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PLANTS OF POSSIBLE INSECTICIDAL VALUE
A Review of the Literature up to 1941

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SCOPE OF THIS REVIEW

This is a review of the literature on plants that have been reported to have insecticidal value or have been tested or used in insecticides or other preparations, such as repellents or attractants, for the control of insect pests. In addition to plants that are sources of the active ingredient of such preparations, brief mention is made of those that furnish such accessory materials as spreaders, adhesives, emulsifiers, and synergists. The notes give only information on the insecticidal value of these plant materials, not on their chemical nature. The preparation of this review was reported in 1942 (McIndoo, 255).

This review covers the literature up to 1941, with a few more recent references that were added in 1944 when the manuscript was revised. Reviews on some of the more common insecticidal plants and their constituents, as well as lists of patents, have already been issued, most of them in the E series of this Bureau, and in such cases the reader is referred to the published reviews. A list of nearly 200 species of plants that had been tested for or reported to possess insecticidal properties was published by Roark (331) in 1919.

Included in this review are about 1,182 species of plants, representing 697 genera and 173 families. The lower orders(cryptogams), including the algae, fungi, mosses, ferns, and horsetails, which total 27 species, 20 genera, and 14 families, are given first, followed by the higher orders (phanerogams), which total about 1,155 species,

677 genera, and 159 families. Most of these species do not deserve further investigation, and some of the families, for example Asteraceae, have been extensively investigated. In each of these two divisions the plants are grouped by families so that the families may be compared from an insecticidal standpoint.

The botanical names are listed in accordance with the International Rules of Botanical Nomenclature, and have been reviewed by botanists[1/] in the Bureau of Plant Industry, Soils, and Agricultural Engineering, the Bureau of Agricultural and Industrial Chemistry, and the National Herbarium.

The references were obtained mostly from the files of the Division of Insecticide Investigations and the Division of Control Investigations, and from the Review of Applied Entomology. Most of the notes were taken from the original articles, although occasionally the author had access only to abstracts.

BRIEF HISTORY OF INSECTICIDAL PLANTS

Dioscorides (A. D. 40-90), according to Blyth and Blyth (64, pp. 4-5), divided poisons into three classes--animal, plant, and mineral. As plant poisons he enumerated opium, black and white Hyoscyamus, Mandragora, Conium, elaterin, and the juices of Euphorbia species. He also especially mentioned aconite, the deadly nature of which the Greeks were well aware. Colchicum was also known to Dioscorides. Veratrum album and V. nigrum were famous medicines of the Romans, and constituents of their "rat and mice powders." They were also used as insecticides.

From the time of the early Romans to the twentieth century only three efficient insecticides were discovered--nicotine, pyrethrum, and hellebore. The nicotine-insecticide industry has been developed largely in America, whereas the pyrethrum and hellebore industries are European in origin. During the nineteenth century there was little interest in searching for new insecticidal plants, although in 1885 the United States Department of Agriculture (Riley, 325) tested 42 species of plants against cotton caterpillars without finding any new effective ones. In the second decade of the present century large-scale investigations were begun which led to a new world-wide industry using Derris and Lonchocarpus as insecticide materials. More recently

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1/ S. F. Blake, C. O. Erlanson, F. R. Fosberg, Oliver M. Freeman, F. J. Hermann, E. C. Leonard, Robert F. Martin, Rogers McVaugh, C. M. Muller, Paul G. Russell, J. A. Stevenson, and Jason R. Swallen.

anabasine, derived from Anabasis aphylla, has become commercially important in the country of its origin, Russia, and Tephrosia is also used locally in a few places in Africa where it is easily obtained.

In 1915 and 1916 the Russian investigators Gomilevsky (164), Goriainov (166), and Schreiber (358-360) wrote considerable about vegetable insecticides, but they tested only a comparatively few plants and discovered none of commercial value. For centuries a few countries, for example China, have had their own insecticides, but these have not become commercially important in other countries.

