* with 103 species, nearly all confined to Australia, a few extending to Tasmania, and three extra-Australian species. These three belong in the section *Andersonia*, which has twelve species, of which nine are confined to Australia, one, *S. uliginosum* Sw., Australia (Queensland), southern China, and Ceylon, and two do not occur in Australia, *S. tenellum* Sw., India to Tonkin and Malacca, and *S. kunthii* Wall., confined to India. For some years a species has been known from the Philippines, but its occurrence here has not before definitely been published. This species is of special interest as it adds another distinct Australian type to our knowledge of the Philippine flora, *S. alsinoides* R. Br., previously known only from Australia, forming with *S. tenerrimum* F. Muell., the section *Alsinoides*.

STYLIDIUM Sw.

STYLIDIUM ALSINOIDES R. Br. Prodr. (1810) 572; DC. Prodr. 7 (1839) 337; F. Muell. Fragm. 1 (1858) 151; Benth. Fl. Austral. 4 (1869) 24; Milbraed in Engl. Pflanzenreich 35 (1908) 40; Ewart, White and Wood in Proc. Royal Soc. Vict. N. S. 23 (1911) 299 (var. *cordifolium*) *pl. 56*.

LUZON, Province of Nueva Vizcaya, *Merrill 107*, June, 1902: Province of Zambales, *Hallier s. n.*: Province of Rizal, *Bur. Sci. 10898 Ramos*: Manila, *Guerrero, s. n.; Loher 6478*: without definite locality, *Loher 3724, 5188* (herb. Kew.). Growing in open wet grassy places, old rice paddies, etc.

The determination of the Philippine material was, I believe, first made by Mr. Rolfe, but one specimen that I sent to Kew was so determined by Mr. Hemsley. Later I examined the material in the Kew herbarium and came to the conclusion that the determination was correct. Still more recently, through the kindness of Mr. F. Manson Bailey, of Brisbane, Dr. A. J. Ewart of Melbourne, and Mr. J. H. Maiden of Sydney, I have received a fine series of Australian specimens of *Stylidium alsinoides* R. Br., and also representative material, including a fragment of the type, of *S. tenerrimum* F. Muell. This material enables me to make a direct

[16] Pflanzenreich 35 (1908) 1–98.

comparison between the Philippine and Australian forms, and although the plants are not identical in all details, no characters have been noted that would warrant distinguishing the Philippine form from the Australian. In our material the length of the capsule varies from 1.5 to 2 cm in length, while in the Australian specimens it is usually 2 cm long or a little longer. The vegetative and floral characters appear to be identical. It is confidently expected that eventually this species will also be found in Celebes and in New Guinea.

The Australian material I have had for comparison is the following:

STYLIDIUM ALSINOIDES R. Br. Mulgrave River, *F. M. Bailey;* Cairns, *E. Betche,* August, 1901; Rockingham Bay, *Dallachy;* Kimberley District, *C. W. Nyulasy;* Port Darwin, *Holtze* (var. *cordifolia* Ewart, White, and Wood).

STYLIDIUM TENERRIMUM F. Muell. North Australia, between Providence Hill and McAdams Range, *F. Mueller,* October, 1855; without definite locality, *Rev. J. E. Tenison Woods.*

COMPOSITAE.

BLUMEA DC.

BLUMEA TENERA sp. nov.

Herba erecta, vix vel pauce ramosa, tenera, usque ad 50 cm alta, parce pilosa vel subglabra; foliis oblongo-oblanceolatis, chartaceis vel subrigidis, subtus parce papilloso-pilosis, 2.5 ad 8 cm longis, acutis, basi angustatis, subsessilibus, margine distanter dentatis, dentibus subrigidis, patulis, spiniformibus; capitulis paucis, paniculatis, pedunculatis, 6 ad 7 mm longis, bracteis linearibus, parce pilosis; pedunculis dense pilosis; receptaculis nudis; floribus hermaphroditis paucis, corolla 4-dentata.

A slender, erect, simple or slightly branched herb 20 to 50 cm high, the stems and branches glabrous or nearly so, less than 1.5 mm in diameter. Leaves oblong-oblanceolate, rather rigid when dry, sessile or subsessile, 2.5 to 8 cm long, 5 to 17 mm wide, acute, base gradually narrowed, margins with rather distant, spreading, rigid, short, spine-like teeth, not lobed, the upper surface slightly hispid when young, scabrid in age, the lower surface with few, soft, white, spreading hairs from papillate bases. Upper part of the stem leafless or nearly so. Heads few, scattered, paniculate, up to 10 in each panicle, peduncled, 6 to 7 mm long, the peduncles slender, densely pilose. Involucral bracts green, linear, acute, the outer ones 1 to 2 mm long, the inner gradually longer, and the innermost 6 to 7 mm long, scarious, slightly hairy or in age nearly glabrous, less than 0.5 mm wide. Flowers yellow, the outer ones numerous, very slender, the corollas about 4 mm long, the styles slightly exserted; interior perfect flowers few, as long as the female ones,

the corolla stouter, somewhat enlarged upwards, 4-toothed, the style not exserted. Achenes 1.2 mm long, linear-oblong or oblong, angled, slightly hairy; pappus hairs about 15, soft, slender, white, about 4 mm long. Disk glabrous.

LUZON, Province of Rizal, between La Loma and Maypajo, near Manila, *Merrill 7363* (type), December 31, 1910, in open grass lands a few meters above sea level, not common. Apparently referable here are *Merrill 679* from Culion, and *For. Bur. 5874 Curran*, from Zambales Province, Luzon, both small forms.

A species apparently related to *Blumea oxyodonta* DC., differing in its more erect habit, the stems not dichotomous, only slightly pubescent and quite differently shaped leaves.

ENHYDRA Lour.

ENHYDRA FLUCTUANS Lour. Fl. Cochinch. (1790) 511; Hook. f. Fl. Brit. Ind. 3 (1881) 304; F.-Vill. Novis. App. (1880) 117.

LUZON, Manila, in open wet grass lands, *F. Espinosa*, March 26, 1911.

India to China southward to Malaya.

This species was reported from the Philippines by F.-Villar, but the specimen cited above is the only one of the species to be recorded from the Archipelago since F.-Villar's previously unverified record was made.

ECLIPTA L.

ECLIPTA ZIPPELIANA Bl. Bijdr. (1826) 914; DC. Prodr. 5 (1836) 490.

LUZON, Manila, *Merrill 44*, May, 1902. Mindanao, District of Zamboanga, *Bur. Sci. 11739 Robinson*, June, 1910; San Ramon, *Hallier*, February, 1904.

This form, which is very much stouter and coarser than *Eclipta alba* (L.) Hassk., I have referred to Blume's species, although with the short published descriptions of that species, it is impossible to determine with certainty whether or not the Philippine material is really referable here. Our material differs from the common *Eclipta alba* not only in its size and habit, but in being prominently hirsute with spreading hairs on all parts, notably on the younger stems, leaves, and petioles, in its broader, differently shaped leaves which are more prominently toothed, and in its much shorter peduncles, which rarely or never exceed 1 cm in length.

Eclipta zippeliana Blume has been reported only from Java, and has been reduced by various authorities to *Eclipta alba* (L.) Hassk.

WEDELIA Jacq.

WEDELIA PROSTRATA (Hook. & Arn.) Hemsl. in Journ. Linn. Soc. Bot. 23 (1888) 434.

Verbesina prostrata Hook. & Arn. Bot. Beech. Voy. (1841) 195.

Wollastonia prostrata Hook. & Arn. l. c. 265.

LUZON, Manila, *Merrill 7549*, April 12, 1911. In open grassy places about the walled city, apparently an introduced plant here.

Japan to southern China and Formosa; not previously reported from the Philippines.

THE PHILIPPINE JOURNAL OF SCIENCE. C, BOTANY.
Vol. VII, No. 4, September, 1912.

DIE SPHAGNA DER PHILIPPINEN.

VON C. WARNSTORF.
(*Berlin-Schöneberg.*)

Obwohl die Torfmoose der zum Monsungebiet gehörenden Provinz der Philippinen in meinem 1911 im Pflanzenreich von Engler erschienenen Werke: "Sphagnales"[1] nach Möglichkeit berücksichtigt worden sind, so ist dennoch unsere Kenntniss dieser überaus schwierigen Pflanzengruppe schon jetzt nach kurzer Zeit nicht unerheblich erweitert worden, indem der Botaniker Herr Merrill in Manila die Güte hatte, mir aus dem dortigen Herbarium des "Bureau of Science" sämtliche dort vorhandenen, von den Philippinen stammenden Torfmoosformen zur Untersuchung zuzusenden, wofür ich ihm an dieser Stelle verbindlichst danke. Nach brieflicher Mitteilung dieses Herrn kommen auf dieser Inselgruppe Sphagna nicht unter 1,400 m Meereshöhe vor, sondern sie steigen auf der Nordinsel Luzon bis 2,700, auf der Südinsel Mindanao bis etwa 2,250 m über dem Meere empor. Vertreten sind nach unserer gegenwärtigen Kenntniss aus dem Gebiet nur 5 Gruppen: 1 *Acutifolia*, 2 *Sericea*, 3 *Cuspidata*, und 4 *Cymbifolia* mit je einer Species, während 5 die *Subsecunda* durch zwei endemische Arten bekannt geworden sind. Es fehlen demnach Vertreter von folgenden Sektionen: 1 *Truncata*, 2 *Polyclada*, 3 *Rigida*, 4 *Squarrosa*, und 5 *Mucronata*.

Am gründlichsten scheint Luzon durchforscht zu sein, da von dort die meisten Torfmoose bekannt sind. Die weiteste Verbreitung findet dort das zu den *Acutifoliis* zählende *Sphagnum Junghuhnianum*, von dem auf Mindoro nur zwei Fundorte zu unserer Kenntniss gelangt sind. Das zu der *Sericeum* Gruppe gehörige, mir bis jetzt nur aus der Westmalayischen Provinz

[1] Warnstorf, C. Sphagnales-Sphagnaceae. Engl. Pflanzenreich 51 (1911) 1–546, fig. 85.

(Sumatra u. Java) bekannte *S. sericeum* ist gegenwärtig nur von Mindoro bekannt, während das schöne charakteristische *S. cuspidatulum*, das ich bisher nur aus der Nordwest-, Südwest- und Zentralmalayischen Provinz sah, an zwei Punkten der Subprovinz von Benguet auf Luzon nachgewiesen werden konnte. Von den zwei endemischen Species der Subsecundumgruppe, *S. luzonense* und *S. Robinsonii* ist die letztere Art für die Wissenschaft neu und soll unten ausführlich beschrieben werden; beide kommen auf Luzon vor. *S. japonicum* var. *philippinense* endlich, der einzige Vertreter von den *Cymbifoliis*, bewohnt ebenfalls nur die Nordinsel. Es sind demnach im Ganzen in der Provinz der Philippinen nur sechs Artentypen von Torfmoosen aufgefunden worden. Dennoch zweifele ich nicht, dass es Botanikern, die die alpine Region der Nord- und Südinsel besuchen, bei grösserer Aufmerksamkeit, die sie den in Rede stehenden *Bryophyten* zuwenden, gelingen wird, dort auch noch andere interessante Species dieser merkwürdigen Moosgruppe aufzufinden, zumal, wenn sie sich zum Gesetz machen, *von jedem einzelnen Sphagnumrasen, der ihnen bei ihren Explorationen aufstösst, Proben aufzunehmen.*

Sectio I. LITHOPHLOEA Russ.

Subsectio 3. CUSPIDATA Schlieph.

1. **SPHAGNUM JUNGHUHNIANUM** Doz. et Mlkb. in Verhandel. Kon. Akad. Wetensch. Amsterd. (1854); Warnst. in Engl. Pflanzenreich 51 (1911) 114.

Diese aus der Provinz der extratropischen Himalaya und der Provinz Yünnan, sowie aus dem Monsungebiet und dem temperierten Ostasien bekannte Species besitzt darnach eine sehr weite Verbreitung und ist, wie bereits hervorgehoben, auch auf den Philippinen, besonders auf Luzon, eine häufige Erscheinung. Fast alle mir aus dieser Monsunprovinz zugekommenen Proben gehören zu

Var. α **TYPICUM** Warnst. in Engl. Pflanzenreich 51 (1911) 116.
LUZON: Province of Abra, Mount Paraga, *Bur. Sci. 7315 Ramos:* Benguet Subprovince, *Bur. Sci. 3455 Mearns;* Baguio, *Elmer 8528;* Mount Pulog, 2500 m, *For. Bur. 16416 Curran, Merritt, & Zschokke;* Pauai, circ. 2075 m, *Merrill, Bur. Sci. 8678 McGregor:* Lepanto Subprovince, Mount Data, 2200 m, *Merrill 4919:* Province of Laguna, Mount Banajao, *Copeland.* MINDANAO: District of Davao, Mount Apo, *Elmer 11369.*

f. **DASYCLADUM** Warnst. l. c.
LUZON: Province of Zambales, Mount Pinatubo *Bur. Sci. 2540 Foxworthy:* Benguet Subprovince, Pauai, 2135 m, *Bur. Sci. 4540 Mearns, Merrill 4920, 4869;* Baguio, 1400 m, *Bur. Sci. 14052 Robinson.* MINDORO: Mount Halcon, 2240 m, *Merrill 5707.*

f. **GRACILE** Warnst. forma nova.

Planta fere submersa, gracilior, ramorum fasciculis remotis; rami patentes tenuiores, recurvati, attenuati, laxe foliosi. Folia ramulina minora, 1.4–1.5 mm longa, 0.7 mm lata, plerumque subito acuminata. Folia caulina permagna, salpe subito acu-



FIG. 1.—*Sphagnum Junghuhnianum* var. *typicum* f. *gracile* Warnst. (*a*) Stamm- (*b*) Astblatt.

minata, circum anguste limbata, 1.7–1.8 mm longa, 0.9 mm lata, usque ad basim multifibrosa et utrinque multiporosa. (Fig. 1.)

LUZON: Benguet Subprovince, Baguio, *Elmer 8528;* Mount Pulog 2700 m, *For. Bur. 16421 Curran, Merritt, & Zschokke.*

Var. **PSEUDOMOLLE** Warnst. l. c. 117.

LUZON: "Luzon central," *Loher.*

Subsectio 2. SERICEA (C. Mull.) Warnst.

2. **SPHAGNUM SERICEUM** C. Müll. in Bot. Zeit. (1847) 481; Warnst. l. c. 169.

MINDORO: Mount Halcon, auf Felswänden, 2000 m, *Merrill 6161.*

Diese schöne, trocken seidenglänzende, zarte Pflanze ist für das Gebiet neu und wird sich gewiss auch noch an anderen Standorten der alpinen Region nachweisen lassen.

Subsectio 3. CUSPIDATA Schleph.

3. **SPHAGNUM CUSPIDATULUM** C. Müll. in Linnæa **38** (1874) 549; Warnst. l. c. 186.

Auch die vorliegende Species war bis jetzt von den Philippinen unbekannt, obgleich ihr Verbreitungskreis innerhalb des Monsungebiets dort ihr Vorkommen vermuten liess. Dieser Verbreitungskreis ist, wie derjenige von *S. Junghuhnianum,* ein sehr ausgedehnter; denn er erstreckt sich über die Nordwest-, Südwest- und Zentralmalayische Provinz. Aus der Provinz der Philippinen ist mir nur folgende Form bekannt geworden:

Var. α **MALACCENSE** Warnst. l. c. 187.

LUZON: Benguet Subprovince, Mount Pulog, 2600 m, *For. Bur. 16395, 16410 Curran, Merritt & Zschokke, Merrill 6402;* Pauai, 2250 m, *Merrill 4972.*

Subsectio 4. SUBSECUNDA Schlieph.

4. **SPHAGNUM LUZONENSE** Warnst. in Bot. Centralbl. 76 (1898) 388; Engl. Pflanzenreich 51 (1911) 397.

LUZON: *Loher* in Herb. Brotherus.

Var. **MACROPHYLLUM** Warnst. l. c. 398.

LUZON: Lepanto Subprovince, Mounta Data, 2250 m, *Merrill 4911.*

Var. **SORDIDUM** Warnst. l. c.

LUZON: Benguet Subprovince, 2300 m, *Merrill 6678.*

5. **SPHAGNUM ROBINSONII** Warnst. sp. nov.

Planta cineracea, habitu et magnitudine fere *S. compacto* similis. Hyalodermis caulina stratis 2 composita. Cylindrus

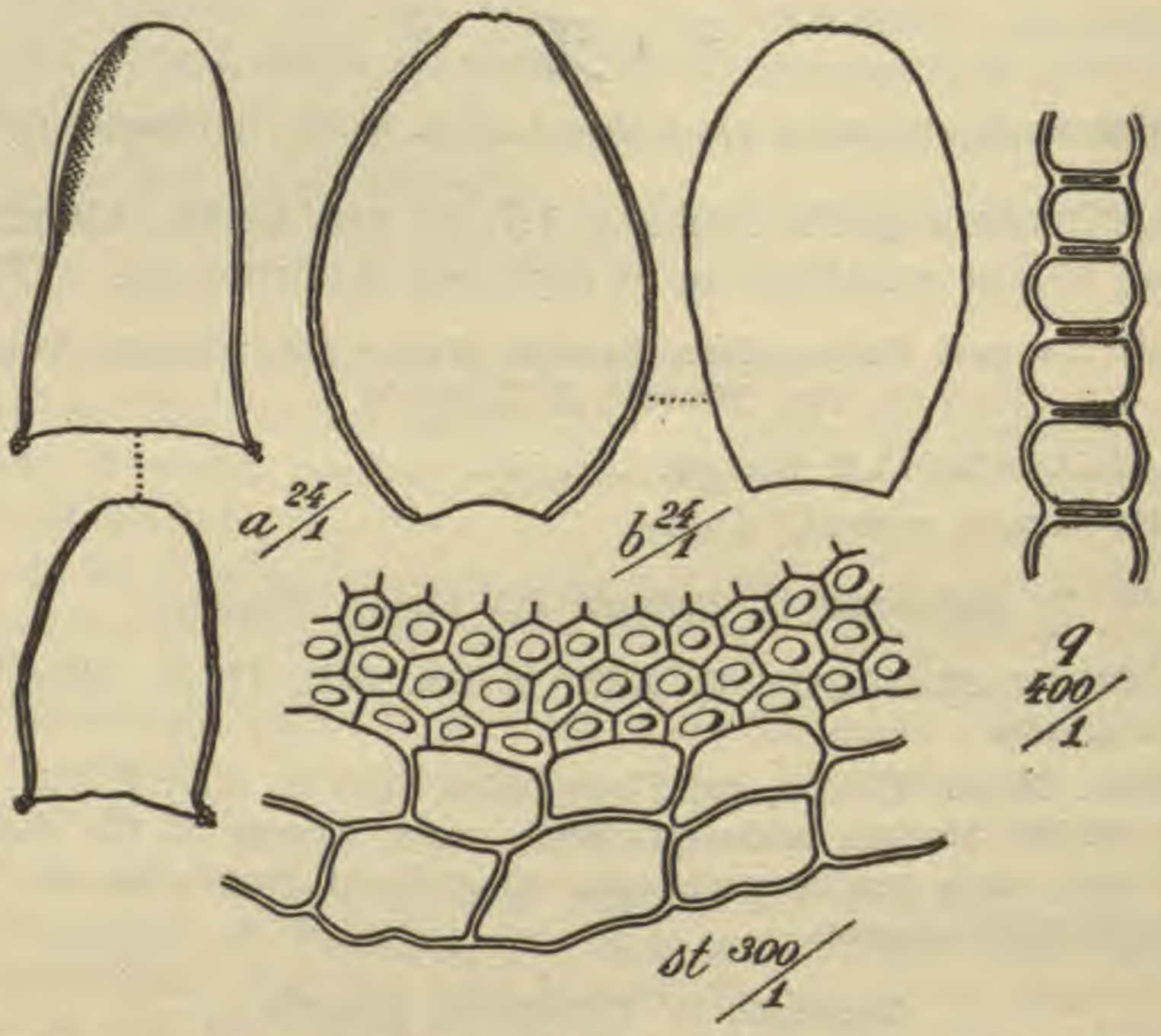


FIG. 2.—*Sphagnum Robinsonii* Warnst. (*a*) Zwei Stammblätter; (*b*) Zwei Astblätter; (9) Astblattquerschnitt; (*st*) Teil eines Querschnitts durch das Stämmchen.

lignosus aetate obscure fuscescens. Folia caulina magnitudine variabilia, lingulata, auguste limbata, apice rotundata, denticulata, 1–1.3 mm longa, 0.6–0.8 mm lata, sursum plus minusve fibrosa; cellulae hyalinae saepius septatae, interiore superficie

foliorum poris magnis multis in cellularum angulis, dorso fere tantum poro uno in angulis superioribus instructa. Ramorum fasciculi ramis 3–4; rami patentes haud parum dense foliosi. Folia ramulina late ovata, 1.3–1.8 mm longa, 1–1.14 mm lata, concava, angustissime limbata, apice rotunda vix truncata denticulataque, utrinque aequaliter multiporosa; pori veri plerumque bini ternive callularum angulis conjunctis, ei prope margines laterales majores; praeterea saepe pseudoporis in series breves ad commissuras dispositis instructa. Cellulae chlorophylliferae sectione transversali anguste rectangulae, ab utroque latere foliorum liberae (Fig. 2).

Pflanzen sowohl nach Grösse als auch Habitus noch am meisten an nicht squarröse Formen von *S. compactum* erinnernd. Stämmchen stark, ihre Hyalodermis rings 2-schichtig und aus weitlichtigen, dünnwandigen Parenchymzellen zusammengesetzt. Holzkörper im Alter dunkelbraun, Stammblätter desselben Stengels in der Grösse veränderlich, zungenförmig, 1–1.3 mm lang und 0.6–0.8 mm breit, an der abgerandeten Spitze meist gezähnelt und an den Seitenrändern schmal- oberwärts hyalingesäumt; im oberen Teile, zuweilen bis zur Mitte herab, fibrös, die Hyalinzellen z. T. septiert, auf der Blattinnenfläche mit vielen grossen ringlosen Löchern in den Zellecken, die Rückseite der Blätter aber fast nur mit einzelnen kleinen Poren in den oberen Zellecken. Astbüschel 3- bis 4-ästig und 2 stärkere, kurz zugespitzte, mehr oder minder dicht- und rundbeblätterte Aestchen abstehend oder teilweis aufstrebend. Ihre Blätter breit-oval, hohl, mit abgerundeter, kaum oder undeutlich gestutzter, klein gezähnelter Spitze und sehr schmalem Randsaum, 1.5–1.8 mm lang und 1–1.14 mm breit. Hyalinzellen reichfaserig und auf beiden Blattflächen mit ziemlich zahlreichen, gleichliegenden Poren; die wahren Löcher allermeist zu 2 und 3 an den zusammenstossenden Zellecken, die gegen die Seitenränder des Blattes allmählich grösser werden. Ausser diesen wirklichen Poren finden sich hier und da noch zu kurzen Reihen verbundene Pseudoporen an den Commissuren. Chlorophyllzellen im Querschnitt schmal rechteckig, centriert, und beiderseits freiliegend.

LUZON: Benguet Subprovince, Baguio, 1440 m, *Bur. Sci. 11996 Robinson.*

Diese Pflanze gehört in die nächste Verwandtschaft von *Sphagnum subrufescens* Warnst. in Engl. Pflanzenreich 51 (1911) 423.

Sectio II. INOPHOLOEA Russ.

Subsectio 5. CYMBIFOLIA Lindb.

6. **SPHAGNUM JAPONICUM** Warnst. in Allgem. Bot. Zeitschr. (1895) 230; Warnst. in Engl. Pflanzenreich 51 (1911) 459.

Var. **PHILIPPINENSE** Warnst l. c. (1911) 521.

LUZON: Province of Isabela, *For. Bur. 16996, Alvarez.*

Es würde mich ungemein freuen, wenn vorstehender Artikel über die Torfmoose der Philippinen dazu beitragen würde, dass die dortigen Botaniker auf ihren Reisen diesen nach Bau und Lebensweise gleich interessanten Brophyten ein erhöhtes Interesse entgegen brächten und sie reichlich einsammelten, wo sich auch immer dazu Gelegenhet böte.

Vol. VII, No. 3, including pages 125 to 208, was issued September 2, 1912.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

A LIST OF THE MAMMALS OF THE PHILIPPINE ISLANDS, EXCLUSIVE OF THE CETACEA.

By NED HOLLISTER.

Order No. 418. Paper, $0.50 United States currency, postpaid.

This is the only recent attempt to enumerate the mammals of the Philippine Islands. The distribution of each species is given and the original descriptions are cited.

PRICE-LIST OF PHOTOGRAPHS.

For sale by the Bureau of Science.

Order No. 417. For free distribution.

This is a list of selected photographs from the splendidly complete collection of the Bureau of Science.

A MANUAL OF PHILIPPINE BIRDS.

By RICHARD C. MCGREGOR.

2 parts, 769 pages.

Order No. 103. Paper, $4 United States currency, postpaid.

Mr. McGregor spent some eight years in active field work, visiting many parts of the Archipelago, before beginning work on this book. Therefore, he was well prepared to undertake the preparation of the manual.

A Manual of Philippine Birds contains in compact form descriptions of all the known species of Philippine birds. The usual keys and diagnoses of orders, families, and genera help the novice in identification.

Under each species are found native, English, and scientific names, distribution by islands, descriptions of the birds and in many instances notes on nesting, migrations, and other habits.

A CHECK-LIST OF PHILIPPINE FISHES.

By DAVID STARR JORDAN and ROBERT EARLE RICHARDSON.

78 pages.

Order No. 102. Paper, $0.75 United States currency, postpaid.

This list will be found a convenient guide to the synonymy of Philippine ichthyology. The nomenclature is thoroughly revised and the distribution of each species within the Philippine Islands is given.

This check-list is uniform in size and style with McGregor and Worcester's Hand-list of Philippine Birds.

INDO-MALAYAN WOODS.

By FRED W. FOXWORTHY.

182 pages, 9 photographic plates.

Order No. 411. Paper, $0.50 United States currency, postpaid.

In Indo-Malayan Woods, Doctor Foxworthy has brought together a large amount of accurate information concerning trees yielding woods of economic value. The work is based largely upon the author's own experience in the Philippine and neighboring regions, but previous publications and information generously given by other dendrologists have been used to correlate commercial and native names of useful Indo-Malayan trees.

PHILIPPINE HATS.

By C. B. ROBINSON.

Order No. 415. Paper, $0.50 United States currency, postpaid.

This paper is a concise record of the history and present condition of hat making in the Philippine Islands. The various materials used and the different kinds of hats made in each center of production are fully described. Not of the least importance are the botanical identifications of the plants from which the hat materials are obtained.

The plates illustrate the hat materials and various kinds and grades of hats. A map of central Luzon shows the towns chiefly concerned in this industry.

THE COCONUT PALM IN THE PHILIPPINE ISLANDS.

149 pages, 30 plates.

Order No. 37. Paper, $1 United States currency, postpaid.

The reprint contains the following articles: On the Water Relations of the Coconut Palm (Cocos nucifera), by Edwin Bingham Copeland; The Coconut and its Relation to Coconut Oil, and The Keeping Qualities of Coconut Oil and the Causes of its Rancidity, by Herbert S. Walker; The Principal Insects Attacking the Coconut Palm (Parts I and II), by Charles S. Banks; with an introduction by Paul C. Freer.

A VOCABULARY OF THE IGOROT LANGUAGE AS SPOKEN BY THE BONTOK IGOROTS.

By WALTER CLAYTON CLAPP.

89 pages.

Order No. 408. Paper, $0.75 United States currency, postpaid.

The introduction to this vocabulary contains notes on pronunciation, vowels, diphthongs, consonants, verbs, conjugations, syllabication and reduplication. The vocabulary is given in Igorot-English and English-Igorot.

THE NABALOI DIALECT.

By OTTO SCHEERER.

65 pages, 29 plates.

AND

THE BATAKS OF PALAWAN.

By EDWARD Y. MILLER.

7 pages, 6 plates.

Order No. 403. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The Nabaloi Dialect and the Bataks of Palawan are bound under one cover.

THE BATÁN DIALECT AS A MEMBER OF THE PHILIPPINE GROUP OF LANGUAGES.

By OTTO SCHEERER.

AND

"F" AND "V" IN PHILIPPINE LANGUAGES.

By CARLOS EVERETT CONANT.

These two papers are issued under one cover, 141 pages.

Order No. 407. Paper, $0.80 United States currency, postpaid.

Orders for these publications may be sent to the Business Manager, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below. Please give order number.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

THE SUBANUNS OF SINDANGAN BAY.

By Emerson B. Christie.

121 pages, 1 map, 29 plates.

Order No. 410. Paper, $1.25 United States currency, postpaid.

Sindangan Bay is situated on the northern coast of Zamboanga Peninsula. The Subanuns of this region were studied by Mr. Christie during two periods of five and six weeks, respectively.

The following is an abstract from the contents of Mr. Christie's report on the Subanuns: Habitat and history; relations with the Moros; material culture; houses; industries; trade; agriculture; family life; social customs; administration of justice; religion; the medicine man; ceremonies; tales; word-lists; physical measurements.

The 29 plates illustrate the Subanuns at work and at play; their industries, houses, altars, and implements; and the people themselves.

THE HISTORY OF SULU.

By Najeeb M. Saleeby.

275 pages, 4 maps, 2 diagrams.

Order No. 406. Paper, $0.75 United States currency, postpaid.

In the preparation of his manuscript for The History of Sulu Doctor Saleeby spent much time and effort in gaining access to documents in the possession of the Sultan of Sulu. It is fortunate that these records have now been translated and preserved in permanent form. This book is a history of the Moros in the Philippines from the earliest times to the American occupation.

STUDIES IN MORO HISTORY, LAW, AND RELIGION.

By Najeeb M. Saleeby.

107 pages, 16 plates, 5 diagrams.

Order No. 405. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

This volume deals with the earliest written records of the Moros in Mindanao. Doctor Saleeby was fortunately able to obtain exact copies of carefully preserved early records written in the Magindanao dialect with Arabic characters. The author presents translations of these as well as 16 half-tone illustrations of certain pages from the originals. The names of the rulers of Magindanao are recorded in five folding diagrams.

NEGRITOS OF ZAMBALES.

By William Allan Reed.

83 pages, 62 plates.

Order No. 402. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The introductory chapter deals with the general distribution of Negritos and with the distribution of the Philippine branch of the race. The succeeding chapters deal with the various industries, amusements, and social relations of these little men.

Plates from photographs, the greater part of which was taken for this publication, show ornaments, houses, men making fire with bamboo, bows and arrows, dances, and various types of the people themselves.

CONTENTS.

	Page.
BROWN, W. H. The Relation of Rafflesia manillana to its Host	209
MERRILL, E. D. Nomenclatural and Systematic Notes on the Flora of Manila	227
WARNSTORF, C. Die Sphagna der Philippinen	253

The "Philippine Journal of Science" is issued as follows:	U. S. currency.
Section A, Chemical and Geological Sciences and the Industries	$2.00
Section B, The Philippine Journal of Tropical Medicine	2.00
Section C, Botany	2.00
Section D, General Biology, Ethnology and Anthropology (Section D began with Volume V)	2.00
Entire Journal, Volume II, III, IV, or V	5.00
Entire Journal, beginning with Volume VI	7.00
Single numbers	.50
Volume I, 1906 (not divided into sections)	10.00
Supplement to Volume I (botany)	3.50
Volume I (without supplement)	6.50

Each section is separately paged and indexed.

Publications sent in exchange for the Philippine Journal of Science should be addressed: Library, Bureau of Science, Manila, P. I.

Subscriptions may be sent to the BUSINESS MANAGER, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below:

AGENTS.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Noordeinde 18, The Hague, Holland.
Mayer & Müller, Prinz-Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

Entered at the post-office at Manila, P. I., as second-class matter.

VOL. VII, C, NO. 5 NOVEMBER, 1912

THE PHILIPPINE JOURNAL OF SCIENCE

ALVIN J. COX, M. A., PH. D.
GENERAL EDITOR

SECTION C. BOTANY

E. D. MERRILL, M. S.
EDITOR

WITH THE COÖPERATION OF

P. W. GRAFF, B. S.; W. H. BROWN, PH. D.
H. N. WHITFORD, PH. D.



MANILA
BUREAU OF PRINTING
1912

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

REPORT OF THE INTERNATIONAL PLAGUE CONFERENCE.

Held at Mukden, April, 1911, under the auspices of the Chinese Government.

Edited by ERICH MARTINI, G. F. PETRIE, ARTHUR STANLEY, AND RICHARD P. STRONG.

483 pages, 18 plates (2 colored, 4 half-tones, 12 charts and maps).

Order No. 416. Cloth $3.50; paper, $2.50 United States currency, postpaid.

The proceedings of this International Conference and information gained therefrom, together with the results of certain bacteriological investigations, constitute the present report.

Nothing hitherto has been published which gives such a complete and comprehensive account of the entire subject of pneumonic plague.

Delegates from America (United States of), Austria-Hungary, France, Germany, Great Britain, Italy, Japan, Mexico, the Netherlands, Russia, and China attended the Conference.

The Bureau of Sorento of the Government of the Philippine Islands has been appointed sole agent for the distribution of the printed proceedings of the International Plague Conference.

THE SUGAR INDUSTRY IN THE ISLAND OF NEGROS.

By HERBERT S. WALKER.

145 pages, 15 plates, 1 map.

Order No. 412. Paper, $1.25 United States currency, postpaid.

Considered from the viewpoint of practical utility, Mr. Walker's Sugar Industry in the Island of Negros is one of the most important papers published by the Bureau of Science. This volume is a real contribution to the subject; it is not a mere compilation, for the author was in the field and understands the conditions of which he writes. The following is a brief synopsis of the contents:

Tables of soil analyses, both chemical and physical; analyses of the cane, juice and bagasse; estimates based on actual information as to the costs of production and of cultivation; and estimates of the cost and location of possible central factories. The island is considered by sugar-producing districts; the area of cultivation and the production per hectare are given, and the possibility for future expansion discussed.

The plates illustrate various phases of sugar industry from the cultivation of the field to the transportation of sugar in native sailboats.

A MANUAL OF PHILIPPINE SILK CULTURE.

By CHARLES S. BANKS.

53 pages, 20 plates.

Order No. 413. Paper, $0.75 United States currency, postpaid.

The silk industry is particularly adapted to be undertaken by persons with small capital, and like the making of hats in the Philippine Islands it should thrive with a little encouragement.

In A Manual of Philippine Silk Culture we have presented the results of several years' actual work with silk-producing larvæ together with a description of the new Philippine race. Half-tone plates illustrate in natural size silkworms in different stages of development, cocoons, adult moths, samples of cloth made from art silk, hand reel, and silk house. Other plates illustrate the various appliances used in raising silkworms and in spinning silk; hand and power reels are illustrated; working drawings are given for a silk house and for a hand reel.

THE PHILIPPINE
JOURNAL OF SCIENCE
C. BOTANY

VOL. VII NOVEMBER, 1912 No. 5

NEW OR NOTEWORTHY PHILIPPINE PLANTS, IX.

By E. D. MERRILL.

(From the Botanical Section of the Biological Laboratory, Bureau of Science, and the Department of Botany, University of the Philippines, Manila, P. I.)

The last paper published under this title appeared in the year 1910,[1] and the present contribution, like the preceding numbers of the series, is composed of descriptions of presumably new species, records of species previously described which have recently been discovered in the Philippines, notes on nomenclature, synonymy, etc. Two new genera are proposed, *Freeria*, of the *Icacinaceae*, and *Macgregorianthus*, of the *Thymelaeaceae*. Four genera, previously not reported from the Archipelago, are included, *Parishia*, *Suriana*, *Cansjera*, and *Vallaris*. One hundred presumably new species are described, all dicotyledons, while about 10 species, previously described from extra-Philippine material, are recorded from the Archipelago for the first time. As is the case with the preceding numbers of the series, all the material on which the present paper is based is preserved in the Herbarium of the Bureau of Science.

CHLORANTHACEAE.

CHLORANTHUS L.

CHLORANTHUS PHILIPPINENSIS sp. nov.

Species C. henryi Hemsl. ut videtur valde affinis, differt floribus multo minoribus, circiter 2.5 mm longis.

An erect, simple, glabrous herb about 40 cm high, from aro-

[1] This Journal, 5 (1910) Botany 167–257.

matic, woody rootstocks, the stems brown, angled and sulcate when dry, with about 5 nodes. Leaves 4, whorled at the apex of the stem, membranaceous, broadly obovate, 12 to 15 cm long, 8 to 9 cm wide, slightly shining, the lower surface paler than the upper one, the apex prominently and sharply acuminate, the base acute, margins sharply and rather finely serrate, the teeth more distant below, the basal margins quite entire; nerves about 9 on each side of the midrib; petioles about 1 cm long. Inflorescence terminal, about 15 cm long, slender, the peduncle about 7 cm long, the branches opposite, usually 4 in two pairs, the lower ones about 6 cm long, the internode 2 cm long or less. Anther-scale about 2.5 mm long, divided nearly to the base into three lobes, the lateral lobes a little shorter than the middle one, oblong, obtuse, the middle one with a 4-locellate anther, the laterial ones with 2-locellate anthers; anthers about 1 mm long, half as long as the lobes or less. Fruit unknown.

LUZON, Province of Cagayan, Abulug River, *Weber 1582*, January, 1912, growing in forests, altitude about 250 m, the roots said to be fragrant, and the fruits white, although none of the latter were preserved.

A species manifestly closely allied to *Chloranthus henryi* Hemsl., of China, apparently differing chiefly in its smaller flowers, which are about one-half as large as in Hemsley's species. In habit, general appearance, vegetative characters, etc., the Philippine plant very closely matches a specimen in the Herbarium of the Bureau of Science, representing *Chloranthus henryi* Hemsl., collected by *Farges* in Su-tchuen; the only difference appears to be in the flowers. I had at first determined the Luzon plant to be the same as *Chloranthus oldhami* Solms-Laub., a species known only from Formosa, and of which the flowers are unknown. That species, however, is described as having its leaves subsessile, which does not apply to our plant, nor are the leaves of our species crenate-dentate throughout, the lower 2 to 4 cm of the margins being quite entire.

ULMACEAE.

TREMA Lour.

TREMA VULCANICA sp. nov.

Frutex circiter 2 m altus subtus foliis ramulisque villosis; foliis numerosis, confertis, oblongo-ovatis vel oblongis, usque ad 5 cm longis, acutis vel acuminatis, basi leviter cordatis, supra scabridis, petiolo circiter 2 mm longo; cymis brevissimis, vix 7 mm longis, floribus 5-meris.

A shrub about 2 m high, the branchlets, petioles, and the lower surface of the leaves, especially on the nerves, rather prominently villous with rather short, pale, spreading or somewhat appressed hairs, the older branches terete, glabrous or nearly

so, reddish-brown; branchlets somewhat crowded, leafless in their lower parts, the leaves rather crowded above the middle. Leaves subcoriaceous, brittle when dry, brownish, oblong-ovate or oblong, 2.5 to 5 cm long, 1 to 2 cm wide, acute or somewhat acuminate, base somewhat cordate, equilateral or subequilateral, the upper surface scabrid, usually with few hairs along the midrib, the lower surface of about the same color as the upper, prominently pubescent with pale hairs on the midrib, lateral nerves, and primary reticulations, the ultimate reticulations close, evident on both surfaces, margins closely and finely coriaceous-serrulate; lateral nerves about 5 on each side of the midrib, prominent, ascending, impressed on the upper surface; petioles densely pale-villous, about 2 mm long. Cymes axillary, few-flowered, pubescent, 4 to 7 mm long. Flowers 5-merous. Male flowers: Sepals 5, elliptic to elliptic-ovate, concave, about 1.8 mm long, imbricate, glabrous except the slightly ciliate margins. Stamens 5. Pistillode cylindric, truncate, 1 mm long, glabrous, except the distinctly ciliate base. Female flowers similar to the males, the style-arms 1 mm long. Fruit reddish, 2.5 mm long, ovoid, fleshy, glabrous, more or less wrinkled when dry, the seed subglobose, about 1.2 mm in diameter.

CAMIGUIN DE MINDANAO, in thickets on slopes of the old volcano, *Bur. Sci. 14600 Ramos*, April 27, 1912.

A species well characterized by its depauperate size, small crowded leaves, short petioles and cymes, and other characters. It resembles somewhat *Trema amboinensis* Blume, and is undoubtedly allied to that species, but is quite distinct in many essential characters.

LORANTHACEAE.

LORANTHUS L.

LORANTHUS CONFUSUS sp. nov. § *Cichlanthus.*

Frutex parasiticus, ramis elongatis, tenuibus, ramulis subtus foliis inflorescentiisque indumento stellato-leproso pallido dense obtecto; foliis oppositis, breviter petiolatis, oblongis ad anguste elliptico-oblongis, rotundatis vel acutis, usque ad 5.5 cm longis; racemis brevibus, paucifloris; floribus 4-meris, corolla 12 mm longa.

A slender parasitic shrub, the branches elongated, the branchlets terete, about 1 mm thick, these, the lower surfaces of the leaves and the inflorescence densely covered with a pale, stellate-leprose indumentum, the tips of the branchlets sometimes ferrugineous. Leaves opposite, coriaceous, oblong to narrowly elliptic-oblong, 2 to 5.5 cm long, 8 to 20 mm wide, apex rounded

or acute, base narrowed, acute, the upper surface, when young, stellate-leprose, soon becoming quite glabrous; nerves 3 or 4 on each side of the midrib, slender, not prominent; petioles 2 mm long. Racemes axillary, short, solitary or fascicled, 2- to 5-flowered, the rachis about as long as the petiole. Flowers 4-merous, somewhat curved. Pedicels about 3 mm long, the bracteole ovate, concave, 0.5 mm long. Calyx 3.5 to 4 mm long, narrowed below into a pseudo-stalk, narrowly obovoid, truncate. Corolla 12 mm long, tube slightly inflated. Reflexed parts of the lobes above the insertion of the stamens 4 mm long, narrowly oblong to linear-oblong. Anther sessile, erect, 1 mm long. Fruit (immature) narrowly obovoid, 5 mm long, shortly stipitate densely stellate-leprose with a pale indumentum.

LUZON, without definite locality, *Cuming 1959* (type): Province of Union, *Elmer 5711*, February, 1904, *Bur. Sci. 12951 Fénix*, December, 1910: Province of Pangasinan, *Bur. Sci. 4977 Ramos*, December, 1907, *Alberto 35*, May, 1904: Province of Tarlac, *Merrill s. n.*, July, 1903.

This form was previously considered by me[2] to be referable to *Loranthus sphenoideus* Blume, but I am now of the opinion that it is specifically distinct. It differs from the Philippine material that has been referred to *Loranthus sphenoideus* in its pale, not ferruginous indumentum, its relatively much narrower, differently shaped leaves, and its somewhat smaller flowers. It is manifestly very closely allied to Blume's species, but less closely allied to *Loranthus estipitatus* Stapf.

LORANTHUS SIMILIS sp. nov. § *Cichlanthus*.

Species praecedente affinis, differt foliis majoribus, petiolo longioribus, indumento ferrugineo, floribusque longioribus, 1.8 cm longis.

A slender parasitic shrub, the branches terete, brown, lenticellate, the branchlets densely brown-stellate-leprose, as are the petioles, lower surfaces of the leaves, and the inflorescence. Leaves elliptic to oblong-elliptic, coriaceous, 5 to 7 cm long, 2 to 3 cm wide, rounded, base somewhat narrowed, rounded or subacute, brown when dry, the upper surface glabrous, somewhat shining, the lower surface densely brown-stellate-leprose; nerves 5 or 6 on each side of the midrib, rather distinct beneath, anastomosing; petioles 8 to 10 mm long. Racemes axillary, solitary or several at each node, few-flowered, the rachis about as long as the petioles, the pedicels 2 to 3 mm long, the bracteole concave, ovate, 1.3 mm long, all parts, including the outside of the flowers, densely stellate-leprose. Calyx subcylindric, 3 mm long, slightly or not narrowed toward the base. Corolla 18 mm long, slender,

[2] This Journal 4 (1909) Bot. 139.

slightly curved, very slightly inflated in the lower one-half, the lobes 4.

LUZON, Benguet Subprovince, Baguio, *Williams 984*, July, 1904.

A species allied to *Loranthus confusus* Merr., and to *L. sphenoideus*, differing from both in its longer flowers, and from the former also in its ferruginous indumentum, larger leaves, and longer petioles. Like the preceding species, the type was previously referred by me to *L. sphenoideus* Blume.

LORANTHUS SUBSESSILIS sp. nov. § *Dendrophthoë*.

Glaber, ramulis teretibus; foliis oppositis, oblongo-ovatis, acuminatis, petiolatis, coriaceis, usque ad 15 cm longis; floribus sessilibus vel subsessilibus, e axillis defoliatis, solitariis vel binis, 6-meris, magnis, miniatis, circiter 7 cm longis, corolla falcata.

A glabrous parasitic shrub, the branches up to 1 m in length, the branchlets terete, slender, grayish or reddish-brown, the ultimate ones 1 to 1.5 mm in diameter. Leaves opposite, the internodes 3 to 9 cm long, coriaceous, oblong-lanceolate, 8 to 15 cm long, 3 to 6 cm wide, acuminate, base narrowed, acute, rarely somewhat rounded, rather pale and somewhat shining when dry; nerves 6 to 8 on each side of the midrib, obscure, slender, often nearly or quite obsolete; petioles about 5 mm long. Flowers in the axils of fallen leaves, large, red, sessile or subsessile, solitary or in pairs, each subtended by two bracteoles, the outer one broadly ovate, slightly apiculate, about 5 mm long, the inner one similar but truncate. Calyx about 7 mm long, 4 mm thick, slightly enlarged upward, truncate. Corolla 6.5 to 7 cm long, distinctly curved, the tube 4 to 4.5 cm long, about 3 mm in diameter at the base, gradually enlarged upward and 7 mm in diameter at the throat, the lobes 6, 4 mm wide at the base, soon narrowed, the reflexed part above the insertion of the stamens 2 cm long, lanceolate, acuminate, about 3 mm wide, much thickened. Filaments 10 to 11 mm long, erect; anthers linear-lanceolate, continuous, about 6 mm long.

MINDANAO, District of Zamboanga, Sax River, *Merrill 8315*, (type), November 28, 1911, altitude about 900 m; *Williams 2425*, March 5, 1905, altitude about 600 m.

A species characterized by its large flowers which are sessile or subsessile in the axils of fallen leaves, solitary or in pairs. When in full flower the plant is a very showy and striking one in the forests where it occurs. Its flowers are larger than in any other known Philippine species.

LORANTHUS PUBIFLORUS sp. nov. § *Dendrophthoë*.

Frutex inflorescentiis exceptis glaber, ramis ramulisque teretibus, crassis; foliis crasse coriaceis, oblongis vel anguste oblongo-ovatis, usque ad 15 cm longis, verticillatis, petiolatis, acutis vel

acuminatis; floribus in triadibus fasciculatis in radicibus vel in ramulis specialibus, inflorescentiis brevibus, puberulis; floribus 4-meris, circiter 3 cm longis, tenuibus, extus puberulis.

A parasitic shrub glabrous except the inflorescence, the branches and branchlets smooth, grayish or brownish, terete, stout, smooth, the apparently specialized flower-bearing branches (roots?) with a brown scaly bark. Leaves in whorls of three or four, the internodes 10 to 12 cm long, petioled, usually brown when dry, scarcely shining, thickly coriaceous, brittle, oblong to narrowly oblong-ovate, acute or somewhat acuminate, 12 to 15 cm long, 4 to 8 cm wide; petioles stout, 1 to 1.5 cm long; lateral nerves 4 to 6 on each side of the midrib, not prominent, the reticulations obsolete. Flowers in fascicled triads, the fascicles scattered, brown-puberulent, the inflorescences, excluding the corollas, less than 1 cm long. Bracteoles oblong-ovate, obtuse, puberulent, about 1.5 mm long. Calyx urceolate-campanulate, brown-puberulent, about 3 mm long, the limb somewhat spreading, about 1 mm long, truncate. Corolla slender, about 28 mm long, outside slightly puberulent, the lobes united for the lower 2 to 3 mm into a short tube, the free parts slender, about 1.5 mm wide, the reflexed part above the insertion of the stamen narrowly oblong, about 5 mm long, 1.3 mm wide, acute or obtuse. Anthers erect, continuous, narrowly oblong, about 3 mm long, the filaments 2 mm long.

LUZON, Province of Laguna, near Paete, *For. Bur. 13086 Curran*, December 17, 1911, in forests.

A very characteristic species, distinguishable by its whorled, thickly coriaceous, petioled leaves, and its flowers puberulent externally and borne in fascicled short triads on the roots or on special leafless branches. In the scattered character of its inflorescences it resembles *Loranthus mirabilis* Muell.-Arg. & Van Huerck, but is not, however, at all allied to that species.

LORANTHUS CAPITULIFERUS sp. nov. § *Lepiostegeres.*

Ramulis brunneo-furfuraceis exceptis glaber; foliis oppositis vel suboppositis, oblongo-ellipticis ad oblongo-ovatis, coriaceis, utrinque angustatis, petiolatis, usque ad 12 cm longis; capitulis axillaribus, solitariis, sessilibus, paucifloris; floribus circiter 1.8 cm longis, 6-meris.

A glabrous parasitic shrub, the branches and branchlets stout, brown, the younger parts furfuraceous, more or less rugose when dry. Leaves opposite or subopposite, coriaceous, oblong-elliptic to oblong-ovate, olivaceous and slightly shining when dry, 7 to 12 cm long, 2.5 to 5 cm wide, obtuse, base narrowed,

acute or cuneate; lateral nerves 4 or 5 on each side of the midrib, indistinct, slender; petioles about 1 cm long. Heads axillary, solitary, sessile, but the flowers quite enclosed by imbricated bracts, forming a globose head. Flowers 6-merous, about 5 in each head, sessile. Calyx 2 mm long, truncate. Corolla 1.6 cm long, the lobes free nearly to the base, the reflexed part above the insertion of the stamens 4 mm long. Anther erect, sessile, 4 mm long.

MINDANAO, District of Zamboanga, Sax River Mountains back of San Ramon, *Merrill 8270*, November 28, 1911, parasitic on *Englehardtia*, altitude about 1100 m.

Allied to *Loranthus williamsii* Merr., but with much shorter flowers.

OLACACEAE.

CANSJERA Juss.

CANSJERA RHEEDII Gmel. Syst. Nat. 1 (1791) 280; Mast. in Hook. f. Fl. Brit. Ind. 1 (1875) 582.

Cansjera scandens Roxb. Pl. Coromandel 1 (1795) 582.

Cansjera malabarica Lam. Encycl. 3 (1791) 433.

SIBUTU ISLAND, Sulu Archipelago, *Merrill 5291*, October 13, 1906, in thickets along the seashore.

India to southern China, through Malaya to northern Australia; the genus new to the Philippines.

Gmelin's specific name is here retained as being the one in common use. Lamarck's *Cansjera malabarica* was, however, published during the same year, and it will be difficult if not impossible to determine which has priority.

The species has previously been reported from the Philippines by Meisner,[3] but solely on Blanco's error in interpreting the species. The species Blanco referred here is an *Antidesma*.

MENISPERMACEAE.

STEPHANIA Lour.

STEPHANIA RAMOSII Diels sp. nov.

Caulis scandens glaber. Foliorum petiolus 4.5 ad 5 cm longus, lamina peltata, papyracea, supra fere lucida, subtus paulo pallidior, triangulari-ovata, apice acuta, acuminato-mucronulata, 8 ad 9 cm longa, 4 ad 5.5 cm lata. Inflorescentiae ♂ pseudoracemosae, 5 ad 7 cm longae; pedicelli 1.5 ad 2 mm longi. Sepala 6, 3 exteriora anguste spathulato-oblonga, 1.5 mm longa, 0.4 mm lata, 3 interiora latiora, elliptico-ovata, concava, circiter 1.2 mm longa, 0.8 mm lata. Petala 5 conchiformia vel

[3] DC. Prodr. 14 (1857) 519.

fere orbicularia basi intus glandulosa, 0.7 ad 1 mm longa et lata. Synandrium 1 mm diametro.

LUZON, Benguet Subprovince, near Baguio, *Bur. Sci. 13487 Ramos*, May, 1911.

Sect. *Thamnothyrsa* Diels. Species nova foliis triangulari-ovatis *S. catosepalae* Diels eiusdem provinciae indigenae haud absimilis sepalis petalisque duplo minoribus haud deflexis conspicue differt.

PYCNARRHENA Miers.

PYCNARRHENA CELEBICA (Boerl.) Diels in Engl. Pflanzenreich 46 (1910) 53.

Cocculus celebicus Boerl. Cat. Pl. Bogor. (1899) 40.

LUZON, Province of Nueva Ecija, *For. Bur. 22157 Alvarez*, December, 1910. MINDANAO, District of Davao, Mount Apo, *Elmer 12000*, September, 1909.

Previously known only from Celebes, and from plants cultivated in the Botanical Garden at Buitenzorg; the Philippine specimens agree closely with specimens in our herbarium from Buitenzorg, and have, morever, been determined by Doctor Diels.

LIMACIA Lour.

LIMACIA BLUMEI (Boerl.) Diels in Engl. Pflanzenreich 46 (1910) 215.

Cocculus blumei Boerl. Cat. Pl. Bogor. (1899) 40.

MINDANAO, District of Davao, Mati, *C. V. Piper 427*, May 15, 1911.

The specimen closely matches typical material in our herbarium taken from cultivated plants in the Botanical Garden at Buitenzorg, and has, moreover, been determined by Doctor Diels. Previously known only from specimens cultivated at Buitenzorg which originated in some part of the Malay Archipelago; new to the Philippines.

ANONACEAE.

MITREPHORA Hook. f. & Thoms.

MITREPHORA WEBERI sp. nov.

Arbor circiter 8 m alta partibus junioribus inflorescentiisque exceptis glabra; foliis ovatis vel oblongo-ovatis, subcoriaceis, nitidis, usque ad 18 cm longis, acuminatis, basi late rotundatis, nervis utrinque 8 ad 10; floribus hermaphroditis, circiter 4 cm diametro, petalis interioribus oblongis, acutis, extus pubescentibus, intus glabris, interioribus brevioribus, arcuatis, basi longe angustatis, glabris, laminibus densissime ciliato-villosis; ovario glabro, ovulis circiter 12.

A tree about 8 m high, glabrous except for the younger parts and the inflorescence. Branches slender, terete, grayish- or reddish-brown, lenticellate, glabrous, the buds and very young leaves densely ferruginous-pubescent. Leaves ovate to oblong-ovate,

subcoriaceous, shining, green and of about the same color on both surfaces, 10 to 18 cm long, 4 to 8 cm wide; lateral nerves 8 to 10 on each side of the midrib, prominent, curved upward, anastomising, the reticulations lax; petioles 7 to 10 mm long. Flowers perfect, yellow and purple, extra-axillary or leaf-opposed, solitary, or at least but one flower opening at a time, the short rachis, the bracts, and the calyx externally densely ferruginous-pubescent. Sepals broadly ovate, acute or slightly acuminate, about 6 mm long. Outer three petals oblong, acute or somewhat obtuse, about 2 cm long, 8 mm wide, externally somewhat appressed-pubescent with brown hairs, inside glabrous, the inner three petals about 14 mm long, vaulted, conniving, their claws slender, glabrous, about 9 mm long, their limbs about 5 mm long, subrhombic, but when spread much wider than long, the inner surface very densely ciliate-villous with long, dark-brown hairs. Stamens indefinite, narrowly oblong, 1 to 1.2 mm long, their connectives truncate, overlapping. Ovaries 12 to 15, glabrous, 1 to 1.2 mm long, oblong; ovules about 12, 2-seriate; styles clavate-oblong. Fruits unknown.

BUSUANGA (Calamianes Islands), *C. M. Weber 1550bis*, February 25, 1911, in forests, limestone region, altitude about 30 meters.

Apparently a very characteristic species, distinguishable by the inner faces of the limbs of the interior petals being very densely ciliate-villous with long, dark-brown hairs, and by its outer petals being quite glabrous inside.

OXYMITRA Hook. f. & Thoms.

OXYMITRA PUBESCENS sp. nov.

Frutex scandens omnibus partibus plus minusve ferrugineo-pilosis, ramulis densissime pilosis; foliis oblongis vel anguste oblongo-obovatis, abrupte brevissime acuminatis, basi leviter cordatis, subcoriaceis vel chartaceis, usque ad 24 cm longis, nervis utrinque circiter 10, distantibus, distinctis; petiolo crasso, vix 6 mm longo; floribus ignotis; fructibus ovoideis vel ellipsoideis, circiter 8 cm longis, aurantiacis, ferrugineo-pilosis.

A scandent shrub, all parts more or less ferruginous-pilose, the branchlets very densely so, the older branches bearly black, lenticellate, becoming glabrous. Leaves subcoriaceous or firmly chartaceous, oblong or narrowly oblong-ovate, 14 to 24 cm long, 5.5 to 8.5 cm wide, usually widest above the middle, the apex shortly and abruptly acuminate, below usually more or less narrowed, the base rounded, somewhat cordate, both surfaces more or less pilose with ferrugenous hairs, the upper surface in age becoming more or less glabrous, the lower surface slightly paler,

the nerves and reticulations especially pilose; lateral nerves 10 on each side of the midrib, prominent, somewhat ascending, anastomosing, the reticulations subparallel, distinct; petioles densely ferruginous-pilose, thickened, 6 mm long, or less. Flowers axillary, sessile or very shortly pedicelled, apparently solitary (not seen). Fruits umbellately arranged on stout, axillary, pubescent tubercles, 6 or more in each umbel, their pedicels pubescent, 5 to 8 mm long, the fruits yellow when fresh, dark-brown when dry, ovoid or ellipsoid, about 8 mm long, more or less ferruginous-pilose, the apex minutely apiculate.

LUZON, Province of Cagayan, Abulug River, *Bur. Sci. 13870 Ramos*, January 26, 1912, on trees in forests.

A species well characterized by its pilose, ferruginous indumentum and comparatively few, distant, lateral nerves.

POLYALTHIA Blume.

POLYALTHIA LOHERI sp. nov.

Species P. lanceolatae Vid. similis et affinis, differt foliis majoribus, tenuiter acuminatis, floribus majoribus, circiter 2 cm longis.

A tree 5 to 10 m high, nearly glabrous, the axils bearded with short, stiff, ferruginous hairs, the branchlets slender, terete, dark-colored when dry, usually lenticellate. Leaves chartaceous or subcoriaceous, glabrous, rather pale when dry, shining and of the same color on both surfaces, lanceolate to oblong-lanceolate, 15 to 25 cm long, 2 to 5 cm wide, gradually narrowed into a long and rather slender acumen, base rounded or narrowed, minutely cordate, often very slightly inequilateral; primary nerves about 19 on each side of the midrib, spreading, anastomosing, the secondary ones often nearly as prominent, the reticulations rather lax, evident; petioles 3 mm long or less. Flowers axillary, solitary, perfect, white, cream-colored, or yellow, the pedicels slender, somewhat thickened upward, 3 to 4 cm long. Sepals triangular-ovate, acute or slightly acuminate, 3 to 4 mm long. Petals 6, subequal, oblong to oblong-obovate, thick, coriaceous, somewhat pubescent especially along the margins toward their tips, obtuse or acute, somewhat united below, 2 to 2.5 cm long, 4 to 7 mm wide. Anthers numerous, the connectives truncate. Ovaries villous. Fruit ellipsoid, apparently red, about 2 cm long, glabrous or nearly so.

LUZON, Province of Cagayan, *Cuming 1346;* Culasing Mountain, *For. Bur. 18437 Alvarez* (type), February 22, 1909, in dipterocarp forests; Pamplona, *For. Bur. 14780 Darling*, March, 1909: Province of Rizal, San

Mateo, *For Bur. 1103 Ahern's collector*, May, 1904, in fruit; Montalban, *Loher 5531*, January, 1906, with immature flowers: Province of Tayabas, Mauban, *For. Bur. 10191 Curran*, March, 1908.

The alliance of this species is manifestly with *Polyalthia lanceolata* Vid., and some of the material cited above has been distributed under that name. *P. loheri*, however, has much larger, differently shaped leaves, and much larger flowers, and is abundantly distinct.

Var. **CAGAYANENSIS** var. nov.

A typo differt ramulis pallidis, foliis majoribus, usque, ad 35 cm longis, venis magis distinctis.

LUZON, Province of Cagayan, Abulug River, near Dabba, *Bur. Sci. 13948 Ramos*, February 2, 1912, in forests, a tree about 5 m high with yellow flowers.

Additional material may show that this form is specifically distinct, or may merge it with *Polyalthia loheri*.

POLYALTHIA TENUIPES sp. nov.

Ut videtur arbor parva, ramulis junioribus exceptis glabra; foliis lanceolatis, sensim angustatis, acuminatis, basi angustatis, obtusis, minute cordatis, usque ad 12 cm longis, nervis utrinque 10 ad 12; floribus in axillis superioribus, solitariis, tenuiter pedicellatis, circiter 8 mm longis, pedicellis 2 ad 3 cm longis; petalis exterioribus triangulari-ovatis, interioribus lanceolatis quam exterioribus duplo longioribus.

Apparently a small tree, nearly glabrous, the growing shoots densely appressed ferruginous-pubescent, the branches slender, glabrous, dark-colored, terete. Leaves lanceolate, chartaceous, 9 to 12 cm long, 1.5 to 2.5 cm wide, gradually narrowed above to the slenderly acuminate apex, the base somewhat narrowed, obtuse, slightly cordate, of nearly the same color and shining on both surfaces when dry; primary nerves 10 to 12 on each side of the midrib, spreading, anastomosing, irregular, the secondary ones often nearly as prominent as the primary ones, the reticulations lax; petioles 2 mm long or less. Flowers solitary, perfect, axillary, in the upper axils, about 8 mm long, their pedicels very slender, 2 to 3 cm long, with a small oblong-lanceolate bracteole near the base. Sepals slightly pubescent, triangular-ovate, acute, about 2 mm long, united. Petals 6, in two series, dissimilar, the outer ones triangular-ovate, acute or somewhat acuminate, 5 mm long or less, the inner three lanceolate, somewhat acuminate, about 8 mm long.

LUZON, Province of Tayabas, Kabibihan, *Bur. Sci. 13472 Foxworthy & Ramos*, March, 1911.

A species with vegetative characters quite similar to those of *Polyalthia lanceolata* Vid., but sharply differentiated by its dissimilar petals.

CAPPARIDACEAE.

CAPPARIS L.

CAPPARIS LOHERI sp. nov.

Frutex scandens, armatus, subtus foliis ramulisque pubescentibus; foliis papyraceis, concoloribus, lanceolatis ad late lanceolatis, brevissime petiolatis, basi rotundatis, apice sensim angustatis, acuminatis, nervis utrinque circiter 11, distinctis, anastomosantibus; floribus longe pedicellatis, 4 ad 6 in umbellis axillaribus.

A scandent shrub, the nodes armed with short, sharp, straight spines 2 mm long or less, the branchlets terete, brownish, pubescent. Leaves lanceolate to broadly lanceolate, rarely ovate-lanceolate, chartaceous, 9 to 19 cm long, 2 to 4.5 cm wide, green and of about the same color on both surfaces when dry, slightly shining, the upper surface quite glabrous or the midrib slightly pubescent, the lower surface softly pubescent at least on the midrib and nerves, base rounded, gradually narrowed upward from about the middle to the long and slender acumen, sometimes slightly falcate; lateral nerves about 11 on each side of the midrib, spreading, prominent, looped-anastomosing, the recticulations lax, distinct; petioles pubescent, about 2 mm long. Umbels axillary, solitary, the peduncles pubescent, slender, 1 to 1.5 cm long, 4- to 6-flowered, the pedicels 2 to 3 cm in length, slender. Sepals 5 to 6 mm long, concave, orbicular-elliptic, rounded. Petals hyaline, thin, oblong, rounded, about 3.5 mm long, base truncate, margins ciliate. Stamens numerous, their filaments about 2 cm long; anthers narrowly oblong, 2 mm long. Gynophore slender, 3 cm in length in anthesis, elongated and 3.5 to 5 cm in length in fruit; ovary narrowly ovoid. Fruit (immature) ellipsoid, fleshy, 1.8 cm long.

