PHYTOLOGIA

An international journal to expedite botanical and phytoecological publication

Vol. 64 January 1988 No. 3

CONTENTS

Published by Harold N. Moldenke and Alma L. Moldenke
590 Hemlock Avenue N.W.
Corvallis, Oregon 97330-3818
U.S.A.

Price of this number $3.00; for this volume $16.00 in advance or $17.00 after close of the volume; $5.00 extra to all foreign addresses and domestic dealers; 512 pages constitute a complete volume; claims for numbers lost in the mail must be made immediately after receipt of the next following number for free replacement; back volume prices apply if payment is received after a volume is closed.

DIAGNOSES OF NEW DELISSEA SPECIES (LOBELIACEAE)

HAWAIIAN PLANT STUDIES 162

Harold St. John
Bishop Museum, Box 19000A, Honolulu, Hawaii 96817, USA

The new types are in the Bishop Museum, Honolulu.

Delissea acuta sp. nov. Frutex est, caule simplici laevi, petiolis 10-16 cm longis glabris, laminis 18-28 X 6-11.3 cm glabris lanceo-ovalibus acutis basi cuneata marginibus crenatis, racemis 4-12-floriferis glabris, pedunculo 1-2 cm longo, pedicellis 7-15 mm longis, dentibus calycis 0.3 mm longis deltoideis, corolis 20 mm longis glabris cum vel sine tumuli lateralibus, antheris superis 7 mm longis. Typus: Oahu I., Kawaiiki Ditch Trail, H. St. John 21,368.

D. angusta sp. nov. Arbor 6 m alta est, ramis glabris, petiolis 2.5-6 mm longis pilosulis, laminis 14-18 X 2-3.2 cm oblanceolatis duploserratulis infra in nervis pilosulis, cymis 4-5 cm longis 5-6-floriferis pilosulis, pedunculo 2-2.8 cm longo, pedicellis 12-15 mm longis, lobis calycis 4-5 mm longis lanceolatis ciliatis, corollis 35 mm longis glabris, antheris superis 6 mm longis. Typus: Maui I., Haleakala, Maunawainui Gulch, 4,900 ft elev., K. Kepler 46.

D. angustior sp. nov. Frutex glaber est, caule 1.3 m longo simplici, petiolis 4-7 cm longis, laminis 23-27 X 7-8.5 cm oblanceolatis denticulatis, racemis 4-5 cm longis 13-17-floriferis, pedunculo 18-20 mm longo, pedicellis 10-13 mm longis, lobis calycis 2-2.5 mm longis lanceo-linearibus, baccis 9-10 mm longis. Typus: Hawaii I., Pahole Stream, J. Davis 688.

D. globosa sp. nov. Caulis 1 m altus simplex est, petiolis 2.5 cm longis puberulis, laminis 32-48 X 7-9.5 cm oblanceolatis subacuminatis serrulatis basi cuneata puberulis, pedicellis 15 mm longis 4-5 cm longis ligulatis hirsutis, corollis 8-9 cm longis pilosis albis, antheris superis 14 mm longis. Typus: Maui I., Iao, C. N. Forbes 106.M.

D. hanaensis (St. John) comb. nov.
Cyanea hanaensis St. John, Phytologia 62: 433-436, fig. 1, 1987.

D. inflatispinosa sp. nov. Frutex est, caule 1.4 m alto simplici hirsutulospinoso, petiolis 2.5-6.5 cm longis hirsutulis spinosis, laminis 25-41 X 8.5-9 cm oblanceolatis lobatis supra pilosis spinosis infra nervis hirsutulis spinosis, inflorescentia 8-12 cm longis pedicellis 15-23 mm longis hirsutulis, lobis calycis

3-4 mm longis subulatis. Typus: Hawaii I., Laupahoehoe, Kilau Stream, L. W. Cuddihy 989.

D. kawelaensis sp. nov. Frutex est, petiolis 3-6 cm longis glabris, laminis 13-21 X 2.7-3.7 cm ligulatis serrulatis acutis infra midnervo pilosulo, racemis 6-7 cm longis 7-floriferis, lobis calycis 2.5=3.5 mm longis lancolatis, corollis 25-27 mm longis glabris, antheris inferis 6 mm longis. Typus: Molokai I., East Kawela Gulch, S. L. Montgomery.

D. kipahuluensis sp. nov. Frutex est, ramis glabris, petiolis 4-7 cm longis puberulis, laminis 33.5-37 X 14-18 cm in aspectu ellipticis sed pinnatevel bipinnate partitis serrato-dentatis infra nervis pilosulis, racemis 5-6 cm longis glabris, pedicellis 7-10 mm longis in fructu lobis calycis 14-16 mm longis ligulatis. Typus: Maui I., Kipahulu, C. N. Forbes 1,730.M.

D. kohalaensis sp. nov. Planta glabra est, petiolis 5-6.5 cm longis, laminis 20-21 X 9.8 cm obovatis subacuminatis basi cuneata, racemis glabris 9-11-floriferis, pedicellis 10-15 mm longis hirsutulis, lobis calycis 3-4 mm longis lanceolatis, corollis 37 mm longis, antheris superis 9 mm longis. Typus: Hawaii I., Waipio Valley, H. L. Lyon.

D. latior sp. nov. Frutex est, petiolis 4 cm longis puberulis, laminis 30-32 X 10.5-11 cm oblanceolatis serrulatisbasi cuneata puberulis, racemis 8-9 cm longis 4-7-floriferis hirsutulis, lobis calycis 11=12 mm longis ellipticis emarginatis, corollis 33.5 mm longis purpureis pilosis. Typus: Maui I., Hanaula, K. M. Nagata & B. Kimura 1,924,

D. Lyonii sp. nov. Petiolis 3 cm longis glabris, laminis 25 X 6.5 cm oblanceolatis subintegribus supra aculeatis infra glabris, pedunuculo 1.5 cm longo, pedicellis 12 mm longis hispidulis, lobis calycis 2.5-3 mm longis oblongis hirsutulis, antheris superis 7 mm longis. Typus: Maui I., Kailua, H. L. Lyon (Rock no.) 10,258.

D. molokaiensis sp. nov. Frutex 1.6-2.6 m altus eramosus glaber est, petiolis 1.8-7.3 cm longis, laminis 8.5-17.5 X 2.3-5.2 cm subcoriaceis ellipticis subacutis serrulatis basi cuneata, racemeis 4-5 cm longis 5-11-floriferis, pedulculo 2-3 cm longo, pedicellis 6-8 mm longis, lobis calycis 0.2-0.3 mm longis deltoideis, corollis 23 mm longis purpureis, antheris superis 5.5 mm longis, baccis 8 mm diametro. Typus: Molokai I., Pipiwai Gulch, S. Perlman 502.

D. muriculata sp. nov. Petiolis 7-8 cm longis puberulis, laminis 28-29 X 9.2-9.5 cm oblanceolatis obtusis denticulatis basi cuneata supra nervis muriculatis infra puberulis, inflorescentia 6-8-florifera, pedunculo 1.5-2 cm longo, pedicellis 1-2 cm longis glabris, lobis calycis

8-13 mm longis ligulatis apice bifido, corollis purpureis in alabastro 5.5-6.5 cm longis. Typus: Maui I., Wai Anapanapa, B. Harrison xi/22/73.

D. nemorosa sp. nov. Frutex 3 dm altus epiphyticus est, calule hirsutulo, petiolis 15 mm longis puberulis, laminis 15-21 X 4.5-6 cm ellipticis subacutis serrulatis basi cuneata puberulis, racemis 3-4 cm longis 7-8-floriferis, pedunculo 1 cm longo, puberulo, pedicellis 2-3 mm longis puberulis, lobis calycis 2.5-3.5 mm longis lanceolatis puberulis, corollis 25 mm longis albis puberulis, antheris superis 4 mm longis puberulis. Typus: Hawaii I., Kilauea Forest Reserve, L. Cuddihy.

D. olokuiensis sp. nov. Frutex 1.3 m altus est, petiolis 13.5-14 cm longis glabris, laminis 34-47 X 13-15 cm ellipticis subintegribus basi cuneata infra in nervis hirsutulis, racemis 10-10.5 cm longis 5-7-floriferis hirsutis, pedicellis 16-20 mm longis, lobis inferis calycis 4.5-5 mm longis ovatis acutis, corollis 45 mm longis albis glabris, antheris superis 10 mm longis glabris. Typus: Molokai I., Olokui plateau, P. K. Higashino & R. A. Holt 9,466.

D. puberula sp. nov. Frutex 2.6 m altus ramosus est, novellis puberulis, petiolis 7-11 mm longis puberulis, laminis 7.6-12.3 X 1.7-2.1 cm oblanceolatis serrulatis basi cuneata infra puberulis, cymis 4-5 cm longis 5-floriferis puberulis, pedicellis 9-11 mm longis, lobis calycis 2.5-4 mm longis lanceolatis, corollis 35 mm longis puberulis, antheris superis 9.5-11 mm longis. Typus: Maui I., Haleakala, Manawainui Gulch, K. Kepler 48.

D. sessilis sp. nov. Frutex 3 m altus eramosus est, foliis 44-45 X 8-10 cm sessllibus glabris oblanceolatis, cymis 13 cm longis 4-floriferis glabris, pedunculo 14 mm longo, pedicellis 10-12 mm longis, lobis calycis superis 12-13 mm longis deltoideis, corollis 10 cm longis obscure purpureis, antheris superis 20 mm longis. Typus: Maui I., Kipahulu Valley, P. K. Higashino & R. A. Holt 9,398.

D. subobtusa sp. nov. Frutex 3-6 dm altus ramosus puberulus est, petiolis 15-22 mm longis puberulis, laminis 17-21 X 4.2-6.2 cm ellipticis subintegribus puberulis, inflorescentia 3.5-5 cm longa 9-17 florifera puberula, pedunculo 8-12 mm longo, pedicellis 4-7 mm longis, lobis calycis 2-2.5 mm longis lanceolatis puberulis, corollis 18-20 mm longis albis puberulis, antheris superis 4 mm longis. Typus: Hawaii I., Kilauea Forest Reserve, J. Davis 397,

D. waikamoiensis sp. nov. Frutex est, novellis hirsutulis, petiolis 2-2.7 cm longis puberulis, laminis 19-26 X 4.4-6.7 cm oblanceolatis denticulatis basi cuneata infra puberulis, racemis 4.5-5 cm longis 4-9-floriferis, pedunculo 6-10 mm longo puberulo, pedicellis 4-6 mm longis puberulis, lobis calycis 6-7 mm longis subulatis

puberulis, corollis 3.5-3.7 cm longis puberulis, antheris superis 6 mm longis hirsutulis. Typus: Maui I., Waikamoi, J. F. Rock 8,806.

D. waikoluensis sp. nov. Frutex 2 m altus eramosus glaber est, petiolis 7-14 cm longis glabris, laminis 25-40 X 9-15 cm oblanceolatis basi cuneata infra nervis pilosulis, racemis 6-10 cm longis 5-9-floriferis hirsutulis, pedunculis 2.5-5 cm longis, pedicellis 15-25 mm longis, lobis calycis 3.5-5 mm longis ovatis. Typus: Molokai I., Waikolu Valleu, H. St. John 23,390.

DIAGNOSES OF SOLANUM SPECIES (SOLANACEAE)

Hawaiian Plant Studies 163

Harold St. John

Bishop Museum, Box 19000A, Honolulu 96817, USA

The new types are in the Bishop Museum, Honolulu, unless otherwise located.

Solanum abollatum sp. nov. (sect. Irenosolanum). Frutex humilis stellati-tomentosus est, petiolis 4-13 mm longis, laminis 1.8-4.3 X 1.3-3.6 cm ovatis subcordatis vadose 4-5-lobatis supra rare in midnervo aculeato, inflorescentia 1-2 cm longa 2-7-florifera, pedunculo 8-12 mm longo, pedicellis 2-3 mm longis, calycibus stellati-tomentosis tubo 1-1.5 mm longo lobis 1.5 mm longis ovatis, corollis 5-6 mm longis stellati-tomentosis 5/6-lobatis. Typus: Lanai I., Aug. 1, 1922, G. C. Munro.

S. angustior sp. nov. (sect. Irenosolanum). Frutex stellati-puberulis est, petiolis 3-4.5 cm longis, laminis 10-15.5 X 6-10 cm ellipticis acutis basi cuneata integribus vel cum 1-2 dentibus, inflorescentiis 9=12 cm longis 11-21-floriferis,stellate puberulis, pedunculo 7-8 mm longo, pedicellis 3-18 mm longis, calycibus stellate puberulis tubo 1-1.5 mm longo lobis 1-1.5 mm longis deltoideis, corollis 8 mm longis stellatis 1/3-lobatis. Typus: Kauai I., J. M. Lydgate.

S. Forbesii sp. nov. (sect. Torvaria). Frutex stellate puberulus est, petiolis 2-4.5 cm longis inermibus vel aculeatis, laminis 13-21 X 6.8-10.5 cm lanceolatis subintegribus vel dentatis plerumque inermibus, inflorescentia 7.5 cm longa multiflorifera, pedunculo 2-5 cm longo, pedicellis 5-10 mm longis, calycibus stellate puberulis tubo 1.5 mm longo lobis 0.3 mm longis deltoideis, corollis 7-8 mm longis albis stellate puberulis ½-lobatis lobis deltoideis, baccis 8-11 mm diametro viridi-nigris. Typus: Maui I., Kipahulu, C. N. Forbes 1,647.M.

S. globosum sp. nov. (sect. Oliganthes). Frutex vel arbor est, novellis stellate puberulis, ramulis glabratis, internodis aculeatis, petiolis 1-4.2 cm longis inermibus vel aculeatislaminis 5-8.5 X 1.7-8 cm ellipticisintegribus vel in midnervo pauce aculeatis, inflorescentia 4.5-8.5 cm longa9-23-florifera stellate puberula, pedunculo 3 cm longo, pedicellis 6-15 mm longis, calycibus stellate puberulis tubo 1-2.3 mm longo lobis 1-1.5 mm longis lanceolatis, corollis 7-8 mm longisalbis stellate puberulis ½-lobatis lobis deltoideis, baccis 13-14 mm diametro luteis. Typus: Lanai I., W. Hillebrand & J. M. Lydgate.

S. honopuense sp. nov. (sect. Brevantherum). Frutex decumbens inermis stellate pilosus est, petiolis 6-20 mm longis, laminis 2.5-8.7 X 1.4-2.8 cm subcoriaceis ellipticis acutis inermibus, inflorescentia 2 cm longa 5-9-florifera stellate pilosa, pedunculo 10-15 mm longo, pedicellis 5-7 mm longis, calycibus tomentosis tubo 1-1.3 mm longo lobis 1.6-2 mm longis deltoideis, corollis 5.5-6 mm longis stellate pilosis 3/4-lobatis lobis lanceolatis, baccis 11-13 mm longis ellipsoideis nigris. Typus: Kauai I., Kalalau Trail, C. N. Forbes 1,081.K.

S. lanaiense sp. nov. (sect. Oliganthes). Frutex est, ramulis stellate puberulis glabratis aculeatis, petiolis 10-12 mm longis hirsutulis, aculeatis, laminis 5.3-6.5 X 2.2-3.5 cm ellipticis denticulatis minute puberulis aculeatis, inflorescentia 3 cm longa 9-florifera racemosa stellate puberula, pedunculo 6-10 mm longo, pedicellis 6-15 mm longis, calycibus glabris tubo 2.3 mm longo lobis 1-1.5 mm longis lanceo-ovatis, corollis 13-14 mm longis stellate puberulis ½-lobatis lobis deltoideis, baccis 11 mm diametro badiis. Typus: Lanai I., W. Hillebrand (US).

S. Lydgatei sp. nov. (sect. Irenosolanum). Frutex stellate puberulus est, ramulis glabratis, petiolis 1.4-2.3 cm longis, laminis 6-9.4 X 3.5-6.2 cm ovatis subintegribus vel lobatis glabratis, paniculis 1.5-2 cm longis 5-9-floriferis, pedunculo 2.5-4.5 cm longo, pedicellis 3-12 mm longis, calycibus stellate puberulis tubo 1.3 mm longo lobis 1 mm longis deltoideis, corollis 7 mm longis albis stellate puberulis ultra ½-lobatis lobis ellipticis, baccis 12 mm diametro badiis. Typus: Sandwich (=Hawaiian) Is., Menzies (BM).

S. MacDanielsii sp. nov. (sect. Irenosolanum). Frutex 1 m altus est, ramulis glabratis, novellis stellate puberulis, petiolis 2.2-3.6 cm longis glabratis, laminis 6.5-10.7 X 4.2-7 cm ellipticis dentatis supra glabris, inflorescentia 8.5 cm longa stellate puberula, pedunculo 4.8 cm longo, pedicellis 8-14 mm longis, calycibus stellate puberulis tubo 1.8 mm longo lobis 0.8 mm longis lanceolatis, corollis 6-9 mm longis albisstellate pilosulis 3/4-lobatis lobis lanceolatis, baccis 12-14 mm diametro nigris. Typus: Kauai I., Haupu, L. H. MacDaniels 732.

S. Nelsoni Dunal in A. DC., var. vadosum var. nov. A var. Nelsoni differt in laminis majoribus plerumque late ellipticis subcordatis vadose lobatis et compluribus infra in midnervo aculeatis. Typus: Hawaii I., Kaulananauna, L. W. Croft 110.

S. nesophilum sp. nov. (sect. Irenosolanum). Frutex stellate puberulus est, petiolis 6-13 mm longis, laminis 3-4.8 X 2-4.2 cm coriaceis subovatis subacutis subcordatis 1/5-1/4-lobatis, paniculis 2.5-3 cm longis 21-27-floriferis stellate puberulis, pedunculo 7-8 mm longo, pedicellis

3-7 mm longis, calycibus stellate tomentosis tubo 2 mm longo lobis 1.5-1.8 mm longis deltoideis, corollis 7-8 mm longis albis stellate pilosis ½-lobatis lobis ovatis acutis. Typus: Maui I., H. Mann & W. T. Brigham 458 (CU).

S. Popolo sp. nov. (sect. Irenosolanum). Planta ramosa lignosa est, ramulis stellate puberulis, petiolis 12-22 mm longis stellate hirsutulis, laminis 4.3-7.7 X 2.4-4 cm ellipticis dentatis infra stellate hirsutulis, inflorescentia 3-3.5 cm longa 13-florifera stellate puberula, pedunculo 5-8 mm longo, pedicellis 8-17 mm longis, calycibus stellate puberulis tubo 1.3 mm longo lobis 0.5-0.8 mm longis ovatis, corolis 6.5 mm longis albis stellate puberulis, baccis 8 mm diametro badiis. Typus: Lanai I., W. Hillebrand (US).

S. pubinervosum sp. nov. (sect. Tovaria). Planta lignosa ramosa subinermis est, ramulis stellate hirsutulis, petiolis 1-4 cm longis stellate hirsutulis, laminis 11-19 X 3.7-8 cm lanceolatis sinuatis vel dentatis infra stellate pilosulis, inflorescentia 6-10 cm longa 11-32-floriferastellate pilosula, pedunculo 20-29 mm longo, pedicellis 14-24 mm longis, calycibus stellate pilosulis tubo 1-1.5 mm longolobis 3-4 mm longis ovatis, corollis 6-6.5 mm longis stellate pilosulis ½-lobatis lobis ovatis, baccis 11 mm diametro subviridibus. Typus: Lanai I., Kaiholea Valley, C. N. Forbes 12.L.

S. semilobatum sp. nov. (sect. Torvaria). Planta lignosa est, ramulis cum aculeis 2.5-3.5 mm longis compressis, petiolis 15-25 mm longis stellate pilosulis, laminis 8-15.5 X 8-9.2 cm ovatis sinuatis vel vadose lobatis infra stellate pilosulis, corymbis 11-13 cm longis multiflorifeis stellate pilosulis, pedunculo 2-4.6 cm longo, pedicellis 10-14 mm longis, caycibus sparse stellate pilosulis tubo 1.3-2 mm longo lobis 1.6-3 mm longis deltoideis, corollis 8 mm longis albis ½-3/4-lobatis stellate pilosulis lobis ovatis, baccis 10 mm diametro badiis. Typus: Maui I., W. Hillebrand (US).

S. tonsum sp. nov. (sect. Torvaria). Planta lignosa est, ramis stellate hirsutulis cum aculeis 2-5 mm longis compressis, petiolis 2-4 cm longis stellate hirstutulis et aculeatis, laminis 9-14.5 X 7-9 cm ovatis subcordatis 1/6-1/4-lobatis infra stellate pilosis midnervo cum vel sine aculeis, cymis 8-9 cm longis multifloriferis stellate pilosulis, pedunculo 4-4.5 cm. longo, pedicellis 8-10 mm longis, calycibus 4.5-5 mm longis subglobosis ½-lobatis lobis lanceolatis, corollis 7 mm longis stellate pilosulis albis ½-lobatis lobis ovatis. Typus: West Maui I., H. Mann & W. T. Brigham 457.

MORE NEW SPECIES OF DELISSEA (LOBELIACEAE)

HAWAIIAN PLANT STUDIES 126

Harold St. John,
Bishop Museum, Box 19000A, Honolulu, Hawaii 96817, USA

Based on morphology, the author describes two new species and makees one new combeination in Delissea (Lobeliaceae) in the Hawaiian flora.

The genus Delissea is already a large element in the wet forests of the Hawaiian mountains, but additional species are continually being discovered.

Delissea aurantiaca sp. nov. Frutex 30 cm altus est, caule hirtelli, foliis hirtellis, petiolis 8-19 mm longis, laminis 8.5-16 X 4-7 cm ellipticis subacuminatis basi cuneata, racemeis 4 cm longis hirtellis, pedunculo 8-10 mm longo, pedicellis 4-5 mm longis, lobis calycis 3-3.5 mm longis lanceolatis, corollis 22 mm longis albis puberulis, tubo filamentarum 16 mm longo glabro, baccis 10-12 mm longis ellipsoideis aurantiacis. Typus: Hawaii I., Glenwood, E. Funk 203.

D. inermis sp. nov. Frutex 2.3-4 m altus glaber est, petiolis 7-14 cm longis, laminis 10-17 X 28-32 cm subcoriaceis anguste ellipticis subacutis basi cuneata, racemis 6.5-12 cm longis 7-15-floriferis, pedunculis 3-8 cm longis, pedicellis 8-17 mm longis, lobis calycis 0.3 mm longis deltoideis, corollis 24-28 mm longis albis glabris, columna filamentarum 20 mm longa glabra, antheris superis 7 mm longis. Typus: Kauai I., Wahiawa Valley, S. Perlman 486A.

D. serratifolia (Rock) comb. nov.

Cyanea coriacea (A. Gray) Hillebr., ver serratifolia Rock, Occas. Papers, Bishop Mus. 22(5): 65, 1957.

Beside the type there is also a second collection from a nearby locality. It is Oahu: Huliwai, Ekahanui ridge, 2,500 ft alt., May 8, 1933, G. W. Russ. Mr. Russ considered his plant a new species and left with it a nearly compete description, but never published it.

The types are all in the Bishop Museum, Honolulu.

DIAGNOSES OF PEPEROMIA SPECIES (PIPERACEAE) HAWAIIAN PLANT STUDIES 164

Harold St. John
Bishop Museum, Box 19000A, Honolulu, Hawaii 96817, USA.

The genus Peperomia is well represented in Hawaii. The basic local treatment, one by Yuncker (1933), accepted 38 species and 25 varietiesto which 6 species have been added by St. John and 2 varieties by Degener and Degener. Most of the Peperomia plants occur in the wooded areas, mostly in the rain forests.

The new type specimens are placed in the Bishop Museum, Honolulu.

Peperomia epihippii sp. nov. Turiones prostrati sunt, ramis 5-10 cm longis hirtellis, foliis 2-3 in nodis, petiolis 2-7 mm longis hirtellis, laminis 7-15 X 5-12 mm suborbicularibus supra glabris infra hirsutis, spicis 2-3.2 cm longis, pedunculo 8-12 mm longo hirtello, bracteis 0.4-0.6 mm diametro, ovariis 2 et 0.5 mm longis. Typus: Hawaii I., Puu Huluhulu, H. St. John 25,347.

P. hanaensis sp. nov. Planta 15 cm alta hirtella est, foliis 3-5-verticillatis, petiolis 2-4 mm longis, laminis 9-15 X 5-9 mm obovatis 1-nervosis, spicis 2.2 cm longis, pedunculo 8 mm longo glabro, bracteis 0.4 mm diametro. Typus: Maui I., Waihoi, B. Harrison 575A.

P. minutilimba (Yuncker) comb. nov.
P. Cookiana C. DC., var. minutilimba Yuncker, Bull. Bishop Mus. 112: 67, 1933.

P. muscorum sp. nov. Turiones repentes sunt, ramis 10-11 cm altis, foliis 3-verticillatis, petiolis 6-9 mm longis hirtellis, laminis 9-18 X 6-9 mm spatulati-oblanceolatis supra glabris infra midnervo puberulo, spicis 0.5-2 cm longis, pedunculo 6 mm longo glabro, bracteis 0.3-0.4 mm diametro, ovariis 0.2 mm longis globosis. Typus: Maui I., Nahiku, H. St. John & R. J. Catto 17,963A.

P. nahikuensis sp. nov. Fig. 1. Turiones repentes sunt, ramis 15-20 cm altis hirtellis, foliis 3-4-verticillatis, petiolis 4-7 mm longis hirtellis, laminis 5-13 X 4-10 mm suborbicularibus vel obovatis 1-3-nervosis supra glabratis infra hirtellis, spicis 7-17 mm longis. Typus: Maui I., Nahiku, H. St. John & R. J. Catto 17,963.