In 1915 the United States Department of Agriculture began a series of investigations on this subject. The first problem was to find a substitute for nicotine, which was expensive, and in 1916 McIndoo (254) reported the results of his studies on nicotine as an insecticide. This was followed in 1917 by a paper on quassia (McIndoo and Sievers, 258), and in 1919 by one on derris (McIndoo, Sievers, and Abbott, 260). Soon after the publication of the last paper an English firm, which had previously tried to sell its derris products in the United States, prepared other derris spray materials on the basis of information given by these writers. Since that time interest in derris has grown rapidly, and it is now used more widely than nicotine.

A later problem was to find a substitute for both nicotine and derris, one that could be grown cheaply in America. This was partly solved by the finding of cube in South America, as first reported by McIndoo and Sievers (259) in 1924. Up to that time cube was practically unknown, both botanically and from an insecticidal viewpoint. It has since been identified as a species of Lonchocarpus. These writers also gave the results of testing 232 preparations from 54 other species of plants against 28 species of insects, and reported on others mentioned in the literature, making a total of 260 different plants.

In 1920 appeared a bulletin on insect powder (pyrethrum) by McDonnell, Roark, LaForge, and Keenan (251).

Work in England on vegetable insecticides was begun at the Rothamsted Experimental Station in 1920 (Tattersfield 390, p. 90). In 1923 Tattersfield and Roach (396) reported on the chemical properties of derris, and Fryer, Stenton, Tattersfield, and Roach (147) on its insecticidal properties. In 1925 appeared a paper by Tattersfield, Gimingham, and Morris (392) on the toxicity of Tephrosia, which grows in West Africa, the Sudan, Rhodesia, and the Comoro Islands. Following a search for some substance that would prove an adequate alternative to nicotine as a contact insecticide, they found that extracts of Tephrosia could be substituted for nicotine against aphids. In 1926 the same writers (393) discussed 28 species of plants as contact

insecticides. In 1932 appeared a second paper on Tephrosia, this one by Tattersfield and Gimingham (391). In 1940 Tattersfield and coworkers (395) described the insecticidal properties of Annona and Mundulea and of some fish-poison plants (394).

In 1931 Roark and Keenan (347) published a long list of plants found in India that were reputed to have insecticidal value. Since 1927 several papers on the insecticidal properties of Indian plants have appeared, and since 1933 several others on plants found in China.

Worsley (431-434) between 1934 and 1939 wrote about the insecticidal properties of some East African plants.

METHODS OF RESEARCH

In the search for insecticidal plants no dependable guide has been found. The only procedure is the trial-and-error method. Botanical classification is not a trustworthy guide, because hundreds of plant species must be examined to find one that is sufficiently promising to warrant intensive chemical and toxicological studies. Evidence of this is the fact that the most important commercial insecticides of plant origin are distributed in five different families as follows: Insect powder or pyrethrum, Asteraceae; anabasine, Chenopodiaceae; derris, cube, and timbo, Fabaceae; hellebore, Liliaceae; and nicotine, Solanaceae.

Much time has been spent in insecticide laboratories trying to find an ideal test insect, which would correspond to the white rat commonly used in other fields of research. A method used by McIndoo and coworkers (260) in a study of Derris in 1919 was to extract the plant materials with several solvents and to test the extracts against several species of insects. A later method, used by Tattersfield and coworkers (392) in a study of Tephrosia in 1925, was to use only two solvents (alcohol and water) and only one species of insect, the bean aphid. A still more recent method is to use only one solvent (alcohol or acetone) and only one species of insect, such as the bean aphid, housefly, mosquito larva, codling moth larva, or Japanese beetle.

Roark (345) has pointed out that many of the tests on insecticidal plants are inadequate because the material was not tested against the proper insect, all parts of the plant were not tested, or the proper solvent was not used for extraction. He considers that the examination of plants for insecticidal value should be prosecuted as follows:

(a) The plant should be identified by a botanist who is a specialist in the order or family to which it belongs.