LUZON, Province of Rizal, Montalban, *Loher 2016* August, 1890, in herb. Kew., *6787* (type), November, 1905.

A species well characterized by its long and slenderly acuminate pubescent leaves, its axillary, solitary, few-flowered umbels, its long-pedicelled flowers, and greatly elongated gynophore. It is allied to *Capparis lobbiana* Turcz., but is very different from that species in vegetative and many other characters.

CAPPARIS LITTORALIS sp. nov.

Species C. lobbianae Turcz., similis et affinis, differt omnibus partibus glabris, vix molliter pubescentibus.

An erect (or somewhat scandent?) shrub about 2 m high,

the branchlets terete, slightly pubescent, the nodes with very short sharp spines 1.5 mm long or less. Leaves ovate to oblong-ovate, 1.5 to 5 cm long, 1 to 2.5 cm wide, coriaceous, shining, glabrous, acute or very slightly apiculate-acuminate, base broad, cordate; nerves about 8 on each side of the midrib, very slender, not at all prominent; petioles 2 mm long or less. Flowers (not seen) in axillary, solitary, apparently few-flowered umbels, the peduncle in fruit 1.5 to 2 cm long, slender, glabrous, the pedicels (gynophore) 1.5 to 2.5 cm in length. Fruit ovoid or subglobose, about 8 mm in diameter, white when fresh, brown when dry, apparently fleshy, 2- or 3- seeded, the seeds 3 to 4 mm in length.

LUZON, Province of Tayabas, *For. Bur. 11111 Curran* (type), April, 1908, on sand dunes along the seashore: Province of Ilocos Norte, *Bur. Sci. 7602 Ramos*, March, 1909, in sandy places near the sea.

A species manifestly very closely allied to *Capparis lobbiana* Turcz., which it closely resembles, differing in having entirely glabrous, shining, coriaceous or subcoriaceous, not softly pubescent leaves.

SAXIFRAGACEAE.

POLYOSMA Blume.

POLYOSMA PIPERI sp. nov.

Frutex vel arbor parva; foliis anguste oblongo-obovatis vel late oblanceolatis, usque ad 16 cm longis, integris, apice acuminatis, basi angustatis, acutis, oppositis, chartaceis, subtus ad costa nervisque plus minusve hirsutis, nervis utrinque circiter 12, prominentibus; racemis terminalibus, pubescentibus, quam folia longioribus; floribus 4-meris, circiter 12 mm longis.

A shrub or a small tree, the branches terete, glabrous, the younger ones nearly black when dry and more or less pubescent with short, spreading, often fulvous hairs. Leaves opposite, narrowly oblong-obovate to broadly oblong-oblanceolate, chartaceous, 12 to 16 cm long, 3.5 to 5 cm wide, entire, the apex rather prominently acuminate, gradually narrowed from about the middle to the acute base, the upper surface glabrous or nearly so, the lower of about the same color, more or less fulvous or pale-pubescent along the midrib and lateral nerves; lateral nerves about 12 on each side of the midrib, prominent, curved, anastomosing, the reticulations rather lax; petioles 1.5 to 2.5 cm long, pubescent. Racemes terminal, more or less hirsute-pubescent with short, pale or grayish hairs, a little longer than the leaves, erect. Flowers numerous, about 12 mm long, their

pedicels 2 to 2.5 mm long, the bracteoles lanceolate, acuminate, pubescent, about 3 mm long. Calyx somewhat urceolate, about 2.5 mm long, slightly constricted at the apex, the 4 teeth spreading, triangular-ovate, acuminate, short. Petals 4, linear, obtuse, 10 to 11 mm long, to 1.5 mm wide, longitudinally 5- or 6-nerved, the nerves distinct, stout, dark-colored, outside more or less appressed-pubescent with short hairs, inside ciliate-pilose with white hairs. Filaments 6 mm long, ciliate-pilose; anther linear, 4 mm long. Fruit (rather immature) ovoid-ellipsoid, glabrous, somewhat longitudinally sulcate when dry, about 12 mm long, 6 to 7 mm wide, somewhat narrowed at both ends.

MINDANAO, Province of Surigao, Hinatuan, *C. V. Piper 519*, May 16, 1911.

A species distinguishable by its leaves being somewhat pubescent beneath, its long racemes, and relatively short flowers.

POLYOSMA VERTICILLATA sp. nov.

Arbor parva 4 ad 5 m alta, partibus junioribus inflorescentiisque parce pubescentibus; foliis oblongis, coriaceis, ternis, verticillatis vel subverticillatis, nitidis, acuminatis, 4 ad 10 cm longis, irregulariter glanduloso-dentatis; racemis axillaribus, multifloris; floribus purpureis, vix 1 cm longis.

A small tree 4 to 5 m high, nearly or quite glabrous except the sparingly pubescent inflorescence and younger parts. Leaves in whorls of threes, coriaceous, when young somewhat pubescent, when mature quite glabrous, shining, usually oblong, 4 to 10 cm long, 1.5 to 3.5 cm wide, rather coarsely and irregularly glandular-dentate, sometimes subentire, acuminate, base acute; nerves 15 to 20 on each side of the midrib, spreading at nearly right angles, slender, anastomosing; petioles 1 to 2.5 cm long. Racemes axillary, slightly pubescent, peduncled, 4 to 5 cm long. Flowers numerous, crowded in the upper one-half of the raceme, their pedicels 2 mm long, pubescent, with 3 oblong, acute, 1 mm long bracts at the apex subtending the calyx. Calyx pubescent, somewhat urceolate, 2.5 mm long, the lobes 4, triangular-ovate, acute, 1 mm long. Petals 4, narrowly oblong, 8 mm long, 1.5 mm wide, slightly appressed-pubescent with very short, scattered hairs. Fruit subglobose to ovoid, black when mature, about 8 mm long.

LUZON, Benguet Subprovince, Mount Tonglon (Santo Tomas), *Phil. Pl. 772 Merrill*, May, 1911 (type), *Williams 1526*, November, 1904, *Bur. Sci. 5411 Ramos*, December, 1908; Mount Ugo, *Bur. Sci. 5593 Ramos;* Mount Pulog, *For. Bur. 18148 Curran, Merritt, & Zschokke;* Baguio, *Elmer 8798.*

A very characteristic species, readily recognizable by its leaves being

in whorls of threes, not opposite as in most species of the genus; it differs from *Polyosma philippinensis* also in its considerably shorter and less pubescent flowers, as well as in its usually more prominently dentate leaves.

LEGUMINOSAE.

DESMODIUM Desv.

DESMODIUM TRIFOLIASTRUM Miq. Fl. Ind. Bat. 1[1] (1855) 248.

MINDANAO, Province of Surigao, Hinatuan, *C. V. Piper 549*, May 16, 1911. This species has not been reported from the Philippines previously, and, in fact, is definitely recorded only from Java. The species has been determined through the kindness of Sir D. Prain, director of the Royal Gardens, Kew, to whom a specimen was sent for comparison with the material in the Kew Herbarium.

DERRIS Lour.

DERRIS CEBUENSIS sp. nov. § *Dipteroderris.*

Frutex scandens, glaber; foliis 13 ad 20 cm longis, foliolis 7, nitidis, oblongis vel oblongo-ellipticis, in siccitate pallidis, utrinque concoloribus, 4 ad 8 cm longis, breviter obtuse acuminatis; floribus ignotis; leguminibus oblongis vel oblongo-lanceolatis, 6 ad 10 cm longis, planis, 2.5 ad 3 cm latis; seminibus 2 vel 3.

A scandent vine, glabrous throughout (flowers unknown), the stems brownish-olivaceous, prominently lenticellate, terete, the young branchlets smooth. Leaves odd-pinnate, 13 to 20 cm long, the common petiole and rachis 7 to 11 cm long. Leaflets 7, coriaceous or subcoriaceous, pale, shining and of the same color on both surfaces when dry, oblong to oblong-elliptic, 4 to 8 cm long, 2.5 to 3.5 cm wide, the base obtuse or rounded, apex shortly and obscurely blunt-acuminate, or sometimes obtuse; nerves slender, obscure, anastomosing, 7 to 10 on each side of the midrib; petiolules 3 to 8 mm long. Flowers unknown. Infrutescence axillary, paniculate, up to 25 cm long, entirely glabrous, the lower branches up to 8 cm long, the upper ones shorter. Persistent calyces shallowly cup-shaped, truncate, 5 mm in diameter. Pods thin, flat, oblong to oblong-lanceolate, pale when dry, 6 to 10 cm long, 2.5 to 3 cm wide, the base acute or acuminate, apex shortly and slightly falcately apiculate-acuminate, the wings thin, 3 to 7 mm wide, of the same width on both sides of the pod. Seeds 2 or 3, rarely only 1, thin, flat, 2 mm long.

CEBU, Bucacao, *Bur. Sci. 11014 Ramos*, March 19, 1912, on dry hills.

A species apparently most closely allied to *Derris mindorensis* Perk., and to *D. micans* Perk., but distinguishable by being entirely glabrous throughout.

MEDICAGO L.

MEDICAGO LUPULINA L. Sp. Pl. (1753) 779; Baker in Hook. f. Fl. Brit. Ind. 2 (1876) 90.

LUZON, Benguet Subprovince, Baguio, *Merrill 7762*, May, 1911, in waste places, open grassy slopes, altitude about 1500 m. Introduced and apparently established, as is *Medicago denticulata* Willd.

Widely distributed in Europe and Asia, introduced in North America.

SIMARUBACEAE.

SURIANA L.

SURIANA MARITIMA L. Sp. Pl. (1753) 284; A. Gray Bot. Wilkes U. S. Explor. Exped. (1854) 307.

LUMBUCAN ISLAND, Sulu Sea, *Phil. Pl. 403 Merrill,* September, 1910. MANGSEE ISLAND, *Wilkes Expedition.*

This species has already been reported from the Philippines by A. Gray, specimens having been collected by the Wilkes Expedition on Mangsee Island, a short distance south of Lumbucan this record having been overlooked by me in my paper on the Philippine plants collected by the Wilkes Expedition.[4] It is widely distributed in the tropics of the World, but its occurrence in the Old World is rather peculiar and apparently restricted. I have found no published record of its occurrence on the Asiatic continent, nor in Formosa. I have specimens collected on Pratas Island, in the China Sea between Hongkong and Luzon, sent to me by Mr. Kawakami of Taihoku, Formosa. Both Miquel and Boerlage record it as Malayan, but without citing any locality or localities for it. It is found in the Laccadive Islands, in German New Guinea, and on the islands off the north-east coast of Australia, while it seems to be widely distributed in southern Polynesia.

MELIACEAE.

AGLAIA Lour.

AGLAIA BRACHYBOTRYS sp. nov. § *Euaglaia.*

Arbor circiter 8 m alta, ramilis subtus foliis inflorescentiisque minute subferrugineo-ciliato-lepidotis; foliis alternis, circiter 40 cm longis, foliolis membranaceis, alternis, circiter 7, oblongo-ovatis vel oblongo-ellipticis, usque ad 17 cm longis; paniculis lateralibus, circiter 9 cm longis; floribus racemose dispositis, brevissime pedicellatis, 4-meris, tubo stamineo cum petalis distincte coalito.

A tree about 8 m high. Branches pale-brown, terete, densely covered with minute ciliate-lepidote scales. Leaves alternate, unequally pinnate, about 40 cm long, the petiole, rachis, and

[4] This Journal 3 (1908) Bot. 73–84.

petiolules densely covered with pale-brown, lepidote, ciliate scales. Leaflets alternate, usually 7, membranaceous, ovate-oblong to oblong-elliptic, 12 to 17 cm long, 5.5 to 8 cm wide, slightly shining when dry, glabrous above, beneath of the same color and ciliate-lepidote on the nerves and midrib, and with scattered, small scales on the surface, the base of the lateral ones inequilateral, somewhat acuminate, of the terminal one equilateral, the apices somewhat acuminate; lateral nerves 8 to 12 on each side of the midrib, prominent; petiolules of the lateral leaflets 1 cm long, of the terminal one about twice as long. Panicles lateral, about 9 cm long, the peduncle less than 1 cm long, somewhat dichotomously branched, the branches spreading, all parts covered with small, pale-brown, ciliate-lepidote scales. Flowers about 3 mm long, racemosely rather densely arranged on the ultimate branchlets, their pedicels 0.5 mm long or less. Calyx ciliate-lepidote, when spread nearly 2 mm square, the teeth 4, rarely 5, broadly triangular, acute, less than 0.5 mm long. Petals 4, glabrous, elliptic-oblong or oblong-obovate, obtuse, about 3 mm long, 2 mm wide, adherent to the staminal-tube in the lower one-third. Staminal-tube 2.5 mm long, truncate, glabrous, bearing 7 or 8 stamens attached at or just above the middle, the anthers about 1 mm long, included. Ovary sessile, ovoid, minute, pubescent. Fruit unknown.

LUZON, Province of Cagayan, San Vicente, in dense forests at an altitude of about 15 m, *For. Bur. 15497 Bernardo,* April 15, 1910.

A species with somewhat the general appearance of *Aglaia hexandra* Turcz., but with fewer leaflets, much shorter panicles, and quite different flowers. According to DeCandolle's scheme of classification it is much more closely allied to *Aglaia turczaninowii* A. DC., but is entirely different from that species.

AGLAIA CAGAYANENSIS sp. nov. § *Euaglaia.*

Arbor circiter 7 m alta, partibus junioribus inflorescentiisque lepidotis, vetustioribus glabris; foliis usque ad 14 cm longis, 3- ad 5-foliolatis, foliolis anguste oblongo-ellipticis vel oblongo-ovatis, caudato-acuminatis; paniculis axillaribus, quam folia brevioribus, paucifloris; floribus racemose dispositis, longe pedicellatis, tubo stamineo liber.

A tree about 7 m high, the branchlets and inflorescence rather densely lepidote, the older parts entirely glabrous. Branches slender, terete, dark-colored when dry, the branchlets pale. Leaves 14 cm long or less, alternate, the rachis and petiole 3 to 5 cm long; leaflets subcoriaceous, brittle when dry, 3 to 5,

narrowly oblong-elliptic to narrowly oblong-ovate, 6 to 10 cm long, 1.5 to 3 cm wide, narrowed at both ends, the apex somewhat caudate-acuminate, base acute, both surfaces shining, the lower a little paler than the upper; nerves 6 to 8 on each side of the midrib, not prominent; petiolules 2 to 3 mm long. Panicles in the upper axils, 10 cm long or less, peduncled, with few branches, each branch with from 1 to 3 racemosely disposed flowers, the pedicels 3 to 10 mm long. Calyx cup-shaped, about 2 mm in diameter, shallowly 5-toothed. Petals glabrous, orbicular, concave, 2.5 to 3 mm in diameter. Staminal-tube globose, free from the petals, about 2 mm long. Anthers 5, 1.5 mm long, included.

LUZON, Province of Cagayan, Abulug River, *Bur. Sci. 13801 Ramos*, January, 1912.

A species well characterized by its lax, very few-flowered panicles, the flowers long-pedicelled.

AGLAIA CURRANII sp. nov. § *Euaglaia.*

Arbor circiter 8 m alta, ramulis petiolis inflorescentiisque plus minusve ciliato-lepidotis; foliis alternis, circiter 30 cm longis, imparipinnatis, foliolis utrinque 5, lanceolatis, subcoriaceis, usque ad 11 cm longis, acuminatis, basi valde inaequilateralibus, subtus ad costa plus minusve ciliato-lepidotis; paniculis axillaribus, circiter 12 cm longis; floribus 5-meris, sessilibus vel subsessilibus, spicatim dispositis; petalis liberis.

A tree about 8 m high. Branches terete, glabrous, lenticellate, brownish, the younger parts more or less covered with minute, ciliate, lepidote scales, pale-brownish in color. Leaves alternate, about 30 cm long, the petioles, rachis, and petiolules densely covered with small, brownish, lepidote-ciliate scales. Leaflets usually 11, lanceolate, subcoriaceous, rather pale and of about the same color on both surfaces when dry, slightly shining above, 9 to 11 cm long, 2 to 3 cm wide, the apex prominently acuminate, the acumen blunt, the base strongly inequilateral, acuminate; nerves about 12 on each side of the midrib, slender, not prominent; petiolules about 1 cm long, that of the terminal leaflet about 1.5 cm long. Panicles axillary, ciliate-lepidote, about 12 cm long, branched from just above the base, the primary branches up to 7 cm in length. Flowers spicately disposed on the ultimate branchlets, sessile or subsessile, not at all crowded. Calyx densely ciliate-lepidote, the teeth 5, ovate, obtuse, ciliate, less than 0.5 mm long. Petals 5, glabrous, free from the staminal tube, oblong, obtuse, 1.5 to 1.8 mm long (just before anthesis). Staminal tube very short, glabrous, 1 mm long or less, truncate.

Stamens 5, inserted on the base of the tube, included, the anthers 0.5 mm long. Fruit unknown.

LUZON, Province of Bataan, Limay Peak, Mariveles Mountain, *For. Bur. 17580 Curran,* November, 1909, on dry forested ridges at an altitude of about 700 m.

A species well characterized by its lanceolate leaflets, its small ciliate-lepidote scales on the inflorescence, petioles, etc., its spicately arranged, sessile or subsessile flowers, and very short staminal-tube. According to De-Candolle's scheme of classification it seems to be allied to *Aglaia llanosiana* C. DC., but in all respects is quite different from that species.

AGLAIA DIFFUSA sp. nov. § *Hearnia.*

Arbor circiter 25 m alta, inflorescentiis exceptis glabra; foliis alternis, imparipinnatis, 3-jugatis, vix 30 cm longis; foliolis lanceolatis vel elliptico-lanceolatis, utrinque acuminatis aequilateralibusque, usque ad 14 cm longis, nervis utrinque circiter 10; paniculis axillaribus, folia aequantibus, diffusis, multifloris, ramis primariis patulis, usque ad 15 cm longis, plus minusve lepidotis vel puberulis; floribus 5-meris, pedicellatis, racemose dispositis.

A tree about 25 m high, glabrous except the somewhat lepidote and puberulent inflorescence. Branches terete, brownish, glabrous, the ultimate ones 4 mm in diameter or less. Leaves alternate, less than 30 cm long, the petiole and rachis 10 to 13 cm long. Leaflets 7, the lateral ones opposite, lanceolate or elliptic-lanceolate, 9 to 14 cm long, 2 to 4 cm wide, narrowed and acuminate at both ends, rather pale and somewhat shining when dry, of about the same color on both surfaces, glabrous, or the midrib beneath with few, small scales; nerves about 10 on each side of the midrib, slender, not very prominent, the reticulations lax, subobsolete; petiolules 4 to 6 mm long. Panicles in the upper axils, usually but one on a branchlet, diffuse, about 30 cm long, the lower branches spreading, 15 cm long, very many flowered, the rachis somewhat brown-lepidote, the ultimate branchlets somewhat brown-puberulent. Flowers yellow, racemosely arranged on the ultimate branchlets, scattered, their pedicels 1 to 1.5 mm long. Calyx-teeth 5, broadly ovate, obtuse, 0.3 mm long, ciliate. Petals 5, glabrous, oblong-obovate to obovate, obtuse, 1.6 mm long, free from the staminal-tube. Staminal-tube broadly obovoid, truncate, about 1 mm long and 1.2 mm in diameter. Stamens 5, inserted on the edge of the staminal-tube, slightly inflexed, 0.25 mm long.

LUZON, Province of Tayabas, Guinayangan, *For. Bur. 18684 Darling,* November 21, 1909. In forests at an altitude of about 50 m, locally known as *malasaguin.*

A species of the section *Hearnia,* well characterized by being nearly

glabrous throughout, and by its very diffuse, ample, many-flowered panicles which are more or less lepidote and puberulent. It does not seem to me to be closely allied to any of the previously described species of the genus, although in many respects it resembles *Aglaia harmsiana* Perk.

DYSOXYLUM Blume.

DYSOXYLUM LAXUM sp. nov. § *Eudysoxylum.*

Arbor circiter 10 m alta, partibus junioribus puberulis exceptis glabra; foliis alternis, abrupte pinnatis, circiter 30 cm longis, 4- vel 5-jugis, foliolis oblongo-ovatis ad late oblongo-lanceolatis, valde acuminatis, in siccitate pallidis; paniculis axillaribus, folia aequantibus, parce ramosis, paucifloribus; floribus 4-meris, circiter 1 cm longis, petalis supra puberulis.

A tree about 10 m high, glabrous except the somewhat puberulent younger parts. Branches terete, brownish, lenticellate, the growing parts grayish and somewhat puberulent. Leaves alternate, evenly pinnate, about 30 cm long, the rachis and petiole slender, more or less puberulent, about 15 cm long; leaflets 4 or 5 pairs, the uppermost ones opposite, the others subopposite or alternate, thinly chartaceous or membranaceous, pale when dry, concolorous, slightly shining, oblong-ovate to broadly oblong-lanceolate or somewhat elliptic-oblanceolate, the lower ones inequilateral at the base, 4 to 5 cm long, the upper ones equilateral, gradually larger and up to 15 cm long and 4.5 cm wide, base acute, apex rather slenderly acuminate; lateral nerves about 10 pairs, slender; petiolules 2 to 5 mm long. Panicles axillary, slender, as long as the leaves, lax, each with very few spreading branches, the lower branches 6 cm long or less and each bearing 2 or 3 flowers, the slender pedicels up to 1.5 cm long. Flowers pinkish, 4-merous. Calyx narrowly funnel-shaped, narrowed below, about 5 mm long, puberulent, obscurely toothed. Petals narrowly oblong, obtuse, about 8 mm long, glabrous on the back except at the apex where they are somewhat puberulent. Staminal tube cylindric, free or nearly so, 6 mm long, somewhat toothed at the apex. Stamens 8, inserted at the top of the tube, included. Disk cylindric, 4-toothed, about 2.5 mm long, glabrous. Ovary hirsute; style 5 mm long, slender, glabrous. Young fruits obovoid or somewhat ellipsoid, 1.5 cm long, glabrous, apiculate at the apex.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14694 Ramos*, March 28, 1912, in forests at Panaytayum.

A very distinct and characteristic species recognizable by its lax, very few-flowered panicles, long-pedicelled flowers, etc. It is probably most closely allied to *Dysoxylum pauciflorum* Merr., but is entirely distinct from that species.

TOONA Roemer.

TOONA PAUCIJUGA sp. nov.

Species ut videtur *T. calantas* Merr. & Rolfe valde affinis, differt foliolis paucioribus, 7 vel 9, glabris, subtus in axillis venarum prominente glandulosis.

A tree reaching a height of about 10 m, glabrous throughout (inflorescence unknown). Branches brownish, glabrous, somewhat striate when dry. Leaves alternate, odd-pinnate, 30 to 35 cm long. Leaflets 7 or 9, oblong-ovate to elliptic-ovate, firmly chartaceous, brownish and of nearly the same color on both surfaces when dry, shining, the median ones 10 to 13 cm long, 5 to 6 cm wide, the lower ones somewhat smaller, opposite or subopposite, entire, the base inequilateral, rounded, or on one side of the lamina sometimes acute or acuminate, the apex distinctly acuminate, the acumen usually somewhat falcate, blunt; lateral nerves 10 to 12 on each side of the midrib, distinct, their axils on the lower surface with distinct glands; petiolules 1 cm long or less. Flowers unknown. Panicles terminal, in fruit about 12 cm long. Mature fruits quite similar to those of *Toona calantas*, about 3.5 cm long.

LEYTE, between Dolores and Ormoc, in forests at an altitude of about 100 m, *For. Bur. 12618 Rosenbluth*, February, 109, locally known as *calantas*.

A species well characterized by its few leaflets which are prominently glandular in the axils of the veins on the lower surface.

DICHAPETALACEAE.

DICHAPETALUM Thou.

DICHAPETALUM CILIATUM sp. nov.

Frutex scandens, ramulis petiolis foliisque utrinque ad costa nervisque insigniter ciliatis; foliis oblongis vel oblongo-ellipticis, usque ad 14 cm longis, chartaceis, apice acuminatis, basi acutis vel subrotundatis, nervis utrinque circiter 8, prominentibus; cymis axillaribus, brevibus, petiolo subaequantibus; fructibus dense griseo-villosis, 14 mm longis, 2-locellatis.

A scandent shrub, prominently ciliate with long, spreading hairs. Branches slender, terete, reddish-brown when dry, the older ones nearly glabrous, the younger ones prominently ciliate with rather pale hairs. Leaves oblong to elliptic-oblong, 8 to 14 cm long, 3 to 6 cm wide, chartaceous, somewhat narrowed to the acute or subrounded base, the apex rather slenderly and sharply acuminate, the acumen 0.5 to 1.5 cm long, the margins and the midrib and nerves on both surfaces prominently ciliate with spreading, pale or somewhat brownish hairs, otherwise

glabrous, both surfaces shining, the lower of about the same color as, or a little paler than, the upper; lateral nerves about 8, very prominent on the lower surface, curved-ascending, anastomosing, the primary reticulations rather lax, prominent; petioles 5 to 10 mm long, prominently ciliate. Cymes axillary, small, sessile or subsessile, dense, not longer than the petioles, ciliate, many-flowered, the bracteoles lanceolate, 2 mm long or less. Sepals oblong, obtuse, 2 mm long, outside densely pubescent. Petals narrowly oblong-spatulate, the apex broad, retuse or slightly cleft, the cleft less than 0.5 mm deep, the base narrowed. Filaments about 2 mm long; anthers 1 mm long. Ovary pubescent. Fruit broadly ellipsoid, more or less compressed, densely gray-pubescent, about 1.5 cm long, divided longitudinally by deep lateral grooves and slightly retuse at the apex, 2-celled.

MINDANAO, District of Zamboanga, Port Banga, *For. Bur. 9293* (type), *9294, 9234 Whitford & Hutchinson*, December, 1907 and January, 1908, *Bur. Sci. 11819 Robinson*, July, 1910, in forests at low altitudes.

A species well caracterized by its prominently ciliate branchlets, inflorescence, and leaves, the latter glabrous except for the ciliate midrib and lateral nerves on both surfaces and usually also the margins.

DICHAPETALUM ROBINSONII sp. nov.

Arbor parva, circiter 8 m alta, subtus foliis ramulis inflorescentiisque dense sericeo-villosis; foliis subcoriaceis, late ellipticis vel ovato-ellipticis, usque ad 15 cm longis, supra nitidis, parce pubescens, basi rotundatis, apice acutis, nervis utrinque circiter 9, prominentibus; petiolo crasso, circiter 4 mm longo; inflorescentiis in axillis superioribus vel subterminalibus, breviter pedunculatis, floribus congestis; fructibus obovoideis, dense breviter fulvo-villosis.

A small tree, reaching a height of 8 m, the branches terete, reddish-brown, somewhat pubescent, the younger branchlets densely covered with short, villous, fulvous hairs, as are the petioles, inflorescence, and lower surfaces of the leaves. Leaves subcoriaceous, broadly elliptic to ovate-elliptic, 10 to 14 cm long, 6 to 8 cm wide, the upper surface brownish-olivaceous when dry, shining, sparingly pubescent, the hairs more numerous on the midrib and nerves, the lower surface densely fulvous-pubescent with short hairs; petioles about 4 mm long; lateral nerves about 9, prominent, the primary reticulations rather lax, distinct. Inflorescence in the upper axils and subterminal, shortly peduncled, up to 4 cm long, all parts fulvous-villous, the bracteoles linear, 1 to 1.5 mm long. Sepals ovate-lanceolate, acute or somewhat acuminate, about 2 mm long, externally densely pubes-

cent. Petals glabrous, elliptic to obovate, cleft to the middle. Filaments as long as the sepals; anthers about 0.5 mm long. Fruit apparently obovoid (immature), 1 to 1.5 cm long, externally densely fulvous-pubescent, apparently 1-seeded.

MINDANAO, District of Zamboanga, Port Banga, *Bur. Sci. 11771 Robinson*, July 5, 1910, growing at the edge of the forest.

A species very similar in appearance *Dichapetalum luzoniense* Merr. & Rolfe, and distinguishable only by some minor characters. The leaves are quite different in shape, not narrowed to the base, acute, not at all acuminate, with a few more nerves and more densely pubescent on the lower surface than in the Luzon species. *D. luzoniense* Merr. & Rolfe is manifestly a woody vine, while *D. robinsonii* is described as a tree, reclining, and reaching a height of 8 m. The inflorescence is also subterminal, not strictly axillary, and not long-peduncled.

ANACARDIACEAE.

PARISHIA Hook. f.

PARISHIA MALABOG *sp. nov.*

Arbor alta, glabra, vel partibus junioribus inflorescentiisque minute puberulis; foliis 30 ad 40 cm longis, imparipinnatis; foliolis 11 ad 15, nitidis, crasse coriaceis, oblongis vel oblongo-ovatis, acuminatis, basi obliquis, valde inaequilateralibus, subacutis vel rotundatis, usque ad 14 cm longis; paniculis folia aequantibus, glabris vel obscure puberulis; floribus breviter pedicellatis, petalis quam sepalis vix longioribus, segmentis calycinis auctis, anguste oblongis, obtusis, usque ad 10 cm longis.

A tall tree, reaching a height of 25 m, glabrous or nearly so. Ultimate branches thickened, 1 to 1.5 cm thick, grayish or brownish, marked with large petiolar scars, glabrous, or the growing tip somewhat puberulent. Leaves somewhat crowded at the ends of the branchlets, 30 to 40 cm long, their petioles stout. Leaflets 11 to 15, oblong to oblong-ovate, thickly coriaceous, 8 to 15 cm long, 4 to 6 cm wide, shining, inequilateral, entire, the apex acuminate, the base oblique, one side of the lamina much broader than the other, usually broadly rounded, the narrower side usually acute; nerves about 14 on each side of the midrib, prominent, anastomosing, the reticulations distinct; petiolules about 8 mm long. Panicles in the upper axils, as long as the leaves, glabrous or very slightly puberulent, their rachises stout, straight, the branches rather few, scattered, the lower ones 10 cm long or less, the upper ones shorter. Flowers 4-merous, short-pedicelled. Calyx at anthesis slightly puberulent, 4-lobed, the lobes about 6 mm long, obtuse, somewhat spreading. Petals 4, triangular-ovate, obtuse, glabrous, reti-

culate, imbricate, about 4 mm long. Ovary ovoid, pubescent, 1-celled, with a single ovule pendulous from near the apex, tapering into the short style; style trifid, sometimes bifid; stigmas capitate; rudimentary stamens 4, inserted outside of the disk, the filaments 1 mm long, the anthers as long as the filaments. Male flowers not seen. Fruit densely villous, about 2 cm long, the accrescent calyx-tube about 2.5 cm in diameter, 1.5 cm long, the lobes when young reddish or reddish-brown, when mature brown, narrowly oblong, rounded, up to 10 cm long, 1 to 1.2 cm wide.

CEBU, Buacao, *Bur. Sci. 11109 Ramos,* March 19, 1912 (type), with leaves, immature fruits, and female flowers. TICAO, *For. Bur. 12530, 12540 Rosenbluth,* December, 1908, sterile specimens. MASBATE, *For. Bur. 21030 Darling,* May, 1910, sterile, *Foxworthy.* NEGROS, *For. Bur. 17356 Curran,* September, 1909, seedlings and fallen fruits. TABLAS, *For. Bur. 19526 José.* MINDORO, *For. Bur. 9831 Merritt.*

This very characteristic species is most closely allied to *Parishia insignis* Hook. f. of Tenasserim and the Andaman Islands, and Penang, although quite different from that species. It is the first representative of the genus to be found in the Philippines.

Rosenbluth notes that it is the most common tree species on the Island of Ticao, especially abundant on dry rocky hills, and that the trunk has a clear length seldom exceeding 15 meters. He notes also that it has abundant white juice in the bark and leaves. In Ticao the lumber is not used by the natives, but in Masbate it is used for making *bancas,* that is, dugout canoes. Mr. Elmer has noted on two of the sheets of sterile specimens "*Anacardiaceae fide* Radlkofer, see *Elmer 12164.*" The inference is that *Elmer 12164,* a number apparently undistributed as yet, represents the same species. Our material shows conclusively that the plant is referable to *Parishia,* and the specific name is taken from its current Visayan name, *malábog.*

SEMECARPUS L.

SEMECARPUS ACUMINATISSIMA sp. nov.

Arbor parva (vel frutex?) inflorescentis exceptis glabra vel subglabra; foliis anguste oblongo-ellipticis ad oblongo-oblanceolatis, chartaceis vel subcoriaceis, usque ad 20 cm longis, basi angustatis, acutis, apice subcaudato-acuminatis, subtus pallidioribus haud glaucescentibus, nervis prominentibus, utrinque circiter 16; paniculis terminalibus, brevibus, angustis, quam folia multo brevioribus, parce pubescentibus vel puberulis, floribus masculinis parvis, 5-meris.

A small tree or a shrub, except the inflorescence nearly glabrous. Branches terete, slender, grayish. Leaves oblong-elliptic to oblong-oblanceolate or narrowly oblong-ovate, 13 to 20 cm long, 4.5 to 6 cm wide, chartaceous or subcoriaceous, narrowed from about the middle or below to the acute base,

the apex prominently and rather slenderly subcaudate-acuminate, the acumen straight or somewhat curved, 1 to 2 cm long, the upper surface glabrous, when dry somewhat olivaceous, shining, the lower surface pale but not glaucous, slightly shining, very minutely puberulent or nearly glabrous; lateral nerves about 16 on each side of the midrib, prominent, spreading, anastomosing, the reticulations distinct, the primary ones slender, leaving the nerves at about right angles and anastomosing with the secondary lateral nerves, the ultimate free ends of the nervules rather distinct; petioles 1 to 2 cm long. Panicles terminal, slender, narrowly pyramidal, about 7 cm long, the lower branches about 2 cm in length, puberulent or somewhat pubescent with grayish hairs, the branchlets more or less ferruginous. Male flowers somewhat crowded on the ultimate branchlets, their pedicels 1 to 1.5 mm long, the bracteoles lanceolate, acuminate, pubescent, 1 to 1.4 mm long. Calyx pubescent, 2.5 mm in diameter, 5-lobed, the lobes broadly ovate, obtuse, puberulent. Petals prominently punctate-striate, oblong-ovate, obtuse, 2 mm long. Disk 1 mm in diameter, ferruginous-pubescent. Anthers 1 mm long. Immature fruits with puberulent pedicels 5 to 8 mm long, the hypocarpium puberulent, when dry about 4 mm long and wide, the drupe obliquely ovoid, somewhat compressed, 5 to 6 mm long, very slightly pubescent, apparently becoming quite glabrous.

LUZON, Province of Tayabas, Kabibihan, *Bur. Sci. 13241 Ramos*, February 27, 1911, in forests along streams, ♂ flowers: Province of Zambales, *Bur. Sci. 5058 Ramos*, December, 1907, with immature fruits.

A species manifestly allied to *Semecarpus philippinensis* Engl., but distinguished by its short and slender panicles, and its differently shaped leaves which are prominently subcaudate-acuminate and usually obscurely puberulent beneath.

SEMECARPUS EUPHLEBIA sp. nov.

Arbor circiter 18 m alta, inflorescentiis puberulis exceptis glabra; foliis crassissime coriaceis, oblongis vel anguste oblongo-ovatis, apice obtusis, basi acutis, usque ad 20 cm longis, supra nitidis, subtus glaucescentibus, nervis utrinque circiter 20, valde prominentibus, petiolo 4 ad 5 cm longo; paniculis folia subaequantibus, anguste pyramidatis, puberulis, floribus 5-meris.

A tree about 18 m high, glabrous except the puberulent inflorescence. Branches stout, brownish, the ultimate ones about 8 mm in diameter. Leaves very thickly coriaceous, oblong to narrowly oblong-ovate, 16 to 20 cm long, about 6 cm wide, narrowed upward to the obtuse apex, and below to the acute

base, of about the same color on both surfaces when dry, rather pale, the upper one shining, the lower more or less glaucous, dull; nerves about 20 on each side of the midrib, very prominent on the lower surface, spreading, parallel, anastomosing near the margins, the primary reticulations leaving the veins at right angles and anastomosing with intermediate secondary veins, the ultimate reticulations not prominent; petioles stout, 4 to 5 cm long. Panicles terminal, about as long as the leaves, uniformly and somewhat olivaceous-puberulent, narrowly pyramidal, the lower branches 5 to 6 cm long. Flowers unknown, but the persistent sepals 5. Hypocarpium 5 to 6 mm long, 2 mm wide at the base, 4 mm wide at the apex, longitudinally obscurely sulcate, slightly puberulent. Drupe (very immature) 7 mm long, 5 mm in diameter, oblong-ovoid, slightly compressed, sparingly pubescent at the apex, apparently becoming entirely glabrous.

LUZON, Province of Tayabas, Quinatacutan River, *Bur. Sci. 13163 Foxworthy & Ramos,* March, 1911, in forests along the river.

Apparently a very characteristic species, its distinguishing features being its very coriaceous, glabrous, comparatively long-petioled, prominently nerved leaves, its narrowly pyramidal puberulent panicles, its hypocarpium much longer than wide, and its oblong-ovoid drupes.

SEMECARPUS LANCEOLATA sp. nov.

Arbor parva, glabra; foliis crasse coriaceis, lanceolatis, usque ad 30 cm longis, utrinque angustatis, apice obtusis, basi acutis, nervis utrinque circiter 22, haud prominentibus, in siccitate supra nitidis, subtus pallidioribus, vix glaucescentibus, petiolo 5 ad 7 cm longo; paniculis glabris, ramis inferioribus circiter 13 cm longis, drupis reniformibus, compressis, leviter carinatis, 2 cm latis.

A small tree, apparently glabrous throughout (inflorescence and flowers not seen.) Branches stout, the ultimate ones 1.5 cm in diameter, lenticellate, dark-brown, shining. Leaves lanceolate, 20 to 30 cm long, 4 to 7 cm wide, narrowed at both ends, the apex obtuse, base acute, thickly coriaceous, when dry shining, the upper surface rather pale, the lower one paler than the upper but not glaucous; lateral nerves about 22 on each side of the midrib, not prominent, spreading, faintly anastomosing, the reticulations very irregular, the ultimate ones dense, indistinct; petioles 5 to 7 cm long. Panicles terminal, in fruit quite glabrous, the lower branches about 12 cm long. Flowers unknown. Hypocarpium, when dry, about 1 cm long, 8 mm wide at the tip, narrowed below, apparently very much larger when fresh, the peduncle usually about 1 cm long. Drupe reniform,

compressed, about 2 cm wide, 1.3 cm long, somewhat keeled, nearly or quite smooth when dry.

LUZON, Abra Subprovince, Dolores, *Bur Sci. 7083 Ramos*, February, 1909, in forests, fruit red.

A very characteristic species, distinguishable by being entirely glabrous, by its lanceolate, elongated, coriaceous, long-petioled leaves, and by its comparatively large drupes which are reniform and distinctly keeled.

SEMECARPUS MAGABOTRYS sp. nov.

Arbor dioica ramulis subtus foliis inflorescentiisque ferrugineo- vel pallide fulvo-villosis; foliis anguste oblongo-obovatis ad obovato-lanceolatis, crasse coriaceis, usque ad 22 cm longis, apice obtusis, acutis, vel rotundatis, basi angustatis, abrupte obtusis vel rotundatis, supra glabris, in siccitate nitidis, subtus pallidis; nervis primariis utrinque circiter 22, prominentibus; paniculis terminalibus, 40 ad 50 cm longis.

A dioecious tree probably of small or medium size. Branches stout, brownish, the younger ones rather prominently pubescent. Leaves narrowly oblong-obovate to obovate-lanceolate, thickly coriaceous, the apex acute, blunt, or rounded, the base narrowed and abruptly obtuse or rounded, 15 to 22 cm long, 5 to 8 cm wide, when dry the upper surface rather pale, shining, glabrous, the lower surface much paler than the upper one, more or less glaucous, and rather densely villous with pale-brownish hairs; lateral nerves about 22 on each side of the midrib, very prominent on the lower surface, spreading or somewhat ascending, the secondary ones subparallel, prominent, the ultimate reticulations distinct; petioles stout, pubescent, 1 to 1.5 cm long. Panicles pyramidal, terminal, 40 to 50 cm in length, ferruginous- or fulvous-villous, the flowers very numerous. Male flowers fascicled or glomerate at the nodes, the calyx 2 mm in diameter, pubescent, 5-toothed, the teeth short, triangular. Petals 5, oblong-ovate, acute, 2 mm long. Disk about 1.3 mm in diameter. Female flowers: Calyx pubescent, 3 mm in diameter. Petals 5, oblong-ovate, acute, 3 mm long. Ovary depressed, densely ferruginous-villous, about 2 mm in diameter. Young fruit with pedicels 1.5 to 2 cm in length, the hypocarpium rather densely ferruginous-villous, 4 mm long, about 5 mm wide when dry, the drupe somewhat compressed (immature), obovoid, about 7 mm long, with scattered, apparently deciduous, ferruginous hairs, apparently ultimately glabrous.

LUZON, Province of Nueva Vizcaya, *For. Bur. 22359 Alvarez*, January, 1911, one specimen with male flowers, one with female flowers (type), and one with immature fruits.

Probably as closely allied to *Semecarous perrottetii* March., as to any other species, but at once distinguished by its indumentum, its more or less pubescent fruits (at least the hypocarpium), and its very large panicles.

SEMECARPUS OBTUSIFOLIA sp. nov.

Arbor circiter 20 m alta, inflorescentiis exceptis glabra; foliis ellipticis, usque ad 13 cm longis, crasse coriaceis, apice late rotundatis, basi acutis, in siccitate supra subolivaceis, nitidis, subtus pallidis, glaucescentibus, nervis utrinque circiter 10, valde prominentibus; paniculis terminalibus pyramidatis, quam folia multo longioribus, plus minusve ferrugineo-hirsutis; floribus 5-meris.

A tree about 20 m high, the branches slender, terete, grayish, sparingly lenticellate. Leaves thickly coriaceous, elliptic or subelliptic, 7 to 13 cm long, 3.5 to 7 cm wide, the apex very broadly rounded, the base abruptly acute, glabrous, when dry the upper surface olivaceous, shining, the lower surface pale, glaucous; lateral nerves about 10 on each side of the midrib, prominent on the lower surface, spreading and somewhat ascending, curved, anastomosing, the primary reticulations lax, distinct, leaving the nerves at right angles, the ultimate ones indistinct; petioles 8 to 15 mm long. Panicles terminal, pyramidal, about 20 cm long, the branches scattered, the lower ones up to 12 cm in length, the younger parts rather prominently ferruginous-pubescent or hirsute. Flowers subglomerately arranged on the ultimate branchlets, sessile, 5-merous, numerous. Male flowers: Calyx 2 mm in diameter, 5-lobed, the lobes obtuse or rounded. Petals oblong-ovate, obtuse, 1.5 mm long. Disk ferruginous-pubescent. Anthers 0.8 mm long.

BALABAC, in forests, *Bur. Sci. 512 Mangubat*, March 4, 1906.

A species distinguishable at once by its elliptic, broadly rounded leaves which are olivaceous above and glaucous beneath.

SEMECARPUS PAUCINERVIA sp. nov.

Arbor parva circiter 10 m alta, inflorescentiis exceptis glabra; foliis anguste oblongo-obovatis vel oblongo-ellipticis, coriaceis, nitidis, apice late rotundatis, basi acutis, usque ad 9 cm longis, nervis utrinque circiter 8, arcuatis, subtus distinctis; paniculis leviter hirsutis, laxis, quam folia multo longioribus, multifloris, floribus ♂ in fasciculis racemosis, distincte pedicellatis, 5-meris.

A small tree about 10 m high. Branches terete, grayish, slightly lenticellate, shining, slender, glabrous, the growing parts slightly pubescent. Leaves narrowly oblong-obovate to oblong-elliptic, 5 to 9 cm long, 2 to 3 cm wide, coriaceous, the apex

broadly rounded, the base usually narrowed, acute, glabrous and shining on both surfaces, when dry the upper surface rather pale, the lower one much paler and somewhat glaucous; nerves about 8 on each side of the midrib, curved-ascending, anastomosing, distinct on the lower surface, the primary reticulations lax, leaving the nerves at right angles, the ultimate reticulations obscure; petioles 5 to 7 mm long. Panicles terminal and in the upper axils, sparingly hirsute with short, scattered, pale-brownish hairs, lax, pyramidal, 12 to 20 cm in length, the lower branches up to 10 cm in length. Male flowers in scattered fascicles which are racemosely arranged on the ultimate branches, their pedicels slender, 1.5 to 2 mm long, the bracteoles ovate-lanceolate, 0.5 mm long. Calyx 1.5 mm in diameter, 5-lobed, the lobes ovate, obtuse, 0.5 mm long. Petals oblong-ovate, obtuse or acute, 1.8 mm long. Disk somewhat ferruginous-pubescent. Anthers 1 mm long.

PALAWAN, Mount Victoria, *Bur. Sci. 570 Foxworthy* March 25, 1906, on river banks, altitude about 180 meters.

A very distinct species, characterized by its small, few-nerved leaves which are broadly rounded at their apices, and by its lax panicles, the flowers being distinctly and slenderly pedicelled.

SEMECARPUS PILOSA sp. nov.

Arbor parva ut videtur S. cuneiformis affinis, differt foliis subtus densissime pilosis, paniculis ferrugineo-pilosis.

A tree apparently of small size, the branches stout, pubescent. Leaves more or less crowded at the ends of the branches, thickly coriaceous, oblong-obovate, 9 to 20 cm long, 4 to 8 cm wide, the apex broadly rounded, sometimes retuse, narrowed below to the abruptly obtuse, not at all decurrent base, the upper surface somewhat grayish when dry, shining, quite glabrous except for the more or less pubescent midrib, the lower surface densely pilose, paler than the upper one; lateral nerves 13 to 16 on each side of the midrib, very prominent, spreading, somewhat curved and anastomosing, the secondary nerves leaving them at right angles, subparallel, distinct; petioles stout, pubescent, 8 to 10 mm long. Panicles terminal, pyramidal, ferruginous-pilose, about 15 cm long, the branches spreading, the lower ones about 8 cm in length. Petals 5, ovate to oblong-ovate, somewhat acuminate, 2.5 mm long. Ovary ovoid, densely fulvous-villous. Hypocarpium, when fresh, orange-yellow, when dry about 4 mm long nearly as thick as the drupe, more or less ferruginous-pubescent, the drupe slightly compressed, obliquely ovoid, obtuse,

smooth, black, about 8 mm long, slightly pubescent externally, ultimately becoming glabrous or nearly so, the pericarp leathery.

LUZON, Province of Nueva Vizcaya, Dupax, *Bur. Sci. 11435 McGregor*, March, 1912, locally known as *baliunasoy*.

A species well characterized by its leaves being densely pilose on the lower surface. Like most or all the species in the genus, the pericarp of the fruit contains a black resin.

SEMECARPUS WHITFORDII sp. nov.

Species S. cuneiformis Blanco similis et ut videtur valde affinis, differt foliis distincte acuminatis, paniculis dense pallide fulvo-pilosis.

A small tree, the branches terete, brownish, slightly sulcate when dry, more or less pubescent. Leaves oblong-oblanceolate, thinly coriaceous, 14 to 24 cm long, 3 to 7 cm wide, narrowed from above the base to the acute, and usually distinctly inequilateral base, the apex distinctly acuminate, the acumen rather sharp, less than 1 cm long, the upper surface pale and shining when dry, glabrous or very slightly pubescent along the midrib, the lower surface rather pale-fulvous-pilose, the hairs rather short, spreading, more dense on the midrib and lateral nerves; lateral nerves 15 to 17 on each side of the midrib, prominent, spreading, anastomosing, the reticulations rather close, distinct; petioles 1 to 2.5 cm long, somewhat pubescent. Panicles terminal, ample, diffuse, about 25 cm long, the lower branches up to 12 cm long, the upper ones shorter, spreading, all parts rather densely pilose with pale-fulvous, spreading hairs. Flowers very numerous, 5-merous, more or less glomerate on the ultimate branchlets, sessile or subsessile. Male flowers 4 mm in diameter in anthesis. Calyx villous externally, shallowly cup-shaped, the lobes orbicular-ovate, obtuse, 0.5 to 0.8 mm long, prominently striate-reticulate, the reticulations dark-colored. Petals oblong-ovate, acute, pubescent externally, reticulate-striate like the calyx. Disk glabrous, shallowly 5-crenate. Rudimentary ovary very small, densely fulvous-villous. Filaments filiform, 3 mm long; anthers ovoid, 0.8 mm long. Female flowers and fruits not seen.

MINDANAO, District of Cotabato, Lebak, *For. Bur. 11774 Whitford*, March 4, 1912, in dipterocarp forests at low altitudes.

A species similar to, and certainly closely allied to *Semecarpus cuneiformis* Blanco, from the typical form of which it differs in its distinctly acuminate leaves which are pale beneath but scarcely glaucous, and by its densely pilose panicles, the indumentum of a pale-fulvous color. It is apparently more closely allied to Blanco's species than to any of the numerous forms recently described by Doctor Perkins.

SEMECARPUS CUNEIFORMIS Blanco Fl. Filip. (1837) 220, ed. 2 (1845) 155, ed. 3, 1: 276, Naves l. c. ed. 3, *pl. 75*.

Semecarpus perrottetii March. Rév. Anac. (1869) 169; Engl. in DC. Monog. Phan. 4 (1883) 380; Vid. Rev. Pl. Vasc. Filip. (1886) 101; Perk. Frag. Fl. Philip. (1904) 28.

Semecarpus anacardium Blanco Fl. Filip. (1837) 217, ed. 2 (1845) 152, non L. f.

Semecarpus microcarpa F.-Vill. Novis. App. (1880) 55, non Wall.

Semecarpus pubescens F.-Vill. l. c., non Thwaites.

Semecarpus sideroxyloides Perk. Frag. Fl. Philip. (1904) 28.

This species is common and widely distributed in the Philippines, and is the most abundant one of the genus found in the Archipelago. There is no valid reason why Blanco's specific name, *cuneiformis*, should not be adopted for the species, although like many of Blanco's descriptions, that of *Semecarpus cuneiformis* is short and imperfect. The one distinctive character that he gives is that the leaves are retuse at the apex, which is true of a number of specimens manifestly referable to *Semecarpus perrottetii* March.

The type of *Semecarpus perrottetii* March. was collected by Perrottet in Luzon, and is preserved in the Herbarium of the Paris Museum of Natural History. Two sheets are so named by Marchand, one of which bears Perrottet's note "trés comun .... á Manille," indicating that the type was collected in Manila. The species is still very common in and about the city, and in essential characters is rather constant. There is considerable variation in the shape of the leaves, their apices varying from broadly rounded to retuse on the one hand, and to acute or shortly and broadly acuminate on the other. Perrottet's type has broadly rounded leaves, according to carbon rubbings kindly made for me by Dr. C. B. Robinson, and according to a carbon rubbing made by myself of the single leaf of Perrottet's plant preserved in the Berlin Herbarium.

Semecarpus anacardium Blanco, non L. f., is manifestly the same species, although, of course, Blanco may have included in it more than the common form. *Semecarpus anacardium* L. f. certainly does not extend to the Philippines.

Semecarpus microcarpa F.-Vill. is only a mis-identification of Blanco's *S. cuneiformis* on the part of F.-Villar., while *S. pubescens* F.-Vill., is a manifest mis-identification of Blanco's *S. anacardium*.

Semecarpus sideroxyloides Perk., is typical *S. perrottetii* March., = *S. cuneiformis* Blanco, and is accordingly reduced. A number of specimens referred by Doctor Perkins to *Semecarpus perrottetii* March.[5] are not properly referable to that species.

I consider *Semecarpus cuneiformis* Blanco (*S. perrottetii* March.) to be well represented by the following specimens:

LUZON, Province of Cagayan, *For. Bur. 16983 Bacani, For. Bur. 18605 Klemme:* Province of Ilocos Norte, *Bur. Sci. 7676 Ramos:* Bontoc Sub-province, *For. Bur. 10981 Curran:* Province of Union, *Elmer 5562, 5637:* Province of Pangasinan, *Alberto 83:* Province of Zambales, *For. Bur. 6977 Curran, Merrill 3010, Sankuhl s. n., Hallier s. n.:* Province of Bulacan, *Mrs. Templeton s. n.* MANILA, *Perrottet* (type of *S. perrottetii* March.,

[5] Frag. Fl. Philip. (1904) 28.

in herb. Paris.), *Malvar 349*, *Cuzner 55*, *Marave 30*, *Ahern 716:* Province of Rizal, Pasay, *For. Bur. 15385 Curran & Schneider;* Antipolo, *Merrill 1720;* Montalban, *Loher 5850:* Province of Bataan, *Merrill 1484*, *For. Bur. 1305*, *2720 Borden*, *For. Bur. 2513 Meyer*, *Ahern 769*, *Williams 646*, *632:* Province of Laguna, *Hallier s. n.* MINDORO, *For. Bur. 8813 Merritt*, *Merrill 2160* (cotype of *Semecarpus sideroxyloides* Perk.). GUIMARAS, *For. Bur. 6477 Everett.* LEYTE, *Elmer 7159.* NEGROS, *Bur. Sci. 7348 Celestino*, *For. Bur. 15159 Tarrosa.*

The common Tagalog name is *ligas*, the Visayan *agas* and *anagas*, the Ilocano *camiring*, the Pampangan *caming*, and the Bontoc *pacan.*

This species is the most common and the best known contact-poison in the Philippines, its noxious properties being well known to the natives. As with the well known contact-poisons in the United States, such as *Rhus toxicodendron* L., and *R. venenata DC.* some persons are immune while others are very subject to it. The symptoms caused by contact with fresh leaves of *Semecarpus cuneiformis* Blanco, especially when the leaves are wet, are quite like those caused by the species of *Rhus* mentioned above, and the eruption is amenable to the same treatment.

SEMICARPUS MICRANTHA Perk. Frag. Fi. Philip. (1904) 27.

Semecarpus taftiana Perk. l. c. 28.

But a single species is represented, for which the name *micrantha* is retained, this having page priority. The type of *Semecarpus micrantha* Perk., is a specimen with staminate flowers, while the type of *S. taftiana* Perk., is a specimen with pistillate flowers. They are from the same locality, with the same habitat, and were collected at the same time, February 15, 1903. In inflorescence, twigs, indumentum, color, shape, and venation of the leaves the specimens are quite the same. The only evident difference is that the leaves of *Semecarpus taftiana* are somewhat smaller and relatively a little narrower than are those of *S. micrantha.*

PALAWAN, Iwahig River, *Merrill 709*, ♂ flowers, cotype of *Semecarpus micrantha* Perk., 734, ♀ flowers, cotype of *Semecarpus taftiana* Perk., both collected February 15, 1903.

SEMECARPUS PHILIPPINENSIS Engl. in DC. Monog. Phan. 4 (1883) 481.

Semecarpus perrottetii March. var. *glabra* March. Rév. Anac. (1869) 170.

This species is rather common and of wide distribution in the Philippines, and is decidedly variable in the shape of its leaves, although in essential characters quite constant. The type of the species and of *Semecarpus perrottetii* var. *glabra* March. is *Cuming 1146*, from the Province of Ilocos Sur, Luzon, two sheets of which are in the Herbarium of the Bureau of Science. Engler[6] has referred to another Philippine specimen *Cuming 1776*, which was collected in Cebu, as apparently being referable to *Semecarpus albescens* Kurz. Specimens of this number are in the Herbarium of the Bureau of Science, and while they are not identical with the type number of *Semecarpus philippinensis*, I can, after examining a large series of specimens, showing numerous intermediate forms, detect no characters

[6] L. c. 489.

that warrant the recognition of two distinct species, and accordingly refer *Cuming 1776* to *Semecarpus philippinensis* Engl. In degree of distinctness the ultimate reticulations in the two specimens differ considerably, and by Engler are accordingly placed in different sections in his key to the species. This character, however, is not at all constant, and all intergrades occur. I refer to *Semecarpus philippinensis* Engler the following material:

LUZON, Province of Abra, *Bur. Sci. 7209 Ramos* ♂ flowers: Province of Ilocos Sur, *Cuming 1146* ♂ flowers (cotype): Benguet Subprovince, *Elmer 6447*, in fruit: Province of Pampanga, *For. Bur. 17669 Curran*, ♂ flowers: Province of Bataan, Lamao River, *Williams 905* ♂ flowers, *For. Bur. 337 Barnes* ♂ flowers, *For. Bur. 674, 708, 1193 Borden*, all in fruit, *For. Bur. 2777 Meyer* ♀ flowers: Province of Tayabas, *For. Bur. 10382 Curran.* LEYTE, *Elmer 7117, Piper 601.* CEBU, *Cuming 1776.*

In this material the leaves vary in shape and size, the tip in the type being rounded or obtuse, in some leaves subacute, but in other specimens it varies to acute or acuminate.

HIPPOCRATEACEAE.

SALACIA L.

SALACIA PHILIPPINENSIS sp. nov.

Frutex scandens, glaber; foliis oppositis, oblongis, coriaceis, nitidis, usque ad 15 cm longis, basi acutis, apice obtusis vel late obscure acuminatis, margine subintegris vel leviter crenatis; inflorescentiis cymosis, dichotomis, pedunculis quam petiolo longioribus; floribus circiter 8 mm diametro.

A scandent shrub, glabrous, the branches slender, terete, dark-colored when dry, with numerous small lenticels, the younger ones somewhat compressed. Leaves opposite, oblong, coriaceous or subcoriaceous, 12 to 15 cm long, 5 to 6 cm wide, shining, when dry the lower surface a little paler than the upper one, the apex obtuse or shortly and broadly acuminate, the base acute, the margins entire or very obscurely and distantly crenate; lateral nerves 7 or 8 on each side of the midrib, curved-ascending, anastomosing, distinct; petioles jointed near the base, 5 to 8 mm long. Inflorescence axillary, solitary, cymose, dichotomous, the peduncles a little longer than the petioles, the cymes about 3 cm long and wide, rather many flowered. Flowers greenish-yellow, their pedicels about 4 mm long, subtended by very short, obscure bracteoles, apparently jointed to the inflorescence. Calyx about 3 mm in diameter, the lobes 5, rarely 4, orbicular-ovate, usually rounded, minutely ciliate on the margins. Petals 5, rarely 4, oblong, spreading, broadly rounded at the apex, about 4 mm long, 2 mm wide. Stamens 3; filaments about 1.2 mm long; anthers 0.5 mm in diameter. Ovary 3-celled; cells 2-ovuled,

narrowed above into the short narrowly conical style, the disk cylindric, prominent. Fruit unknown.

LUBANG ISLAND, *Merrill 977*, April 8, 1903, a shrub about 3 m high sprawling or climbing in thickets near sea-level. CEBU, *Bur. Sci. 11095 Ramos*, March, 1912, in thickets.

This apparently undescribed species seems to be allied to *Salacia perakensis* King, and to *S. griffithii* Laws., but is entirely different from both. Mature fruits have not been seen, but they were sufficiently developed to show that the plant is a *Salacia* and not a *Hippocratea*.

ICACINACEAE.

FREERIA gen. nov.

Flores dioici, spicati. Perianthium 4-merum, simplex, lobi valvati, tubo brevi. Fl. ♂ ..... Fl. ♀ : Ovarium sessile, l-loculare; stigma sessile, crassum, truncatum; ovula 2, ex apice loculi pendula. Drupa oblonga leviter compressa, epicarpio carnoso, putamine crustaceo extus punctato, intus papillato. Semen pendulum; embryo albumine carnoso valde ruminato parum brevior, cotyledonibus planis, tenuiter foliaceis. Frutex alte scandens, ramis ramulisque tenuibus. Folia alterna, oblonga vel oblongo-lanceolota, glabra, repanda, glanduloso-dentata, acuminata, basi leviter cordata. Racemi supra-axillares, simplices. Flores pauci, parvi, sessiles, bracteolati.

FREERIA REPANDA sp. nov.

Frutex scandens subglaber, ramulis teretibus, tenuibus, minutissime verruculosis; foliis oblongis vel oblongo-lanceolatis, subcoriaceis, usque ad 14 cm longis, in siccitate pallidis, nitidis, subtus leviter asperulis, nervis utrinque 5 vel 6, prominentibus, distantibus, anastomosantibus, reticulis laxis, distinctis; spicis 2 ad 4 cm longis, pedunculatis, tenuibus; floribus paucis, circiter 2 mm longis, bracteolatis; fructibus oblongis, leviter compressis, circiter 1.8 cm longis.

A woody vine reaching a height of about 8 m (fide Ramos), nearly glabrous, the branches and branchlets slender, terete, 1 to 2 mm in diameter, very minutely verruculose, the growing parts minutely pubescent. Leaves alternate, subcoriaceous, oblong to oblong-lanceolate, 6 to 14 cm long, 1.5 to 4 cm wide, rather slenderly acuminate, base slightly narrowed, distinctly cordate, the margins more or less repand and with a short glandular tooth opposite the excurrent end of each primary lateral nerve, rather pale, shining, and of about the same color on both surfaces when dry, the upper surface smooth and glabrous, the

lower one minutely scabrid; lateral nerves 5 or 6 on each side of the midrib, prominent, distant, somewhat curved, anastomosing, the reticulations lax, distinct; petioles 0.5 to 1.5 cm long, minutely pubescent, becoming glabrous, usually strongly curved. Spikes supra-axillary, slender, minutely pubescent, 2 to 4 cm long, flower-bearing only in the upper one-fourth or one-fifth. Male flowers unknown. Female flowers few, 10 or less on each spike, sessile, scattered, each subtended by an oblong-lanceolate, acuminate, 0.4 mm long bracteole. Perianth simple, 1.8 to 2 mm long, the calyx represented by a very obscure disk, the tube very short, the lobes 4, valvate, oblong, obtuse, about 0.7 mm wide, pubescent externally. Staminodes very minute, alternating with the perianth-lobes. Ovary ellipsoid, densely pubescent, about 1 mm long, 1-celled; ovules 2, pendulous; stigma sessile, truncate, round, minutely papillate. Drupe oblong, slightly compressed, glabrous, red or yellowish when mature, about 1.8 cm long, 1 cm wide, the pulp rather thin, fleshy. Seed about 1.5 long, 8 mm wide, about equally narrowed and acute at both ends, slightly compressed, the testa crustaceous, externally somewhat punctate, internally papillose, the papillae projecting into the interstices of the ruminate albumen. Albumen firm, deeply ruminated, yellow, oily, externally deeply pitted.

LUZON, Province of Tayabas, Kabibihan, climbing in tall trees in forests along the river, *Bur. Sci. 13289 Ramos*, March 3, 1911.

Apparently a very distinct generic type, possibly most closely allied to *Sarcostigma* Wight & Arnott, although differing from that genus in many essential characters, such as the absence of the calyx, or at least the calyx represented by a very obscure disk, the scattered, not fascicled, spicate flowers, the repand and glandular-toothed, not entire leaves, and in its albuminous seeds, the albumen being deeply pitted and ruminate.

Dedicated to the late Doctor Paul Caspar Freer, founder and director of the Bureau of Science from its inception as the Bureau of Government Laboratories in the year 1901, until his death in April, 1912.

PHYTOCRENE Wall.

PHYTOCRENE LOHERI sp. nov.

Frutex scandens, ramulis foliisque subglaber; ramulis teretibus, 3 ad 4 mm diametro, leviter longitudinaliter striatis, bruneis, parce breviter pubescentibus; foliis ovatis, coriaceis, integris, acuminatis, basi late rotundato-truncatis vel subcordatis, 5-nerviis, reticulis obscuris; capitulis ut videtur globosis, drupis numerosis, oblongis, 7 ad 8 cm longis, dense adpresse villosis.