P. Woolfordii sp. nov. Fig. 2. Planta diffusa est, ramis 9-16 cm longis hirtellis, foliis oppositis, petiolis 2-6 mm longis hirtellis, laminis 8-13 X 6-12 mmellipticis vel suborbicularibus puberulis 3-nervosis, spicis 2-2.5 cm longis, pedunculo 12 mm longo hirtellis, bracteis 0.3 mm diametro, fructibus 0.5 mm longis ellipsoideis glanculose punctatis rostro bifido. Typus: Maui I., Ukumehame Gulch, H. St. John et al. 25,745.

Literature Cited

Yuncker, Truman George, 1933. Revison of the Hawaiian Species of Peperomia. Bull. Bishop Mus. 112: 1-131, figs. 1-38.

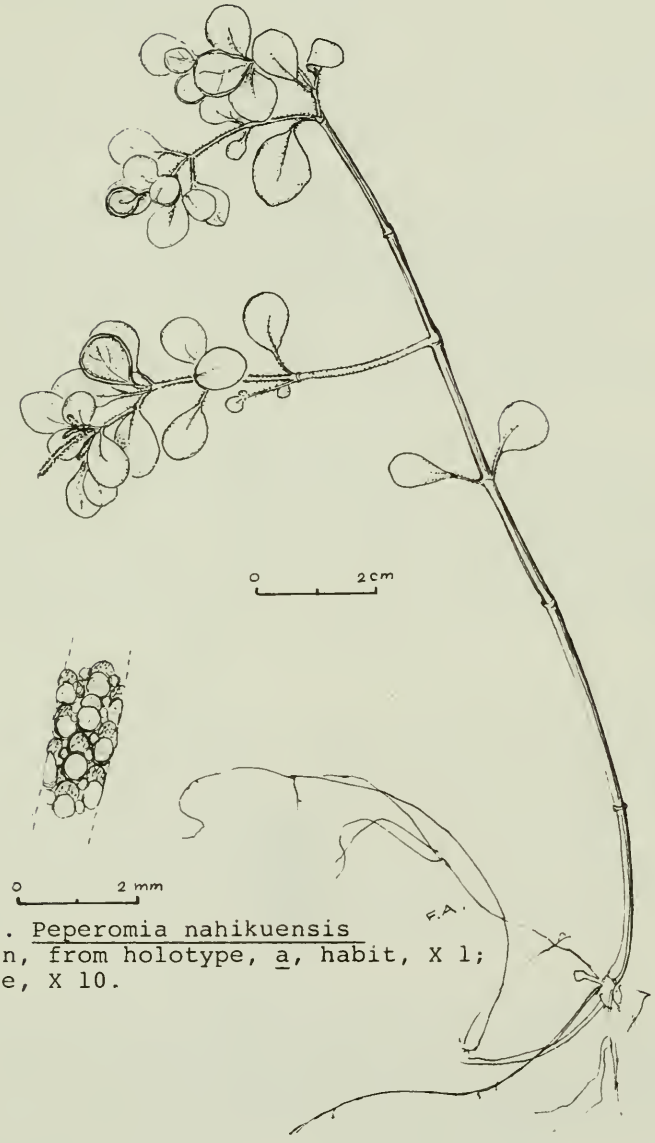

Fig. 1. Peperomia nahikuensis St. John, from holotype, a, habit, X 1; b, spike, X 10.

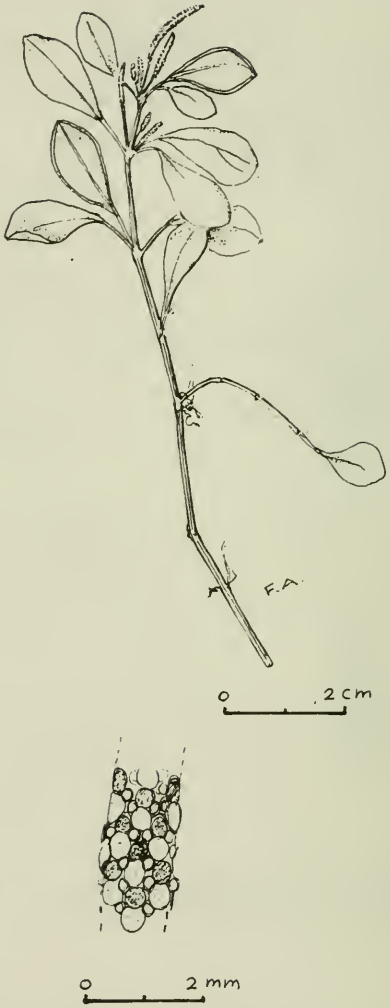

Fig. 2. Peperomia Woolfordii St. John, from holotype. a, habit, X 1; b, spike, X 10.

DIAGNOSES OF SOME PHANEROGAMAE

HAWAIIAN PLANT STUDIES 165

Harold St. John
Bishop Msueum, Box 19000A, Honolulu, Hawaii 96817, USA

The types are in the Bishop Mseum, Honolulu.

Gramineae

Eragrostis Hobdyi sp. nov. Planta perennis caespitosa 34-40 cm alta est, culmis glabris, foliis basilaribus cum vaginis 14-16 mm longis, laminis 7-25 mm longis, foliis caulinaribus 3 cum vaginis 4.5-5 cm longis glabris ligulis pilis 0.3 mm longis, laminis 30-45 cm longis 5-6 mm latis sed mox involutis et in aspectu 1-2 mm latis glabris paniculis 13 X 1.5-2 mm 6-7-floriferis. gluma exteriori 2 mm longa lanceolata glabra, palea 1-1.2 mm longa elliptica costis binis ciliatis . Typus: Molokai I., Kikipua, R. Hobdy 2,158.

E. molokaiensis sp. nov. Planta pereniis 20-40 cm alta glbra est, foliis basilaribus multis, ligulis ciliatis, laminis 5-6 X 0.1-0.2 cm involutis supra pilosulis infra in nervis scabris, foliis caulinaribus 1-2, paniculis 8-15 X 3-9 cm ovoideis ramis 2.5-6 cm longis scabris, pedicellis 2-10 mm longis, spiculis 4-6 mm longis 5-9-floriferis ellipsoideis, gluma exteriori 1.5 mm longa 3-nervosa, lemmis 1.7-2 mm longis lanceo-ovatis 3-nervosis ciliolatis. Typus: Maui I., Haleakala, J.Henrıckson 3,947.

Palmae

Pritchardia limahuliensis sp. nov. Arbor est, petiolis 92 X 7 cm hinuleo-tomentosis, laminis 80 cm longis parte indivisa 45 cm longa plicis 46 segmentis centralibus in basi 22 mm latis cum lepidiis 0.1-0.2 mm longis ellipticis, pedunculo 26-50 cm longo, bracteis superis 30 cm longis lanceolatis tomentosis, floribus 6-6.5 mm longis, calycibus 2 mm longis 3-dentatis, petalis 3 X 1.8 mm ellipticis, antheris 2.5 mm longis, drupis 16-19 X 12-15 mm ellipsoideis, endocarpio 0.2 mm crasso, endospermo 12 X 19 mm albo. Typus: Kauai I., Limahuli Valley, Perlman & Wichman 7.

Caryophyllaceae

Schiedea kauaiensis sp. nov. Frutex 1 m altus glaber est, foliis oppositis, petiolis 3-5 mm longis, laminis 3.7-10 X 1.4-2.1 cm coriaceis ellipticis in apicubus ambis acutis 1-costatis nervis minoribus diffusis, paniculis 24-30 cm longis 7-14 cm latis, pedunculo 5-9 cm longo, ramis lateralibus 5-9 cm longis horizontalibus, pedicellis 5-15 mm longis puberulis, sepalis 2.2-3 mm longis lanceolatis puberulis. Typus: Kauai I., C. Christensen 290.

S. Obatae sp. nov. Frutex glaber est, foliis sessilibus 4-8 X 0.3-0.8 cm ligulati-ellipticis apicibus ambis acutis midnervo forti nervis secundariis obscuris reticulatis, panicula 6-10.5 X 0.1-0.3 cm glabro, pedicellis 2-4 mm longis, sepalis 2 mm longis ovatis acutis, nectariis 2 mm longis linearibus integribus. Typus Oahu I., J. Obata 368.

S. Wichmanii sp. nov. Frutex est, herbis glabris, petiolis 3-6 mm longis, laminis 4-9 X 1.4-2.8 cm elliptici-lanceolatis basi cuneata 1-nervosis, inflorescentia ad 25 cm longa puberula, pedicellis 3-12 mm longis, sepalis 3 mm longis lanceolatis acuminatis puberulis, nectariis cum basi 0.5 mm longa pulviniformi bilobata tubo lineari bidentato, staminibus 10, filamentis 4 mm longis, antheris 0.7 mm longis elliptici-ovoideis, stylis 4 mm longis filiformibus cum apice spathulato. Typus: Kauai I., Perlman & Wichman 219.

Pittosporaceae

Pittosporum radiculatum sp. nov. Arbor est, ramulis tomentosis, petiolis 15-35 mm longis laminis 4.5-8 X 1.1-2.5 cm coriaceis oblanceolatis obtusis basi cuneata longe decurrenti supra glabris reticulatis infra ferruginose tomentosis margine revoluto, inflorescentiis lateralibus tomentosis, bracteis linearibus, sepalis 5 mm longis lanceolatis, petalis 15 mm longis albis glabris, capsulis 1.8-2.4 X 2-2.4 X 1.3 cm oblongo-orbicularibus rugosis glabris, seminibus 3.5-4 mm longis. Typus: Hawaii I., Volano Natl. Park, J. Jacobi & Thorne 275.

Fabaceae

Canavalia mauiensis sp. nov. Liana est, ramulis glabris, petiolis 35-45 mm longis glabris, foliolis lateralibus cum petiolulis 5-8 mm longis glabris, laminis 7-10.5 X 4.7-6.4 cm ovatis subinconcinnis acuminatis glabris, foliolo terminali cum petiolulo 7-10 mm longo, stipelis 9 mm longis linearibus, laminis 8-11 X 5.2-6.8 cm ellipticis ad apicem acuminatum deminuenti, floribus "violaceis," pedicellis 2 mm longis, calycibus 20 mm longis tubo 7-8 mm longo pilosulo lobis superis 14 mm longis loba infera 5 mm longa lanceolata, vexillo 35 mm longo, alis 31 mm longis, carina 35 mm longa. Typus: Maui I., Paunau, K. M. Nagata et al. 1,669.

SEED GERMINATION IN SIDALCEA NELSONIANA (MALVACEAE)

Richard R. Halse
4535 NW Beta Place, #3
Corvallis, Oregon 97330

Richard Mishaga
CH2M Hill, Inc.
2020 SW Fourth Avenue
Portland, Oregon 97201

Sidalcea nelsoniana Piper (Malvaceae) is an endemic species of the Willamette Valley and Coast Range of western Oregon (Halse and Glad, 1986) and is a Category 2 candidate for possible federal listing as threatened (U.S. Fish and Wildlife Service, 1985). The discovery of a population of Sidalcea nelsoniana within the area of a proposed water supply reservoir initiated a study program funded by the City of McMinnville, Water and Light Department and managed by CH2M Hill, Inc. to determine if experimental populations of this species could be successfully established in other suitable locations. One study in this program was to determine if large numbers of Sidalcea nelsoniana could be propagated from seed. This paper describes the germination studies.

Seed germination in the Malvaceae has not been closely studied except for economically important species. In the Gossypieae, Fryxell (1981) states that the seed coat is relatively indurate, is impregnated with lignins and tannins, is impervious to moisture, and has a degree of dormancy. This dormancy is broken after weathering or after the seed coat is physically damaged. Seeds of Alcea rosea L., hollyhock, will germinate after 14 to 21 days when kept in moist soil at 18 to 24°C; seeds of Abelmoschus esculentus (L.) Moench, okra, germinated after 4 to 14 days when kept in moist soil at 20 to 30°C (U.S. Dept. Agric., 1961). Within the genus Sidalcea, Sullivan and Daley (1981) report that the seeds of Sidalcea malvaeflora (DC.) Gray will germinate after being soaked in hot or warm water for 6 hours. The seeds of Sidalcea nelsoniana were reported by J. Kierstead (personal communication, 1985) to germinate if the seed coat was punctured or broken. With this information, a study was designed to develop large scale germination techniques for Sidalcea nelsoniana.

MATERIALS AND METHODS - The fruit of Sidalcea nelsoniana is a schizocarp, each carpel containing one seed. The carpel and seed dehisce as a single unit. The carpel wall, when mature, is dry and membranous. The seeds are arcuate, with the length averaging 2 mm and the width 1.5 mm. When fully mature, the seed coat is hard and shiny brown; when immature, the seed coat is softer and a dull greenish color.

Seeds of Sidalcea nelsoniana were collected during the late summer and early fall of 1985 from throughout the range of the species. Entire, dried inflorescences were picked and then stored in a cold room at 2°C until December 1985 and January 1986. At the time of collection the carpels were still partially enclosed by the persistent dry calyx.

Prior to germination, the following techniques were implemented for fruit preparation, seed scarification, and water and light exposure. The fruits were gently rubbed between two pieces of fine sandpaper to remove the carpel wall and the calyx. The papery calyx and carpel disintegrated, leaving the hard seeds intact. This process did not damage the seeds, other than leaving fine scratches on the seed coat. A block of slate drilled with holes about 3 mm in diameter and 2 mm in depth was used to hold the seeds. One seed was placed in each hole and the hard seed coat was ruptured with a fine-tipped probe. The scarification method used was to pry off a fairly large piece of the seed coat. The seed coat on a mature seed is quite hard and will crack off in pieces if pressure is applied in the appropriate manner. It was easiest to remove a piece of the seed coat from the dorsal surface of the seed. This process was carried out under 10X magnification.

The scarified seeds were then placed on moist filter paper in a petri dish where the embryos imbibed water and swelled, frequently escaping entirely from the seed coat (which remained intact). This usually occurred within 24 hours. If the embryo did not escape from the seed coat within the next 24 hours, it was squeezed out manually. The seed's proximal and distal ends were gently squeezed with forceps to expell the embryo. Germination occurred within 1 to 4 days of the breaking of the seed coat.

Once embryos had escaped from their seed coats they were allowed to remain on the moist filter paper for at least 24 hours. During that time rapid growth was observed. The cotyledons expanded, turned green, and frequently opened. The root increased in length and developed root hairs. Embryos were transferred to peat pots filled with potting soil when the cotyledons turned green or when root hairs developed, a process which took 2 to 7 days.

The effect of light on germination was also studied. Thirty seeds with unbroken seed coats were kept in the dark and another 30 seeds were kept in the light, all on moist filter paper in petri dishes. This treatment was repeated using the same number of scarified seeds. The majority, over 3000, of the scarified seeds were germinated in the light.

Germinating seeds sometimes became moldy. Surface sterilization with a weak bleach solution for 1 to 2 minutes usually prevented or delayed mold growth until after the embryo had emerged from the seed coat. In most cases, however, germination occurred so quickly that

surface sterilization was not necessary, particularly if the seed coat had been adequately broken.

RESULTS - Germination of Sidalcea nelsoniana seeds occurred readily once the seed coat was ruptured and part of it removed. The percentage of germination varied greatly among samples, ranging from 0 to 100 percent (Table 1). Sample numbers refer to different collection localities or collection dates of Sidalcea nelsoniana seed. The lower germination percentages primarily reflect the process of determining that only fully mature seeds will germinate and learning to differentiate between mature and immature seeds. Seeds which were inadequately scarified also show no signs of germination. When these two problems were identified, the germination percentage greatly increased.

Scarified seeds had approximately the same germination percentage regardless of whether they were kept in the light or dark (Table 2). Both groups germinated readily and in the same period of time. The only difference noted was that the cotyledons of seeds kept in the dark did not turn green until the embryos were transplanted into pots and exposed to light.

Seeds with intact seed coats had approximately the same germination percentage regardless of whether they were kept in the dark or in the light (Table 2). Of the 30 seeds kept in the light 4 seeds germinated for a germination percentage of 13 percent; none of the unscarified seeds kept in the dark germinated. The unscarified seeds were kept on moist filter paper for 4 months.

DISCUSSION - Successful laboratory germination of Sidalcea nelsoniana seeds depends on several factors. Only fully mature seeds germinate readily. If immature seeds are scarified some will germinate but most will not. It is most effective to remove a large piece of seed coat. Although puncturing the seed coat with the tip of a probe allows water and oxygen to enter and germination to begin, the embryo is unable to expand and crack open the seed coat and eventually the embryo dies.

The major problem in seedling (embryo) survival was the persistence of the seed coat. The best method for scarification was found to be removal of a piece of the seed coat from the middle of the dorsal surface. If the seed coat was removed from the broad end (cotyledon end) of the seed, the cotyledons would readily emerge but the radicle would not. Removal of the seed coat from the narrow end (radicle end) allowed the radicle to escape but not the cotyledons. When either situation occurred, the seed coat had to be manually removed, with a concomitant greater risk of damaging the embryo. On the other hand, if the embryo was squeezed out of the seed coat with forceps, as previously described, little or no visible damage to the embryo could be detected.

TABLE 1. Seed Germination in Sidalcea nelsoniana

SAMPLE NUMBER	SEEDS SCARIFIED	SEEDS GERMINATED	PERCENTAGE GERMINATION
1	39	0	0[a]
2	389	93	24[a]
3	150	69	46
4	34	3	9[b]
5	30	1	3[b]
6	106	14	13[a]
7	22	0	0[c]
8	54	30	56
9	19	13	68
10	9	0	0[a]
11	204	80	39[a]
12	77	0	0[a]
13	124	60	48
14	79	68	86
15	56	19	34[b]
16	77	63	82
17	177	123	69
18	69	58	84
19	32	7	22[c]
20	29	18	62
21	103	103	100
22	79	64	81
23	81	79	98
24	39	24	62
25	20	11	53
26	18	10	56
27	14	6	43
28	67	54	80
29	36	29	80
30	201	193	96
31	215	205	96
32	387	356	92
33	87	87	100
TOTALS	3123	1940	62

a. Seeds immature.
b. Seeds inadequately scarified.
c. Seeds insect damaged.

If seed coats still covered the radicle or the cotyledons when embryos were planted in the peat pots, they usually died. When the seed coat covered the cotyledons, the root grew down into the soil but the cotyledons never managed to crack open the seed coat and escape. The epicotyl often lengthened, elevating the seed-enclosed

TABLE 2. Seed Treatments of Sidalcea nelsoniana

SEED TREATMENTS		NUMBER of SEEDS	SEEDS GERMINATED	PERCENTAGE GERMINATION
SEED COAT BROKEN	LIGHT	30	30[a]	100
	DARK	30	29[a]	97
SEED COAT INTACT	LIGHT	30	4[b]	13
	DARK	30	0	0

a. Germination occurred within 7 days.
b. Germination occurred after 30 days.

cotyledons. If the cotyledons were free of the seed coat but the radicle was not, the cotyledons turned green and started to develop normally; however, the root was unable to shed the seed coat and it remained firmly attached to the root tip. In these cases, the root frequently twisted and appeared to be malformed. Often the root tip was immobilized by the adhering seed coat, which caused the seedling to push itself out of the soil.

Frequently, either the cotyledons or the radicle were physically damaged by the probe during the removal of a piece of the seed coat. If the damage was not too severe, the embryo developed normally. If only one cotyledon was damaged, the other developed sufficiently for the plant's survival. The embryo died if both cotyledons were damaged. If the radicle was damaged, a new root developed, provided that the cotyledons were green and the embryo was left in the petri dish for several days.

The results of these germination studies has implications as to how Sidalcea nelsoniana seeds germinate in nature. As noted above, the seed coat is quite hard. Under natural conditions, this hardness would appear to be the critical impediment to the seed's ability to germinate and develop successfully. If this species' seeds are ruptured in a way that allows water and oxygen to enter but are not broken enough to allow the embryo to expand (as occurred frequently under laboratory conditions), they would be expected to eventually die. Even if the hard seed coat is broken open enough to allow either the cotyledons or the radicle to escape, that also would be insufficient for continued development. It appears that, under natural conditions, either most of the seed coat must be sufficiently

softened to allow water and oxygen to enter and to allow the embryo to expand and break out of the seed coat, or the seed coat must be broken open completely to allow the entire embryo to escape its confines.

CONCLUSIONS - Mature seeds of Sidalcea nelsoniana germinated readily, with high germination percentages obtained under laboratory conditions, as long as the seeds were first adequately scarified. The seeds need no pre-treatment, other than scarification, to germinate; germination is not affected by light or dark.

REFERENCES CITED

Fryxell, P. A. 1981. The natural history of the cotton tribe. Texas A & M University Press, College Station. 245 pp.

Halse, R. R. and J. B. Glad. 1986. A note on the status of Sidalcea nelsoniana (Malvaceae). Madrono 33:225-226.

Sullivan, G. A. and R. H. Daley. 1981. Directory to resources on wildflower propagation. Missouri Botanical Garden, St. Louis. 331 pp.

U. S. Department of Agriculture. 1961. Seeds. The yearbook of agriculture. 89th Congress, 1st Session: House Document No. 29.

U. S. Fish and Wildlife Service. 1985. Endangered and threatened wildlife and plants; Review of plant taxa for listing as endangered or threatened species; notice of review. Federal Register 50:39526-39584.

NOTES ON THE GENUS *CLERODENDRUM* (VERBENACEAE). XXXVIII

Harold N. Moldenke

CLERODENDRUM PANICULATUM var. *DIVERSIFOLIUM* (Vahl) C.B. Clarke in Hook. f., Fl. Brit. India 4: 593 [as "*Clerodendron*" and "*diversifolia*"]. 1885.

Synonymy: *Volkameria diversifolia* Vahl ex C. B. Clarke in Hook. f., Fl. Brit. India 4:593 in syn. 1885; *Clerodendron paniculatum* var. *diversifolia* C. B. Clarke in Hook. f., Fl. Brit. India 4: 593. 1885; *Clerodendron paniculatum* f. *diversifolium* Vahl ex Voss in Vilm., Blumengärt. 1: 831. 1895; *Clerodendrum diversifolium* Vahl, Symb. Bot. 2: 75. 1791; *Clerodendron diversifolium* Raeusch., Nom. Bot., ed. 3, 182. 1797; *Clerodendrum foliis integris, trilobisque ovatis; paniculâ, ramis dichotomis, villosis; pedicellis racemosis* Vahl ex Poir. in Lam., Encycl. Méth. Bot. 5: 167 in syn. 1804.

Bibliography: Vahl, Symb. Bot. 2: 75. 1791; P. Mill., Gard. Dict., ed. 9, 1: Clerodendrum 8. 1797; Raeusch., Nom. Bot., ed. 3, 182. 1797; Willd. in L., Sp. Pl., ed. 4 [5], 3(1): 387. 1800; Poir. in Lam., Encycl. Méth. Bot. 5: 167. 1804; Pers., Sp. Pl. 3: 366. 1819; Steud., Nom. Bot. Phan., ed. 1, 207. 1821; Spreng. in L., Syst. Veg., ed. 16, 2: 760. 1825; D. Dietr., Syn. Pl. 3: 617-618. 1842; Manetti, Cat. Pl. Caes. Reg. Modic, suppl. 2: 69. 1845; Walp., Repert. Bot. Syst. 4: 102. 1845; Schau., in A. DC., Prodr. 11: 668-669. 1847; Buek, Gen. Spec. Syn. Candoll. 3: 106. 1858; Bocq., Adansonia, Ser. 1 [Baill., Rec. Observ. Bot.] 3: [Rev. Verbenac.] 214. 1863; C.B. Clarke in Hook. f., Fl. Brit. India 4: 593. 1885; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1,: 561 (1893) and imp. 1, 2: 1219. 1895; Voss in Vilm., Blumengart. 1: 831-832. 1895; Craib, Kew Bull. Misc. Inf. 1911: 444. 1911; Craib, Contrib. Fl. Siam Dicot. 166. 1912; Rehnelt, Pareys Blumengärt., ed. 1, 280-281. 1932; Burkill, Dict. Econ. Prod. Malay Penins., imp. 1, 1: 589. 1935; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 561 (1946) and imp. 2, 2: 1219 (1946) and imp. 3, 1: 561 (1960) and imp. 3, 2: 1219. 1960; Burkill, Dict. Econ. Prod. Malay Penins., imp. 2, 1: 589. 1965; Mold., Résumé Suppl. 14: 3 & 8. 1966; Mold., Fifth Summ. 1: 282, 443 & 452 (1971) and 2: 870. 1971; Mold., Phytologia 31: 395-396. 1975; Mold., Phytol. Mem. 2: 272, 388 & 541. 1980; H.N. & A.L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 413. 1983; Mold., Phytologia 59: 344 & 347 (1986) and 63: 57. 1987.

This variety differs from the typical form of the species in having, according to Clarke (1885) the 'upper leaves not lobed", but basally "cordate or hastate".

Vahl's original (1791) description [as quoted by Poiret (1804)] was "foliis integris, trilobisque ovatis; panicula ramis dichotomis, villosis; pedicellis racemosis" or, as quoted by Dietrich (1842) "foliis ovatis angulato-trilobis glaberrimis trinerviis; paniculae trichotomae ramis villosis racemosis". It was said by Vahl to originate "In Ind. or." Clarke (1885), basing his variety *diversifolia* on *"V[olkameria] diversifolia* Vahl Symb. ii. 75" [but Vahl did not place the species in *Volkameria*!], cites a Parish collection from Moulmein, Burma. Craib (1911) cites Kerr 762, also from Moulmein, as probably representing this variety.