(b) The entire plant should be tested unless it is known that the active principles are localized in one part.

(c) The plant should be tested shortly after it is collected, because many plant constituents, e. g., the pyrethrins, deteriorate when the dried plant material is stored.

(d) Several species of insects, representative of different orders, should be employed as test organisms.

(e) The plant material should be tested as a contact poison, as a stomach poison, and as a fumigant by the aerosol method.

(f) The plant material should be tested as a finely pulverized powder and in the form of extracts made with different classes of organic solvents.***

If these precautions are observed, many plants formerly discarded as worthless may be found to have value.

Botanists, chemists, entomologists, plant physiologists, and toxicologists should cooperate more than ever to find suitable insecticidal plants that can be introduced and grown in the countries in which insecticides are used on a large scale.

As McIndoo and Sievers (259) stated in 1924 the search for a plant which may be made commercially available as an insecticide at a reasonable price extends much further than merely finding a plant with satisfactory insecticidal properties. It involves, in addition, a study of the botanical characteristics of such a plant, its habitat, the available natural supply, the effective part of the plant, the means necessary for its collection and shipment, and, above all, the cost at which it can be delivered to the manufacturers in this country.

COMMERCIAL AND EXPERIMENTAL CULTIVATION OF INSECTICIDAL PLANTS

A book by Holman (198) on insecticides of vegetable origin was published in 1940. He named 9 countries as the principal producers of nicotine insecticides and 10 others as lesser producers, and gave the total production as more than 3,593 long tons. He devoted 66 pages to plants containing rotenone and allied compounds. Derris was grown commercially in 12 localities and was under experimental cultivation in 20 others. The derris root exported from British Malaya alone in 1939 amounted to 1,456 long tons, and 913 tons of

this came to the United States. Cube and timbo are produced commercially in Peru and Brazil, and Venezuela, Colombia, Ecuador, and the Guianas are potential producers. Peru exported 550 long tons of cube in 1938 and 770 tons during the first 8 months of 1939. In 1938 Brazil exported 1,038 long tons of Lonchocarpus powder and 38 tons of roots, most of which came to the United States. Holman also gave very brief accounts of Tephrosia, Mundulea, and Millettia, which up to 1940 had not been cultivated for commercial purposes. He devoted 37 pages to pyrethrum, Chrysanthemum cinerariaefolium and C. coccineum. The first species is the only one of commercial importance and is grown chiefly in Japan, Kenya, and Yugoslavia, although there are 16 other producing countries. The United States consumed a large proportion of the world's exportable surplus of the crop. The total exports in 1937 were 8,969 (long) tons; in 1938, 6,490 tons; and in 1939, 6,058 tons. Short accounts of anabasine, hellebore, and quassia are also given.

Roskill (349, p. 114) and Sievers (364) discussed the growing of derris, and the former told about the exports of cube and timbo. Tattersfield and coworkers (394) said that the well-known insecticidal properties of Derris and Lonchocarpus have stimulated the search for the other plants in many parts of the world, partly with the object of establishing local industries or of finding local means for the control of insect pests. Sievers and coworkers (365) discussed the possibilities of the devil's-shoestring as a commercial source of insecticides. Moore (283) reported on the introduction of insecticidal plants in Puerto Rico.

In 1939 there were imported into the United States 2,335,048 pounds of crude derris root, 1,907,194 pounds of crude cube and timbo roots, and 896,640 pounds of powdered roots (U. S. Bureau of Entomology and Plant Quarantine, 406). Before World War II the United States imported annually 15 to 20 million pounds of pyrethrum flowers, largely from Japan. About 1 million pounds of quassia wood were also imported annually.

PART I--CRYPTOGAMS

AGARICACEAE
(Fungi--Mushrooms)

AMANITA MUSCARIA Fr. Synonym: Agaricus muscarius L. Fly mushroom.