A scandent shrub, nearly glabrous, the branchlets terete, dark-brown when dry, dull, slightly longitudinally striate, slightly pu-

bescent with scattered hairs. Leaves alternate or subopposite, ovate, coriaceous, brown and slightly shining when dry, entire, 8 to 10 cm long, 4 to 7 cm wide, apex shortly acuminate and minutely apiculate, base broadly rounded-truncate or subcordate, the upper surface glabrous, the lower surface at first sparingly pubescent especially along the nerves, ultimately becoming glabrous; basal nerves 5, the outer pair short, the inner pair curved-ascending, reaching nearly to the middle of the leaf, evanescent, the lateral nerves above the basal ones usually two on each side of the midrib, curved-ascending, evanescent or very obscurely anastomosing, the primary reticulations very lax, not prominent, the ultimate ones rather close but indistinct; petioles about 2 cm long. Heads apparently globose, of many drupes. Individual drupes oblong or narrowly oblong, 7 to 8 cm long, about 2 cm thick, longitudinally 5-ridged, more or less narrowed at both ends, densely covered with yellowish-brown or tawny, stiff, appressed, villous hairs.

LUZON, Province of Rizal, Montalban, *Loher 5769*, November, 1905.

A very distinct species, characterized by its comparatively small leaves, with few, distant nerves, and its obscure reticulations; in this latter character it is very different from the other Philippine forms.

SABIACEAE.

MELIOSMA Blume.

MELIOSMA MACROPHYLLA sp. nov.

Arbor 12 ad 15 m alta, subglabra, partibus junioribus plus minusve pubescentibus; foliis imparipinnatis, elongatis, usque ad 1 m longis; foliolis oppositis vel suboppositis, 15 ad 17, ovatis ad oblongis vel oblongo-ovatis, integris, acuminatis, basi inaequilateralibus, rotundatis, superioribus usque ad 27 cm longis, inferioribus minoribus; paniculis amplis, terminalibus axillaribusque; fructibus circiter 5 mm longis.

A tree 12 to 15 m high, ultimately glabrous or nearly so, the younger parts more or less ferruginous-pubescent. Leaves elongated, up to 1 m in length, odd-pinnate, the leaflets 15 to 17, opposite or the lower ones subopposite, ovate to oblong-ovate or oblong, coriaceous, puberulent on the midrib and nerves beneath, the upper ones up to 27 cm in length and 10 cm wide, entire, acuminate, somewhat falcate, base inequilateral, of the upper leaves acute or acuminate, of the lower ones broad and rounded, the lower leaves gradually smaller than the upper ones; nerves 9 to 13 on each side of the midrib. Panicles axillary and terminal, ample, diffuse, the axillary ones as long as the leaves or shorter.

Flowers unknown. Fruit ovoid to globose-obovoid, 5 to 6 mm long, glabrous.

LUZON, Benguet Subprovince, Sablan, *Phil. Pl. 483 Fénix*, November, 1910, on slopes along trails, locally known to the Igorots as *arocong*.

A species distinguishable from the other Philippine ones by its comparatively very large leaves, entire leaflets, and in being nearly glabrous, at least when mature.

ELAEOCARPACEAE.

ELAEOCARPUS L.

ELAEOCARPUS GRANDIFLORUS Sm. in Rees Cyclop. 12 (1802–20) no. 5; Pierre in Fl. Forest. Cochinch. *pl. 142;* Gagnepain in Lecomte Fl. Gén. Indo-Chine 1 (1910) 568.

BUSUANGA, Bintuan, *C. M. Weber 1554 bis*, March 3, 1912, common along streams in forests.

Not previously reported from the Philippines; Burma, Indo-China, and Java.

The Busuanga specimens appear to be quite typical, at least of the species as interpreted by Pierre and by Gagnepain. It agrees with Gagnepain's description in all essential details, and, so far as the specimens are comparable, with a Cochinchina collection by *Thorel,* in the Herbarium of the Bureau of Science. The Philippine material is in full flower and with a single nearly mature fruit, while our specimen of Thorel's collection has very immature fruits. A specimen from Java, *VI, C, 178* of the Botanical Garden at Buitenzorg, probably typical *Elaeocarpus lanceolatus* Blume, which is generally considered to be a synonym of *E. grandiflorus* Sm., seems to differ from the Philippine material more than does the Cochinchina material. Although the three specimens before me are not directly comparable, all being in different stages of development, they apparently represent a single species.

ELAEOCARPUS PUSTULATUS sp. nov. § *Euelaeocarpus.*

Arbor, foliis utrinque sepalisque extus pustulis minutis instructis; foliis lanceolatis vel anguste ovato-lanceolatis, acuminatis, usque ad 8 cm longis, glabris, longe acuminatis; racemis numerosis, e axillis defoliatis; floribus 5-meris, circiter 5 mm longis.

A tree, glabrous except the sparingly appressed-pubescent inflorescence, the branches smooth, terete, the branchlets usually reddish-brown. Leaves lanceolate to narrowly ovate-lanceolate, 5 to 8 cm long, 1.5 to 2.5 cm wide, subcoriaceous, the base acute, the apex slenderly acuminate, margins distantly and somewhat obscurely toothed, both surfaces with numerous small pustules, the lower one a little paler than the upper and with glands in the axils of the lateral nerves; nerves about 6 on each side of the midrib, not prominent; petioles about 7 mm long, often with a pair of small lateral glands at the apex. Racemes in the axils

of fallen leaves, numerous, solitary, rather slender, 5 to 7 cm long, sparingly appressed-pubescent, about 15-flowered. Flowers 5-merous, about 5 mm long, their pedicels 5 to 7 mm in length. Sepals externally sparingly appressed-pubescent, distinctly pustulate, lanceolate, narrowed upward to the acute or somewhat acuminate apex, 5 mm long, 1.2 mm wide, inside glabrous or nearly so. Petals equaling or a little longer than the sepals, up to 1.8 mm wide, externally glabrous except for very few hairs at the base, the margins densely villous-ciliate, inside prominently villous-ciliate in the lower one-half, the apical one-third split into 9 to 11 linear-filiform segments about 2 mm in length. Stamens about 20, their filaments 1 mm long or less; anthers linear, 2 mm long, cleft at the apex, the cells scabrid, one a little longer than the other and with a tuft of few short hairs at the tip. Ovary densely villous, 3-celled.

CAMIGUIN DE MINDANAO, in forests, Mount Mahinog, *Bur. Sci. 14635 Ramos*, April 11, 1912.

A species manifestly allied to *Elaeocarpus verruculosus* Aug. DC., which it strongly resembles, differing especially in its much longer racemes, long and slender pedicels, and in its much shorter petioles.

TILIACEAE.

TRIUMFETTA L.

TRIUMFETTA PROCUMBENS Forst. f. Prodr. (1786) 35; Hemsl. in Journ. Bot. 28 (1890) 1, *fig. 1;* Sprague & Hutchinson in Journ. Linn. Soc. Bot. 39 (1909) 246; Gagnepain in Not. Syst. 1 (1910) 170, cum descr.

Triumfetta fabreana Gaudich. Voy. (1826) 478, *t. 102.*

COMIRAN ISLAND, Sulu Sea, *Phil. Pl. 410 Merrill*, distributed as "*Triumfetta repens* Forst.," September, 1910, sandy seashore just above the limits of high tides, extending inland only a short distance.

The specimens previously reported from the Philippines by me as this species [7] were later found to represent the allied but quite distinct *Triumfetta repens* (Bl.) Merr. & Rolfe.[8]

Triumfetta procumbens Forst. is widely distributed in Polynesia, extending eastward to the islands off the north-east coast of Australia, Purdy Island, north of New Guinea, to the small islands in the Indian Ocean off the east coast of Africa, and the Keeling Islands. *Triumfetta repens* (Blume) Merr. & Rolfe, for which Gagnepain prefers the later name *T. radicans* Bojer (1843), extends from Madagascar and the Seychelles to the Keeling Islands, Java, Borneo, Indo-China, the islands in the Gulf of Siam, and to the small islands off the north-east coast of Australia.

[7] Govt. Lab. Publ. (Philip.) 6 (1904) 17.
[8] This Journal 3 (1908) Bot. 111.

COLUMBIA Pers.

COLUMBIA MACGREGORII sp. nov.

Arbor, ramulis petiolis inflorescentiisque fulvo-ciliatis; foliis oblongis vel ovato-oblongis, acuminatis, basi rotundatis vel obtusis, subaequilateralibus, 5-nerviis, margine irregulariter denticulatis; paniculis terminalibus, bracteolis trifidis, circiter 8 mm longis, dense ciliatis; sepalis extus dense stellato-pubescentibus, petalis, basi stellato-puberulis exceptis, glabris.

A large tree, fide McGregor, the younger parts and the inflorescence prominently fulvous-ciliate. Leaves chartaceous, oblong to oblong-ovate, shining, somewhat brownish when dry, of nearly the same color on both surfaces or the lower one a little paler, 14 to 20 cm long, 4.5 to 7.5 cm wide, the base rounded or obtuse, subequilateral, the apex acuminate, the margins irregularly denticulate, upper surface with few, scattered, ciliate hairs, the lower one very minutely stellate-puberulent; basal nerves 5, the lateral ones above the base about 7 on each side of the midrib, prominent, ascending; petioles prominently fulvous-ciliate, 1.5 to 2 cm long; stipules oblong, stellate-pubescent and ciliate, about 6 mm long. Panicles terminal, about 15 cm long, prominently fulvous-ciliate with spreading hairs and also fulvous-stellate-pubescent. Flowers numerous, yellowish with reddish spots, about 1.5 cm in diameter. Sepals narrowly oblong or oblong-lanceolate, about 8 mm long, 3 mm wide, narrowed to the acute base and the acuminate apex, externally densely fulvous-stellate-pubescent. Petals narrowly oblong-obovate or subspatulate, 6 to 7 mm long, 2.5 mm wide, the apex broadly rounded, narrowed below, glabrous except the basal part, which is stellate pubescent, and the slightly setose back, the basal gland about 1.5 mm in diameter. Ovary subglobose, 2 mm in diameter, 5-sulcate, 5-ridged, densely stellate-pubescent with fulvous hairs. Style 4 mm long, narrowed above and glabrous except near the base. Bracteoles involucrate, 8 to 10 mm long, usually 3-cleft or divided into three, lanceolate, acuminate lobes, their backs and margins ciliate with 1 to 1.5 mm long fulvous hairs.

LUZON, Province of Nueva Vizcaya, Dupax, *Bur. Sci. 11492 McGregor*, April 12, 1912.

A species distinguishable by its fulvous indumentum composed in part of short stellate hairs and in part of long slender, ciliate ones. It belongs in the group with the nearly equilateral leaves, allied to *Columbia subaequalis* Planch., but differs from Planchon's species, as well as from the numerous forms described by Warburg, in the character of its indumentum.

COLUMBIA MEGACARPA sp. nov.

Arbor (22 m alta fide Manalo); foliis oblongis, coriaceis, circiter 20 cm longis, rectis vel leviter falcatis, basi valde oblique cordatis, apice longe acuminatis, margine irregulariter repando-dentatis, supra, nerviis exceptis, glabris vel subglabris, subtus dense molliter cinereo-pilosis; fructibus dense pubescentibus, 2 ad 3 cm longis, 3-alatis.

A tree, 10 m high or more. Branches terete, rather stout, brownish, strongly pubescent with long, spreading, yellowish-brown hairs. Leaves alternate, oblong, coriaceous, about 20 cm long, 5 to 8 cm wide, the apex rather long acuminate, the base strongly and obliquely cordate, both lobes rounded, but one much broader than the other, the margins irregularly repand-dentate, the upper surface brown, shining when dry, glabrous or nearly so except the somewhat pubescent nerves, the lower surface softly and densely stellate-pilose with cinereous hairs; petioles stout, densely pilose with spreading hairs; basal nerves reaching to or above the middle of the leaf. Flowers unknown. Panicles in fruit ample, terminal and in the upper axils, pilose with long, soft, spreading, yellowish-brown hairs. Fruits oblong-ovoid in outline, 3-winged, 2 to 3 cm long, nearly 2 cm wide, densely subcinereous-pubescent or puberulent throughout, the portions opposite the seed-bearing parts also densely pilose with long, spreading hairs.

PALAWAN, about one mile north-east of Tanabag, *For. Bur. 7416 Manalo*, December, 1906, in flat forests near sealevel, locally known as *anilao*.

A species manifestly allied to *Columbia serratifolia* (Cav.) DC., but distinguished at once by its very much larger fruits. The fruits are considerably larger than those of any other species of the genus known to me, and apparently dehisce tardily.

Imperfect material, possibly a mixture, collected in Palawan by Mr. Curran (*For. Bur. 3587*), may also be referable here.

GREWIA L.

GREWIA EDULIS sp. nov. § *Omphacarpus.*

Arbor parva, ramulis subtus foliis inflorescentiisque simpliciter pilosis; foliis breviter petiolatis, oblongo-ovatis, subcoriaceis, usque ad 18 cm longis, acuminatis, aequilateralibus, integris; fructibus pyriformibus, carnosis, 2.5 ad 3 cm longis, puberulis.

A small tree, the branchlets, petioles, inflorescence, and lower surface of the leaves more or less pubescent with simple, not stellate, hairs. Branches terete, grayish-brown, glabrous, the branchlets rather densely pubescent with short, brownish, spreading hairs. Leaves oblong-ovate, equilateral, 15 to 18 cm long, 5

to 7 cm wide, rather pale when dry, shining, the base rounded, 3-nerved, the apex shortly acuminate, the acumen blunt, the margins entire, or very slightly undulate above, the upper surface pubescent only on the midrib and primary nerves, the lower surface pubescent also on the reticulations; basal nerves not extending above the middle of the leaf, the lateral ones above the basal pair 6 or 7, anastomosing, prominent, the reticulations prominent, lax; petioles very pubescent, stout, about 5 mm long. Inflorescence axillary, solitary, umbellate or subracemose, pubescent, the peduncles about 1 cm long, the pedicels in fruit about the same length. Flowers unknown. Fruit pyriform, obovoid, fleshy, 2.5 to 3 cm long, yellowish-green, the pericarp thin, slightly puberulent, the mesocarp fleshy, containing numerous fibers, the seed apparently solitary.

LUZON, Province of Nueva Ecija, Mataas na Cahoy, near Cabanatuan, *Bur. Sci. 5292 McGregor*, September, 1908.

A species manifestly allied to *Grewia stylocarpa* Warb., but well distinguished by its pubescence, and by its differently shaped fruits. The fruits are fleshy, yellowish-green when nearly mature, and have a pleasant acid flavor.

GREWIA OVATA sp. nov. § *Eugrewia*.

Frutex scandens, omnibus partibus plus minusve stellato-pubescentibus; foliis breviter petiolatis, ovatis, subcoriaceis, breviter acuminatis, basi cordatis, margine crenato-denticulatis, supra scabridis, plus minusve pubescentibus, subtus molliter stellato-pubescentibus; inflorescentiis terminalibus axillaribusque, umbellatis; floribus 2 cm longis; fructibus 4-lobatis, circiter 1.5 cm diametro, extus dense stellato-hirsutis, endocarpio osseo, 4-lobato, lobis 2-locellatis.

A scandent shrub. Branches terete, brownish, and with the branchlets densely covered with short, stellate, brownish-olivaceous hairs. Leaves ovate, subcoriaceous, 7 to 12 cm long, 4 to 8 cm wide, the upper surface scabrid when dry, brownish, distinctly stellate-pubescent, and on the nerves densely so, the lower surface paler, rather densely and uniformly stellate-pubescent, somewhat paler than the upper surface, the apex shortly acuminate, the base broad, rounded, distinctly cordate, the margins finely and rather uniformly crenate-denticulate; basal nerves reaching to or above the middle, the lateral ones above the basal pair 5 or 6 on each side of the midrib, prominent; petioles densely pubescent, less than 5 mm long; stipules lanceolate-acuminate, pubescent, 2 mm long. Inflorescence axillary and terminal, umbellate, densely stellate-pubescent with ferruginous hairs, the

peduncles 1 to 1.5 cm long, each with 4 to 6 flowers, subtended by a whorl of small, oblong-ovate to oblong-lanceolate, pubescent, 4 to 5 mm long bracteoles. Flowers yellow and white. Sepals 2 cm long, oblong-lanceolate, 3.5 mm wide at the base, somewhat narrowed upward, very densely ferruginous-stellate-pubescent outside, obtuse or subacute. Petals 5, thin, oblong, obtuse, 6 to 7 mm long, 2.5 mm wide, the basal gland large, prominent, ciliate-pubescent, coriaceous, truncate, about 3 mm long and wide. Stamens indefinite; filaments 6 to 11 mm long; anthers subglobose, 0.7 mm in diameter. Ovary densely villous with ferruginous hairs; style glabrous, 10 to 12 mm long; stigma 1.5 mm wide. Fruit depressed, 4-lobed, the lobes rounded, densely stellate-hirsute outside, about 1.5 cm in diameter, the endocarp bony, each lobe 2-celled, each cell with a single seed.

LUZON, Province of Rizal, San Mateo, *For. Bur. 1121 Ahern's collector*, May, 1904, *Decades Philip. Forest Flora 237 Ahern's collector:* Province of Bataan, Lamao River, *For. Bur. 1483 Ahern's collector*, July, 1904 (type).

A species manifestly allied to *Grewia acuminata* Juss. (*G. umbellata* Roxb.), characterized by its very different and more dense pubescence, its distinctly cordate leaves, etc.

GREWIA PALAWANENSIS sp. nov. § *Eugrewia.*

Frutex 2 ad 3 m altus, erectus vel subscandens; foliis chartaceis vel subcoriaceis, oblongis, acuminatis, basi rotundatis, margine denticulatis, usque ad 12 cm longis, utrinque, praesertim ad nervos, plus minusve stellato-pubescentibus; inflorescentiis axillaribus, umbellatis, umbellis solitariis vel fasciculatis, pauciforis; floribus circiter 5 mm longis; fructibus obovoideis, circiter 1 cm diametro, rugosis, parce hirsutis, 4-locellatis, vix lobatis.

An erect subscandent shrub 2 to 3 m high. Branches terete, brownish or reddish-brown, lenticillate, ultimately glabrous, the younger ones rather densely stellate-puberulent. Leaves chartaceous or subcoriaceous, oblong, 6 to 12 cm long, 2 to 5 cm wide, the base equilateral, rounded, the apex shortly acuminate, the margins denticulate, the upper surface somewhat stellate-pubescent on the nerves and midrib, the lower surface with short, scattered, stellate hairs, more dense on the nerves; basal nerves 3, prominent, extending above the middle of the leaf, the lateral ones on each side of the midrib about 4, prominent; stipules not seen, apparently very early deciduous; petioles densely stellate-pubescent, 5 to 10 mm long. Umbels axillary, solitary or more usually fascicled, numerous, those in the uppermost axils sometimes simulating a terminal inflorescence, densely stellate-pube-

rulent, their peduncles 1 cm long or less. Flowers usually 3 in each umbel, subtended by a whorl of very early deciduous, linear-oblong, pubescent, 2 to 2.5 mm long bracteoles. Sepals 5, stellate-puberulent with grayish hairs, obtuse or acute, 5 mm long, 2 mm wide. Petals oblong, 2 mm long, obtuse, thin, glabrous except the large, basal gland which is 1 mm long and prominently ciliate-pubescent. Stamens indefinite; filaments 2 to 2.5 mm long. Ovary densely villous. Style 2 mm long, glabrous; stigma somewhat lobed, about 1 mm wide. Fruit depressed-obovoid, about 1 cm in diameter, prominently wrinkled when dry, brown, when immature prominently hirsute, when mature with few, scattered, long hairs, not at all lobed, the endocarp bony, 4-celled, each cell with a single seed.

PALAWAN, near Iwahig, *For. Bur. 3522 Curran*, January, 1906 (type), *Bur. Sci. 794, 864, 888 Foxworthy*, April to May, 1906.

A species with much the aspect of *Grewia acuminata* Juss., and manifestly allied to that species, differing especially in its very much smaller flowers.

GREWIA PARVA sp. nov. § *Eugrewia.*

Arbor parva circiter 4 m alta, ramulis subtus foliis inflorescentiisque parce stellato-pubescentibus; foliis oblongis, acuminatis, 3.5 ad 4.5 cm longis, aequilateralibus, apice acuminatis, basi acutis vel obtusis; inflorescentiis axillaribus, solitariis, umbellatis; fructibus subglabris, 2-lobatis, lobis 1- vel 2-locellatis, circiter 5 mm longis.

A small tree or a shrub about 4 m high. Branches slender, terete, brownish, prominently lenticellate, glabrous, the branchlets slightly pubescent with somewhat appressed, short, simple or stellate hairs. Leaves oblong, chartaceous, 3.5 to 4.5 cm long, 1.2 to 1.6 cm wide, somewhat brownish when dry, the upper surface shining, slightly pubescent on the midrib and lateral nerves, the lower surface slightly paler, rather uniformly pubescent with scattered, short, stellate hairs, the apex acuminate, the base obtuse or acute, the margins distinctly and uniformly crenate-serrate; base 3-nerved, the nerves not prominent, reaching the middle of the leaf or slightly above, the lateral nerves above the basal pair 3 or 4 on each side of the midrib, ascending, curved, slender; petioles pubescent, 2 to 3 mm long; stipules not seen, apparently very early deciduous. Flowers unknown. Infrutescence axillary, solitary, umbellate, somewhat pubescent, the peduncles less than 1 cm long, each bearing from 1 to 3 fruits. Fruits black when dry, nearly glabrous, or with

few, scattered, short hairs, 2-lobed, the lobes 5 mm long or less, 1- or 2-celled, each cell with a single seed.

LUZON, Province of Ilocos Sur, San Quintin, *For. Bur. 5627 Klemme*, October 18, 1906, on steep rocky slopes at an altitude of about 90 m. locally known to the Ilocanos as *duraring*.

A species manifestly allied to *Grewia laevigata* Vahl, *G. multiflora* Juss., and related forms, characterized, however, by its small, pubescent leaves.

GREWIA ROLFEI sp. nov. § *Eugrewia*.

Grewia tiliaefolia Rolfe in Journ. Bot. 23 (1885) 211, non Vahl.

Arbor parva 10 ad 15 m alta, ramulis inflorescentiis foliisque utrinque, praesertim ad nervos, griseo-stellato-puberulis; foliis chartaceis, oblongo-ovatis, acuminatis, basi rotundatis, leviter inaequilateralibus, margine denticulatis; stipulis linearis, acuminatis; umbellis axillaribus, solitariis vel binis, 3-floris; floribus parvis, circiter 7 mm longis.

A small tree 10 to 15 m high, sometimes less. Branches slender, terete, glabrous, reddish-brown to nearly black when dry, lenticellate, the branchlets rather densely stellate-puberulent with grayish or sometimes brownish hairs. Leaves oblong-ovate, chartaceous, 5 to 12 cm long, 3 to 5 cm wide, of nearly the same color on both surfaces when dry, slightly shining, the base rounded, usually somewhat inequilateral, the margins denticulate except at the base which is entire, the apex rather slenderly acuminate, the acumen 1 to 2 cm long, denticulate, both surfaces rather densely gray-stellate-puberulent on the midrib and lateral nerves, and with scattered, minute, stellate hairs on the surface, the veins pale in contrast to the darker color of the leaf; basal nerves reaching above the middle of the leaf, the lateral ones above the basal pair 3 on each side of the midrib; petioles 5 to 10 mm long, rather densely stellate-puberulent; stipules linear, acuminate, pubescent, nearly 1 cm long. Umbels 3-flowered, numerous, axillary, solitary or paired, puberulent, their peduncles 5 to 10 mm long, the pedicels shorter, subtended by a whorl of three or four, oblong, obtuse or acute, 5 to 6 mm long and 2 mm wide, pubescent bracteoles. Sepals narrowly oblong or narrowly oblong-obovate, acute or obtuse, pubescent, spreading or reflexed in anthesis, 7 mm long, 2 to 2.5 mm wide. Petals 5, membranaceous, glabrous, narrowly oblong-obovate, apex rounded or retuse, about 3 mm long, 1 mm wide, the basal glands very minute or wanting. Stamens indefinite; filaments 3 to 4 mm long; anthers 0.25 mm in diameter. Ovary densely

villous; style glabrous, 3 mm long; stigma broad, somewhat cleft. Very young fruit obovoid, densely pale-puberulent and with longer pale hairs intermixed.

LUZON, Province of Cagayan, *Cuming 1319* (type): Province of Bataan, Lamao River, *For. Bur. 3048 Borden*, May, 1905, *For. Bur. 1489 Ahern's collector*, July, 1904, *Whitford 1288*, May, 1905: Province of Pampanga, Turo, *For. Bur. 19290 Curran*, March, 1910; Mount Arayat, *For. Bur. 9616 Zschokke*, October, 1907: Province of Tayabas, San Narciso, *For. Bur. 14970 Darling*, October, 1909.

This form has been referred by recent authors, following Rolfe, to the Asiatic *Grewia tiliafolia* Vahl. It does not appear to me to be referable to Vahl's species, and is accordingly here described as new. Hooker f. states that *Grewia tiliaefolia* Vahl is best distinguished by its auricled, falcate stipules, a character that does not at all apply to the specimens cited above.

GREWIA RIZALENSIS sp. nov. § *Eugrewia.*

Species G. rolfei simillima et valde affinis, differt foliis subtus densissime ubique griseo-stellato-puberulis.

A small tree. Branches terete, slender, black when dry, glabrous, slightly lenticellate, the branchlets densely and uniformly stellate-puberulent with cinereous or sometimes ferruginous hairs. Leaves ovate to oblong-ovate, chartaceous, 5 to 10 cm long, 2 to 4 cm wide, base rounded, slightly inequilateral, apex acuminate, margins denticulate except in the basal portions which are entire, the upper surface dark-colored when dry, slightly stellate-puberulent, especially on the nerves, the lower surface densely and uniformly covered with grayish, stellate, very short hairs; petioles stellate-puberulent, 1 cm long or less; stipules lanceolate, acuminate, pubescent, deciduous, about 5 mm long. Umbels numerous, axillary, solitary or fascicled, similar to those of *G. rolfei*. Sepals lanceolate, acuminate, or acute, pubescent, 7 mm long, 2 mm wide. Petals membranaceous, glabrous, oblong, 2.5 to 3 mm long, 1 mm wide, obtuse or retuse. Ovary densely villous; style glabrous, 3 mm long. Very young fruits densely cinereous-pubescent.

LUZON, Province of Rizal, San Mateo, *For. Bur. 1132 Ahern's collector*, May, 1904 (type); Antipolo, *For. Bur. 3139 Ahern's collector*, June, 1905, *Phil. Pl. 265 Ramos*, June, 1910; Bosoboso, *Merrill 2679*, June, 1903, small leaved form.

A species manifestly very closely allied to *Grewia rolfei* Merr., and perhaps not specifically distinct, although differing in its uniform, dense, grayish indumentum on the lower surfaces of the leaves, while *G. rolfei* is densely puberulent on the nerves only, and with scattered hairs on the surface otherwise, that do not conceal the epidermis of the leaf.

STERCULIACEAE.

PTEROSPERMUM Schreb.

PTEROSPERMUM ELMERI sp. nov.

Arbor plus minusve stellato-pubescens; foliis obliquis, ovatis vel oblongo-ovatis, subcoriaceis, 7 ad 10 cm longis, basi rotundatis, subpeltatis, apice breviter acute acuminatis, in siccitate supra nigricantibus, glabrescentibus, subtus densissime fusco-stellato-pubescentibus; floribus racemosis, bracteolis profunde tripartitis, segmentis lineari-lanceolatis; sepalis circiter 3 cm longis.

A tree, all parts more or less stellate-pubescent, the branchlets, inflorescence, sepals, and lower surface of the leaves very densely so. Branches reddish-brown, terete, ultimately glabrous, the younger ones densely brown-stellate-pubescent. Leaves subcoriaceous, entire, strongly oblique, ovate to oblong-ovate, 7 to 10 cm long, 3.5 to 4.5 cm. wide, the wider side of the leaf more than twice wider than the narrower one, the base rounded, subpeltate, the petiole inserted 2 to 4 mm from the margin, the apex shortly and sharply acuminate, upper surface, when dry, black or nearly so, somewhat covered with deciduous, brown, stellate hairs, ultimately glabrous or nearly so, the lower surface very densely brown-stellate-pubescent; lateral nerves 4 or 5 on each side of the midrib; petioles densely pubescent, about 3 mm long. Racemes terminal and in the upper axils, few-flowered, short; pedicels 2.5 cm long or less, each with several bracteoles which are cleft nearly to the base into three linear, acuminate, 8 to 12 mm long lobes. Sepals 3 cm long, about 3 mm wide, externally densely stellate-pubescent with brown hairs, internally densely grayish-pubescent. Petals about 3 cm long, 8 mm wide. Sterile stamens 2 cm long, the fertile ones, including the linear 7 mm long anthers, 2 cm in length. Ovary densely brown-stellate-pubescent.

MINDANAO, District of Davao, Todaya (Mount Apo) *Elmer 11928*, October, 1909, distributed as *Pterospermum obliquum* Blanco.

A species manifestly very closely allied to *P. subpeltatum* Merr., differing in its somewhat smaller, fewer nerved leaves and in its shorter sepals.

PTEROSPERMUM LONGIPES sp. nov.

Arbor circiter 10 m alta, ramulis subtus foliis inflorescentiisque dense albido- vel subfusco-tomentosis; foliis oblongo-ovatis, subcoriaceis, leviter obliquis, usque ad 8 cm longis, integris, acuminatis, basi rotundatis vel subtruncatis vix cordatis, supra glabris, subtus albido- vel subfusco-tomentosis; floribus paniculatis, long pedicellatis, sepalis circiter 5 cm longis.

A tree about 10 m high, more or less densely tomentose, the branches terete, reddish-brown, the younger ones covered with a somewhat deciduous, white or somewhat brownish tomentum. Leaves oblong-ovate, often subrhomboidal, subcoriaceous, 5 to 8 cm long, 3 to 5 cm long, entire, somewhat inequilateral, the base broad, rounded or subtruncate, not cordate or auriculate, the apex shortly and sharply acuminate, the upper surface glabrous, shining, the lower surface densely white-tomentose, or the tomentum somewhat brownish; lateral nerves distinct, ascending, 3 or 4 on each side of the midrib; petioles 5 mm long or less, tomentose. Flowers terminal and in the upper axils, forming a distinct and rather many-flowered panicle, their pedicels, or pedicels and the ultimate branchlets, 2 to 5 cm long, each with several scattered bracteoles which are lanceolate, acuminate, about 6 mm long, and somewhat sagittate at the base by a pair of prominent, rounded auricles. Buds densely brown-stellate-pubescent externally, cylindric, oblong. Sepals about 5.5 cm long, 5 mm wide, acuminate, inside appressed pubescent with grayish hairs. Petals thin, about 4 cm long, 7 mm wide. Sterile stamens five, 3.5 to 4 cm long, the fertile ones 15, including the 8 mm long linear anthers, 2.5 cm in length. Ovary pubescent; style 3.5 cm long. Immature capsules cylindric, glabrous, narrowly oblong, about 4 cm long.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14632 Ramos*, April 9, 1912, in forests, Mount Mahinog, flowers yellow, fragrant.

A species manifestly closely allied to *Pterospermum niveum* Vid., which it greatly resembles, differing in its somewhat smaller leaves which are not at all cordate or auriculate at the base, but are rounded or subtruncate and much less inequilateral than in Vidal's species, and in its paniculate, long-pedicelled flowers.

DILLENIACEAE.

DILLENIA L.

DILLENIA BOLSTERI sp. nov. § *Wormia ?*

Arbor circiter 10 m alta, foliis junioribus ramulis inflorescentiisque plus minusve pilosis; foliis ellipticis vel oblongo-ellipticis, acute acuminatis, basi acutis vel rotundatis, margine serratis, usque ad 25 cm longis, nervis utrinque circiter 17; inflorescentiis in axillis superioribus terminalibusque, 2 ad 5-floris; floribus albidis, circiter 6 cm diametro; stylis 8 vel 10.

A tree about 10 m high. Branches terete, reddish-brown, glabrous, the branchlets appressed-pilose, rarely nearly glabrous. Leaves alternate, elliptic to oblong-elliptic, subcoriaceous, 10 to 25 cm long, 4 to 10 cm wide, more or less pilose when young,

becoming nearly glabrous, the apex sharply and rather abruptly acuminate, the acumen about 1 cm long, the base acute or somewhat rounded; nerves about 17 on each side of the midrib, prominent; petioles 2 to 3 cm long, when young somewhat pilose, becoming glabrous, at first with the membranaceous stipules adherent to and bordering the petioles, these soon deciduous. Inflorescence more or less pilose, in the upper axils and terminal, solitary, 2- to 5-flowered. Flowers white, about 6 cm in diameter. Petals ovate, obtuse, about 1.5 cm long. Petals elliptic, obtuse, 3 cm long. Stamens very numerous. Styles 8 or 10, spreading. Fruit unknown.

MINDANAO, Province of Surigao, Surigao, *Bolster 311*, April, 1906 (type), in forests, altitude about 65 m, *Piper 224*, April, 1911; Hinatuan, *Piper 515*, April 1911.

This species was indicated in the herbarium as new in 1906, but was not described on account of paucity of material. The additional specimens collected by Mr. Piper show that the characters of the species are constant and that it is apparently distinct. Its venation and shape of the leaves distinguish it from other Philippine forms. Specimens from Leyte distributed by Mr. Elmer (*No. 7149*) under this name certainly do not represent the species, but are probably referable to *Dillenia philippinensis* Rolfe.

SAURAUIA Willd.

SAURAUIA MACGREGORII sp. nov.

Arbor circiter 10 m alta, novellis setae 1.5 ad 3.5 mm longae dense obtectis; foliis oblongis, coriaceis, usque ad 35 cm longis, subtus parce setosis; inflorescentiis caulifloris, fasciculatis, vix 4 cm longis, setosis, paniculatis; floribus circiter 1.5 cm diametro, ovario 5-loculare.

A tree about 10 m high, the young parts very densely covered with brownish, slender, spreading, 1.5 to 3.5 mm long setae, these setae less numerous on the petioles and midribs of the leaves and on the older parts. Leaves oblong, coriaceous, shining, the lower surface considerably paler than the upper, 15 to 35 cm long, 5 to 10 cm wide, the apex shortly acuminate, the base obtuse or rounded, the margins distantly glandular-denticulate, each small tooth bearing a long ciliate seta; lateral nerves 11 to 13, prominent on the lower surface, anastomosing, the reticulations prominent, the midrib, nerves, and reticulations with scattered setae; petioles 2.5 to 3.5 cm long, setiferous. Inflorescence fascicled on the trunk, paniculate, less than 4 cm long, rather densely brownish pubescent and with scattered short setae, the bracts narrowly oblong, 4 to 5 mm long, thick. Flowers white, 5-merous, about 1.5 cm in diameter. Outer two sepals elliptic-ovate, rounded, concave, slightly setose externally, 5 to

6 mm long, thicker than the three somewhat petaloid inner ones which are broadly ovate, rounded or retuse, somewhat longer than outer two and with thin margins. Petals 8 mm long, about 6 mm wide, glabrous, elliptic-obovate, more or less retuse. Stamens about 25; filaments stout, 3 mm long; anthers narrowly oblong, as long as the filaments. Ovary depressed, glabrous, somewhat 5-sulcate, 5-celled. Style 2 mm long, divided into 5, slender, 4 mm long arms.

LUZON, Province of Nueva Vizcaya, Campote, *Bur. Sci. 11407 McGregor*, March, 1912.

A species at once distinguishable by its dense indumentum on the younger parts, composed of long, slender, spreading, setae-like hairs. In this character it differs from all the known Philippine forms. Another distinctive character is its cauliflory, although this is by no means uncommon in the genus.

GUTTIFORAE.

CALOPHYLLUM L.

CALOPHYLLUM KUNSTLERI King. in Journ. As. Soc. Beng. 59[2] (1890) 174; Vesque in DC. Monog. Phan. 8 (1893) 607.

LUZON, Province of Nueva Ecija, *For. Bur. 22182 Alvarez*, December, 1910: Province of Laguna, San Antonio, *For. Bur. 13197 Curran*, March, 1912.

Not previously reported from the Philippines; Malay Peninsula and Borneo.

My conception of *Calophyllum kunstleri* King is based on the original description by King, and the later one by Vesque, together with a cotype (*King's collector 5328*) preserved in the herbarium of the Bureau of Science. While the Philippine form shows some very slight differences, it appears to me to agree with King's species in all essential characters. A specimen from Borneo, Sarawak, *Foxworthy 302*, appears also to be referable to the same species.

GARCINIA L.

GARCINIA RAMOSII sp. nov. § *Cambogia.*

Arbor parva, ramis teretibus, ramulis tenuibus, obscure quadrangularis; foliis subcoriaceis, anguste oblongo-obovatis, obtusis vel acutis, basi angustatis usque ad 6 cm longis, nervis obscuris, utrinque circiter 10, subtus lineis longitudinalibus undulatis tenuibus nigris vel purpureis notatis; floribus axillaribus, sessilibus, fasciculatis ad nodos incrassatis, 4-meris; staminibus 14; ovario rudimento nullo.

A small tree, quite glabrous, the branches terete, dark-colored, the branchlets obscurely 4-angled, slender, often olivaceous. Leaves opposite, small, subcoriaceous, when dry rather pale, shining and of the same color on both surfaces, 4 to 6 cm long, 1 to 2 cm wide, narrowly oblong-obovate or oblong, apex acute

or obtuse, base narrowed, acute; lateral nerves very obscure, about 10 on each side of the midrib, the lower surface marked with slender, more or less undulate, not prominent, longitudinal, purplish lines; petioles 2 to 3 mm long. Flowers fascicled at the thickened nodes, axillary, sessile, mostly in the axils of fallen leaves, 4-merous. Male flowers: Sepals 4, orbicular, rounded, 2 mm in diameter. Petals oblong, in mature bud 3 to 3.5 mm long, thick. Stamens 14, obscurely 2-seriate, covering the slightly raised torus, oblong-obovate, about 1.2 mm long, the anthers opening by introrse slits. Rudimentary ovary none.

LUZON, Province of Cagayan, Abulug River, *Bur. Sci. 13919 Ramos*, January, 1912, in forests on slopes.

A species well characterized by its small leaves with the faint, longitudinal, purplish lines on the under surface.

BEGONIACEAE.

BEGONIA L.

BEGONIA AFFINIS sp. nov. § *Petermannia.*

Species B. agusanensis valde affinis differt ramulis dense longe ciliato-setosis, capsulis majoribus, circiter 1.5 cm longis.

An erect, somewhat branched, suffrutescent herb 50 cm high or less, the stems sparingly long-ciliate, the branchlets densely covered with long, brown, ciliate hairs. Leaves glabrous, membranaceous, inequilaterally oblong-obovate to oblong-oblanceolate, rarely merely oblong, 9 to 15 cm long, 1.5 to 3.5 cm wide, apex slenderly acuminate, gradually narrowed below the middle to the rather narrow, laterally cordate base, the margins irregularly and rather coarsely toothed above the middle, the lower one-half entire or subentire, the base usually less than 1 cm wide, one side rounded, the narrower side acute; petioles prominently ciliate, about 3 mm long; stipules oblong-lanceolate, with a long and slender, ciliate, flagellate acumen. Panicles terminal, glabrous, 4 to 7 cm long, the peduncles slender, the branches dichotomous, few, slender; bracts lanceolate, acuminate, 5 to 7 mm long, the bracteoles similar, smaller. Flowers pink. Male flowers: Pedicels 4 to 5 mm long. Sepals 2, elliptic, obtuse, about 6 mm long, 3 to 3.5 mm wide, 6-nerved. Petals 2, oblong, obtuse, 4 to 5 mm long, 1.5 to 2 mm wide. Stamens about 25; anthers oblong-obovoid, retuse, 1.5 mm long, the filaments shorter. Female flowers solitary at the base of the male panicle, their pedicels slender, 1 to 1.5 cm long. Perianth segments 5, the outer two oblong-elliptic, somewhat narrowed to the obtuse apex, about 12 mm long, 5 to 5.5 mm wide, slenderly 9-nerved,

the inner three as long as the outer ones, about 4 mm wide, slenderly 5-nerved. Styles 3, forked, 4 mm long; stigmas spirally arranged. Capsules about 1.5 cm long, 1.5 to 2 cm wide, equally 3-winged, somewhat depressed-rhomboid in outline, the wings subequally rounded at their tips.

MINDANAO, District of Zamboanga, Sax River Mountains back of San Ramon, *Merrill 8251* (type), *8248*, November 27, 1911, in damp ravines, altitude about 900 m.

A species manifestly closely allied to *Begonia agusanensis* Merr., distinguished chiefly by its larger capsules and its densely ciliate branchlets.

BEGONIA ELATOSTEMATOIDES sp. nov. § *Petermannia.*

Species B. ciliiferae affinis, differt foliis minoribus, integris vel subintegris.

An erect or ascending, simple or slightly branched suffrutescent herb, the stems often prostrate below, 20 to 40 cm high, the stems, petioles, and lower surfaces of the leaves, at least on the veins, prominently ciliate with brown hairs. Leaves green above, red beneath when fresh, membranaceous, oblong to narrowly oblong-obovate, often subequally narrowed at both ends, 3.5 to 7 cm long, 1 to 2.5 cm wide, slightly acuminate, entire, base slightly inequilateral and slightly cordate, the upper surface with very few, short, scattered, brown hairs or nearly glabrous, the lower surface prominently ciliate with brown hairs on the nerves, and with scattered shorter hairs on the surface; nerves pinnately arranged, 3 or 4 on each side of the midrib, ascending; stipules lanceolate, acuminate, brown-ciliate, about 1 mm long; petioles 1 to 3 mm long. Flowers pink and white, in axillary fascicles, but one or two opening at a time. Male flowers: Pedicels slender, 4 to 5 mm long, subtended by several, lanceolate, long-acuminate, brown-ciliate bracts about 2 mm wide, 5 to 7 mm long, their margins prominently fimbriate-ciliate. Sepals 2, broadly ovate, acute, 8 to 9 mm long, 5 to 6 mm wide, slenderly 7-nerved, outside with few, scattered, short hairs. Petals 2, oblong, obtuse, about 6 mm long, 2 mm wide. Stamens about 30, the torus somewhat elongated; filaments about 0.5 mm long; anthers oblong-obovate, retuse, about 1 mm long. Capsules broadly subrhomboid-obovate, truncate, about 8 mm long, 1 cm wide, equally 3-winged, the outer upper angles of the wings subacute, base narrowed and acute.

MINDANAO, District of Zamboanga, Sax River Mountains back of San Ramon, *Merrill 8232*, November 27, 1911, in damp shaded ravines, and on forested slopes, altitude 800 to 1000 m.

A species manifestly closely allied to *Begonia ciliifera* Merr., a species also known only from the Zamboanga Peninsula. The present species

differs especially in its smaller size, and in its smaller entire leaves which are nearly glabrous on the upper surface, not prominently ciliate with long hairs. In habit and general appearance it approximates some species of *Elatostema*, from which the specific name.

BEGONIA OBLONGATA sp. nov. § *Petermannia.*

Species B. contractae Warb. affinis, differt foliis angustioribus, valde oblique cordatis, capsulis majoribus, circiter 15 mm longis.

An erect, glabrous, sparingly branched, succulent herb up to 60 cm in height, the stems often somewhat prostrate below, the nodes sometimes emitting rootlets. Leaves membranaceous, green, oblong to oblong-lanceolate, 8 to 12 cm long, 1.2 to 3 cm wide, often somewhat falcate, gradually narrowed above and slenderly acuminate, the base very strongly inequilateral, cordate, the sinus lateral, the lower lobe very much larger than the upper one, usually about 2 cm wide, rounded-angular, the upper lobe acute or slightly rounded, about 5 mm wide, the sinus narrow, acute, the lobes not overlapping; basal nerves 1 or 2 in the narrow lobe, 4 or 5 in the broader one, radiate, the lateral ones above the base 2 to 4, ascending, anastomosing, the margins rather prominently but irregularly toothed; petioles 1.5 to 3 cm long; stipules membranaceous, oblong-lanceolate, acuminate, about 1 cm long. Inflorescence terminal, slender, 6 cm long or less, divaricately branched, few-flowered, the basal flower female, the upper ones male. Male flowers: Sepals 2, suborbicular, pink, rounded, about 4 mm in diameter, slenderly 7-nerved. Petals none. Stamens 30 to 35; anthers obovoid, slightly retuse, 0.8 to 1 mm long, the filaments less than 1 mm in length. Female flowers not seen. Capsules ovoid, truncate, about 15 mm long, 15 to 17 mm wide, equally 3-winged, the outer angles of the wings subacute, the base broadly rounded.

MINDANAO, District of Zamboanga, mountains back of Zamboanga, *Merrill 8166* (type) *8175*, December 6, 1911, in damp shaded ravines, altitude 100 m and above.

A species manifestly allied to *Begonia contracta* Warb., but differing in a number of characters, especially in its relatively narrow leaves and its much larger capsules.

BEGONIA MACGREGORII sp. nov. § *Petermannia.*

Species ut videtur B. cumingii A. Gray affinis, differt floribus masculinis multo minoribus, partibus junioribus ramisque longe ciliato-setosis.

An erect or ascending sparingly branched plant 20 to 100 cm high, the stems with numerous, long, slender, brownish, ciliate-

setose, spreading hairs 5 mm long or less. Leaves oblong, when fresh dark-green on the upper surface and often blotched with gray, the lower surface deep red, chartaceous or membranaceous, 15 to 20 cm long, 6 to 7 cm wide, not narrowed at the base but very strongly obliquely cordate, the broad lobe rounded, the narrow one subacute or obtuse, the apex rather slenderly acuminate, margins shallowly, distantly, and irregularly sinuate-toothed or lobed, ciliate-denticulate, the upper surface glabrous, the lower one brownish-pubescent and ciliate-setose on the nerves; basal nerves radiate, about 8, prominent; petioles prominently ciliate-setose with long hairs, 1 to 3 cm long; inflorescence axillary, few-flowered, 4 cm long or less, sparingly branched. Male flowers: Sepals 2, ovate, obtuse, about 8 mm long. Petals none. Stamens about 30; anthers narrowly oblong-obovate, obtuse, 2 mm long, the filaments very short or none. Bracteoles lanceolate, acuminate, 3 mm long, deciduous. Female flowers on separate plants. Sepals 5, thin, reticulate, broadly lanceolate to ovate-lanceolate, acuminate, at anthesis about 8 mm long, 4 to 5 mm wide, accrescent and up to 13 mm long before falling. Styles 2 mm long; stigmas forked, spirally twisted, about 2 mm long. Mature capsules 2 to 2.5 cm long, about 2 cm wide, truncate at the apex, the outer upper angles acute, subequally 3-winged, one wing rounded and broader at its base than are the other two which are narrowed and acute at the base.

LUZON, Province of Nueva Vizcaya, Dupax, *Bur. Sci. 11334 McGregor*, March, 1912, in forests along small streams.

This distinct species is probably most closely allied to *Begonia cumingii* A. Gray, from which it is at once distinguished by its long and slender ciliate-setose hairs and by its small male flowers. It somewhat resembles *Begonia crispipila* Elmer, but lacks the prominently bracteate inflorescence of that species, and has very different capsules.

BEGONIA QUERCIFOLIA A. DC. in Ann. Sci. Nat. IV 11 (1859) 129, Prodr. 15[1] (1864) 320; F.-Vill. Novis. App. (1880) 99; Vid. Phan. Cuming. Philip. (1885) 116, Rev. Pl. Vasc. Filip. (1886) 143.

Begonia leytensis Elm. Leafl. Philip. Bot. 2 (1910) 739; Merr. in Philip. Journ. Sci. 6 (1911) Bot. 384.

This species was wrongly interpreted by me in my recent paper of Philippine *Begonia*[2], for all the recently collected material I rather tentatively referred to DeCandolle's species, represents a quite different form. After a careful study of the available material and the descriptions I am confident that *Begonia leytensis* Elm. is an exact synonym of *B. quercifolia* A. DC., and it is accordingly here reduced. So far as known *B. quercifolia* A. DC.

[2] This Journal 6 (1911) Bot. 387.

is represented only by the type collection from Samar, *Cuming 1696*, of which I have examined a specimen preserved in the Kew Herbarium, and of which I have a carbon rubbing representing the leaf-outline and venation, and *Elmer 7255* from the neighboring island of Leyte, type collection of *Begonia leytensis* Elm. The material I referred to *B. quercifolia* may prove to be only a luxuriant form of *B. contracta*, but it seems advisable to wait for more material before definitely deciding this point.

THYMELAEACEAE.

MACGREGORIANTHUS gen. nov.

Flores hermaphroditi. Perianthii tubus elongatus, cylindricus, lobi 5, patentes, fauce intus nuda. Stamina 10, tubo 2-seriatim inclusa, filamentis brevissimis; antherae oblongae, parvae. Discus annularis, brevissimis, obscurissimis, lobatis. Ovarium sessile, villosissimum, 1-loculare, in stylum desinens, stigmate obovoideo, papilloso. Fructus ignotus. Frutex ut videtur scandens. Folia opposita, plana, margine cartilaginacea. Flores in paniculis axillaribus terminalibusque laxis elongatis dispositis. Perianthia extus puberula.

MACGREGORIANTHUS PANICULATUS sp. nov.

Frutex inflorescentiis exceptis glaber; foliis coriaceis, ovato-ellipticis ad oblongo-ellipticis, usque ad 9 cm longis, obtusis vel obscure brevissime late acuminatis, nervis utrinque circiter 13; paniculis elongatis, paucifloris, griseo-puberulis, 12 at 25 cm longis; floribus ad apices ramulorum fasciculatis, circiter 8 mm longis.

A shrub, climbing (*fide* McGregor), glabrous except the inflorescence. Branches reddish-brown, terete, slender, the younger ones often somewhat puberulent, soon becoming quite glabrous, wrinkled when dry. Leaves opposite, coriaceous, olivaceous and slightly shining when dry, the lower surface somewhat paler than the upper, ovate-elliptic to oblong-elliptic, 6 to 9 cm long, 3 to 5.5 cm wide, base rounded or subacute, apex obtuse or very broadly, shortly, and bluntly acuminate, the margins entire, cartilaginous; nerves about 13 on each side of the midrib, spreading-ascending, anastomosing directly with the cartilaginous leaf-margin, the reticulations obscure; petioles reddish-brown when dry, about 1 cm long. Panicles terminal and in the upper axils, elongated, lax, few-flowered, all parts densely and uniformly gray-puberulent, and with scattered, reduced, linear bracts 5 mm long or less. Flowers pale-green, 5-merous, 9 mm long, fascicled at the ends of the ultimate branchlets, their pedicels 5 mm long or less.

Perianth-tube cylindric, about 1.5 mm in diameter, inside glabrous, outside gray-puberulent, the lobes 5, elliptic, spreading, 2.5 to 3 mm long, rounded, imbricate, densely gray-pubescent on the inner surface. Stamens 10, alternate in two series, inserted just at the apex of the perianth-tube but included, the anthers oblong, about 1 mm long; filaments of the upper row about 1 mm long, those of the lower row shorter. Ovary sessile, densely villous, oblong-ovoid, about 3 mm long, 1-celled, narrowed above; style slender, glabrous, about 1.5 mm long; stigma obovoid, papillose, about 0.5 mm long. Fruit unknown.

LUZON, Province of Laguna, Calauan, *Bur. Sci. 12360 McGregor*, December 12, 1910, a vine in hill-side forests.

The genus here proposed is dedicated to Mr. R. C. McGregor of the Bureau of Science by whom it was collected, and who has made extensive botanical collections in the Philippines and in Guam during the past eight years.

Macgregorianthus is manifestly allied to *Wikstroemia* Endl., differing especially in its 5-merous flowers, as well as in its habit. All known species of *Wikstroemia* have a 4-parted perianth, and 8 stamens. Mr. McGregor notes that the plant is a vine which is presumably correct, although this is a most unusual character in the *Thymelaeaceae*. The cartilaginous leaf-margin, with which the lateral nerves anastomose direct, is a striking character of the proposed genus.

GYRINOPSIS Decne.

GYRINOPSIS BRACHYANTHA sp. nov.

Arbor parva, glabra; foliis chartaceis vel subcoriaceis, nitidis, oblongis, usque ad 16 cm longis, acuminatis, basi acutis vel obtusis; floribus axillaribus, solitariis vel fasciculatis, 4 mm longis, perianthio campanulato, capsulis anguste obovoideis, leviter compressis, 1.2 ad 1.5 cm longis.

A small tree, or according to Ramos a shrub 2 m high, glabrous, the branches slender, terete, brownish when dry, the growing tips usually pubescent. Leaves oblong, chartaceous or subcoriaceous, oblong, 8 to 16 cm long, 2 to 4.5 cm wide, shining on both surfaces, the base acute or obtuse, the apex acuminate, margins recurved; midrib very prominent, the nerves exceedingly numerous, spreading, parallel, very dense, slender; petioles about 5 mm long. Flowers greenish, axillary, solitary or several in a fascicle on a short axis, the pedicels about 3 mm long. Perianth campanulate, 4 mm long, in bud distinctly pubescent externally, becoming nearly glabrous, the lobes 5, oblong, or ovate-oblong, pubescent internally, as long as the perianth-tube. Stamens 10, five opposite the perianth-lobes, their anthers about 0.7 mm long,

with longer filaments than the five alternate with the lobes, all inserted with the scales, not below them, the scales 10, oblong, ciliate, alternating with the filaments, about 1 mm long. Ovary ovoid, 2-celled, slightly pubescent; style 1 mm long. Capsule narrowly obovoid, 2-valved, more or less compressed, 1.2 to 1.5 long, the seed pubescent, including the projecting ends, about 1 cm long.

LUZON, Province of Cagayan, Abulug River, *Bur. Sci. 13862 Ramos* (type), *For. Bur. 19562 Curran*, January, 1912; Pamplona, *Bur. Sci. 7489 Ramos*, March, 1909, distributed as *G. cumingiana* Decne.

A species in vegetative characters closely resembling *Gyrinopsis cumingiana* Decne., but with entirely different flowers. In floral characters it approaches the genus *Aquilaria*, and appears to be more or less intermediate between *Gyrinopsis* and *Aquilaria*. In consideration of its axillary inflorescence, and in its having 10 scales at the throat instead of five, I have referred it to the former genus. In structure the flower appears to differ a little from both genera cited above in that the stamens are inserted with and alternate with the scales, not below them.

MYRTACEÆ.

EUGENIA L.

EUGENIA CAMIGUINENSIS sp. nov. § *Syzygium*.

Species E. densinerviae Merr. simillima et valde affinis, differt foliis minoribus, floribus brevioribus.

A glabrous tree about 8 m high, the branches terete, light-gray, the ultimate ones 3 to 4 mm thick. Leaves elliptic to elliptic-obovate, thickly coriaceous, 8 to 11 cm long, 5 to 7 cm wide, somewhat shining when dry, the lower surface glandular-punctate, a little paler than the upper one, the apex broad, rounded or very broadly and obtusely acuminate, the base acute; nerves dense, slender, indistinct, parallel, 25 to 30 on each side of the midrib, anastomosing into a very obscure submarginal nerve; petioles stout, 5 to 7 mm long. Inflorescence terminal, corymbose, many flowered, peduncled, or branched from the base, the branches trichotomous, the whole inflorescence up to 8 cm long, 7 to 13 cm in diameter. Ultimate branchlets short, densely arranged, the flowers in threes, subsessile, each subtended by a pair of ovate, concave, stiff, rounded bracteoles 1.5 mm long, the bracts similar, a little larger. Buds 6 to 7 mm long, narrowly obovoid to broadly club-shaped. Calyx about 5 mm long, 3 mm wide at the apex, obscurely 4-toothed. Petals calyptrate.

CAMIGUIN DE MINDANAO, in forests near the summit of Mount Mahinog, *Phil. Pl. 1175 Ramos*, April, 1912.

EUGENIA CILIATO-SETOSA sp. nov. § *Syzygium ?*

Arbor parva 2 ad 5 m alta, ramulis foliis subtus ad nervos inflorescentiisque insigniter ciliato-setosis; foliis oblongo-lanceolatis, usque ad 20 cm longis, acuminatis, basi cordatis, brevissime petiolatis, nervis lateralibus marginalibusque subtus prominentibus; inflorescentiis terminalibus, paniculatis, ut videtur paucifloris, fructibus inaequilateraliter obovoideis, 1.5 ad 2 cm longis.

A small tree or a shrub 2 to 5 m high, the branches, nerves on the lower surfaces of the leaves, especially the midribs, and the inflorescence prominently ciliate-setose. Branches terete, grayish, slender. Leaves opposite, oblong-lanceolate, 14 to 20 cm long, 3 to 6 cm wide, chartaceous, the upper surface glabrous, olivaceous, shining, the lower paler, the midrib prominently, the lateral nerves sparingly ciliate-setose, apex sharply and slenderly acuminate, the base rather abruptly rounded-cordate; nerves very prominent on the lower surface, 20 to 25 on each side of the midrib, anastomosing in nearly straight marginal nerves as prominent as the lateral ones; petioles ciliate-setose, about 2 mm long. Inflorescence terminal, ciliate-setose, paniculate, 10 to 15 cm long including the elongated peduncle, the branches few, spreading, apparently few-flowered. Immature buds obovoid, about 4 mm long. Fruits inequilaterally obovoid, 1.5 to 2 cm long, nearly smooth, green when fresh.

LUZON, Province of Cagayan, Abulug River, *Bur. Sci. 13974 Ramos* (type), with immature buds and fruits, *For. Bur. 11590, 13974 Curran*, with fruits, all collected in January, 1912, in dipterocarp forests 30 to 50 meters above sea-level.

A most striking species, differing from all the Philippine forms, and from most or quite all of the previously described species in the genus by its prominently ciliate-setose branches, leaves, and inflorescence.

EUGENIA PROPINQUA sp. nov. § *Syzygium.*

Species E. pauciveniae C. B. Rob., simillima et affinis, differt foliis minoribus, distincte petiolatis, floribus ut videtur minoribus.

A tree (*fide* Ramos), 10 m high, glabrous, the branches terete, somewhat grayish and reddish-brown, the young branchlets slightly compressed, slender. Leaves numerous, crowded, coriaceous, shining on both surfaces, oblong-elliptic to obovate, the base acute, the apex rounded, usually broadly so, 3 to 5 cm long, 1.5 to 3 cm wide; nerves about 10 on each side of the midrib, indistinct, irregular, very obscurely anastomosing; petioles 3 to 4 mm long. Inflorescence terminal, many-flowered, 3 to 4 cm

long, 5 to 6 cm wide, corymbose, 3-branched from the base, the branches trichotomous, the ultimate branchlets bearing from 3 to 5 sessile flowers, the nearly mature buds oblong-ellipsoid or narrowly obovoid-ellipsoid, about 5 mm long.

LUZON, Province of Cagayan, Abulug River, *Bur. Sci. 13911 Ramos*, January, 1912, in forests.

A species manifestly very closely allied to *Eugenia paucivenia* C. B. Rob., differing in its smaller, differently shaped, distinctly petioled leaves which are acute at the base, its more densely flowered inflorescence, and its apparently somewhat smaller flowers.

EUGENIA TENUIPES sp. nov. § *Jambosa*.

Species E. bataanensis simillima et valde affinis, differt pedicellis tenuibus, valde elongatis, usque ad 12 cm longis.

A small tree, quite glabrous, the branches terete, grayish or reddish, slender, the ultimate branchlets 1 to 1.5 mm in diameter. Leaves opposite, shortly petioled, chartaceous, oblong-ovate to ovate-lanceolate, 5 to 12 cm long, 1.5 to 3.5 cm wide, rather pale and somewhat shining when dry, the lower surface paler than the upper, narrowed to the acute or rarely somewhat rounded base, the apex slenderly and sharply acuminate, the acumen usually about 1 cm long; nerves irregular, distant, about 6 on each side of the midrib, anastomosing and forming an undulate submarginal nerve about as prominent as the primary lateral ones; petioles about 2 mm long. Flowers axillary and terminal, solitary, white, their pedicels very slender, elongated, 4 to 12 cm long, with 2 minute bracteoles in the lower one-fifth or one-sixth. Calyx jointed to the pedicel, funnel-shaped in anthesis, about 2 cm long, narrowed below to the slender stalk, about 1.8 cm wide, the lobes distinct, rounded, in fruit becoming ovoid and about 2 cm long and wide. Petals free. Stamens very numerous.

LUZON, Province of Cagayan, Abulug River, *For. Bur. 19608 Curran* (type), January, 1912, *Bur. Sci. 13963 Ramos*. I refer here also *Bur. Sci. 7367 Ramos*, from Claveria, Cagayan Province, previously considered by Doctor Robinson in his treatment of the Philippine *Myrtaceae*[10] as *Eugenia bataanensis* Merr. Doctor Robinson notes that this Cagayan specimen differs from the typical form of *Eugenia bataanensis* Merr., in its leaves being acute at the base. Additional material shows that the peculiar character of the inflorescence, the very long and slender pedicel, is constant, and hence the form is described as new. Unquestionably closely allied to *Euge-*

[10] This Journal 4 (1909) Bot. 348.

nia bataanensis Merr., differing especially in its leaves being usually acute at the base, and in its flowers always being long and slenderly pedicelled.

TRISTANIA R. Br.

TRISTANIA LITTORALIS sp. nov. § *Eutristania.*

Species T. obovatae R. Br. similis et affinis, differt foliis brevissime petiolatis vel subsessilis, basi distincte auriculatis, petalis integris, vix denticulatis.

A tree with hard wood, quite glabrous except the puberulent inflorescence. Branches terete, light-gray, slender, the branchlets reddish-brown as are the panicles and midribs of the leaves when dry. Leaves alternate, coriaceous, narrowly obovate-oblong to obovate-elliptic, 9 to 22 cm long, 4 to 10 cm wide, shining when dry, the lower surface distinctly paler than the upper one, the apex obtuse, acute, or distinctly and shortly acuminate, narrowed below to the distinctly auriculate base, the margins recurved; lateral nerves slender, 8 to 10 on the smaller leaves, up to 30 on the larger ones, usually 5 to 8 mm apart, spreading, straight or nearly so, anastomosing and forming a continuous, slender, submarginal nerve; petioles stout, 2 to 3 mm long, wider than long, or wanting and the leaves sessile. Inflorescence axillary, pedúncled, cymose, somewhat puberulent, 2 to 9 cm long. Flowers sessile or nearly so, the calyx funnel-shaped, about 3 mm long, 3 mm wide at the throat, with 5 broadly triangular teeth which are acute or obtuse. Petals 5, glabrous, rounded, obovate, 1.2 mm long. Stamens 15, in five groups of three each opposite the petals, the middle filament of each group 1 to 1.2 mm long, the two lateral ones a little shorter, the anthers very small. Ovary globose, slightly gray-pubescent; style slender, 1 mm long. Capsules obovoid-ellipsoid, 4 mm long, the three valves coriaceous, slightly pubescent, ultimately glabrous or nearly so. Seeds thin, flat, narrowly obovoid, including the wings about 4 mm long.

MINDANAO, District of Zamboanga, Taligbao River, *For. Bur. 13534 Foxworthy, De Mesa, & Villamil,* June 17, 1912, common here, occurring just back of the mangrove on dry land, and on a low ridge running back from the edge of the swamp. The same species is represented by a sterile specimen, *For. Bur. 11246 Hutchinson,* from Santa Maria, Zamboanga. It is known to the Moros as *taba.*

The wood is hard and is said to be very durable. The species is the second one of the genus to be recorded from the Archipelago, but apparently one or two additional distinct forms are represented by sterile material from different parts of the Philippines.