Voss (1985) describes the variety as having the "oberen Blätter deren Grund herz- oder spiessförmig ...nicht gelappt. Blütenrispen 10-35 cm lang bei 8-23 cm Breite, weichhaarig, im unteren Teile oft beblättert, sehr, locker; ihre Äste oft verlängert und fast traubig, gewöhnlich rotgefärbt. Kelch 4-6 mm lang, fast bis zum Grunde in schmal-längliche Zipfel deteilt. Blumenkrone leuchtend-rot, porangerot oder fast weiss. Kronröhre 1 1/2- 2 cm lang, fadenförmig."

Poiret (1804) gives a rather lengthy description: "Des rapports nombreux avec le *Clerodendrum trichotomum* pourroient faire croire que cette espéce n'en est qu'une variété; mais on reconnoîtra qu'elle doit en être séparée, par ses rameaux velus à leur partie supérieure, par ses feuilles plus étroites, par sa panicule velue, d'abord dichorome, puis terminée par un grand nombre de grappes; enfin par les divisions du calice plus longues.

"Ses tiges sont ligneuses, divisées en rameaux tétragones, creuses à chaque face par un fillon profond, velus à leur partie supérieure, garnis de feuilles opposées, pétiolées, presquovales, glabres, lisses & d'un vert foncé en dessous, rudes & couvertes en dessous d'un grand nombre de petites écailles semblables á celles dont nous avons parté á l'article du *Clerodendrum squamatum*, longues de six à huit pouces, larges de cinq à six. Les feuilles inférieures, très-grandes, sont échancrées, très-élargies à leur base, divisées à leurs borders cinq grands lobes aigus, celui du milieu beaucoup plus long, très-acuminé; les feuilles supérieures sont plus petite, rétrécies a leur insertion sur le pétiole, & n'ont que trois lobes, les deux latéraux courts, médiocrement aigus. Les pétioles ont à peine un tiers de la longueur des feuilles; enfin, les feuilles terminales sont petites, entières,

lancéolées, sessiles ou rétrécies en pétiole à leur base.

"La panicule est ample, terminale, longue de huit à dix pouces, composée de rameaux velus dans toute leur longueur & sur toutes leurs ramifications. Ces rameaux forment les pédoncules communs, qui sont opposés, très-ouverts, une & deux fois dichotomes, & se terminent par des grappes partielles, le long desquelles sont placées les fleurs, munies chacune d'un pédoncule court. Les feuilles terminales dont nous avons parlé, sont situées à la base de chacun des grands rameaux de la panicule. Le calice est pubescent, partagé en cinq découpures oblongues, aiguës. Le tube de la corolle est d'environ un pouce de long, légérement pubescent, partagé à son orifice en cinq découpures droites, inégales, linéaires, obtuses, qui se divisent presqu'en deux lèvres, dont l'inférieure est à trois lobes, les deux latéraux plus courts que celui du milieu. Les étamines dont pourvues de filamens capillaires, une & même presque deux fois plus longs que de la corolle.

"Cette plante croît dans les Indes orientales, d'où Sonnerat en a rapporté des exemplaires qu'il a communiqués au citoyen Lamark. C'est d'après un de ces exemplaires que M. Vahl a décrit & nommé cette plante. (V. s. in herb. Lam.)"

Nothing is known to me of this plant beyond what is stated in its bibliography (above).

CLERODENDRUM PARVITUBULATUM Thomas, Engl. Bot. Jahrb. 68:[Gatt. *Clerodendrum*] 101-102. 1936.

Bibliography: B. Thomas, Engl. Bot. Jahrb. 18, 68, 95 & 101-102. 1936; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 47 & 91. 1942; Hill & Salisb., Ind. Kew. suppl. 10: 55. 1947; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 113 & 183. 1949; Mold., Résumé 139 & 452. 1959; Mold., Fifth Summ. 1: 223 (1971) and 2: 870. 1971; Mold., Phytol. Mem. 2: 214 & 451. 1980.

A partly bushy scandent shrub; branches canescent, 15-20 cm. in diameter [teste Thomas]; branchlets rubiginous, often striate; leaves decussate-opposite, petiolate; petioles 4-8 mm. long, hispidulous with an accessory bud in the leaf axil; leafblades membranous, obovate-oblong, 6-10 cm. long, 3-4 cm. wide, apically obtuse and long-acuminate, marginally undulate, basally rounded-cuneate, glabrous and shiny on both surfaces; inflorescence cymose-paniculate, terminal or cauliflorous; peduncles about 1 cm long, pubescent; pedicels 1-3 mm. long, pubescent; bracts subulate-filiform, 1-5 mm. long, pilose; calyx cylindric-tubular, about 7 mm. long, basally pubescent, 5-dentate to about 1/5 the length, the teeth deltoid, apically acute; corolla

green, the tube 4-5 mm. long, not surpassing the calyx, basally and apically dilated, the limb 5-lobed, the lobes obovate, subequal, 2-3 mm. long, slightly distant, not reclinate; stamens short; filaments 4-5 mm. long, subequal, inserted at the mouth of the corolla-tube; anthers 2 mm. long; style 3-4 mm. long; stigma very shortly bifid; ovary 2 mm. long, subglabrous, dark-fuscous; mature fruit unknown.

This remarkable species is based on Ledermann 5889 from light mountain forest at Muti-Abhang, Mfongu, altitude 1700-1900 m., in the Cameroons. Thomas (1936) notes that "Die Art ist durch die kleine Blümenkrone, die vom Kelch stets umhüllt bleibt, genügend deutlich gekennzeichnet."

A key to help distinguish this species from other African species of Section *Siphonocalyx* will be found under *C. mildbraedii* Thomas in the present series of notes. Nothing is known to me of it beyond what is stated in the bibliography (above). The author's statement regarding the diameter of the branches seems highly questionable -- probably he meant to say 1.5-2 cm.

CLERODENDRUM PARVULUM L.S. Sm., Contrib. Queensl. Herb. 6:[1] & 19-20. 1969.

Bibliography: L.S. Sm., Contrib. Queensl. Herb. 6: [1] & 19-20. 1969; Mold., Fifth Summ. 1: 345 (1971) and 2: 870. 1971; P.G. Wils., Excerpt. Bot. (A) 18: 470. 1971; Heslop-Harrison, Ind. Kew. suppl. 15: 33 & 151. 1954; Mold., Phytol. Mem. 2: 335 & 541. 1980.

A few-branched shrub, about 1 m. tall; branchlets 0.7-2 mm. in diameter, covered with ascending, spreading or curvate, white hairs 0.15-0.5 mm. long, the younger ones more or less stramineous and somewhat compressed, the older ones grayish, terete, and longitudinally fissured; principal internodes 0.3-2.2 mm. long; leaves decussate-opposite or subopposite to ternate or at times spiral, sessile, 'ad apicem projecturae persistentis e ramulo ortae articulata" [fide Smith]; leafblades subcoriaceous, narrowly obovate or narrowly elliptic to narrowly rhomboid "(7.5-4.5:1.0), (0.7) 1.5-2.5 cm longa, (1.5) 2.5-3.5 mm lata" [fide Smith], apically obtuse or subacute, "margine decurva" [fide Smith], basally narrowly cuneate, shortly spreading-pubescent, black-dotted; midrib obscure above, prominent beneath; other venation obscure; flowers single in the leaf-axils or often in 3-flowered cymules; peduncles of the cymules to 1.7 cm. long, pubescent, apically bibracteate, eventually divaricate; pedicels 1.2-1.5 cm. long, bibracteolate above the middle, pubescent, not bracteolate beneath the middle

flower of the cymule; calyx tubular-campanulate, 4.5-5.5 mm. long, subequally 5-lobed, pubescent, the lobes deltoid, about 1.8 mm. long, apically acute, ventrally more or less pubescent; corolla white, the tube more or less cylindric, 8.5-10 mm. long, about 2 mm. wide, slightly oblique at the mouth, externally glabrous, internally pubescent above the insertion of the stamens, the lobes 5, obovate or the anterior one elliptic, 6.6-8.5 mm. long, 4.1-5 mm. wide, apically subrotund or obtuse, marginally ciliate, dorsally slightly pubescent; stamens 4, 9.6-10.8 mm. long, inserted about 3 mm. above the base of the corolla-tube, exserted 5-6.8 mm.; filaments basally barbate, "paribus anterioribus þ 1.2 mm longioribus" [fide Smith]; anthers elliptic, about 2.3 mm long; style about 1.25 mm. long, glabrous; stigma shortly bilobed, the lobes 0.7-1 mm. long; ovary subglobose, 1.5 mm. long and wide, glabrous, longitudinally lightly 4-canaliculate, imperfectly 4-celled, 4 ovulate; fruit (immature?) globose, about 7 mm. long and wide, not deeply 5-lobed, basally partly included by the accrescent calyx; seeds not seen.

This remarkable species is based on Pedley 2647 from 35 miles east of Musgrave Telegraph Office, Cook District, Queensland, Australia, collected in June of 1968, deposited in the Queensland Herbarium as No. 78534. Smith notes of it "floribus parvis cum foliis parvis angustis a congeneribus australiensibus diversa".

Smith (1969) comments that "*Clerodendrum traceyanum* (F. Muell.) F. Muell. and *C. holtzei* Blesser are the only other Australian species with the corolla tube less than 1.5 cm. long. However, both have broadly ovate or ovate leaves whereas those of *C. parvulum* are narrowly obovate or narrowly elliptic. It was not possible to place the species in Bakhuizen's treatment of the genus in Malaysia in Bull. Jard. Bot. Buitenz. ser. 3, 3: 73-96 (1921).

"Largely because it was the only tropical member of the family described as having narrow leaves and in some ways resembling *Clerodendrum*, type material of *Huxleya linifolia* Ewart & Rees was kindly compared with the Breeden collection of *C. parvulum* by Mr. J. H. Willis, who confirmed that the two were distinct, *Huxleya* having "...leaves...glabrous, narrow linear,3-6 mm. long and with tightly revolute margins..." as well as "distinctly quadrangular stems and quite a long corolla-tube". He was also unable to match the Queensland plant among collections at Melbourne of *Clerodendrum* or unplaced Verbenaceae."

Smith cites also Breeden s.n. from "near Musgrave Telegraph Office, +/- 37 mi SW of southernmost part of Princess Charlotte Bay, May 1968" and notes that "Both collectors were able to obtain only a single sheet and stated that the plant was rare. In both localities is was found growing on poorly drained sandy soil in open tea-tree (*Melaleuca* sp.) woodland."

Nothing is known to me of this species beyond what is stated in its bibliography (above).

CLERODENDRUM PAUCIDENTATUM Mold., Lloydia 13: 212-213. 1950.

Bibliography; Mold., Lloydia 13: 212-213. 1950; E. J. Salisb., Ind. Kew. suppl. 11: 56. 1953; Mold., in Humbert, Fl. Madag. 174: 149, 178, 179 & 268, fig. 28 (4). 1956; Mold., Résumé 156 & 452. 1959; Mold., Fifth Summ. 1: 260 (1971) and 2: 870. 1971; Mold., Phytol. Mem. 2: 249 & 541. 1980; P. Holmgren et al., Ind. Vasc. Pl. Types Microf. 442. 1985; Mold., Phytologia 58: 186. 1985.

Illustrations: Mold. in Humbert, F. Madag. 174: 179, fig. 28 (4). 1956.

A shrub, 1-3 m. tall, apparently much branched; branches, branchlets, and twigs all very slender, light-gray, wiry, the youngest parts rather densely short-pilose with yellowish upwardly curved hairs, the older parts glabrous; nodes not annulate; principal internodes 0.5-2 cm. long or even more abbreviated; leaves decussate-opposite; petioles filiform, 3-5 cm. long, glabrous or sometimes pilosulous in the channel above, nigrescent; leafblades membranous, nigrescent in drying, narrowly elliptic, 1.5-4 cm. long, 1-1.3 cm. wide, apically blunt or subacute, marginally entire or usually with 1 or 2 coarse, apically acute or subacute teeth at or above the middle, basally acute, glabrous on both surfaces, rather shiny above; midrib very slender, flat on both surfaces or very slightly prominulous beneath; secondaries filiform, about 4 per side, mostly obscure on both surfaces; veinlet reticulation indiscernible on both surfaces; inflorescence terminal, cymose; cymes subcapitate, rather few-flowered, nigrescent in drying; peduncles obsolete or subobsolete and pilose; peduncles filiform, 1-3 mm. long, densely puberulent; bracts and bractlets absent; calyx campanulate, about 2 mm. long, nigrescent in drying, glabrous, the rim very minutely 5-apiculate-toothed; corolla externally white, internally pink, hypocrateriform, the tube very slender, cylindric, 1-2 cm. long, externally glabrous, the limb about 6 mm. wide; stamens exserted about 1 cm. from the corolla-mouth; fruiting-calyx and fruit not known.

This endemic species is based on Service Forestiere 151 from alluvial soil at Bevasaha, in a valley at about 100 m. altitude, Ankarafantaika, Seventh Reserve, Madagascar, collected in March of 1933 and deposited in the Paris herbarium.

A key to help distinguish this species from other Madagascar taxa in this genus will be found under *C. baronianum* Oliv. in the present series of notes [Phytologia 58: 184-190].

Citations: MADAGASCAR: Perrier 10276 (P); Service Forestier 151 (E--photo of type, F--photo of type, Ld--photo of type, N--isotype, N--photo of type, P--type).

CLERODENDRUM PAUCIFLORUM Mold., Lloydia 13: 213. 1950.

Bibliography: Mold., Lloydia 13: 213. 1950; E. J. Salisb., Ind. Kew. suppl. 11: 56. 1953; Mold., in Humbert, Fl. Madag. 174: 154, 229-231 & 268, fig. 37 (4 & 5). 1956; Mold., Résumé 156 & 452. 1959; Mold., Fifth Summ. 1: 260 (1971) and 2: 870. 1971; Mold., Phytol. Mem. 2: 249 & 541. 1980; Mold., Phytologia 58: 189. 1985;

Illustrations: Mold., in Humbert, Fl. Madag. 174: 229, fig. 37 (4 & 5). 1956.

A shrub; branchlets apparently virgate, very slender, obtusely tetragonal, densely appressed-puberulent with yellowish hairs; nodes not annulate; principal internodes 1.5-5 cm. long; leaves decussate-opposite; petioles filiform, 1-2 mm. long, appressed-puberulent; leafblades submembranous, dark-green on both surfaces, brunnescent in drying, elliptic, 2.5-3.5 cm. long, 1.3-1.5 cm. wide, apically acute or slightly attenuate-acute, marginally entire, basally acute, very sparsely and minutely strigillose-puberulent on both surfaces or glabrescent; midrib very slender, flat above, subprominulous beneath; secondaries filiform, 2 or 3 per side, flat or obscure above, subprominulous beneath, arcuate-ascending; veinlet reticulation indiscernible on both surfaces; inflorescence apparently terminating in very short axillary twigs, few-flowered; peduncles filiform, 1-1.5 cm. long, densely appressed-puberulent with yellowish hairs; pedicels filiform, 3-5 mm. long, minutely appressed-puberulent; bractlets obsolete; calyx campanulate, 2-2.5 mm. long, more or less yellowish-strigose toward the apex, the rim plainly 5-lobed, the lobes elongate-linear, divaricately recurved; corolla hypocrateriform, 1 cm. long or less; fruiting-calyx and fruit not known.

This endemic species is based on Garnier 135 from between Tamative and Tananarive, Madagascar, collected in 1869 and deposited in the Paris herbarium. Thus far

the species is known to me only from the original collection.

A key to help distinguish this species from other Madagascar taxa in this genus will be found under *C. baronianum* Oliv. in the present series of notes [Phytol. 58: 184-190].

Citations: MADAGASCAR: Garnier 135 (E--photo of type, F--photo of type, Ld--photo of type, P--type).

CLERODENDRUM PEII Mold., Known Geogr. Distrib. Verbenac., ed. 1, 79. 1942.

Synonymy: *Clerodendron longipetiolatum* P'ei, Mem. Sci. Soc. China 1 (3): 159-160, plate 29. 1932. [not Gürke, 1893].

Bibliography: P'ei, Mem. Sci. Soc. China 1 (3): 125 & 159-160, pl. 29. 1932; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 57, 79, 80 & 91. 1942; Mold., Alph. List Cit. 1: 271. 1946; Mold., Alph. List Inv. Names Suppl. 1: 6. 1947; H.N. & A.L. Mold., Pl. Life 2: 75. 1948; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 131 & 183. 1949; E.J. Salisb., Ind. Kew. suppl. 11: 56. 1953; Mold., Résumé 169, 266 & 452. 1959; Mold., Fifth Summ. 1: 288 & 450 (1971) and 2: 870. 1971; Mold., Phytol. Mem. 2: 277 & 541. 1980; Mold., Phytologia 62: 86 & 126. 1987.

Illustrations: P'ei, Mem. Sci. Soc. China 1 (3): pl. 29. 1932.

A shrub about 2.5 m. tall, practically glabrous throughout; leaves decussate-opposite; petioles about 6.5 cm. long, glabrous; leafblades chartaceous, ovate, 13-15 cm. long, 8-9 cm. wide, apically shortly acuminate to an obtuse tip, marginally serrate, basally truncate, glabrous on both surfaces but with "traces of glandular hairs on the midrib beneath" (fide P'ei); secondaries about 5 per side, prominent beneath; inflorescence axillary, cymose, few-flowered; peduncles about 10 cm. long; calyx 5-toothed, with large glands at the base, in fruit about 8 mm. long; fruit drupaceous, subglobose, 5-7 mm. long and wide, glabrous.

This species is based on A. Henry 13511, deposited in the Britton Herbarium at the New York Botanical Garden. P'ei notes that "This species resembles *Clerodendron bracteatum* Wall. but differs by its glabrous leaves, and long-peduncled infructescences." The collector describes it as a "shrub, 7 feet". The species is known thus far only from the original collection and that is in fruit.

A key to help distinguish this species from other Chinese taxa will be found under *C. henryi* P'ei in the present series of notes [Phytologia 60: 180-181].

P'ei's *C. longipetiolatum* (1932) is invalidated by the *C. longipetiolatum* of Gürke in Engl., Bot. Jahrb. 18: 178 (1893).

Citations: CHINA: Yünnan: A. Henry 13511 (N--type, Qu--isotype). MOUNTED ILLUSTRATIONS: P'ei, Mem. Sci. Soc. China 1 (3): pl. 29. 1932 (ld--photo of type, Z--photo of type).

CLERODENDRUM PEREGRINUM Mold., Lloydia 13: 213-214. 1950.

Bibliography: Mold., Lloydia 13: 213-214. 1950; E.J. Salisb., Ind. Kew. suppl. 11: 56. 1953; Mold., in Humbert, Fl. Madag. 174: 155, 235-237 & 268, fig. 38 (3-5). 1956; Mold., Résumé 156 & 452. 1959; Mold., Fifth Summ. 1: 260 (1971) and 2: 870. 1971; Mold., Phytol. Mem. 2: 249 & 541. 1980; Mold., Phytologia 58: 189. 1985.

Illustrations: Mold., in Humbert, Fl. Madag. 174: 235, fig. 38 (3-5). 1956.

A shrub, to 2 m. tall, much-branched; branches, branchlets, and twigs very slender, very obtusely tetragonal or subterete, blackish, glabrate, marked with numerous elevated, whitish, corky lenticels, the youngest parts appressed-pubescent or strigose with very short brownish or stramineous antrorse hairs; nodes not annulate; principal internodes much abbreviated on twigs, mostly 2-10 mm. long, elongated on older wood to 4.5 cm.; leaves decussate-opposite, brunnescent in drying; petioles very slender, 2-5 mm. long, slightly strigillose or glabrescent, brunnescent in drying, flat above; leafblades thin-chartaceous, uniformly dark-green on both surfaces and brunnescent in drying, elliptic or elliptic-ovate, 2-4 cm. long, 1-2.3 cm. wide, apically short-acuminate, marginally entire, basally mostly acute, glabrous or subglabrate on both surfaces, somewhat impressed-punctate beneath; midrib slender, flat on both surfaces or subprominulous beneath; secondaries filiform, about 3 per side, indiscernible above, barely discernible beneath, arcuate-ascending, not anastomosing; veinlet reticulation mostly indiscernible on both surfaces; inflorescence terminal, subcapitate, few- or rather many-flowered, congested, nigrescent in drying, sessile; pedicels filiform, mostly 1-2 mm. long, sparsely appressed-pilosulous or glabrous, nigrescent; foliaceous bracts absent; bractlets obsolete or very minute and setaceous; calyx narrow-campanulate, 2-3 mm. long, about 1 mm. wide, nigrescent, glabrous, its rim truncate and subentire; corolla white, hypocrateriform, its tube narrow-cylindric,12-20 mm. long, about 1 mm. wide or less, the limb about 8 mm. wide; stamens inserted in

the upper 1/4 of the corolla tube, exserted about 7 mm. from its mouth, the exserted portion violet; anthers oblong; pistil to 3.5 cm. long; fruiting-calyx incrassate, cupuliform, about 1 cm. long and wide, glabrous, longitudinally prominently venose, its rim deeply lobed, the lobes apically subacute, marginally scarious; fruit drupaceous, subglobose, nigrescent in drying, about 1 cm. long and 8 mm. wide, glabrous.

This endemic species is based on Perrier s.n. from somewhere in Madagascar, collected in 1898, and deposited in the Paris herbarium. A key to help distinguish it from other Madagascar taxa in this genus will be found under *C. baronianum* Oliv. in the present series of notes [Phytologia 58: 184-190].

Citations: MADAGASCAR: Baron 4617 (P); Perrier 10217 (P), 10223 (N, P), s.n. [1898] (E--photo of type, F--photo of type, Ld--photo of type, N--photo of type, P--type).

CLERODENDRUM PERRIERI Mold., Lloydia 13: 214-215. 1950.

Bibliography: Mold., Lloydia 13: 214-215. 1950; Mold., Phytologia 4: 45. 1952; E.J. Salisb., Ind. Kew. suppl. 11: 56. 1953; Mold., in Humbert, Fl. Madag. 174: 150, 154, 192-194 & 268, fig. 31 (1-2). 1956; Mold., Résumé 156 & 452. 1959; Mold., Fifth Summ. 1: 260 (1971) and 2: 870. 1971; Mold., Phytol. Mem. 2: 249 & 541. 1980; P. Holmgren et al., Ind. Vasc. Pl. Type Microf. 442. 1985; Mold., Phytologia 58: 181 & 187. 1985.

Illustrations: Mold., in Humbert, Fl. Madag. 174: 193, fig. 31 (1 & 2). 1956.

A shrub, 1-2 m tall, apparently very twiggy; branchlets and twigs very slender, subterete, brownish, densely spreading-pubescent, less so in age, the older wood subglabrate; nodes more or less annulate; principal internodes abbreviated, 0.7-4 cm. long; leaves decussate-opposite or ternate; petioles very slender, 2-6 mm. long, densely spreading-pubescent; leafblades chartaceous, bright-green, somewhat lighter beneath, not nigrescent nor brunnescent in drying, broadly elliptic or elliptic-ovate, sometimes suborbicular, 0.7-2 cm. long (usually less than 2 cm. long), 5-16 mm. wide, apically obtuse or rounded, marginally entire or slightly irregularly subsinuate, basally rounded to acute, rather densely spreading-pubescent on both surfaces, punctate beneath; midrib filiform, flat and obscure above, subprominulous beneath; secondaries filiform, 3 or 4 per side, ascending, mostly indiscernible above, slightly subprominulous beneath; veinlet reticulation indiscernible on both surfaces; inflorescence terminal, capitate, very densely many-

flowered, 1.5-5.6 cm. wide; peduncles obsolete; cyme-branches filiform, densely spreading-pubescent, 1-5 mm. long, mostly obsolete; pedicels obsolete or filiform and about 1 mm. long, very densely spreading-pubescent; calyx campanulate, about 2 mm. long and wide, rather densely spreading-pubescent, its rim very shortly 5-toothed; corolla white, hypocrateriform, its tube very slender, about 1 cm. long, externally glabrate, the limb about 7 mm. wide; stamens and pistil exserted about 1 cm. from the corolla-mouth; filaments rose or pinkish; anthers brown or blackish, especially marginally; fruiting-calyx and fruit not known.

This endemic species is based on Humbert 20214 from a tropophilous forest on schist, in the Sakoa Forest, in the basin of the Onilahy River, at about 300 m. altitude, southwestern Madagascar, collected on February 10 or 11, 1947, and deposited in the Paris herbarium.

This plant has been found growing in tropophilous forests and in the transition zone between bush and low sclerophyllous forest, at 300-900 m. altitude, in flower in December and January.

A key to help distinguish this species from its relatives in Madagascar will be found under *C. baronianum* Oliv. in the present series of notes [Phytologia 58: 184-190]. Seyrig notes that his collection, cited below, is "tres voisin" to the plant represented on his no. 442.

A vernacular name reported for the plant is "selimbiky". Seyrig 438 in the Paris herbarium is mounted on the same sheet as an isotype of *C. magnifolium* (which is *C. subtruncatum* f. *magnifolium*).

Citations: MADAGASCAR: Humbert 11340 (N, P), 13834 (P), 20214 (E--photo of type, F--photo of type, Ld--photo of type, N--photo of type, P--type); Perrier 10234 (P); Seyrig 438 [Herb. Jard. Bot. Tananariva 6093 in part] (N, P, P).

CLERODENDRUM PERRIERI var. *LAXICYMOSUM* Mold., Lloydia 13: 213. 1950.

Bibliography: Mold., Lloydia 13: 213. 1950; Mold., Phytologia 4: 45. 1952; Mold., in Humbert, Fl. Madag. 174: 150, 193, 194 & 268, fig. 31 (3). 1956; Mold., Résumé 156 & 452. 1959; Mold., Fifth Summ. 1: 260 (1971) and 2: 870. 1971; Mold., Phytol. Mem. 2: 249 & 541. 1980; P. Holmgren et al., Ind. Vasc. Pl. Type Microf. 442. 1985; Mold., Phytologia 58: 181 & 187. 1985.