Bug agaric.

A solution of the alkaloid muscarine increased the heart activity of the larva of Corethra crystallina (Deg.).--Dogiel (120, p. 29).

The spraying of peach trees with a decoction of poisonous mushrooms (1 kg. to 10 liters of water) was recommended to destroy peach aphids in France.--Anonymous (5).

This mushroom has been used in Europe as a fly poison for hundreds of years.--Chesnut (87, p. 13).

This fungus was used formerly as a popular insecticide. It was bruised, steeped in milk, and the milk exposed as we now expose arsenical flypaper.--Blyth and Blyth (64, p. 426).

The poisonous qualities of this fungus probably depend on the presence of volatile matter and the alkaloid amanitine (muscarine). An extract of the whole fungus is likely to prove effective against all kinds of gnawing insects and their larvae.--Gomilevsky (164).

Comments by reviewer.--Since poisonous mushrooms are extremely toxic to people and appear to be also to certain insects, toxicological studies should be made with various orders of insects. If the poisonous fungi prove to be worth while, they might be cultivated as we now cultivate the edible mushrooms.

AMANITA PANTHERINA Fr.

This fungus was used as a fly poison.--Lyons (248, p. 29).

CHARACEAE
(Algae--Stoneworts)

CHARA FOETIDA

An active principle isolated from this alga was toxic to mosquito larvae. In action it appeared to be similar to derris.--Howard (204, p. 10).

CHARA FRAGILIS Desv.

Ponds in which this alga grows naturally were free from mosquito larvae. It was lethal to four species of Culex larvae, and the lethal action seemed to be closely associated with high pH. The pH seemed to vary directly with photosynthetic activity. Tests with the dried plants also showed a marked lethal action.--Matheson (271, pp. 85-86).

Chara is grown widely in India in paddy fields and in pools. It is said to destroy mosquito larvae. Alcoholic extracts and water suspensions had no effect on caterpillars.--Puttarudriah and Subramaniam (312).

EQUISETACEAE
(Horsetails)

EQUISETUM ARVENSE L. Common horsetail.

EQUISETUM HYEMALE L. Scouring-rush.

Extracts from these horsetails were not repellent to the Japanese beetle.--Metzger and Grant (277).

An aqueous extract and a powder of E. arvense were recommended as insecticides in a German patent.--Diener (119).

HYPOCREACEAE
(Fungi)

CLAVICEPS PURPUREA (Fr.) Tul. Ergot of rye.

A water extract killed aphids, psyllas, and thrips.--Gomilevsky (164).

Extractum secale cornuti (10 percent in water) and secale cornutum pulvis (100 percent, and 10 percent in flour) had no perceptible effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

LYCOPERDACEAE
(Fungi--Puffballs)

CALVATIA GIGANTEA (Pers.) Cunningham. Synonyms: Lycoperdon bovista L., L. giganteum Batsh. Giant puffball.

This fungus was used in its mature condition as a styptic and for stupefying bees.--Greshoff (170, p. 167).

The spores may be used in the same way as flowers of sulfur. Insects covered with this powder either perish from its mechanical effects or are poisoned by it.--Gomilevsky (164).

LYCOPODIACEAE
(Club Mosses)

LYCOPODIUM COMPLANATUM L. Ground cedar.

The decoction killed lice.--Williams (428, p. 924).

LYCOPODIUM SELAGO L. Fir club moss.

Listed as an insecticide.--Greshoff (170, p. 165).

OSMUNDACEAE
(Ferns)

OSMUNDA CINNAMONEA L. Cinnamon fern.

OSMUNDA REGALIS L. Flowering fern.

Extracts of the cinnamon fern were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the rhizomes of both species killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PARMELIACEAE
(Lichens)

CETRARIA ISLANDICA (L.) Ach. Iceland moss.