ARALIACEAE.

SCHEFFLERA Forst.

SCHEFFLERA STELLULATA sp. nov. § *Heptapleurum.*

Arbor parva, inflorescentiis stellato-furfuraceis exceptis glabra; foliis longe petiolatis, palmatim 6- ad 9-foliolatis, foliolis subcoriaceis, oblongis, brevissime abrupte acuminatis, usque ad 25 cm longis; inflorescentiis terminalibus, ramis paucis, elongatis, racemosis; floribus 5-meris, capitato-umbellatis, umbellis pedunculatis, racemosis.

A small tree (*fide* McGregor), glabrous except the inflorescence which is minutely stellate-furfuraceous throughout with a somewhat brownish or grayish indumentum. Branches terete, gray, marked with the annular scars of fallen petioles. Leaves palmately 6- to 9-foliolate, their petioles about 28 cm long. Leaflets oblong, subcoriaceous, somewhat shining, of about the same color on both surfaces when dry, 15 to 25 cm long, 6 to 7 cm wide, the apex very shortly and abruptly acuminate or merely acute, the base usually rounded, sometimes subacute; primary nerves 10 to 12 on each side of the midrib, rather distinct, anastomosing; petioles 5 to 8 cm long. Inflorescence terminal, paniculate, peduncled, the peduncle and rachis about 30 cm long, each panicle with about 6, slender, elongated, racemosely arranged primary branches 25 to 35 cm in length, all parts stellate-furfuraceous, each primary branch with about 30 peduncled, racemosely arranged subcapitate umbels, the umbels with from 15 to 20 flowers, the lower umbels with peduncles 10 to 12 mm in length, the upper ones gradually shorter, the umbels 1 cm in diameter or less. Flowers greenish-yellow, 5-merous, their pedicels 1 to 1.5 mm long, in fruit up to 4 mm long. Calyx funnel-shaped, subtruncate, about 2 mm in diameter. Petals 5, ovate, free, acute or obtuse, 2 mm long, marked with small brownish-yellow dots and dashes. Stamens 5; filaments slender, 3 to 4 mm long; anthers about 1 mm long. Ovary 5-celled. Fruit turbinate, 2.5 mm in diameter, the apex convex, grayish, rugose.

LUZON, Province of Nueva Vizcaya, Dupax, *Bur. Sci. 11251 McGregor,* April 15, 1912.

A characteristic species, distinguishable by its stellate-furfuraceous inflorescence, its capitate-umbellate flowers, the umbels being racemosely disposed on the elongated branches of the inflorescence, and by its oblong leaflets.

ALANGIACEAE.

ALANGIUM Lam.

ALANGIUM BRACHYANTHUM sp. nov. § *Eualangium.*

Arbor circiter 7 m alta; floribus in ramis defoliatis, axillaribus, fasciculatis, brevissime pedicellatis, petalis 6, 1.5 cm longis, pubescentibus; staminibus 15, basi vix curvato-geniculatis.

A tree about 7 m high. Branches and branchlets light-gray or somewhat reddish, slender, glabrous. Flowers yellowish-white, very fragrant, numerous, appearing before the leaves, axillary, fasciculate, several at each node, the fascicles rather congested; pedicels very short, pubescent. Calyx 2 mm long, 3 mm in diameter, pubescent, obscurely 6-toothed. Petals 6, 1.5 cm long, about 1 mm wide, appressed-pubescent externally. Stamens 15; filaments slender, 7 to 8 mm long, not inflexed or geniculate at the base, somewhat villous at about the middle; anthers 6 to 7 mm long; style as long as the petals; stigma globose.

LUZON, Province of Tayabas, Pagsalam, *For. Bur. 10341 Curran*, April 9, 1908, in beach forests, altitude about 5 m, locally known as *malatapay*.

I have refrained from describing the leaves of this apparently very distinct species, as Mr. Curran notes that they were picked up on the ground from under the tree, there being no leaves on the tree at the time it was found in flower. The species is manifestly allied to *Alangium salviifolium* (L. f.) Wangerin, but differs remarkably in its much smaller flowers and in its fewer stamens. The detached leaves with the specimen, which however may belong to a different plant, are penninerved, not at all 3-nerved from the base.

ALANGIUM LONGIFLORUM sp. nov. § *Eualangium.*

Species A. salviifolio (L.) Wangerin affinis, differt floribus 5-meris, multo longioribus, staminibus paucioribus, 16 vel 17, petalis usque ad 4.5 cm longis.

A deciduous tree 7 to 10 m high. Branches terete, grayish-brown, glabrous, the ultimate ones softly pubescent with short, pale-brown or olivaceous hairs. Leaves appearing after the flowers, oblong to obovate-oblong, membranaceous or chartaceous, ultimately glabrous on both surfaces, when young slightly pubescent on the nerves beneath, 10 to 15 cm long, 4 to 7 cm wide, entire, equilateral, the base rather abruptly rounded or obtuse, distinctly 3-nerved, the apex prominently acuminate; lateral nerves above the basal pair 4 or 5 on each side of the

midrib, as prominent as the basal ones, somewhat ascending, anastomosing, the reticulations distinct; petioles 5 to 8 mm long, pubescent when young, ultimately glabrous. Flowers on defoliated branches, axillary, several in each axil, white, the pedicels densely pubescent, stout, 3 to 4 mm long. Calyx obconic, about 5 mm long, 4 mm in diameter, the limb produced 1.5 to 2 mm above the ovary, very broadly and obscurely 5-toothed. Petals 5 (rarely 4), on the type 4.5 cm long (on other specimens referred here 3.5 to 4 cm in length), 2 mm wide below, free, narrowed above, cinereous-pubescent. Stamens 16 or 17, as long as the petals; filaments villous in the lower one-half or one-third, not curved-geniculate; anthers 10 mm long. Style glabrous, as long as the petals; stigma globose, 2 mm in diameter. Fruit ovoid or ellipsoid, cinereous-puberulent, nearly 2 cm long.

LUZON, Province of Cagayan, Malueg, *For. Bur. 14773 Darling*, April 16, 1909, on slopes along streams, altitude about 60 m (type); Casambalangan, *For. Bur. 13112 Bernardo*, May, 1909: Province of Laguna, Los Baños, *Elmer*, April, 1906, *Alberto*, May, 1905; Santa Maria Mavitac, *For. Bur. 10084 Curran*, February, 1908: Province of Camarines, Caramoan, *For. Bur. 10576 Curran*, June, 1908; Mount Isarog, *For. Bur. 10501 Curran*, May, 1908: Province of Tayabas, *For. Bur. 10388 Curran*.

A species manifestly allied to *Alangium salviifolium* (L. f.) Wangerin, differing in its very much longer, 5-merous flowers, fewer stamens, and in its filaments which are not curved-geniculate near the base, but which are more or less pilose for the lower one-third or one-half, and very much longer than in *A. salviifolium*.

I do not hesitate to refer here *Cuming 1716* from Samar, which is cited by Wangerin [11] under *Alangium salviifolium* (L. f.) Wangerin, subsp. *hexapetalum* (Lam.) Wangerin. Our specimen of Cuming's plant has 5-merous flowers with the petals 4 cm in length, characters by which I have distinguished the species above described. *Alangium salviifolium* var. *hexapetalum*, as described by Wangerin, has 6-merous flowers and petals 2 to 2.5 cm in length.

In Cagayan Province the species is known as *apitan;* in Camarines as *bunglas* and *malatapay*.

This form has previously been considered by Philippine botanists to represent *Alangium octopetalum* Llanos, F.-Villar and Vidal reducing that species to *Alangium lamarckii* Thwaites. In working over the identifications of the species described by Blanco, I followed F.-Villar in referring *A. octopetalum* to *A. lamarckii*. The description of *Alangium octopetalum* Llanos, for Blanco definitely states that it was described by Llanos, is very short and incomplete, but a careful examination of it shows conclusively that it can not be the same as *Alangium salviifolium*, or *A. longiflorum*. The description calls for a plant with 8 petals and from 9 to 11 stamens, with no style or stigma; if Llanos correctly described his plant, then the last character would exclude *Alangium octopetalum* from the genus.

[11] Engl. Pflanzenreich 41[3] (1910) 11.

ALANGIUM SALVIIFOLIUM (L. f.) Wangerin, subsp. **HEXAPETALUM** (Lam.) Wangerin in Engl. Pflanzenreich 41[3] (1910) 9.

MINDANAO, Lake Lanao, Camp Keithley, *Mrs. Clemens 594*, and several sheets without number.

The above specimens seem to agree fairly well with Wangerin's conception of this species, as expressed in his description. The flowers have 6 petals, which vary from 2.5 to 3.3 cm in length, hence averaging considerably longer than indicated for *Alangium salviifolium*. The stamens are usually about 22, and as long as the petals, glabrous below, then villous on the inside for from 5 to 7 mm, and glabrous above.

A specimen from Balabac Island, *Bur. Sci. 400 Mangubat*, may represent still another form. In vegetative characters it is very similar to *A. salviifolium* var. *hexapetalum*, the petals are 6 in number, about 2.2 cm long, while the stamens vary from 15 to 17, the filaments near the base supplied with a prominent, internal, densely villous appendage.

ALANGIUM MEYERI Merr. in Govt. Lab. Publ. (Philip.) 35 (1905) 54; Wangerin l. c. 15.

Additional material of this endemic species is as follows: LUZON, Province of Cagayan, San Vicente, *For. Bur. 11301 Klemme:* Province of Laguna, Los Baños, *Elmer 8308:* Province of Camarines, Mount Isarog, *For. Bur. 10437 Curran;* Dalupaon, *Ahern 120.* POLILLO, *Bur. Sci. 10413 McGregor.* MINDORO, *For. Bur. 12902 Rosenbluth, Whitford 1444, For. Bur. 3643, 3682, 6136 Merritt.* NEGROS, *For. Bur. 4334 Everett, For. Bur. 15016 Danao.*

Native names: *Angatuan* (Cagayan: Negrito); *putian* (Negros, Mindoro: Visayan); *malatapay, paang daraga* (Camarines: Bicol); *maragabulo* (Tayabas: Tagalog).

ERICACEAE.

VACCINIUM L.

VACCINIUM CAMIGUINENSE sp. nov.

Species V. jagori Warb. affinis et similimis, differt foliis obtusis vel rotundatis, vix acuminatis vel apiculatis, calycis lobis ciliatis.

A species very similar to and apparently closely allied to *Vaccinium jagori* Warb. A small glabrous tree, the branches terete, olivaceous or brownish, smooth. Leaves thickly coriaceous, subsessile, oblong-obovate to narrowly oblong-obovate, 3.5 to 8 cm long, 1.5 to 3 cm wide, somewhat brownish when dry, shining, the lower surface a little paler than the upper one, somewhat glandular, the apex rounded or obtuse, base narrowed to the very short petiole, subacute or abruptly obtuse, margins slightly recurved; midrib prominent, the lateral nerves sharply ascending, slender, obscure, 2 or 3 basal pairs and one or two additional pairs leaving the midrib below the middle; petioles stout, very short or none. Flowers unknown. Racemes axillary, solitary, 5 to 6 cm long, glabrous. Nearly mature fruits sub-

globose, glabrous, about 5 mm in diameter, their pedicels 5 to 10 mm long, 10 to 20 in a raceme. Persistent calyx lobes triangular-ovate, acute or somewhat acuminate, 2 mm long, their margins above distinctly ciliate.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14622* (type), *14680 Ramos*, April 9, 1912, in forests near the summit of Mount Mahinog.

A species similar to and manifestly allied to *Vaccinium jagori* Warb., from which it differs chiefly in its obtuse or rounded, not acuminate or apiculate leaves. Among the extra-Philippine species it appears to be allied to *Vaccinium bancanum* Miq., from which it also differs in its vegetative characters.

VACCINIUM EPIPHYTICUM sp. nov.

Frutex epiphyticus, 2 ad 3 m altus, glaber; foliis ovatis vel oblongo-ovatis, coriaceis, nitidis, acute acuminatis, basi rotundatis vel acutis, usque ad 12 cm longis, 7-plinerviis; petiolo 5 mm longo; racemis axillaribus, solitariis, quam folia brevioribus; floribus circiter 14 mm longis, cylindraceo-campanulatis, fauce vix contractis.

An epiphytic shrub, manifestly closely allied to *Vaccinium barandanum* Vid., glabrous or nearly so, 2 to 3 m high. Branches terete, smooth, grayish, the younger ones somewhat wrinkled or angular when dry, slender. Leaves alternate, ovate to oblong-ovate, coriaceous, shining, 8 to 12 cm long, 3.5 to 6.5 cm wide, the base broad and rounded or acute, 7-plinerved, the apex sharply and rather slenderly acuminate, margin entire; outer two pairs of nerves leaving the base of the leaf, the outermost ones not reaching the middle of the leaf, the next inner pair extending above the middle, the innermost pair leaving the midrib 5 to 10 mm above the base, more prominent than the others, extending nearly to the apex, the primary lateral nerves above these basal ones about 5 on each side of the midrib, ascending, not prominent, reticulations distinct; petioles 5 mm long. Racemes axillary, solitary, about 5 cm long, comparatively few-flowered, glabrous or very slightly pubescent. Bracteoles lanceolate-oblong, acuminate, membranaceous, about 11 mm long, 4 mm wide; pedicels about 12 mm long. Flowers pink. Calyx-tube globose-ovoid, about 2 mm long, not contracted, the teeth 5, oblong-ovate, acute, about 2 mm long, margins minutely pubescent. Corolla about 12 mm long (10 mm wide when flattened), glabrous, or with very few scattered hairs, tubular, not contracted above, the lobes broadly ovate, obtuse, reflexed, about 2 mm long. Stamens 10; filaments 5 mm long, sparingly ciliate;

anthers 4 to 4.5 mm long, the terminal tubes 2 mm long, opening by pores. Style 12 mm long, pubescent.

MINDANAO, District of Zamboanga, Sax River Mountains, back of San Ramon, *Merrill 8087*, November 30, 1911, altitude about 900 m.

A species closely allied to *Vaccinium barandanum* Vidal, of Luzon and Mindoro (*V. hutchinsonii* Merr.), which it closely resembles, differing in its somewhat smaller flowers, shorter petioles, its epiphytic habit, and its pubescent, not glabrous styles.

VACCINIUM LOHERI sp. nov.

Frutex parvus, epiphyticus, glaber; foliis crasse coriaceis, ellipticis, in siccitate pallidis, nitidis, 1.5 ad 2 cm longis, integris, apice rotundatis, basi obscure triplinerviis, acutis, 2-glandulosis, petiolo vix 2 mm longo; floribus solitariis, axillaribus, pedicellatis.

A small, epiphytic, glabrous shrub, the branches terete, grayish, the younger ones reddish-brown, wrinkled when dry. Leaves numerous, crowded, elliptic, 1.5 to 2 cm long, thickly coriaceous, when dry rather pale and shining, the apex rounded, the base acute, with two prominent glands near the juncture with the petiole, the margins thickened, somewhat recurved, base obscurely 3-plinerved, the lateral nerves nearly as prominent as the midrib, nearly or quite reaching the apex, the reticulations obsolete or nearly so; petioles 1 to 2 mm long. Flowers white, according to the collector (corolla not seen). Pedicles solitary, axillary, slender, about 6 mm long, somewhat curved, the basal bracteoles ovate, about 0.5 mm long. Calyx 2 mm long, broadly urceolate, the tube ovoid, globose, about 1.5 mm in diameter, the limb somewhat spreading, 5-toothed, the teeth broadly triangular-ovate, acute or slightly acuminate, 0.5 mm long.

LUZON, Province of Rizal, Montalban; that is, in the mountains back of Montalban, *Loher 6187*, April 18, 1905.

Although my specimen is imperfect, the corolla being lacking, I have not hesitated to describe this distinct form. It is well characterized by its small, crowded, entire, obtuse, obscurely nerved leaves which are rounded at the apex, acute and 2-glandular at the base, and by its solitary, axillary flowers. Among the Philippine species it is most closely allied to *Vaccinium microphyllum* Blume (*V. mindorense* Rendle), but is very different from that species.

MYRSINACEAE.

ARDISIA Sw.

ARDISIA CAGAYANENSIS sp. nov. § *Acrardisia*.

Species A. scabridae Mez affinis, differt foliis majoribus, usque ad 16 cm longis, obscure crenato-dentatis, nervis magis numerosis, 25 ad 30 utrinque.

A shrub or small tree, the branches brown, smooth, somewhat shining, the branchlets distinctly ferruginous-furfuraceous, slender. Leaves oblong-elliptic to broadly oblong-oblanceolate, chartaceous, 10 to 16 cm long, 3 to 4.5 cm wide, subequally narrowed at both ends, the base acute or decurrent-acuminate, the apex sharply acuminate, the margins subentire or obscurely serrate-crenate, the upper surface slightly shining, the lower of about the same color, with very numerous, dark-brown glands; nerves slender, 25 to 30 on each side of the midrib; petioles about 1 cm long. Inflorescence terminal or subterminal, much shorter than the leaves, usually leaf-opposed with the uppermost leaf on the branchlet, more or less glandular-furfuraceous with brown glands, the branches few, the flowers umbellately arranged on the ultimate branchlets, about 6 in an umbel, the pedicels glandular, 5 to 7 mm long. Flowers about 8 mm in diameter. Calyx about 3.5 mm in diameter, the lobes spreading, triangular-ovate, glandular, acute, about 1 mm long. Corolla-lobes ovate, imbricate, acuminate, about 3.5 mm long, glandular-punctate. Anthers narrowly ovoid, 2 mm long, sharply acuminate, somewhat glandular in the median part of the back, subsessile. Ovary ovoid, glandular, style 4 mm long. Fruit globose, apparently fleshy when fresh, black when dry, about 7 mm in diameter.

LUZON, Province of Cagayan, Abulug River, *For. Bur. 19620 Curran*, January, 1912.

A species of the section *Acrardisia*, manifestly allied to *Ardisia scabrida* Mez, but differing from that species in very many characters.

ARDISIA RAMOSII sp. nov. § *Crispardisia.*

Frutex circiter 1 m altus, glaber; foliis anguste oblong-ellipticis, membranaceis, utrinque subaequaliter angustatis, acute acuminatis, subtus pallidioribus, minute vel haud puncticulatis, subintegris vel obscurissime undulatis, usque ad 20 cm longis, nervis utrinque 15 ad 20; floribus ignotis; fructibus globosis, valde glandulosis, glabris, sepalis oblongis, obtusis, glandulosis, vix ciliatis, circiter 2.5 mm longis.

A shrub about 1 m high, quite glabrous, the branches pale-brownish. Leaves narrowly elliptic-oblong, membranaceous, 15 to 20 cm long, 4 to 7 cm wide, subequally narrowed at both ends, the base acute or cuneate, the apex slenderly and sharply acuminate, the margin subentire or very obscurely undulate, with distant glands, when dry slightly shining or dull, the lower surface a little paler than the upper, beneath eglandular or with small, scattered glands which are not more numerous toward

the margins; nerves 15 to 20 on each side of the midrib, rather distinct on the lower surface, anastomosing and forming submarginal nerves very close to the edges of the leaf; petioles 8 to 12 mm long. Flowers unknown. Infrutescence leaf-opposed or subterminal, always at the tips of the branchlets, the peduncle 5 mm long or less, bearing usually about 4 or 5 umbellately arranged primary branchlets 1 to 1.5 cm in length, the branchlets in turn bearing usually two umbellately arranged fruits, the pedicels as long as the peduncles. Fruit globose, about 8 mm in diameter, very prominently marked with round and elongated glands, the persistent calyx about 7 mm in diameter, prominently glandular-punctate, the lobes oblong, obtuse, about 2.6 mm long, not at all ciliate.

LUZON, Province of Cagayan, Abulug River, *For. Bur. 19613 Curran, Bur. Sci. 13968 Ramos* (type), January, 1912, in forests.

A species probably most closely allied to *Ardisia jagori* Mez, but very distinct in vegetative and other characters.

DISCOCALYX Mez.

DISCOCALYX LONGIFOLIA sp. nov.

Frutex glaber 2.5 m altus; foliis oblanceolatis, circiter 55 cm longis, coriaceis, acutis vel acuminatis, basi angustatis, acutis, margine supra distincte dentatis; inflorescentiis bipinnatim paniculatis, tenuibus, paniculis fasciculatis, in ramis specialibus dispositis; floribus 0.3 mm diametro, prominente glanduloso-punctatis.

A glabrous, dioecious shrub about 2.5 m high. Leaves apparently crowded at the apices of the branches, coriaceous, oblanceolate, about 55 cm long, 11 cm wide at the upper two-thirds, from there gradually narrowed to the acute or cuneate base, the apex acute or acuminate, the margins in the upper two-thirds distinctly and regularly dentate, the lower surface obscurely glandular-punctate; nerves 40 or more on each side of the midrib, rather distinct, anastomosing, the ultimate reticulations indistinct, petioles stout, about 4 cm long. Inflorescence of slender, bipinnately paniculate panicles 10 cm long or less, which are fascicled near the apices of stout, specialized branches, these branches about 4 mm thick, more or less thickened at their apices and marked with scars of fallen bracts. Male flowers crimson, about 3 mm in diameter, the calyx rotate, very prominently glandular-punctate, the glands black, the lobes oblong, obtuse, about 1.3 mm long, their margins thin, subhyaline. Corolla of the same diameter as the calyx, prominently and densely glandular-punctate with black glands, the lobes oblong-ovate,

obtuse. Rudimentary ovary narrowly club-shaped, 1 mm long. Anthers broadly ovoid, 0.5 mm long.

LUZON, Province of Tayabas, Quinacatucan, *Bur. Sci. 13181 Foxworthy & Ramos*, March, 1911.

A characteristic and strongly marked species, distinguished by its unusually long, oblanceolate, denticulate leaves, and by its rotate flowers, the calyx of the same size as the corolla, and both calyx and corolla very densely glandular-punctate with black glands. Its allies are *Discocalyx insignis* Merr., and *D. macrophylla* Merr.

DISCOCALYX MACULATA sp. nov.

Frutex parvus, circiter 4 m altus, glaber; foliis oblongis, coriaceis, utrinque angustatis, acutis vel acuminatis, nitidis, usque ad 25 cm longis, subtus parce glanduloso-punctatis et maculis purpureis notatis, nervis utrinque 12 ad 15, distinctis; inflorescentiis bipinnatim paniculatis, paniculis tenuibus, glanduloso-punctatis, in ramis specialibus dispositis; floribus ♂ minutis, 5-meris.

A small tree or a shrub, 4 m high (*fide* Ramos), dioecious, glabrous. Leaves oblong, coriaceous, entire, 15 to 25 cm long, 4 to 8 cm wide, subequally narrowed at both ends, shining, the apex acuminate, base acute, the lower surface somewhat paler than the upper, with minute, scattered glands and with numerous, scattered, purplish spots 1 to 1.3 mm in diameter; primary lateral nerves 12 to 15 on each side of the midrib, distinct, anastomosing, the secondary ones sometimes nearly as distinct, the reticulations rather lax; petioles 2 to 3 cm long. Special branches bearing the inflorescence up to 18 cm long, slightly branched, the upper one-half often much thickened and marked with the scars of fallen bracts, the panicles more or less fascicled at the ends of the branches, slender, bipinnately paniculate, more or less glandular-punctate, 3 to 8 cm or more in length. Male flowers 5-merous, small, nearly mature buds about 1 mm in diameter, the calyx and corolla glandular-punctate.

LUZON, Province of Cagayan, Abulug River, *Bur. Sci. 13967 Ramos*, February, 1912, in forests.

A species apparently most closely allied to *Discocalyx montana* Elm., which it rather closely resembles, distinguished, however, by its small flowers and by its leaves being prominently maculate on the lower surface.

EMBELIA Burm. f.

EMBELIA NIGRO-PUNCTATA sp. nov. § *Choripetalum*.

Species ut videtur E. viridiflorae (A. DC.) Scheff., affinis, differt floribus majoribus, sessilibus vel subsessilibus, petalis acutis vel acuminatis.

An erect (or scandent?) shrub, glabrous throughout, the

branches terete, smooth, gray. Leaves coriaceous, oblong to oblong-obovate, usually brown when dry, somewhat shining, 8 to 16 cm long, 3.5 to 7 cm wide, the base acute, apex obtuse, acute, or very obscurely and broadly acuminate, both surfaces, but especially the lower one, with rather large, scattered, black glands; primary lateral nerves 8 to 10 on each side of the midrib, not very prominent, the secondary ones nearly as distinct, the reticulations rather close; petioles 1.5 to 3 cm long. Inflorescence spicate or subracemose, from the axils of fallen leaves, solitary, 2.5 to 4 cm long, the base subtended by numerous, small, imbricate bracts. Flowers 4-merous, sessile or subsessile, whitish, the bracteoles lanceolate, acute or acuminate, 2 mm long, 0.6 mm wide, with black glands. Calyx 2.5 mm long, black-glandular, the lobes ovate, acuminate, nearly 2 mm long. Petals 4, free, oblong-ovate, acute or acuminate, 3.5 mm long, 1.7 mm wide, black-glandular. Filaments slender, 3 mm long; anthers oblong, 1.5 mm long, the connective black-glandular. Ovary ovoid, tapering into the style. Fruit ovoid, apiculate, 8 to 10 mm long, smooth.

MINDORO, near Calapan, *Bur. Sci. 938 Mangubat*, June, 1906, said by the collector to be a common shrub in thickets. Probably referable here is *Bur. Sci. 1068* Ramos (distributed as *Antidesma*), from Bosoboso, Province of Rizal, Luzon, the specimen in fruit.

The species is manifestly allied to *Embelia viridiflora* (A. DC.) Scheff., but differs in the size of its flowers which are sessile or subsessile, acute or acuminate petals, and in its leaves being punctate with decidedly scattered but prominent black glands.

MAESA Forsk.

MAESA FERRUGINEA sp. nov. § *Eumaesa*.

Arbuscula circiter 1 m alta, ramulis foliis inflorescentiisque plus minusve ferrugineo-pilosis; foliis oblongo-ovatis, crenato-dentatis, usque ad 12 cm longis, nervis utrinque circiter 6; racemis axillaribus, solitariis, densis, petiolo subaequantibus vel brevioribus; sepalis extus dense tomentosis.

A shrub about 1 m high, all parts rather densely and softly ferruginous-pilose. Branches dark-brown, pilose, with small scattered lenticels. Leaves chartaceous, oblong-ovate, 7 to 12 cm long, 2.5 to 5.5 cm wide, both surfaces pilose with soft scattered hairs, base rounded or subacute, apex acute or slightly acuminate, margins distinctly crenate-serrate; petioles very densely ferruginous-pilose, about 2 cm long; nerves 5 to 7 pairs, prominent, reticulations indistinct. Inflorescence racemose, densely pilose, very rarely in depauperate panicles, the racemes dense, many-flowered, usually about as long as the petioles; pedi-

cels 1 to 1.5 mm long; bracts lanceolate, acuminate, 1 mm long. Calyx about 2 mm long, the lobes ovate, obtuse or acute, about 8 mm long, marked with longitudinal lines, obscurely glandular, the tube and lobes densely pilose. Corolla about 1.8 mm long, the lobes suborbicular, rounded, slightly glandular-punctate, about one-half as long as the corolla. Anthers 0.5 mm long, exceeding the filaments. Ovary wholly inferior, the apex quite glabrous. Fruit unknown.

LUZON, Province of Abra, Mount Paraga, *Bur. Sci. 7109 Ramos*, February 7, 1909, said to grow in forests at an altitude of about 300 m.

A species allied to *Maesa manillensis* Mez, but very distinct from that species; it is well characterized by its rather dense, soft, ferruginous tomentum.

MAESA PACHYPHYLLA sp. nov. § *Eumaesa.*

Species ut videtur M. ramentaceae affinis, differt foliis minoribus, crasse coriaceis, inflorescentiis axillaribus terminalibusque puberulis.

Apparently a scandent shrub, glabrous except the inflorescence, the branches terete, lenticellate, the reddish-brown slender branchlets terete, with few scattered lenticels. Leaves ovate to elliptic-ovate, thickly coriaceous, pale and shining when dry, of about the same color on both surfaces, 5 to 8 cm long, 2 to 4 cm wide, the base rounded or acute, the apex obtuse or very broadly and shortly acuminate, margins entire; lateral nerves 5 or 6 on each side of the midrib, curved-ascending, the reticulations obscure; petioles 1 to 1.5 cm long. Inflorescence puberulent, axillary, solitary, narrow, bipinnately-paniculate, by the reduction of the upper leaves forming terminal panicles, the lower ones 10 cm long or less, their branches less than 1 cm in length, the upper ones much shortened, the upper reduced leaves about 1 cm long, narrowly oblong. Flowers unknown, racemosely arranged. Bracts oblong-lanceolate, puberulent, acuminate, about 1.5 mm long, the pedicels about 1.2 mm long, with two, ovate, acuminate, 1 mm long bracteoles immediately below the fruit. Fruit globose, glabrous, about 2 mm in diameter, the persistent calyx-lobes reniform-ovate, about 0.5 mm long, not punctate, their margins minutely ciliate.

CEBU, hills back of the City of Cebu, *Bur. Sci. 11030 Ramos*, March, 1912.

A species apparently closely allied to *Measa ramentacea* Wall., from which it differs in its smaller, much thicker leaves, and its puberulent inflorescence. It is distinguishable among the Philippine species by its very thick, entire, glabrous leaves in conjunction with is puberulent axillary and pseudo-terminal inflorescence.

OLEACEAE.

LIGUSTRUM Linn.

LIGUSTRUM PUBINERVE Blume Mus. Bot. Lugd. Bat. 1 (1850) 314.
Visiania pubinervis Miq. Fl. Ind. Bat. 2 (1856) 548.
Ligustrum cumingianum Decne. in Nouv. Arch. Mus. Paris II 2 (1879) 28; Rolfe in Journ. Bot. 23 (1885) 214; Vid. Phan. Cuming. Philip. (1885) 125; Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 116.

There seems to be but a single species represented in the Philippines, although there is some variation in the material before me. The type of Blume's species was from the Philippines, collector not indicated, and the leaves are described as "in nervo medio subtus pubescentibus." Most of our material has the leaves entirely glabrous, but a few specimens from northern Luzon agree with Blume's description as to the pubescent midrib: *Elmer 6031, Vanoverbergh 78, Bur. Sci. 5998 Ramos*, and *For. Bur. 15993 Bacani.* Eighteen other specimens from northern and central Luzon, and from Mindoro, agree with the above specimens in all essential characters, but have entirely glabrous leaves. Unless distinctions are exceedingly finely drawn, but a single species is represented. It is with no hesitation that I reduce *Ligustrum cumingianum* Decne. (1879), to *L. pubinerve* Blume (1851). It is very closely allied to some species of southern China (*Henry 7879 E*), and of India; in fact Miquel has queried if it is not the same as *Ligustrum pubescens* DC.

Doctor H. Hallier has kindly examined the type of Blume's species in the Rijks Herbarium, Leiden, which is indicated as "ex herb. Delessert," no collector given, and considers that *Ligustrum cumingianum* Decne. is only a more glabrous variety of *L. pubinerve*, the type of the latter and cotype of the former differing only in the pubescent midribs of the leaves of *L. pubinerve*.

LOGANIACEAE.

GENIOSTOMA Forst.

GENIOSTOMA STENOPHYLLUM sp. nov.

Frutex vel arbor parva usque ad 4 m altus, glaber vel ramulis junioribus petiolisque minute pubescentibus; foliis anguste elliptico-oblongis vel lanceolatis, chartaceis, acuminatis, basi acutis, 2 ad 6 cm longis, nervis lateralibus utrinque 5 vel 6, subtus prominentibus, anastomosantibus; floribus axillaribus, solitariis, breviter pedicellatis; fructibus ovoideo-ellipticis, circiter 8 mm longis.

A shrub or small tree reaching a height of 4 m, glabrous except the slightly pubescent young branchlets and petioles. Branches pale-gray, the branchlets slender. Leaves chartaceous, narrowly elliptic-oblong to lanceolate, 2 to 6 cm long, 0.5 to 2 cm wide, slightly falcate, acuminate, base acute, pale when dry, not turning blackish, shining; lateral nerves 5 or 6 on each side of the midrib, prominent on the lower surface, anastomosing in a distinct, looped,

submarginal vein; petioles 1.3 to 3 mm long. Flowers greenish-white, axillary, solitary, rarely 2 in an axil, the pedicels about 2 mm long, the base with two or three, ovate, 0.5 mm long bracts, a similar bracteole subtending the flower. Calyx-lobes ovate, acute, 1 mm long. Corolla broadly campanulate, about 3 mm long, 4 mm in diameter, the throat hairy, the lobes reflexed, ovate, obtuse, about 2 mm long. Anthers nearly 1 mm long. Ovary subglobose, 1 mm in diameter; style stout, 2 mm long; stigma globose. Fruit ovoid-elliptic, about 8 mm long, red when mature. Seeds numerous, oblong-ellipsoid, brown, about 8 mm long.

LUZON, Benguet Subprovince, Mount Santo Tomas, *Williams 1127* (type), 1068, 923, June and September, 1904; San Fernando Trail, *Phil. Pl. 725 Merrill,* May, 1911.

A species allied to *Geniostoma cumingianum* Benth., differing in its relatively much narrower leaves which are pale, not at all blackish when dry, its more prominent nerves which anastomose to form distinct submarginal veins, and in its solitary, short-pedicelled flowers.

APOCYNACEAE.

ALYXIA Banks.

ALYXIA BLANCOI sp. nov.

Brabejum lucidum Blanco Fl. Filip. ed. 2 (1845) 40, non *Alyxia lucida* Wall.

Frutex scandens, glaber, ramis teretibus, ramulis 4-angulatis; foliis lanceolatis vel oblanceolatis, coriaceis, nitidis, 3.5 ad 5 cm longis, verticillatis, obtusis, breviter petiolatis; fructibus ovoideis vel subglobosis, 1 cm longis, crasse apiculatis.

A scandent glabrous shrub, aromatic in drying. Branches slender, terete, grayish or brownish, the branchlets distinctly 4-angled, the internodes on the branchlets 5 to 12 mm long. Leaves whorled, 3, rarely 4 at each node, lanceolate or obanceolate, coriaceous, shining, 3.5 to 5 cm long, 6 to 10 mm wide, the margins recurved, base acute, apex obtuse or subacute; lateral nerves very obscure; petioles 1.5 to 2.5 mm long. Flowers unknown. Fruit ovoid or subglobose, not moniliform, about 1 cm long, with a thick apiculate point, yellow when fresh.

CEBU, in thickets on dry hills back of the City of Cebu, *Bur. Sci. 11118 Ramos,* March, 1912.

F. Villar reduced Blanco's species to *Alyxis stellata* R. & S., which was undoubtedly an error. Vidal referred *Alyxia stellata* F.-Vill. to his *A. monilifera,* but correctly excluded the reference to Blanco. In my paper on the determination of Blanco's species [12] I followed F.-Villar in his reduction

[12] Govt. Lab. Publ. (Philip.) 27 (1905) 58.

of *Brabejum lucidum*, but erroneously carried the reduction still further to *Alyxia monilifera* Vid. Now that I have specimens from Cebu, from which island Blanco received his material, which agree perfectly with his short description, I have no hesitation in redescribing it under the above specific name, for Blanco's name, *lucida*, is invalid in *Alyxia*.

Alyxia blancoi is allied to *A. parvifolia* Merr., and to *A. luzoniensis* Merr., but its leaves are shaped very differently from those of either of the above species.

ANODENDRON A. DC.

ANODENDRON AXILLARE sp. nov.

Frutex scandens subglaber; foliis oblongis, nitidis, usque ad 15 cm longis, apice breviter acuminatis, basi acutis vel subrotundatis, nervis patulis, tenuibus, utrinque circiter 13; inflorescentiis axillaribus, cymosis, vix 2 cm longis, brevissime pedunculatis, alabastro 8 mm longo.

A scandent woody vine, the branches, when dry, reddish-brown, slender, minutely and densely brownish-lepidote or punctate. Leaves opposite, oblong, subcoriaceous or firmly chartaceous, 12 to 15 cm long, 5 to 6 cm wide, shining and of about the same color on both surfaces when dry, the upper surface entirely glabrous, the lower one with minute, scattered, brown, lepidote spots, base subacute or rounded, apex abruptly short-acuminate; nerves distant, spreading, not prominent, anastomosing near the margin, about 13 on each side of the midrib, the secondary ones nearly as distinct as the primary ones; petioles 8 to 10 mm long. Inflorescence axillary, cymose, short, many-flowered, the peduncle 2 to 3 mm long. Flowers greenish to yellowish-white, in nearly mature bud about 8 mm long, the pedicels 2 to 3 mm long, each subtended by two or three, ovate, 1 mm long bracteoles. Sepals 5, ovate, acute, imbricate, 2 mm long, eglandular. Corolla apparently salver-shaped, the tube cylindric, not inflated, about 5 mm long, 1.5 mm in diameter, the lobes twisted to the left, oblong-ovate, acute, somewhat falcate, about 6 mm long, 2.5 mm wide. Stamens inserted at the base of the tube, conniving in a cone around the stigma, united to it by projections from the connective; anthers oblong-ovate, sessile or subsessile, base sagittate by prolongation of the cells, apex acuminate or acute, about 1.5 mm long. Disk cup-shaped, about 0.5 mm high, crenate. Carpels 2, free, united by their backs to the disk, enclosed, that is, not exceeding the disk; ovules many. Stigma narrowly top-shaped, 1 mm long.

NEGROS, Faraon, *For. Bur. 13572 Meyer & Foxworthy*, August 25, 1909.

A species apparently allied to *Anodendron pauciflorum* Hook. f., of the Malay Peninsula, but judging from the description quite distinct.

ANODENDRON LOHERI sp. nov.

Frutex alte scandens glaber; foliis lanceolatis ad anguste elliptico-lanceolatis, utrinque acutis vel leviter acuminatis, usque ad 10 cm longis, nervis utrinque circiter 9, obscuris; paniculis terminalibus, parvis, pedunculatis, multifloris; corollae tubo intus villosus, 4 ad 5 mm longus.

A glabrous scandent shrub reaching a height of 10 m or more, the branches slender, reddish-brown when dry. Leaves lanceolate to narrowly elliptic-lanceolate, narrowed about equally at both ends and acute or slightly acuminate, 5 to 10 cm long, 1.5 to 3 cm wide, shining when dry, the lower surface paler than the upper; nerves about 9 on each side of the midrib, slender, indistinct, distant, faintly anastomosing, the reticulations obsolete or nearly so; petioles 1 to 1.5 cm long. Panicles terminal, including the peduncle 4 to 9 cm long, usually many-flowered, trichotomous, the peduncles 2 to 5 cm long. Flowers numerous, cream-colored or yellowish, fragrant, somewhat crowded on the ultimate branchlets of the inflorescence, the bracts ovate, 1.3 to 1.7 mm long. Sepals oblong-ovate, acute, imbricate, 2 to 2.5 mm long. Corolla-tube cylindric, 4 to 5 mm long, about 2 mm in diameter, villous inside, the lobes oblong-lanceolate, obtuse, falcate, about 6 mm long, 1.5 mm wide, villous on the inner surface, spreading, in bud twisted to the left. Anthers sessile on the bottom of the tube, lanceolate, acuminate, 2 mm long, surrounding the stigma and adherent to it. Stigma about 1 mm long, top-shaped. Disk cupular, about 0.5 mm long. Follicles unknown.

LUZON, Province of Zambales, Mount Pinatubo, *Loher 6494* (type), February, 1906: Province of Bataan, Lamao River, Mount Mariveles, *For. Bur. 2607 Meyer*, February, 1905, *For. Bur. 6256 Curran*, February, 1907, *Whitford s. n.*, 1905, month not indicated.

This new species is allied to *Anodendron paniculatum* A. DC., and to *A. candolleanum* Wight, and one of the specimens from Bataan Province was identified as the former species [13], all duplicates having been distributed as *A. paniculatum* A. DC. *Anodendron loheri* differs from *A. paniculatum* especially in its very much smaller leaves and fewer nerves; it is apparently much more closely allied to *A. candolleanum* Wight, differing not only in its smaller leaves but in the corolle-tube and lobes being prominently villous.

A specimen from Rizal Province, Montalban, *For. Bur. 2452 Ahern's collector*, distributed as *Anodendron paniculatum* A. DC., is probably referable to *A. loheri*, but the leaves are a little larger than in the type, and the nerves are decidedly prominent, in fact nearly as prominent as in typical *A. paniculatum*.

[13] This Journal 1 (1906) Suppl. 117.

ANODENDRON MANUBRIATUM (Wall.) comb. nov.

Echites manubriata Wall. Cat. (1829) No. 1663.
Echites paniculata Roxb. Fl. Ind. ed. 2, 2 (1832) 17, non Poir.
Anodendron paniculatum A. DC. Prodr. 8 (1844) 444; King & Gamble in Journ. As. Soc. Beng. 74[2] (1907) extra number 486; Rolfe in Journ. Bot. 23 (1885) 214; Vid. Rev. Pl. Vasc. Filip. (1886) 187.
Echites coriacea Wall. l. c. no. 1586, non Blume.

This species was first reported from the Philippines by Rolfe, *Cuming 1176*, from the Province of Ilocos Sur, Luzon. It is apparently also represented by the following specimens: LUZON, Province of Union, Mount Tonglon, *Loher 6482*, April, 1906. PALAWAN, Puerto Princesa, *Bur. Sci. 352 Bermejos*, January, 1906. The specimens agree closely with the descriptions, and with a specimen in our herbarium from a plant cultivated in the Royal Botanic Garden at Calcutta.

Echites paniculata Roxb., being invalidated by the earlier *E. paniculata* Poir., it is not clear how the specific name can be retained under *Anodendron*. *Echites manubriata* Wall. apparently supplies the earliest name that is tenable, although originally only a *nomen nudum*.

India to Ceylon, through the Malay Peninsula to the Malay Archipelago and the Philippines.

ICHNOCARPUS R. Br.

ICHNOCARPUS OVATIFOLIUS A. DC. Prodr. 8 (1844) 435; Vid. Rev. Pl. Vasc. Filip. (1886) 116; Hook. f. Fl. Brit. Ind. 3 (1882) 670; King & Gamble in Journ. As. Soc. Beng. 74[2] (1907) extra number 494.
Echites caudata Blanco Fl. Filip. (1837) 106, ed. 2 (1845) 77, non Burm.
Springia indica Muell.-Arg. & Van Huerck Plant. Nov. (1871) 143.
Ichnocarpus frutescens F.-Vill. Novis. App. (1880) 131; Vid. Sinopsis Atlas (1883) *t. 67, f. E.*: Naves in Blanco Fl. Filip. ed. 3, *pl. 97*, non R. Br.
Ichnocarpus navesii Rolfe in Journ. Linn. Soc. Bot. 21 (1884) 313.

BATANES ISLANDS, Dalupiri, *Bur. Sci. 10647 McGregor*. LUZON, Province of Ilocos Norte, *For. Bur. 13892 Merritt & Darling:* Benguet Subprovince, *Elmer 6610:* Province of Nueva Ecija, *For. Bur. 8499 Curran, For. Bur. 22131 Alvarez:* Province of Pangasinan, *Merrill 2871:* Province of Pampanga, *Merrill 4214:* Province of Bataan, *For. Bur. 1464 Ahern's collector, Leiberg 6013:* Manila, *Didrichsen, Galathea Expedition 3192, Loher 3884:* Province of Bulacan, *Bur. Sci. 6118 Robinson & Merritt:* Province of Rizal, *Guerrero 36, Bur. Sci. 13536 Ramos, For. Bur. 3125, Merrill 2629, Loher 3889, 6527:* Province of Cavite, *Bur. Sci. 1320 Mangubat:* Province of Laguna, *Hallier, Elmer*. MINDORO, *Cuming 1547, 1572, Bur. Sci. 10869 Celestino, For. Bur. 5385 Merritt*. PALAWAN, *Bur. Sci. 206 Bermejos, Bur. Sci. 690 Foxworthy*. MASBATE, *Merrill 3080*. CEBU, *Cuming 1770*. NEGROS *Bur. Sci. 9924 Robinson, Cuming 1809* (cotype). MINDANAO, Lake Lanao, *Mrs. Clemens 665:* District of Davao, *Piper 476*. BASILAN, *For. Bur. 6569 Hutchinson*.

India, Malay Peninsula, Sumatra, Borneo, Celebes, and Timor.

This species is common and widely distributed at low altitudes in the Philippines, but I can see no reason for considering that more than

one species is represented. There is some variation in the shape of the leaves, and in the pubescence, sometimes the leaves being quite glabrous, sometimes villous on the midrib beneath.

Echites affinis R. & S. Syst. 4 (1819) 393 (*E. caryophyllata* Roth Nov. Sp. Pl. (1821) 133, non Roxb.) would supply the oldest specific name for this species were Hooker f. correct in the reduction of *Echites affinis* to *Ichnocarpus ovatifolius* A. DC.[14] Finding, however, that the description given by Roemer & Schultes did not agree at all well with specimens of De Candolle's species, I asked Herr J. Martin, director of the Natural History Museum at Oldenburg, Germany, to examine Roth's specimen, the type both of *Echites affinis* R. & S., and of *E. caryophyllata* Roth. This he has kindly done and informs me that *Ichnocarpus ovatifolius* A. DC. is certainly not the same as *E. caryophyllata* Roth (*E. affinis* R. & S.) in Roth's herbarium. The sketch he has kindly supplied me shows *Echites affinis* to have broadly ovate or ovate-elliptic leaves with but two pairs of lateral nerves, the latter character entirely at variance with *Ichnocarpus ovatifolius* A. DC.

Ichnocarpus frutescens R. Br., has been reported from the Philippines by several authors, but I have seen no material from the Archipelago that I would refer to that species. *Ichnocarpus navesii* Rolfe is typified by *plate 97* of the third edition of Blanco's "Flora de Filipinas;" in fact the species was based solely on the plate. The figure is manifestly a very poor representation of *I. ovatifolius*, and hence *I. navesii* Rolfe is reduced.

Three species enumerated by F.-Villar[15] under this genus are not species of *Ichnocarpus*, but *I. velutinus* F.-Vill. is *Aganosma velutina* A. DC., *I. acuminatus* F.-Vill. is *Aganosma acuminata* G. Don, and *I. macrocarpus* F.-Vill. is a synonym of *A. acuminata* G. Don.

MICRECHITES Miq.

MICRECHITES SCHRIECKII (Huerck & Muell.-Arg.) Rolfe in Journ. Bot. 23 (1885) 214; Vid. Phan. Cuming. Philip. (1885) 126.

Ecdysanthera schrieckii Huerck & Muell.-Arg. Obs. Bot. 191.

Trachelospermum sp. Merrill in Forestry Bureau (Philip.) Bull. 1 (1903) 49.

Trachelospermum philippinense Elm. Leafl. Philip. Bot. 2 (1908) 488.

LUZON, Province of Tayabas, Lucban, *Elmer 9135* (cotype of *Trachelospermum philippinense* Elm.), in flower, May, 1907: Province of Camarines Sur, Pasacao, *Ahern 300*, January, 1902, in fruit: Province of Albay, *Cuming 910* (cotype of *Ecdysanthera schrieckii* Huerck & Muell.-Arg.). NEGROS, Gimagaan River, *For. Bur. 4250 Everett*, April, 1906, in fruit. MINDANAO, District of Zamboanga, Dumanquilas Bay, *For. Bur. 12360 Hutchinson*, previously determined as *Ichnocarpus ovatifolius* A. DC. Locally known in Camarines as *bayacto*.

The cotypes of *Trachelospermum philippinense* Elm., and *Micrechites schrieckii* Rolfe, both in flower, are identical in all respects, hence the necessity of reducing the former species.

Endemic.

[14] Fl. Brit. Ind. 3 (1882) 670. [15] Novis. App. (1880) 131.

PARSONSIA R. Br.

PARSONSIA OBLANCIFOLIA sp. nov.

Frutex scandens, glaber; foliis oblanceolatis ad anguste oblongo-obovatis, usque ad 12 cm longis, apice acuminatis, basi angustatis, acutis, nervis utrinque 8 ad 10; cymis terminalibus, pedunculatis, multifloris, floribus circiter 1 cm longis, filamentis inter se spiraliter dextrorsum contortis.

A scandent, glabrous, woody vine, the branches pale-brown or somewhat grayish, very minutely pustulate, the younger ones dark-brown. Leaves chartaceous, oblanceolate to narrowly oblong-obovate, 7 to 12 cm long, 2 to 3.5 cm wide, slightly shining when dry, the lower surface paler than the upper one, apex shortly but sharply acuminate, base narrowed, acute; nerves 8 to 10 on each side of the midrib, distant, anastomosing, the reticulations very lax, faint or often nearly obsolete; petioles 1 to 1.5 cm long. Cymes terminal, many-flowered, 5 to 6 cm long, sometimes slightly pubescent, usually trichotomous, the peduncle 1.5 cm long or less, the branches again trichotomous, the flowers crowded on the ultimate branchlets. Bracteoles oblong-ovate, acute, 1 to 1.5 mm long, the pedicels 5 to 8 mm long. Sepals oblong, acute or obtuse, about 3 mm long, slightly imbricate in bud. Corolla-tube about 3.5 mm long and 3 mm in diameter in the middle, more or less inflated, glabrous on both sides, the throat glabrous, not bearded, the lobes oblong-lanceolate, obtuse, 6 to 7 mm long, about 1.5 mm wide, base a little wider. Filaments about 5 mm long, somewhat villous, strongly twisted about the style; anthers lanceolate, 4 mm long.

LUZON, Province of Zambales, Candelaria, *Bur. Sci. 4723* Ramos, December 7, 1907.

A species manifestly allied to *Parsonsia confusa* Merr., and *P. cumingiana* A. DC., of the Philippines, and *P. spiralis* Wall., of India and Malaya, but quite different in vegetative characters. It is probably most closely allied to *P. cumingiana* A. DC., but is at once distinguished from that species by its oblong-lanceolate to oblong-ovate, more numerously veined leaves; from *P. confusa* it differs in its leaf characters and its glabrous or nearly glabrous inflorescence.

VALLARIS Burm.

VALLARIS ANGUSTIFOLIA sp. nov.

Arbor parva, 6 ad 10 m alta, glabra; foliis lanceolatis, coriaceis vel subcoriaceis, utrinque angustatis acuminatisque, usque ad 8 cm longis, 0.7 ad 1.5 cm latis; floribus axillaribus, fasciculatis, circiter 13 mm diametro, corollae tubo apice constricto.

A small glabrous tree 6 to 10 m high, the branches slender, terete, dark-reddish-brown, often nearly black when dry. Leaves lanceolate, coriaceous or subcoriaceous, narrowed and more or less acuminate at both ends, shining when dry, the lower surface paler than the upper one, 5 to 8 cm long, 0.7 to 1.5 cm wide; nerves 6 or 7 on each side of the midrib, slender, distant, spreading, anastomosing, not glandular in the axils, the reticulations obsolete or nearly so; petioles 5 to 10 mm long. Flowers white or yellowish, fragrant, axillary, fascicled, few to many in an axil, or sometimes in a very dense, fascicle-like, reduced and very shortly peduncled cyme, the pedicels slender, 5 to 8 mm long. Sepals slightly pubescent, triangular-ovate, acute, about 1.5 mm long, imbricate. Corolla-tube 5 mm long, inflated below, narrowed above and constricted at the apex, the lobes spreading, oblong-ovate, obtuse, falcate, 6 to 7 mm long, about 3.5 mm wide, somewhat villous on the inner surface. Stamens lanceolate, acuminate, slightly hairy on the back, the base of the connective with a rather large gland. Style slender, 5 mm long.

LUZON, Province of Sorsogon, Sorsogon, *For. Bur. 10507 Curran,* June, 1908, in thickets, altitude about 300 m; near Pilar, *For. Bur. 15077 Rosenbluth* (type), April 15, 1909, in flat lands not far back of the limits of high tide, locally known as *lanete.*

A species well characterized by its small lanceolate leaves, probably most closely allied to *Vallaris lancifolia* Hook. f., of the Malay Peninsula, but very different from that species. The first representative of the genus to be reported from the Philippines other than an undetermined form, *Vidal 3278,* from the Province of Albay, reported as *Vallaris* sp. by Ceron.[16]

VOACANGA Thouars.

VOACANGA MEGACARPA sp. nov.

Arbor glabra usque ad 10 m alta; foliis oblongis vel anguste oblongo-obovatis, breviter acuminatis, basi acutis, petiolatis, 15 ad 30 cm longis, nervis utrinque 10 ad 14; paniculis axillaribus, longe pedunculatis, dichotomis, paucifloris; calycibus 2 ad 3 cm longis, profunde 5-lobatis; corolla alba, tubo circiter 3 cm longo, contorto, lobis late oblique ovatis, usque ad 4 cm longis; fructibus globosis, usque ad 10 cm diametro.

A glabrous tree 5 to 10 m high, the branches pale-gray. Leaves oblong to narrowly oblong-obovate, 15 to 30 cm long, 6 to 12 cm wide, entire, apex shortly and rather abruptly acuminate, base narrowed, cuneate; nerves 10 to 14 on each side

[16] Cat. Pl. Herb. (Manila) (1892) 115.

of the midrib, distant, prominent, the reticulations very faint, lax; petioles 1 to 2.5 cm long, the base somewhat inflated and clasping the stems. Inflorescence paniculate, axillary, lenticellate, the peduncles about 15 cm long, dichotomously branched, the flowers somewhat crowded at the ends of the branches, the two elongated primary branches frequently equaling the peduncles in length, marked with numerous scars of fallen flowers or branchlets. Flowers large, white, fragrant. Calyx 2 to 3 cm long, split nearly to the base into 5, narrowly oblong, erect, obtuse lobes. Corolla-tube about 3 cm long, somewhat contracted above, distinctly twisted at and above the insertion of the anthers; lobes spreading, obtuse, obliquely and broadly ovate, up to 3.5 cm long and 4 cm wide. Anthers narrowly lanceolate, acuminate, base sagittate, about 7 mm long. Ovary of 2 distinct carpels united by the style, surrounded by the fleshy disk. Fruit in pairs, sessile, globose, when fresh smooth, up to 10 cm in diameter, when dry much smaller, wrinkled. Seeds very numerous, rugose, 8 to 10 mm long.

LUZON, Province of Tayabas, Tununi River, along streams, *Bur. Sci. 12324 Foxworthy,* February, 1911 (type); Binangonan, *Whitford 829,* September, 1904; Baler, *Bur. Sci. 10668 McGregor,* August, 1909: Province of Camarines, Tinambuc, *For. Bur. 14256 Aguilar,* April, 1909.

A very characteristic species, readily distinguished from the others in the genus by its large flowers and fruits, and especially by its calyx being split nearly to the base into 5, long, narrow lobes.

TABERNAEMONTANA L.

TABERNAEMONTANA CORDATA sp. nov.

Frutex circiter 2 m altus, fructibus immaturis exceptis glaber; foliis oblongis, usque ad 14 cm longis, acute acuminatis, sessilibus, basi late cordatis; cymis axillaribus, paucifloris; folliculis maturis glabris, junioribus griseo-puberulis, rubris, oblongis, falcatis, longitudinaliter 5-carinatis; seminibus circiter 15.

An erect shrub about 2 m high. Branches slender, terete, light-gray. Leaves oblong, sessile, base broad, cordate, apex sharply acuminate, 2 to 4 cm wide, 6 to 14 cm long, chartaceous, glabrous, one of each pair somewhat smaller than the other; nerves 9 or 10 on each side of the midrib. Cymes in the upper axils, short, few-flowered, the flowers often only 2 or 3, apparently white, the pedicels slender, about 1.5 cm long. Calyx-tube short, the lobes ovate, acute, about 1.5 mm long. Corolla-tube about 1.4 cm long, 1.5 mm in diameter in the middle, the lobes narrowly oblong, falcate, rounded, about 9 mm long, 2.5 to 3 mm wide. Calyx-teeth oblong-ovate, acute. Follices

red, oblong, when young gray-puberulent, soon becoming quite glabrous, 2 to 3.5 cm long, 1.2 to 1.5 cm wide, curved, slightly keeled down the back, rather distinctly winged or broadly keeled down the suture, with two intermediate keels along the sides. Seeds about 15, irregularly triangular-ovoid, not or but very slightly sulcate.

MINDANAO, Butuan Subprovince, Cabadbaran, *Weber*, April, 1911 (type), in clearings, altitude about 15 m, *Piper 287, 345*, April, 1911.

A species strongly characterized by its sessile leaves which are broad and cordate at the base.

VERBENACEAE.

CALLICARPA L.

CALLICARPA ELEGANS Hayek in Just's Bot. Jahresb. 33 (1905) 8.

This species was based on *Cuming 1460*, a specimen of which is in the herbarium of the Bureau of Science; according to Cuming's own list of localities, the above number was collected in the Province of Camarines Sur, Luzon. The species appears to be quite widely distributed in the northern Philippines, and is also represented by the following specimens:

LUZON, Province of Abra, Mount Paraga, *Bur. Sci. 7054 Ramos*, February, 1909: Province of Ilocos Norte, Mount Piao, *For. Bur. 13994 Merritt & Darling:* Province of Zambales, Subic, *Hallier*, January, 1904; Candelaria, *Bur. Sci. 4815 Ramos*, December, 1907; Cabiluagan, *For. Bur. 7018 Curran*, May, 1907: Province of Bataan, Lamao River, *Williams 340*, December, 1903. MINDORO, south-west of Lake Naujan, *For. Bur. 6725 Merritt*, April, 1907.

Endemic.

CALLICARPA CAULIFLORA sp. nov.

Arbor parva, ramulis quadrangularibus stellato-plumoso-pilosis glandulosisque; foliis amplis, chartaceis, oblongo-ellipticis, acuminatis, usque ad 35 cm longis, leviter irregulariter denticulatis vel subintegris, supra glabris, subtus glandulosis, ad costa nervosque plus minusve stellato-pilosis; inflorescentiis fasciculatis, caulifloris; floribus 4-meris, pedicellatis; corolla circiter 7 mm longa.

A small tree, the branchlets quadrangular, rather stout, rather densely covered with brownish plumose-stellate hairs and also yellow-glandular. Leaves chartaceous, oblong-elliptic, 30 to 35 cm long, 9 to 13 cm wide, the apex slenderly and sharply acuminate, the base gradually narrowed, margins distantly and irregularly denticulate or subentire, the upper surface glabrous, the lower one somewhat paler, yellow-glandular, sparingly stellate-pilose on the midrib, nerves, and reticulations, the hairs often plumose; primary nerves about 14 on each side of the midrib, prominent beneath, anastomosing, the reticulations prom-

inent, rather lax; petioles stout, densely stellate-pubescent, 1 to 2 cm long. Inflorescences on the trunk, of sessile, hemispherical, rather dense fascicles 2 to 3 cm in diameter, slightly hirsute, the pedicels 3 to 5 mm long, the bracteoles linear-lanceolate, 1 to 2 mm long. Calyx oblong-ovoid, about 3 mm long, 1.8 mm diameter, equally 4-toothed, the teeth narrowly ovate, acute, 0.5 mm long. Corolla dark-red, about 7 mm long, cylindric, 4-lobed, slightly glandular and pubescent externally. Anthers oblong, 3 mm long, glandular on the back. Fruit globose, the lower one-half enclosed in the calyx, about 4 mm in diameter, containing 4 pyrenes.

MINDANAO, District of Zamboanga, Port Banga, in canyons in forests, altitude about 20 m, *For. Bur. 9321 Whitford & Hutchinson*, January 13, 1908.

A species well characterized by its cauline, fascicled inflorescence, in this character differing from all the other species of the genus known to me. Allied to *C. ramiflora* Merr., but with a quite different indumentum.

CALLICARPA DOLICHOPHYLLA sp. nov.

Arbor parva, glabra, vel partibus junioribus pilis simplicibus, non stellatis, munita; foliis lanceolatis, chartaceis, 15 ad 30 cm longis, 2.5 ad 7 cm latis, subtus glandulosis, apice tenuiter acuminatis, basi acutis vel acuminatis; nervis utrinque 13 ad 16; cymis axillaribus, solitariis, laxis, usque ad 6 cm longis, pedunculis quam petioli longioribus.

A small tree, entirely glabrous, or the younger parts more or less pubescent with simple, not stellately arranged hairs, a few hairs sometimes persistent on the leaves, especially beneath. Branches terete or somewhat compressed, smooth, brown, glabrous or somewhat pubescent when young. Leaves lanceolate, chartaceous, 15 to 30 cm long, 2.5 to 7 cm wide, mostly entirely glabrous except the younger ones which are sometimes puberulent or pubescent, the base acute or acuminate, the apex rather slenderly acuminate, the margins crenate-denticulate or subentire, the lower surface distinctly yellow-glandular, the glands in minute pits; petioles 1 to 2.5 cm long; nerves 13 to 16, distinct, curved-ascending, anastomosing, the reticulations subparallel. Cymes axillary, solitary, lax, glabrous or somewhat pubescent with simple hairs, 6 cm long or less, often as wide as long, the peduncles longer than the petioles. Flowers apparently reddish. Calyx cup-shaped or somewhat funnel-shaped, 1 to 1.5 mm long, with 4 obscure, short teeth. Corolla somewhat exserted, 2.5 to 3 mm long, glabrous, the tube somewhat enlarged upward.

Stamens exserted; anthers 0.6 mm long. Fruit (immature), globose, small, containing 4 pyrenes.

LUZON, Province of Cagayan, *Cuming 1330* (type): Province of Nueva Vizcaya, Mount Umugum, *Bur. Sci. 8268 Ramos*, May, 1909: Province of Rizal, Bosoboso, *Bur. Sci. 1063 Ramos*, July, 1906.

Cuming's specimen has been referred by Schauer to *Callicarpa longifolia* Lam., var. *subglabra* Schauer, in conjunction with other specimens from India, Java, and Japan. The description does not apply particularly well to the Philippine plant, which to me does not appear to be very closely allied to Lamarck's species. It is well characterized by lax cymes and its entirely glabrous vegetative parts, or if pubescent at all, then with simple, not stellate hairs, in this last character differing from most, if not all, other species of the genus. Two specimens of Cuming's No. 1330 are in the Herbarium of the Bureau of Science, one with rather narrow, somewhat pubescent leaves, and with pubescent stems and inflorescence, quite manifestly a young stage of the plant, the other with larger, glabrous leaves and inflorescence; this latter I have made the type sheet.

CALLICARPA RIVULARIS sp. nov.

Species C. angustae Schauer simillima et valde affinis, differt foliis paulo majoribus, nervis lateralibus paucioribus, indumento plus minusve stellato-plumosis, antheris majoribus.

A shrub, apparently sometimes subscandent, 2 to 5 m high. Branches terete, or the ultimate ones somewhat compressed, very densely covered with a whitish or yellowish-white indumentum composed of short, stellate hairs, with some stellate-plumose ones intermixed, the inflorescences, petioles, and lower surface of the leaves with a similar indumentum. Leaves narrowly lanceolate or narrowly oblanceolate, chartaceous, 10 to 18 cm long, 1.5 to 3.5 cm wide, the upper surface dark-colored when dry, quite glabrous, or with few stellate hairs along the midrib, the lower surface with a dense, whitish or yellowish-white indumentum, about equally narrowed at both ends, the apex slenderly acuminate, the margins in the lower one-half entire, above slightly and irregularly denticulate; petioles about 1 cm long; nerves about 9 on each side of the midrib, curved-ascending, anastomosing, prominent beneath. Cymes axillary, solitary, the peduncles about as long as the petioles, dichotomously branched, the cymes rather lax, comparatively few-flowered, 3 cm in diameter or less. Calyx somewhat funnel-shaped, about 2 mm long, slightly 4-toothed, externally densely white- or grayish-puberulent. Corolla-tube scarcely exserted, the corolla white, about 3 mm long, 4-lobed, slightly pubescent externally. Anthers 1.3 mm long, glandular on the back. Fruit globose, glabrous, about 3 mm in diameter, containing 4 pyrenes.