Illustrations: Mold., in Humbert, Fl. Madag. 174: 193, fig. 31 (3). 1956.

This variety differs from the typical form of the species in having its inflorescences at the time of anthesis open and loosely spreading, not congested, the very slender peduncles often being up to 2.5 cm. long and the filiform pedicels up to 1 cm. long.

The variety, apparently endemic, is based in Decary 8533 in part, collected at Ambovombe, southwestern Madagascar, in February of 1931 and deposited in the Paris herbarium. Thus far it is known to me only from the original collection. A key to help distinguish it from its relatives in Madagascar will be found under *C. baronianum* Oliv. in the present series of notes [Phytologia 58: 184-190].

Citations: MADAGASCAR: Decary 8533 in part (N--fragment of type, P--type).

CLERODENDRUM PERRIERI var. *MACROPHYLLUM* Mold., Lloydia 13: 215. 1950.

Bibliography: Mold., Lloydia 13: 215. 1950; Mold., in Humbert, Fl. Madag. 174: 154, 194 & 268. 1956; Mold., Résumé 156 & 452. 1959; Mold., Fifth Summ. 1: 260 (1971) and 2: 870. 1971; Mold., Phytol. Mem. 2: 249 & 541. 1980; P. Holmgren et al., Ind. Vasc. Pl. Type Microf. 442. 1985; Mold., Phytologia 58: 189. 1985.

This variety differs from the typical form of the species in having its mature leafblades to 4.5 cm. long and 2.8 cm. wide.

It is based on Humbert 20145 from the tropophilous forest and xerophilous bush on limestone rocks at Vallon d'Andranolahy, in the valley of the Onilahy River, near Tongobory, western Madagascar, at 50-200 m. altitude, collected on February 5, 1947, and deposited in the Paris herbarium.

A key to help distinguish this plant from its other Madagascar relatives will be found under *C. baronianum* Oliv. in the present series of notes [Phytologia 58: 184-190].

Citations: MADAGASCAR: Grandidier s.n. [Mars 1869] (P); Humbert 20145 (E--photo of type, F--photo of type, Ld--photo of type, N--photo of type, P--type).

CLERODENDRUM PETASITES (Lour.) S. Moore, Jour. Bot. Brit. 63: 285 [as "*Clerodendron*"]. 1925; E.D. Merr., Trans. Amer. Philos. Soc., ser. 2, 24(2):338. 1935.

Synonymy: *Volkameria petasites* Lour., Fl. Cochinch., ed. 1, 2: 388-389. 1790; *Clerodendron subpandurifolium* Kuntze, Rev. Gen. Pl. 1: 506. 1891; *Clerodendron robinsonii* Dop, Notul. Syst. 4: 9. 1920; Lecomte, Fl. Gén. Indo-chine 4: 872, fig. 89 (8) & 90 (1 & 2). 1935:

Clerodendron petasites S. Moore apud Fedde & Schust., Justs Bot. Jahresber. 53 (1): 1072. 1932; *Clerodendrum petasites* Moore apud E.D. Merr., Trans. Amer. Philos. Soc., ser. 2,, 24 (2): 338 in text. 1935; Santapau, Bull. Bot. Serv. India 3: 14. 1961; *Clerodendrum petasites* (Lour.) Moore apud E. D. Merr., Trans. Amer. Philos. Soc., ser. 2, 24 (2): 338. 1935; *Clerodendrum petasites* (Lour.) A. Meeuse, Blumea 5: 76. 1942.

Bibliography: Lour., Fl. Cocinch., ed. 1, imp. 1, 2: 388-389. 1790; Lour., Fl. Cocinch., ed. 2, 2: 471-473 &882. 1793; Lour., Fl. Cocinch., ed. 3, 182. 1797; Vent., Jard. Malm. pl. 25. 1803; Pers., Ap. Pl. 3: 364. 1819; Steud., Nom. Bot. Phan., ed. 1, 889. 1821; Walp., Repert. Bot. Syst. 4: 108. 1845; Schau., in A. DC., Prodr. 11: 657 & 667. 1847; Miq., Fl. Ind. Bat. 2: 876. 1856; Buck, Gen. Spec. Syn. Candol. 3: 503. 1858; C.B. Clarke in Hook. f., Fl. Brit. India 4: 594. 1885; Kuntze, Rev. Gen. Pl. 2: 506. 1891; Jacks. in Hook. f. & Jacks., Ind. Kew. suppl. 1, 2: 1219. 1895; E.D. Merr., Interpret. Herb. Amb. 455. 1917; H. Hallier, Meded. Rijks. Herb. Leid. 37: 63. 1918; Dop, Notul. Syst. 4: 9. 1920; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 90. 1921; S. Moore, Journ. Bot. Brit. 63: 285. 1925; Fedde & Schust., Justs Bot. Jahresber. 48 (1): 497. 1927; A.W. Hill, Ind. Kew. suppl. 7: 51. 1929; Hand.-Mazz., Oesterr. Bot. Zeitschr. 80: 343. 1931; Fedde & Schust., Justs Bot. Jahresber. 53 (1): 1072. 1932; P'ei, Mem. Sci. Soc. China 1(3): 130. 1932; Dop in Lecomte, Fl. Gén. Indo-chine 4: 852, 865 & 872-874, fig. 89 (8) & 90 (1-2). 1935; E.D. Merr., Trans. Amer. Philos. Soc., ser. 2, 24 (2): 338 & 420. 1935; E.D. Merr., Brittonia 2: 197. 1936; E.D. Merr., Journ. Arnold Arb. 19: 65. 1938; Meeuse, Blumea 5: 76-77. 1942; Mold., Alph. List Inv. Names 19, 20 & 56. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 59 & 91. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 2: 1219. 1946; Mold., Alph. List Cit. 1: 108. 1946; Mold., Alph. List Inv. Names suppl. 1: 6 & 7. 1947; Mold., Alph. List Cit. 3: 957. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 136 & 183. 1949; E.J. Salisb., Ind. Kew. suppl. 11: 56. 1953; R. Hay, Gard. Chron. ser. 3, 137: 130 & 154, fig. 63. 1955; Synge in Chittenden, Roy. Hort. Soc. Dict. Hort., ed. 2, 1: 505. 1956; Mold., Résumé 175, 265, 268, 270, 273, 392 & 452. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 2: 1219. 1960; Hundley & Ko in Lace, Trees Shrubs Burma, ed. 3, 203. 1961; Santapau, Bull. Bot. Surv. India 3: 14. 1961; Anon., Bot. Gard. Glasg. List Seeds 3. 1966; Lour., Fl. Cochinch., ed. 1, imp. 2, 2: 388-389. 1967; Vivekanathan, Bull. Bot. Surv. India 10: 240. 1968; Mold., Fifth Summ. 1: 300, 359,

447, 453, 454, 456 & 464 (1971) and 2: 734 & 870. 1971; Babu, Herb. Fl. DehraDun 398. 1977; Mold., Phytol. Mem. 2: 291, 292, 350, 388 & 541. 1980; Varma, Fl. Bhagalpur Dicot. 309-310. 1981; H.N. & A.L. Mold., in Dassan & Fosb., Rev. Handb. Fl. Ceyl. 4: 463, 467, 473, 475 & 476. 1983; Mold., Phytologia 58: 286 (1985), 59: 104 & 106 (1986), 60: 142 (1986), 61: 180-182 & 186 (1986), 62: 206 (1987) and 63: 61. 1987.

Illustrations: Dop in Lecomte, Fl. Gén. Indo-chine 4: 865 & 874, fig. 89 (8) & 90 (1-2). 1935.

A bush or shrub, 2-3.3 m. tall; stems 1.2-2.5 cm. in diameter; wood very hard; branches subtetragonal, glabrous, the bark rugose and lenticellate; leaves decussate-opposite; petioles slender, 7-10 mm. long, glabrous; leafblades subcoriaceous, oblong or elliptic-oblong, 7-11 cm. long, 3-3.5 cm. wide, apically acute, marginally entire or subentire, basally rounded, glabrous on both surfaces, shiny above; midrib rounded, prominent; secondaries 12-14, the lowest ones opposite and recurved, the remainder alternate, at first straight, then abruptly recurved and anastomosing in intramarginal loops; veinlet reticulation irregular but distinct; inflorescence paniculate, terminal or subterminal, pedunculate, glabrous, 7 cm. long, 5 cm. wide; peduncles 2 cm. long; cyme-ramifications distant, ramose, the terminal ones 1- or 3-flowered; bracts very small, linear; bractlets almost obsolete; pedicels 5-10 mm. long; flower pendant; calyx campanulate, large, red-violet, 11-12 mm. long, 8 mm. wide, glabrous; the tube almost none, the lobes oval-lanceolate, 4 mm. long, 3-veined, apically acute and apiculate; corolla yellow, glabrous, the tube cylindric, 1 mm. [=cm. fide Dop, but surely not] long, equaling the calyx [fide Dop], the lobes spatulate, 8-9 mm. long, 3-4 mm. wide, subequal, apically rounded; stamens slightly exserted; filaments white, glabrous; anthers oblong; style slender; stigma shortly bifid; ovary glabrous.

The type of this species is based on a Loureiro collection from Cochinchina, deposited in the herbarium of the British Museum. *C. robinsonii* is based on an unnumbered Robinson collection from Nha-trang, a Clemens collection from Tourane, a Poilane collection from Cana, an Eberhardt collection from Thua-luu, Cibi in Thua-thien province, and a Pirey collection from Quang-tri, all the localities being in Annam and all the collections unnumbered (by Dop). It seems most probable that the Robinson collection is no. 1290 coll. betw. March 11 & 26, 1911; the Clemens collection is Clemens & Clemens 4261, and the Eberhardt collection is no. 2662; probably the Robinson collection should be

designated as the type collection. *C. subpandurifolium* is based on Kuntze 3687 from Turong.

This plant has been encountered by collectors in open forests, dense thickets, and dense underbrush near riverbanks, at sea level, in flower from March to July and in October. The Clemenses describe the corollas as white, while Dop refers to them as yellow, with the calyx red-violet. Squires on his no. 329 says "flowers bright-scarlet, with cream petals" [perhaps meaning that the calyx was bright-scarlet and the corolla cream?] but on no. 226 "flowers deep-crimson sheath, lemon-yellow calyx" [probably unintentional reversal of color characters?].

Unfortunately, this species has been badly misinterpreted in the literature and herbaria. Steudel (1821) lists it as "*Volkameria Petasites* Lour., page 10 (not *Clerodendrum infortunatum*)".

Merrill (1935) quotes Loureiro (1790) as saying "Habitat in dumetis Cochinchinae" and then comments that "Loureiro took his specific name [*Petasites*] from *Petasites agrestis* Rumph. (Herb. Amb. 4: 108. pl. 49) which he cites as illustrating his species, but which, however, represents a species very different from *Clerodendrum petasites* Moore. Schauer, perhaps interpreting the species from the Rumphius illustration, erroneously reduced *V. petasites* Lour. to *C. infortunatum* Gaertn. [in spite of Steudel's explicitly stating, in 1821, that it is not *C. infortunatum*]. Loureiro's type is preserved in the herbarium in the British Museum, which on examination Moore found to be identical with *Clerodendrum subpandurifolium* O. Ktz., a species based on specimens collected by Kuntze at Tourane, Annam; Kuntze's actual type is preserved in the herbarium of the New York Botanical Garden; the species is also represented by Squires 329, from the classical locality Hue, and by Robinson 1290 from Nha Trang. *Petasites agrestis* Rumph. which I (Interpret. Herb. Amb. 455. 1917) referred to *Clerodendrum speciosissimum* Van Geert is placed by H. Lam (Bull. Jard. Bot. Buitenzorg III 3: 91. 1921) as a synonym of *Clerodendrum buchanani* (Roxb.) Walp., this apparently being the correct disposition of it." Actually, I place *Petasites agrestis* Rumph. in the synonymy of *Clerodendrum viscosum* Vent.

In his 1936 work Merrill virtually repeated what he said in 1935; in his 1938 work he summarizes the situation as follows: "This fairly well characterized species, known only from Indo-China, was originally described by Loureiro in 1790. Loureiro's type, probably from the vicinity of Hue, being preserved in the Herbarium of the British Museum. Moore examined this in

1925 and found it to be identical with *Clerodendron subpandurifolium* O. Ktze. (1891), type from Tourane. Dop overlooked both species in 1935, having redescribed the same form in 1920 as *Clerodendron Robinsonii* Dop, type Robinson 1290 from Nha Trang. Loureiros specific name should be retained."

Merrill's discussion is very precise and clear and correct. Unfortunately, Meeuse (1942) re-investigated the situation and arrived at an entirely different (and erroneous) conclusion, namely, that *C. petasites* should be the adopted name for *C. viscosum* Vent. His discussion is: "*Clerodendrum Petasites* (Lour.) A. Meeuse, nov. comb. -- *Volkameria Petasites* Lour., Fl. Cochinch. 2, 1790, 388, excl. syn. Rumph. -- *Clerodendron viscosum* Vent., Jard. Malm. 1803, t. 25; Walp., Rep. 4, 1844, 108; Hall. f., Ergebn. 63; Bakh. in Rev. 90 (excl. syn. *Cl. confusum* Hall. f., see Rev. Addit. II-III):, P'Ei, Verb. China 130. --*Clerodendron infortunatum* L., Schau. in DC. 667, pro parte; Miq., Fl. Ind. Bat. 2, 1856, 876, pro parte; C.B. Clarke in Hook. f., Fl. Brit. Ind. 4, 1885, 594, excl. syn. *Cl. viscosum*; *Cl. infortunatum* (haud L., nec Bl., nec Lindl.) Lam, Verb. 284-285; Dop in F. G. I. C. 859; Fletcher, Siam. Verb. 430.

"The nomenclature of this species, currently known as *'Clerodendron infortunatum'* is rather intricate. *Clerodendrum infortunatum* ., Sp. Pl. Ed. 1, 1753, 637 was -- judging from Linné's references to Hermann (Mus. Zeyl., 1717, 25, 29) and to Burman (Thes. Zeyl. 1737, 66, t. 29) in Sp. Pl. and in his Flora Zeylanica 1748, 104, no. 232 -- based on Ceylon material either from the Herb. Hermann, or received from Burman. Anyhow, it is obvious that the name of *Clerodendrum infortunatum* L. should be reserved for the Ceylon species, which was extensively described later on by Trimen in Handb. Fl. Ceylon 3, 1893, 361 and which is apparently endemic in Ceylon. Gaertner, in Fruct. 1, 1788, 271, t. 57, f. 1, described the fruit also from Ceylon material (extant in H. L.-B.).

"Another species described as *Clerodendron viscosum* by Ventenat is quite distinct from *Cl. infortunatum*, but was often confused with it (cf. Hallier l.c. 63-65). It has a rather wide geographical distribution, ranging from British India to South China to the Malay Peninsula, Sumatra and Java. Loureiro's binomial *Volkameria Petasites* was based on *Petasites agrestis* Rumph., Herb. Amb. 6, 1743, 108, t. 49, but his description was from a different plant, so that he actually described a new species. This species was combined with *Clerodendrum viscosum* by Walpers and Backhuizen van den Brink, with *'Cl. infortunatum'* (inclus. *Cl.*

viscosum) by Schauer and with *'Cl. infortunatum'* = *Cl. viscosum* by Dop. Loureiro's statement 'Hab. in dumetis Cochinchinae', indicates that *Volkameria Petasites* is some wild Indo-Chinese species. In our opinion, the only species occuring in these regions to which Loureiro's description is applicable, is *Cl. viscosum* Vent. However, Loureiro's name antedates Ventenat's, so that this necessitates a new combination." Meeuse's argument is rejected by me because he obviously at that time had not consulted Loureiro's type specimen. I have seen type material of all the binomials involved and accept Merrill's conclusion with no reservations.

Meeuse (above) cites the Walpers reference as "1844", but it should be 1845. The so-called *C. petasites* Synge (1956) of Hundley & Ko (1961), Santapau (1961), Vivekanathan (1968), Babu (1977), and Varma (1981) is actually *C. viscosum* Vent. Hundley & Ko actually give as synonyms of *C. petasites*: *C. infortunatum* Gaertn. f., *C. castaneifolium* Klotzsch, *C. cordatum* Don, and *C. viscosum* Vent., all erroneously -- the first is a synonym of *C. infortunatum* L. and all the rest belong to *C. viscosum* Vent. The vernacular name, from Burma, which he records doubtless also belongs, not to *C. petasites*, but to *C. viscosum*. Bakhuizen (1921) reverses the disposition by reducing *C. petasites* to the synonymy of *C. viscosum*, as also does Santapau (1961).

In a letter to me from Dr. Meeuse, dated December 9, 1953, he states that "*Volkameria petasites* Lour. I found that the combination in *Clerodendrum* had already been made before. Also, this is a distinct species (I saw the type) probably confined to Indo-China and possibly identical with one of the species described or mentioned by Dop in Fl. Gen. Indo-Chine 4 (7,8). In this connection I may mention that, later, I received more material of the group of species round *C. infortunatum* L. A careful study of these specimens convinced me of the insufficiency of the differences between *C. adenophysum, C. confusum* and *C. infortunatum* L. (see my key in my 1942 paper on p. 77) and they were treated as one species, *C. infortunatum* L., in the above-mentioned provisional 'Flora of Java'". Actually, I regard the Hallier species quite valid, with differences quite consistent from the true *C. infortunatum* L., which I agree with Meeuse's original (1942) claim is endemic to Sri Lanka.

A key to help distinguish *C. petasites* from related Indochinese species will be found under *C. hahnianum* in the present series of notes [Phytologia 60: 141-143]. Material of *C. petasites* has been misidentified and

distributed in some herbaria as *Volkameria pyramidata* Royen [a synonym of *C. serratum* (L.) Moore].

L. Maurice Mason exhibited a flowering plant, purporting to represent this species, and it received a Royal Horticultural Society (London) Award of Merit on March 22, 1955. The plant was grown by Mr. R. Sayers at Talbot Manor, Fincham, King's Lynn, Norfolk, England, and is described as "An attractive greenhouse shrub with broad ovate leaves, strongly veined, dark-green, about 5 inches long. The broad dense panicle of flowers is about 8 inches long and the tubular corollas, about an inch long, are expanded into a 5-petalled limb an inch across. The flowers are white, flushed with rose in the centre. The effect is enhanced by long exserted stamens." It does not seem possible that this plant was correctly identified. Probably it was *C. viscosum* Vent.

Citations: VIETNAM: Annam: Clemens & Clemens 4261 (N), s.n. [by Great Sapot near Mission, May 1927] (Ca--339961); Eberhardt 2662 (B); Kuntze 3687 (N, N); C.B. Robinson 1290 (N, W--713360); Squires 226 (Ca--305998), 329 (Ca--306090, La, Pd, W--1425798); Cochinchina: Loureiro s.n. (F--photo of isotype, Ld--rubbing of type, Ld--photo of isotype, N--photo of isotype, S--isotype, Sg--photo of isotype); Squires 328 (Bz--20161, N). Tonkin: Pételot 6204 (N). CULTIVATED: Hong Kong: W.Y. Chun 6140 (Ca--357704). MOUNTED ILLUSTRATIONS: Dop in Lecomte, Fl. Gén. Indo-chine 4: 865, fig. 89 (8). 1935 (Ld), fig. 90 (1 & 2). 1935. (Ld); R. Hay, Gard. Chron., ser. 3, 137: 154, fig. 63. 1955. (Ba, Ld).

CLERODENDRUM PETUNIOIDES J.G. Baker, Jour. Linn. Soc. Lond. Bot. 20: 230 [as "*Clerodendron*"]. 1883; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 53 & 91. 1942.

Synonymy: *Clerodendron petunioides* J.G. Baker, Jour. Linn. Soc. Lond. Bot. 20: 230. 1883.

Bibliography: J.G. Baker, Jour. Linn. Soc. Lond. Bot. 20: 230. 1883; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 53 & 91. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew. suppl, imp. 2, 1: 561. 1946; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 123 & 183. 1949; Mold. in Humbert, Fl. Madag. 174: 151, 199, 202, 203, 266 & 268, fig. 32 (6). 1956; Mold., Résumé 156 & 452. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew. suppl, imp. 3, 1: 561. 1960; Mold., Fifth Summ. 1: 260 (1971) and 2: 870. 1971; Mold., Phytol. Mem. 2: 249 & 541. 1980; Mold., Phytologia 58: 187 & 283. 1985

Illustrations: Mold. in Humbert, Fl. Madag. 174: 199, fig. 32 (6). 1956.

An erect shrub or small tree, to 9 m tall; branchlets and twigs slender, woody, terete, very light-gray, glabrous, shiny, not prominently lenticellate; nodes not annulate; principal internodes 1.5-9 cm. long; leaves decussate-opposite; petioles rather slender, 3-9 mm. long, stramineous, canaliculate above, glabrous, shiny; leafblades subcoriaceous, light-green or bright-green on both surfaces, not at all brunnescent in drying, elliptic to obovate or oblanceolate, 4.5-12 cm. long, 1.7-5 cm. wide, apically acute or acuminate, marginally entire, basally acute or deltoid, glabrous and shiny on both surfaces; midrib slender, slightly prominulous within a channel above, very sharply prominent beneath; secondaries slender, 5-10 per side, prominulous above, sharply prominent beneath, widely divergent, arcuately joined several mm. from the margins beneath; veinlet reticulation very abundant, prominulous on both surfaces on mature leaves; inflorescence axillary and terminal, mostly borne only at th tips of the twigs, 1- to 3-flowered; peduncles mostly much abbreviated or obsolete, similar to the twigs in color and texture; pedicels elongated, stout, 2-3 mm. long, smooth-textured and glabrous; branchlets very small, setaceous or scale-like, 1-2 mm. long, obscure; calyx obconic, subcoriaceous, not particularly heavy, greenish when fresh, slightly brunnescent but not at all nigrescent in drying, apically more or less venose, glabrous, 4-5.7 cm. long, the rim 5-lobed, the lobes erect, triangular-ovate or oblong-deltoid, apically acute, rather shorter than the tube, mostly about 8 mm. long, but the calyx often deeply split on one side to 17 mm.; corolla infundibular, very large, rose-red or purple, the tube equalling the calyx or slightly longer, 6-7.5 cm. long, 6-7 mm. wide in the calyx, gradually ampliate apically in funnelform fashion to 3 cm., externally glabrous, the limb ascending-erect, 6-8 cm. wide, 5-lobed, the lobes equal, oblong, about 3 cm. long, 1.5-2.5 cm. wide, apically rounded; stamens and pistil about equaling the corolla-lobes; fruiting-calyx and fruit not known.

This distinctive endemic Madagascar species is based on Baron 1624 from Ankeramadinika and G.W. Parker s.n. from the forests of the province of Imerina, in central Madagascar, collected in 1881, deposited in the Kew Herbarium.

Collectors have encountered this plant in forests and wet woodlands and along forest roadsides, in flower in August. The corollas are described as "rose" on Catat 1679 and Decary 4434, "rouge" on Decary 4604, "rose vif" on Decary 4834, "rougatre" on Catat 1751,

"rose vivieux" on Decary 5021, and "purple" on Parker s.n.

A key to help distinguish this species from other Madagascar species will be found under *C. baronianum* Oliv. in the present series of notes [Phytologia 58: 184-190].

Citations: MADAGASCAR: Baron 1624 (K--cotype, P--cotype), 6735 (K); Catat 1679 (N, P), 1751 (P); Decary 4434 (P), 4604 (P), 4834 (P), 5021 (P); Kitching s.n. [Ianele] (k); G.W. Parkers.n. [Central Madagascar, 1881] (E--photo of cotype, F--photo of cotype, K--cotype, Ld--photo of cotype, N--photo of cotype); Perrier 4490 (P).

CLERODENDRUM PHILIPPINENSE Elm., Leafl. Philip. Bot. 9: 3223 [as "Clerodendron"]. 1934; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 62 & 91. 1942.

Synonymy: *Clerodendron philippinense* Elm., Leafl. Philip. Bot. 9: 3223. 1934.

Bibliography: Elm., Leafl. Philip. Bot. 9: 3223. 1934; A.W. Hill, Ind. Kew. suppl. 9, imp. 1, 68. 1938; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 62 & 91. 1942; Mold., Alph. List Cit. 2: 462 (1948) and 3: 841. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 141 & 183. 1949; A.W. Hill, Ind. Kew. suppl. 9, imp. 2, 68. 1958; Mold., Résumé 183, 419 & 452. 1959; Mold., Résumé Suppl. 15: 18. 1967; Mold., Fifth Summ. 1: 316 & 453 (1971) and 2: 776 & 870. 1971; Mold., Phytol. Mem. 2: 307 & 541. 1980; Mold., Phytologia 62: 327. 1987.

A shrub, 1 m. tall; corollas pinkish-white (Ramos & Edano H.P.B.S. 48479).

This species is based on Elmer 22379.

It has been collected in mossy forests, at 4000 feet altitude, in flower in February, March, May, and September; and in fruit in November.

Material of this species has been misidentified and distributed in some herbaria as *C. brachyantherum* Schau., *C. lanuginosum* Blume, *C. macrostegium* Schau., and *C. multibracteatum* Merr. On the other hand, the Fosberg 54722, distributed as *C. philippinense*, actually is *C. phillipinum* f. *multiplex* (Sweet) Mold.

Citations: PHILIPPINE ISLANDS: Luzon: Elmer 22379 [R.M. King neg. 296] (Bz--20162--isotype, Ca--7754--isotype, Mi--isotype, N--isotype, N--photo of isotype, W--2605874--isotype, W--photo of isotype); F.C. Gates 7685 (Mi), s.n. [May 31, 1914](Mi); Loher 12423 (Ca--240578, Mu--4373), s.n. [Rizal Prov., March 1913](Ca--229209); M. Ramos, Herb. Philip. Bot. Sci. 27367 (Bz--18739); Ramos & Edaño, Herb. Philip. Bot. Sci. 48479 (Ca--321580, N, W--1527905).

A NEW VARIETY OF BERLANDIERA LYRATA FROM NORTHWESTERN MEXICO

B.L. Turner

Dept. of Botany, University of Texas, Austin, TX, 78713 U.S.A.

On-going studies of the Asteraceae of Mexico has revealed the following new variety.

A. Berlandiera lyrata A. Gray var. lyrata scapis monocephalis non ramosis, foliis non lobatis, et pedunculis dense albohirsutis differt.

TYPE: MEXICO.CHIHUAHUA: Yepachic (ca 28°30'N, 108°30'W), 21 Jun 1970, C.W. Pennington 1 (holotype TEX).

ADDITIONAL SPECIMENS EXAMINED: MEXICO. CHIHUAHUA: El Cima, 29 Jun 1936, LeSueur 1037 (LL, TEX); Sitenapuchi, 8 Jul 1955, Pennington 506 (TEX); ca Pawiciki, 13 Jul 1945, Pennington 548 (TEX); Yepachic, 3 Sep 1971, Pennington 17 (TEX).

SONORA: Quipar, 23 Jul 1970, Pennington 80 (TEX); Maicoba, 5000 ft, Jul 1968, Pennington 153, 189 (TEX); 23.5 mi NE Bacoachic, on road to Esqueda, 4480 ft, 10 May 1948, Wiggins 11743 (TEX).

The distribution of the two varieties is shown in Figure 1.

Berlandiera received a fairly intensive study by Pinkava (1967). He recognized two varieties within B. lyrata, a widespread var. lyrata and a sporadically occurring var. macrophylla A. Gray, much as did Turner and Johnston (1956) in a preliminary survey of the species. Indeed, in our paper we stated that "var. macrophylla Gray is a distinct taxon occurring at high altitudes on limestone mountains (Guadalupe and Glass Mountains in Trans-Pecos Texas). Occasional specimens intermediate between this variey and var. lyrata (which occurs at lower elevations) may be found in herbaria, but these are few, and for the most part the taxa can be clearly distinguished by differences in habit and leaf features. Both varieties were recognized by Gray, and the present treatment does not differ appreciably from his."

This has proven to be a naive statement and should have been apparent at the time in that we recognized (by

map, Fig. 6) var. macrophylla as occurring in disparate regions of Arizona, northeastern Mexico, and northwestern Mexico. Our views might have influenced Pinkava in that he accepted the variety with implied reservation, but mapped its distribution in a manner similar to our own.

After 30 years of more extensive familiarity with Berlandiera lyrata, both in the field and in the herbarium, I now view the var. macrophylla (type from southeastern Arizona) as only a high-elevational leaf-form which is unworthy of varietal recognition, the only characters distinguishing this from the typical form being that of unlobed leaves, and this being variable both within populations and occasionally upon the same plant.

Recent collections of B. lyrata from west-central Chihuahua and adjacent Sonora (along with a few earlier collections), however, has revealed the relatively "clean" regional variety described herein. The var. monocephala apparently does not occur with var. lyrata and possesses several characters which are not found in combination elsewhere, although the occasional character may vary in peripheral regions. Examples of both varieties were examined by Pinkava and myself (at least such were mapped) but sufficient collections were unavailable at the time for character evaluation.

The var. monocephala superficially resembles the form previously referred to as var macrophylla in that the leaves are generally longer and unlobed, like the latter. It differs in that these characters are reasonably consistent and combine with yet several others such as elongate monocephalic peduncles, white antrose or spreading white hairs which are largely without purplish swollen basal cells, and have larger spatulate outer pales. Indeed, were I so inclined, I might have accorded the group specific on subspecific rank, for the taxon appears to be as distinct from the var. lyrata as B subacaulis, which both Pinkava and I maintain.

Most of the recent collections of the var. lyrata which I have examined (cited above), including the type, were made by Dr. Campbell Pennington, geographer at Texas A. & M. University who has studied the ethnobotany of west-central Chihuahua (Pennington, 1969). He has made the following observations regarding the use of the roots of this taxon (information from labels):

506- used to make tea for stomach disorders and as a laxative

17- the mashed root is used as a poultice for burns, or mashed and used as a strong tea for stomach disorders

548- a tea for lung ingestion

80- a tea used to cure "pulmonia" (also gathered and sold to herb dealers elsewhere)

153 and 159- a tea for lung congestion (not cited in the above tabulations).

Indeed, the type of var. monocephala, which is referred to as "peonia", a mestizo term, bears the following notations:

(1) The Pima Bajo claim that the root of this yellow-flowered plant is used in preparing a tea taken to cure stomach disorders. The root (tatkara) is boiled for about two hours and the liquid is strained through a loosely woven basket or a tin can which has had holes punched in its bottom. This medicine is taken in the early morning, before eating.

(2) It is also claimed that about six such roots are useful in preparing a drink taken by a woman who delays giving birth. The potion must be left outside of the pregnant woman's house for at least forty-eight hours before being taken.

Finally, it should be noted that the roots of var. monocephala appears to be much larger and woodier than those of var lyrata, to judge from Pennington 506 (TEX) which has a massive woody tap root up to 20 cm long and 4 cm wide at the apex, which is topped by several short woody basal crowns.

LITERATURE CITED

Pennington, C. 1969. The Tepehuan of Chihuahua. Univ. of Utah Press, Salt Lake, 413 pp.

Pinkava, D.J. 1967. Biosystematic study of Berlandiera (Compositae). Brittonia 19:285-298.

Turner, B.L. & M.C. Johnston. 1956. Chromosome numbers and geographic distribution of Lindheimera, Engelmannia, and Berlandiera. Southwestern Naturalist 1:125-132.

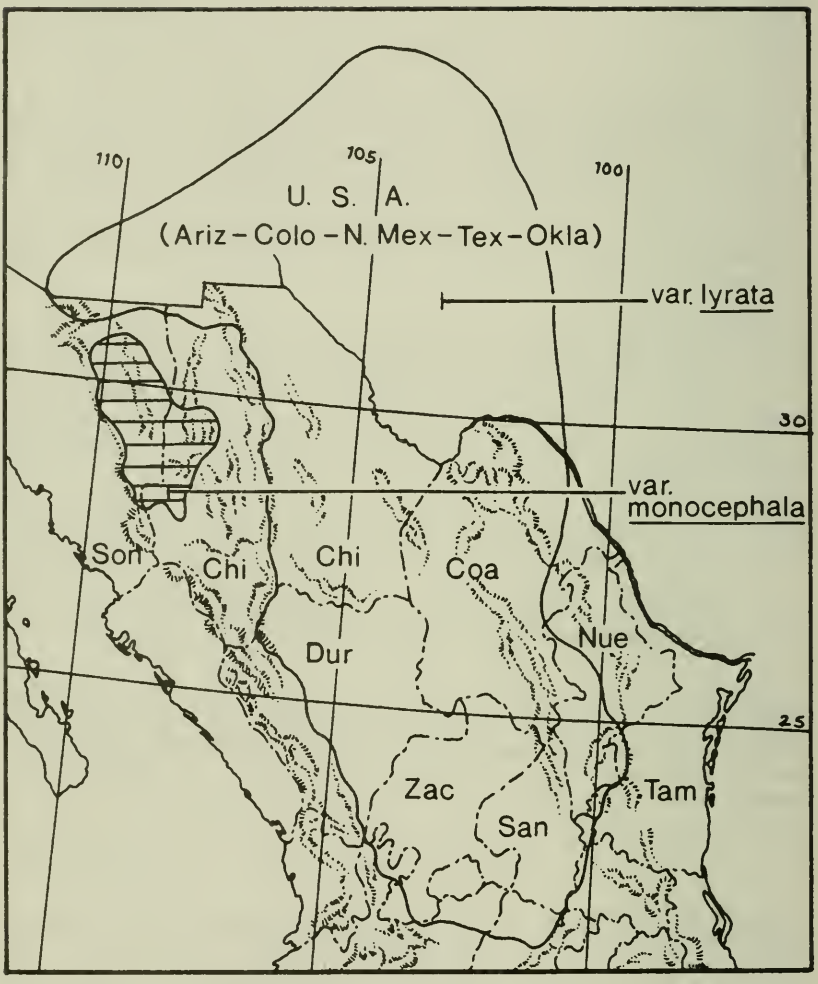

Fig 1 Distribution of Berlandiera varieties.

REDUCTION OF THE MEXICAN GENUS AGIABAMPOA TO ALVORDIA (ASTERACEAE, HELIANTHEAE)

B.L. Turner

Department of Botany, University of Texas, Austin, TX 78713, USA

Agiabampoa Rose ex Hoffm., a monotypic genus of coastal Sonora and adjacent Sinaloa, was first published by Hoffmann and subsequently accounted for in the appendix to his treatment of the Compositae for Die Naturlichen Pflanzenfamilien (1894). In the latter he would position this as genus 407a, in the tribe Heliantheae, subtribe Verbesininae, next to genus 407 (Gymnolomia H.B.K.). The latter has proven to be an artificial assemblage of epappose genera now largely dispersed among Viguiera and yet other Verbesinoid genera (Blake, 1918). In spite of its epappose achenes, however, Agiabampoa, has been retained by subsequent workers, including Blake (1926) Stuessy (1976) and Robinson (1981).

Alvordia Brandegee was also accounted for by Hoffmann (1894) in Die Naturlichen Pflanzenfamilien, this too in his appendix as genus 423a, next to Viguiera, largely because of achenal characters. Alvordia, a small genus of Baja California, Mexico, with only three, closely related species, received an excellent treatment by Carter (1964). She apparantly accepted Hoffmann's position of the genus (between Tithonia and Viguiera) and does not mention at all Agiabampoa, which might easily be mistaken for Alvordia were it not epappose. In any case, Blake (1926) also retained both genera distinguishing between these by their epappose vs pappose condition.

Stuessy (1977) also retained both Agiabampoa and Alvordia but placed them next to each other, along with Lagascea, as the only members of "Group 5" within his subtribe Verbesininae and this view was maintained in his revisional study of Lagascea (Stuessy, 1978).

Robinson (1981) retained both Agiabampoa and Alvordia but included these (along with Lagascea) in his subtribe Helianthinae, which includes Viguiera, a position which I would also favor.

In connection with a treatment of the above mentioned genera for a treatment of the Asteraceae of Mexico, I have had to compare in some detail the characters which distinguish between them. In comparing Agiabampoa with Alvordia I was unable to find a single

significant morphological character that would adequately distinguish between them, except that of pappus present (in Alvordia) vs pappus absent (in Agiabampoa). Indeed, the two genera are almost identical in details of their stylar, androecial, and corolla characters, as well as those of habit, capitulescence and involucre. Alvordia, then, would appear to be a "reduced" Agiabampoa, the latter having more numerous florets to a head (8-20 vs 1-5), but is more advanced in having pappose achenes. The chromosome number of Agiabampoa will perhaps prove pivital in convincing possible skeptics since Alvordia has a base chromosome number of x = 15 (Carter, 1964), an unusual number in the Helianthinae, but not found in Viguiera. I suspect that Agiabampoa will also be found to have a base number of x = 15. Regardless, on morphological grounds, I would opt to treat Agiabampoa as part of Alvordia, as follows:

ALVORDIA CONGESTA (Rose ex Hoffmann) B. Turner, comb. nov.

Based upon Agiabampoa congesta Rose ex Hoffmann, Wiss. Beil. Jahresb. Fried. Werd. Gym. Berl. (reprint 20) and in Die Naturlichen Pflanzenfamilien 4 (5): 390.1894.

LITERATURE CITED

Blake, S. F. 1918. A revision of the genus Viguiera. Contr. Gray Herb. 54: 1-205.

_____ 1926. Compositae. Contr. U.S. Natl. Herb. 23: 1401-1641.

Carter, A. 1964. The genus Alvordia (Compositae) of Baja California, Mexico. Proc. Calif. Acad. Sci 30: 157-174.

Robinson, H. 1981. A revision of the tribal and subtribal limits of the Heliantheae (Asteraceae) Smithsonian Contr. Bot. 51: 1-96.

Stuessy, T. 1977. Heliantheae - systematic review. In, the Biology and Chemistry of the Compositae 2: 621-671.

_____. 1978. Revision of Lagascea (Compositae, Heliantheae). Fieldiana: Bot. 38: 75-133.

NEW COMBINATIONS IN STEVIA (ASTERACEAE: EUPATORIEAE)

B.L. Turner

Dept. of Botany, University of Texas, Austin, TX 78713, U.S.A.

Preparation of a treatment of Stevia for Mexico has necessitated the following new combinations:

STEVIA SCABRELLA Benth. var. VENOSA (A.Gray) B. Turner, comb. nov.

Based upon Stevia venosa A.Gray, Proc. Amer. Acad. Arts 21:382.1886.

Grashoff (1972) placed this taxon, along with S. scabrella, within his shrubby series Fruticosae, largely because these appear to have a "sub-shubby" or fruticose habit. I believe, however, that these are perhaps best placed in the herbaceous series Corymbosae where they presumably relate to S. plummerae A. Gray. I would also include with these several taxa S. urceolata Grashoff, which Grashoff (1974) also relates to S. scabrella. All of these are so similar in head and floret structure, as to details, that it is difficult to emphasize habit as a major feature separating them.

Grashoff (1972) maintained S. venosa as distinct from S. scabrella largely on the basis of "its smaller, narrower leaves, less pubescent infloresence branches, smaller and obtuse to rounded phyllaries, bright pink or lavender flowers and smaller achenes." Nevertheless, McVaugh (1984) included S. venosa as a synonym of S. scabrella with the observation that "on specimens assigned by Grashoff to venosa, the phyllaries are often acute and up to 7 mm long, the corollas often 6.5-7 mm long, and the achenes up to 4 mm long, as they often are in scabrella... Until the differences between scabrella and venosa can be more adequately demonstrated, they are best combined as a single species."

I tend to agree with McVaugh's observations. Certainly character intergradation occurs, at least occasionally, in the numerous specimens from Chihuahua cited by Grashoff as S. venosa. Nonetheless the combination of characters (taken as a syndrome), noted by Grashoff , do appear to mark S. venosa and these appear to be largely restricted to Chihuahua and adjacent Sinaloa. Fig. 1 shows the distribution of the two varieties as currently known. The single collection from Morelos is based upon Lyonnet 801 (Cempoala, Nov, 1932; LL!) and is cited by

Grashoff (1972).

A series of recent collections of S scabrella collected by Ms Gonzalez and colleagues from about the city of Durango clearly shows that regional intermediates between S. venosa and S scabrella occur, largely vindicating McVaugh's observations. The collections concerned, nine individuals from as many populations, mostly from areas to the south and southeast of Durango city, have narrow leaves like S. venosa, and pink corollas, and the involucral bracts are mostly 6-7 mm long with acute apices approaching those of S. scabrella. In any case, I feel confident that future workers will recognize but a single species, S. scabrella, with some workers also wishing to recognize the regional variations represented by S. venosa, hence the combinations proposed above.

Finally, it should be noted that Stevia urceolata Grashoff may be a dwarf form, or perhaps populational variant, of S. scabrella, as noted by McVaugh (1984). It was compared to the latter species by Grashoff (1974), and from the illustration and description provided, I can find few, if any, characters for specific recognition, other than leaf size (1.0-2.5 cm long, 3-6 mm wide).

STEVIA HINTONII (Grashoff) B. Turner, comb. Nov.

Based upon Metastevia hintonii Grashoff, Brittonia 27:69.1975.

Grashoff presented a tedious and ernest attempt to erect this taxon as the monotypic genus, Metastevia. In spite of emphasis upon several characters which are more-or-less unique to S. hintonii, most notably the obconical or clavate achenes which are devoid of pappus scales, I do not find sufficient grounds for excluding the species from Stevia. Even Grashoff concludes that "the genus Metastevia is quite obviously, very similar to Stevia, and it appears to have been derived directly from Stevia series Podocephalae" (sensu Grashoff, 1972). This being so, S. hintonii would appear to be a paraphyletic element of Stevia proper.

LITERATURE CITED

Grashoff, J. 1972. A systematic study of the North and Central American species of Stevia. Doctoral Thesis. The University of Texas, Austin

_____.1974. Novelties in Stevia (Compositae: Eupatorieae). Brittonia 26:347-384.

McVaugh, R. 1984. Stevia, in Nova-galiciana 12:864-908.

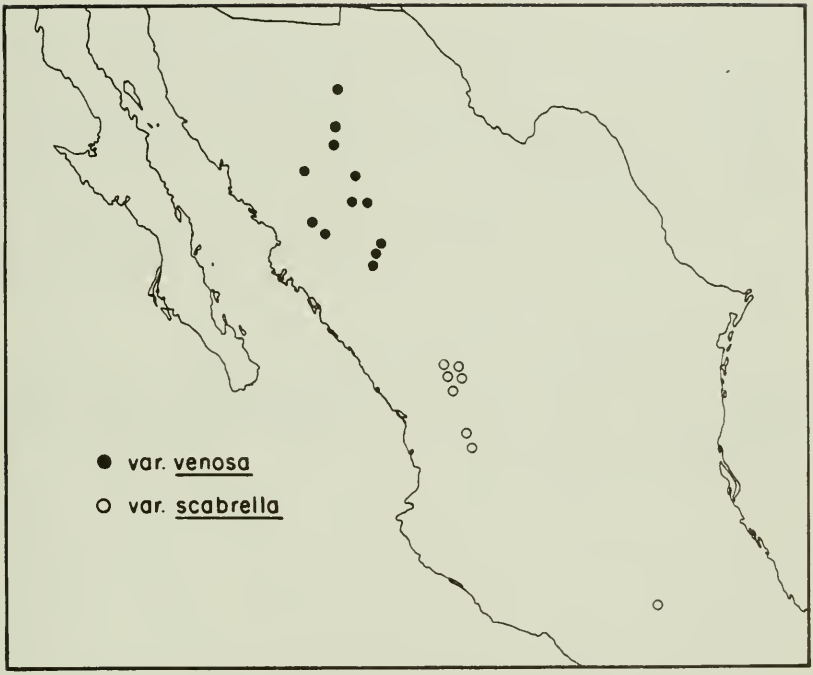

Fig. 1. Distribution of Stevia scabrella.

BLAINVILLEA BRASILIENSIS BLAKE TRANSFERRED TO CALYPTOCARPUS (ASTERACEAE).

B.L. Turner

Dept. of Botany, University of Texas, Austin, TX 78713 U.S.A.

H. Robinson (1978, Phytologia 41:34. 1978), in his transfer of *Blainvillea biaristata* DC. into *Calyptocarpus*, alluded to "the transfer of all of the subgenus *Oligogyne* from *Blainvillea* to *Calyptocapus*.", commenting thereafter that "A second South American species, *C. bahiensis* (DC.) Sch.-Bip. has previously been placed in the genus."

Robinson was apparently unaware that the latter is synonymous with the earlier *Blainvillea brasiliensis* (Nees & Mart.) Blake, as noted by Blake (1925, Proc. Biol. Soc. Wash. 38:85.). Thus the following new combination would appear to be in order:

CALYPTOCARPUS BRASILIENSIS (Nees & Mart.) B. Turner, comb. nov. based upon *Galophthalmum brasiliense* Nees & Mart. in Wied, Nov. Act. Acad. Leop.-Carol. Nat. Cur. 12:8. *pl. 2*, 1824.

ANAX AND *CALLITHAUMA*, TWO GENERA OF AMARYLLIDACEAE-EUSTEPHIEAE FROM PERU

Pierfelice Ravenna

INTA, Universidad de Chile, Santiago, Chile

Anax is described as a new genus with two species from Peru, viz., *A. mirabilis* (Rav.) Rav., and *A. elwesii* (Bak.) Rav., the former being the type species.

The genus *Callithauma* Herb., based on *Pancratium viridiflorum* Ruiz & Pav., is revalidated. It is closely related to *Paramongaia* Velarde, rather than to *Stenomesson* Herb. *P. viridiflorum* had been mistaken in the past with the species here identified as *Anax elwesii* (Herbert 1841, Bentham & Hooker f. 1883, Baker 1888, Macbride 1931).

ANAX gen. nov.

Flores patentes textura crassa breviter pedicellati. Perigonii tubus et pars concrescens tepalorum edistincti corpum unicum anguste infundibulatum rectum vel leviter arcuatum conformantes. Tepala contigua in urceola conniventia subaequalia oblongo-elliptica. Poculum staminale perigonio breviore obtuse sex-lobatum margine integro. Filamenta infra marginem poculi inserta, petalina sepalinis paulo breviora. Antherae anguste ellipticae; pollinis granuli subfusiformes. Stylus perigonio haud superans; stigma capitato-clavatum. Capsula tricocca latiuscula coccis inferne prominentibus. Semina compressa nigra papyracea ovato-oblonga. — Plantae procerae bulbosae. Bulbus ovato-oblongus in pseudocollo praelongo productus. Folia ad anthesin nulla vel incipientia lorata basin versus carinata. Scapus compressus solidus. Spatha bivalvata valvis ovatis saepe persistentibus. Inflorescentia 4-5-flora. — Typus generis: *Anax mirabilis* (Rav.) Rav. (*Stenomesson mirabile* Ravenna).

Two species from the Andes of Peru. The genus name was taken from the greek ἄναξ, meaning prince.

DISCUSSION OF CHARACTERS

Bulb. It resembles those in *Callithauma* Herb., and *Paramongaia* Velarde; although being somewhat narrower than in these genera, it is similarly prolonged into a long pseudoneck.

Leaves. They are quite similar to those in *Paramongaia* Velarde, resembling also, but less, those of *Callithauma*.

Scape. It is compressed as in *Paramongaia*; the scape of *Callithauma* is cylindric.

Spathe bivalved, compressed, the valves ovate, often persistent. *Callithauma* bears a pair of lanceolate, soon marcescent valves, and *Paramongaia* a single membranous, marcescent tubular valve.

Pedicels. They are short to very short. In *Callithauma* they are well developed, and in *Paramongaia* the single flower is sessile.

Perigone. It is fleshy, and of a rather thick texture, contrasting with *Callithauma* and *Paramongaia*, where the perigone has the usual fairly delicate substance.

Androecium. The staminal cup is fleshy and thick textured; it is 6-lobed, as in *Callithauma*, and *Paramongaia*, but in these genera it is fragile, and with denticulate edges. Herbert (1841) gave two different distorted representations of the staminal cup of "*Callithauma viridiflorum*" (actually *Anax elwesii*) with the presumable intention to match it as close as possible to Ruíz and Pavón's description of *Pancratium viridiflorum*, basionym of *Callithauma viridiflorum* (Ruiz et Pav.) Herb. *Callithauma* Herbert (1837), was based on this description. The filaments are of two different lengths and inserted below the edges of the staminal cup.

Gynoecium. Ovary, style, and stigma show no special distinctive feature. Capsule and seeds are similar to those in *Stenomesson*, *Phaedranassa* Herb., or *Pucara* Rav. for instance.

CONCLUSIONS. *Anax* is a distinct genus allied to *Callithauma*, and *Paramongaia*, belonging in tribe *Eustephieae* Pax (syn.: *Stenomesseae* Traub).

Species included:

1. *Anax mirabilis* (Rav.) comb. nov.

Basionym: *Stenomesson mirabile* Ravenna, Pl. Life 27: 77, 1971.

Perigone tube, and concrescent part of tepals green, free portion of tepals red, staminal cup snow white.

2. *Anax elwesii* (Bak.) comb. nov.

Basionym: *Stenomesson viridiflorum* (Ruiz et Pav.) Benth. et Hook. fil., var. *elwesii* Baker, Gard. Chron. n.s. 9: 756, 1878. = *S. elwesii* (Bak.) Macbride, Field Mus. Bot. 11: 10, 1931.- Flowers entirely green.

THE GENUS *CALLITHAUMA*

Callithauma Herbert, Amaryll.: 225, 1837.

Descriptio generico-specifica emend. et ampl.

Callithauma viridiflorum (Ruiz et Pav.) Herbert, Amaryllidaceae: 225, 1837.- Excl. opera Herbertiana in Curtis Bot. Mag. 67: tab. 3866, 1841 a *Anax elwesii* refero.

Basionym: *Pancratium viridiflorum* Ruiz et Pavon, Fl. Peruv. et Chil. 3: 55, 1802.
Syn.: *Stenomesson viridiflorum* (Ruiz et Pav.) Bentham et Hooker fil., Gen. Pl. 3: 733, 1883.

Plant 70-80 cm high. Bulb ovoid or ovoid-oblong, 10-15 cm long, 6-8 cm wide, the pseudoneck often very long, and mostly aerial, 30 mm broad at the apex Leaves lorate, channelled, erect, dull green, subacute, usually appearing simultaneously with the flower scape, 30-50 cm long, 25-35 mm broad. Scape cylindrical, solid, glaucescent. Spathe bivalved, valves lanceolate, marcescent, 30-35 mm long. Inflorescence 4-5-flowered. Pedicels well developed, spreading obliquely, 7-9 cm long. Flowers green, subpatent. Perigone ca. 53 mm long, 30 mm wide, the tube slightly curved, and slightly enlarged above; both series of tepals ascending or spreading obliquely, 18-20 mm long; the outer ones oblanceolate, 7-8 mm broad, the apicles 3 mm long; inner tepals subelliptic, subacute, 9-10 mm broad. Staminal cup ca. 20 mm long, 18 mm wide, 6-lobate, the lobes sparsely denticulate, and crenulate, 1.5-2 mm long, indentate-apiculate for 0.8-1 mm. Filaments filiform except for the slightly ampliate base; the episepal ones 5-5.5 mm long, attached at 9 mm above the staminal cup base; the epipet-epipetal 6 mm long, attached at 11 mm above the cup base. Anthers versatile, reniform, 4.5-4.9 mm long. Ovary oblong, green, 6 mm long, 2.8 mm thick. Style equalling the cup in length; stigma capitate.