PALAWAN, Mount Victoria, on rocky river banks at an altitude of about 1,150 m, *Bur. Sci. 660 Foxworthy* (type), March 23, 1906, also from the same locality, at an altitude of 60 m, on large boulders in the river bed, *Bur. Sci. 719 Foxworthy*, March 24, 1906.

A species manifestly very closely allied to *Callicarpa angusta* Schauer, differing especially in its indumentum.

CALLICARPA ANGUSTA Schauer in DC. Prodr. 11 (1847) 642.

LUZON, Province of Nueva Ecija, *Cuming 1425* (cotype): Province of Zambales, Subic, *Hallier s. n.:* Province of Rizal, Bosoboso, *Bur. Sci. 1030 Ramos, For. Bur. 1888 Ahern's collector.* MINDORO, *Tubili, For. Bur. 8878 Merritt*, January, 1908.

Endemic.

CLERODENDRON L.

CLERODENDRON ELLIPTIFOLIUM sp. nov.

Arbor parva, circiter 3 m alta, inflorescentiis exceptis glabra; foliis ellipticis vel ovato-ellipticis, chartaceis, usque ad 15 cm longis, basi rotundatis, apice breviter acuminatis, margine leviter subundulatis, nervis utrinque circiter 6, distinctis; inflorescentiis terminalibus, subsessilibus, densis, multifloris, circiter 10 cm diametro, bracteolis aciculatis; floribus circiter 2.5 cm longis.

A small tree or a shrub about 3 m high, glabrous except the inflorescence. Branches terete or obscurely angled, the younger ones olivaceous, lenticellate. Leaves elliptic to elliptic-ovate, chartaceous or submembranaceous, olivaceous when dry, the upper surface shining, the lower one of about the same color, dull, 12 to 15 cm long, 7 to 11 cm wide, the base rather broadly rounded, sometimes very obscurely cordate, the apex shortly and stoutly acuminate, the margins obscurely subundulate, the incipient teeth 1 to 1.5 cm apart; lateral nerves 5 or 6 on each side of the midrib, prominent, curved, anastomosing, the reticulations lax; petioles 3 to 3.5 cm long. Inflorescence terminal, dense, many-flowered, subsessile or at least branched from the base, cymose, sparingly pubescent with short, scattered hairs, the bracteoles acicular, pubescent, 1 to 2.3 mm long, the inflorescence about 10 cm in diameter. Flowers numerous, white or nearly so. Calyx narrowly funnel-shaped or somewhat cup-shaped, about 6 mm long, the apex truncate, obscurely 5-toothed, 3.5 mm in diameter, narrowed below to the acute base, externally sparingly pubescent with very short hairs. Corolla-tube slender, cylindric, glabrous, about 18 mm long, the limb spreading, about 12 mm in diameter, the lobes ovate or broadly oblong-ovate, rounded. Ovary glabrous.

CAMIGUIN DE MINDANAO, Panatayum, in thickets, *Bur. Sci. 14463 Ramos*, March 20, 1912.

A characteristic species not, apparently, very closely allied to the other Philippine forms, although manifestly in the same group with *Clerodendron quadriloculare* Merr., *C. mindorensis* Merr., and *C. klemmei* Elm. It is distinguishable by its elliptic, obscurely undulate leaves, and its dense, terminal, many-flowered, cymose panicles.

CLERODENDRON VILLOSUM Blume Bijdr. (1826) 811; Schauer in DC. Prodr. 11 (1847) 667; Clarke in Hook. f. Fl. Brit. Ind. 4 (1885) 589; F.-Vill. Novis. App. (1880) 161; Gamble in Journ. As. Soc. Beng. 74² (1909) Extra Number 836.

CULION, Halsey Harbor, *Merrill 761*, February, 1903.

Burma to the Malay Peninsula, Java, and Sumatra.

The specimen agrees closely with the description and with Singapore specimens in our herbarium.

CLERODENDRON MINDORENSE nom. nov.

Clerodendron simile Merr. in Govt. Lab. Publ. (Philip.) 35 (1906) 64, non Pearson (1901).

A new name is necessary for the Philippine plant, as the one previously selected by me was preoccupied.

GEUNSIA Blume.

GEUNSIA HOOKERI sp. nov.

Callicarpa pentandra Schauer in DC. Prodr. 11 (1847) pro parte, quoad *Cuming 1773*.

Species G. farinosae Bl., et G. cumingianae (Schauer) Rolfe similis et affinis, differt foliis subtus parce pubescentibus, vetustioribus subglabrescentibus.

A shrub or a small tree, the young branches, petioles, leaves, and inflorescence more or less stellate-pubescent with brown hairs, the older parts becoming glabrous or nearly so. Branches terete, or the younger ones somewhat compressed, ultimately glabrous. Leaves opposite and alternate, ovate to oblong-ovate, chartaceous, entire, the base abruptly acuminate, the apex long and slenderly subcaudate-acuminate, 9 to 17 cm long, 5 to 9 cm wide, brownish when dry, of about the same color on both surfaces, the upper surface slightly stellate-pubescent, the hairs more numerous on the midrib and lateral nerves, ultimately nearly glabrous, the lower surface slightly pubescent, and with numerous, small, yellow, glands; nerves about 8 on each side of the midrib, the reticulations subparallel, distinct; petioles 2 to 4 cm long. Cymes axillary, solitary, 10 cm long or less, rather densely brown-stellate-pubescent, the peduncles about as long as the petioles, mostly dichotomously branched, the cymes 10 cm wide or less. Pedicels 1 to 2 mm long. Calyx cup-shaped, 2 mm long, somewhat pubescent externally, with 5, short, broad, rather sharp teeth. Corolla 5 mm long, glandular exter-

nally, the tube somewhat enlarged upward, the lobes 5, oblong, blunt, about 2 mm long. Filaments exserted; anthers 2 mm long, more or less glandular.

CEBU, *Cuming 1773.*

Duplicates of the above number were referred by Schauer to *Callicarpa pentandra* Roxb.=*Geunsia farinosa* Blume, but Sir Joseph Hooker in his "Flora of British India" under *Geunsia farimosa* Blume, says "Cuming's No. 1773, reduced to *G. farinosa* by Schauer, is probably, as stated in Gen. Pl. 2, p. 1150, a good species."

It seems to me to be much more distinct from Blume's species than is *Geunsia cumingiana* (Schauer) Rolfe, which Hooker thinks is perhaps not distinct from *G. farinosa* Blume. In this genus, as in *Callicarpa*, the amount of pubescence on different forms seems to vary considerably, but *Geunsia hookeri*, above described, is distinguished from the previously described forms especially by its very scanty pubescence, which by no means covers the lower surface of the leaf, as in *G. farimosa*, and in *G. cumingiana*.

GEUNSIA CUMINGIANA (Schauer) Rolfe in Journ. Linn. Soc. Bot. 21 (1884) 315.

SAMAR, *Cuming 1707* (cotype). NEGROS, Cadiz, *For. Bur. 12444 Danao*, March, 1908. LEYTE, Palo, *Elmer 7368*, January, 1906. MINDANAO, District of Zamboanga, Tetuan, *Ahern 378:* Province of Misamis, Mount Malindang, *For. Bur. 4712 Mearns & Hutchinson*, May, 1906.

Endemic.

VITEX L.

VITEX NITIDA sp. nov.

Arbor circiter 5 m alta, partibus junioribus floribusque plus minusve pubescentibus; foliis tri- vel quinquefoliolatis, foliolis nitidis, elliptico-ovatis, obtusis vel obscure acuminatis, usque ad 10 cm longis, 2 basilaribus multo minoribus; cymis pedunculatis, axillaribus, folia subaequantibus; floribus ut videtur albidis, calycibus truncatis, subglabris, corolla extus dense pubescente.

A tree about 5 m high, the branches light-gray, smooth, somewhat 4-angled, the growing parts black when dry, more or less fulvous-pubescent, becoming glabrous or nearly so. Leaves 3- and 5-foliolate on the same branches, their petioles 5 to 7 cm long. Leaflets elliptic-ovate, dark-colored when dry, shining, glabrous or nearly so, entire, base acute or acuminate, apex obtuse or shortly and broadly acuminate, the central one 7 to 10 cm long, the two next below somewhat smaller, the basal pair, when present, much reduced, 2 to 3.5 cm long, all petiolulate. Cymes axillary, solitary, in the upper axils, forming a terminal leafy inflorescence, a little shorter than the leaves, their peduncles 2 to 6 cm long, very slightly pubescent or glabrous, dichotomous, eventually rather lax, comparatively few-flowered. Flowers white, according to the collector, in triads on the ulti-

mate branchlets, the middle one of each triad sessile or subsessile, the two lateral ones pedicelled; bracts triangular-ovate, acute, 1.5 mm long, deciduous. Calyx cup-shaped, about 2.5 mm long, very slightly appressed-pubescent, truncate or very obscurely 5-toothed. Corolla-tube about 6 mm long, villous within, outside densely brown-pubescent above, the upper lip 2-lobed, the lobes oblong-ovate, 3.5 to 4 mm long, the lower lip much larger, 3-lobed, the middle lobe orbicular, 5 mm in diameter, the two lateral ones oblong-ovate, obtuse, 3 mm long, both lips densely brown-pubescent on both surfaces. Filaments villous below. Style 10 mm long.

MINDANAO, Province of Misamis, Tangob, *For. Bur. 19546 Klemme*, May 7, 1911, growing near the mountains, locally known to the Visayans as *tugaspan* or *sasalit*.

A species well characterized by its 3- and 5-foliolate leaves, the lower two leaflets, when present, much reduced, its axillary, peduncled cymes, truncate calyx, and densely pubescent corolla. It is most closely allied to *Vitex pentaphylla* Merr., but is apparently sufficiently distinct from that species.

LABIATAE.

COLEUS Lour.

COLEUS AMBOINICUS Lour. Fl. Cochinch. (1790) 372.

Marrubium album Amboinicum Rumph. Herb. Amboin. 5 (1747) 294, *t. 102, f. 2.*

Coleus aromaticus Benth. in Wall. Pl. As. Rar. 2 (1831) 15, Lab. Gen. Sp. (1832–36) 51, DC. Prodr. 12 (1848) 72; Hook. f. Fl. Brit. Ind. 4 (1885) 635; F.-Vill. Novis. App. (1880) 163.

Coleus suganda Blanco Fl. Filip. (1837) 483, ed. 2 (1845) 337; Miq. Fl. Ind. Bat. 2 (1856) 948.

LUZON, Manila, *Merrill 7568*, sterile specimen.

This species is found in the Philippines only in cultivation, and is locally known by the Tagalog name *suganda*, and the Spanish name *orégano*. Its probable origin is the Malayan region, and it is certainly of prehistoric introduction in the Philippines. The species very rarely produces flowers in the Philippines, a fact already noted by Blanco. Although this species has been known to me many years I have never seen a flowering specimen and hence have hesitated in considering it. Material of the above number was sent to Kew for comparison, eliciting the statement that the leaf specimens supplied agree with Ceylon material of *Coleus amboinicus*, and with the figure given by Rumphius. Although no Philippine flowering material is available I consider the specimens certainly to represent Blanco's *Coleus suganda*, which species is identical with *Coleus aromaticus* Benth.= *Coleus amboinicus* Lour., a reduction already made by F.-Villar. *Coleus amboinicus* Lour. was based in part on botanical material from plants cultivated in Cochichina, and on several references to pre-Linnean literature including the description and plate given by Rumphius, which he erroneously cites as *l. 8 c. 75. tab. 72*, the reference apparently taken from

the index in the last volume of Rumphius' work. So far as sterile material is comparable with the figure, I consider Rumphius' delineation to be an excellent representation of the Philippine plant. *Coleus amboinicus* Lour. is the type of the genus.

MESONA Blume.

MESONA CLAUSA sp. nov.

Herba erecta, stricta, vix ramosa, circiter 30 cm alta, caulibus foliis inflorescentiisque plus minusve dense pallide fulvo-villosis; foliis petiolatis, oblongis, usque ad 6 cm longis, obtusis vel acutis; inflorescentiis interruptis circiter 15 cm longis, verticillis densis, subglobosis; calycibus sub fructu plus minusve inflatis, 8 mm longis, 2-labiatis, labiis integris, inferioribus orbicularibus os calycis claudentibus, superioribus oblongis.

An erect unbranched herb about 30 cm high. Stems rather stout, obscurely angled, rather densely covered with pale-fulvous, villous hairs. Leaves oblong or narrowly oblong, 5.5 to 6 cm long, 1 to 1.5 cm wide, apex acute or obtuse, base acute, the margins somewhat crenulate, both surfaces more or less villous, especially on the nerves and midrib; nerves ascending, about 8 on each side of the midrib; petioles 5 to 10 mm long, those of the basal leaves sometimes 2 cm in length. Inflorescence interrupted, about 15 cm long, the whorls dense, globose, 2 to 2.5 cm apart, the upper ones closer, about 1.5 cm in diameter, the rachis densely villous, the bracts subtending the whorls oblong-ovate, brown, reflexed, more or less villous, acuminate, 0.8 to 1.5 cm long, the lowermost ones subfoliaceous. Calyx just after anthesis 3 mm long, densely villous, in fruit accrescent, 8 mm long, slightly inflated in the middle, the mouth oblique, closed by the orbicular lower lip which is 2 mm in diameter and villous on the outside, entire, the upper lip oblong, 1.5 mm long, obtuse, not at all lobed or toothed, villous on the outside. Corolla unknown.

CULION, in damp, open grass lands, *Merrill 460*, December 13, 1902.

A species well characterized by its entire calyx-lips, the lower one orbicular, appressed to and quite closing the mouth of the calyx-tube. I have found on the specimen a single badly withered corolla showing the four stamens, the upper two filaments appedanged at the base, characteristic of the genus.

POGOSTEMON Desf.

POGOSTEMON CABLIN (Blanco) Benth. in DC. Prodr. 12 (1848) 156; Mip. Fl. Ind. Bat. 2 (1856) 964; F.-Vill. Novis. App. (1880) 164; Vid. Rev. Pl. Vasc. Filip. (1886) 213; Prain in Journ. As. Soc. Beng. 74[2] (1907) Extra Number 708, Kew Bull. (1908) 78.

Mentha cablin Blanco Fl. Filip. (1837) 472.

Pogostemon patchouly Pellet. in Mém. Soc. Sc. Orléans 5 (1845) 277, *t. 7.*
Mentha auricularia Blanco l. c. ed. 2 (1845) 329, non Linn.
Pogostemon suavis Ten. in Giorn. Bot. Ital. 2 (1847) 56.
Pogostemon patchouli Hook. Kew Journ. Bot. 1 (1849) 328, *t. 11.*
Pogostemon patchouli var. *suavis* Hook. f. Fl. Brit. Ind. 4 (1885) 634.
Pogostemon heyneanus Merr. in Philip. Journ. Sci. 2 (1907) Bot. 426, non Benth.

The above is the nomenclatural history of this interesting plant, which is represented by the following Philippine specimens: LUZON, Province of Cagayan, *For. Bur. 16470 Bacani,* January, 1909: Bontoc Subprovince, Bauco, *Vanoverbergh 1057,* December, 1910, in gardens, Ilocano "*cablin*": Province of Pampanga, Mount Arayat, *Merrill 5025,* on dry, steep, talus slopes, altitude about 400 m, February, 1906: Province of Laguna, *Vidal 505* in Herb. Kew.: Province of Rizal, Bosoboso, *Bur. Sci. 2060 Ramos,* February, 1907; Montalban, *For. Bur. 2442 Ahern's collector,* January, 1905; Antipolo, *Bur. Sci. 5199 Ramos,* June, 1908, in gardens, Tagalog "*cadling*": Manila, *Bur. Sci. 299 Merrill,* February, 1910, in gardens: without definite locality, *Loher 4211.*

Doctor Prain has recently shown[17] that the patchouli of commerce is the product of *Pogostemon cablin* (Blanco) Benth. (*P. patchouli* Pellet., non *P. patchowli* Dalz. & Gibs), and that the specific name given to the plant by Blanco has priority over the other proposed ones, and is hence the proper one for the species. I had previously confused it with *Pogostemon heyneanus* Benth., and recorded it from the Philippines under the latter name.[18]

Pogostemon cablin (Blanco) Benth., is of wide distribution in the Philippines, more commonly in cultivation only, but occasionally found growing wild (Mount Arayat, Bosoboso, and Montalban). There is no evidence that it is a native of the Philippines, but it has unquestionably been introduced, although probably in prehistoric times. Whatever its origin it has found favorable conditions for growth and reproduction in the Philippines, for here it flowers freely and has become spontaneous in some regions. In contrast to this, in India and in the Malay Peninsula, where it is extensively cultivated, it very rarely produces flowers. In the Philippines the plant is not now, and apparently never has been, cultivated on a commercial scale, but as a cultivated plant one finds only scatered individuals in native gardens. Dr. Leon Guerrero informs me that it is claimed that if a few leaves of this plant be enclosed in a book, the small beetles whose larvae are frequently so destructive to bindings in tropical countries will not attact bindings of volumes so protected.

POGOSTEMON HEYNEANUS Benth. in Wall. Pl. As. Rar. 2 (1831) 16; DC. Prodr. 12 (1848) 153; Wight Icon. *t. 1440;* Prain in Journ. As. Soc. Beng. 74[2] (1907) Extra Number 707.
Pogostemon patchowli Dalz. & Gibs. Bomb. Fl. Addend. (1861) 66, non *patchouly* Pellet.
Pogostemon patchouli Hook. f. Fl. Brit. Ind. 4 (1885) 633, non *P. patchouly* Pellet.

[17] Journ. As. Soc. Beng. 74[2] (1907) Extra Number 708, Kew Bull. (1908) 78.
[18] This Journal 2 (1907) Bot. 426.

MINDANAO, District of Zamboanga, near Zamboanga, *Merrill 5467*, October 1906, in coconut groves along small streams; Basagan, *Merrill 8238*, December, 1911, in waste places near houses. PALAWAN, near Puerto Princesa, *Bur. Sci. 287 Bermejos*, January, 1905, locally known as *cadlum*.

This species, like the preceding, is certainly not a native of the Philippines, but has been introduced from some other part of Malaya. It appears to be less common than *Pogostemon cablin*, or at any rate more restricted in its distribution. It is found in waste places in and near settlements, and is thoroughly naturalized; it is doubtless also cultivated, but I have seen no cultivated specimens.

POGOSTEMON NEPETOIDES Stapf in Kew Bull. (1908) 116.

This species was described from a specimen collected by Micholitz in the Philippines, no definite locality being given. Dr. C. B. Robinson, who has kindly examined the type in the Kew Herbarium informs me that it seems to be well matched by a specimen collected in Ilocos Norte, Luzon, by Merritt and Darling, *For. Bur. 12479*, although the specimens were not quite comparable, the type being more mature. So far as the specimen goes, *For. Bur. 12479 Merritt & Darling* agrees with Stapf's description, and doubtless represents his species. It has much the appearance of *Pogostemon cablin* Benth., but differs in being less pubescent, its leaves scarcely lobed, and its panicled spikes much more numerous and smaller than in Bentham's species.

Var. **GLANDULOSUS** var. nov.

A typo differt calycibus minoribus, 3.5 ad 4 mm longis, glandulosis.

LUZON, Province of Rizal, Bosoboso (San Isidro), *Bur. Sci. 1849, 2130, 13406* (type) *Ramos*, January, 1907, February, 1911, the specimens indicated as growing in forests.

This form may eventually prove to be a distinct species, but it appears to be closely allied to Stapf's *Pogostemon nepetoides*, which it closely resembles. It differs at least in that its calyces are shorter, 3.5 to 4 mm long, and distinctly glandular with waxy glands. The plant is aromatic, with about the odor of *Pogostemon cablin* Benth., but much weaker. No native names are recorded.

POGOSTEMON MEMBRANACEUS sp. nov.

Herba erecta, ramosa, erecta, 50 cm alta vel ultra, subglabra vel plus minusve puberula; foliis membranaceis, ovatis, nitidis, basi rotundatis, apice acuminatis, margine distincte crenato-serratis, usque ad 9 cm longis, subtus glandulosis, ad costa nervisque puberulis; inflorescentiis terminalibus, solitariis, cylindraceis, usque ad 15 cm longis, 1.5 ad 2 cm diametro, anguste paniculatis, spiciformibus; verticillastris subapproximatis, internodiis 5 ad 10 mm longis; floribus 5-meris, calycibus circiter 6.5 mm longis.

An erect branched herb 50 cm high or more, subglabrous, or more or less puberulent. Branches subterete or slightly

angled, brownish, slightly pubescent or puberulent. Leaves ovate, membranaceous, 5 to 9 cm long, 2.5 to 5 cm wide, shining, nearly glabrous, the base rounded or subacute, the apex acuminate, margins distinctly and usually doubly crenate-serrate, the lower surface distinctly glandular-punctate, somewhat puberulent on the midrib and nerves, the nerves distinct, the reticulations lax, not prominent; petioles 1 to 3 cm long, puberulent. Inflorescence a terminal, solitary, cylindric, spiciform panicle 6 to 15 cm long, 1.5 to 2 cm in diameter, somewhat pubescent with short hairs, the verticels subapproximate, 5 to 10 mm apart, each with from 12 to 25 flowers racemosely arranged on the short spreading branches, the bracts none or very early deciduous. Calyx shortly pedicelled, oblong, acute at both ends, 5-angled, sparingly pubescent, glandular-punctate, 6 to 7 cm long, the teeth 5, lanceolate, slenderly acuminate, 1.5 mm long. Corolla slender, glabrous, 10 mm long, the tube very slender below, 6 to 7 mm long, more or less funnel-shaped above; lower lip lanceolate, acuminate, entire, about 3 mm long, 1 mm wide, 3-nerved; upped lip much larger, 3 mm wide, 3-lobed, the middle lobe oblong, obtuse, about 1.8 mm long, 0.8 mm wide, 3-nerved, the two lateral ones broadly ovate, rounded, about 1.2 mm long and wide, usually 4-nerved. Filaments slender, exserted, bearded below the middle. Nutlets oblong-ovoid, black, shining, smooth, obscurely 3-angled, 0.8 mm long.

LUZON, Province of Laguna, Capuan, *Bur. Sci 16419 Ramos*, August 20, 1910, near streams, flowers pink.

Distinct from all other known Philippine forms, characterized by its thin, nearly glabrous leaves and its spiciform narrow panicles.

POGOSTEMON RETICULATUS sp. nov.

Herba erecta, aromatica, ramosa, 50 cm alta vel ultra, ciliata; foliis membranaceis, late ovatis, usque ad 12 cm longis, obtusis vel late breviter obtuse acuminatis, basi distincte cordatis, margine grosse irregulariter crenatis, subtus nervis reticulisque laxis prominentibus; inflorescentiis terminalibus, spiciformibus, verticillastris inferioribus remotis, superioribus approximatis; calycibus 6 mm longis, 5-dentatis, minute puberulis, parcissime ciliatis, bracteis filiformibus.

An erect, branched, apparently annual herb 50 cm or more in height, all parts distinctly ciliate with long, weak, scattered, spreading, white hairs, and also more or less puberulent. Branches obscurely angled, dark-colored when dry. Leaves opposite, long-petioled, broadly ovate, membranaceous, 5 to 12 cm long, 3.5 to 9 cm wide, obtuse or very shortly and obtusely

acuminate, the base broadly rounded, prominently cordate, the sinus 1 to 1.5 cm deep, the margins coarsely and irregularly crenate, both surfaces ciliate, the hairs on the upper surface scattered, those on the lower surfaces mostly on the midrib and nerves; nerves and reticulations lax, prominent, dark-colored in contrast to the grayish lower surface of the leaf; petioles 5 to 8 cm long. Inflorescence of terminal, solitary, long-peduncled, spiciform racemes, these, when young, and including the peduncles, 6 to 14 cm long, apparently much longer when mature, the verticels with from 6 to 8 flowers, the lower ones distant, the internodes up to 2 cm in length, the upper ones approximate, the bracteoles filiform, 2 mm long, puberulent, very sparingly ciliate. Flowers 5-merous, subsessile or shortly pedicelled. Calyx 6 mm long, 5-angled, minutely puberulent and very sparingly ciliate toward the upper end, narrowed at both ends, 5-toothed, the teeth oblong-lanceolate, acuminate, margins minutely ciliate. Mature corollas not seen, but from buds with the characteristic lobing and with the characteristic stamens of the genus.

LUZON, Province of Rizal, Montalban, *For. Bur. 3395 Ahern's collector* (type), November, 1905. Apparently also represented by *Loher 3395* from Angat, Province of Bulacan, Luzon, in the Kew Herbarium.

This species has the characteristic odor of *Pogostemon cablin* Benth., and bears the same native name as that species. It is, however, not at all closely allied, being entirely different in its vegetative characters, its indumentum, and in its inflorescence. It is well characterized by its thin, coarsely crenate, broadly ovate leaves which are prominently and laxly reticulate, and by all parts being sparingly ciliate and more or less minutely puberulent.

SCUTELLARIA L.

SCUTELLARIA COPELANDII sp. nov. § *Stachymachris.*

Herba usque ad 30 cm alta, plus minusve puberula vel leviter pubescens; foliis ovatis, obtusis, usque ad 4 cm longis, basi late rotundatis, truncatis, vel leviter cordatis, margine crenatis; racemis terminalibus, brevibus; floribus oppositis, circiter 13 mm longis.

A perennial herb, slightly branched, the stems slender, terete or obscurely angled, often prostrate below, puberulent or slightly pubescent, pale when dry. Leaves ovate, 1 to 4 cm long, 1 to 2.7 cm wide, membranaceous, of about the same color on both surfaces when dry, the apex obtuse, base broadly rounded, subtruncate, or somewhat cordate, both surfaces minutely puberulent or the lower one somewhat ciliate-pubescent on the nerves, the lower surface minutely glandular, the margins crenate; pe-

tioles puberulent, slender, 1 to 2 cm long. Racemes terminal, puberulent, comparatively few-flowered, 2 to 5 cm long. Flowers opposite, pale-blue; pedicels puberulent, 2 to 3 mm long; bracteoles oblong-spatulate, obtuse, about 2 mm long. Calyx slightly puberulent, the lips rounded, about 2.2 mm long, the appendage convex, nearly 2 mm in diameter, accrescent and in fruit 5 to 6 mm in diameter. Corolla 12 to 13 mm long, enlarged upward, slightly curved, slightly ciliate on the outside. Nutlets about 1.6 mm long, minutely verruculose.

MINDANAO, District of Cotabato, *Weber 1512* (type), August, 1911, on damp rocky banks of streams, altitude about 135 m: District of Zamboanga, Sax River, *Copeland 1597*, February, 1905, *Merrill 8210*, November, 1911, on cliffs and boulders along streams, altitude 100 to 150 m.

A species manifestly allied to *Scutellaria indica* Linn., differing especially in its stems, leaves, etc. being slightly puberulent, not villous, and its somewhat smaller flowers.

SOLANACEAE.

SOLANUM L.

SOLANUM EPIPHYTICUM sp. nov.

Frutex epiphyticus, glaber vel subglaber, simplex vel leviter ramosis, ramis griseis, nitidis, teretibus, in siccitate plus minusve sulcatis vel angulatis; foliis membranaceis, geminis, altero oblongo , acuminato, usque ad 17 cm longo, altero ovato, haud 5 cm longo; floribus 5-meris, axillaribus, 1 ad 5 fasciculatis, pedicellis 1 ad 2 cm longis; calycis truncatis; fructibus globosis, seminibus 2 vel 3, obovatis, minute rugosis.

An epiphytic glabrous or subglabrous, simple or slightly branched shrub usually less than 1 m in length. Stem pale-gray, somewhat shining, stout, when dry somewhat striate or angled, often a little zigzag, in life somewhat fleshy. Leaves membranaceous, shining, in pairs at each node, one very much larger and of different shape than the other: Larger leaves of each pair oblong, 10 to 17 cm long, often slightly falcate, acuminate, base strongly inequilateral, acute or acuminate; nerves 5 to 8 on each side of the midrib, curved-ascending, anastomosing, the reticulations indistinct; petioles 1 to 1.5 cm long. Smaller leaves of each pair ovate, 2 to 5 cm long, shortly and abruptly acuminate, acute, or obtuse, base usually rounded, subequilateral; petioles 2 to 5 mm long. Flowers axillary, solitary, or in fascicles of from 2 to 5, pedicelled, the pedicels 1 to 2 cm long, slender, slightly thickened upward. Calyx cup-shaped, truncate, not at all toothed, about 2 mm long. Corolla white, 6 to 7 mm long, the tube short,

the lobes oblong-lanceolate, acute or somewhat obtuse, about 4 mm long. Stamens 5, equal; anthers 2 mm long. Style 5 mm long. Berry globose, fleshy, at first white, becoming orange or red when mature, 5 to 6 mm in diameter, containing but 2, rarely 3 seeds, the seeds obovate, somewhat compressed, about 5 mm long, pale, minutely pitted-rugose.

LUZON, Province of Albay, *Cuming 873* (type): Province of Cagayan, *Bur. Sci. 7482 Ramos:* Province of Tayabas, Lucban, *Elmer 7494.* MINDORO, Alag River, *Merrill 6157;* South of Lake Naujan, *For. Bur. 6895 Merritt.* MINDANAO, Butuan Subprovince, *Merrill 7307, Weber 1207:* District of Davao, *Copeland 329:* Lake Lanao, *Mrs. Clemens 428, s. n.*

This species is well characterized by its epiphytic habit, its pale-gray, more or less thickened stems, its leaves in very unequal pairs, its solitary or fascicled, pedicelled, 5-merous flowers with truncate calyces, and its 2- or 3-seeded berries. It has been determined at times as *Solanum blumei* Nees, and at other times as *S. parasiticum* Blume. It is, from its habit, a very different plant from *Solanum blumei* Nees, and is at once distinguished from *S. parasiticum* Bl. by its geminate, not solitary leaves.

SOLANUM PHILIPPINENSE sp. nov.

Herba annua, erecta, glabra, dichotoma, inermis, ramis teretibus, in siccitate plus minusve sulcatis; foliis geminis, membranaceis, acuminatis, basi decurrento-acuminatis, ovatis vel oblongo-ovatis, altero subdimidio minore; pedunculis filiformibus, unifloris, axillaribus, solitariis geminis ternisve; calycis truncatis, integerrimis.

An annual, erect, glabrous, dichotomously branched herb 1 m high or less, the branches terete, more or less sulcate when dry. Leaves membranaceous, entire, in pairs at each node, the smaller of each pair half as large as the other or smaller, of the same shape, acuminate, base decurrent-acuminate, the larger ones 7 to 12 cm long, 3.5 to 6 cm wide, their petioles up to 2 cm in length, the smaller ones of each pair 2 to 5 cm long, short-petioled. Pedicels axillary, slender, solitary, in pairs, or in threes, 1.5 to 3 cm long, somewhat thickened upward, 1-flowered. Flowers pale-yellowish. Calyx cup-shaped, about 3 mm long, 3 mm in diameter, truncate, not at all toothed. Corolla 6 to 7 mm long, the lobes ovate, 2 to 3 mm long, acute or somewhat obtuse. Stamens equal; anthers broadly ovoid, about 1.2 mm long. Fruit globose, fleshy, red when mature, about 7 mm in diameter. Seeds numerous, pale, somewhat translucent, orbicular-elliptic, flattened, smooth, about 1.2 mm long.

LUZON, Benguet Subprovince, Mount Tonglon (Santo Tomas), *Elmer 6561,* June, 1904, *Williams 1275* (type) July 1, 1904, *Bur. Sci. 5406 Ramos,* December, 1908, *Merrill 8003,* May, 1911. MINDANAO, Sax River Mountains back of San Ramon, *Merrill 8164,* November, 1911.

This species is common along the trail through the mossy forest on Mount Tonglon, above an altitude of 1,700 m; in Mindanao it grows along small streams in very damp shaded ravines at an altitude of about 800 m.

It is allied to *Solanum blumei* Nees, and some of the specimens cited above have been determined as that species, and the duplicates so distributed. Among other characters it differs in its habit, being an erect, dichotomously branched herb, not a suffrutescent or woody plant, with longer petioles than in Nees' species. It is not certain that the plant described as *Solanum blumei* by Prain in Journ. As. Soc. Beng. 74 [2] (1905), Extra Number 330, is the same as *S. blumei* Nees, as Nees describes the calyx as entire and truncate, while Prain describes it as subtruncate, with 5 subulate and 5 intervening minute teeth.

BIGNONIACEAE.

RADERMACHERA Hassk.

RADERMACHERA WHITFORDII sp. nov.

Arbor parva, glabra, novellis resinosis; foliis pinnatis, usque ad 35 cm longis, foliolis 5 vel 7, subcoriaceis, oblongo-ellipticis, acuminatis, basi acutis, 11 ad 15 cm longis; paniculis quam folia longioribus, diffusis, floribus 2.5 cm longis.

A small tree, glabrous throughout, the young parts more or less resinous. Ultimate branches somewhat compressed, with few, large, scattered lenticels. Leaves simply pinnate, 25 to 35 cm long, the basal part of the petiole more or less lenticellate. Leaflets 5 to 7, oblong-elliptic, subcoriaceous, subequally narrowed at both ends, the base acute, apex acuminate, 11 to 15 cm long, 3.5 to 6 cm wide; lateral nerves spreading, about 12 on each side, the reticulations lax; petiolules of the lower leaflets 1.5 to 2 cm long, of the upper ones half as long or shorter. Panicles longer than the leaves, up to 40 cm in length, rather lax, open, the branches distant, spreading, the lower ones up to 15 cm long. Flowers rather few, 2.5 cm long, the corolla slightly pubescent externally in the upper part. Calyx not ribbed. Immature follicles 25 cm long, 4 mm wide, somewhat compressed.

MINDANAO, District of Cotabato, Lebak, *For. Bur. 11817 Whitford*, March 7, 1912, in dry river bottoms at low altitudes.

Well characterized by its simply pinnate leaves; among the Philippine species most closely allied to *Radermachera elliptica* Merr., but with very different leaves and inflorescence, and smaller flowers.

CUCURBITACEAE.

ALSOMITRA Roem.

ALSOMITRA SARCOPHYLLA (Wall.) Roem. Syn. 2 (1846) 118; Cogn. in DC. Monog. Phan. 3 (1881) 929.

Zanonia sarcophylla Wall. Cat. (1831) no. 3724, nomen, Pl. As. Rar. 2 (1831) 28, *t. 133*.

LUZON, Province of Bataan, Lamao River, *Copeland 255*, January, 1904.

Not previously reported from the Philippines: Siam, Burma, and Timor.

The specimen collected by Doctor Copeland has staminate flowers, and while it agrees with the description of *Alsomitra sarcophylla* Roem., very closely, still with the lack of pistillate flowers and fruits the identity of the Philippine form with the above species can not be considered to be certain.

ALSOMITRA INTEGRIFOLIOLA (Cogn.) Hayata in Journ. Col. Sci. Tokyo 30[1] (1911) 121.

Gynostemma integrifoliolum Cogn. in DC. Monog. Phan. 3 (1881) 916.
Alsomitra clavigera F.-Vill. Novis. App. (1880) 98 (probably), non Hook. f.
Gynostemma elongatum Merr. in Philip. Journ. Sci. 3 (1908) Bot. 267.

LUZON, Benguet Subprovince, Bued River, *Merrill 4312*, with staminate flowers; Sablan, *Bur. Sci. 12675 Fénix*, with staminate flowers, *Phil. Pl. 453 Fenix*, with mature fruits: Province of Rizal, Bosoboso and Montalban, *For. Bur. 1897, 3409 Ahern's collector*, with staminate flowers: Province of Bataan, *Elmer 6694, Merrill 1527, For. Bur. 2425 Meyer*, all with staminate flowers, *For. Bur. 5474 Curran* (type of *Gynostemma elongatum* Merr.), with pistillate flowers: Province of Laguna, Calauan, *Bur. Sci. 12460 McGregor*, with staminate flowers: Province of Tayabas, *Cuming 767* (cotype of *Gynostemma integrifoliolum* Cogn.), with staminate flowers.

I concur with Hayata in the transfer of *Gynostemma integrifoliolum* Cogn. to *Alsomitra*, for the mature fruits of *Gynostemma elongatum* Merr., which is certainly conspecific with *G. integrifoliolum* Cogn., are typical of *Alsomitra*, not of *Gynostemma*.

Cogniaux, as noted by Hayata, has described the fruits of *Gynostemma integrifoliolum* as brown, glabrous or slightly puberulent, 7 to 8 mm thick. On several of our specimens are what I had previously taken to represent immature fruits of Cogniaux's species. These organs are ovoid or subglobose, 1 cm long or less, and closely simulate very immature fruits. An examination of them, however, shows that they are globose or ovoid galls, crowned by the calyx, and usually also the stamens of the pistillate flowers; they usually contain numerous larvae. It is strongly suspected that Cogniaux saw similar galls on one of Cuming's specimens examined by him, and mistook them for immature fruits.

Alsomitra integrifoliola Hayata is closely allied to *A. clavigera* Hook. f., but has smaller fruits, in our specimens 4 to 5 cm long and about 1 cm in diameter, and the seeds are quite glabrous, not at all muricate.

A species known only from Luzon and Formosa.

GOODENOVIACEAE.

SCAEVOLA L.

SCAEVOLA FRUTESCENS (Mill.) Krause in Engl. Pflanzenreich 54 (1912) 125.

Lobelia frutescens Mill. Gard. Dict. ed. 8 (1768) No. 1, p. p.

Whether or not Doctor Krause is correct in his interpretation of *Lobelia frutescens* Mill., it is probably best to follow him and accept the above specific name for this common and widely distributed species. Miller's *Lobelia frutescens* was a mixture, based on two references, *Fl. zeyl. 313*, which is the same as *Scaevola koenigii* Vahl[19], and *Lobelia frutescens por-*

[19] Trimen Fl. Ceyl. 3 (1895) 54.

tulacae folio Plum. Nov. Gen. 21, which is manifestly *Scaevola plumieri* (L.) Vahl, where it is referred by Krause. The seeds mentioned by Miller as having been sent to England from the Bahamas by Mr. Catesby must have been of the latter species, *S. plumieri*, not of *S. koenigii* Vahl, for *S. koenigii* Vahl is not found in the western hemisphere. If the *first reference* be taken as the type, then Krause is correct in adopting Miller's specific name for the present species; if on the other hand the *first reference to a figure* be taken as the type, then *Lobelia frutescens* Mill., is a synonym of *Scaevola plumieri* Vahl.

W. F. Wight [20] in applying the principle of generic types has decided that the plants referred by botanists generally to *Scaevola* should be referred to *Lobelia*, as the type of the genus *Lobelia* is a *Scaevola*. While this may be the logical outcome of the application of the principle in this case, yet the nomenclatural confusion that this course of procedure entails is so great that it is not considered probable that Mr. Wight's proposition will receive the support of any considerable number of botanists.

Scaevola frutescens (Mill.) Krause is represented by the following Philippine material:

BABUYANES ISLANDS, Camaguin, *Bur. Sci. 4100 Fénix;* BATANES ISLANDS, Batan, *Bur. Sci. 3643 Fénix.* LUZON, Province of Zambales, *Merrill 2095:* Province of Pangasinan, *For. Bur. 8364 Curran & Merritt:* Province of Tayabas, *Whitford 897, For. Bur. 3208 Hagger:* Province of Camarines, *Ahern 229.* APO ISLAND, Mindoro Strait, *Merrill 416.* BUSUANGA, *Phil. Pl. 405 Merrill.* POLILLO, *Bur. Sci. 6950 Robinson.* PALAWAN, *Bur. Sci. 617 Foxworthy.* BALABAC, *Bur. Sci. 384 Mangubat.* MASBATE, *Merrill 3043.* BASILAN, *For. Bur. 3997 Hutchinson.* MINDANAO, District of Davao, *Elmer 12033.*

The above form is the most common one in the Philippines and has glabrous or only slightly pubescent leaves. The corolla externally and the fruits are quite glabrous.

A form with nearly or quite glabrous leaves, the corolla, externally, and the fruits more or less hirsute is less common and is represented by the following specimens:

LUZON, Province of Zambales, *Sandkuhl,* November, 1909: Province of Pangasinan, *Bur. Sci. 4897 Ramos.* PALAWAN, *For. Bur. 3774 Curran.* MINDANAO, District of Davao, *Piper 405, Copeland 674.*

This form appears to be intermediate between the glabrous plant, which I take to be typical *Scaevola frutescens* as interpreted by Krause, that is, the Ceylon form, and *Scaevola sericea* Forst., which Krause has sunk with numerous other synonyms under *Scaevola frutescens.* I consider that Forster's plant is at least worthy of varietal rank.

Var. **SERICEA** (Forst) comb. nov.

Scaevola sericea Forst. Prodr. (1786) 504.

LUZON, without definite locality, *Haenke* in Herb. Prague: Province of Ilocos Sur, *Merrill 339,* June, 1912. *Volkens 133,* from the Island of Yap, Carolines, is identical.

This variety is distinguished from the more common and nearly glabrous form by its leaves being uniformly and rather softly pubescent on both surfaces, the inflorescences, flowers externally, and the fruits also pubescent.

[20] Contr. U. S. Nat. Herb. 9 (1905) 310.

COMPOSITAE.

GYNURA Cass.

GYNURA PIPERI sp. nov.

Species G. sarmentosae DC. simillima et ut videtur valde affinis, differt foliis utrinque ramulis inflorescentiisque plus minusve dense crispato-pubescentibus.

A scandent herbaceous vine the ultimate branches 2 to 3 mm in diameter, reddish-brown, slightly striate, glabrous, the younger parts sparingly crisped-pubescent with short, weak hairs. Leaves chartaceous or subcoriaceous, oblong to oblong-lanceolate, entire or rarely distantly and irregularly toothed, oblong to oblong-lanceolate, acuminate, base obtuse or acute, 3 to 9 cm long, 1.5 to 2.5 cm wide, the upper ones much reduced, the uppermost scarcely 2 cm in length and bract-like, both surfaces rather densely and uniformly pubescent with short, rather pale or brownish, weak, crisped hairs; lateral nerves about 3 on each side of the midrib, obscure; petioles 3 to 6 mm long, densely pubescent. Inflorescence terminal, peduncled, lax, crisped-pubescent, the heads 7 to 10, slenderly peduncled, oblong, in anthesis about 14 mm long. Involucral bracts linear, about 10 mm long, acute, sparingly pubescent on the back.

SIQUIJOR, *C. V. Piper 384*, May 9, 1911.

A species manifestly closely allied to *Gynura sarmentosa* DC., but distinguished at once by its entire or subentire leaves and by its characteristic indumentum.

EUPATORIUM L.

EUPATORIUM JAPONICUM Thunb. Fl. Jap. (1784) 308; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 23 (1888) 403.

BATANES ISLANDS, Batan, Santo Domingo de Basco, *Bur. Sci. 3177 Mearns*, May 27, 1907.

The specimen here referred to *Eupatorium japonicum* Thunb. has leaves up to 12 cm in length and divided quite to the base into three segments, even the upper leaves subtending the branches of the inflorescence being deeply divided. It may be referabie to some other species, but from the material available here for comparison, and from the descriptions, I can see no reason for separating it from Thunberg's species.

Japan to Formosa and southern China. A distinct northern type in the Philippine flora.

EUPATORIUM CAMIGUINENSE sp. nov. § *Eximbricata.*

Herba scandens, caulibus teretibus, leviter pubescentibus; foliis ovatis vel late oblong-ovatis, submembranaceis, usque ad 13 cm longis, basi late rotundatis, apice longe tenuiter acuminatis, margine argute serrato-dentatis, utrinque leviter glandulosis, ad costa nervisque pubescentibus; inflorescentiis terminalibus,

corymboso-paniculatis; capitulis numerosis, 5-floris, squamis circiter 12, 6 interioribus 6 mm longis, acuminatis, glabris, exterioribus brevioribus, extus leviter pubescentibus.

A scandent herb, the stems brownish when dry, striate, terete, slightly brownish-pubescent with short hairs, the younger parts more densely so. Leaves opposite, ovate to broadly oblong-ovate, submembranaceous, 9 to 13 cm long, 4 to 6 cm wide, the base broadly rounded, the apex long and slenderly subcaudate-acuminate, the margins rather coarsely serrate-dentate except at the base and along the sides of the acumen which are entire, both surfaces somewhat shining when dry, the upper one olivaceous, the lower somewhat paler, both with scattered minute glands, and shortly pubescent on the midrib and nerves; lateral nerves about 5 on each side of the midrib, slender, distinct, anastomosing; petioles densely pubescent, 1.5 to 2 cm long. Inflorescence terminal, corymbosely paniculate, about 15 cm long, the branches few, distant, spreading, opposite, the lower ones up to 12 cm long, all parts densely brown-pubescent with short hairs. Heads rather crowded on the ultimate branchlets, greenish-white, their pedicels 1 to 3 mm long. Involucral bracts about 12, the outer 6 slightly pubescent externally, oblong-ovate to oblong, obtuse, the outermost ones 1.5 to 2 mm long, the others longer, the inner six oblong-linear, 6 mm long, 1 mm wide, glabrous, acuminate, 3-nerved. Flowers 5 in each head. Corolla white, 3.6 mm long, the teeth 5, oblong-ovate, acute, 0.5 mm long. Style-arms exserted, 3 mm long. Achenes 1.8 mm long. Pappus white, about as long as the corolla.

CAMIGUIN DE MINDANAO, Mount Mahinog, in forests, *Bur. Sci. 14688 Ramos*, April 11, 1912.

A species manifestly allied to the Luzon forms, *Eupatorium sambucifolium* Elm., *E. toppingianum* Elm., and *E. benguetense* C. B. Rob., and nearer the first than to either of the others. It is distinguished from all by its much larger leaves which are differently shaped and with a different venation.

BLUMEA DC.

BLUMEA BICOLOR sp. nov.

Herba erecta, simplex vel parce ramosa, omnibus partibus leviter adpresse pilosis; foliis alternis, usque ad 16 cm longis, chartaceis vel membranaceis, oblongo-ellipticis, apice acute acuminatis, margine irregulariter denticulatis, basi longe decurrente acuminatis, supra subglabra, subtus leviter adpresse pilosis, purpurascens; paniculis circiter 15 cm longis, pedunculatis; capitulis circiter 8 mm longis.

An erect, simple or sparingly branched herb 80 cm high or less, the lower part of the stem naked, leafless. Stems terete, brownish when dry, sparingly appressed-pilose. Leaves mostly in the middle of the stem, somewhat crowded, alternate, oblong-elliptic, 8 to 16 cm long, 3 to 6 cm wide, chrtaceous or membranaceous, the apex sharply acuminate, the base long-decurrent-acuminate, margins irregularly and sharply denticulate, not at all lobed; nerves 8 to 11 on each side of the midrib, curved-ascending; upper surface of the leaf green, sparingly pubescent, becoming glabrous or nearly so, the lower surface uniformly and rather dark-purple, sparingly appressed-pilose. Panicles pedunculed, about 15 cm long, rather lax, pilose, the branches few, the lower ones 7 cm long or less, the upper ones gradually shorter. Heads rather few, somewhat scattered, peduncled, about 8 mm long; peduncles slender, pubescent, 5 to 8 mm long, the bracteoles few, scattered, linear. Involucral-bracts appressed-pubescent, the outer few linear-lanceolate, acuminate, 1.5 to 2 mm long, the inner ones gradually longer, the innermost up to 7.5 mm long, about 0.5 mm wide. Disk glabrous, pitted. Outer female flowers numerous, yellow, their achenes slender, about 1 mm long, slightly ciliate-hirsute; pappus copious, white, minutely scabrid, about 5 mm long; corolla-tube very slender, cylindric, about 5 mm long. Perfect flowers few, usually 5 or 6 in each head, their achenes stouter than those of the female flowers, 0.8 to 1 mm long, sparingly ciliate. Corolla 5.5 to 6 mm long, slightly enlarged upward, equally 5-toothed. Anthers 2.5 mm long.

MINDANAO, District of Zamboanga, Sax River Mountains back of San Ramon, *Merrill 8080*, November 28, 1911, on boulders and banks in dense damp forests, altitude 900 to 1,000 m, very rare.

A species characterized by its simple stems, its leaves mostly in the median portion, not at all lobed but sharply and irregularly denticulate, sharply acuminate, base decurrent and their lower surfaces uniformly purple.

REVIEW.

Koorders, S. H. Exkursionsflora von Java umfassend die Blütenpflanzen mit besonderer Berücksichtigung der im hochgebirge wildwachsende Arten. 1 (1911), pp. XXIV + 413 (Monocotyledonen); 2 (1911), pp. 742 (Dicotyledenen Archichlamydeae); 3 (1912), pp. VIII + 498 (Dicotyledonen Metachlamydeae). Jena: Gustav Fischer.

Java is botanically better known than is any other island of the Malay Archipelago, and its rich and varied flora has long been studied and by many botanists. Up to the present time, on account of the very numerous articles dealing with the subject, it has been quite impossible for the working botanist to gain any comprehensive idea of the flora of the island as a whole, the total number of genera and species, habitats and ranges of the latter, and other data of interest. Doctor Koorders has undertaken to compile a complete list of Javan flowering plants, but his work is immensely more valuable than a mere enumeration of genera and species, on account of the included keys, references, and other data. With his extensive knowledge of the subject, based on long residence in Java, very comprenhensive botanical exploration, and critical study of all available material, Doctor Koorders has succeeded in completing an exceedingly valuable and apparently eminently usable work. He has included analytical keys to the families, genera, and species, the key to families alone occupying 48 pages of text. This extensive treatment is largely due to the necessity of frequently including the same family under two or more heads on account of exceptional characters in various genera or species. An excellent glossary of technical terms is included.

The arrangement of families and genera is that of Engler and Prantl's "Natürlichen Pflanzenfamilien," and it is the first work of great importance on the Malayan flora that has been published after this system. As practically all recent works on the floras of tropical Asia and Malaya have followed the sequence of Bentham & Hooker's "Genera Plantarum," an alphabetical list of families has been given with their equivalents in the latter

system. In nomenclature the Vienna Code is followed rather closely, but, as to accepted specific names, not invariably. No attempt seems to have been made critically to study the various cases of synonymy, and few new combinations are made. A strict interpretation of the Vienna Code would necessitate the acceptance of different specific names in an appreciable percentage of cases. Very few new forms are described.

The work is unequal in its treatment of various groups. In some cases the species are simply enumerated under their proper genera in the form of analytical keys, while in others more critical enumerations are included, with literature references, synonyms, native names, and other data. Where recent monographs were available these have been followed closely as to the Javan forms. In most families, however, no recent monographs are available, and the data given under these of necessity have been compiled by the author. However, he has had the assistance of many eminent European specialists in working up the material in various families. Special attention is given to the mountain flora throughout the work.

The "Exkursionsflora von Java" should prove to be of the very greatest value to residents of Java who are at all interested in the rich vegetation of that island, but it has a much wider application. It will, in fact, prove to be of great assistance to students of the entire Malayan-Polynesian flora, in the vast area extending from the Malay Peninsula to Polynesia and including the Philippines. As to the Philippines practically every family found in the Archipelago should be determinable by the use of the analytical key given by Doctor Koorders, as well as approximately 90 per cent of the genera found in the Islands. As to species, with an endemic element in the Philippines averaging about 40 per cent, comparatively few of our forms can be determined to the species, by this work, excepting in the case of the low country flora. In the settled areas the great majority of the species are of very wide distribution, and of these at least 50 per cent should be determinable by the keys given by Doctor Koorders. Approximately the same figures will apply to the Malay Peninsula and to most of the islands in the Malay Archipelago.

Including introduced and cultivated forms, a total of about 4,930 species are considered, distributed into about 1,560 genera, in 194 families, which gives botanists additional definite data for comparisons of temperate and tropical floras of restricted areas. In this connection it is of interest to note that in the

entire Philippine Archipelago, a region much larger than the Island of Java, we now know approximately 5,500 species, in about 1,350 genera, representing 183 families.

The work is illustrated by a total of 19 plates, 139 text figures, most of the former and some of the latter original, and 4 charts. It must be considered to be one of the most important publications dealing with the Malayan flora that has been issued in recent years and the most important single publication dealing with the flora of the Netherlands East Indies that has appeared since the publication of Miquel's "Florae Indiae Batavae" over fifty years ago.

E. D. MERRILL.

Vol. VII, No. 4, including pages 209 to 258, was issued September 30, 1912.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

A LIST OF THE MAMMALS OF THE PHILIPPINE ISLANDS, EXCLUSIVE OF THE CETACEA.

By NED HOLLISTER.

Order No. 418. Paper, $0.50 United States currency, postpaid.

This is the only recent attempt to enumerate the mammals of the Philippine Islands. The distribution of each species is given and the original descriptions are cited.

PRICE-LIST OF PHOTOGRAPHS.

For sale by the Bureau of Science.

Order No. 417. For free distribution.

This is a list of selected photographs from the splendidly complete collection of the Bureau of Science.

A MANUAL OF PHILIPPINE BIRDS.

By RICHARD C. MCGREGOR.

2 parts, 769 pages.

Order No. 103. Paper, $4 United States currency, postpaid.

Mr. McGregor spent some eight years in active field work, visiting many parts of the Archipelago, before beginning work on this book. Therefore, he was well prepared to undertake the preparation of the manual.

A Manual of Philippine Birds contains in compact form descriptions of all the known species of Philippine birds. The usual keys and diagnoses of orders, families, and genera help the novice in identification.

Under each species are found native, English, and scientific names, distribution by islands, descriptions of the birds and in many instances notes on nesting, migrations, and other habits.

A CHECK-LIST OF PHILIPPINE FISHES.

By DAVID STARR JORDAN and ROBERT EARLE RICHARDSON.

78 pages.

Order No. 102. Paper, $0.75 United States currency, postpaid.

This list will be found a convenient guide to the synonymy of Philippine ichthyology. The nomenclature is thoroughly revised and the distribution of each species within the Philippine Islands is given.

This check-list is uniform in size and style with McGregor and Worcester's Hand-list of Philippine Birds.

INDO-MALAYAN WOODS.

By FRED W. FOXWORTHY.

182 pages, 9 photographic plates.

Order No. 411. Paper, $0.50 United States currency, postpaid.

In Indo-Malayan Woods, Doctor Foxworthy has brought together a large amount of accurate information concerning trees yielding woods of economic value. The work is based largely upon the author's own experience in the Philippine and neighboring regions, but previous publications and information generously given by other dendrologists have been used to correlate commercial and native names of useful Indo-Malayan trees.

PHILIPPINE HATS.

By C. B. ROBINSON.

Order No. 415. Paper, $0.50 United States currency, postpaid.

This paper is a concise record of the history and present condition of hat making in the Philippine Islands. The various materials used and the different kinds of hats made in each center of production are fully described. Not of the least importance are the botanical identifications of the plants from which the hat materials are obtained.

The plates illustrate the hat materials and various kinds and grades of hats. A map of central Luzon shows the towns chiefly concerned in this industry.

THE COCONUT PALM IN THE PHILIPPINE ISLANDS.

149 pages, 30 plates.

Order No. 37. Paper, $1 United States currency, postpaid.

The reprint contains the following articles: On the Water Relations of the Coconut Palm (Cocos nucifera), by Edwin Bingham Copeland; The Cocoonut and its Relation to Cocoonut Oil, and The Keeping Qualities of Coconut Oil and the Causes of its Rancidity, by Herbert S. Walker; The Principal Insects Attacking the Cocoonut Palm (Parts I and II), by Charles S. Banks; with an introduction by Paul C. Freer.

A VOCABULARY OF THE IGOROT LANGUAGE AS SPOKEN BY THE BONTOK IGOROTS.

By WALTER CLAYTON CLAPP.

89 pages.

Order No. 408. Paper, $0.75 United States currency, postpaid.

The introduction to this vocabulary contains notes on pronunciation, vowels, diphthongs, consonants, verbs, conjugations, syllabication and reduplication. The vocabulary is given in Igorot-English and English-Igorot.

THE NABALOI DIALECT.

By OTTO SCHEERER.

65 pages, 29 plates.

AND

THE BATAKS OF PALAWAN.

By EDWARD Y. MILLER.

7 pages, 6 plates.

Order No. 403. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The Nabaloi Dialect and the Bataks of Palawan are bound under one cover.

THE BATÁN DIALECT AS A MEMBER OF THE PHILIPPINE GROUP OF LANGUAGES.

By OTTO SCHEERER.

AND

"F" AND "V" IN PHILIPPINE LANGUAGES.

By CARLOS EVERETT CONANT.

These two papers are issued under one cover, 141 pages.

Order No. 407. Paper, $0.80 United States currency, postpaid.

Orders for these publications may be sent to the Business Manager, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below. Please give order number.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

THE SUBANUNS OF SINDANGAN BAY.

By Fansaon B. Christie.

121 pages, 1 map, 29 plates.

Order No. 410. Paper, $1.25 United States currency, postpaid.

Sindangan Bay is situated on the northern coast of Zamboanga Peninsula. The Subanuns of this region were studied by Mr. Christie during two periods of five and six weeks, respectively.

The following is an abstract from the contents of Mr. Christie's report on the Subanuns: Habitat and history; relations with the Moros; material culture; houses; industries; forest; agriculture; family life; social customs; administration of justice; religion; the medicine man; ceremonies; tales; word-lists; physical measurements.

The 29 plates illustrate the Subanuns at work and at play; their industries, houses, altars, and implements; and the people themselves.

THE HISTORY OF SULU.

By Najeeb M. Saleeby.

275 pages, 4 maps, 2 diagrams.

Order No. 406. Paper, $0.75 United States currency, postpaid.

In the preparation of his manuscript for The History of Sulu Doctor Saleeby spent much time and effort in gaining access to documents in the possession of the Sultan of Sulu. It is fortunate that these records have now been translated and preserved in permanent form. This book is a history of the Moros in the Philippines from the earliest times to the American occupation.

STUDIES IN MORO HISTORY, LAW, AND RELIGION.

By Najeeb M. Saleeby.

107 pages, 16 plates, 5 diagrams.

Order No. 405. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

This volume deals with the earliest written records of the Moros in Mindanao. Doctor Saleeby was fortunately able to obtain exact copies of carefully preserved early records written in the Magindanao dialect with Arabic characters. The author presents translations of these as well as 16 half-tone illustrations of certain pages from the originals. The names of the rulers of Magindanao are recorded in five folding diagrams.

NEGRITOS OF ZAMBALES.

By William Allan Reed.

83 pages, 62 plates.

Order No. 402. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The introductory chapter deals with the general distribution of Negritos and with the distribution of the Philippine branch of the race. The succeeding chapters deal with the various implements, ornaments, and social relations of these little men.

Plates from photographs, the greater part of which was taken for this publication, show ornaments, houses, men making fire with bamboo, bows and arrows, dances, and various types of the people themselves.

CONTENTS.

	Page
MERRILL, E. D. New or Noteworthy Philippine Plants, IX	259
REVIEW	358

The "Philippine Journal of Science" is issued as follows:	U. S. currency.
Section A. Chemical and Geological Sciences and the Industries	$2.00
Section B. The Philippine Journal of Tropical Medicine	3.00
Section C. Botany	2.00
Section D. General Biology, Ethnology and Anthropology (Section D began with Volume V)	2.00
Entire Journal, Volume II, III, IV, or V	5.00
Entire Journal, beginning with Volume VI	7.00
Single numbers	.50
Volume I, 1906 (not divided into sections)	10.00
Supplement to Volume I (botany)	3.50
Volume I (without supplement)	6.50

Each section is separately paged and indexed.

Publications sent in exchange for the Philippine Journal of Science should be addressed: Library, Bureau of Science, Manila, P. I.

Subscriptions may be sent to the BUSINESS MANAGER, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below:

AGENTS.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Noordeinde 18, The Hague, Holland.
Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N.W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

Entered at the post-office at Manila, P. I., as second-class matter.

VOL. VII, SEC. C, NO. 6 DECEMBER, 1912

THE PHILIPPINE JOURNAL OF SCIENCE

ALVIN J. COX, M. A., PH.D.
GENERAL EDITOR

SECTION C. BOTANY

E. D. MERRILL, M. S.
EDITOR

WITH THE COÖPERATION OF

P. W. GRAFF, B. S.; W. H. BROWN, PH.D.
H. N. WHITFORD, PH.D.



MANILA
BUREAU OF PRINTING
1912

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

REPORT OF THE INTERNATIONAL PLAGUE CONFERENCE.

Held at Mukden, April, 1911, under the auspices of the Chinese Government.

Edited by ERICH MARTINI, G. F. PETRIE, ARTHUR STANLEY, AND RICHARD P. STRONG.

483 pages, 18 plates (2 colored, 4 half-tones, 12 charts and maps).

Order No. 415. Cloth, $3.50; paper, $2.50 United States currency, postpaid.

The proceedings of this International Conference and information gained therefrom, together with the results of certain bacteriological investigations, constitute the present report.

Nothing hitherto has been published which gives such a complete and comprehensive account of the entire subject of pneumonic plague.

Delegates from America (United States of), Austria-Hungary, France, Germany, Great Britain, Italy, Japan, Mexico, the Netherlands, Russia, and China attended the Conference.

The Bureau of Science of the Government of the Philippine Islands has been appointed sole agent for the distribution of the printed proceedings of the International Plague Conference.

THE SUGAR INDUSTRY IN THE ISLAND OF NEGROS.

By HERBERT S. WALKER.

145 pages, 10 plates, 1 map.

Order No. 412. Paper, $1.25 United States currency, postpaid.

Considered from the viewpoint of practical utility, Mr. Walker's Sugar Industry in the Island of Negros is one of the most important papers published by the Bureau of Science. This volume is a real contribution to the subject; it is not a mere compilation, for the author was in the field and understands the conditions of which he writes. The following is a brief synopsis of the contents:

Tables of soil analyses, both chemical and physical; analyses of the cane, juice and bagasse; estimates based on actual information as to the costs of production and of cultivation; and estimates of the cost and location of possible central factories. The island is considered by sugar-producing districts; the area of cultivation and the production per hectare are given, and the possibility for future expansion discussed.

The plates illustrate various phases of sugar industry from the cultivation of the field to the transportation of sugar in native sailboats.

A MANUAL OF PHILIPPINE SILK CULTURE.

By CHARLES S. BANKS.

53 pages, 20 plates.

Order No. 413. Paper, $0.75 United States currency, postpaid.

The silk industry is particularly adapted to be undertaken by persons with small capital, and like the making of hats in the Philippine Islands it should thrive with a little encouragement.

In A Manual of Philippine Silk Culture we have presented the results of several years' actual work with silk-producing larvæ together with a description of the new Philippine race. Half-tone plates illustrate in natural size silkworms in different stages of development, pupæ, adult moths, samples of cloth made from raw silk, hand reel, and silk house. Other plates illustrate the various appliances used in raising silkworms and in spinning silk; hand and power reels are illustrated; working drawings are given for a silk house and for a hand reel.

THE PHILIPPINE
JOURNAL OF SCIENCE
C. BOTANY

VOL. VII DECEMBER, 1912 No. 6

THE PINEDA MONUMENT AND THE PROBABLE SITE OF THE FIRST BOTANIC GARDEN IN THE PHILIPPINES.

By E. D. MERRILL.*

(From the Botanical Section of the Biological Laboratory, Bureau of Science, Manila, P. I.

The Pineda monument probably localized the first botanic garden to be established in the Philippines, and one of the first in the Orient, although an institution long since forgotten. The monument was erected in 1792 to the memory of Antonio Pineda who, up to his death, was in charge of the natural history investigations of the Malaspina Expedition. As the monument has now been destroyed it has been considered advisable to reproduce what is probably the only picture of it extant, to compile what is definitely known regarding Pineda, and at the same time to correct some misconceptions regarding the nature of his work.

The Malaspina Expedition, so called from its commander, Captain Alejandro Malaspina, was dispatched by the Spanish Government, and was one of the first great scientific and exploring expeditions sent out by the various European nations. Montero [1] states that the frigates *Descubierta* and *Atrevida*, which made up the squadron, were thoroughly equipped with instruments and with scientific literature, for astronomical, mathematical, and physical research, as well as for investigations in natural history. The ships left Cadiz, Spain, July 30,

* Associate Professor of Botany, University of the Philippines.

[1] Hist. Filip. 2 (1894) 321.

1789, and the expedition was undoubtedly the most thoroughly equipped one of its kind up to that date. In fact it is doubtful if any similar expedition had previously been dispatched by any nation, with the same objects in view. Very many voyages had previously been made for geographic and commercial purposes by the navigators of Spain, Portugal, England, Holland, and France, but the more purely scientific aspects of exploration had been ignored or largely subordinated to more practical matters. An account of the expedition has been given by Novo,[2] whose work I have not seen, but it is said by Safford [3] to be greatly condensed and is hence of comparatively little value.

In spite of the thorough equipment of the expedition, the time occupied, nearly five years, and the known industry and effectiveness of some of its staff, notably the botanists Thaddeus Haenke and Luis Née, the expedition proved to be peculiarly barren of published results.

Enormous collections of botanic material were made by Haenke and Née, much of which is still extant. Haenke's collection was sent to Prague, Haenke himself having died in South America in 1817. In 1825 Presl undertook the publication of his pretentious work entitled "Reliquiae Haenkeanae," which extended over the years 1825 to 1836, but which was never finished, only one volume and a portion of the second being printed. The most complete set of Haenke's botanic material is still preserved at Prague, in part in the "Museum Království Ceského," and in part in the University Herbarium in that city, while more or less duplicate material has been distributed to other institutions, the K. K. Naturhistorisches Hofmuseum, Vienna, the Kgl. Botanisches Museum, Munich, the Kgl. Botanisches Museum, Berlin, and the Bernhardi Herbarium, now the property of the Missouri Botanical Garden, St. Louis, Missouri. Scattered specimens are to be found in the DeCandolle Herbarium, and the Delessert Herbarium, both in Geneva, the Rijks Herbarium, Leiden, and doubtless in other European botanic institutions. Haenke's botanic material, to a greater or less degree, has been accessible to various European specialists, and his specimens are constantly cited in monographs.

Née, however, was less fortunate in the disposition of his material, which was deposited in the herbarium of the Jardin

[2] La vuelta al mundo por las corbetas *Descubierta* y *Atrevida* al mando del Capitán de Navío Don Alejandro Malaspina, desde 1789 a 1794. Publicado con una introducción en 1885 por el Teniente de Navío Don Pedro de Novo y Colson.

[3] Contr. U. S. Nat. Herb. 9 (1905) 28.

Botánico at Madrid, where, presumably, it is still preserved, for Vidal [4] who examined certain types in 1886, states that the material was then in an excellent state of preservation. Both Colmeiro [5] and Jordana [6] state that Née's collections *comprised 10,000 species, of which 4,000 were new.* Only a few hundred, however, were ever described, a very few by Née himself, the others by Cavanilles. No duplicates seem to have been distributed to other institutions and the material has not been available to other botanists. Née is almost never quoted as a collector, and DeCandolle,[7] in his extensive enumeration of botanic authors and collectors, does not even mention Née in spite of the latter's enormous collections. If Colmeiro is correct in his estimate of the number of species collected by Née, the record has perhaps been equalled or exceeded by but few botanists or collectors.

Antonio Pineda was the naturalist in charge of the natural history investigations of the Malaspina Expedition.[8] Most Spanish authors consider him as a botanist, but I can find no evidence to this effect. Sternberg [9] definitely states that he was a zoölogist, which statement is verified by the inscription on the Pineda monument, quoted below, which contains a direct reference to the *fauna,* but no mention of the *flora.*

Pineda was born in Guatemala in 1759, [10] and was an official in the Spanish military service. Zaragoza [11] states that he was a colonel, but this needs verification. He died at Badoc, Province of Ilocos Norte, Luzon, in June, 1792. His monument, now entirely destroyed, was erected in Manila by his friends and colleagues. The monument is figured in the plate accompanying this article.

Very little is definitely known regarding Pineda and his life, and I have been able to find but short, meager, and at least in some respects, mostly inaccurate accounts of his work. Sternberg's few notes [12] comprise the earliest published record of

[4] Rev. Pl. Vasc. Filip. (1886) 13.
[5] La botánica y los botánicos de la península Hispano-Lusitana (1858) 182.
[6] Revista de Filipinas 2 (1877) 174; Bosquejo geográfico e histórico natural del Archipiélago Filipino (1883) 356.
[7] La Phytographie (1880) 391–462.
[8] Jordana l. cc. (1885) 173, 356.
[9] Presl Rel. Haenk. 1 (1825) XII.
[10] Colmeiro *l. c.*
[11] La Ilustración Filipina 2 (1892) 271.
[12] Presl Rel. Haenk. 1 (1825) XII.

Pineda which I have seen. Colmeiro [13] gives a short and apparently mostly accurate account from which later authors have largely drawn. Jordana, in an article entitled "Don Antonio Pineda y la flora de Filipinas" [14] gives the longest account known to the writer. In this he amplifies Colmeiro's notes, and gives some additional data. He quotes the inscription on the Pineda monument, which is, however, printed wrongly, in 18 lines, instead of in 12, as it appears on the monument. He later gives an abbreviated account [15] of Pineda. Zaragoza's statements [16] are manifestly very incorrect. Montero [17] draws his data largely from Jordana's earlier account and quotes the inscription from him. Blanco speaks of him as a botanist,[18] but is in error as to the date of his death. Both Colmeiro and Zaragoza consider him as a botanist, while Montero is authority for the statement that he was commissioned by the Spanish Government to study the flora of the Philippines and the state of its agriculture.

Whether Pineda was a botanist or a zoölogist is perhaps of little importance. Aside from the references given above no allusions to him have been found in botanic literature, although the genus *Pineda* Ruiz and Pavon (=*Banara* Aubl.) seems to have been dedicated to him. Pineda apparently published nothing, either in botany or in zoölogy, and there is no record that he collected any material of either a botanic or zoölogic nature; at least no such material is preserved.

Zaragoza states that Pineda's chief work was the establishment of a mulberry plantation at a place since called Pineda, situated between Pasay and Malate, but this is certainly incorrect. Pineda arrived in Manila on March 27, 1792, and died about three months after his arrival. Sternberg states that he selected the region about Bulacan for his investigations, so that it is probable that he left Manila shortly after the arrival of the expedition. In the three months intervening between his arrival and death, especially considering the slow methods of transportation, and the fact that he died at Badoc, more than 200 miles from Manila, he could have had little time for the

[13] L. c.

[14] Revista de Filipinas 2 (1877) 173, 174.

[15] Bosquejo geográfico e histórico-natural del Archipiélago Filipino (1885) 356.

[16] La Ilustración Filipina 2 (1892) 271.

[17] Hist. Filip. 2 (1894) 321.

[18] Flora de Filipinas (1837) IV. "Igualmente y a principios de este siglo, había fallecido en estas Islas el sabio botánico D. Antonio Pineda."

work indicated by Zaragoza, nor could he have visited many islands of the Archipelago as stated by him. As to the place called Pineda, this was until recently the official name of the present town of Pasay, immediately south of Manila. In fact on one Spanish map, drawn as late as 1896, Pineda is given as the only name of the town now known as Pasay.

There is evidence that a botanic garden was in existence in the city of Manila at the time of the arrival of the Malaspina Expedition, but the only definite reference to it that I have been able to find is the following quotation from an article written by James Britten,[19] the data for which were taken from Deschamps' manuscripts in the library of the British Museum, and from other sources. "Noroña died at the Isle de France of an obstruction of the liver, contracted in Madagascar * * *. The Spaniards have erected a monument to the memory of their indefatigable countryman in the island of Luzon, near Manilla, on ground belonging to the royal botanic garden, which, during his residence there, Dr. Noroña had done everything in his power to bring into order, and to stock with many valuable plants."

Noronha died in 1787, according to Colmeiro,[20] and according to corroborative evidence given by Britten, who quotes from Dupetit-Thouars "Genera Nova Madagascariensia," which is direct evidence that a botanic garden was in existence near Manila before the arrival of the Malaspina Expedition. It has been impossible, however, to find any traces of the Noronha monument, nor have any other published references to it been noted.

Mr. A. E. W. Salt, of the University of the Philippines, who has made an exhaustive examination of the archives of the city of Manila, has found no references to a botanic garden earlier than the one established in the zone of fortification of the Walled City in 1858. This, however, applies only to such an institution as might have been established or supported by the city of Manila. No references, naturally, would be found in the city archives to an institution belonging to the central government.

If the Pineda monument localized this long forgotten botanic garden, as it probably did, the institution was certainly located outside of the limits of the city of Manila, as the city was constituted from 1780 to 1800.

[19] Bibliographical Notes XXX.—L. A. Deschamps and F. Noronha. *Journ. Bot.* 41 (1903) 282–285.

[20] L. c. 214.

There is little doubt but that the Pineda monument was erected in what was at that time, 1792, the Botanic Garden, and the Noronha monument, mentioned above, of which no traces have been found, was probably located on the same tract of ground. There could be no logical reason, otherwise, for erecting the monument to Pineda in such an isolated place, distant from the city, and near no street. Zaragoza's picture, reproduced below, gives an excellent idea of the isolation of the monument, and up to the beginning of the present century, when its destruction was completed, it had quite the appearance of being located in the midst of abandoned fields. The abandonment of the Botanic Garden, when and why not evident, was the probable reason that the Pineda monument was allowed by the authorities to fall into a ruinous condition. We have Arenas' evidence, cited below, that the monument had long been uncared for, as early as 1850. Whether or not the Pineda monument localizes this long forgotten Botanic Garden, the institution was the first of its kind to be established in the Philippines, if not in the entire Orient.

The tract of land on which the Pineda monument was erected is at the present time occupied by the Philippine Bureau of Agriculture as an experimental station. The ruins of the monument, consisting of the foundation only, remained *in situ* until the early part of the year 1904, when they too were removed in the construction of what is now known as Wright Street. The location of this monument was approximately in the middle of what is now Wright Street, immediately north of the new Malate school building.

Arenas,[21] writing in 1850, considered it strange that the Pineda monument still stood at that date after the many years during which no one had cared for it: "Extraño es también que se conserve en pié después de tantos años no habiendo ninguno que lo cuide." Its abandonment, then, long antedates 1850, and nothing seems to have been done after that date to keep it in repair, for Zaragoza, writing in 1892, speaks of the abandoned monument in the midst of a *sementera* (small plantation) having excited his curiosity as a youth, and closes his article as follows: "De sentir es que nuestro ilustre Ayuntamiento tenga en completo abandono aquel monumento, eregido por nuestros antepasados a la memoria de un sabio, que sacrificó su vida en aras de la ciencia y por el bien de estas Islas." Montero, writing

[21] Memorias históricas y estadísticas de Filipinas (1850) no. 10.

in the same year, states that the monument was then almost completely destroyed.

According to all verbal accounts that I have been able to secure, the monument still stood at the time of the American occupation in 1898, but was then in a very ruinous condition. On my first visit to it in the early part of the year 1904, nothing remained but the square foundation, all parts above the surface of the ground having been removed. The granite slab bearing the inscription was left near the foundation, but was later removed by the authorities of the City of Manila and has been placed in the center of a small triangular grass plot at the intersection of three streets in the parked portion of the Cementerio del Norte.

The stone of which the monument was constructed was soft volcanic tuff, locally known as Guadalupe stone, and is said to have been removed by the person or persons who rented the land between the years 1898 and 1902. The tract of land, on which the monument was erected, was purchased by the Philippine Government in the year 1903, for the site of an agricultural experiment station, for which, in part, it is still used.

The inscription on the granite slab, said by Colmeiro, Jordana, Montero, and others, to have been written by Haenke, is as follows:

ANTONIO PINEDA.
TRIBUNO. MILITUM.
VIRTUTE. IN. PATRIAM. BELLO. ARMISQUE. INSIGNI.
NATURAE. DEMUM. INDEFESSO. SCRUTATORI.
TRIENNII. ARDUO. ITINERE. ORBIS. EXTREMA. ADIIT.
TELLURIS. VISCERA. PELAGI. ABYSSOS. ANDIUMQUE. CACUMINA. LUSTRANS.
VITAE. SIMUL. ET LABORUM. GRAVIUM.
DIEM. SUPREMUM. ORIIT.[22] IN. LUCONIA. PHILIPPINARUM.
VI. CALENDAS. IULII. MDCCXCII.
PRAEMATURAM. OPTIMI. MORTEM.
LUGET. PATRIA. LUGET. FAUNA. LUGENT. AMICI.
QUI. HOCCE. POSUERE. MONUMENTUM.

The accompanying plate, representing the Pineda monument, is reproduced from the figure given by Zaragoza in a periodical formerly published in Manila, entitled "La Ilustración Filipina." [23] It is, in all probability, the only picture of the monument extant. According to Montero,[24] who quotes Jordana, the total height of the monument was three and one-half meters.

[22] Apparently a sculptor's error for OBIIT.
[23] 2 (1892) 271.
[24] Hist. Filip. 2 (1894) 322.

ILLUSTRATION.

PLATE XXII. The Pineda monument reproduced from a figure given by Zaragoza in "La Ilustración Filipina" 2 (1892) 271.



PLATE XXII. THE PINEDA MONUMENT.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 6, December, 1912.

ON THE IDENTITY OF EVODIA TRIPHYLLA.

By E. D. MERRILL.*

(From the Botanical Section of the Biological Laboratory, Bureau of Science, Manila, P. I.)

It not infrequently happens in taxonomy that, due to imperfect original descriptions, nonaccessibility of type or typical material to later botanists, or other reasons, the current conception of a particular species is quite different from that originally intended by its author. An excellent illustration of this is to be found in the case of *Evodia triphylla* DC., which, on examination of the type, proves not to be an *Evodia* at all, but a species of the allied genus *Melicope*. As the species has passed in botanic literature for about ninety years as a true *Evodia*, and has been credited with the extended range of Tenasserim and Burma to China, Japan, the Philippines, and Malaya, due to misinterpretation of *Fagara triphylla* Lam., it is only reasonable to suppose that the error will persist in some quarters for some time in the future.

In the year 1788, Lamarck [1] described as a new species *Fagara triphylla,* which DeCandolle later transferred to the genus *Evodia,* in which it has been retained by all botanists up to the present time, and to it many species described by other authors have been reduced as synonyms, mostly erroneously. *Evodia triphylla* DC. has been confused with *E. roxburghiana* Benth., by many authors, a species which it certainly very closely resembles in gross characters, but which is really generically distinct. Hooker f.[2] retains *Evodia roxburghiana* Benth. and *E. triphylla* DC. as distinct species, but notes that there is some doubt as to which name the former should bear because of the obscurity of *Evodia triphylla* DC. Guillaumin [3]

* Associate Professor of Botany, University of the Philippines.

[1] Encycl. 2 (1788) 447.

[2] Fl. Brit. Ind. 1 (1875) 488.

[3] Lecomte Fl. Gén. Indo-chine 1 (1911) 632.

reduces *E. roxburghiana* Benth. to *E. triphylla* DC., including most of the synonyms of the two as given by Hooker f.

Lamarck's description is based on a fruiting specimen collected in the Philippines by Sonnerat, which is preserved in the Herbarium of the Paris Museum of Natural History. Naturally his original description is incomplete, as the flowers were lacking. To the species he also referred *Ampacus angustifolius* Rumph. Herb. Amboin. 2: 188, *t. 62,* and Rumphius' plate has undoubtedly been the basis of interpretation of Lamarck's species for most if not all succeeding botanists. The figure very closely resembles our Philippine *"Evodia triphylla,"* and may represent the same species, but this can be definitely determined only by an exhaustive botanical exploration of Amboina, and a critical study of the material secured. Sonnerat's specimen must be the type of the species, because it is the plant described. The reference to Rumphius, which may or may not represent the same form as the Philippine plant, cannot logically be interpreted as the type.

In 1824 DeCandolle [4] transferred Lamarck's species to *Evodia* as *Evodia triphylla* DC., giving only a very short diagnosis. This name has been retained until the present time, although there is nothing in the original description definitely to indicate that the species really belongs in *Evodia.* Later authors referred to it Philippine material, *Cuming 1819,* which was accepted by all botanists considering the species, until very recently K. Schumann,[5] examining the specimen in the Berlin herbarium, noted that it had 8 stamens, and was therefore a *Melicope* and not an *Evodia.* The Cuming plant, with other Philippine material was designated by Engler as a new species, *Melicope luzonensis* Engl., and published under this name by Doctor Perkins l. c.

Shortly after the publication of *Melicope luzonensis* Engl., I examined our Philippine material, which had been referred to *Evodia triphylla* Lam., and found that, so far as flowering specimens were concerned, all of the collections had 8 stamens, and that all the material was hence *Melicope* and not *Evodia.*[6] Since that time I have examined many Philippine specimens in the hope of finding one having flowers with 4 stamens that would agree with Lamarck's description of *Fagara triphylla,* but without success. In November, 1911, Doctor C. B. Robin-

[4] Prodr. 1: 724.
[5] Perk. Frag. Fl. Philip. (1905) 162.
[6] Bur. Govt. Lab. Publ. (Philip.) 35 (1905) 24.

son had an opportunity of examining Lamarck's type, the Philippine plant collected by Sonnerat, in the Herbarium of the Paris Museum of Natural History. He has supplied me with a carbon rubbing showing form and venation of characteristic leaves of the type, and with the following note "All Philippine numbers here are determined as *Evodia triphylla* Lam.: there is no doubt about the correctness of the determinations, *Gaudichaud 255*, *Barthe s. n.*, *Cuming 1819*, *Loher 199*, and the type." The leaf-form and venation of the type, as shown by the carbon rubbing made by Doctor Robinson, is quite the same as in our abundant material of *Melicope luzonensis* Engl. There is, hence, no doubt but that *Fagara triphylla* Lam.=*Evodia triphylla* DC., is really a species of *Melicope*, that, so far as is known, is confined to the Philippine Islands. The synonymy of the Philippine plant, as well as of the Asiatic forms referred to DeCandolle's species by various authors, through error, needs adjustment.

Chamisso [7] considered the species under *Zanthoxylum* referring to it a Philippine plant collected by himself, but arbitrarily changed the name to *Zanthoxylum lamarkianum*. Blanco [8] a little later described the same form as *Fagara octandra* (non Linn.). Champion [9] referred *Cuming 1819* to his *Zanthoxylum pteleaefolium*, that species being based in part on Cuming's specimen. Bentham [10] later reduced this, together with *Fagara triphylla* Lam., to his *Evodia lamarckiana*, the latter name being a transfer of Chamisso's *Zanthoxylum lamarkianum*. Vidal and Fernandez-Villar referred the Philippine material to the correct genus, but to the wrong species, *Melicope ternata* Forst. Recently Engler [11] has redescribed the species as *Melicope luzonensis*, while the most recent description is that given by Mr. Elmer[12] as *Melicope odorata*. I can see no valid reason for distinguishing the latter species.

The full synonymy of the Philippine form is given below:

MELICOPE TRIPHYLLA (Lam.) comb. nov.

Fagara triphylla Lam. Encycl. 2 (1788) 447.

Evodia triphylla DC. Prodr. 1 (1824) 724; Hook. f. Fl. Brit. Ind. 1 (1875) 448 p.p., quoad Philip.; F.-Vill. Novis. App. (1880) 34; Vidal Phan. Cuming. Philip. (1885) 100, Rev. Pl. Vasc. Filip. (1886) 74.

[7] Linnaea 5 (1830) 58.
[8] Fl. Filip. (1837) 67, ed. 2 (1845) 48.
[9] Bentham in Hook. Kew Journ. Bot. 3 (1851) 330.
[10] Fl. Hongk. (1861) 59.
[11] Perk. Frag. Fl. Philip. (1905) 161.
[12] Leafl. Philip. Bot. 2 (1908) 476.

Zanthoxylum lamarkianum Cham. in Linnaea 5 (1830) 58.
Fagara octandra Blanco Fl. Filip. ((1837) 67, ed. 2 (1845) 48, ed. 3, 1: 90.
Zanthoxylum pteleaefolium Champ. ex Benth. in Hook. Kew Journ. Bot. 3 (1851) 330, p.p., quoad *Cuming 1819*.
Evodia lamarckiana Benth. Fl. Hongk. (1861) 59, p.p.
Melicope ternata Vid. Sinopsis Atlas (1883) *t. 24, f. A;* F.-Vill. Novis. App. (1880) 34, non Forst.
Melicope luzonensis Engl. in Engl. & Prantl Nat. Pflanzenfam. 3[4] (1897) 122, *nomen;* Perk. Frag. Fl. Philip. (1905) 161; Merr. in Govt. Lab. Publ. (Philip.) 35 (1906) 24, Philip. Journ. Sci. 3 (1908) Bot. 411, 5 (1910) Bot. 355.
Melicope odorata Elm. Leafl. Philip. Bot. 2 (1908) 476.

The genesis of this rather formidable list of synonyms is given above. In some cases they are due to arbitrary changing of specific names, in others manifestly to careless work, and in all cases more or less to the imperfect original description.

The species is common and widely distributed in the northern and central parts of the Philippines, being uniform in essential characters, but like most other species showing some variation in vegetative characters and in the denseness or laxness of its inflorescence. It is dioecious, but the male flowers constantly have 8 stamens and the female ones 8 staminodes, so that with flowering material the generic determination is evident if the flowers are examined. In gross characters, habit, leaves, leaflets, inflorescence, and fruits it strongly resembles Asiatic specimens that have variously been referred to *Evodia triphylla* DC., *E. roxburghiana* Benth., etc., and which are true Evodias, having four stamens. The resemblances are so great that it is not surprising that representatives of two distinct genera have been referred by several prominent botanists to a single species. So far as can be determined at present *Melicope triphylla* is confined to the Philippines, for all the Asiatic material that I have had an opportunity of examining, determined as *Evodia triphylla*, has four stamens, or four staminodes. I have examined the following Philippine material, preserved in the Herbarium of the Bureau of Science:

LUZON, without definite locality, *Jagor 732:* Cagayan Province, *Bolster 118:* Benguet Subprovince, *For. Bur. 15867 Bacani, Williams 1070, Elmer 6282, For. Bur. 18180, 18211 Curran, Merritt, & Zschokke:* Province of Nueva Vizcaya, *For. Bur. 14858 Darling:* Province of Bataan, *For. Bur. 3056 Borden:* Province of Cavite, *For. Bur. 7691 Curran:* Province of Rizal, *Bur. Sci. 4671, 13562 Ramos, For. Bur. 439 Ahern's collector, Merrill 2787, Phil. Pl. 67 Ramos, For. Bur. 10021 Curran:* Province of Laguna, *Bur. Sci. 12333 McGregor, Bur. Sci. 12025 Ramos, Holman 73:* Province of Sorsogon, *For. Bur. 10520 Curran.* MINDORO, *For. Bur. 6749, 9999 Merritt, Merrill*

2397. PALAWAN, *Merrill 736, Bur. Sci. 860 Foxworthy.* ROMBLON, *Hallier.* TICAO, *For. Bur. 1069 Clark.* MASBATE, *Merrill 2289.* NEGROS, *Elmer 9529, 9628, 10432.* CEBU, *For. Bur. 6422 Espinosa.* BOHOL, *Cuming 1819.*

We have seen above that *Fagara triphylla* Lam.=*Evodia triphylla* DC., is really not an *Evodia* at all, but must be classified under the genus *Melicope* as *M. triphylla* (Lam.) Merr. The numerous Philippine synonyms have been disposed of, but there remain to be considered the still more numerous names, for the most part based on material from the Asiatic continent, that have erroneously been referred to *Evodia triphylla* DC. From an examination of the specimens available here I am personally of the opinion that two distinct species are represented in the Asiatic material, or at least among the synonyms, that have been referred to *Evodia triphylla* DC. by Guillaumin,[13] in this being in agreement with the expressed opinion of Bentham [14] and Hooker f.[15]

Much of the material from China and apparently from Indo-China in superficial characters very strongly resembles the Philippine *Melicope triphylla;* in fact the resemblances are so great that it is difficult if not impossible to separate them unless the specimens are in anthesis. The earliest valid name for this form appears to me to be that supplied by *Xanthoxylum pteleaefolium* Champ., and the following new combination is accordingly made:

EVODIA PTELEAEFOLIA (Champ.) comb. nov.

Xanthoxylum pteleaefolium Champ. ex Benth. in Hook. Kew Journ. Bot. 3 (1851) 330, p.p., excl. *Cuming 1819.*

Evodia lamarckiana Benth. Fl. Hongk. (1861) 59, p.p., excl. syn. Lamarck and Chamisso.

Evodia gracilis Kurz in Journ. As. Soc. Beng. 2 (1871) 48.

I refer here the following specimens in the Herbarium of the Bureau of Science: YUNNAN, *Henry 10351A, 11658A;* TONKIN, *Bon 6187.* Two specimens from Formosa, *Nakahara 294,* with fruit, and a sterile specimen, *No. 1268,* may be referable here, or they may be the same as the Philippine *Melicope triphylla* Merr.

The Indian and Malayan material, for the most part determined as *Evodia roxburghiana* Benth., appears to me to represent a species distinct from *Evodia pteleaefolia.* Its leaves are apparently always pale when dry, are quite different in shape and venation, while the inflorescence is decidedly different. The Philippine form described by me as *Evodia semecarpifolia* [16]

[13] Lecomte Fl. Gén. Indo-chine 1 (1911) 632.
[14] Fl. Hongk. (1861) 59.
[15] Fl. Brit. Ind. 1 (1875) 488.
[16] Govt. Lab. Publ. (Philip.) 35 (1906) 23.

may ultimately prove to be the same species. The following is an attempt to straighten out the rather complicated synonymy.

EVODIA LUNUR-ANKENDA (Gaertn.) comb. nov.

Fagara lunur-ankenda Gaertn. Fruct. 1 (1788) 334, *t. 68, f. 9*
Lepta triphylla Lour.[17] Fl. Cochinch. (1790) 82.
Zanthoxylum zeylanicum DC. Prodr. 1 (1824) 728.
Fagara triphylla Roxb. Fl. Ind. 1 (1832) 416; Wight Ic. *t. 204*, non Lam.
Zanthoxylum roxburghianum Chamisso in Linnaea 5 (1830) 58.
Evodia roxburghiana Benth. Fl. Hongk. (1861) 59, in obs.; Hook. f. Fl. Brit. Ind. 1 (1875) 487; King in Journ. As. Soc. Beng. 62[2] (1893) 208.
Zanthoxylum marambong Miq. Fl. Ind. Bat. Suppl. (1861) 533.
Evodia marambong Miq. Ann. Mus. Bot. Lugd. Bat. 3 (1867) 244.
Evodia triphylla Guillaumin in Lecomte Fl. Gén. Indo-chine 1 (1911) 632 p.p.

This species appears to be widely distributed, and is represented in the Herbarium of the Bureau of Science by the following material: SOUTHERN INDIA, *Fischer 2751.* SINGAPORE, *Ridley,* four specimens. BORNEO, Sarawak, *Hewitt.* Its reported range is from the Khasia Mountains south to Ceylon, Tenasserim, the Malay Peninsula, Sumatra, and Java. As noted above, the Philippine *Evodia semecarpifolia* Merr., may eventually have to be reduced to this species; it is, at least, very closely allied.

[17] From the very short description this may be the same as the preceding form, *E. pteleaefolia.* Loureiro's specific name is, however, invalid in *Evodia.*

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 6, December, 1912.

NOTES ON PHILIPPINE EUPHORBIACEAE.

By E. D. MERRILL.*

(From the Botanical Section of the Biological Laboratory, Bureau of Science, Manila, P. I.)

This family is one of the largest in the Philippines, both in number of genera and in species; in the *Spermatophyta* it is probably exceeded in the Archipelago only by the *Rubiaceae* and the *Orchidaceae*. While much work has been done on the group in the past few years, a great deal still remains to be accomplished, and in order thoroughly to understand the relationships of the various forms, a great deal of field work is necessary. In the majority of species the plants are dioecious, and hence usually at least three collections are necessary before adequate material is secured for study, for it is always desirable to have not only male and female flowers, but also mature fruits. In the case of our Philippine forms, and this is also true of extra-Philippine ones as well, a high percentage of the species are inadequately known for the reason that material in all stages has never been collected.

In the present paper about twenty-six new species are proposed, in twelve genera. One genus, *Alcinaeanthus*, of the *Euphorbiaceae-Gelonieae* is proposed as new, manifestly allied to the Malayan genus *Cheilosa* Blume. Two genera, *Cladogynos* Zipp., and *Blumeodendron* Kurz, are recorded from the Archipelago for the first time, the first by the discovery of a rather widely distributed Malayan species in two localities in the Philippines, and the second by transfer of an endemic species from *Sapium* where it was originally described. A few new combinations are made, and some nomenclatural notes are included.

ALCINAEANTHUS gen. nov.

(Euphorbiaceae-Gelonieae.)

Flores dioici, apetali. Floris ♂ sepala 4, aequalia, valde imbricata. Disci glandulae 6, minutissimae. Stamina 6; filamenta libera; antherae late ovoidae, breves. Ovarii rudimentum

* Associate Professor of Botany, University of the Philippines.

villosum, oblongo-ovoideum, subtruncatum, interdum 2-fidum. Floris ♀ sepala 4, leviter inaequalia. Ovarium 2-loculare; styli 2, breves, basi breviter connati, apice 2-fidi, lobis brevissimis, crassiusculis; ovulis in loculis solitariis. Capsula ellipsoidea, vix sulcata, 1-sperma, in valvas 4 dehiscens vix in coccos 2-valves dissiliens. Semen ecarunculatum, magnum. Arbor parva, fere glabra. Folia alterna, petiolata, penninervia, plus minusve glanduloso-denticulata, basi supra 2-glandulosa. Paniculae ♂ axillares, laxae, multiflorae; inflorescentiae ♀ ut videtur racemosae.

ALCINAEANTHUS PHILIPPINENSIS sp. nov.

Arbor parva, 4 ad 10 m alta, inflorescentiis puberulis exceptis glabra; foliis chartaceis vel subcoriaceis, obovatis vel elliptico-obovatis, breviter acuminatis, 8 ad 20 cm longis, basi acutis, supra 2-glandulosis, margine distanter glanduloso-denticulatis, nervis utrinque 6 vel 7; paniculis ♂ diffusis, usque ad 10 cm longis; floribus minutis, 4-meris; staminibus 6; fructibus ellipsoideis, circiter 2.5 cm longis, extus dense pallide puberulis.

A small tree 4 to 10 m high, glabrous except the puberulent inflorescence, the branches slender, terete, grayish. Leaves chartaceous to subcoriaceous, obovate to elliptic-obovate, usually brownish and somewhat shining when dry, of the same color on both surfaces or somewhat olivaceous above and brownish beneath, 8 to 20 cm long, 3.5 to 12 cm wide, the base acute and with two small but distinct glands on the upper surface at the junction with the petiole, the apex shortly acuminate, the margins distantly glandular-denticulate, or sometimes subentire, sometimes the teeth rather prominent in the upper part of the leaf; lateral nerves 6 or 7 on each side of the midrib, prominent, anastomosing, the reticulations distinct; petioles 1.5 cm long. Male inflorescence paniculate, the panicles puberulent, axillary, usually solitary, diffusely branched, up to 10 cm long, many-flowered. Flowers small, 4-merous, the bracts ovate, acute or acuminate, about 1.3 mm long, the bracteoles similar but smaller, each subtending a single flower; pedicels 1 to 1.5 mm long, the buds globose, glabrous. Sepals 4, strongly imbricate, orbicular, 1.5 to 2 mm in diameter, subequal. Stamens 6; filaments about 1 mm long; anthers broadly ovoid, 0.5 mm long. Rudimentary ovary villous, about 1 mm long, oblong-ovoid, obtuse or truncate, sometimes 2-fid; disk-glands 6, alternating with the filaments, very minute. Female inflorescence apparently racemose, the flowers not seen, but the persistent sepals in very young fruits four, unequal, ovate, acute, up to 2 mm long; styles

2, shortly united below, 2-fid, the four resulting lobes thick, 1 mm long or less; ovary 2-celled, cells 1-ovuled, puberulent. Fruits when nearly mature ellipsoid, 1-celled, 1-seeded, 2.5 cm long, not at all sulcate and not formed of cocci, but of four valves which are subequal, oblong-elliptic, acute at both ends, crustaceous, very densely and softly puberulent externally with a pale indumentum. Seed (immature) 2 cm long.

MINDORO, in hill forests south of Lake Naujan, *For. Bur. 6851 Merritt*, April 6, 1907, with very young fruits, altitude 80 meters. LEYTE, near Ormoc, *For. Bur. 12759 Rosenbluth*, March, 1909, with male flowers, in forests, altitude about 20 meters. MINDANAO, District of Davao, *Williams 2884*, June 6, 1905, with nearly mature fruits: District of Cotabato, Lebak, *For. Bur. 11815* (type), *11767 Whitford*, March, 1912, both with male flowers, in river bottoms at low altitudes.

This proposed new genus is manifestly closely allied to the monotypic Javan *Cheilosa* Blume, and belongs in the *Euphorbiaceae-Gelonieae*. It is, in fact, so similar to Blume's genus that I at first considered it to be referable to *Cheilosa*. *Cheilosa javanica* Blume is represented in the Herbarium of the Bureau of Science by two specimens collected in Java by Blume himself, and presumably cotypes; both of these have female flowers. Our Philippine material resembles these specimens in vegetative characters, except that Blume's species lacks the basal leaf-glands so characteristic of *Alcinaeanthus*. In the arrangement of both the male and female flowers it is also similar to *Cheilosa*, except that the male flowers are solitary in each bracteole, while the entire or 2-fid rudimentary ovary is similar in both genera. The differences, however, are found in the leaves, in the male and female flowers, and in the fruits, and are, it is considered, of sufficient importance to warrant the separation of the Philippine form as a distinct genus. As noted above, in *Alcinaeanthus* the leaves are 2-glandular at the base, although in other characters very similar to those of *Cheilosa*. The flowers of both sexes are 4-merous, not 5-merous, while the male flowers are solitary in the axils of the bracteoles, and the sepals are very strongly imbricate. In the female flowers the ovary is 2-celled, not 3-celled as in *Cheilosa*, and the styles are two, very short, each with 2, equal, short, thick lobes. The fruits are not at all sulcate, and are not composed of cocci, but split into four equal valves; they are also 1-celled and 1-seeded, not composed of three 1-seeded cocci as in *Cheilosa*.

The genus is dedicated to Father Francisco Ignacio Alcina of the Jesuit Order, in whose honor Cavanilles has already proposed the genus *Alcina*[1] (=*Alcinia* HBK.), which is a synonym of the earlier *Melampodium* of Linnaeus.

Father Alcina was born in Gandia, Spain, in the year 1610, entered the Jesuit Order in 1624, and came to the Philippines in 1632. Here he was rector of various colleges, but his chief labors were of an evangelical nature in the Visayan Islands. He died July 30, 1674. He is the author of an interesting and still unpublished work on the natural history of the Philippines, a copy of the first part of which is preserved in the Library of the Ateneo de Manila, and which I have examined. The full title of the

[1] Icones 1 (1791) 10, *t. 15*.

work is "Historia natural del sitio, fertilidad y calidad de las islas é indios de Visayas, compuesto por el Padre Francisco Ignacio Alzina, de la compañia de Jesús, después de más de treinta y tres años en ellas, y entre ellos de Ministerio. Año de 1668." Added to the copy in the Ateneo de Manila, is the following note "1802—A uso de Fr. Agñ. Ob. el. de N. Sega.," which may be interpreted: "For the use of Fr. Augustín, Bishop-elect of New Segovia", indicating that the copy was made, presumably from the original, in the year 1802. Facing the title-page is a note pasted in which gives the following information regarding the origin of the copy: "Esta 1.ª parte de la obra del P. Alcina (la 2.ª no se encuentra) perteneció al Prelado D. Fr. Augustín Pedro Blaguier, que tomó posesión del Obispado de Nueva Segovia en 1779, y ha sido comprada en una almoneda en París este año de 1875 por 52 francos."

The above data supplement the very meager account of Alcina given by Colmeiro,[2] while Pritzel[3] simply mentions Alcina's name, giving a reference to Colmeiro. F.-Villar[4] quotes the title of Alcina's work correctly.

I am indebted to Father Solá, S. J., of the Ateneo de Manila, for assistance in securing data regarding Father Alcina and his work.

The species described by Mr. Elmer as *Elateriospermum paucinervium*,[5] of which Pax repeats the description[6] expressing some doubts as to whether or not it is referred to the proper genus, cannot possibly be an *Elateriospermum*. It is, I think, possibly referable to *Alcinaeanthus* or *Cheilosa;* at any rate it is undoubtedly referable to the *Euphorbiaceae-Gelonieae*, and apparently represents a generic type near those above-mentioned if not one of them. As fruits alone are known, it will be impossible properly to refer the species to a genus until either the female or the male flowers, or both, are known. It is represented by the following specimens, all with fruits:

LUZON, Province of Bataan, Lamao River, *For. Bur. 758 Borden*, May, 1904: Province of Tayabas, Lucban, *Elmer 7416* (type number), May, 1906. SIBUYAN, *Elmer 12367*, April, 1910.

ALCHORNEA Swartz.

ALCHORNEA PARVIFLORA (Benth.) Muell.-Arg. in Linnaea 34 (1865) 168, DC. Prodr. 15[2] (1866) 902.

Stipellaria parviflora Benth. in Hook. Journ. Bot. & Kew Miscel. 6 (1854) 4.

In a previous paper I reduced this species to *Alchornea sicca* (Blanco) Merr.[7], but I am now of the opinion that two distinct species are represented in the material then referred by me to Blanco's species. *Alchornea parviflora* Muell.-Arg. seems to be represented by *Bur. Sci. 5220 Ramos*, Rizal Province, Luzon, and by *Loher 6843*, from Union Province, Luzon, in addition to *Cuming 1800*, the type number. It is distinguished from *A. sicca* (Blanco) Merr. by its somewhat larger, distinctly pubescent leaves,

[2] La Botánica y los Botánicos de la Península Hispano-Lusitiana (1858) 158.
[3] Thesaurus Lit. Bot. (1872) 4.
[4] Blanco Fl. Filip. ed. 3, 4[2] (1880) IV.
[5] Leafl. Philip. Bot. 2 (1908) 484.
[6] Pflanzenreich 44 (1910) 102.
[7] This Journal 5 (1910) Bot. 192.

its elongate, slender, staminate inflorescence, which is 10 to 15 cm in length, and its somewhat rugose capsules.

Alchornea sicca (Blanco) Merr. is glabrous or nearly so, and its dense male spikes are usually less than 2 cm long, rarely 4 to 5 cm in length. In addition to the material previously referred here, it is represented by *Merrill 4100*, *Phil. Pl. 988 Merrill*, and *Didrichsen 3146*, *3170*, all from Manila.

ALCHORNEA RUGOSA (Lour.) Muell.-Arg. in Linnaea 34 (1865) 170, DC. Prodr. 15[2] (1866) 905; J. J. Sm. in Koord. & Val. Bijdr. Boomsoort. Java 12 (1910) 466.

Cladodes rugosa Lour. Fl. Cochinch. (1790) 704.

Conceveibum javanense Blume Bijdr. (1825) 614.

Adelia glandulosa Blanco Fl. Filip. (1837) 814.

Alchornea javensis Muell.-Arg. in DC. Prodr. 15[2] (1866) 905.

This widely distributed species is represented in our herbarium by about 30 specimens from the Philippines, for the most part determined and distributed as *Alchornea javensis* Muell.-Arg. It extends from northern Luzon to southern Mindanao. It is represented also by *Ridley 107*, from Christmas Island (south of Java), and by specimens from Java collected by Boerlage. India, through Malaya to the Admiralty Islands.

ANTIDESMA Burmann.

ANTIDESMA CRASSIFOLIUM (Elm.) comb. nov.

Sapium crassifolium Elm. Leafl. Philip. Bot. 2 (1908) 485.

NEGROS, Cuernos Mountains, *Elmer 10312*, June, 1908, type number.

This species is an *Antidesma* in all respects, and is apparently very closely allied to *Antidesma bunius* Spreng. It differs from that species in its more pubescent spikes, and thicker, fewer-nerved leaves. Mature leaves are very thickly coriaceous, but immature ones, distributed under the type number, are membranaceous or chartaceous. Pax and K. Hoffmann[1] state that the species does not belong in the *Euphorbiaceae*, as the specimen examined by them appeared to have perfect flowers. All the flowers on my specimens are staminate, and are the characteristic ones of *Antidesma;* in poor material the rather prominent pistillode might have been mistaken for a fertile ovary.

ANTIDESMA MINDANAENSE sp. nov.

Frutex 3 ad 4 m altus ramulis inflorescentiisque exceptis glaber; foliis oblongis vel anguste oblongo-ovatis, acuminatis, usque ad 20 cm longis, breviter petiolatis, nervis utrinque circiter 7, prominentibus, anastomosantibus; stipulis oblongo-lanceolatis, acuminatis, 8 ad 10 mm longis; racemis terminalibus, pubescentibus, 5 ad 15 cm longis, solitariis; floribus ♀ 4-meris, sepalis ovatis, acutis, circiter 4 mm longis; fructibus ovoideis, purpureis, in siccitate rugosis, 4 ad 5 mm longis.

A shrub or small tree 3 to 4 m in height. Branches slender, terete, grayish, glabrous, the younger ones somewhat pubescent.

[1] Pflanzenreich 52 (1912) 257.

Leaves alternate, oblong to narrowly oblong-ovate, chartaceous, 10 to 20 cm long, 4 to 9 cm wide, when dry shining and of about the same color on both surfaces, glabrous, the apex prominently and sharply acuminate, the base rather broadly rounded or subacute; nerves about 7 on each side of the midrib, somewhat ascending, prominent, anastomosing near the margin, the reticulations lax, distinct; petioles 3 to 5 mm long, slightly pubescent; stipules oblong-lanceolate, acuminate, 8 to 10 mm long, glabrous or nearly so, often slightly falcate. Male flowers unknown. Female racemes terminal, solitary, 5 to 15 cm long, pubescent. Flowers 4-merous. Fruit ovoid, slightly compressed, rugose when dry, purple, 4 to 5 mm long, glabrous, tipped by the remains of the style; pedicels pubescent, about 2 mm long. Persistent calyx pubescent, the lobes 4, ovate, acute, about 0.5 mm long.

MINDANAO, District of Zamboanga, Sax River, San Ramon, *Williams 2117* (type), February 5, 1905, *Hallier s. n.*, February, 1904; near Zamboanga, *Merrill 8274*, December 6, 1911.

Apparently distinct from all other Philippine forms, and possibly most closely allied to *Antidesma cumingianum* Muell.-Arg., but very different from that species. It appears to be well characterized by its shortly petioled leaves, its pubescent simple racemes, 4-merous flowers, and oblong-lanceolate stipules.

BLUMEODENDRON Kurz.

BLUMEODENDRON SUBROTUNDIFOLIUM (Elm.) comb. nov.

Sapium subrotundifolium Elm. Leafl. Philip. Bot. 3 (1910) 930.

SIBUYAN, *Elmer 12349*, April, 1910, type number.

Although the flowers of this species are unknown, and the fruits in the type collection very immature, I have no hesitation in transferring the species from *Sapium*, to which genus it cannot possibly be referred, to *Blumeodendron*. Kurz's genus has been sunk in *Mallotus* as a subgenus, but is so very different from the other plants usually grouped under *Mallotus* that I consider J. J. Smith[9] entirely justified, in his recent treatment of *Blumeodendron*, in again restoring it to generic rank. We have in the Philippines a second species of the genus, as yet undescribed, represented by abundant material, with vegetative characters very similar indeed to *Blumeodendron subrotundifolium*, but with entirely different fruits.

BRIDELIA Willdenow.

BRIDELIA PLATYPHYLLA sp. nov. § *Monospermae*.

Species B. moonii Thw., ut videtur similis et affinis, differt foliis distincte acuminatis, utrinque glabris.

A tree 8 to 20 m high, quite glabrous except for the slightly pubescent axillary fascicles. Branches terete, slender, lenti-

[9] Meded. Dept. Landbouw 10 (1910) 458 (Koorders & Valeton Bijdr. Boomsoort. Java 12).

cellate, usually light-brown or somewhat reddish, rarely dark-colored. Leaves firmly membranaceous to chartaceous, elliptic to oblong-elliptic, up to 20 cm in length and 10 cm wide, smaller leaves half as large, shining when dry, of about the same color on both surfaces, the base usually broadly rounded, apex prominently acuminate; nerves 13 to 16 on each side of the midrib, prominent, somewhat ascending, curved near the margins, scarcely or very slightly anastomosing, the reticulations subparallel, slender; petioles 5 to 10 mm long. Flowers 5-merous, small, in dense, axillary, many-flowered fascicles, male and female flowers in the same fascicle, sessile. Male buds globose, the anthers broadly elliptic, about 0.5 mm long. Petals about 1 mm long. Female flowers 2 mm long, the calyx-lobes oblong-ovate, acuminate, 1.5 mm long. Petals narrowly oblong, thin, 0.5 mm long. Disk slightly hairy, surrounding the ovary, the narrowly ovoid ovary and the style together 2 mm long. Bracts thin, more or less hirsute, about 2 mm long. Fruit reddish-purple when mature, ellipsoid, 8 to 10 mm long, shortly stipitate, apex rounded and minutely apiculate, indehiscent, 1-celled, 1-seeded, the seed hard, very deeply sulcate longitudinally.

LUZON, Province of Cagayan, Lalloc, *For. Bur. 18504 Alvarez*, in fruit, March, 1909; Abulug River, *Bur. Sci. 14557 Ramos*, in fruit, January, 1912: Province of Laguna, Siniloan, *For. Bur. 17634 Curran*, February, 1910, in fruit; Santa Maria, *For. Bur. 22229 Mariano*, sterile; Mount Maquiling, *For. Bur. 11725 Whitford*, sterile: Province of Bulacan, Angat, *For. Bur. 11167 Aguilar* (type), in flower, April, 1908: Province of Batangas, Santo Tomas, *For. Bur. 21528 Tamesis*, May, 1910, in flower: Province of Tayabas, Guinayangan, *For. Bur. 18676 Darling*, sterile. TABLAS, *For. Bur. 19530 José*, sterile. MINDANAO, District of Cotabato, *For. Bur. 15421 Pray*, March, 1911, in flower: Province of Misamis, Dapitan, *Piper 87*, April, 1911, in flower.

All of the above specimens have some or all of the leaves large with from 12 to 16 pairs of lateral nerves; some of them in addition have smaller leaves, about one-half the normal size, with from 8 to 10 pairs of nerves. The following series of specimens have only the smaller, few-nerved leaves, but in all essential characters appear to be the same as the species described above: LUZON, Province of Camarines, *For. Bur. 10431 Curran*, May, 1908, in fruit: Province of Tayabas, Guinayangan, *Merrill 2025*, in flower. MINDANAO, District of Zamboanga, *Ahern 372, 641*, in flower. BASILAN, *Hallier s. n.*, in flower.

Most of the material cited above has been identified as *Bridelia ovata* Decne., a species belonging in the section *Eubridelia*, which does not appear to occur in the Philippines. At least one specimen of the small-leaved form, *Merrill 2025*, has been named by Gehrmann in the Herbarium of the New York Botanical Garden as *Bridelia subnuda* K. Schum. & Lauterb., a species described from New Guinea material, which is also placed by Gehrmann in the section *Eubridelia*.[10] Fruiting specimens of

what I take to be exactly the same form as *Merrill 2025* have 1-celled, 1-seeded fruits, with deeply longitudinally sulcate seeds.

Native names: *Tamarina, Maragata* (Negrito, Cagayan); *Subiang* (Tag., Laguna); *Pahobo* (Tag., Bulacan); *Cubi tahiran* (Tag., Tayabas); *Bagotadhau* (Vis., Tablas); *Magantumit* (Cotabato); *Taran* (Zamboanga).

CLADOGYNOS Zippel.

CLADOGYNOS ORIENTALIS Zipp. ex Span. in Linnaea 15 (1841) 349; Muell.-Arg. in DC. Prodr. 15² (1866) 384; J. J. Sm. in Koord. & Val. Bijdr. Boomsoort. Java 12 (1910) 384.

Conceveiba tomentosa Span. l. c.

Rottlera albicans Hassk. Hort. Bogor. (1858) 238.

Adenogynum discolor Reichb. f. & Zoll. in Verh. Nat. Ver. Ned. Ind. 1 (1856) 23, Linnaea 28 (1856) 325.

Chloradenia discolor Baill. Étud. Euph. (1858) 472, *t. 19, f. 24, 25.*

Cephalocroton albicans var. *genuinus* Muell.-Arg. in Linnaea 34 (1865–66) 155.

Cephalocroton discolor Muell.-Arg. in DC. Prodr. 15² (1866) 761.

Cephalocroton orientalis Scheff. in Ann. Mus. Bot. Lugd. Bat. 4 (1868) 120.

SIQUIJOR, *Merrill 7208*, September, 1910, in thickets along roads near the seashore. CEBU, *Bur. Sci. 11055 Ramos*, April, 1912.

I have followed J. J. Smith in the synonymy as given above, and in the reduction of the genus *Chloradenia* to *Cladogynos*. The genus has not previously been reported from the Philippines, and I am now able to extend its range still farther, as *C. orientalis* is undoubtedly represented by *Robinson 1321* from Nha-trang, Annam, Indo-China, March 16, 1911. Previously known from Java, Timor, Celebes, and Kisser.

CLEISTANTHUS Hooker f.

CLEISTANTHUS ANGUSTIFOLIUS sp. nov.

Frutex 2 ad 3 m altus, glaber; foliis lanceolatis vel anguste lanceolatis, subcoriaceis, sensim tenuiter acuminatis, usque ad 12 cm longis, basi obtusis vel rotundatis, brevissime petiolatis, nervis utrinque circiter 10, obscuris; floribus ut videtur fasciculatis, 4-meris, sessilibus, calycis lobis lanceolatis, 2.5 mm longis, villosis; fructibus ovoideis vel subglobosis, leviter 3-sulcatis, crustaceis, circiter 1 cm longis, extus parce pilosis.

A shrub 2 to 3 m high, glabrous, monoecious. Branches terete, slender, reddish or somewhat grayish. Leaves lanceolate to narrowly lanceolate, 3 to 12 cm long, 8 to 10 mm wide, subcoriaceous, shining, rather pale and of about the same color on both surfaces when dry, the base abruptly rounded or obtuse, gradually narrowed from the lower one-fourth to the long and slenderly acuminate apex, often slightly falcate; nerves about 10 on each side of the midrib, very obscure, anastomosing, the reticulations close but not elevated; petioles 2 mm long or less.

[10] Engl. Bot. Jahrb. 41 (1908) Beibl. 95: 30.

Flowers apparently fascicled, possibly solitary, axillary, sessile or subsessile, 4-merous. Female flowers: Calyx about 3 mm long, the lobes somewhat appressed-hirsute, lanceolate or oblong-lanceolate, 2 to 2.5 mm long. Petals 4, narrowly oblong-obovate, truncate, about one-half as long as the calyx lobes. Ovary ovoid, not sulcate, densely hirsute; styles 3.1 mm long, cleft. Capsules ovoid or subglobose, crustaceous, slightly longitudinally 3-sulcate, sparingly pilose, 8 to 10 mm long.

LUZON, Province of Cagayan, Abulug River, *Weber 1562* (type), *For. Bur. 17796 Curran, Bur. Sci. 13927 Ramos*, January, 1912, in forests, altitude 80 to 180 m, said by Mr. Curran to be one of the commonest shrubs in the ridge forests.

A very characteristic species, distinguished by its narrow, lanceolate, short-petioled, long-acuminate, obscurely nerved leaves. In leaf-form it is quite different from all the other known Philippine species.

CYCLOSTEMON Blume.

CYCLOSTEMON MEGACARPUS sp. nov.

Species ut videtur C. bordenii Merr. affinis, differt fructibus multo majoribus, usque ad 3 cm diametro.

A tree, nearly glabrous (flowers unknown). Branches terete, the older ones light-gray, shining, the growing tips more or less olivaceous. Leaves oblong, coriaceous, of the same color and strongly shining on both surfaces, smooth, glabrous, 11 to 15 cm long, 3 to 7.5 cm wide, entire, the apex acute or obscurely acuminate, the base inequilateral, acute on one side of the midrib, subacute or somewhat rounded on the other; lateral nerves about 7 on each side of the midrib, rather prominent, curved-ascending, anastomosing near the margins; petioles 8 to 10 mm long. Flowers unknown. Fruits globose, 3 cm in diameter, somewhat gray-pubescent, the indumentum deciduous, the pedicels 1.5 cm long, solitary or in fascicles apparently from the larger branches or from the trunk, the persistent calyx about 8 mm in diameter. Seeds 2 in each fruit.

LUZON, Province of Laguna, San Antonio, *Bur. Sci. 14953 Ramos* (type), June, 1912, *Bur. Sci. 13521 Ramos*, August, 1910, in forests.

In vegetative characters the species rather closely resembles *Cyclostemon bordenii* Merr., but its fruits are very much larger, and are apparently cauline or borne on the larger branches.

CYCLOSTEMON RAMIFLORUS sp. nov.

A praecedente differt fructibus paullo majoribus, foliis basi acutis, aequilateralibus.

A species manifestly closely allied to *Cyclostemon megacarpus*, differing in the above characters. Glabrous throughout. Branches stout, light-gray, terete. Leaves oblong, coria-

ceous, shining, 15 to 20 cm long, 5 to 7 cm wide, entire, apex apparently obtuse, base acute, equilateral or subequilateral, never rounded on one side; lateral nerves 6 or 7, slender, ascending; petioles about 1 cm long. Flowers unknown. Fruit from the old branches below the leaves, solitary or fascicled, from tubercles, globose, fleshy, glabrous, apparently about 4 cm in diameter, red, with an agreeable flavor (*teste* Foxworthy), each with two seeds.

NEGROS, Mount Marapara, *For. Bur. 13640 Curran & Foxworthy*, September, 1909, on forested ridges, altitude about 700 meters.

Very similar to *Cyclostemon megacarpus* Merr., and perhaps not specifically distinct. The material, however, shows no intergradations in the differential character presented by the bases of the leaves.

CYCLOSTEMON SUBCRENATUS sp. nov.

Arbor circiter 12 m alta; foliis oblongo-lanceolatis, chartaceis vel subcoriaceis, usque ad 8 cm longis, rectis vel leviter falcatis, plus minusve inaequilateralibus, apice obtuse acuminatis, basi acutis vel leviter acuminatis, margine distincte irregulariter crenatis; fructibus axillaribus, oblongo-ellipsoideis, dense griseo-puberulis, circiter 1 cm longis, 6 mm diametro, 1-locularibus, 1-spermis.

A tree about 12 m high, glabrous except the obscurely puberulent petioles, younger branches and the infrutescence. Branches terete, grayish, lenticellate, rather slender, glabrous, younger ones somewhat olivaceous, more or less angular and slightly puberulent. Leaves alternate, oblong-lanceolate, chartaceous or subcoriaceous, of the same color and shining on both surfaces when dry, 5 to 8 cm long, 1.5 to 2.5 cm wide, straight or somewhat falcate, the base somewhat inequilateral, acute or somewhat acuminate, the apex obscurely and bluntly acuminate, the margins distinctly and irregularly crenate; primary nerves about 10 on each side of the midrib, not prominent, anastomosing, scarcely more distinct than are the secondary nerves and the reticulations; petioles 2.5 to 5 mm long. Flowers unknown. Fruits axillary, solitary, oblong-ellipsoid, densely gray-puberulent outside, about 1 cm long and 6 mm in diameter, crowned by the styles, 1-celled, 1-seeded, the pedicels very slightly pubescent, about 4 mm long.

LUZON, Province of Batangas, near Santo Tomas, *For. Bur. 21567 Tamesis*, May 22, 1910, in forests at an altitude of about 200 m, locally known as *balicbican*.

A species distinguished from the other Philippine representatives of the genus by its comparatively narrow leaves which are distinctly crenate. In some respects it resembles *C. cumingii* Benth., but has much smaller, differently shaped leaves.

EXCOECARIA Linnaeus.

EXCOECARIA PHILIPPINENSIS Merr. var. EUPHLEBIA var. nov.

Very similar to the type in all essential characters, differing chiefly in its much more prominent lateral nerves. In *Excoecaria philippinensis* the primary nerves are scarcely more prominent than are the secondary ones, while in the present form on the lower surface they are raised and very much more prominent than the secondary ones. In the shape of the leaves, their variation in form and size, texture, and in the flowers and fruit so far as our material shows, the variety appears to be quite the same as the species.

LUZON, Province of Cagayan, *For. Bur. 16591, 16853, 17808, 19629 Curran, Bur. Sci. 13973* (type), *7478 Ramos.* Two specimens from Benguet Province may be referable here, but they have fewer nerves than the Cagayan material, *Bur. Sci. 2514 Mearns* and *Bur. Sci. 13502 Ramos.* Similarly two specimens from Tayabas Province differ, *Whitford 773* and *Bur. Sci. 13345 Ramos.*

EXCOECARIA OBTUSA sp. nov.

Frutex glaber; foliis oblongo-obovatis, subcoriaceis, usque ad 12 cm longis, apice late rotundatis, basi acutis, nervis utrinque 10 ad 12, patulis, anastomosantibus, distinctis, margine recurvatis; inflorescentiis ♂ in axillis superioribus, densis, quam petioli vix longioribus, floribus brevissime pedicellatis, bracteolis reniformibus, rotundatis.

A glabrous shrub. Branches terete, brownish or olivaceous when dry. Leaves subcoriaceous, oblong-obovate, 8 to 12 cm long, 3.5 to 6.5 cm wide, shining, the lower surface considerably paler than the upper, the apex broadly rounded, more or less narrowed below the middle to the acute base, margins recurved; primary nerves 10 to 12 on each side of the midrib, spreading at nearly right angles, distinct, anastomosing and forming a looped marginal nerve, the secondary nerves about as prominent as the reticulations; petioles 1.5 to 2.5 cm long. Male racemes in the upper axils, solitary, shorter than the petioles, densely many-flowered, the rachis stout, the pedicels 1 to 1.5 mm long, the axillary glands prominent; bracteoles reniform, rounded, about 1.5 mm wide, 1 mm long, obscurely glandular on the margins. Sepals broadly ovate, acute, slightly glandular on the margins, 1 mm long. Filaments 1 to 2 mm long. Female flowers and fruits not seen.

LUZON, Province of Cagayan, Abulug River, in forests near Dabba, *Bur. Sci. 13917 Ramos,* January, 1912, flowers yellow.

A species manifestly allied to *Excoecaria philippinensis* Merr., but distinguished at once by its very differently shaped, broadly rounded, not acute or acuminate leaves.

HOMALANTHUS H. Jussieu.

HOMALANTHUS POPULNEUS (Geisel.) Pax, var. **MINOR** (Muell.-Arg.) comb. nov.

Carumbium populneum Muell.-Arg. var. *minus* Muell.-Arg. in DC. Prodr. 15 [2] (1866) 1145.

Homalanthus populneus Pax, var. *siccus* Pax in Engl. Pflanzenreich 52 (1912) 46 (non *Excoecaria sicca* Blanco!).

Mueller's name for this variety must be maintained, for Pax and K. Hoffmann are in error in the adoption of the varietal name *siccus*, based on *Excoecaria sicca* Blanco. Mueller first suggested that *Excoecaria sicca* Blanco was a synonym of *Carumbium populneum*,[11] but was not sure, "*Excaecaria sicca* Blanco ..... etiam hic pertinere videtur." An examination of Blanco's description shows that this reduction is impossible, as he described a very different plant, with leaves very similar to those of *tuba camaisa* (*Croton tiglium* L.), 3-nerved at the base, said by him to be common along the margins of estuaries and rivers. *Excoecaria sicca* Blanco is common in some localities in and about Manila, in the habitats ascribed to it by Blanco, habitats in which *Homalanthus* never grows; moreover no *Homalanthus* is known from the immediate vicinity of Manila. I am confident that F.-Villar was correct in his reduction of Blanco's *Excoecaria sicca* to the genus *Alchornea;* it is not, however, the same as *Alchornea mollis* Muell.-Arg. I have already [12] transferred Blanco's name to *Alchornea*, as *A. sicca* (Blanco) Merr., and reduced to it the more recently described *Alchornea parviflora* Muell.-Arg. While there is absolutely no doubt as to the correctness of the transfer of Blanco's species to *Alchornea*, I am now of the opinion that I was in error in the reduction of *Alchornea parviflora* to *A. sicca* Merr., and that two distinct species are represented. See page 382.

Homalanthus populneus var. *minor* is common and widely distributed in the Philippines, and is represented by the following material: LUZON, Province of Laguna, *Elmer:* Province of Zambales, *Hallier:* Province of Bulacan, *Bur. Sci. 13034 Ramos:* Province of Bataan, *Williams 289, For. Bur. 20008 Topacio, For. Bur. 1209 Borden, Whitford 478, 1281:* Province of Rizal, *Merrill 1879* (not "*Elmer 1879*," as quoted by Pax), *Phil. Pl. 309 Merrill, Loher 4801:* Province of Batangas, *For. Bur. 21559 Tamesis, Elmer 9226, Merrill 2893* (not "*Elmer 2893*," as quoted by Pax), *Ritchie 45:* Province of Albay, *Bur. Sci. 2889, 2891 Mearns, Bur. Sci. 6409 Robinson:* Province of Sorsogon, *For. Bur. 10525 Curran.* MARINDUQUE, collector unknown. NEGROS, *For. Bur. 11209 Everett, Whitford 1626.* LEYTE, *Elmer 7338.* PALAWAN, *Merrill 702, 843* (not "*Elmer 702, 843*," as quoted by Pax). MINDANAO, District of Zamboanga, *Williams 2077, For. Bur. 9245 Whitford & Hutchinson:* District of Davao, *Elmer 12499.*

Native names: *Balanti, bayanti* (Negros, Marinduque); *bota-bota* (Tayabas); *buta* (Rizal); *malabinunga, binuang-susong* (Bataan); *banti* (Tawi-tawi).

[11] Prodr. 15 [2]: 1144. [12] This Journal 5 (1910) Bot. 192.

HOMONOIA Loureiro.

HOMONOIA JAVENSIS (Blume) Muell.-Arg. in Linnaea 34 (1865) 200, DC. Prodr. 15² (1866) 1022; J. J. Sm. in Koord. & Val. Bijdr. Boomsoort. Java 12 (1910) 544.

Spathiostemon javense Blume Bijdr. (1826) 622.
Adelia javanica Miq. Fl. Ind. Bat. 1² (1858) 388.
Mallotus eglandulosus Elm. Leafl. Philip. Bot. 1 (1908) 313.

LEYTE, Palo, *Elmer 7152* (type of *Mallotus eglandulosus* Elm.), *7318*, January, 1906, in fruit; Ormoc, *For. Bur. 11631 Whitford*, March, 1909, with staminate flowers. CEBU, Danao, *For. Bur. 6462, 6444, 6467 Everett*, February, 1907, with staminate flowers. MINDANAO, District of Davao, *Williams 2808*, May, 1905, with staminate flowers.

Mallotus eglandulosus Elm. was described from fruiting specimens, and was reduced to *Homonoia javensis* Muell.-Arg. by J. J. Smith l. c., a species not previously recorded from the Philippines under its proper name. An examination of our material with staminate flowers confirms the reduction, for the stamens are arranged in branched phalanges.

Java, Timor, Amboina, Key, and New Guinea.

Var. **CILIATA** var. nov.

A typo differt foliis subtus ad costa petiolisque ciliato-hirsutis.

NEGROS, Cauayan, *For. Bur. 7246 Everett* (type), March, 1907; Tanjay River, *For. Bur. 12325 Everett*, April, 1908.