DISTRIBUTION AND HABITAT. Rocky slopes above Palca, in the dept. of Junín, Perú; also near Huasahuasi (acc. to R.& P.), a nearby hamlet. The environment is somewhat xerophytic, and the species grows close to thorny bromeliads; altitude 2500-2800 m.

COLLECTIONS. In decliviis abruptis supra Palca civit. Junin Peruviae; Ravenna 2852, Sept.1982 (Herb. Ravennae neotype).

Callithauma is closely related to *Paramongaia*. As a matter of fact, the flower design is quite similar to that in the latter genus. It is clearly distinguished in the cylindrical scape, 2-valved spathe, several flowered inflorescence, well developed pedicels, and much smaller, almost patent flowers.

LITERATURE CITED

Baker, J.G. 1888. Handbook of Amaryllideae, 216 pp.

Bentham, G., & Hooker, J.D. 1883. Genera Plantarum 3: 733.

Herbert, W. 1837. Amaryllidaceae, 428 pp., 48 pls., facsimile ed. 1970 by J. Cramer, Lehre.

———— 1841. Callithauma viridiflorum; Curtis's Bot. Mag. 67: tab. 3866.

Macbride, F. 1931. Spermatophytes mostly Peruvian III; Field Mus. Nat. Hist. Bot. 11: 3-35.

A NEW SPECIES OF *EUCHARIS* (AMARYLLIDACEAE) FROM BOLIVIA

Pierfelice Ravenna

Eucharis boliviensis Ravenna, sp. nov.

Planta 50-55 cm alta. Bulbus subglobosus 48 mm latus tunicis exterioribus fusco-ochraceis in pseudocollum ad 5 cm longum productus. Folia 10-15 cm longa lamina elliptica 17 cm longa et 6.5-7 cm lata. Scapus cylindricus 43-51 cm longus. Spatha 4-8-flora valvis subaequalibus lanceolato-attenuatis marcescentibus ad 30 mm longis. Pedicelli brevi 10-16 mm longi. Flores nutantes. Ovarium ovatum subtriquetrum 3-4 mm longum et 2.5-3.5 mm latum. Perigonium explatum album 43-45 mm latum, tubo 25-30 mm longo. Tepala subaequalia lanceolata 23-25 mm longa et 8-12 mm lata, exterioribus apiculo 2-2.5 mm longo, interioribus acutis. Poculum staminale 9-10 mm longum in lobos sex 1.7 mm longos partita; filamenta lanceolata ab apice loborum continuantia, sepalinis 4 mm longis, petalinis 5 mm longis. Antherae oblongae 2.2 mm longae. Stylus filiformis ad 5 mm longus. Stigma capitato-trilobatum.

COLLECTIONS. Bolivia, La Paz, vic. Rurrenabaque, 550 m; Cárdenas 1553, 25-V-1921 (NY). Idem, Cosendo, 407 m; G. E. White 930, 19-VIII-1921 (NY holotype).

In a previous paper (Ravenna 1982), I recorded the genus (as Urceolina) in Bolivia, upon the same materials cited, which I studied at NY in 1976. However, I consider now the specimens representing a new species; the narrower leaves, shorter pedicels, and smaller flowers support this new appraisal.

REFERENCES

Ravenna, P. 1982. Contributions to South American Amaryllidaceae IX; Pl. Life 38: 42-55.

NEW SPECIES AND COMBINATIONS IN MESOAMERICAN PSYCHOTRIA SUBGENUS PSYCHOTRIA (RUBIACEAE)

Clement W. Hamilton
Center for Urban Horticulture, GF-15, University of Washington, Seattle, WA 98195

A revision of Mesoamerican Psychotria subgenus Psychotria (Hamilton, 1985 and in prep.) revealed the need to recognize 15 new species, 2 new varieties, and 5 new combinations in the group. Complete keys and discussions of relationships will follow in the revision. Publication of these new names is necessary now so that they may be validly referred to in a study of evolution of reproductive biology of the group (Hamilton, submitted for publication). In the floral descriptions, "pin" refers to the long-style morph and "thrum" to the short-style morph in the distylous floral dimorphism common in the family. Note that John D. Dwyer, of St. Louis University and the Missouri Botanical Garden, is co-author of 4 of the new species.

1. Psychotria balancanensis Hamilton, sp. nov. Type. Mexico. Tabasco: Balancán, La Palma, 1-6 Jun 1939 (fl), Matuda 3286 (holotype, F; isotypes, A, MEXU, NY).

Nervatura P. costivenia simili, praecipue differt foliis latioribus et inflorescentiis parvioribus axibus secundariis paucioribus bifariis non quadrifariis.

Shrub ca. 2.5 m tall; young stems glabrous, the bark smooth, sometimes with shallow fissures; stipules ovate-triangular, 6.5-7.5 x 3-4 mm, fringed, glabrous, caducous. Leaves petiolate; petioles 0.9-2 cm long, glabrous; blades membranous, elliptical to slightly obovate, the apex acuminate, the base attenuate, (6-)7-11(-13) x (2-)3-6 cm, glabrous above and below, drying dull green; secondary veins 8-10 pairs, diverging 65°-75°, eucamptodromous to brochidodromous, constantly arcuate, elevated below, glabrous, the axils lacking domatia and hairs; tertiary veins evident, orthogonal reticulate to percurrent. Inflorescences terminal, panicles of cymes; panicle branched to 3-4 degrees; main axis 3.5-9 cm long, the peduncle 2.5-7 cm long; secondary axes in 2 ranks, the first rank axes 2-4, the longer pair 0.8-1.2 cm long, the shorter pair 0.2-0.8 cm long, the second rank axes 4, equal, 0.3-0.7 cm long; cymes branched to 1-2 degrees; bracts and bracteoles irregular triangular, 0.7 x 0.8 mm, puberulent, fringed. Flowers pedicellate; pedicels 0.7-1 mm long; calyx cup-shaped, the tube 0.3-0.5 mm, the lobes 5, broadly triangular to barely evident, 0.2-0.3 x 0.5 mm, fringed; corolla white, the tube cylindrical, 2.5-3 x 1.2 mm, white pubescent in throat, the lobes 5(-6), triangular, spreading, 1.5 x 1 mm;

stamens 5(-6), the filaments 2.5-3 mm long in pins, not seen in thrums, the anthers 1 mm long; style 4.5 mm long in pins, not seen in thrums, the branches linear. Fruit not seen.

Distribution. Known only from the type collection from eastern Balancán, Tabasco in a region of evergreen forest and savanna with equatorial (tropical) climate.

Psychotria balancanensis may be recognized by its moderate-sized (l=7-11 cm) broad-elliptic leaves drying dull green to green-brown with conspicuous intersecondary veins and by its inflorescence with the secondary axes in 2 ranks near the apex of the peduncle. Only one flower morph has been seen; additional collections will reveal whether this species is indeed distylous. It differs from P. costivenia in having broader-elliptic leaves and smaller inflorescences with fewer (2 versus 4) ranks of secondary axes.

2. Psychotria cascajalensis Hamilton, sp. nov. Type. Panama. Coclé: N of Penonomé, between Llano Grande and Cascajal, rd. to Coclesito, 480 m, 2 May 1979 (fl), Hammel 7227 (holotype, MO-2901097; isotypes, ENCB, MO).

Foliis coriaceis nervis secundariis paucis et inflorescentiis P. olgae similibus, praecipue differt foliis multo parvioribus.

Tree 10 m tall; young stems glabrous to sparsely puberulent, the bark smooth; stipules oval, rounded, 6-7 x 3-3.5 mm, fringed, glabrous, caducous. Leaves petiolate; petioles 2-4 mm long, glabrous; flat above; blades coriaceous, elliptical, the apex acute, the base attenuate, 3.5-6(-7) x (1.5-)2-2.7 cm, glabrous above and below, drying dull red-brown to green-brown; secondary veins 4-6 pairs, diverging 55°-65°, brochidodromous with secondary loops inconspicuous, straight then arcuate near margin, not elevated below, glabrous, the axils lacking domatia or hairs; tertiary veins inconspicuous. Inflorescences terminal, panicles of cymes or glomerules; panicle branched to 3 degrees; main axis 6 cm long, the peduncle 2-3.5 cm long; secondary axes in 3 ranks, the first rank axes 2 or 4, the longer pair 1-2 cm long, the shorter pair 0.4-1.2 cm long, the second rank axes 2, 0.5-0.8 cm long, the third rank axes 2, 0.1-0.3 cm long; cymes branched to 1-2 degrees; bracts and bracteoles broad triangular, 1-2 mm long, red-brown pubescent. Flowers subsessile, the pedicels 0.5 mm long; calyx cup-shaped, the tube 0.8 mm long, the lobes 5, triangular to barely evident, to 0.3 x 0.8 mm, puberulent, fringed; corolla green-white, the tube cylindrical, 1.5 x 1.5 mm, thick white pubescent in throat, the lobes 5, triangular, 1.5 x 1 mm; stamens 5, the filaments not seen in pins, 1.5 mm long in thrums, the anthers 1 mm long; style not seen in pins, 1 mm long in thrums, the branches linear. Fruit not seen.

Distribution. Known only from the type collection from the foothills south of the divide in Coclé, Panama, at 480 m in a region of tropical moist to premontane wet forest with equatorial (mountainous) climate.

Psychotria cascajalensis may be recognized by its small (3.5-6 x 2-2.7 cm), coriaceous, elliptical leaves and robust pedunculate inflorescences with secondary axes 2(-4) per rank in three ranks. Only one flower morph was seen, with the stamens slightly longer than the style; the length difference is so slight as to suggest that there may indeed by only one morph in this species. Psychotria cascajalensis resembles most closely, in its coriaceous leaves, few secondary veins, and inflorescence form, P. olgae; the two may share a common ancestor.

3. Psychotria chitariana Dwyer & Hamilton, sp. nov. Type. Costa Rica. Cartago: 13 km E of Turrialba, hwy. to Limón, canyon of Río Chitaría, 9°55'N, 83°36'W, 750-800 m, 10 May 1983 (fl), Liesner et al. 15400 (holotype, MO).

Differt a speciebus subgeneris Psychotria in Mesoamerica foliis grandibus obovatis apicibus rotundis vel obtusis et inflorescentiae axibus secundariis unifariis fasciculatisque terminaliter.

Shrub 1 m tall; young stems glabrous, the bark irregularly furrowed, with organic material accumulated in leaf axils; stipules not seen. Leaves petiolate; petioles ca. 1.5 cm long, glabrous, winged; blades membranous to chartaceous, obovate, the apex rounded to obtuse, the base attenuate, 28-33 x 13-15 cm, glabrous above and below, drying pale brown to greenish red-brown; secondary veins 16-19 pairs, diverging (50°-)60°-65°(-70°), brochidodromous, straight to arcuate near margin, elevated below, glabrous, the axils lacking domatia or hairs; tertiary veins evident, orthogonal reticulate, the intersecondaries conspicuous. Inflorescences terminal, dense globose panicles of cymes; panicle branched to 3 degrees; main axis 7.5 cm long, the peduncle 4.5 cm long; secondary axes in 1 rank plus terminal cluster, the first rank axes 2, 1 cm long, the clustered axes ca. 8, equal, 0.7-1 cm long; cymes branched to 1-2 degrees; bracts linear to triangular, 5 x 2.5 mm, glabrous. Flowers pedicellate, the pedicels 3-5 mm long; calyx cup-shaped, the tube 1 mm long, the lobes 5, barely evident, glabrous; corolla greenish white, the tube cylindrical, 4.5-5 x 1.5 mm, white pubescent in throat, the lobes 5, triangular, 2.3 x 1.5 mm; stamens 5, the filaments 4.5 mm long in pins, not seen in thrums, the anthers 1.5 mm long; style 7 mm long in pins, not seen in thrums, the branches minute. Fruit not seen.

Distribution. Known only from the type collection from Cartago, Costa Rica, at 750-800 m in an area of premontane to lower montane rain forest with equatorial (mountainous) climate.

Psychotria chitariana may be recognized by its large (28-33 x 13-15 cm) obovate leaves with rounded to obtuse apex and its inflorescence secondary axes in one rank plus a terminal cluster. Only the long-style flower morph has been collected, but it appears perfectly normal; further collections are needed to confirm or deny the existence of distyly in this species. Its low habit with organic material accumulated in leaf axils and reduced globose inflorescences suggest that it is related to P. calophylla Standley and its allies.

4. Psychotria cocosensis Hamilton, sp. nov. Type. Costa Rica. Cocos Island, 18 Jun 1898 (fr), Pittier 12375 (holotype, US).

Differt a P. panamensis foliis coriaceis et fructibus grandibus globosis vel ellipsoideis calycibus persistentibus cupulatis coriaceis.

Shrub; young stems glabrous, the bark furrowed longitudinally; stipules lanceolate, 12-35 x 2-5 mm, glabrous, caducous. Leaves petiolate; petioles 7-14 mm long, glabrous; blades membranous to coriaceous, elliptical, the apex acuminate to subcaudate, the base attenuate, (12-)14-17 x 5.5-7 cm, glabrous above and below, drying red-brown to green-brown; secondary veins (9-)10-12 pairs, diverging 45°-50°, eucamptodromous to brochidodromous, straight then arcuate near margin, elevated below in less coriaceous leaves, the axils with small domatia below; tertiary veins inconspicuous to evident, percurrent to reticulate. Inflorescences terminal, panicles of cymes; panicle branched to 2-3 degrees; main axis 1 cm long, the peduncle lacking; secondary axes in 2 ranks, the first rank axes 2, 0.6 cm long, the second rank axes 2, reduced; cymes branched to 1 degree; bracts triangular, 0.7-1.5 mm long, glabrous. Flowers pedicellate, the pedicels 2-3 mm long; calyx cup-shaped, the tube 1 mm long, the lobes 5, broadly triangular to barely evident, glabrous; corolla color unknown, the tube cylindrical, 3 x 3 mm, white pubescent in throat, the lobes 5, linear, 4 x 2 mm; stamens 5, the filaments 7 mm long, the anthers 2 mm long; style 9-10 mm long, the branches minute, linear. Fruit when dry spherical to ellipsoidal, 6 mm long, 5.5-6 mm in diameter, drying dark red-brown; persistent calyx cuplike, coriaceous, 1.5 mm long; seeds 2, the dorsal surface with 4 shallow irregular longitudinal furrows, the ventral surface with 2 deep irregular longitudinal furrows.

Distribution. Known only from Cocos Island at 50 m elevation in premontane rain forest. It has been collected in fruit in January and June.

Additional specimens examined. COSTA RICA. Cocos Island: La vallée de Chatham, 50 m, Jan 1902 (fl,fr), Pittier 16279 (GH, US).

Psychotria cocosensis may be recognized by its close resemblance to P. panamensis and by its coriaceous leaves and large (6 x 5.5-6 mm)

spherical to ellipsoidal fruit with persistent calyx a coriaceous cup ca. 1.5 mm long. Only one morph has been seen; perhaps it is a long-style morph, but both stamens and style are exserted, with the latter only slightly longer, suggesting the possibility of breakdown of distyly in this island endemic. Psychotria cocosensis may have diverged from P. panamensis stock on Cocos Island and differs from its supposed progenitor in the characters mentioned above.

5. Psychotria costivenia Grisebach var. altorum (Standley & Steyermark) Hamilton, comb. nov. --Psychotria altorum Standley & Steyermark, Publ. Field Mus. Nat. Hist., Bot. Ser. 23: 86. 1944. Type. Guatemala. Quezaltenango: Montaña Chicharro, on lower SE-facing slopes of Volcán Sta. María, 2-4 mi S of Sta. María de Jesús, 1400-1500 m, 17 Jan 1940 (fl), Steyermark 34302 (holotype, F).

6. Psychotria dressleri (Dwyer) Hamilton, comb. nov. --Cephaëlis dressleri Dwyer, Ann. Missouri Bot. Gard. 67(1): 68, fig. 15. 1980. Type. Panama. San Blas: SE of Puerto Obaldía, 18 Aug 1971 (fl), Croat 16801 (holotype, MO).

7. Psychotria dwyeri Hamilton, sp. nov. Type. Mexico. Oaxaca: Dto. Choápam (Santiago Choapan), Sta. María, Montaña Sta. María, 1500 m, 7 Apr 1938 (fr), Mexia 9265 (holotype, NY; isotypes, B, F, GH, MO, US).

Inflorescentiis et characteribus vegetativis P. panamensis similibus, praecipue differt fructibus parvis globosis.

Shrub or small tree, 3-6 m tall; young stems glabrous, the bark smooth; stipules sheathing, triangular, 8-13 x 3-5 mm, glabrous, caducous. Leaves petiolate; petioles (5-)15-40(-45) mm long, glabrous; blades membranous, elliptical, the apex cuspidate, the base cuneate to attenuate, (12-)15-23 x 5-10 cm, glabrous above, glabrous to minute white puberulent below, drying green-brown, paler below; secondary veins (12-)15-18, diverging 55°-70°(-80°), eucamptodromous, straight to slightly arcuate, elevated below, often white puberulent below, the axils lacking domatia or hairs; tertiary veins evident, orthogonal reticulate, the loops near margin evident. Inflorescences terminal, panicles of cymes; panicle branched to 4 degrees; main axis 5.5-10.5 cm long, the peduncle lacking or to 2 cm long; secondary axes in 4-5(-6) ranks, the first rank axes 2, (2.5-)7-9 cm long, the second rank axes 2(or 4), (2-)3-5.5 cm long, the third rank axes 2, (0.5-)1.5-4 cm long, the fourth rank axes 2(or 4), (0.5-)1-2 cm long, the fifth rank axes 2, 0.6-0.8 cm long, the sixth rank axes 2, 0.3 cm long; cymes branched to 1-2 degrees; bracts inconspicuous. Flowers pedicellate, the pedicels 0.5-1.5 mm long; calyx cup-shaped, the tube 0.5 mm long, the lobes 5, broad

triangular, minute, glabrous to minutely fringed; corolla white, the tube cylindrical, 2-2.5 x 2 mm, white pubescent in throat, the lobes 5, triangular, 1.5-2 x 1 mm; stamens 5, the filaments 2-2.5 mm long in pins, 2.5-3 mm long in thrums, the anthers 1 mm long; style 4-4.5 mm long in pins, 1.5-2 mm long in thrums, the branches linear in pins, clublike in thrums. Fruit when dry spherical, 4.5-5 mm long, 4.5-5 mm in diameter, maturing red, drying deep red-brown; calyx persistent as a beak, to 0.8 mm long; seeds 2, the dorsal surface with 4 irregular longitudinal furrows, the ventral surface with 2 deep longitudinal furrows.

Distribution. Known from Veracruz and Oaxaca, Mexico, at elevations of 50-1500 m in a region of subevergreen forest with tropical to tropical (mountainous) climate. It has been collected in flower in April and May and in fruit April, June, and December.

Additional specimens examined. MEXICO. Oaxaca: Ubero, 30-90 m, Jun 1937 (fr), Ll. Williams 9475 (F). Veracruz: San Lorenzo Tenochtitlan, 9 Dec 1967 (st), Chavelas et al. ES-2832 (MEXU); 9 Dec 1967 (fr), Chavelas et al. ES-2843 (MEXU); El Mirador, 1853 (fl), F. Muller 424 (NY); Apr 1932 (fl), Purpus 14124 (A, F); Zacuapan, 1915 (fl), Purpus 7525 (MO, US); May 1926 (fl), Purpus 10705 (US); Jalapa, 1200-1350 m, 1894 (fl), C. Smith 1844 (F, US).

Psychotria dwyeri resembles, in inflorescence and vegetative characters, P. panamensis and is distinguished from it most easily in fruit. Psychotria dwyeri has spherical (versus ellipsoidal to obovoid) fruit 4-5.5 mm (versus 4.5-8 mm) long.

Psychotria dwyeri is named for Dr. John D. Dwyer, who has contributed extensively to our understanding of Rubiaceae in Central America and who provided invaluable assistance to the author during his doctoral study.

8. Psychotria fosteri Hamilton, sp. nov. Type. Panama. Veraguas: Playa Rosario, northern tip of Coiba Island, 26 Aug 1970 (fl,fr), Foster 1605 (holotype, DUKE; isotypes, F, GH, MO).

Inflorescentiis et fructibus P. chagrensis similibus, praecipue differt foliis grandioribus et stipulis longioribus.

Shrub ca. 1 m high; young stems glabrous, the bark slightly furrowed longitudinally; stipules sheathing, narrow, with 2 triangular lobes, the sheath 8-12 x 1-3 mm, the lobes 2-3 mm long, fringed, with darker red-brown midrib leading to apex of each lobe, caducous. Leaves petiolate; petioles 5-10 mm, glabrous; blades membranous, elliptic-obovate, the apex acuminate to mucronate, the base attenuate, (6-)8-12 x (2-)3-5 cm, glabrous above and below, drying green-brown above, deep red-brown below; secondary veins 11-14 pairs, diverging 70°-80°, brochidodromous, slightly arcuate,

prominulous below, glabrous, drying deeper red-brown than blade, the axils lacking domatia or hairs; tertiary veins inconspicuous, reticulate. Inflorescences terminal, fascicles of several flowers, ca. 8 mm long, 10 mm across; peduncles lacking; bracts broadly triangular, irregularly cleft, ca. 5 x ca. 5 mm, fringed. Flowers sessile; calyx cup-shaped, the tube 1.5 mm long, the lobes 5, triangular, 0.5-1 x 0.5 mm, slightly fringed; corolla white, the tube cylindrical, 3.5 x 0.8 mm, white pubescent in throat, the lobes 5, triangular, 2 x 0.7 mm; stamens 5, the filaments 3 mm long in pins, not seen in thrums, the anthers 0.5 mm long; style 4-4.5 mm long in pins, not seen in thrums, the branches linear. Fruit when dry ellipsoidal, 5-6 mm long, 2.5-3 mm in diameter, maturing orange, drying dark red-brown; calyx persistent, the tube 1-1.5 mm long, the lobes ca. 1 mm long; seeds 2, the dorsal surface with 5 longitudinal furrows, the ventral surface with 2 longitudinal furrows.

Distribution. Known only from the type collection from Coiba Island, Panama, in tropical moist forest with tropical (equatorial) climate.

Psychotria fosteri may be recognized as a magnified version of P. chagrensis, having an inflorescence consisting of a fascicle of flowers and fruit ellipsoidal with a conspicuous persistent calyx. Only the long-style flower morph has been seen and much more flowering material needs to be collected. Psychotria fosteri may have diverged from P. chagrensis on Coiba Island. Psychotria fosteri differs from its supposed progenitor in having larger (sheath 1=8-12 versus 4-7 mm) biaristate (versus aristate) stipules, larger mature leaves (8-12 x 3-5 versus 4-7.5 x 1.5-2.5 cm), shorter calyx lobes (0.5-1 mm versus 2-2.5 mm), and much shorter corolla tubes (3.5 versus 6-7 mm).

Psychotria fosteri is named for Dr. Robin Foster, whose floristic knowledge of the neotropics is well known and who provided valuable help to the author during his fieldwork in Panama.

9. Psychotria hornitensis Dwyer & Hamilton, sp. nov. Type. Panama. Chiriquí: Ridge and summit of Cerro Hornito, above Los Planes de Hornito, 8°42'N, 82°06'W, 2100 m, 14 Mar 1982 (fl, early fr), Knapp et al. 4198 (holotype, MO).

Differt a speciebus subgenus Psychotria in Mesoamerica foliis parvis angustis et inflorescentiis parvis floribus paucis.

Shrub 2 m tall; young stems glabrous, the bark deeply furrowed longitudinally; stipules sheathing, ovate to lanceolate, 3-4 x 1-1.5 mm, glabrous, caducous. Leaves subsessile; petioles to 2 mm long, glabrous; blades membranous, narrow elliptic, the apex long acuminate, the base attenuate, 2.5-3.5 x 0.5-0.7 cm, glabrous above and below, drying dull green-brown above, dull green below;

secondary veins 5-6 pairs, diverging ca. 50°, eucamptodromous, constantly arcuate, not evident above, barely evident below, glabrous, the axils lacking domatia or hairs; tertiary veins inconspicuous. Inflorescences terminal, panicles of 3-5 individual flowers or cymes; panicle branched to 2 degrees; main axis 2.5-3 cm long, the peduncle 1.5-2 cm long; secondary axes in 1-2 ranks, the first rank axes 1-2, 0.3-0.4 cm long, the second rank axes 1-2, 0.1 cm long; cymes branched to 1 degree; bracts and bracteoles linear, 1.5-2 x 0.7 mm, glabrous to puberulent within near base. Flowers sessile to pedicellate, the pedicels to 1 mm long; calyx cup-shaped, the tube ca. 1 mm long, the lobes 5, triangular, 0.8-1 x 0.8 mm, glabrous; corolla white, the tube cylindrical, 3.5-4 x 1.5 mm, white pubescent in throat, the lobes 5, ovate, 1-1.5 x 0.8 mm; stamens 5, 3-4 mm long, the anthers 1 mm long; style 4-6 mm long, the branches short, linear. Fruit not seen in mature state.

Distribution. Known only from the type locality, Cerro Hornito, Chiriqui, Panama, at ca. 2000 m elevation in low montane rain forest with equatorial (mountainous) climate. It has been collected in flower in February and March and with immature fruit in March.

Additional specimen examined. PANAMA. Chiriquí: Ridge nr. top of Cerro Hornito, 1950 m, 15 Feb 1979 (fl), Hammel 6189 (MO).

Psychotria hornitensis may be recognized readily by its small narrow (2.5-3.5 x 0.5-0.7 cm) leaves and small (1=2.5-3 cm) few-flowered inflorescences. The one flower morph found does not show significant differentiation in length between the style and stamens; perhaps distyly has broken down in this species. Psychotria hornitensis appears most similar to P. chiriquina.

10. Psychotria insueta (Dwyer) Hamilton, comb. nov. --Cephaëlis insueta Dwyer, Ann. Missouri Bot. Gard. 67(1): 73. 1980. Type. Panama. Veraguas: 11 km from Escuela Agricola Alto de Piedra, along Río Dos Bocas, Atlantic slope, 15 Nov 1974 (early fr), Mori & Kallunki 3108 (holotype, MO).

11. Psychotria jinotegensis Nelson, Molina, and Standley var. morazanensis Hamilton, var. nov. Type. El Salvador. Morazán: Easternmost peak, Montes de Cacaguatique, nr. summit on N side, 13°46'N, 88°13'W, 1500 m, 25 Dec 1941 (fr), Tucker 610 (holotype, US; isotypes, F, NY).

Differt a P. jinotegensis var. jinotegensis aspectu glabro.

Shrub: young stems very sparsely tomentose. Leaves: petioles glabrous; blades glabrous above and below, drying grey-green to pale red-brown; secondary veins 9-11 pairs, glabrous, the axils with tufts of whitish hairs below. Fruit when dry glabrous.

Distribution. Known only from the type collection from eastern El Salvador, at ca. 1500 m.

12. Psychotria lamarinensis Hamilton, sp. nov. Type. Costa Rica. Alajuela: E of Río San Rafael, W of La Marina, 10°23'N, 84°23'W, 500 m, 19 May 1968 (fl), Burger & Stolze 5062 (holotype, NY; isotype, MO).

Nervatura et inflorescentiis P. quinqueradiata similibus, praecipue differt foliis longioribus et corollae tubis brevioribus.

Shrub 1.8-2 m tall; young stems glabrous, the bark pale, smooth; stipules ovate, 12 x 8 mm, glabrous, caducous. Leaves petiolate; petioles 5-7 mm long, glabrous; blades membranous, elliptic, the apex acuminate, the base attenuate to attenuate-truncate, (13-)16-20 x (5-)7.5-9.5 cm, glabrous above and below, drying green-brown above, red-brown below; secondary veins 9-11 pairs, diverging 70°-85°, eucamptodromous, constantly arcuate, elevated below, glabrous, the axils lacking domatia or hairs; tertiary veins evident, orthogonal reticulate. Inflorescences terminal, condensed globose panicles of cymes; panicle branched to 3 degrees; main axis 1.5-2 cm long, the peduncle lacking; secondary axes in 2-3 ranks, the first rank axes 4, subequal, 0.5-1.5 cm long, the second rank axes 4, subequal, 0.4-0.7 cm long, the third rank axes 4, subequal, 0.2 cm long; cymes branched to 1-2 degrees; bracts triangular, 2 mm long, glabrous; bracteoles not evident. Flowers pedicellate, the pedicels 0.5-1.5 mm long; calyx cup-shaped, 0.5 mm long, the lobes not evident to barely evident, glabrous; corolla white, the tube cylindrical, 3 x 1 mm, white pubescent in throat, the lobes 5, linear with 1.5 mm linear extension from near apex, 2 x 1 mm; stamens 5, the filaments not seen in pins, 3.5-4 mm long in thrums, the anthers 0.7 mm long; style not seen in pins, 2-2.5 mm long in thrums, the branches linear. Fruit not seen.

Distribution. Known only from the type locality near La Marina, Alajuela, Costa Rica, at ca. 500 m elevation in a region of tropical wet to premontane wet forest with equatorial (mountainous) climate. It was collected in flower on May 19.

Additional specimens examined. COSTA RICA. Alajuela: E of Río San Rafael, W of La Marina, 10°23'N, 84°23'W, 500 m, 19 May 1968 (fl), Burger & Stolze 5069 (MO, NY).

Psychotria lamarinensis may be recognized by its large, broad-elliptical leaves with the base narrowly subcordate, its reduced globose inflorescence drying red-brown, and its broad-ovate stipules. Only a short-style flower morph has been seen of this little-collected species. Psychotria lamarinensis may be a local derivative from P. quinqueradiata, from which it differs in having much larger leaves with secondary veins diverging 70°-85° instead of 45°-60° and shorter (3 mm versus 4-5 mm) corolla tubes.

13. Psychotria laselvensis Hamilton, sp. nov. Type. Costa Rica. Heredia: Finca La Selva, OTS field station, Río Puerto Viejo just E of its junction with Río Sarapiquí, ca. 100 m, 19 May 1980 (fl), Hammel 8706 (holotype, DUKE).

Differt a P. graciliflora et P. orosiana foliis grandioribus nervis secundariis pluribus inflorescentiis grandioribus.

Shrub 1.5-4 m tall; young stems glabrous, the bark smooth; stipules triangular, 3-4 x 3 mm, glabrous, caducous. Leaves subsessile to petiolate; petioles 1-7 mm long, glabrous; blades membranous to chartaceous, elliptical, the apex acuminate, the base attenuate to caudate to subcordate, (5-)7.5-13(-16) x (1.5-)2.5-5 cm, glabrous above and below, drying red-black; secondary veins (8-)10-13 pairs, diverging (65°-)80°-85°, brochidodromous, constantly arcuate, prominulous below, glabrous, the axils often with domatia below; tertiary veins evident, reticulate. Inflorescences terminal, spreading panicles of cymes; panicle branched to 4 degrees; main axis 6.5-15 cm long, the peduncle 4-9 cm long; secondary axes in 4-5 ranks, the first rank axes 2 or 4, the longer pair 1.8-4.2 cm long, the shorter pair if present 0.5-0.7 cm long, the second rank axes 2 or 4, the longer pair 0.6-1.8 cm long, the shorter pair when present 0.2 cm long, the third rank axes 2, 0.3-0.9 cm long, the fourth rank axes 2, 0.1-0.4 cm long, the fifth rank axes 2, 0.2 cm long; cymes branched to 1 degree; bracts lanceolate to triangular, 2-3 mm long, glabrous; bracteoles lanceolate, 0.5-1 mm long, glabrous. Flowers pedicellate, the pedicels ca. 0.5 mm long; calyx cup-shaped, the tube 0.3 mm long, the lobes 5, triangular, barely evident, minutely ciliate; corolla white, the tube cylindrical, 2.5-3 x 1.2 mm, white pubescent in throat, the lobes 5, lanceolate, 2 x 1 mm; stamens 5, the filaments 2 mm long in pins, 3-3.5 mm long in thrums, the anthers 1-1.2 mm long; style 5-5.5 mm long in pins, 2.5-3 mm long in thrums, the branches linear, recurved. Fruit not seen.

Distribution. Known only from the type locality, the Organization for Tropical Studies field station at Finca La Selva, Rio Puerto Viejo, Heredia, Costa Rica, at ca. 100 m elevation in tropical wet forest with equatorial climate. It has been collected in flower February-May and with immature fruit in July.

Additional specimens examined. COSTA RICA. Heredia: Finca La Selva, OTS field station, Río Puerto Viejo, 100 m, 1 May 1981 (fl), Folsom 9958 (DUKE); 4 May 1981 (fl), Folsom 10004 (DUKE); 18 Feb 1980 (fl), Hammel 7778 (DUKE); 1 Jul 1981 (early fr), Hammel 10938 (DUKE); 27 Mar 1982 (fl), Hammel 11491 (DUKE).

Psychotria laselvensis may be recognized by its resemblance to P. graciliflora and P. orosiana and its generally larger inflorescences and leaves. It differs from P. orosiana in having leaf blades to 13(-16) cm (versus 10.5 cm) long, more secondary veins (10-13 versus 7-9), inflorescence secondary axes commonly 4 (versus 2) in the

first rank, and usually shorter corolla tubes (2.5-3 versus 2.5-5 mm). These three closely related species--P. graciliflora, P. orosiana, and P. laselvensis--form a continuum with regard to many quantitative characters, but their recognition as species is straightforward.

14. Psychotria mirandae Hamilton, sp. nov. Type. Mexico. Chiapas: Berriozábal a Las Vistas, 17 Jul 1949 (fl), Miranda 5395 (holotype, US; isotype, MEXU).

Foliis et inflorescentiis P. nervosa similibus, praecipue differt fructibus latioribus et calycibus persistentibus conspicuis tubiformibus.

Shrub ca. 1 m tall; young stems red-brown tomentose, the bark pale, smooth; stipules sheathing, rounded at apex, 4-8 x 3-4 mm, red-brown tomentose outside, caducous. Leaves subsessile to petiolate; petioles 1-4 mm long, red-brown tomentose; blades membranous, narrowly obovate, the apex caudate, the base attenuate, 6-12 x 2-4 cm, glabrous above and below, drying dull red-brown; secondary veins 7-10 pairs, diverging 48°-55°, eucamptodromous, slightly arcuate, prominent below, red-brown sparsely tomentose below, the axils with small tufts of hair below; tertiary veins evident, reticulate to slightly percurrent. Inflorescences terminal, fascicles of flowers or with several short axes, 1-1.5 cm long, 1-2.5 cm across; peduncle lacking; bracts triangular, 0.5 x 0.5 mm, glabrous to sparsely tomentose. Flowers subsessile, the pedicels 1-2 mm long; calyx cylindrical, the tube 2-2.5 mm long, the lobes 5, linear, 2-3 x 1.2 mm, sparsely ciliate on margin; corolla white(?), the tube cylindrical, 3 x 1 mm, white pubescent in throat, the lobes 5, linear, 1.5-2 x 0.5 mm; stamens 5, the filaments not seen in pins, 4 mm long in thrums, the anthers 0.8 mm long; style not seen in pins, 2.5-3 mm long in thrums, the branches club-shaped. Fruit when dry ellipsoidal, 5-7 mm long, 4-5 mm in diameter, maturing red, drying red-brown, red-brown tomentose; calyx persistent, the tube 2-2.5 mm long, the lobes ca. 2 mm long; seeds 2, the dorsal surface with 5 longitudinal furrows, the ventral surface with 2 longitudinal furrows.

Distribution. Limited to eastern Veracruz and northwestern Chiapas, Mexico, at 700-1000 m elevation in evergreen forest with equatorial (tropical) to tropical climate. It has been collected in flower in March and May-July and in fruit in August and December.

Additional specimens examined. MEXICO. Chiapas: Mpio. Berriozábal, 13 km N or Berriozábal nr. Pozo Turipache and Finca El Suspiro, 900 m, 15 May 1973 (fl), Breedlove 35316 (MEXU); Cerro de San Martín, Mar 1845 (fl), Galeotti 2684 (F-3 sheets, US); Berriozábal a Las Vistas, 4 Dec 1949 (fr), Miranda 5834 (MEXU, US); San Fernando, Predio del Rosario, 21 Jun 1951 (fl), Miranda 7216

(MEXU). Veracruz: Mpio. Catemaco, cerro entre Zapoapan y San Juan Seco al SW de Lago Catemaco, 700 m, 7 Jun 1972 (fl), Beaman 6094 (F, MEXU-2 sheets); region of San Andres Tuxtla, nr. Zapoapan, SE of Catemaco, 17 Aug 1953 (fr), Dressler & Jones 93 (GH, NY, US); Catemaco, 25 Mar 1956 (fl), Paray 1946 (ENCB); km 156.5 of Veracruz-Coatzacoalcos rd., 13 Jul 1974 (fl), Sohmer 9409 (MEXU).

Psychotria mirandae may be recognized first by its marked resemblance to P. nervosa and second by its contracted, sometimes fasciculate, inflorescences and wider (d=4-5 mm versus 2.5-3 mm in P. nervosa) fruit with persistent calyx a conspicuous tube and lobes ca. 4 mm long. Only the short-style flower morph has been seen in this little-collected species. Psychotria mirandae is named for Dr. Faustino Miranda, eminent Mexican botanist and prolific collector.

15. Psychotria monteverdensis Dwyer & Hamilton, sp. nov. Type. Costa Rica. Guanacaste-Puntarenas: Al oeste de Reserva de Monteverde, 1520-1590 m, 24 Jun 1977 (fl), Dryer 1531 (holotype, MO).

Differt a P. psychotriifolia et speciebus affinibus inflorescentiae axibus secundariis bifariis axibus distalibus sessilibus et corollis coriaceis.

Shrub 2.5 m tall; young stems glabrous, the bark irregularly furrowed longitudinally; stipules sheathing, truncate with 2 aristate appendages from apical corners, 7-8 x 4 mm, the extensions 2 mm long, glabrous, caducous. Leaves sessile to petiolate; petioles to 0.5 cm long, glabrous; blades subcoriaceous, elliptic, the apex acuminate, the base cuneate, (9-)13-15 x (2-)3-4.5 cm, glabrous above and below, drying pale green-brown; secondary veins 9-11 pairs, diverging 45°-60°, brochidodromous with collector vein undulating near margin, constantly arcuate, prominent below, glabrous, the axils lacking domatia or hairs; tertiary veins inconspicuous, orthogonal reticulate. Inflorescences terminal, few-branched panicles of glomerules; panicle branched to 2 degrees; main axis 3.6 cm long, peduncle 2.4 cm long; secondary axes in 2 ranks, the first rank axes 2, 0.6-0.7 cm long, the second rank axes 2, reduced; bracts linear, 8 mm long, ciliate; bracteoles ovate, 3-4 mm long, ciliate. Flowers sessile to pedicellate, the pedicels to 1.5 mm long; calyx cup-shaped, the tube ca. 1 mm long, the lobes 5, triangular to lanceolate, to 1 mm long, ciliate; corolla green-yellow, leathery, the tube cylindrical, 3 x 2 mm, pubescent in throat, the lobes 5, triangular with robust keel-like appendages, 2 x 1 mm; stamens 5, the filaments 2.5 mm long, the anthers 1.2 mm long; style 4 mm long, the branches clublike. Fruit not seen.

Distribution. Known only from the type collection from near the Monteverde Reserve near the Guanacaste-Puntarenas border, Costa Rica, at ca. 1550 m elevation in low montane wet forest with equatorial (mountainous) climate.

Psychotria monteverdensis may be recognized by its subcoriaceous medium-sized (13-15 x 3-4.5 cm) leaves with collector vein, its small (l=3.6 cm) inflorescences with secondary axes 2 per rank in 2 ranks, those of the second rank sessile, and its leathery greenish corollas with keel-like abaxial appendages on the lobes. Only one flower was dissected, but the minute separation (0.3 mm) between stigma and anthers suggest breakdown of distyly in this species. Its sheathing biaristate stipules, collector vein, inflorescence form, and appendaged corolla lobes places P. monteverdensis among P. calophylla and its allies.

16. Psychotria neillii Hamilton & Dwyer, sp. nov. Type. Nicaragua. Río San Juan: Río Sábalos, 2 km al O de Sta. Eduviges, 11°03'N, 84°29'W, 80 m, 18 Feb 1984 (fl,fr), P.P. Moreno 23060 (holotype, MO).

Differt a P. micrantha foliis parvioribus nervis secundariis paucioribus et inflorescentiae axibus tenuibus et fructibus grandioribus.

Shrub or small tree, 1-4 m tall; young stems ferrugineous, the bark smooth; stipules sheathing, lanceolate, biacuminate, 10-14 x 3-5 mm, ferrugineous, ciliate, caducous. Leaves petiolate; petioles 4-8 mm long, ferrugineous; blades membranous, oblanceolate, the apex acuminate, the base cordate, 10-18 x 4-7.5 cm, glabrous above, the midvein basally ferrugineous, sparsely ferrugineous below, drying green-brown to red-brown; secondary veins 12-15 pairs, diverging (60°-)65°-75°, brochidodromous, constantly arcuate, elevated below, ferrugineous below, the axils lacking domatia or hairs; tertiary veins evident to conspicuous, percurrent, the quaternaries orthogonal reticulate. Inflorescences terminal or pseudoaxillary, panicles of cymes; panicle branched to 3-4 degrees, the axes delicate; main axis (6-)9-15 cm long, the peduncle (3.5-)6-8 cm long; secondary axes in 3 ranks, the first rank axes 4, the longer pair (1.5-)3-6 cm long, the shorter pair (0.8-)1-3.5 cm long, the second rank axes 2 or 4, (0.8-)1.4-3.2 cm long, the shorter pair when present ca. 1.5 cm long, the third rank axes 2, 0.6-1.4 cm long; cymes branched 2-3 degrees; bracts triangular, 4 mm long, ferrugineous; bracteoles linear, 0.5 mm long, ferrugineous. Flowers sessile to pedicellate, the pedicels to 1 mm long; calyx cup-shaped, the tube 0.3 mm long, the lobes 5, triangular, 0.2 mm long, ferrugineous; corolla cream, the tube cylindrical, 1.5-2 x 1 mm, white pubescent in throat, red-brown pubescent without, the lobes 5, triangular, 1 x 0.8 mm; stamens 5, the filaments not seen in pins, 2.5 mm long in thrums, the anthers 0.8 mm long; style not seen in pins, 2 mm long in thrums, the branches linear. Fruit when dry ellipsoidal to obovoid, 5-7 mm long, 3-3.5 mm in diameter, maturing red, drying dark red-brown, sometimes puberulent; persistent calyx inconspicuous or a minute beak; seeds 2, the dorsal surface with 3 deep longitudinal furrows, the ventral surface with 2 shallow longitudinal furrows.

Distribution. Known from Caribbean coastal Costa Rica and just north into Nicaragua, at 80-400 m elevation in tropical moist to wet forest with equatorial climate. It has been collected in flower in January, February, and April and in fruit in February and May.

Additional specimens examined. NICARAGUA. Río San Juan: Nr. Caño Chontaleño, 20 km NE of El Castillo, 200 m, 18-21 Apr 1978 (fl), Neill & Vincelli 3503 (MO). COSTA RICA. Heredia: Magsasay, entre el campamento Canta Rana y Río Peje, 400 m, 14 Jan 1983 (fl), Chacón 76 (MO). Limón: 7 km SW of Bribri, 100-250 m, 4 May 1983 (early fr), L.D. Gómez et al. 20357 (MO-2 sheets).

Psychotria neillii may be recognized by its great resemblance to P. micrantha and its delicate ferrugineous inflorescence axes. Only the short-style flower morph has been seen in this seldom-collected species. Psychotria neillii differs from P. micrantha in having smaller (l=10-18 versus 20-32 cm) mature leaves with fewer (12-15 versus 20-26) secondary veins, delicate inflorescence axes, and larger (l=5-7 mm versus 4 mm) fruit.

Psychotria neillii is named for Dr. David Neill, whose recent collections from Nicaragua have proven extremely valuable.

17. Psychotria pacorensis Hamilton, sp. nov. Type. Panama. Panama: Vic. Cerro Jefe, Altos de Pacora, 720 m, 18 Dec 1980 (early fr), Antonio 3241 (holotype, MO; isotype, ENCB).

Nervatura et fructibus P. psychotriifolia et speciebus affinibus similibus, praecipue differt foliis nervis tertiariis conspicuis arcibus multis prope marginem folii.

Shrub 2-3 m tall; young stems minute red-brown puberulent, the bark longitudinally grooved and fluted; stipules ovate, 10 x 4 mm, glabrous, caducous. Leaves petiolate; petioles 5-13 mm long, glabrous; blades membranous, elliptic to obovate, the apex acute to caudate, the base cuneate, (13-)16-25 x (4-)5-10 cm, glabrous above, glabrous below except on veins, drying red-brown, paler below; secondary veins 12-14 pairs, diverging 70°-80°, eucamptodromous to brochidodromous, constantly arcuate, elevated below, minutely puberulent below, the axils lacking domatia or hairs; tertiary veins conspicuous, orthogonal reticulate, the percurrent tertiaries especially conspicuous, the tertiary arches near margin numerous. Inflorescences terminal, panicles of cymes; panicle branched to 3 degrees; main axis 4.5 cm long, the peduncle 3.5 cm long; secondary axes in 3 ranks, the first rank axes 4, the longer pair 0.5-0.6 cm long, the shorter pair 0.3 cm long, the second rank axes 4, the longer pair 0.2-0.3 cm long, the shorter pair reduced, the third rank axes 2, 0.2 cm long; cymes branched to 1-2 degrees; bracts and bracteoles broad, to 1 mm long, fringed. Flowers sessile to pedicellate, the pedicels to 2 mm long; mature flowers not seen.

Fruit when dry ellipsoidal, 5.5-7 mm long, 3.5-5 mm in diameter, maturing purple, drying red-brown; persistent calyx cup ca. 0.5 mm long; seeds 2, the dorsal surface with 4-5 deep longitudinal furrows, the ventral surface with 2 shallow longitudinal furrows.

Distribution. Known only from the Altos de Pacora region near Cerro Azul and Cerro Jefe, eastern Panama province, Panama, at ca. 750 m elevation in premontane wet forest with tropical (equatorial) climate. It has been collected with immature fruit in December and in fruit in February.

Additional specimens examined. PANAMA. Panama: Cerro Jefe, 6 mi past Cerro Azul on rd. to Altos de Pacora, 780 m, 19 Feb 1981 (fr), Sytsma & D'Arcy 3689 (MO-2 sheets).

Psychotria pacorensis may be recognized by its large (16-25 x 5-10 cm) leaves drying red-brown and with brochidodromous veins with secondary loops (not marginal collector vein) and conspicuous tertiary veins including numerous arches between the secondaries and the margin. Its brochidodromous venation and ellipsoidal fruit with persistent calyx cup recommend its placement in the "calophylla" group, within which its inflorescence is unique in having 4, not 2, secondary axes in the first rank.

18. Psychotria panamensis Standley var. compressicaulis (K. Krause) Hamilton, comb. nov. --Psychotria compressicaulis K. Krause, Bot. Jahrb. Syst. 54: Beibl. 119: 44. 1916. Type. Costa Rica. Cartago: Tuis, 600 m, Jul 1898 (fl), Pittier 12412 (holotype, B, destroyed, photo, GH; isotype, US).

19. Psychotria panamensis Standley var. ixtlanensis Hamilton, var. nov. Type. Mexico. Oaxaca: Dto. de Ixtlán, 21.4 km al S de Valle Nacional, 17°41'N, 96°18'W, 1140 m, 28 Nov 1979 (fr), Wendt et al. 2258 (holotype, MEXU-317322; isotype, ENCB).

Differt a varietatibus ceteris P. panamensis inflorescentiae axe primario brevi axibus secundariis paucioribus et fructibus obovoideis.

Shrub 2-4 m tall; stipules lanceolate-acuminate, (10-)30-60 x (2.5-)5-7 mm, minutely puberulent. Leaves: blades membranous, the base cuneate to attenuate, (9-)16-21 x (3-)5-7.5 cm, drying green-brown; secondary veins 12-17 pairs, the axils lacking domatia or hairs; tertiary veins inconspicuous, orthogonal reticulate. Inflorescences: panicle branched to 3-4 degrees; main axis 1.5-3 cm long, the peduncle lacking; secondary axes in 3(-4) ranks, the first rank axes 4 (or 2), subequal, 0.8-2.2 cm long, the second rank axes 2, 0.4-1.0 cm long, the third rank axes 2, 0.2-0.6 cm long, the fourth rank axes 2, 0.2 cm long; cymes branched to 1-2 degrees.

Flowers: corolla cream, the tube 3 x 1.5 mm, the lobes triangular, 1.5 x 1 mm; stamens 5, the filaments 2-2.5 mm long in pins, not seen in thrums; style 4 mm long in pins, not seen in thrums, the branches short, clublike. Fruit when dry obovoid, 5-6 mm long, 4-4.5 mm in diameter, drying dark red-brown to red-black; persistent calyx inconspicuous or a minute beak to 0.5 mm long; seeds 2, the dorsal surface with 4 deep irregular longitudinal furrows, the ventral surface with 2 incompletely divided central plus 2 deep lateral longitudinal furrows.

Distribution. Known only from type region of Ixtlán, Oaxaca, Mexico, at ca. 900-1140 m elevation in a region of evergreen to subevergreen forest with tropical (mountainous) climate. It has been collected in flower April-June and in fruit September, November, and April.

Representative specimens examined. MEXICO. Oaxaca: Dto. de Ixtlán, Sierra de Juárez, a 2.5 km al NE de Puerto Eligio, 900 m, 2 Jun 1983 (fl), Cedillo & Lorence 2397 (MEXU); entre Vista Hermosa y Comaltepec, a 1.5 km al S de Vista Hermosa, Sierra Juarez, 16 Sep 1965 (fr), G. Martinez C. 296 (ENCB, MO); Dto. de Ixtlán, 5.3 km al N de Vista Hermosa, carr. a Oaxaca-Tuxtepec, 27 Sep 1982 (fr), Torres & Cedillo 1461 (ENCB, MEXU).

This variety of P. panamensis differs from all others in having a short (1.5-3 versus 5-12 cm) inflorescence main axis, secondary axes in 3-4 (as opposed to 5-7) ranks, and obovoid (as opposed to ellipsoid) fruit.

20. Psychotria panamensis Standley var. magna (Standley) Hamilton, comb. nov. --Psychotria magna Standley, Contr. U.S. Natl. Herb. 18: 131. 1916. Type. Panama. Colón: Loma de la Gloria, nr. Fato (Nombre de Dios), 10-104 m, Aug 1911 (fl), Pittier 4092 (holotype, US-679188; isotype, US-693188).