MACARANGA Thouars.

MACARANGA GIGANTIFOLIA sp. nov.

Arbor parva, foliis glabris vel subglabris, late ovatis, circiter 60 cm longis, distanter denticulatis vel integerrimis, basi late rotundatis, alte peltatis, apice acuminatis, subtus glandulis minutis ceraceis nitidis instructis; inflorescentiis ♂ ut videtur axillaribus, pubescentibus, circiter 50 cm longis, anguste paniculatis; bracteis orbicularibus, concavis, 3 ad 4 mm diametro, minute denticulatis; staminibus 2 ad 4.

A small tree, the leaves nearly glabrous, the inflorescence rusty-pubescent. Leaves firmly chartaceous or subcoriaceous, broadly ovate, about 60 cm long, 40 cm wide, acuminate, base broadly rounded, deeply peltate, the petiole inserted about 13 cm from the basal margin, the margins entire or with few, scattered, minute teeth, the upper surface quite glabrous, rather pale when dry, shining, the lower one brownish, slightly pubescent along the nerves and reticulations, and with numerous, minute, shining, pale-yellow, waxy glands; nerves 9, radiate, very prominent, the lateral ones above the base about 10 on each side of the midrib; primary reticulations very prominent, parallel; petioles

stout, at least 50 cm in length, about 1 cm in diameter, glabrous, or near the apex more or less pubescent. Staminate inflorescence apparently axillary, about 50 cm long, rather densely brown-pubescent with very short hairs, the lower branches up to 14 cm long, the upper gradually shorter, very numerous. Bracts very numerous, orbicular, concave, pubescent, 3 to 4 mm in diameter, minutely and irregularly toothed. Male flowers 6 to 10 in the axil of each bract, sessile. Calyx 0.6 to 0.8 mm long. Stamens 2 to 4. Female flowers and fruit unknown.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14702 Ramos*, March, April, 1912.

A species in the same group with and allied to *Macaranga noblei* Elm., but very different from it. A single excellent distinguishing character is its nearly glabrous leaves.

MACARANGA AMPLIFOLIA sp. nov.

Arbor circiter 10 m alta, partibus junioribus dense ferrugineo-tomentosis glabrescentibus, ramulis crassis, 1 ad 1.5 cm diametro, stipulis lanceolatis, acuminatis, 3 ad 4 cm longis, subpersistentibus; foliis coriaceis, alternis, usque ad 40 cm longis, integris, ovatis ad oblongo-ovatis, acuminatis, basi acutis vel subtruncatis, prominente 3-plinerviis, subtus dense pallide glanduliferis; inflorescentiis axillaribus, paniculatis, diffusis, amplis, quam folia brevioribus; capsulis glandulosis, parvis, 2-coccibus, inermibus.

A tree about 10 m high. Branchlets stout, 1 to 1.5 cm in diameter, brown, glabrous, the tips densely brown-tomentose, the stipules lanceolate, acuminate, 3 to 4 cm long, subpersistent, appressed-ciliate on the back. Very young leaves densely ferruginous-tomentose, soon becoming glabrous or nearly so. Leaves alternate, ample, ovate to oblong-ovate, coriaceous, 20 to 40 cm long, 9 to 20 cm wide, long and rather slenderly acuminate, margins entire, base subtruncate or acute, prominently 3-plinerved, with one or two additional pairs of very short basal nerves, the upper surface shining, quite glabrous, brownish, the lower surface somewhat paler, rather densely covered with minute, pale, waxy glands, the nerves often slightly hairy; lateral nerves above the basal pair 9 or 10 on each side of the midrib, ascending, parallel, very prominent, anastomosing close to the margin, the reticulations subparallel, prominent; petioles about 20 cm long, at first pubescent, becoming glabrous or nearly so. Panicles axillary, very densely ferruginous-pubescent, ample, diffuse, many-flowered, usually exceeding the petioles in length, the bracts obovate, 3 mm long, subdigitately toothed.

Capsules with two cocci, each coccus globose, about 4 mm in diameter, glandular, unarmed.

LUZON, Province of Laguna, near San Antonio, *Bur. Sci. 13513 Ramos* (type) August, 1910, in fruit; between Paete and Piapi, *For. Bur. 10153 Curran*, March, 1908, with very young flowers.

A species characterized by its large, entire, acuminate, long-petioled leaves which are not at all peltate or cordate, its paniculate, densely pubescent inflorescence, and its unarmed capsules, each consisting of two small, globose, glandular cocci.

MACARANGA LEYTENSIS sp. nov.

Species M. gigantifoliae affinis differt foliis vix peltatis, basi latissime subtruncato-cordatis subauriculatisque, subtus eglandulosis, bracteolis distincte palmato-lobatis, lobis oblongis, brevibus, obtusis.

A tree about 12 m high. Leaves broadly ovate, about 35 cm long, 25 to 30 cm wide, chartaceous, entire, the upper surface olivaceous when dry, shining, glabrous, or slightly pubescent on the nerves, the lower surface paler, shining, not at all glandular, ciliate with scattered, long, white hairs on the nerves and reticulations, apex subcaudate-acuminate, the acumen about 1.5 cm long, the base very broadly subtruncate-cordate, at the insertion of the petiole subauriculate, prominently 3-nerved, with 4 or 5 supplementary pairs of progressively shorter basal nerves, the longest about 9 cm long, the others very much shorter; lateral nerves above the basal pair about 12 on each side of the midrib, prominent, anastomosing close to the margin, the reticulations prominent, subparallel; petioles more or less ciliate, about 30 cm long. Male panicles axillary, they or their branches 20 to 30 cm long, ferruginous-tomentose, the younger parts densely so, the older parts glabrescent and dark-colored when dry. Flowers very numerous, the bracts obovate, densely pubescent, 2.5 to 3 mm long, 4 to 6 fascicled at each node, subpalmately lobed, the lobes 10 to 12, oblong, obtuse, about 1 mm long, each bract subtending about 8 sessile flowers. Calyx about 0.8 mm long, narrowly funnel-shaped, obscurely 3-lobed, somewhat pubescent above. Stamens 2 or 3, the filaments about as long as the perianth. Female flowers and fruits not seen.

LEYTE, Mount Ibuni, near Dagami, *Bur. Sci. 15253 Ramos*, August 21, 1912, on forested slopes near streams.

A species manifestly allied to *Macaranga gigantifolia* Merr., *M. noblei* Elm., and *M. amplifolia* Merr., distinguished from all by its eglandular leaves. It is, perhaps, most closely allied to the first, from which it is also distinguished by its very differently shaped leaves, truncate-cordate and subauriculate at the base, not deeply peltate, and its different bracts.

MACARANGA GRANDIFOLIA (Blanco) comb. nov.

Croton grandifolius Blanco Fl. Filip. (1837) 753, ed. 2 (1845) 518 (*grandifolium*).

Macaranga porteana André in Rev. Hort. 60 (1888) 176, *f. 36;* Hook. f. in Curtiss' Bot. Mag. (1895) *t. 7407;* Merr. in Philip. Journ. Sci. 7 (1912) Bot. 238.

Macaranga mappa F.-Vill. Novis. App. (1880) 185; Vid. Sinopsis Atlas (1883) *t. 84, f. D,* Rev. Pl. Vasc. Filip. (1886) 246; Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 80, non Muell.-Arg.

This species is apparently distinct from the Malayan *Macaranga mappa* Muell.-Arg., the reference of Philippine material to which has been largely due to Mueller's erroneous reduction of Blanco's *Croton grandifolius.* In considering the species previously,[13] I erroneously considered Blanco's specific name invalid in *Macaranga,* but there is no "*Macaranga grandifolia* Muell.-Arg." to invalidate it, and the name is quite valid in *Croton* where originally described. I accordingly, transfer Blanco's specific name to *Macaranga* as the oldest valid one for the species. It is represented by the following specimens:

LUZON, Province of Cagayan, *For. Bur. 16717 Curran:* Benguet Subprovince, Sablan, *Phil. Pl. 473 Fénix:* Province of Bataan, Lamao River, *For. Bur. 2059 Borden, Whitford 12, 1052:* Province of Rizal, *Merrill 1288:* Province of Tayabas, *Bur. Sci. 13109 Foxworthy & Ramos.* MINDORO, *Ritchie s. n.*

Nearly all the material was distributed as *Macaranga mappa* Muell.-Arg.

MACARANGA MONTANA sp. nov.

Arbor circiter 12 m alta; foliis alternis, longe petiolatis, vix peltatis, oblongo-ovatis, usque ad 20 cm longis, acuminatis, integris, basi late subrotundatis, subtus parce glandulosis, costa nervisque leviter pubescentibus, nervis utrinque circiter 11; paniculis ♀ axillaribus, quam petioli brevioribus, paucifloris, leviter pubescentibus; ovario dense glanduloso, 1-loculare; stigmate laterali, lineari, papilloso.

A tree about 12 m high, subglabrous. Branches dark-colored when dry, terete, glabrous, the growing parts slightly lepidote with deciduous, brownish, minute scales. Leaves alternate, long-petioled, oblong-ovate, subcoriaceous, shining, 15 to 20 cm long, 8 to 10 cm wide, entire, apex shortly and rather sharply acuminate, base broad, subrounded, the upper surface quite glabrous, the lower surface of nearly the same color when dry, with scattered, minute, pale, waxy glands, the midrib and lateral nerves slightly pubescent; nerves pinnately arranged, prominent, somewhat curved, anastomosing near the margin, about 11 on each side of the midrib, the reticulations subparallel; petioles 7 to 9 cm long, usually a little thickened and curved at the apex; stipules narrowly oblong, subacute, about 6 mm long, deciduous.

[13] Supra 238.

Male flowers and fruits unknown. Female inflorescence axillary, solitary, rather lax, paniculate, about 6 cm long, slightly pubescent; bracts oblong-lanceolate, acuminate, 3 mm long or less. Calyx about 1.5 mm long, irregularly splitting into 3 or 4, ovate-lanceolate, acuminate lobes. Ovary globose, densely covered with pale waxy glands, 1-celled, 1-ovuled; stigma lateral, simple, papillose throughout, somewhat curved, tapering, 5 to 6 mm long.

MINDANAO, District of Zamboanga, Sax River Mountains back of San Ramon, *Merrill 8076*, November 28, 1911. In forests on ridges, altitude about 1,100 m.

A species probably belonging in *Macaranga*, although the male flowers are unknown, well characterized by its 1-celled ovaries, lateral simple styles which are stigmatose throughout, and pinnately veined, non-peltate leaves.

MALLOTUS Loureiro.

MALLOTUS ALTERNIFOLIUS sp. nov. § *Eumallotus*.

Arbuscula vel arbor parva circiter 4 m alta, plus minusve glandulosa, novellis inflorescentisque stellato-puberulis; foliis membranaceis, oblongo-ovatis vel ovatis, basi cordatis, triplinerviis, apice acuminatis; inflorescentiis ♂ terminalibus, racemosis, floribus numerosis, staminibus circiter 20; capsulis dense molliter echinatis.

A shrub or small tree reaching a height of about 4 m. Branches terete, slender, glabrous, smooth, reddish or reddish-brown, the branchlets slightly puberulent. Leaves alternate, membranaceous, oblong-ovate or ovate, 8 to 15 cm long, 5 to 8.5 cm wide, the base rather broad, cordate, the basal lobes rounded, the sinus narrow, about 0.5 cm deep, the apex prominently and rather slenderly acuminate, the margins slightly subrepand-denticulate or nearly entire, the upper surface glabrous, somewhat shining, with usually two glands on either side of the midrid at the base, the lower surface slightly paler than the upper, with few, scattered glands, the midrib and nerves often slightly ciliate; basal pair of nerves reaching from one-third to one-half the length of the leaf, with usually two additional short, supplementary pairs of basal ones, the lateral nerves above the basal pair 5 or 6 on each side of the midrib, somewhat ascending, anastomosing, the reticulations subparallel, lax; petioles 2.5 to 5.5 cm long, usually puberulent. Flowers usually appearing with or just before the new leaves, the racemes terminal, erect, stellate-puberulent, the staminate ones 8 cm long or less. Flowers in fascicles of 10 or less, their pedicels 1 to 3 mm long, puberulent, the bracts none or very early deciduous. Calyx-

segments 3, narrowly ovate, acute, about 2 mm long, 1-nerved, slightly stellate-puberulent. Stamens about 20, the filaments 2 mm long or less. Disk none. Pistillate flowers unknown. Young fruits glandular, puberulent, densely covered with numerous, soft, spine-like processes.

PALAWAN, near Puerto Princesa, *For. Bur. 3905, 4124* (type) *Curran*, April, 1906, *Bur. Sci. 250 Bermejos*, December, 1905.

This species has been confused in the herbarium with *Mallotus leucocalyx* Muell.-Arg., but differs from that species not only in its distinctly alternate leaves, not in unequal pairs, but also in many other characters; it is probably most closely allied to *Mallotus helferi* Muell.-Arg.

MALLOTUS AURICULATUS sp. nov. § *Eumallotus.*

Arbor parva, partibus junioribus plus minusve ciliata; foliis longe petiolatis, usque ad 15 cm longis, oblongo-ellipticis vel late ovato-lanceolatis, chartaceis, subtus parce glandulosis, penninerviis, acuminatis, basi angustatis, biauriculatis, auriculis brevibus, obtusis, supra glandulis 1 ad 3 instructis; nervis utrinque circiter 8, subtus prominentibus; stipulis setaceis; inflorescentiis ♂ axillaribus, solitariis, spicatis; fructibus pubescentibus, valde muricatis.

A small tree reaching a height of about 5 m, the branchlets, inflorescences and under surfaces of the leaves with scattered, rounded, colored or pale, waxy glands. Branches terete, brownish, glabrous, the branchlets, petioles, and midrib and nerves on the under surface of the leaves with scattered, long, white, ciliate hairs, ultimately becoming nearly glabrous. Leaves alternate, oblong-elliptic to broadly ovate-lanceolate, 8 to 15 cm long, 2 to 6 cm wide, brownish or somewhat olivaceous when dry, paler beneath, slightly shining, firmly chartaceous, the margins obscurely and distantly repand-denticulate or subentire, the apex subcaudate-acuminate, the acumen blunt, often 2 cm long, the base narrowed, biauriculate, the auricles about 2 mm long, rounded, the sinus very narrow, each auricle with from one to three, prominent, dark-colored glands on the upper surface, the lower surface of the leaves with scattered, round, pale or colored, waxy glands; lateral nerves about 8 on each side of the midrib, curved-ascending, distant, prominent beneath, looped-anastomosing, the reticulations lax, prominent; petioles 2.5 to 5 cm long, when young ciliate, ultimately nearly glabrous; stipules setaceous, brown, acuminate, about 6 mm long. Staminate inflorescence axillary, solitary, spicate, the spikes about 5 cm long, pubescent, glandular, the bracteoles ovate to ovate-lanceolate, acuminate, about 2 mm long, each subtending from one to several sessile or subsessile flowers. Calyx-segments obovate,

about 2 mm long, 1.3 mm wide, acute or obtuse, with scattered glands outside. Disk none. Stamens 20 to 25; filaments about 1.8 mm long, glabrous. Pistillate inflorescence axillary, apparently paniculate, the flowers unknown. Fruits brown, consisting usually of two dehiscent cocci, each coccus subglobose, about 8 mm in diameter, brown-puberulent, glandular, covered with numerous, stout, stiff, spreading spines 1.5 to 2 mm long; seeds brown, globose, about 5 mm in diameter.

MINDANAO, Lake Lanao, Camp Keithley, *Mrs. Clemens 1013*, April, 1907, and without number, June, 1907. NEGROS, Himugaan River, *For. Bur. 7271 Everett*, May 20, 1907 (type); Sicaba River, *For. Bur. 7259 Everett*, May, 1907; Faraon, *For. Bur. 13563 Meyer & Foxworthy*, August, 1909; *For. Bur. 13696, 19393 Curran*, Sept., 1909, June, 1910. LEYTE, Dagami, *Bur. Sci. 15298 Ramos*, August, 1912.

A species well characterized by its distinctly auriculate leaves.

MALLOTUS BARBATUS (Wall.) Muell.-Arg. in Linnaea 34 (1865) 184; Hook. f. Fl. Brit. Ind. 5 (1887) 428; J. J. Sm. in Koord. & Val. Bijdr. Boomsoort. Java 12 (1910) 407.

Rottlera barbata Wall. Cat. (1847) No. 7822.

LUZON, Province of Tayabas, Atimonan, *Whitford 711*, August, 1904.

I refer this specimen here with some hesitation, as it has pistillate flowers only. It agrees, however, with the description in essential characters, differing chiefly in its leaves not being at all 3-lobed. In *Mallotus barbatus*, however, the leaves appear not to be always 3-lobed, as in *Henry 9525* from Yunnan.

Not previously reported from the Philippines; Burma to southern China, southward to Java.

MALLOTUS CAMIGUINENSIS sp. nov. § *Eumallotus.*

Arbuscula vel arbor parva, plus minusve glandulosa pubescensque; foliis suboppositis vix vel paulo inaequalibus, apice longe acuminatis, basi cordatis, trinerviis; calycis segmentis 4, reflexis; staminibus circiter 35; capsulis 3-coccis, glandulosis, glabris, aculeis paucis circiter 2 mm longis vix rigidis instructis.

A shrub or small tree, the younger branchlets, petioles, inflorescences, and nerves on the lower surfaces of the leaves more or less pubescent with simple hairs, and including the fruits and lower surfaces of the leaves with scattered, yellowish, waxy glands. Branches terete, reddish-brown, glabrous. Leaves oblong-ovate or narrowly ovate, membranaceous, 11 to 17 cm long, 5 to 7.5 cm wide, the base rather broad, rounded, cordate, the basal lobes short, rounded, the sinus narrow, the apex gradually long and slenderly acuminate, the margins distantly denticulate or subentire, the upper surface glabrous, or when young with few hairs on the nerves, the lower surface with numerous, scattered, yellowish, waxy glands, glabrous except for the pubescent midrib and primary nerves, the base distinctly

3-nerved, the lateral nerves reaching one-third the length of the lamina, there anastomosing with the upper lateral nerves, the base also with two or three pairs of supplementary, very short, nerves; primary nerves above the basal ones 4 or 5 on each side of the midrib, ascending, anastomosing, distinct beneath, the reticulations rather lax; petioles 2.5 to 5.5 cm long, pubescent; stipules lanceolate, acuminate, about 3 mm long, early deciduous. Staminate inflorescence in the upper axils, solitary, racemose, slightly pubescent, about 10 cm long, the flowers arranged in fascicles of from 4 to 9 flowers each, their pedicels 1.5 to 2.5 mm long. Calyx-segments usually 4, reflexed, glandular, oblong to oblong-ovate, subequal, about 2.2 mm long, 1- or 2-nerved. Stamens about 35; filaments 2.5 mm long, glabrous, the connective not produced. Fruits about 1.5 cm in diameter, consisting of three dehiscent cocci, depressed, deeply sulcate between the cocci, glabrous, glandular, with few, scattered, rather soft, glabrous, spine-like processes about 2 mm in length.

BABUYANES ISLANDS, Camiguin, *Bur. Sci. 4047 Fénix,* June 27, 1907, in thickets in old clearings.

This species has previously been reported by me as *Mallotus leucocalyx* Muell.-Arg.,[14] to which it is manifestly allied, but from which it differs strikingly in its fruit characters, *M. leucocalyx* having capsules covered with numerous, elongate, softly pubescent spine-like processes.

MALLOTUS CARDIOPHYLLUS sp. nov. § *Eumallotus.*

Ut videtur arbor parva, partibus junioribus inflorescentiisque dense fulvo-stellato-tomentosis; foliis cordato-ovatis, acuminatis, usque ad 10 cm longis, basi late cordatis, supra glabris, subtus eglandulosis, leviter hirsutis glabrescentibus; racemis erectis, circiter 10 cm longis; floribus masculinis pedicellatis; staminibus circiter 50, locellis oblongis, connectivo haud producto.

Apparently a shrub or small tree, the branches glabrous, dark-reddish-brown, terete, the growing parts, the young leaves, and the rachis of the inflorescence very densely covered with matted, fulvous, stellately arranged, tomentose hairs, the leaves when mature nearly glabrous. Leaves opposite, cordate-ovate, subcoriaceous, 6 to 10 cm long, 5 to 7 cm wide, base broadly rounded, usually prominently cordate and with two large, black glands near the insertion of the petiole, not at all peltate, the apex acuminate, pale and somewhat shining when dry, the upper surface glabrous, minutely papillose, the lower surface eglandular, more or less stellate-ciliate with pale-brown hairs, the indumentum more or less deciduous; basal nerves a single

[14] This Journal 3 (1908) Bot. 416.

pair reaching the middle of the leaf or above, the lateral nerves above the basal ones 3 or 4 on each side of the midrib, prominent, the reticulations subparallel; petioles 2 to 5 cm long, those of each pair of leaves unequal in length, when young densely tomentose, becoming glabrous or nearly so. Racemes terminal and in the upper axils, erect, many-flowered, 10 cm long or less, the rachis densely tomentose, the bracteoles lanceolate, acuminate, 1.5 mm long, tomentose; pedicels ciliate-tomentose, about 4 mm long. Buds globose, slightly tomentose, the lobes 3 or 4, in flower reflexed, elliptic to oblong-elliptic, acute or obtuse, often concave, 4 to 5 mm long. Stamens about 50; filaments up to 4 mm in length; anthers 1 to 1.3 mm long, the cells oblong, one often situated a little higher than the other, the connective very short, merely uniting the two cells. Pistillate flowers and fruits unknown.

LUZON, Province of Cagayan, *Cuming 1267*.

This form, collected over 70 years ago, has not appeared in any recent collections. It is apparently undescribed, and does not appear to be closely allied to any other known Philippine form. Unfortunately the fruits are unknown, so that it is difficult to determine its proper alliance.

MALLOTUS CAULIFLORUS sp. nov. § *Eumallotus*.

Arbor parva, ramulis petiolis inflorescentiisque plus minusve pubescentibus; foliis oblongis vel oblongo-ovatis, chartaceis vel subcoriaceis, usque ad 33 cm longis, glabris, penninerviis, nervis utrinque 11 ad 15, prominentibus, apice acuminatis, basi acutis, obtusis, vel subauriculato-cordatis, supra 2-glandulosis, subtus vix glandulosis; inflorescentiis truncifloris, fasciculatis et in axillis foliorum solitariis, racemosis, elongatis; coccis pellucido-glandulosis, echinatis.

A small tree, 2 to 3 m high *fide* Curran, 10 m high *fide* Ramos. Branches, petioles, and inflorescence more or less pubescent, otherwise glabrous. Leaves opposite, penninerved, oblong to oblong-ovate, chartaceous or subcoriaceous, opposite, unequal, one of each pair considerably smaller and with a shorter petiole than the other but of about the same shape, prominently acuminate, base more or less narrowed, acute, obtuse, or subauriculate-cordate, 2-glandular on the upper surface at the base, the lower surface not at all waxy-glandular, quite smooth and glabrous; nerves 11 to 15 on each side of the midrib, prominent, anastomosing; petioles of the larger leaves about 5 cm long, of the smaller ones about one-half as long; stipules lanceolate, somewhat acuminate, about 2 cm long, striate. Inflorescence racemose, the racemes slender, up to 15 cm long, solitary in the axils of the leaves but more abundant on the trunk, springing

from elongate, rugose tubercles, solitary or several on each tubercle. Male flowers numerous, yellow, their pedicels pubescent, about 5 mm long, the subtending bracteoles ovate, obtuse or acute, about 1.5 mm long, stellate-pubescent. Sepals usually 3, reflexed, elliptic-ovate, acute, about 3.5 mm long. Stamens about 30, 2 to 2.5 mm long, the connectives broad, truncate, the anther-cells about 0.5 mm long. Fruit of two or three cocci, about 1 cm wide, depressed-globose, 3-sulcate, the individual cocci subglobose, externally prominently waxy-glandular with small yellow glands, and with scattered, short, spine-like processes 2 mm long or less.

LUZON, Province of Cagayan, Abulug River, *Bur. Sci. 13909 Ramos* (type), January, 1912, *For. Bur. 17794 Curran*, January, 1912. On hillsides, limestone region, altitude about 80 meters.

A species well characterized by its cauline inflorescence, but frequently also with axillary racemes on the same specimen, its penninerved, glabrous, non-glandular leaves, etc. It somewhat resembles in vegetative characters *Mallotus camiguinensis* Merr., but is not closely allied to that species.

MALLOTUS PANICULATUS (Lam.) Muell.-Arg. in Linnaea 34 (1865) 189, DC. Prodr. 15[2] (1866) 965.

Croton paniculatus Lam. Encycl. 2 (1786) 207.

Mallotus cochinchinensis Lour. Fl. Cochinch. (1790) 635; Hook. f. Fl. Brit. Ind. 5 (1887) 430.

Croton appendiculatus Elm. Leafl. Philip. Bot. 1 (1908) 312.

LUZON, Province of Tayabas, Lucban, *Elmer 9215*, May, 1907, in fruit, cotype of *Croton appendiculatus* Elm.: Province of Laguna, San Antonio, *Bur. Sci. 10990 Ramos*, August, 1910, with staminate flowers. NEGROS, Faraon, *For. Bur. 17465 Curran*, October, 1909, with pistillate flowers. MINDANAO, District of Davao, *Elmer 11926*, October, 1909, with staminate flowers and fruits.

This species has previously been reported from the Philippines by F.-Villar[15], but the record was not before verified. The specimen reported by me as *Mallotus paniculatus*[16] is *M. playfairii* Hemsl. *Croton appendiculatus* Elm., was described from fruiting specimens only, and has been reduced to *Mallotus cochinchinensis* Lour. (=*M. paniculatus* Muell.-Arg.) by J. J. Smith,[17] and by Hallier f.[18] There is no doubt as to the correctness of the reduction, for the Philippine specimens agree both with the descriptions of *Mallotus paniculatus*, and with extra-Philippine material representing the species in the Herbarium of the Bureau of Science: India, *Wallich 7818*, Hongkong, *Curran*, Singapore, *Ridley*, Penang, *Ridley*, and Borneo, Sarawak, *Foxworthy 87, 146*.

[15] Novis. App. (1880) 195.
[16] For. Bur. Bull. (Philip.) 1 (1903) 31.
[17] Koord. & Val. Bijdr. Boomsoort. Java 12 (1910) 413.
[18] Meded. 's Rijks Herb. 1910 (1911) 7.

MALLOTUS MOLUCCANUS (L.) Muell.-Arg. in Linnaea 34 (1865) 958, DC. Prodr. 15² (1866) 958.

Croton moluccanus L. Sp. Pl. (1753) 1005.

This species is very common in the Philippines, extending from northern Luzon to southern Mindanao, being one of the characteristic trees of the settled areas, second growth woodlands, etc. Its known extra-Philippine range is from Formosa southward through the Malay Archipelago to Sumatra, and New Guinea, with a variety in the Marianne Islands.

There is some doubt as to the type of the species, for Linnaeus in the original description of the species cites first *Fl. zeyl. 346*, and second *Burm. zeyl. 170*, giving the range of the species as Ceylon and the Moluccas. Now the species does not occur in Ceylon, and Trimen[19] states that the specimens in Hermann's herbarium to which Linnaeus had access are only leaves and almost certainly belong to *Givotia rottleriformis* Griff. Muell.-Arg.,[20] however, indicates that he has seen the specimen in the Linnean herbarium and cites it with certainty as being *Mallotus moluccanus;* there is no indication, however, that the specimen in Linnaeus' herbarium is the type. Unless the reference to Burmann is in part *Mallotus moluccanus,* then it would seem that the specific name would have to be transferred to *Givotia,* and a new one adopted to designate the plant that is usually known as *Mallotus moluccanus* Muell.-Arg.

Our Philippine material is somewhat variable, and most of the specimens have very densely tomentose capsules; a form from Mindanao has capsules glabrous or nearly so, and is indicated as follows:

Var. **PENDULUS** var. nov.

Inflorescentiis quam in typo longioribus, pendulis, usque ad 60 cm longis, capsulis glabris vel subglabris, haud dense tomentosis.

MINDANAO, Butuan Subprovince, Veruela, *Weber 1104,* July 3, 1911: District of Zamboanga, Basagan River, *Merrill 8305,* November, 1911: District of Cotabato, *Bur. Sci. 11552 Robinson,* June, 1910.

MALLOTUS RAMOSII sp. nov.

Arbor parva, circiter 4 m alta, inflorescentiis parcissime hirsutis exceptis glabra; foliis alternis, chartaceis, ellipticis vel ovato-ellipticis, usque ad 14 cm longis, eglandulosis, penninerviis, basi rotundatis, apice tenuiter acuminatis, margine crenato-serratis, nervis utrinque 8 ad 10, distinctis; inflorescentiis ♂ axillaribus, spicatis, 12 ad 20 cm longis, floribus numerosis, ad nodos fasciculatis.

A small tree, glabrous except the very slightly hirsute inflorescence, about 4 m high. Branches grayish, terete, glabrous. Leaves alternate, chartaceous, elliptic to elliptic-ovate, sometimes

[19] Fl. Ceyl. 4 (1898) 51. [20] DC. Prodr. 15² (1862) 958.

oblong-ovate, 8 to 14 cm long, 3 to 8 cm wide, eglandular, of the same color and slightly shining on both surfaces when dry, the base rounded, the apex rather slenderly acuminate, margins distinctly crenate-serrate; lateral nerves 8 to 10 on each side of the midrib, distinct, anastomosing near the margins, the reticulations slender, the primary ones subparallel; petioles 1 cm long. Male inflorescence spicate, very slender, 12 to 20 cm long, axillary, solitary, slightly hirsute at the nodes, the flowers numerous, fascicled or subsolitary at the nodes, the internodes 1 to 4 mm long. Sepals 3, broadly ovate, acuminate, 2 mm long. Stamens many; filaments short. Female flowers and fruits not seen.

CAMIGUIN DE MINDANAO, *Bur. Sci. 14602 Ramos*, April 27, 1912, in forests near the summit of Mount Catarman.

A species difficult to refer to its proper subgenus in the absence of female flowers and fruits, but well characterized by its short-petioled, eglandular, pinnately nerved, crenate-serrate leaves, and by its slender, elongate staminate spikes.

MALLOTUS SANCHEZII sp. nov. § *Eumallotus*.

Arbor parva vel frutex, plus minusve stellato-villosus; foliis anguste ovatis ad oblongo-ovatis, usque ad 20 cm longis, tenuiter caudato-acuminatis, basi late rotundatis, peltatis, utrinque glandulosis, margine repando-dentatis; capsulis depressis, glandulosis, processibus mollibus ciliatis instructis.

A shrub or small tree, the branchlets, inflorescence, and both surfaces of the leaves with scattered, stellate, pale or brownish, ciliate hairs, the tips of the branches very densely pubescent. Leaves alternate, narrowly ovate to oblong-ovate, chartaceous, 12 to 20 cm long, 6 to 11 cm wide, brownish and somewhat shining when dry, of about the same color on both surfaces, the apex long and slenderly caudate-acuminate, the acumen 2.5 to 3 cm long, the base broadly rounded, peltate, the petiole inserted at from 1 to 1.5 cm from the margin, both surfaces with scattered, stellate, pale, ciliate hairs, and with scattered, shining, yellowish, waxy glands, the margins repand-dentate, the teeth short, less than 1 cm apart, the basal margin quite entire; basal nerves 7 to 10, radiate, the lower ones short; lateral nerves above the basal ones 6 to 8 on each side of the midrib, ascending, prominent, the reticulations subparallel, prominent; petioles 5 to 10 cm in length, more or less ciliate-pubescent; stipules linear, densely pubescent, 1 cm long or less, deciduous. Inflorescence

racemose, terminal, up to 20 cm in length. Flowers unknown, the bracteoles densely pubescent, linear, about 5 mm long. Capsules depressed, of three cocci, about 1 cm wide, waxy-glandular with yellowish dots, and covered with numerous, scattered, spreading, ciliate, rather soft processes 2 to 3 mm in length.

MINDANAO, Province of Misamis, Talisayan, *Q. F. Quadras.*

The type is from the herbarium of the Ateneo de Manila, communicated to me by Father Francisco Sanchez, to whom this most distinct species is dedicated.

A strongly marked species, readily recognizable by its peltate, oblong-ovate to narrowly ovate, long and slenderly caudate-acuminate, repand-dentate leaves.

OSTODES Blume.

OSTODES ANGUSTIFOLIA sp. nov.

Frutex glaber circiter 1 m altus; foliis plus minusve confertis, alternis, sessilibus vel subsessilibus, lineari-lanceolatis, acuminatis, basi cordatis, usque ad 27 cm longis, 1 ad 1.5 cm latis; pedunculis tenuibus, circiter 8 cm longis, ut videtur paucifloris.

A glabrous shrub or undershrub about 1 m high. Branches terete, slender, grayish. Leaves somewhat crowded toward the apices of the branchlets, sessile or subsessile, firmly characeous or subcoriaceous, linear-lanceolate, 18 to 27 cm long, 1 to 1.5 cm wide, gradually narrowed into the slender acumen, base abruptly cordate, often somewhat surrounding but not clasping the stem, shining when dry; nerves 0.8 to 1 cm apart, spreading, anastomosing, rather distinct beneath but slender, the reticulations lax. Peduncles axillary, slender, about 8 cm long, apparently few-flowered. Pedicels about 1.5 cm long, slightly thickened upward, and somewhat sulcate or angled at the apex. Sepals persistent, oblong-ovate, acute or obtuse. Ovary glabrous, 3-celled, cells 1-ovuled; styles 3, cleft nearly to the base.

MINDANAO, District of Zamboanga, Port Banga, *For. Bur. 9343 Whitford & Hutchinson,* January 14, 1908, in dipterocarp forests, altitude about 30 m.

This species has been described from imperfect material, no flowers having been seen, and only one immature fruit; it belongs, with very little doubt, to the genus *Ostodes,* and is well characterized by its sessile, very long and narrow leaves which are abruptly cordate at the rather broad base.

OSTODES MACROPHYLLA (Muell.-Arg.) Benth. ex Pax in Engl. Pflanzenreich 47 (1911) 18.

Tritaxis macrophylla Muell.-Arg. in Flora 47 (1864) 482.

Trigonostemon macrophyllus Muell.-Arg. in Linnaea 34 (1865) 213, DC. Prodr. 15[2] (1866) 1106.

Ostodes serrato-crenata Merr. in Philip. Journ. Sci. 4 (1910) Bot. 283.

Pax is perfectly correct in his recent reduction of *Ostodes serrato-crenata* Merr. to *O. macrophylla* (Muell.-Arg.) Benth.,[21] a conclusion I had already reached from an examination of the abundant material now in the Herbarium of the Bureau of Science. It is represented by the following material:

LUZON, Province of Cagayan, *For. Bur. 7078, 11271 Klemme, For. Bur. 15247 Bernardo:* Province of Laguna, *For. Bur. 22305 Mariano, Bur. Sci. 10051, 10966 Ramos, For. Bur. 17637 Curran.* SIBUYAN, *Elmer 12366, 12480*, April, May, 1910.

It is also represented by a specimen from Sarawak, Borneo, *Foxworthy 141*, so that its known range is now from the Malay Peninsula, through northern Borneo to Sibuyan, central and northern Luzon.

PHYLLANTHUS Linnaeus.

PHYLLANTHUS LUZONIENSIS sp. nov. § *Cicca, Prosorus.*

Arbor parva, 6 ad 9 m alta, dioica, decidua, partibus junioribus plus minusve ciliatis, vetustioribus glabris; foliis subellipticis vel oblongo-obovatis, rotundatis, usque ad 5 cm longis; floribus 4-meris, ♂ fasciculatis, tenuiter pedicellatis, biseriatim 4-partitis, disco annulari, disciformi; fructibus crustaceis, in valvis 4 dehiscentibus.

A small, dioecious, deciduous tree 6 to 9 m high, in age quite glabrous, but the young branchlets, young leaves, and flowers more or less ciliate with weak, scattered, brownish hairs. Branches terete, grayish, the branchlets lenticellate, slender, sometimes reddish-brown. Leaves when young, at time of anthesis, membranaceous, in age becoming quite glabrous, scattered, subcoriaceous, subelliptic to oblong-obovate or obovate, usually rounded at the apex or obtuse, the base acute, 2.5 to 5 cm long, 1 to 2.5 cm wide, shining, the lower surface a little paler than the upper one; nerves slender, 5 or 6 on each side of the midrib, anastomosing, the reticulations not prominent; petioles slender, 2 to 4 mm long; stipules lanceolate, acuminate, ciliate, deciduous, about 1.5 mm long. Male flowers fascicled, appearing with the leaves, their pedicels slender, 5 to 8 mm long, ciliate. Perianth-lobes 4, in two pairs, 1.5 to 1.8 mm long, slightly ciliate, two broadly ovate to obovate, rounded, about 1.5 mm wide, the other two oblong, about 0.8 mm wide. Disk annular, disciform, about

[21] Pflanzenreich 52 (1912) 286.

0.8 mm in diameter. Stamens 4, the filaments 1.5 mm long, free; anthers 0.8 mm long, opening by vertical slits. Female flowers not seen, apparently solitary, their pedicels, in fruit, up to 1.5 cm long, the persistent calyx of 4, reflexed, broadly ovate, 2 mm long sepals, the disk annular, disciform, about 1.3 mm in diameter. Fruit globose, glabrous, crustaceous, about 8 mm in diameter, splitting into 4 valves, containing 3 or 4 seeds. Seeds 4 mm long, their outer surface convex, the inner two plane, usually of a brilliant blue color.

LUZON, Province of Pampanga, Mount Arayat, *For. Bur. 17698 Curran* (type), March, 1910, on dry slopes, altitude about 50 m, male flowers: Province of Nueva Ecija, *For. Bur. 8435 Curran*, with very old fruits, *For. Bur. 14320 Saraca*, sterile: Province of Bataan, Mount Mariveles, on dry slopes, altitude 10 to 200 m, *For. Bur. 6348, 6391 Curran*, sterile. CORREGIDOR, *For. Bur. 13225 Curran*, September, 1911, with mature fruits.

This species apparently belongs in the subsection *Prosorus* of the section *Cicca*, following Mueller's classification. I am of the opinion, however, that the subsection *Eucicca* should be maintained as a distinct genus, *Cicca*, as originally proposed by Linnaeus, and as recently considered by Doctor Robinson. The present species very strongly resembles *Fluggea virosa* Baill., in its vegetative characters and in its inflorescence, especially those specimens collected at time of anthesis. Several sterile specimens were collected by Mr. Curran, with the hope that the species could be determined from such material, as the species is abundant locally on dry hills, and is one of the dominant if not the dominant species over considerable areas in the Provinces of Bataan, Pampanga, and Nueva Ecija. Although the male flowers have been known for some time, our material did not show any of the details of the female flowers until it was recently collected on Corregidor Island by Mr. Curran.

PHYLLANTHUS ROBINSONII sp. nov. § *Emblicastrum?*

Frutex circiter 2 m altus, glaber; foliis distichis, imbricatis, coriaceis, nitidis, 4 ad 7 mm longis, anguste obovatis, leviter obliquis, acutis, nervis obsoletis; floribus ♀ solitariis, 5-meris, sessilibus, 2.5 ad 3 mm longis, disco angusto, ovario anguste ovoideo, stylis brevissime 3-lobatis.

A shrub about 2 m high, glabrous, the branches slender, terete, rather stiff, grayish or brownish, the branchlets 4 to 6 cm long, slender, distinctly angled, solitary, in pairs, or somewhat fascicled at the nodes. Leaves numerous, small, shining, distichous, imbricating, narrowly oblong-obovate, somewhat oblique, 4 to 7 mm long, 2 to 3 mm wide, acute, subsessile, the midrib very obscure, the lateral nerves obsolete; stipules about 1 mm long, deciduous. Female flowers solitary, sessile, axillary, in a single row on the lower side of the branchlets, the bracteoles lanceolate, acuminate, brown, 1.5 mm long. Perianth 2 to 2.5 mm long, the lobes 5, unequal, oblong, obtuse, coriaceous, 1.5

to 1.8 mm long, or the inner one shorter. Disk annular, narrow, distinct. Ovary narrowly ovoid, 1.2 mm long, glabrous; style about 1 mm long, columnar, exserted about 0.5 mm, brown, very slightly 3-lobed at the apex. Male flowers unknown. Fruit globose, about 3.5 mm in diameter, slightly villous, splitting into cocci.

CEBU, Buacao, *Bur. Sci. 11059 Ramos*, March 19, 1912, on dry hills.

This species is similar to, and probably closely allied to *Phyllanthus curranii* C. B. Rob., although its male flowers being unknown, its proper section is uncertain. It is distinguishable by its nerveless leaves. Another form, apparently undescribed, from Bataan Province, Luzon, is apparently still more closely allied than is *P. curranii*, but its leaves have distinct nerves.

SAPIUM P. Browne.

SAPIUM SANCHEZII sp. nov. § *Parasapium*.

Arbor parva circiter 5 m alta, glabra, vel partibus junioribus parce pubescentibus; foliis oblongis vel oblongo-ellipticis, chartaceis vel subcoriaceis, usque ad 10 cm longis, acute acuminatis, basi acutis vel rotundatis, margine leviter crenato-serratis, nervis utrinque 15 ad 20, haud prominentibus; capsulis ovoideis, 2 cm longis, inermibus, abrupte acuminatis; seminibus ellipsoideis, glabris, maculatis, 8 mm longis.

A small tree, about 5 m high *fide* Bolster, glabrous, or the young twigs sparingly pubescent (inflorescence not seen). Branches terete, gray, lenticellate, the twigs reddish-brown. Leaves alternate, oblong to oblong-elliptic, chartaceous or subcoriaceous, 5 to 10 cm long, 2 to 3 cm wide, the upper surface usually shining, the lower dull, often somewhat glaucescent, the apex usually sharply acuminate, base acute or somewhat rounded, 2-glandular or glandless, margins finely crenate-serrate; nerves 15 to 20 on each side of the midrib, slender, not prominent, spreading, somewhat curved, anastomosing, the reticulations not distinct; petioles slender, about 8 mm long. Inflorescence terminal, flowers not seen. Pedicels in fruit 1.5 to 2 cm long, the young fruits apparently fleshy, their style-arms terete, recurved. Mature fruits ovoid, black and shining when dry, 2 cm long, nearly as wide, unarmed, obscurely reticulate, the base broadly rounded or somewhat heart-shaped, the apex abruptly sharply acuminate, composed of 3 dehiscent cocci, the mesocarp hard, woody, the columella short. Seeds ellipsoid, 8 mm long, equally rounded at both ends, not at all keeled, smooth and shining, one side nearly black, but the most of the surface blotched and spotted with grayish-brown.

MINDANAO, Province of Surigao, Surigao, *F. H. Bolster 373*, August 15, 1906 (type), along tidal streams; Mainit, *J. F. Quadras 209*, ex herb.

Ateneo de Manila, locally known as *bantiyano:* District of Cotabato, *For. Bur. 18784 Tarrosa, Miranda, & Rafael, For. Bur. 18289 Miranda,* June, 1912.

A species manifestly closely allied to *Sapium virgatum* Hook. f. and to *S. indicum* Willd., differing from the former in its smaller fruits and differently shaped seeds. From the latter it differs in its ovoid, prominently acuminate, not depressed-globose fruits and in its smaller, differently shaped, not at all keeled seeds. Dedicated to Father Francisco Sanchez of the Ateneo de Manila.

SAUROPUS Blume.

SAUROPUS ROBINSONII sp. nov. § *Ceratogynum.*

Frutex erectus, glaber, 1 ad 1.5 m altus, ramis teretibus, ramulis plus minusve angulatis vel angustissime alatis; foliis alternis, oblongo-ovatis ad anguste ovatis, membranaceis vel chartaceis, usque ad 18 cm longis, acuminatis, basi rotundatis vel subacutis, breviter petiolatis, nervis utrinque 7 vel 8; floribus ♂ 3 ad 4.5 mm, ♀ 6 ad 8 mm diametro.

An erect, monoecious, slightly branched, glabrous shrub 1 to 1.5 m high, the stems naked, the leaves mostly at the top; branches terete, the branchlets more or less compressed, often narrowly winged, frequently somewhat zig-zag. Leaves oblong-ovate to narrowly ovate, membranaceous or chartaceous, 8 to 18 cm long, 3 to 8 cm wide, olivaceous when dry, somewhat shining on both surfaces, the lower surface a little paler than the upper one, apex acuminate, base rounded or subacute; nerves 7 or 8 on each side of the midrib, prominent beneath, curved, anastomosing, the reticulations rather lax, distinct; petioles about 3 mm long; stipules lanceolate, acuminate, 4 to 5 mm long. Male flowers axillary, fascicled, few in each axil, their pedicels 4 to 9 mm long. Calyx 3 to 4.5 mm in diameter, 6-lobed, the lobes broadly ovate, rounded, their appendages surrounding the anthers, thick, erect, suborbicular, 0.5 mm long or less. Female flowers axillary, solitary, subpendulous, their pedicels 2 to 2.5 cm long, thickened upward, in fruit elongated, and up to 6 cm in length. Calyx dull-red, 6 to 8 mm in diameter, the lobes 6, broadly ovate, obtuse or acute, imbricate, 3 to 3.5 mm long, persistent, somewhat accrescent in fruit and 5 to 6 mm long. Ovary 3-celled; cells with two ovules; stigma broad, flat, about 3 mm in diameter, the branches stout, recurved, borne on the margin of the truncate top of the ovary. Fruit pink or red, somewhat fleshy, subglobose, 1 to 1.5 cm in diameter, ultimately dehiscent, 3-celled, 6-seeded.

LUZON, Benguet Subprovince, Baguio, *Elmer 6441* (type), June, 1904, *6308,* May, 1904; Twin Peaks, *Elmer 5907,* March, 1904. MINDANAO, Lake Lanao, Camp Keithley, *Mrs. Clemens 939,* February, 1907.

A distinct species, entirely different from the two previously known from the Archipelago. Named in honor of Dr. C. B. Robinson, formerly of the Bureau of Science, who monographed the Philippine *Phyllanthinae*.[20] The material cited above had been distributed into the herbarium without having been studied, as *Solanum* sp., and hence was overlooked by him.

TRIGONOSTEMON Blume.

TRIGONOSTEMON EVERETTII sp. nov.

Arbor parva, inflorescentiis gemmisque exceptis glabra; foliis chartaceis, oblongis, nitidis, acuminatis, basi acutis, integris, usque ad 18 cm longis, nervis utrinque 6 ad 8, petiolo 1 ad 2 cm longo; inflorescentiis brevibus, oppositifoliis, cymosis, paucifloris; floribus 5-meris, ♂ circiter 1.5 cm diametro, petalis obcordatis; antheris 3, filamentis supra liberis; fructibus circiter 8 mm diametro, ovoideis vel subglobosis.

A small tree or shrub about 6 m high, glabrous except the buds and the slightly pubescent inflorescence. Branches slender, terete, reddish-brown or grayish, the ultimate ones about 1 mm in diameter. Leaves alternate, chartaceous, when dry brownish, somewhat shining, of about the same color on both surfaces, oblong, 7 to 18 cm long, 2 to 6.5 cm wide, apex rather prominently acuminate, the base acute, with usually two small glands on the upper surface at the junction with the petiole, shortly 3-nerved; nerves 6 to 8 on each side of the midrib, rather prominent, curved-ascending, anastomosing near the margin, the reticulations rather lax, distinct; petiole 1 to 2 cm long. Cymes leaf-opposed, as long as the petiole or somewhat shorter, slightly appressed-pubescent, each with 3 to 5 branches, the flowers racemosely disposed, but one or two developing at a time, each pedicel subtended by 2, oblong, 1.5 mm long bracteoles, the pedicel and the two bracteoles forming a whorl. Flowers red, monoecious, 5-merous. Male flowers: Pedicels slender, about 1 cm long. Sepals 5, free, elliptic-oblong, imbricate, obtuse, concave, about 4 mm long, 2 mm wide. Petals 5, free, imbricate, spreading, about 8 mm long, 7 mm wide, broadly obovate and the apex deeply retuse, or obcordate, apex broad, the sinus narrow, rounded, about 3 mm deep, the lobes broadly rounded, base narrowed, acute. Disk flat, entire, about 1.5 mm in diameter, the glands none. Staminal column 1.5 to 2 mm long; anthers 3, 0.8 to 1 mm long, basifixed, the cells close, parallel, dehiscing longitudinally; filaments 0.5 mm long, spreading. Rudimentary ovary none. Capsules ovoid or subglobose, about 8 mm in diameter, of three dehiscent 1-seeded cocci, the pedicels about

[20] This Journal 4 (1909) Bot. 71–105.

3 cm long, thickened upwards, the persistent sepals 5, reflexed, oblong, about 4 mm long.

NEGROS, Mount Silay, in forests at an altitude of about 500 m, *For. Bur. 7257 Everett*, (type) September, 1907; Sicaba River, *For. Bur. 5584 Everett*, November, 1906.

This very characteristic species is not referable to any recognized section of the genus *Trigonostemon*, although it apparently belongs in that genus. In essential characters it agrees with *Trigonostemon*, differing in its leaf-opposed cymose inflorescence, and in its filaments being united below into a column but free and spreading above. It is possible that the examination of a full series of specimens and direct comparison with the known species of *Trigonostemon* may show the characteristic features of the present species to be sufficiently distinct to warrant its separation as a distinct genus.

TRIGONOSTEMON OBLONGIFOLIUS sp. nov. § *Eutrigonostemon.*

Arbor parva usque ad 6 m alta, subglabra; foliis oblongis, usque ad 18 cm longis, integris, obtusis, basi acutis, coriaceis, nervis utrinque circiter 9, distantibus, reticulis subobsoletis; petiolo 1.5 ad 2.5 cm longo; paniculis angustis, axillaribus, folia subaequantibus, longe pedunculatis; floribus ♂ numerosis, subfasciculato-glomeratis, 3 mm longis; antheris 3, apice haud bifidis; capsulis depresso-globosis, pubescentibus, circiter 1 cm diametro.

A small tree or a shrub 6 m high or less, nearly glabrous. Branches terete, brownish, striate when dry, glabrous, the growing parts more or less fulvous-hirsute with appressed hairs, these hairs often persisting in the axils of the petioles. Leaves alternate, entire, oblong, coriaceous, 9 to 18 cm long, 2.5 to 5 cm wide, coriaceous or subcoriaceous, narrowed at both ends, the apex obtuse, the base acute, glabrous or nearly so, rather pale when dry, somewhat shining, the lower surface often brownish; nerves about 9 on each side of the midrib, distinct on the lower surface, curved-anastomosing, the reticulations obsolete or nearly so; petioles 1.5 to 2.5 cm long, sparingly appressed-pubescent, ultimately glabrous or nearly so. Panicles axillary, solitary, narrow, long- and slenderly peduncled, slightly pubescent, the peduncles 7 to 10 cm long, less than 1 mm in diameter. Male flowers very numerous, more or less glomerate-fascicled, pedicelled, the bracts lanceolate, 2 to 3 mm long, the bracteoles much smaller. Sepals imbricate, the outer two about 1.6 mm long, the inner three larger, about 2.5 mm long, orbicular-ovate, concave, imbricate. Petals 5, dark-purple when dry, free, obovate, about 3 mm long, 2.5 mm wide, apex rounded-truncate, base much narrowed. Disk cupular, truncate, about 0.4 mm high. Filaments entirely united, nearly 1 mm long;

anthers 3, at the top of the staminal column, about 0.7 mm long, 2-celled, extrorse, apex scarcely bifid or divaricate. Female flowers not seen, 5-merous. Pedicels in fruit about 1.5 cm long, thickened upwards, the persistent calyx about 6 mm in diameter, the lobes ovate, 1.5 to 2 mm long. Ovary densely villous; stigmas 3, cleft, the lobes 0.5 mm long. Mature capsules depressed-globose, about 8 mm long, 10 mm wide, appressed-hirsute externally, pale, splitting into 3 dehiscent cocci. Seeds ovoid, smooth, mottled, somewhat pointed at one end, about 6 mm long.

LUZON, Province of Cagayan, Abulug River, *Bur. Sci. 13965 Ramos* (type), February, 1912; trail between Viola and Mount Narig, *For. Bur. 19604 Curran*, January, 1912, both with male flowers: Province of Ilocos Norte, *Bur. Sci. 7745 Ramos*, March, 1909, with mature fruits.

A species probably most closely allied to *Trigonostemon sumatranus* Pax & K. Hoffm., but with differently shaped, obtuse, not caudate-acuminate leaves, narrow panicles, etc.

An allied species is represented by *Trigonostemon longipedunculatus* (Elm.) Leafl. Philip. Bot. 4 (1911) 1306 (*Croton longipedunculatus* Elm. l. c. 1 (1908) 311, represented by *Elmer 7264* from Leyte, and *Piper 325* from Butuan Subprovince, Mindanao. *T. longipedunculatus* Elm., differs, however, from the species above described, in its larger, sparingly appressed-hirsute leaves which are acute or acuminate, not obtuse, and which have from 15 to 18 pairs of lateral nerves.

THE PHILIPPINE JOURNAL OF SCIENCE, C. BOTANY.
Vol. VII, No. 6, December, 1912.

ROXBURGH'S HORTUS BENGALENSIS.

By C. B. ROBINSON.

(From the New York Botanical Garden, New York, U. S. A.)

Carey's introduction to this work is dated June 4, 1814, and shows that the text had already been printed;[1] the title-page is dated 1814. Consecutively paged after the *Hortus Bengalensis*, is "A Catalogue of Plants, described by Dr. Roxburgh, in his Mss. Flora Indica, but not yet introduced into the Botanical Garden." Although its title-page is dated 1813, it must have been printed after the *Hortus Bengalensis*, of which it practically forms a part, and it appears safe to keep the accepted date, 1814, as that of publication of both.

Together, these contain nearly 4,000 binomial names, and it has been customary to consider either, that all such as appear for the first time are therein published, or that none of them are deserving of such recognition. A brief consideration of four cases, each typical of many, will be sufficient to show that the binomial names of the *Hortus Bengalensis* fall into at least four classes.

Systematic names.	*Synonyma & Remarks.*	*Native place.*	*Donors and time, &c.*	*Duration & habit.*	*Time of flowering.*	*Time of seed.*
CANNA.						
glauca		America	W. Hamilton, Esq. 1799.	H. E.	R. S.	C. S.
PHRYNIUM.						
dichotomum, R.	H. Seetul-patee. 3.	India, &c	1795	♄ E.	H. S.	7-8.
spicatum, R.		Pegu	Mr. F. Carey, 1809.	♃ E.	R. S.	
GRATIOLA.						
amara, R. 5.		Moluccas	H. C. 1800	C. S.	☉. D. C. S.	

[1] "In examining the catalogue, several errors in the terminations of the specific names have been detected ..... The greatest part of it was printed off before this was discovered."

There is clearly no sufficient description for publication of the name *Canna glauca,* but this had already been accomplished by Linnaeus.[2] Neither is *Phrynium spicatum* published, but this is its first appearance, and Roxburgh himself subsequently [3] printed for it a sufficient diagnosis.

The "3" after *Phrynium dichotomum* refers to a footnote, which is "S. Seetula-putrika. H. A. 4. t. 7." This enables the insufficient information given in the text to be supplemented by the figure cited in Rumphius' *Herbarium Amboinense,* which is accompanied by text, and is an ample description of the species. But Roxburgh had already [4] published this name.

Similarly, the "5" after *Gratiola amara,* points to the footnote "Karanga amara. Vahl. H. A. 5. t. 170. f. 1." This is the first appearance of *Gratiola amara,* and it is here published. Vahl actually wrote the generic name as *Caranga,*[5] and Jussieu as *Curanga;*[6] both cited the figure of *Herbarium Amboinense.*

There are ninety-one cases, approximately of the same nature as the last of these, where a new binomial is published, by citation either of a previous binomial, or of a sufficient description with or without a plate. Admittedly, some of those referring to a previous binomial do so merely by inference, the generic name only being given. However, even these would be considered to be published, by almost all botanists, when the specific name was used by the author cited under the given generic name. As it happens, this is not always true of the new combinations made in such fashion by Roxburgh; some, therefore, must be rejected as unpublished; and no other of the names in the *Hortus Bengalensis* based on a binomial of earlier authors has stood the test of time. *Oldenlandia herbacea* may prove to be an exception.

It may fairly be questioned whether there was any intention of publishing species in the *Hortus Bengalensis,* but Carey, at least, thought that this was being done. "The number of described species now in the garden amounts to about Three Thousand Five Hundred; for the knowledge of no fewer than One Thousand Five Hundred and Ten of which, as named and described in this catalogue, we are indebted to his (Roxburgh's) indefatigable and discriminating researches." There is much reason to believe, if from nothing else than the title of the second

[2] Sp. Pl. (1753) 1.
[3] Fl. Ind. 1 (1820) 5.
[4] As. Res. 11 (1810) 324.
[5] Enum. Pl. 1 (1805) 100.
[6] Ann. Mus. Hist. Nat. 9 (1807) 319.

part of the catalogue, that all of these had been written up by Roxburgh for his *Flora Indica* from living plants; and that he would have considered the plates cited in the *Hortus Bengalensis* mere synonyms, rather than the foundation for his species. We are nevertheless confronted with the fact, that they can not be considered as published in the earlier work except by the citation of these plates, and that substantially similar publication by very many other authors has obtained universal recognition. For various reasons, it seems desirable to list the species that appear to have been published in the *Hortus Bengalensis*.

Species Published	On Page	By Citation of
Gratiola amara	4	*Karanga amara* Vahl; H. A. 5. *t. 170. f. 1.*
Gratiola integrifolia	4	H. M. 9. *t. 57.*
Anthistiria cymbaria	6	*Andropogon cymbarius* Linn. Mant. 303.
Andropogon bicolor	7	*Holcus* Linn.
Andropogon saccharatum	7	*Holcus* Linn.
Panicum spicatum	7	*Holcus spicatus* Linn.
Ixora fulgens	10	H. A. 4. *t. 46.*
Ixora stricta var. 1.	10	H. A. 4. *t. 47.*
Ixora stricta var. 2.	10	B. M. 169.
Ixora barbata	10	H. M. 2. *t. 13.*
Pladera virgata	10	*Exacum diffusum* Willd.
Pladera pusilla	10	*Hopea dichotoma* Vahl. *Exacum sessile* Willd.
Oldenlandia alata	11	*Hedyotes racemosa* Willd.
Oldenlandia crystallina	11	*Hedyotes pumila* Willd.
Oldenlandia diffusa	11	*Hedyotes diffusa* Willd.
Oldenlandia herbacea	11	*Hedyotes herbacea* Willd.
Brucea sumatrana	12	H. A. 7. *t. 15.*
Ipomoea sepiaria K.[7]	14	H. M. 11. *t. 53.*
Morinda bracteata	15	H. M. 1. *t. 52.*
Scaevola Taccada	15	H. M. 4. *t. 59.*
Cordia campanulata	17	H. A. 2. *t. 75.*
Vitis latifolia	18	H. M. 7. *t. 7.*
Heliconia buccinata	19	H. A. 5. *t. 62. f. 2.*
Achyranthes triandra	19	H. M. 10. *t. 11.*
Echites coryophyllata	20	H. M. 9. *t. 14.*
Tabernaemontana crispa	20	H. M. 1. *t. 46.*
Asclepias annularia	20	H. M. 9. *t. 7.*
Asclepias pseudosarsa	20	H. M. 10. *t. 34.*
Asclepias odoratissima	20	H. M. 7. *t. 26. f. 1.*
Panax conchifolium	21	H. A. 4. *t. 31.*
Semecarpus Cassuvium	22	H. A. 1. *t. 70.*
Crinum Toxicarum	23	H. A. 6. *t. 69.*
Curculigo sumatrana	24	H. A. 6. *t. 53.*

[7] Koenig.

Species Published	On Page	By Citation of
Dracaena angustifolia	24	H. A. 4. *t. 35.*
Yucca superba	25	*Agave tuberosa* Hort. Kew.
Bambusa baccifera	25	H. M. 1. *t. 60.*
Bambusa spinosa	25	H. A. 4. *t. 3.*
Leersia aristata	26	H. M. 10. *t. 12.*
Polygonum rivulare	29	H. M. 12. *t. 76.*
Laurus malabathrica	30	H. M. 5. *t. 53.*
Laurus porrecta	30	Marsd. Sumat. p. 129.
Caesalpinia paniculata	32	H. M. 6. *t. 19.*
Garuga pinnata	33	H. M. 4. *t. 33.*
Jussiaea exaltata	33	H. M. 2. *t. 50.*
Bergia ammannioides	34	*Lechea verticillata* Willd.
Metrosideros vera	37	H. A. 3. *t. 7.*
Diospyros Sapota	40	*Sapota-nigro* Sonnerat.
Callophyllum Bintagor	41	H. A. 2. *t. 71.*
Ajuga disticha	44	*Ballota disticha.*
Ajuga fruticosa	44	*Nepeta malabarica.*
Plectranthus aromaticus	45	H. A. 5. *t. 101.*
Plectranthus strobiliferus	45	H. M. 10. *t. 90.*
Ruellia zeylanica	46	H. M. 9. *t. 45.*
Ruellia cernua	46	H. A. 6. *t. 23. f. 1.*
Volkameria infortunata	46	*Clerodendrum.*
Gmelina arborea	46	H. M. 1. *t. 41.*
Columnea balsamica	47	H. M. 9. *t. 85* & 12. *t. 36.*
Modecca tuberosa	49	Modecca. H. M. 8. *t. 20.*
Sterculia guttata	50	H. M. 4. *t. 61.*
Hibiscus tortuosus	51	H. M. 1. *t. 30.*
Carpopogon giganteum	54	H. M. 8. *t. 36.*
Dolichos virosus	55	H. M. 8. *t. 45.*
Aeschynomene spinulosa	56	*Coronilla aculeata* Willd.
Hedysarum Neli-tali	57	H. M. 9. *t. 18. Aeschynomene* L.
Melaleuca Cajuputi	59	H. A. 2. *t. 17. f. 1.*
Serratula anthelmentica	60	*Vernonia* Willd.
Serratula cinerea	60	*Conyza* L.
Arum viviparium	65	H. M. 12. *t. 9.*
Arum gracile	65	H. M. 11. *t. 21.*
Calla oblongifolia	65	H. A. 5. *t. 108.*
Ficus infectoria	66	H. M. 3. *t. 64.*
Ficus Tsiela	66	H. M. 3. *t. 63.*
Ficus racemifera	66	H. A. 3. *t. 93.*
Gnetum scandens	66	H. M. 7. *t. 22;* H. A. 5. *t. 7, 8.*
Urtica tenacissima	67	Marsd. 75.
Morus paniculata	67	H. A. 4. *t. 56.*
Sagus spinosus	68	*Sagus laevis* H. A. 1. p. 76; Willd. 4. 404–5.
Sagus inermis	68	*Sagus genuina* H. A. 1. p. 75. *t. 17* & *18.*
Saguerus Rumphii	68	H. A. 1. *t. 13. Arenga* Labillard.
Phyllanthus Leucopyrus	69	*Fluggea* Willd.
Sapium sebiferum	69	*Croton* Linn. *Stillingia* Willd.
Bradleia multilocularis	69	*Agyneja* Willd.