21. Psychotria sixaolensis Hamilton, sp. nov. Type. Costa Rica. Limón: Rd. between Limón and Shiroles, Río Sixaola, 0.9 mi SW of Bambu, 6.5 mi SW of Bribri, 0-50 m, 12 Aug 1977 (fr), Croat 43303 (holotype, MO).

Habitu et stipulis et nervatura et fructibus P. psychotriifolia et speciebus affinibus similibus, praecipue differt inflorescentiae pedunculis longis bracteis grandibus.

Shrub or subshrub, to 1.5 m tall; young stems ferrugineous; stipules sheathing, ovate, 10 x 6 mm, ferrugineous, caducous. Leaves petiolate; petioles 1-3.5 cm long, red-brown puberulent; blades membranous, elliptic to obovate, the apex acuminate, the base attenuate, (14-)16-30 x (5.5-)8-13 cm, glabrous above, sparsely

red-brown tomentose below, the midvein more densely tomentose, drying red-brown; secondary veins (20-)25-35 pairs, diverging 75°-80°, brochidodromous with collector vein near margin, constantly arcuate, elevated below, red-brown tomentose below, the axils lacking domatia or hairs; tertiary veins inconspicuous, orthogonal reticulate. Inflorescences terminal or pseudoaxillary, panicles of glomerules; panicle branched to 2-3 degrees; main axis in fruit 9.5-15 cm long, the peduncle in fruit 7.5-13.5 cm long; secondary axes in 2 ranks, the first rank axes 2, 1.5-2 cm long, the second rank axes 2, 0.5 cm long; bracts and bracteoles ovate, 7 x 6 mm, ferrugineous. Flowers sessile; calyx cup-shaped, the tube 1-2 mm long, the lobes 5, linear, 2-3 x 0.8 mm, ferrugineous; corolla white, cylindrical, 4 x 2.5 mm, white pubescent in throat, the lobes 5, ovate with blunt robust protruberance from near apex, 3 x 1.5 mm; stamens 5, the filaments 3 mm long in pins, not seen in thrums, the anthers 1.3 mm long; style ca. 6 mm long in pins, not seen in thrums, the branches linear. Fruit when dry ellipsoidal, 7-9 mm long, 5 mm in diameter, drying red-brown; persistent calyx 2-3 mm long; seeds 2, the dorsal surface with 4 deep longitudinal furrows, the ventral surface with 2 shallow longitudinal furrows.

Distribution. Known from southeastern Limón, Costa Rica, and Bocas del Toro, Panama, at 0-50 m elevation in tropical moist forest with equatorial (tropical) climate. It has been collected in fruit in August.

Additional specimens examined. COSTA RICA. Limón: Nr. Río Sixaola, ca. 0.5 mi Sw of Bambú, ca. 3 mi NE of Bratsi, 15 m, 12 Aug 1977 (early fr), Croat 43250 (MO). PANAMA. Bocas del Toro: Río Teribe between Qda. Treglo and Puerto Palenque, 2 Apr 1968 (early fr), Kirkbride & Duke 536 (MO-2 sheets).

Psychotria sixaolensis may be recognized by its ferrugineous aspect, its large (16-30 x 8-13 cm) leaves with 25-35 secondary veins and a collector vein, and its long-pedunculate panicles of glomerules with large (7 x 6 mm) ovate bracts. Only the long-style form has been collected for this species. Its low habit, pubescence, long sheathing stipules, brochidodromous secondary venation, inflorescence form, corolla lobes with apical protruberances, and ellipsoidal fruit with conspicuous persistent calyx place P. sixaolensis in the "calophylla" group.

22. Psychotria stockwellii Hamilton, sp. nov. Type. Costa Rica. Alajuela: Region of Zarcero, 1800 m, 18 Oct 1937 (fl, early fr), A. Smith 543 (holotype, US; isotype, F).

Cortice et stipulis et corolla P. chiriquina et speciebus affinibus similibus, praecipue differt inflorescentiae axibus secundariis divergentibus obtuse.

Tree or shrub, (1-)2-10 m tall; young stems puberulent, the bark pale, ridged longitudinally; stipules sheathing, ovate, 9-15 x 3.5-9 mm, glabrous, caducous. Leaves petiolate; petioles 0.5-2(-2.5) cm long, glabrous; blades membranous, obovate or elliptical, the apex acuminate, the base attenuate, (8.5-)9-19 x (2-)3-7 cm, glabrous above and below, the midvein sometimes minute puberulent below, drying dark brown above, slate brown or pale brown below; secondary veins (11-)14-17 pairs, diverging 60°-75°(-80°), eucamptodromous to sometimes brochidodromous, constantly arcuate, prominulous below, glabrous or minute puberulent below, the axils lacking domatia or hairs; tertiary veins conspicuous to evident, orthogonal reticulate. Inflorescences terminal or pseudoaxillary, spreading panicles of cymes; panicle branched to 3-4 degrees; main axis (7-)9-12 cm long, the peduncle (4-)5-9 cm long; secondary axes in 4-5 ranks, usually diverging over 90°, the first rank axes 2, 1.8-5 cm long, the second rank axes 2 or rarely 4, 1-2.5 cm long, the shorter pair when present 0.4 cm long, the third rank axes 2, 0.7-1.5 cm long, the fourth rank axes 2, 0.4-0.6 cm long, the fifth rank axes 2, 0.3 cm long; cymes branched to 1-2 degrees; bracts and bracteoles triangular, 0.5-2 mm long, ciliate. Flowers pedicellate, the pedicels 0.5-1.5 mm long; calyx cup-shaped, the tube 0.8 mm long, the lobes 5, triangular, often reflexed, 0.7 mm long, puberulent; corolla cream, the tube cylindrical, 4-5 x 1.5-2 mm, white pubescent in throat, minute puberulent without, the lobes 5, ovate, 2 x 1 mm; stamens 5, the filaments 3.5-4 mm long in pins, 4.5-5.5 mm long in thrums, the anthers 1-1.2 mm long; style 6-7 mm long in pins, 3-4 mm long in thrums, the branches clublike or linear. Fruit when dry ellipsoidal, 5-6 mm long, 4.5-5 mm in diameter, maturing red, drying dark red-brown; persistent calyx not evident or a beak or ring drying pale brown; seeds 2, the dorsal surface with 6-10 irregular longitudinal furrows, the ventral surface with 2 deep plus sometimes several irregular longitudinal furrows.

Distribution. Known from Alajuela, Costa Rica, and western Chiriquí, Panama, at 1000-2200 m elevation in regions of low montane rain forest with equatorial (mountainous) climate. It has been collected in flower January-October, primarily January-March, with immature fruit July-October, and in fruit January-March.

Additional specimens examined. COSTA RICA. Alajuela: Region of Zarcero, 1800 m, 18 Jan 1937 (fl), A. Smith 165 (F, MO). PANAMA. Chiriquí: Las Nubes, ca. 2000 m, 7 Aug 1974 (fl,early fr), Croat 26450 (MO); Bajo Chorro, 1800 m, 22 Jan 1938 (fl), Davidson 172 (F, MO); 2 Mar 1938 (fl,fr), M. Davidson 363 (A, F, MO); end of rd. to Bajo Mono, 21 Mar 1977 (fl), Folsom et al. 2250 (MO); E slopes of Cerro Pando, 8°55'N, 82°44'W, 2000-2300 m, 15 Oct 1981 (fr), Knapp 1646 (MO); vic. Las Nubes, 2.7 mi NW of Río Chiriquí Viejo W of Cerro Punta, 2200 m, 27 Feb 1973 (fl,fr), Liesner 293 (F, MO-2 sheets, NY); Las Nubes, 5 km NW of Cerro Punta, 1800-1950 m, 19 Jul 1975 (early fr), Mori & Bolten 7240 (MO-2 sheets); Cerro Pando, nr. Panama-Costa Rica border, 2000-2482 m, 21 Jul 1975 (fl,early fr),

Mori & Bolten 7328 (MO, US); NW side of Cerro Punta beyond Las Nubes, 2250 m, 15 Jan 1971 (fl,fr), Wilbur et al. 13211 (DUKE-2 sheets, MO); above San Ramón nr. Bajo Mono, 4 mi NW of Boquete, 1800 m, 22 Jan 1971 (fl,fr), Wilbur et al. 13544 (DUKE).

Psychotria stockwellii may be recognized readily by its inflorescence, whose secondary axes diverge over 90° from the main axis and whose tertiary axes diverge likewise from the secondary axes, and so forth, a character state unique in the subgenus. In addition, P. stockwellii differs from P. panamensis in having a larger corolla tube (l=4-5 versus 2-3 mm), long-pedunculate inflorescences, and conspicuous to evident (versus inconspicuous) tertiary veins. It is most closely allied to the P. chiriquina complex in the "trichotoma" group, sharing with those species the long corolla, the usually pedunculate inflorescences, the sheathing and ovate stipules, and the pale, cracked, and longitudinally fissured bark. Members of the P. chiriquina complex -- P. lundellii, P. chiriquina, and P. hornitensis -- all have smaller leaves than does P. stockwellii.

Psychotria stockwellii is named for Dr. Henry Stockwell, pediatrician and amateur natural biologist whose enthusiasm and knowledge of the insects, birds, and plants of Panama (as well as Baroque music) were tremendous resources to the author during fieldwork in that country.

ACKNOWLEDGMENTS

I am grateful to Alwyn Gentry, Peter Raven, John Dwyer, Barry Hammel, Julian Steyermark, and David Lorence for their assistance in the taxonomic portion of this work. Research was performed at the Missouri Botanical Garden as part of a doctoral dissertation for Washington University.

LITERATURE CITED

Hamilton, C.W. 1985. An Ecosystematic Study and Revision of Psychotria subgenus Psychotria (Rubiaceae) in Mexico and Central America. Ph.D. Thesis, Washington University.

------. Submitted for publication. Variations on a distylous theme in Mesoamerican Psychotria subgenus Psychotria (Rubiaceae). In G. Prance and G. Gottsberger, eds., Reproductive Biology of Plants (working title). N.Y. Bot. Gard., Bronx, NY.

BOOK REVIEWS

Alma L. Moldenke

"THE PLANT-BOOK -- A Portable Dictionary of the Higher Plants" by D.J. Mabberley, xi + 706 pp., Cambridge University Press, Cambridge, U.K. & New York, N.Y. 10022. 1987. $34.50 with a flexible plastic binding.

This welcome publication replaces the eighth edition of Willis' "Dictionary of Flowering Plants and Ferns" by Airy Shaw printed in 1973. It has many new and additional entries with the inevitable taxonomic changes over these intervening years. It adopts the Cronquist system basically and it lists it in outline at the end of the text. This edition is one half inch higher and one half inch narrower, and in smaller neat print which is nevertheless far from easy to read. All editions since 1897 have been tremendously valuable to the taxonomic and systematic botanists of those years; this one will be increasingly so to present-day botanists, other scientists and interested amateurs. Look up *Actinotinus* Oliver and you will find "=*Viburnum*. The species *A. sinensis* Oliver was based on a trick, the inflorescence of a *Viburnum* having been inserted in the terminal bud of an "*Aesculus*". There are similar stories for *Papilionopsis* and *Stalagmitis*.

"DINOSAURS PAST AND PRESENT, Volume II" edited by Sylvia J. Czerkas & Everett C. Olson, xiii + 149 pp., 33 color pl. & 100 black/white illus. University of Washington Press, P.O. Box 50096, Seattle, Washington 98145-5096. 1987. $35.00.

In a recent issue of PHYTOLOGIA (63:6) the appreciative review on Volume I announced the appearance of this second volume for this Spring. Here it is ahead of time with more beautifully illustrated, well documented and reasoned papers from the presentations and discussions of that same symposium at the Natural History Museum of Los Angeles County. These papers consider how physical evidence can be interpreted correctly or incorrectly for restorations, the Choteau (Montana) nesting grounds ecologically, the stegosaurus' armor, and the survival of some of these creatures from the Cretaceous "Armageddon" even into the Tertiary period. This is an excellent book for many levels of reading and study.

"THE GENUS *PAPHIOPEDILUM*" by Phillip Cribb, 224 pp., 56 colored botanical pl., 71 line draw. & 15 maps. Royal Botanic Gardens, Kew, U.K. & Timber Press, Portland, Oregon 97225. 1987. $39.95.

This horticulturally popular orchid genus is herein taxonomically revised into 60 accepted species and 14 varieties and all are carefully keyed and described. Synonomy, taxonomic relationships, geographic distributions and special cultivation requirements are provided. The author, long and widely known as an outstanding orchidologist, is curator of the Orchid Herbarium at the Royal Botanic Gardens at Kew. He makes a very necesary plea against gluttonous and destructive collections of rare and new forms. This attractive publication is important to taxonomic botanists as well as the horticulture ones and their students, especially keen collectors and breeders.

"GROWING ORCHIDS: THE SPECIALIST ORCHID GROWER" by J.N. Rentoul, xi + 208 pp., 117 color + 42 black/white photo. Timber Press, Portland, Oregon 97225. 1987. $20.95 paperback & $35.95 hardcover.

This author is so well known to so many professional and amateur orchid propagators by the various means available today that his book should receive a real welcome. Orchid culture started two whole centuries ago with the introduction of exotic floral gems in the cargo of exploring ships as those of Sir Joseph Banks. This Australian author has spent a whole half century on his orchid work. The beautiful color plates show blossoms at their very best. The text describes, among other topics, climates, plans for species collections and specialized quality collections, growing methods and orchid terrestrial, epiphytic and open root systems. Horticulture departments in our junior colleges and universities will be enriched by acquiring and using this book.

"THE NATURAL HISTORY OF SQUIRRELS" by John Gurnell, xiii + 201 pp., 26 color photo., 64 black/white fig., 23 diag., 18 tab. & 4 maps. Facts on File Publications, New York, N.Y. 10016. 1987. $21.95.

This is an ecologically well prepared, interesting account of the world's past and present sciurids of the Northern Hemisphere, especially the red originally European tree squirrel and the gray originally American

tree squirrel. Both are now widespread. Dr. Gurnell, a leading British wildlife biologist, behaviorist and ecologist has prepared the subject matter for amateur naturalists who want an "in depth" study, ecologists, field zoologists and biology students. It describes habitats and their threats, sociality, feeding, population dynamics and human interactions. The color photographs, drawings, figures and charts add much to the book's information and its attractiveness. I have glanced at some of the other books in this series and find them equally well done for otters, badgers, antelopes and butterflies.

"RIVER PLANTS OF WESTERN EUROPE: The Macrophytic Vegetation of Watercourses of the European Economic Community" by S.M. Haslam with contributions and illustrations by P.A. Wolseley, xii + 512 pp., 300 black/white fig. incl. 115 maps & 158 tab. Cambridge University Press, Cambridge & London, U.K. & New York, N.Y. 10022. 1987. $125.00.

This book treats from many identifying, descriptive and ecological angles the vegetation of rivers and other water courses of the European Economic Community, countries including almost 28,000 sites. Many effective charts, maps and diagrams organize the subject matter very well, but a few leave unnecessary space blank and correspondingly have to use very small printing. This book is written for river botanists, river geographers and so specialized students. It should become an important informative resource for ecology courses, more so in Europe than in the U.S.

"THE ECOLOGY OF TEMPORARY WATERS" by D.Dudley Williams, 205 pp., 57 fig. & illus., Croom Helm - in London & Sydney; Timber Press - Portland, Oregon 97225: 1987. $36.95.

This is the first book on this subject that has come across my desk. "The organisms that live in these types of habitats have, therefore, to be very well adapted to these conditions if they are to survive. Survival depends largely on exceptional physiological tolerance or effective immigration and emigration abilities." The text begins with forming of temporary waters and their abiotic features. It considers the biota involved, their special adaptations and colonization patterns and applied aspects as in aquaculture, agricultural rotation and such wee puddles in tree holes, pitcher plants and bromeliads.

"RATIONAL PESTICIDE USE: Proceedings of the Ninth Long Ashton Symposium" edited by K.J. Brent & R.K. Atkin, ix + 348 pp., 58 black/white fig., 51 tab. + 1 photo., Cambridge University Press, Cambridge & London, U.K. & New York, N.Y. 10022. 1987. $49.50.

There are herein 24 papers on this topic of world-wide importance as they were presented at the Long Ashton Research Station of the University of Bristol. The four papers in Section 1 deal with: the influences from and on the environment; Section 2: is oriented toward application to areas rather than individual plants; Section 3: considers resistance to various pesticides especially of different types and consequently deals with considering hormoligosis effects; Section 4: organizes the advances and problems in forecasting methods. Rational use of pesticides is necessary for all of the huge agrochemical industry, farmers and other users and the knowledgeable public that does not want its air, water, land, food and other living creatures choked with irritants and poisons. This book should bring very important information and reasoning sources to agricultural, organic chemical, pesticide and horticultural laboratory, college and university students and those scientists actually practicing in the fields.

"KOREA FANTASIA" photography by John Chang McCurdy & captions by Alan C. Heyman, 118 pp., 10½ x 12, 118 color plates. Chas. E. Tuttle Co., Rutland, Vermont 05701-0410. 1986. $20.00.

The photographer, Korean-born and U.S.-rescued is indeed a most highly skilled and sensative-feeling artist in his field. The exquisite nature pictures and scenes are those he remembers from his childhood and has revisited a few times as an adult. They are so beautiful. The captions are so fittingly chosen and well expressed. An excellent gift prospect for the real, armchair or intending traveler and naturalist.

"A FLORA OF THE VASCULAR PLANTS OF CATTARAUGUS COUNTY, NEW YORK" by Steven W. Eaton & Edith Feuerstein Schrot, iv + 234 pp., 40 black/white fig. incl. 46 photo., 46 maps + 5 tab., Bulletin Buffalo Academy Natural Sciences Vol. 31. Buffalo, N.Y. 14211-1293. 1987. $15.95 paperback.

This is an annotated list of the vascular plants *à la* Cronquist from what is almost the southwest corner of New York State. The land area is about 3400 km^2 including 32 towns (townships). Only the northern area is glaciated with wide drift-filled valleys; the southern area is a dissected driftless plateau at the northern tip of the Appalachians. Because of the westerly winds there are many more adventives from that direction; because of railroad development some Atlantic Coastal Plain specimens have become established. The data comes from herbaria and botanical literature. This careful study would be more attractive and "modern", if the illustrations were naturally colored.

"KOREAN COUNTRYSIDE -- RHAPSODY IN NATURE" Photographs by Kwan-jo Lee & Poems by Dong-jin Lee. 120 pp., 120 color photo., Chas. E. Tuttle Co., Rutland, P.O. Box 410, Vermont 05701-0410, 1985. $18.00.

Buddhist monk Kwan-jo Lee of the Pomo Temple in Pusan has faithfully recorded with his camera the intrinsic beauty that can be seen throughout the Korean countryside of the mountains, coastlines, fields and some early artifacts and sculptures. Foreign ministry diplomat Dong-jin Lee has a few of his sensitive poems interspersed among the beautiful pictures. This book is a visual treat for any sensitive and inquiring viewer.

"PETER KALM'S TRAVELS IN NORTH AMERICA: The English Version of 1770" revised from the original Swedish and edited by Adolph B. Benson, xviii + 796 pp., 14 black/white fig., 6 tab. & 3 maps. Dover Publications Inc., Mineola, N. Y. 11501. 1987. $14.95 paperbound.

Welcome to this attractive reprinting of interest to many more than botanists! We treasured the earlier Dover two volume edition of 1966 which was also based on the English version of 1770. In this new single volume the print is clearer, illustrations are increased and improved in printing. The fold-out map of these travels from Delaware to southern Canada is enlarged 3-4 times and so is legible throughout. Peter Kalm was sent by Linnaeus to America in 1747 for native plant material suitable to the soils and climate of Sweden. Even though some materials were lost, a great deal arrived in Sweden along with his journals that were rich in so many details besides the botanical information.

"THE ENCYCLOPEDIA OF ANIMAL BEHAVIOR" edited by Peter J.B. Slater, 144 + xvi pp., 120 color photo. & 50 diag., Facts on File Inc., New York., N.Y. 10016. 1987. $24.95.

"THE ENCYCLOPEDIA OF ANIMAL ECOLOGY" edited by Peter D. Moore, 144 + xvi pp., 100+ color photo. & 35 diag., Facts on File Inc., New York, N.Y. 10016. 1987. $24.95.

"THE ENCYCLOPEDIA OF ANIMAL BIOLOGY" edited by R. McNeill Alexander, 144 + xvi pp., 140 color photo., & 80+ diag. Facts on File Inc., New York, N.Y. 10016. 1987. $24.95.

"THE ENCYCLOPEDIA OF ANIMAL EVOLUTION" edited by R.J. Berry & A. Hallam, 144 + xvi pp., 100 (mostly) color photo. & portraits, & 80 diag., Facts on File Inc., New York, N.Y. 10016. 1987. $24.95.

Rather than encyclopedias in the academic sense with their copious minutia in necessarily cramped printing and with small black/white diagrams and photographic prints, these are alluring and accurate surveys by many highly regarded, mostly British scientists. The formats are artistically very effective. The explanations are clear-cut. The books serve as "coffee table, pleasurable informative reading and study source material for homes, public and school libraries, and even university use.

"AGRICULTURAL INSECT PESTS OF TEMPERATE REGIONS AND THEIR CONTROL" by Dennis S. Hill, ii + 659 pp., 285 black/white fig. & draw., 135 photo., 4 tab., 205 geog. dist. maps, 1987. $95.00.

"On a worldwide basis there is something in the region of 1,000 species of serious crop pest species, including pests of forests and ornamentals, and maybe up to 30,000 minor pest species." The major and minor crops and the major and minor insect and mite pests are considered on a worldwide basis in the most common language of instruction -- English -- for universities, colleges, agricultural training stations, etc. This is the unique feature of this text and source book in which "large amounts of information have been incorporated into a summarized form for easy assimilation." There are chapters on pest ecology, principles and methods of chemical and biological pest control, and major temperate crops and their pest

spectra. The geographic distribution maps on a worldwide scale give an important orientation. Appendices list pesticides cited with their main trade names, a glossary, shipment directions for pest identifications, and standard abbreviations.

"A HANDBOOK OF MEXICAN ROADSIDE PLANTS" by Charles T. Mason & Patricia B. Mason. 380 pp., 214 black/white line draw., University of Arizona Press, Tucson, Arizona 85719. 1987. $19.95 paperbound.

This book fulfills the authors' intentions admirably: to include those plants whose beautiful showy flowers and/or fruits, unusual leaves and/or plant shapes or other special features are admired by the tourists along the main highways and about motels and hotels. There is a clear simple key in front and an illustrated glossary in back. In between are the effective descriptions and the clear excellent line drawings. This book should make a delightful touring companion or an after-trip souvenir for any ordinarily intelligent folks.

"STOMATAL FUNCTION" edited by Eduardo Zeiger, G.D. Farquhar & I.R. Cowan, xiv + 503 pp., 160 black/white photo., line draw. & tab. Stanford University Press, Stanford, California 94305-2235. 1987. $65.00.

This volume covers the main aspects of current stomatal-functional research as it has been reported by almost 40 scientists at a virtually international symposium in 1983 sponsored by the U.S. National Science Foundation and the Australian Department of Science and Technology. The 20 papers cover such topics as: evolution, development and structure, mechanics, ionic relations, bioenergetics, cytokinins, leaf-age effects, and calculations related to gas exchange. The papers are carefully presented and well documented and therefore this study is very important.

Inasmuch as we do no editing, papers accepted for publication *must* be submitted in *exactly* the form that the author wants to have them published. They will then be photographed and printed by photo-offset in exactly the form as submitted except that we will add page numbers and running-heads.

Typescripts should be prepared single-spaced on clean white heavy bond smooth and opaque paper. Elite type is probably the most space-economical. Typescript text must not exceed a rectangle 5⅝ inches wide (horizontal) by 8⅝ inches high (vertical), not including the running-head and page number.

The title of the paper should be typed in all uppercase (capital) letters with 2 blank lines above the title and one beneath; then the name of the author in ordinary upper- and lower-case letters, along with his address (if so desired); followed by 2 blank lines; then the first line of text. It is usually best to leave a blank line between paragraphs.

All scientific plant and animal names and group names should be typed either in italic type (if available) or underscored. Any corrections in the text made by the author must be complete and neat as they will be photographed as they are.

The finished typescript as submitted by the author will be reduced from the 8⅝ x 5⅝ inch size as submitted to 6⅞ x 4 inches by the printer. It is therefore advisable to place a centimeter or millimeter scale on all text figures and plates included.

Use a *new* heavily inked black typewriter ribbon and be sure to *clean* the type on the typewriter after each several pages of typing.

Cost of publication at present is $12.00 US per page, with no subsequent rebates, but this rate may vary depending on inflation and costs, so it is best to inquire as to current rates. The page charges are due *with* the typescript and no paper will be published before payment is received in full. Each author will receive gratis a proportionate share of the printed copies remaining after paid subscriptions are filled, but if separates (reprints or offprints) are desired, these will be charged extra in accord with the current rate for offprints provided by the printer. The cost of all such separates ordered must also be paid for in advance at the time the typescript is sent. No orders for separates will be accepted later, nor can additions or corrections be accepted.

Authors are asked to indicate in light pencil on the *reverse* side of each page of their typescript the page number so that no mistakes in sequence occur.

All manuscripts accepted will be published in the next issue, so that the size of the numbers may vary greatly. A volume will contain 512 pages. The plan insures prompt publication of all accepted manuscript.

Illustrations will be published according to the desires of the authors. No extra charge is made for line drawings, such as are ordinarily reproduced in zinc, or for diagrams, tables, or charts, provided they conform to certain limitations of size and proportion. An extra charge will be made for halftones, depending on their size, as fixed by the engraver.

Articles dealing with research in all lines of botany and plant ecology, in any reasonable length, biographical sketches, and critical reviews and summaries of literature will be considered for publication.