Species Published	On Page	By Citation of
Bradleia pinnata	69	*Phyllanthus obscurus* Willd.
Pandanus furcatus	71	H. M. 2. *t. 8.*
Batis spinosa	71	H. A. 5. *t. 15. f. 2.*
Calamus latifolius	73	H. M. 12. *t. 65.*
Lycopodium aristatum	75	Dill. Musc. *t. 66. f. 7.*
Ophioglossum filiforme	75	H. M. 12. *t. 34.*
Polypodium excavatum	75	H. A. 6. *t. 35. f. 1.*
Pteris scandens	75	H. M. 12. *t. 35.*
Eranthemum montanum	80	*Justicia montana* Cor. Pl.
Piper arborescens	80	H. A. 5. *t. 28. f. 1.*

The following are at first sight in the same class, but must be held unpublished, except possibly *Pandanus Millore.*

Name.	Page.	Remarks.
Eleusine stricta	8	"*Cynosurus* Linn." There is no *Cynosurus strictus* Linn.
Cerbera quaternifolia	19	"H. A. 2. *t. 363.*" There is no such plate, and no other means of identifying the species.
Crinum brevifolium	23	"See asiaticum. Curt. Mag. 1073."
Hedysarum lagenaria	57	"*Aeschynomene* L." There is no *Aeschynomene lagenaria* Linn., though there is one of Loureiro. Roxburgh's name, at the utmost, is a synonym.
Leucacephala graminifolia	68	"*Eriocaulon* Linn." There is no *Eriocaulon graminifolium* Linn., nor was the generic name *Leucacephala* ever published.
Leucacephala spathacea	68	Same as preceding.
Pandanus Millore	71	"Nicobar bread fruit tree, As. Res. 3. 161. seems only a variety of *odoratissima.*"

A short supplementary list might be made of species where Roxburgh's spelling differs somewhat strikingly from that of preceding authors, but where he apparently had no intention of forming new names. Perhaps the best cases of this are *Jasminum Zambac, Pettospermum Tobira, Laurus Culitlaban, Vitex trifoliata,* and *Piper Malmaris.*

This list is based on the assumption that a published binomial can never be used for any species other than that to which it was originally applied, whether or not the name be valid in the genus to which it was attributed or in any other to which it may be transferred. There are about 185 additional names in the *Hortus Bengalensis* which would be considered as published therein, were it not that they had already been used. In nearly all of these cases, Roxburgh was correctly using names which

had previously been published by other authors; occasionally, his identification is considered wrong. Thus *Cyperus procerus* Roxb. is distributed by Clarke [8] between *Cyperus malaccensis* Lam., *Pycreus puncticulatus* Nees, and (herbarium only) *Cyperus tuberosus* Rottb. But if *Cyperus procerus* Roxb. be considered as described in the *Hortus Bengalensis,* it is by the citation of Rheede's Hortus Malabaricus **12**: *pl. 50,* which according to Clarke would identify it with *C. malaccensis* Lam. However, there is an older *C. procerus.*[9]

Returning to the ninety-one names published in the *Hortus Bengalensis,* investigation shows that the priority of singularly few is changed by the throwing back of the date of publication. On the other hand, the new means of typifying them raises or solves many intricate problems. These will briefly be stated.

The following remain unchanged as good species: *Oldenlandia diffusa, Brucea sumatrana, Dracaena angustifolia, Garuga pinnata, Bergia ammannioides, Sterculia guttata, Ficus Tsiela, Sapium sebiferum,* and *Calamus latifolius. Morinda bracteata* is also unaffected, but there is grave doubt as to its value as a species. But *Ficus racemifera* Roxb. replaces *F. variegata* Bl. *Metrosideros vera* and *Gmelina arborea* are to be credited to Roxburgh, instead of to Lindley and Linnaeus, respectively.

Half of the names have no importance except as synonyms, except that a few, with unaltered status, form the basis for generally accepted binomials. The synonyms are: *Gratiola amara, Pladera virgata, Pladera pusilla, Scaevola Taccada, Cordia campanulata, Vitis latifolia, Heliconia buccinata, Achyranthes triandra, Asclepias pseudosarsa, Asclepias odoratissima, Panax conchifolium, Crinum Toxicarum, Curculigo sumatrana, Yucca superba, Leersia aristata, Polygonum rivulare, Caesalpinia paniculata, Jussiaea exaltata, Diospyros Sapota, Calophyllum Bintagor, Ajuga disticha, Ajuga fruticosa, Plectranthus strobiliferus, Ruellia zeylanica, Volkameria infortunata, Columnea balsamica, Modecca tuberosa, Hibiscus tortuosus, Carpopogon giganteum, Dolichos virosus, Aeschynomene spinulosa, Hedysarum Neli-tali, Melaleuca Cajuputi, Serratula anthelmentica, Serratula cinerea, Arum viviparium, Arum gracile, Urtica tenacissima, Saguerus Rumphii, Phyllanthus Leucopyrus, Bradleia multilocularis, Bradleia pinnata, Ophioglossum filiforme, Polypodium excavatum, Pteris scandens,* and *Eranthemum montanum.*

The remaining thirty-two cases all require comment, some of

[8] Fl. Brit. Ind. **6** (1893) 608, 593, 616.
[9] Rottb. Descr. Nov. Pl. (1773).

the issues raised being of considerable importance. In several cases, new specific combinations seem to be necessary, but as it is not possible here to form definite conclusions on the actual merits of the problems, except in the case of a few species, none are herein proposed.

Gratiola integrifolia was placed by Hooker [10] under *Vandellia erecta* Benth., but he appears to have been in doubt as to the identity of Roxburgh's species. Rheede's figure and description both show 2-stamened flowers, whereas in *Vandellia,* the number of stamens is always 4.

Andropogon bicolor, Andropogon saccharatus, and *Anthistiria cymbaria* are treated by Hackel [11] as different from *Holcus bicolor* Linn., *Holcus saccharatus* Linn., and *Andropogon cymbarius* Linn., respectively, but they must be typified by those species.

Panicum spicatum Roxb. is given by Hooker [12] as a synonym of *Pennisetum typhoideum* Rich., but the oldest name cited by him is *Panicum americanum* Linn., still valid for transfer to *Pennisetum.*

Ixora fulgens, I. stricta, and *I. barbata* are all maintained by Hooker,[13] but as the plates on which they are based are not cited by him, no opinion can be formed as to whether they represent the original types.

Oldenlandia alata Koenig is also retained by Hooker [14] as a good species, but *O. alata* Roxb. is based on *Hedyotis racemosa* Willd., which is Lamarck's species of that name, and this is said by Hooker generally to be cited under *O. paniculata* Linn., but probably to belong to a different section of the genus.

Oldenlandia crystallina Roxb. is also maintained by Hooker,[15] with *Hedyotis pumila* Linn. f. as a synonym, and *H. pumila* Willd. must be held typified by the Linnaean species. There is no apparent reason for calling the species other than *Oldenlandia pumila* (Linn. f.) DC.

Oldenlandia herbacea Roxb. is based on *Hedyotis herbacea* Willd., which is typified by *H. herbacea* Linn., although the two are treated as doubtfully identical.[16] If, then, *Hedyotis herbacea*

[10] Fl. Brit. Ind. 4 (1884) 281.
[11] DC. Monog. Phan. 6 (1889) 519, 510, 629, 668.
[12] Fl. Brit. Ind. 7 (1896) 82.
[13] Fl. Brit. Ind. 3 (1880) 145–148.
[14] Fl. Brit. Ind. 3 (1880) 70.
[15] Fl. Brit. Ind. 3 (1880) 65.
[16] Fl. Brit. Ind. 3 (1880) 65.

Linn. is the same as *Oldenlandia Heynei* R. Br., the latter name must be replaced by *O. herbacea* (Linn.) Roxb.

Ipomoea sepiaria is maintained,[17] but the oldest name for the species would appear to be *Convolvulus marginatus* Desr. ex Lam., a name still available for transfer to *Ipomoea.*

In the case of *Echites caryophyllata* (to use Carey's permission to correct obvious typographical errors), it is evident from Hooker's [18] discussion that this can not be taken as the basis for the species now known as *Aganosma caryophyllata* (Roxb.) Don; and it also seems that the species known [19] under the name of *Tabernaemontana crispa* Roxb. is not that of the *Hortus Bengalensis. Asclepias annularia* Roxb. is identified [20] as *Holostemma Rheedii* Wall. Roxburgh's name is the oldest, and is available for transfer.

Semecarpus Cassuvium is cited by Engler [21] as of Sprengel, who also published the name, basing it on *Anacardium longifolium* Lam., a Philippine species, said by Lamarck also to grow in India. Rumphius' plant, the basis of *Semecarpus Cassuvium* Roxb., appears to differ from any known Philippine species; and, curiously enough, the apparent position of the matter is that *Semecarpus Cassuvium* Roxb., but not of Sprengel, is the species treated by Engler under that name; while *S. Cassuvium* Spr. is a homonym, its exact identity to be determined by that of *Anacardium longifolium* Lam.

Bambusa baccifera Roxb. appears to be the oldest name for *Melocanna bambusoides* Trin., and to require transfer.[22]

Bambusa spinosa Roxb., as typified by Hort. Amb. 4: *pl. 3,* is probably not *B. arundinacea* Willd., and there are various points in Rumphius' description, which oppose its identification as *B. Blumeana* Schult. f.

Laurus malabathrica Roxb., is considered a doubtful species.[23] *L. porrecta,* by the changed date of publication, becomes the oldest name for *Cinnamomum Parthenoxylon* (Jack) Meissn., and is available for transfer.

Plectranthus aromaticus Roxb. is the basis for *Coleus aromaticus* Benth., but *Coleus amboinicus* Lour. is said to be the oldest name. Roxburgh's species is based solely on Herb. Amb. 5: *pl. 101,* which is also the basis of *Ocimum scutellarioides* Linn.=*Coleus scutellarioides* (Linn.) Benth. If Loureiro's species is the same as the *C. aromaticus* of the *Flora of British*

[17] Fl. Frit. Ind. 4 (1883) 209.
[18] Fl. Brit. Ind. 3 (1882) 664.
[19] Fl. Brit. Ind. 3 (1882) 648.
[20] Fl. Brit. Ind. 4 (1883) 21.
[21] DC. Monog. Phan. 4 (1883) 487.
[22] Fl. Brit. Ind. 7 (1896) 417.
[23] Fl. Brit. Ind. 5 (1886) 136.

India, there is double reason for taking it up. It is based primarily on "Marrubium Amboinicum album Rumph. Amb. 1. 8. c. 75. *tab. 72.*" [24] It has especial importance as the type of the genus *Coleus* Lour.

Ruellia cernua Roxb. is maintained [25] for a species of very local distribution in India, which can hardly possibly be typified by a description founded on a plant of Amboina.

Calla oblongifolia is the basis for *Aglaonema oblongifolium* Schott, but following the synonymy cited, would not have been the oldest name, but for the corrected date of publication.

Ficus infectoria Roxb. is not the species of that name in recent works,[26] but being based on Hort. Malab. 3: *pl. 64,* is *Ficus Tjakela* Burm.

Gnetum scandens Roxb. is maintained in the *Flora of British India,* but its oldest name is *G. edule* (Willd.) Bl., based on the same plate of Rheede.

Morus paniculata Roxb. appears to be the oldest name for *Pipturus velutinus* (Decne.) Wedd.

The treatment of the names *Sagus spinosus* and *S. inermis,* as compared with that of the plates on which they are based, is different in the *Flora of British India* [27] and in the *Hortus Bengalensis.*

Pandanus furcatus Roxb. is maintained,[28] but Rheede's plate on which it was based is cited under *P. fascicularis* Lam.

Batis spinosa Roxb. is treated [29] as the original publication of the species known as *Plecospermum spinosum* Trécul, but with the exclusion of the synonym of Rumphius, which is its sole basis.

Lycopodium aristatum is doubtfully placed by Baker [30] under *Selaginella exigua* Spring.

Piper arborescens Roxb. ex Wall. Cat. is identified [31] as *Thottea dependens* Kl., but there can be no doubt that the true *Piper arborescens,* typified by Herb. Amb. 5: *pl. 28. f. 1,* is a genuine *Piper.*

[24] The plate number is wrong, and a better citation would be Herb. Amb. 5: 294. *pl. 102, f. 2.*
[25] Fl. Brit. Ind. 4 (1884) 413.
[26] Fl. Brit. Ind. 5 (1888) 514, 515.
[27] 6 (1893) 481.
[28] Fl. Brit. Ind. 6 (1893) 484.
[29] Fl. Brit. Ind. 5 (1888) 491.
[30] Fern Allies (1887) 67.
[31] Fl. Brit. Ind. 5 (1886) 74.

Vol. VII, No. 5, including pages 259 to 362, was issued November 15, 1912.

ERRATA.

Page 43, line 8, for born read borne.
Page 63, line 2 from the bottom, for *stiplacea* read *stipulacea.*
Page 102, line 11 from the bottom, for *H. palustris* read *M. palustris.*
Page 196, line 24, for *cannbina* read *cannabina.*
Page 285, line 9, for MAGABOTRYS read MEGABOTRYS.
Page 290, line 19, for SEMICARPUS read SEMECARPUS.
Page 307, line 16, for GUTTIFORAE read GUTTIFERAE.
Page 342, line 3, for *mindorensis* read *mindorense.*
Page 343, lines 7 and 16, for *farimosa* read *farinosa.*
Page 359, line 18, for comprenhensive read comprehensive.

INDEX.

(New genera and species and combinations published for the first time are in **black-faced type**; synonyms and species mentioned incidentally in the text are indicated by the page references being in italics.)

A

Page.

Acanthaceae 103, 248
Achyranthes triandra Roxb. 413, *416*
Acoridium venustulum Ames *26*
Acrocephalus capitatus Benth. *101*
indicus (Burm.) O. K. 101
Adelia glandulosa Blanco *383*
javanica Miq. *391*
papillaris Blanco *238*
Adenogynum discolor Reichb. f. & Zoll. .. *396*
Adiantum cupreum Copel. *55*
flabellulatum L. 55
opacum Copel. *55*
scabripes Copel. 55
Aeschynomene sesban L. *235*
spinulosa Roxb. 414, *416*
Aganosma acuminata G. Don *334*
caryophyllata (Roxb.) Don *418*
velutina A. DC. *334*
Aglaeonema oblongifolium Schott *419*
Aglaia Lour. 274
brachybotrys Merr. 274
cagayanensis Merr. 275
curranii Merr. 276
diffusa Merr. 277
harmsiana Perk. *278*
hexandra Turcz. *275*
llanosiana C. DC. *277*
turczaninowii A. DC. *275*
Aglaomorpha meyeniana Schott *42*
Agrostis matrella L. *230*
Ajuga disticha Roxb. 414, *416*
fruticosa Roxb. 414, *416*
Alangiaceae 319
Alangium Lam. 319
brachyanthum Merr. 319
lamarckii Thwaites *320*
longiflorum Merr. 319
meyeri Merr. 321
octopetalum Llanos *320*
salviifolium (L. f.) Wangerin 319, 320
salviifolium hexapetalum (Lam.) Wangerin *320*, *321*
Alchornea Sw. 382
javensis Muell.-Arg. *383*
mollis Muell.-Arg. *390*
parviflora (Benth.) Muell.-Arg. 382, *390*
rugosa (Lour.) Muell.-Arg. 383
sicca (Blanco) Merr. 382, 383, *390*

Page.

Alcinaeanthus Merr. 379
philippinensis Merr. 380
Alectridia quartiniana A. Rich. *229*
Alpinia L. 75, *78*
vanoverberghii Merr. 75
Alsomitra Roem. 352
clavigera F.-Vill. *353*
integrifoliola (Cogn.) Hayata 353
sarcophylla (Wall.) Roem. 352
Alyxia Banks 330
blancoi Merr. 330
luzoniensis Merr. *331*
monilifera Vid. *330*
parvifolia Merr. *331*
stellata F.-Vill. *330*
Anacardiaceae 281
Anacardium longifolium Lam. *418*
Andropogon L. 228
bicolor Roxb. 413, 417
cymbarius L. *413*, *417*
saccharatus Roxb. 413, 417
squarrosus L. f. *228*
zizanioides (L.) Urb. 228
Aneilema R. Br. 232
malabaricum (L.) Merr. 232
nudiflorum R. Br. *232*
versicolor Dalz. 232
Anodendron A. DC. 331
axillare Merr. 331
candolleanum Wight *332*
loheri Merr. 332
manubriatum (Wall.) Merr. 333
paniculatum A. DC. *332*, *333*
pauciflorum Hook. f. *331*
Anonaceae 109, 234, 266
Anona cherimolia Mill. 112, 113
glabra L. 113, 119
laurifolia Dun. 119
muricata L. 113, 118
palustris L. 119
reticulata L. 113, 117
squamosa L. 113, 115
uncinata Lam. *234*
Anthistiria cymbaria Roxb. 413, 417
Antholyza meriana Blanco *233*
Antidesma Burm. 383
bunius Spreng. *383*
crassifolium (Elmer) Merr. .. 383
cumingianum Muell.-Arg. *384*
mindanaense Merr. 383

Page.
Apocynaceae 242, 330
Aquilaria Lam. 314
Araliaceae 95, 241, 318
Aralia cochleata Lam. *241*
guilfoylei Cogn. & Marché *242*
Ardisia Sw. 323
cagayanensis Merr. 323
jagori Mez *325*
ramosii Merr. 324
scabrida Mez *324*
Artabotrys R. Br. 234
odoratissimus R. Br. *234*
uncinatus (Lam.) Merr. 234
Arthraxon Beauv. 229
ciliaris Beauv. *229*
ciliaris langsdorffii Hack. *229*
ciliaris quartinianus Hack. *229*
hispidus (Thunb.) Merr. 229
quartinianus Merr. 229
Arum gracile Roxb. 414, *416*
viviparium Roxb. 414, *416*
Arundinaria glaucescens Beauv. *230*
Asclepias annularia Roxb. 413, 418
odoratissima Roxb. 413, *416*
pseudosarsa Roxb. 413, *416*
ambiguum Schkuhr *62, 63*
confertum Bak. *62*
lanceum Thunb. *55*
Aspidium stipellatum Bl. *60*
Athyrium carnosum Copel. 61
christii (C. Chr.) Copel. 62
confertum (Baker) Copel. 62
cumingii (Presl) Milde 63
elatum (Fée) Copel. 63
hewitti Copel. 62
lanceum Milde 55
maximum Milde *61*
muricatum Copel. 61
pinnatum (Blanco) Copel. *63*
polycarpum Copel. 61
sarawakense Copel. 62
sorsogonense poense Copel. 61
subserratum (Bl.) Milde *63*

B

Ballota disticha L. *414*
Bambusa Schreb. 230
arundinacea Willd. *418*
baccifera Roxb. 414, 418
blumeana Schult. f. *418*
glaucescens (Willd.) Sieb. 230
nana Roxb. *230*
spinosa Roxb. 414, 418
Bartramia indica L. *239*
Batis spinosa Roxb. 415, 419
Begoniaceae 308
Begonia L. 308
affinis Merr. 308
agusanensis Merr. *309*
ciliifera Merr. *309*
contracta Warb. *310, 312*
crispipila Elmer *311*
cumingii A. Gray 311
elatostematoides Merr. 309
leytensis Elmer *311*
macgregorii Merr. 310
oblongata Merr. 310
quercifolia A. DC. 311
Bergia ammannioides Roxb. 414, 416
Bignoniaceae 352
Blumea DC. 50, 105, 356
bicolor Merr. 356
oxyodonta DC. 251
tenera Merr. 250
vanoverberghii Merr. 105
Blumeodendron Kurz. 384
subrotundifolium (Elmer) Merr. 384
Blyxa Thou. 73
octandra (Roxb.) Planch. 73
roxburghii Rich. *73*
Brabejum lucidum Blanco *330*
Bradleia multilocularis Roxb. 414, *416*
pinnata Roxb. 415, *416*
Brainea J. Sm. *47*
Bridelia Willd. 384
ovata Decne. *385*
platyphylla Merr. 384
subnuda K. Schum. & Lauterb. *385*
Brucea sumatrana Roxb. 413, 416
Bulbophyllum Thou. 23, 125
adenopetalum Lindl. *24, 25*, 126, *128, 131, 134*
alagense Ames 126
antenniferum Reichb. f. 126, *138*
auratum Reichb. f. 126, 139
balaeniceps Reichb. f. 126
bataanense Ames 126
blumei J. J. Sm. 127
bolsteri Ames 126, 139
bontocense Ames 126, 135
braccatum Reichb. f. *24, 25*, 126, 134
canlaonense Ames 126, 136
careyanum Spreng. 126
carinatum Ames 126, 140
cheiri Lindl. 126, 127
chryseum (Kränzl.) Ames 127, 140
clandestinum Lindl. 138
clemensiae Ames 127, 129
copelandii Ames 127
corticola Schltr. 137
cumingii Reichb. f. 127, 139, 143
cuneatum Rolfe 127
curranii Ames 127, 130
cuspidilingue Reichb. f. *127*
dasypetalum Rolfe *24, 25*, 127, 128, 134
dearei Reichb. f. 127
elmeri Ames 127, 136
exile Ames 127
gimagaanense Ames 127, 130
gnomoniferum Ames 127
halconense Ames 127, 136
lancipetalum Ames 23, 127
lasianthum Lindl. 127, 128
lasioglossum Rolfe 127

Page.

Bulbophyllum lepantense Ames 127, 131
leysianum Burbidge *140*
longiflorum Thouars 127, *142*, *143*
luzonense Ames 127, 141, 142
macgregorii Ames 127, 137
makoyanum Reichb. f. 127
marivelense Ames 127, 132
maxillare Reichb. f. 127
merrittii Ames 127
mindorense Ames 127, 137
myrianthum Schltr. 138
napelli Lindl. *126*
nutans Reichb. f. 24, 128
orthoglossum Wendl. & Kränzl. 128
pauciflorum Ames 128, 132
penicillium Par. & Reichb. f. 128
pleurothallioides Ames 128
profusum Ames 128, 137
ramosii Ames *24*, 25, 128, 131
saurocephalum Reichb. f. .. 128
sessile J. J. Sm. 138
stellatum Ames 128, 141
trisetum Ames 128, 142
vagans Ames & Rolfe 128
vanoverberghii Ames 128, 133
vermiculare Hook. f. *131*
weberi Ames *127*, 128, *142*
whitfordii Rolfe 128
zambalense Ames 128, 134

C

Caesalpinia paniculata Roxb. 414, *416*
Calamus latifolius Roxb. 415, 416
Calanthe R. Br. 11
lacerata Ames 11
ramosii Ames 12
Calla oblongifolia Roxb. 414, 419
Callicarpa L. 338
angusta Schauer *341*
cauliflora Merr. 338
dolichophylla Merr. 339
elegans Hayek 338
longifolia subglabra Schauer.. *340*
pentandra Schauer *342*
ramiflora Merr. *339*
rivularis Merr. 340
Calophyllum L. 92, 307
bintagor Roxb. 414, *416*
blancoanum Pl. & Tr. *92*
glabrum Merr. 92
kunstleri King 307
Campanumoea Bl. 104
axillaris Oliv. *104*
truncata Endl. 104
Canna glauca Linn. 411, 412
Cansjera Juss. 265
malabarica Lam. *265*
manillana Bl. *238*
rheedii Gmel. 265
scandens Roxb. *265*

Page.

Capparidaceae 235, 270
Capparis L. 235
baducca Blanco *235*
cordifolia Lam. 235
littoralis Merr. 270
lobbiana Turcz. *270*, *271*
loheri Merr. 270
mariana Jacq. *235*
spinosa mariana K. Sch. *235*
Caranga amara Vahl *413*
Carpopogon giganteum Roxb. 414, *416*
Carumbium populneum Muell.-Arg. *390*
populneum minus Muell.-Arg. *390*
Cephalocroton albicans genuinus Muell.-Arg. *386*
discolor Muell.-Arg. *386*
orientalis Scheff. *386*
Cerbera quaternifolia Roxb. 415
Cestichis Pfitz. 7
compressa Ames *8*
cumingii (Ridl.) Ames 7
Champereia Griff. 233
cumingiana Merr. *233*
griffithiana Planch. *233*
griffithii Kurz *233*
manillana (Blume) Merr. 233
Characeae 69
Chara L. 69
benthami A. Br. 70
brachypus A. Br. 70
braunii Gmel. 70
congesta Spreng. *70*
corallina Willd. 69
corallina basilaris A. Br. 69
flaccida A. Br. 70
gymnopitys A. Br. 70
gymnopus A. Br. *70*
hydropitys A. Br. *70*
zeylanica Willd. 70
Cheilosa javanica Bl. *331*
Chloradenia discolor Baill. *386*
Chloranthaceae 259
Chloranthus L. 259
henryi Hemsl. *260*
oldhami Solms-Laub. *260*
philippinensis Merr. 259
Cinnamomum parthenoxylon (Jack) Meissn. *418*
Cirrhopetalum antenniferum Lindl. *126*, *138*
auratum Reichb. f. *126*, *139*
chryseum Kränzl. *127*
cumingii Lindl. *127*
koordersii Rolfe *142*
maxillare Lindl. *127*
nutans Lindl. *128*
thouarsii Lindl. *127*, *143*
Cissus L. *209*
Cladium P. Br. 74
cyperoides Merr. 74
Cladodes rugosa Lour. *388*
Cladogynos Zippel. 386
orientalis Zipp. 386

Page.
Cleistanthus Hook. f. 386
angustifolius Merr. 386
Cleistoloranthus verticillatus Merr. 78
Clerodendron L. 98, 245, 341
Clerodendron brachyanthum Schauer 98
capsulare Blanco 245
commersonii (Poir.) Spreng. 245
elliptifolium Merr. 341
inerme Auct. 245
infortunatum L. 98
klemmei Elmer 342
macrostegium Schauer 98
mindorense Merr. 342
multibracteatum Merr. 98
neriifolium Wall. 245
quadriloculare Merr. 342
simile Merr. 342
vanoverberghii Merr. 98
villosum Bl. 98, 342
Cocculus DC. 81
blumei Boerl. 266
celebicus Boerl. 266
laurifolius DC. 81
Codonopsis truncata Wall. 104
Coleus Lour. 344
amboinicus Lour. 344, 418
aromaticus Benth. 344, 418
scutellarioides (L.) Benth. 418
suganda Blanco 344
Columbia Pers. 297
macgregorii Merr. 297
megacarpa Merr. 298
serratifolia (Cav.) DC. 298
subaequalis Planch. 297
Columnea balsamica Roxb. 414, 416
Commelinaceae 232
Commelina nudicaulis Burm. 232
nudiflora L. 232
Compositae 105, 250, 355
Conceveiba tomentosa Span. 386
javanense Bl. 383
Coniogramme Fée 50
Convolvulaceae 244
Convolvulus caespitosus Roxb. 244
hirtus L. 244, 245
marginatus Desr. 418
reptans L. 244, 245
Cordia campanulata Roxb. 413, 416
Coronilla aculeata Willd. 414
sesban Willd. 235
Craspedodictyon Copel. 50
Crinum brevifolium Roxb. 415
toxicarum Roxb. 413, 416
Croton appendiculatus Elmer 400
grandifolius Blanco 238, 394
longipedunculatus Elmer 410
moluccanus L. 401
paniculatus Lam. 400
Cucurbitaceae 104, 352
Curculigo sumatrana Roxb. 413, 416
Cyclodon distans Griff. 105
Cyclostemon Bl. 387

Page.
Cyclostemon bordenii Merr. 387
cumingii Benth. 388
megacarpus Merr. 387, 388
ramiflorus Merr. 387
subcrenatus Merr. 388
Cyperaceae 74, 231
Cyperus dilutus Vahl. 231
malaccensis Lam. 416
procerus Roxb. 416
tuberosus Rottb. 416

D

Davallia chaerophylla Ces. 67
viscidula Mett. 68
Davallodes Copel. 43
viscidulum (Mett.) v. A. v. R. 68
Dendrobium Sw. 14
albayense Ames 14
aloifolium Reichb. f. 15
angustifolium (Bl.) Lindl. .. 14
basilanense Ames 14
brongniartii Kränzl. 15
clemensiae Ames 16
distichum Reichb. f. 17
epidendropsis Kränzl. 19
filiforme J. J. Sm. 17
indivisum Miq. 17
jenkensii Griff. 18
kentrophyllum Hook. f. 18
lunatum Lindl. 17
macgregorii Ames 17
merrillii Ames 15
o'brienianum Kränzl. 19
parciflorum Reichb. f. 18
ramosii Ames 18
ventricosum Kränzl. 19
Dendrochilum Blume 26
convallariaeforme Schauer 26
copelandii Ames 26
exile Ames 27
longibulbum Ames 26
macgregorii Ames 27
maleolens Kränzl. 26
marivelense Ames 18
microcheilum (Schltr.) Ames 26
oliganthum Pfitz. 26
pumilum Reichb. f. 26
vanoverberghii Ames 27
venustulum Pfitz. 26
Dennstaedtia Bernh. 48, 49
cuneata obtusa Copel. 63
Derris Lour. 82, 273
cebuensis Merr. 273
elliptica Benth. 83
micans Perk. 273
mindorensis Perk. 273
oblongifolia Merr. 82
Desmodium Desv. 273
trifoliastrum Miq. 273
Desmotrichum angustifolium Blume 14
Dichapetalaceae 279

	Page.
Dichapetalum Thou.	279
ciliatum Merr.	279
luzoniense Merr. & Rolfe.	281
robinsonii Merr.	280
Dilleniaceae	91, 305
Dillenia L.	305
bolsteri Merr.	305
philippinensis Rolfe	306
Dionaea Ellis	40
Diospyros sapota Roxb.	116, 414
Diplazium acuminatum Bl.	62
christii C. Chr.	62
elatum Fée	63
malaccense Presl	63
petiolare Presl	63
schkuhrii J. Sm.	62, 63
Discocalyx Mez	325
insignis Merr.	326
longifolia Merr.	325
macrophylla Merr.	326
maculata Merr.	326
montana Elmer	326
Dolichos conspersus Grah.	235
punctatus W. & A.	235
virosus Roxb.	414, 416
Doryopteris J. Sm.	50
Dracaena angustifolia Roxb.	414, 416
Drymoglossum Presl	47, 49
Drynaria Adans.	42
Dryopteris adenophora C. Chr.	54
angustipes Copel.	60
aquatilis Copel.	59
aquatiloides Copel.	59
balabacensis Christ	54
dichrotricha Copel.	54
dissecta O. Ktz.	54
jaculosa C. Chr.	60
mesodon Copel.	54
parasitica O. Ktz.	60
porphyricola Copel.	60
purpurascens Copel.	54
salicifolia C. Chr.	59
sparsa O. Ktz.	54
stipellata O. Ktz.	60
sumatrana v. A. v. R.	60
Dryostachyum J. Sm.	42
Dunbaria W. & A.	235
conspersa Benth.	235
punctata (W. & A.) Benth.	235
Dysoxylum Bl.	278
laxum Merr.	278
pauciflorum Merr.	278

E

	Page.
Echites affinis R. & S.	334
caryophyllata Roxb.	413, 418
caryophyllata Roth	334
caudata Blanco	333
coriacea Wall.	333
manubriata Wall.	333
paniculata Roxb.	333
Eclipta L.	251
alba Hassk.	251
Eclipta zippeliana Bl.	251
Elaeocarpaceae	295
Elaeocarpus L.	295
grandiflorus Sm.	295
lanceolatus Bl.	295
pustulatus Merr.	295
verruculosus Aug. DC.	296
Elateriospermum paucinervium Elmer	382
Eleusine stricta Roxb.	415
Eleutherine Herb.	233
americana (L.) Merr.	233
plicata Herb.	233
Embelia Burm. f.	326
nigro-punctata Merr.	326
viridiflora (A. DC.) Scheff.	327
Emerus sesban O. Ktz.	235
Enhydra Lour.	251
fluctuans Lour.	251
Eragrostis Host.	229
mangalorica Hochst.	229
tenella viscosa Stapf	229
viscosa Trin.	229
Eranthemum bicolor Schrank	248
montanum Roxb.	415, 416
pulchellum Hort.	248
Eria Lindl.	20
longibracteata Leavitt	20
vanoverberghii Ames	20
Ericaceae	96, 321
Eriocaulaceae	232
Eriocaulon L.	232
alatum H. Lecomte	232
Eschatogramme Trev.	49
Eugenia L.	314
bataanensis Merr.	316, 317
camiguinensis Merr.	314
ciliato-setosa Merr.	315
paucivenia C. B. Rob.	316
propinqua Merr.	315
tenuipes Merr.	316
Eulophia R. Br.	13
vanoverberghii Ames	13
Euphorbiaceae	237, 379
Euphorbia prostrata Ait.	237
thymifolia Burm.	237
Eupatorium L.	355
benguetense C. B. Rob.	356
camiguinense Merr.	355
japonicum Thunb.	355
sambucifolium Elmer	356
toppingianum Elmer	356
Evodia Forst.	84, 375
gracilis Kurz	377
lamarckiana Benth.	375, 376, 377
lunur-ankenda (Gaertn.) Merr.	378
marambong Miq.	378
pteleaefolia (Champ.) Merr.	377, 378
roxburghiana Benth.	373, 376, 377, 378
semecarpifolia Merr.	377, 378
triphylla DC.	373, 374, 375, 377
triphylla Guillaumin	378
villosa Merr.	84
Exacum L.	96

Page.

Exacum diffusum Willd. 413
parviflorum Merr. 96
sessile Willd. 413
tetragonum Roxb. 96
Excoecaria Linn. 389
obtusa Merr. 389
sicca Blanco 390
philippinensis Merr. 389
philippinensis euphlebia Merr. 389

F

Fagara lunur-ankenda Gaertn. 378
octandra Blanco 375, 376
triphylla Lam. 373, 374, 375
triphylla Roxb. 378
Ficus infectoria Roxb. 414, 419
racemifera Roxb. 414, 416
tjakela Burm. 419
tsiela Roxb. 414, 416
variegata Bl. 416
Fimbristylis Vahl 231
corniculata Merr. 231
diphylla Vahl 75
tenera R. & S. 231
Fluggea virosa Baill. 405
Freeria Merr. 292
repanda Merr. 292
Gaertneria laurifolia Wall. 236
Garcinia L. 307
ramosii Merr. 307

G

Garuga pinnata Roxb. 414, 416
Gastrodia R. Br. 6
javanica (Bl.) Lindl. 6
Geniostoma Forst. 329
cumingianum Benth. 330
stenophyllum Merr. 329
Gentianaceae 96
Geunsia Bl. 342
cumingiana (Schauer) Rolfe 343
farinosa Bl. 343
hookeri Merr. 342
Givotia rottleriformis Griff. 401
Gmelina arborea Roxb. 414, 416
Gnetum edule (Willd.) Bl. 419
scandens Roxb. 414, 419
Goniophlebium Presl 49
Goodenoviaceae 353
Gramineae 74, 228
Gratiola amara Roxb. 411, 412, 413, 416
integrifolia Roxb. 413, 417
pusilla Willd. 246
Grewia L. 89, 298
acuminata Juss. 300, 301
edulis Merr. 298
laevigata Vahl 90, 302
multiflora Juss. 90, 302
ovata Merr. 299
palawanensis Merr. 300
parva Merr. 301

Page.

Grewia rizalensis Merr. 303
rolfei Merr. 302, 303
setacea Merr. 89
stylocarpa Warb. 299
tiliaefolia Rolfe 302
umbellata Roxb. 300
Guttiferae 92, 307
Gynostemma elongatum Merr. 353
integrifoliolum Cogn. 353
Gynura Cass. 355
piperi Merr. 355
sarmentosa DC. 355
Gyrinopsis Decne. 313
brachyantha Merr. 313
cumingiana Decne. 314

H

Habenaria Willd. 2
curranii Ames 2
delessertiana Kränzl. 2
diphylla Dalz. 6
falcigera Reichb. f. 6
hystrix Ames 2, 3
mearnsii Ames 3
muricata Vid. 2, 3
ponerostachys Reichb. f. 4
robinsonii Ames 5
rosulata Ames 5
Haemaria merrillii Ames 6
Halophila Thou. 228
beccarii Aschers. 228
Harrisonia R. Br. 236
bennetii Hook. f. 236
perforata (Blanco) Merr. 236
Hedyotis diffusa Willd. 413
herbacea Willd. 413, 417
pumila Willd. 413, 417
racemosa Willd. 413, 417
Hedysarum lagenaria Roxb. 415
nelitali Roxb. 414, 416
Heliconia buccinata Roxb. 413, 416
Hemionitis L. 47, 50
Hibiscus tortuosus Roxb. 414, 416
Hippocrateaceae 291
Hiraea reclinata Blanco 236
Histiopteris integrifolia Copel. 63
stipulacea (Hook.) Copel. 63
Holcus bicolor L. 417
saccharatus L. 417
spicatus L. 413
Holostemma rheedii Wall. 418
Homalanthus H. Juss. 390
populneus minor (Muell.-Arg.) Merr. 390
populneus siccus Pax 390
Homonoia Lour. 391
javensis (Bl.) Muell.-Arg. 391
javensis ciliata Merr. 391
Hopea dichotoma Vahl 413
Hornemannia viscosa Willd. 246
Humata Cav. 49
angustata J. Sm. 55
brooksii Copel. 64

Page.

Humata dimorpha Copel. 68
introrsa Christ 67
microsora Copel. 55
puberula Copel. 64
tenuis Copel. 67
vestita Moore 67
Hydrocharitaceae 73, 228
Hymenolepis Kaulf. 49
Hypophorium pergracile Nees 75

I

Icacinaceae 292
Ichnocarpus R. Br. 333
acuminatus F.-Vill. 334
frutescens F.-Vill. 333, 334
macrocarpus F.-Vill. 334
navesii Rolfe 333, 334
ovatifolius A. DC. 333
velutinus F.-Vill. 334
Illicium L. 81
montanum Merr. 81
philippinense Merr. 82
Ipomoea L. 244
aquatica Forsk. 244
linifolia Bl. 244
philippinensis Choisy 244
reptans Poir. 244, 245
sepiaria Koenig 413, 418
Iridaceae 233
Ixia americana Aubl. 233
Ixora barbata Roxb. 413, 417
fulgens Roxb. 413, 417
stricta Roxb. 413, 417

J

Jussiaea L. 240
Jussiaea acuminata Sw. 240
blumeana Presl 240
costata Presl 240
exaltata Roxb. 414, 416
linifolia Vahl 240
Justicia montana Roxb. 415

K

Kuhlhasseltia J. J. Sm. 6
merrillii Schltr. 6

L

Labiatae 100, 344
Lasiolepis bennetii Planch. 236
multijuga Benn. 236
paucijuga Benn. 226
Laurus malabathrica Roxb. 414, 418
porrecta Roxb. 414, 418
Lechea verticillata Willd. 414
Leersia aristata Roxb. 414, 416
Leguminosae 82, 235, 273
Lentibulariaceae 102, 247
Lepidagathis Willd. 103
dispar Clarke 103
psilantha Nees 103
subglabra Merr. 103

Page.

Lepta triphylla Lour. 578
Leptolepia Mett. 48
Leucacephala graminifolia Roxb. 415
spathacea Roxb. 415
Leucostegia Presl 49
Ligustrum L. 329
cumingianum Decne. 329
pubescens DC. 329
pubinerve Bl. 329
Limacia Lour. 266
blumei (Boerl.) Diels 266
Limnophila R. Br. 246
diffusa G. Don. 247
manilensis Merr. 246
Lindsaya azurea Christ 68
nitida Copel. 68
papuana Copel. 68
Liparis cumingii Ridl. 7
Litobrochia incisa integrifolia Bedd. 63
Lobelia L. 105
bialata Merr. 105
filiformis Lam. 105
frutescens Mill. 353
radicans Thunb. 105
Loganiaceae 329
Lomagramma J. Sm. 67
brooksii Copel. 60
perakensis Bedd. 61
Lomariopsis Fée 67
Loranthaceae 78, 261
Loranthus L. 261
appendiculatus Merr. 78
capituliferus Merr. 264
confusus Merr. 261, 263
estipitatus Stapf 262
mirabilis Muell.-Arg. & Van Huerck 264
pentagonus Merr. 80
pubiflorus Merr. 263
similis Merr. 262
sphenoideus Bl. 262, 263
subsessilis Merr. 263
tetranthus Merr. 79
verticillatus R. & P. 78
williamsii Merr. 265
Ludolphia glaucescens Willd. 230
Ludwigia prostrata Roxb. 241
Lycopodium aristatum Roxb. 415, 419
Lysimachia L. 93
capillipes Hemsl. 93
decurrens Forst. f. 93

M

Macaranga Thouars 238, 391
amplifolia Merr. 392, 393
gigantifolia Merr. 391, 393
grandifolia (Blanco) Merr. .. 394
leytensis Merr. 395
mappa F.-Vill. 238, 394
montana Merr. 394
noblei Elmer 392, 393
porteana André 238, 394
Macgregorianthus Merr. 312

	Page.
Macgregorianthus paniculatus Merr.	312
Maesa Forsk.	327
ferruginea Merr.	327
manillensis Mez	*328*
pachyphylla Merr.	328
ramentacea Wall.	*328*
Magnoliaceæ	81
Mallotus Lour.	238, 395
alternifolius Merr.	395
auriculatus Merr.	396
barbatus (Wall.) Muell.-Arg.	397
camiguinensis Merr.	397, *400*
cardiophyllus Merr.	398
cauliflorus Merr.	399
cochinchinensis Lour.	*400*
eglandulosus Elmer	*391*
helferi Muell.-Arg.	*396*
leucocalyx Muell.-Arg.	*396, 398*
moluccanus (L.) Muell.-Arg.	401
moluccanus pendulus Merr.	401
paniculatus (Lam.) Muell.-Arg.	400
papillaris (Blanco) Merr.	238
playfairii Hemsl.	*239, 400*
ramosii Merr.	401
sanchezii Merr.	402
zollingeri F.-Vill.	*238*
Malpighiaceae	236
Malvaceae	90, 240
Malva coromandelina L.	*240*
Malvastrum A. Gray	240
coromandelinum (L.) Garcke.	240
tricuspidatum A. Gray	*240*
Marattia brooksi Copel.	59
Mariscus Gaertn.	231
dilutus (Vahl) Nees	231
microcephalus Presl	*231*
Marrubium album amboinicum Rumph.	*344*
Medicago L.	274
denticulata Willd.	274
lupulina L.	274
Medinilla Gaudich.	94
confusa Merr.	*94*
intermedia Bl.	*94*
myriantha Merr.	*94*
subsessilis Merr.	94
vanoverberghii Merr.	94
Melaleuca cajuputi Roxb.	414, *416*
Melastomataceae	94
Meliaceae	237, 274
Melia koetjape Burm. f.	*237*
Melicope Forst.	375
luzonensis Engl	*374, 375, 376*
odorata Elmer	*375, 376*
ternata Vid.	*375, 376*
tripylla (Lam.) Merr.	375
Meliosma Bl.	294
macrophylla Merr.	294
Melocanna bambusoides Trin.	*418*
Melothria L.	104
lobata Merr.	104
Meniscium Schreb.	*47*
Menispermaceae	81, 265
Mentha auricularia Blanco	*346*
cablin Blanco	*345*

	Page.
Merremia Dennst.	244
caespitosa Hallier f.	*244*
hirta (L.) Merr.	244
Merrittia Merr.	*106*
Mesona Bl.	101, 345
chinensis Benth.	*102*
clausa Merr.	345
palustris Bl.	*102*
philippinensis Merr.	102
procumbens Hemsl.	*102*
prunelloides Hemsl.	*102*
wallichiana Benth.	*102*
Metrosideros vera Roxb.	414, 416
Microchites Miq.	334
schreickii Rolfe	97, 334
Microcarpaea R. Br.	100
alterniflora Bl.	*100*
minima (Koenig) Merr.	100
muscosa R. Br.	*100*
Microchloa R. B.	74
indica (L. f.) Merr.	74
setacea R. Br.	*74*
Microlepia Presl	*48*
Mimosa pudica L.	37
Mitrephora Hook. f. & Thoms.	266
weberi Merr.	266
Modecca tuberosa Roxb.	414, *416*
Moraea plicata Sw.	*233*
Morinda bracteata Roxb.	413, 416
Morus paniculata Roxb.	414, 419
Myrsinaceae	323
Myrtaceae	314

N

Nardus indica L. f.	*74*
Nepeta malabarica L.	*414*
Nephrodium molle major Bedd.	*60*
Nitella Agardh	69
acuminata A. Br.	69
mauritiana A. Br.	*69*
polyglochin A. Br.	*69*
roxburghii A. Br.	69
Notholaena R. Br.	*47*
Nothopanax Miq.	241
cochleatum (Lam.) Miq.	241
crispatum (Bull.) Merr.	241
fruticosum (L.) Miq.	241
guilfoylei (Cogn. & Marché) Merr.	241
ornatum (Bull.) Merr.	241

O

Oberonia Lindl.	8
benguetensis Ames	8
griffithiana Lindl.	*10*
hispidula Ames	8
merrillii Ames	9
setigera Ames	10
Ocimum capitellatum L. f.	*101*
scutellarioides L.	*418*
Odontosoria Fée	*48*
Oenotheraceae	24
Olacaceae	265

Page.

Oldenlandia alata Roxb. 413, 417
crystallina Roxb. 413, 417
diffusa Roxb. 413, 416
herbacea Roxb. 412, 413, 417, 418
heynei R. Br. 418
paniculata L. 417
pumila (L. f.) DC. 417
Oleaceae 329
Oleandra Cav. 49
oblanceolata Copel. 64
Ophioglossum filiforme Roxb. 415, 416
Opiliaceae 233
Opilia cumingiana Baill. 233
manillana Baill. 233
Orchidaceae 125
Osterdamia matrella O. Ktz. 230
Ostodes Blume 403
angustifolia Merr. 403
macrophylla (Muell.-Arg.) Benth. 404
serrato-crenata Merr. 404
Oxymitra Hook. f. & Thoms. 267
pubescens Merr. 267

P

Paederota minima Koenig 100
Paliurus dubius Blanco 236
perforatus Blanco 236
Paltonium Presl 49
Panax cochleatum DC. 241
conchifolium Roxb. 413, 416
crispatum Bull. 241
fruticosum L. 241
ornatum Bull. 241
Pandanus fascicularis Lam. 419
furcatus Roxb. 415, 419
millore Roxb. 415
Panicum americanum L. 417
arborescens L. 230
glaucescens Lam. 230
sparsicomum Nees 230
spicatum Roxb. 413, 417
Parishia Hook. f. 281
insignis Hook. f. 282
malabog Merr. 281
Parsonsia R. Br. 335
confusa Merr. 335
cumingiana A. DC. 335
oblancifolia Merr. 335
spiralis Wall. 335
Pennisetum typhoideum Rich. 417
Pergularia Auct. 243
accedens Vid. 243
angustiloba Warb. 243
filipes Schltr. 243
glabra Blanco 243
procumbens Blanco 243
Phaius Lour. 10
flavus Lindl. 11
linearifolius Ames 10
Phalaris hispida Thunb. 229
zizanioides L. 228
Phreatia Lindl. 20
aristulifera Ames 22
bracteata Ames 22

Page.

Phreatia densiflora (Bl.) Lindl. 23
infundibuliformis Ames 20
mearnsii Ames 21
myosurus Ames 21
ramosii Ames 22
sulcata J. J. Sm. 22
vanoverberghii Ames 22
Phrynium dichotomum Roxb. 411, 412
spicatum Roxb. 411, 412
Phyllanthus L. 404
curranii C. B. Rob. 406
leucopyrus Roxb. 414, 416
luzoniensis Merr. 404
obscurus Willd. 415
robinsonii Merr. 405
Phymatodes J. Sm. 47
Phytocrene Wall. 293
loheri Merr. 293
Piper arborescens Roxb. 415, 419
Pipturus velutinus (Decne.) Wedd. 419
Pladera pusilla Roxb. 413, 416
virgata Roxb. 413, 416
Platyclinis microcheila Schltr. 26
Platynema laurifolium W. & A. 236
Platytaenia requinaria Kuhn 50
Plecospermum spinosum Tréc. 419
Plectranthus aromaticus Roxb. 414, 418
strobiliferus Roxb. 414, 416
Pleurogramme loheriana Christ 53
minor (Fée) Copel. 53
pusilla Christ 53
Pogostemon Desf. 345
cablin (Blanco) Benth. .. 345, 347, 349
heyneanus Merr. 346
membranaceus Merr. 347
nepetoides Stapf 101, 347
nepetoides glandulosus Merr. 347
patchouli Hook. 346
patchouli Hook. f. 346
patchouli suavis Hook. f. 346
patchouly Pellet. 346
patchowli Dalz. & Gibs. 346
reticulatus Merr. 348
suavis Ten. 346
Polyalthia Bl. 268
lanceolata Vid. 269
loheri Merr. 268
loheri cagayanensis Merr. 269
tenuipes Merr. 269
Polygalaceae 237
Polygala ciliata L. 237
Polygonum rivulare Roxb. 414, 416
Polyosma Bl. 271
philippinensis Merr. 273
piperi Merr. 271
verticillata Merr. 272
Polypodiaceae 41, 47
Polypodium L. 48
excavatum Roxb. 415, 416
lineare Thunb. 65
linguaeforme Mett. 68
loxogrammoides Copel. 65
macrophyllum Reinw. 65

Page.

Polypodium merrittii poense Copel. 65
musaefolium Bl. 68
nectariferum Bak. 42
taeniophyllum Copel. 65
wrayi Bak. 65
Polyscias fruticosa Harms 241
Portulacaceae 234
Portulaca L. 234
pilosa L. 234
Potamogetonaceae 228
Primulaceae 93
Prunella indica Burm. 101
Pseuderanthemum Radlk. 248
bicolor Radlk. 248
pulchellum (Hort.) Merr. 248
Pteris L. 50
cretica L. 54
opaca J. Sm. 54
scandens Roxb. 415, 416
taenitis Copel. 53
Pterospermum Bl. 304
elmeri Merr. 304
longipes Merr. 304
niveum Vid. 305
obliquum Blanco 304
subpeltatum Merr. 304
Pycnarrhena Miers 266
celebica (Boerl.) Diels 266
Pycreus puncticulatus Nees 416

R

Radermachera Hassk. 352
elliptica Merr. 352
whitfordii Merr. 352
Rafflesiaceae 209
Rafflesia R. Br. 209
manillana Teschem. 209
philippinensis Blanco 210
Rhus toxicodendron L. 290
venenata DC. 290
Rhynchosia Lour. 82
volubilis Lour. 82
Riedelia Oliv. 78
Rottboellia setacea Roxb. 74
Rottlera albicans Hassk. 386
barbata Wall. 397
Ruellia cernua Roxb. 414, 419
zeylanica Roxb. 414, 416
Ruppia L. 228
maritima rostellata Koch 228
Rutaceae 373

S

Sabiaceae 294
Saccoloma Kaulf. 48
Saguerus rumphii Roxb. 414, 416
Sagus inermis Roxb. 414, 419
laevis Willd. 414
spinosus Roxb. 414, 419
Salacia L. 291
griffithii Laws. 292
perakensis King 292
philippinensis Merr. 291

Page.

Salomonia Lour. 237
ciliata (L.) DC. 237
oblongifolia DC. 237
Sandoricum Cav. 237
indicum Cav. 237
koetjape (Burm. f.) Merr. .. 237
Sapium P. Br. 406
crassifolium Elmer 383
indicum Willd. 407
sanchezii Merr. 406
sebiferum Roxb. 414, 416
subrotundifolium Elmer 384
virgatum Hook. f. 407
Sarcopodium dearei Reichb. f. 127
Sarcostigma W. & A. 293
Saurauia Willd. 91, 306
macgregorii Merr. 306
vanoverberghii Merr. 91
Sauropus Bl. 407
robinsonii Merr. 407
Saxifragaceae 271
Scaevola L. 353
frutescens (Mill.) Krause..... 353
frutescens sericea (Forst.) Merr. 354
koenigii Vahl..... 353, 354
plumieri (L.) Vahl..... 354
sericea Forst. 354
taccada Roxb. 413, 416
Schefflera Forst. 95, 318
albida Merr. 95
stellulata Merr. 318
Schizoloma ensifolium J. Sm. 48
Scleria Berg. 75
pergracilis (Nees) Kth. 75
Scrophulariaceae 100, 246
Scutellaria L. 349
copelandii Merr. 349
indica L. 350
Scyphularia pentaphylla (Bl.) Fée..... 65
simplicifolia Copel. 64
triphylla (Hook.) Fée..... 65
Selaginella exigua Spring..... 419
Selago pusilla Thunb. 246
Selliguea Bory..... 47
Semecarpus L. 282
acuminatissima Merr. 282
albescens Kurz..... 290
anacardium Blanco..... 289
cassuvium Roxb. 413, 418
cassuvium Spr. 418
cuneiformis Blanco..... 288, 289
euphlebia Merr. 283
lanceolata Merr. 284
megabotrys Merr. 285
micrantha Perk. 290
microcarpa F.-Vill. 289
obtusifolia Merr. 286
paucinervia Merr. 286
perrottetii March. 286, 289
perrottetii glabra March. 290
philippinensis Engl. 288, 290
pilosa Merr. 287
pubescens F.-Vill. 289

Page.

Semecarpus sideroxyloides Perk. *289*
taftiana Perk. *290*
whitfordii Merr. 288
Serratula anthelmentica Roxb. 414, *416*
cinerea Roxb. 414, *416*
Sesbania Pers. 235
aegyptiaca Poir. *235*
picta Cav. *235*
sesban (L.) Merr. 235
Sida L. 90
acuta Burm. *240*
corylifolia Wall. *91*
puberula Merr. 90
Simarubaceae 236, 274
Sisyrinchium bulbosum Mill. *233*
palmifolium L. *233*
Skinneria caespitosa Choisy *244*
Solanaceae 350
Solanum L. 350
blumei Nees *351, 352*
epiphyticum Merr. 350
parasiticum Bl. 351
philippinense Merr. 351
Spathiostemon javense Bl. *391*
Sphaeromariscus microcephalus E. G. Camus *231*
Sphagnaceae 253
Sphagnum L. 254
cuspidatulum C. Müll. 255
japonicum Warnst. 258
junghuhnianum D. & M. 254
luzonense Warnst. 256
robinsonii Warnst. 256
sericeum C. Müll. 255
subrufescens Warnst. 257
Spinifex L. 229
littoreus (Burm. f.) Merr. 229
squarrosus L. *229*
Springia indica Muell.-Arg. *333*
Staurogyne Wall. 248
rivularis Merr. 248
Stenochlaena aculeata Kunze *67*
intermedia Copel. 67
Stephania Lour. 265
catosepala Diels *266*
ramosii Diels 265
Sterculiaceae 304
Sterculia guttata Roxb. 414, 416
Stipa littorea Burm. f. *229*
spinifex L. *229*
Stipellaria parviflora Benth. *332*
Stylidiaceae 249
Stylidium Sw. 249
alsinoides R. Br. 249, 250
tenerrimum F. Muell. *249*, 250
Suriana L. 274
maritima L. 274
Symplocaceae 29
Symplocos ahernii Brand 32
angularis Elmer 33, *34*
cagayanensis Brand 35
ciliata Presl *31*
confusa Brand 31
congesta Brand 33

Page.

Symplocos cumingiana Brand 34
curtiflora Elmer 34
depauperata Merr. 36
depauperata angustissima Brand 36
ferruginea philippinensis Brand 32
floridissima Brand 32
fragrans Elmer 33
imbricata Brand 31
loheri Brand 32
luzoniensis Rolfe 35
merrilliana Brand 36
patens Presl 31
polyandra Brand 32
purpurascens Brand 33
whitfordii Brand 33
Syngramma alismifolia J. Sm. *50*
angusta Copel. *50*
borneensis J. Sm. *50*
cartilagidens Diels *50*
hookeri C. Chr. *50*
pinnata J. Sm. *50*
wallichii Hook. *50*

T

Tabernaemontana L. 242, 337
cordata Merr. 337
crispa Roxb. 413, 418
pandacaqui Poir. *243*
sphaerocarpa Bl. *243*
subglobosa Merr. 242
Taenitis Willd. *47*
blechnoides Sw. *48*
Tapeinidium C. Chr. *48*
Tectaria decurrens Copel. *54*
menyanthidis Copel. *55*
weberi Copel. 54
Telosma Coville 243
angustiloba (Warb.) Merr. 243
procumbens (Blanco) Merr. 243
Teramnus Sw. 83
angustifolius Merr. 83
Tetrastigma Planch. 85
angustifolium Planch. *87*
brunneum Merr. 85
crassipes Planch. *89*
lanceolarium Planch. *86, 87*
loheri Gagnep. *87*
pedunculare Planch. *89*
pergamaceum Bl. *86*
philippinense Merr. 86
sepulchrei Merr. 88
Teucrium L. 100
philippinense Merr. 100
tomentosum Heyne *101*
Thayeria Copel. 41
cornucopia Copel. *41*, 43
nectarifera (Bak.) Copel. *41*, 43
Thottea dependens Kl. *419*
Thymelaeaceae 92, 312
Tiliaceae 89, 239, 296
Toona Roemer 279
paucijuga Merr. 279

	Page.
Torenia hirta Cham. & Schlecht.	246
Trachelospermum L.	97
Trachelospermum fragrans Hook. f.	97
jasminoides Lem.	97
philippinense Elmer	97, 334
vanoverberghii Merr.	97
Tradescantia malabarica L.	232
Trema Lour.	260
amboinensis Bl.	261
vulcanica Merr.	260
Trichilia nervosa Vahl	237
Trichomanes craspedoneurum Copel.	53
henzaianum Hook.	53
sublimbatum C. Müll.	53
Trigonostemon Bl.	408
everettii Merr.	408
longipedunculatus Elmer	410
macrophyllus Muell.-Arg.	404
oblongifolius Merr.	409
sumatranus Pax & K. Hoffm.	410
Tristania R. Br.	317
littoralis Merr.	317
Tristellateia Thouars	236
australasiae A. Rich.	236
australasica Auct.	236
australis A. Rich.	236
malintana Blanco	236
Tritaxis macrophylla Muell.-Arg.	404
Triumfetta L.	296
bartramia L.	239
fabreana Gaudich.	296
indica Lam.	239
procumbens Forst.	296
radicans Bojer	296
repens (Bl.) Merr. & Rolfe	296
rhomboidea Jacq.	239
Tropidia Lindl.	7
angulosa Bl.	7
calcarata Ames	7

U

Ulmaceae	260
Unona uncinata Dun.	234
Urtica tenacissima Roxb.	414, 416
Utricularia L.	102, 247
exoleta R. Br.	102
nivea Vahl	247
racemosa filicaulis C. B. Clarke	247
scandens Benj.	247
scandens Oliv.	247
tenerrima Merr.	247
wallichiana Wight	247

V

Vaccinium L.	96, 321
bancanum Miq.	322
barandanum Vid.	323
camiguinense Merr.	321
epiphyticum Merr.	322
hutchinsonii Merr.	323
Vaccinium indutum Vid.	96
jagori Warb.	322
loheri Merr.	323
microphyllum Bl.	323
mindorense Rendle	323
Vallaris Burm.	335
angustifolia Merr.	335
lancifolia Hook. f.	336
Vallisneria octandra Roxb.	73
Vandellia L.	246
erecta Benth.	417
hirsuta Ham.	246
pusilla (Willd.) Merr.	246
scabra Benth.	246
viscosa (Willd.) Merr.	246
Vanoverberghia Merr.	76
sepulchrei Merr.	76
Verbenaceae	98, 245, 338
Verbesina prostrata H. & A.	251
Vernonia Schreb.	106
acrophila Merr.	106
phanerophlebia Merr.	106
Vetiveria zizanioides Nash	228
Visiania pubinervis Miq.	329
Vitex L.	343
nitida Merr.	343
pentaphylla Merr.	344
Vitis latifolia Roxb.	413, 416
Vittaria Sm.	47
elongata Sw.	48
minor Fée	53
scolopendrina Thw.	48
Voacanga Thouars	336
megacarpa Merr.	336
Volkameria commersonii Poir.	245
infortunata Roxb.	414, 416
nereifolia Roxb.	245

W

Wedelia Jacq.	251
prostrata Hemsl.	251
Wikstroemia Endl.	92, 313
angustissima Merr.	92
lanceolata Merr.	93
Wollastonia prostrata H. & A.	251

Y

Yucca superba Roxb.	414, 416

Z

Zanonia sarcophylla Wall.	352
Zanthoxylum lamarkianum Cham.	375, 376
marambong Miq.	378
pteleaefolium Champ.	375, 376, 377
roxburghianum Cham.	378
zeylanicum DC.	378
Zebrina Schnizl.	232
pendula Schnizl.	232
Zingiberaceae	75
Zoisia Willd.	230
matrella (L.) Merr.	230
pungens Willd.	230

PUBLICATIONS FOR SALE BY THE BUREAU OF SCIENCE, MANILA, PHILIPPINE ISLANDS

THE SUBANUNS OF SINDANGAN BAY.

By EMERSON B. CHRISTIE.

121 pages, 1 map, 29 plates.

Order No. 410. Paper, $1.25 United States currency, postpaid.

Sindangan Bay is situated on the northern coast of Zamboanga Peninsula. The Subanuns of this region were studied by Mr. Christie during two periods of five and six weeks, respectively.

The following is an abstract from the contents of Mr. Christie's report on the Subanuns: Habitat and history; relations with the Moros; material culture; houses; industries; trade; agriculture; family life; social customs; administration of justice; religion; the medicine man; ceremonies; tales; word-lists; physical measurements.

The 29 plates illustrate the Subanuns at work and at play; their industries, houses, altars, and implements; and the people themselves.

THE HISTORY OF SULU.

By NAJEEB M. SALEEBY.

275 pages, 4 maps, 2 diagrams.

Order No. 406. Paper, $0.75 United States currency, postpaid.

In the preparation of his manuscript for The History of Sulu Doctor Saleeby spent much time and effort in gaining access to documents in the possession of the Sultan of Sulu. It is fortunate that these records have now been translated and preserved in permanent form. This book is a history of the Moros in the Philippines from the earliest times to the American occupation.

STUDIES IN MORO HISTORY, LAW, AND RELIGION.

By NAJEEB M. SALEEBY.

107 pages, 16 plates, 5 diagrams.

Order No. 405. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

This volume deals with the earliest written records of the Moros in Mindanao. Doctor Saleeby was fortunately able to obtain exact copies of carefully preserved early records written in the Maguindanao dialect with Arabic characters. The author presents translations of these as well as 16 half-tone illustrations of certain pages from the originals. The names of the rulers of Maguindanao are recorded in five folding diagrams.

NEGRITOS OF ZAMBALES.

By WILLIAM ALLAN REED.

83 pages, 62 plates.

Order No. 402. Paper, $0.25; half morocco, $0.75 United States currency, postpaid.

The introductory chapter deals with the general distribution of Negritos and with the distribution of the Philippine branch of the race. The succeeding chapters deal with the various industries, amusements, and social relations of these little men.

Plates from photographs, the greater part of which was taken for this publication, show ornaments, houses, men making fire with bamboo, bows and arrows, dances, and various types of the people themselves.

CONTENTS.

	Page.
MERRILL, E. D. The Pineda Monument and the Probable Site of the First Botanic Garden in the Philippines	363
MERRILL, E. D. On the Identity of Evodia triphylla DC.	373
MERRILL, E. D. Notes on Philippine Euphorbiaceae	379
ROBINSON, C. B. Roxburgh's Hortus Bengalensis	411
Errata	421
Index	423

The "Philippine Journal of Science" is issued as follows:

	U. S. currency.
Section A, Chemical and Geological Sciences and the Industries	$2.00
Section B, The Philippine Journal of Tropical Medicine	3.00
Section C, Botany	2.00
Section D, General Biology, Ethnology and Anthropology (Section D began with Volume V)	2.00
Entire Journal, Volume II, III, IV, or V	5.00
Entire Journal, beginning with Volume VI	7.00
Single numbers	.50
Volume I, 1906 (not divided into sections)	10.00
Supplement to Volume I (botany)	3.50
Volume I (without supplement)	6.50

Each section is separately paged and indexed.

Publications sent in exchange for the Philippine Journal of Science should be addressed: Library, Bureau of Science, Manila, P. I.

Subscriptions may be sent to the BUSINESS MANAGER, Philippine Journal of Science, Bureau of Science, Manila, P. I., or to any of the agents listed below:

AGENTS.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Meyer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N. W., Germany.
Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.
Thacker, Spink & Co., P. O. Box 54, Calcutta, India.

Entered at the post-office at Manila, P. I., as second-class matter.