To destroy eggs of Lepidoptera, trees were sprayed with a solution made by boiling 4 pounds of Iceland moss for 1 hour in 20 gallons of water, adding more water as needed to maintain a constant volume.--Chmielewski (96).

POLYPODIACEAE
(Ferns)

ADIANTUM CAPILLUS-VENERIS L. Southern maidenhair.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore. Hay-scented fern.

Acetone extracts of the rhizomes killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

DRYOPTERIS FELIX-MAS (L.) Schott. Synonym: Aspidium filix-mas (L.)

SW. Male fern.

The powdered rhizome of the male fern has been used since ancient times as an anthelmintic. A commercial extract (an oleoresin) was secured, and crude filicin was obtained from it. Preliminary tests on mosquito larvae (Culex quinquefasciatus Say) showed that the oleoresin was toxic. Purified filicic acid was four times as toxic as the crude filicin to these larvae. Satisfactory control of bean aphids was obtained with a spray containing 0.03 percent of crude filicin and 0.5 percent of Penetrol.--Wilcoxon and coworkers (425).

Acetone extracts of the rhizomes and the oleoresin (25 p.p.m.) killed 100 percent of the mosquito larvae tested. A 0.1-percent concentration of filicin killed 99 and 96 percent of the bean aphids tested.--Hartzell and Wilcoxon (188).

ONOCLEA SENSIBILIS L. Sensitive fern.

Acetone extracts of the rhizomes killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PHYLLITIS SCOLOPENDRIUM (L.) Newman. Hartstongue.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

POLYSTICHUM AGROSTICHOIDES (Michx.) Schott. Christmas fern.

Acetone extracts of the rhizomes killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PTERIDIUM AQUILINUM (L.) Kuhn. Bracken.

In Spain it was suggested that fern leaves be placed among clothes, for it was claimed that clothes moths do not deposit eggs in the presence of these leaves.--Anonymous (27).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PTERIDIUM LATIUSCULUM (Desv.) Hieron. Bracken.

Acetone extracts of the rhizomes of this fern killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

POLYPORACEAE
(Bracket Fungi)

FOMES OFFICINALIS (Fr.) Faull. Synonym: Polyporus officinalis Fr.

Larch agaric.

Agaricine (10 percent in flour) and agaricus alba had no perceptible effect on caterpillars of Prodenia litura (F.).--DeBussy (76). [These botanical drugs are derived from this species.]

Extracts from this fungus were not repellent to the Japanese beetle.--Metzger and Grant (277).

POLYTRICHACEAE
(Mosses)

POLYTRICHUM JUNIPERINUM Willd. Haircap moss.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

RHODOPHYCEAE
(Red Algae)

CHONDRUS CRISPUS (L.) Stack. Carrageen. Irish moss.

In Germany it was believed that seaweed mucilage might control insects in orchards and vineyards. The mucilage was prepared by boiling 4 pounds of Irish moss in 20 gallons of water for 1 hour. When the mucilage was sprayed on infested plants, pieces flaked off taking with them the eggs and larvae of the injurious insects. Still more effective results were obtained by adding 2 pounds of ethereal oil of mustard, dissolved in 10 pounds of methylated spirit, to every 2,000 to 4,000 pounds of mucilage.--Issleib (215).

Alginic acid is derived from a seaweed, probably from Chondrus or other alga. Woolen fabrics are impregnated with a soluble salt of alginic acid and then placed in a bath of antimony salt (Ger. patent 304,506).--Roark (333, p. 7).

This moss was a constituent of a petrolatum emulsion used for mothproofing fabrics (U. S. patent 1,799,047).--Roark (335, p. 24).

SALVINIACEAE
(Fernlike Plants)

AZOLLA CAROLINIANA Willd.

This small floating plant grows densely in stagnant water and covers the surface for large areas so that mosquito larvae are unable to reach the surface to breathe. It is recommended in Austria as a good plant to raise in stagnant waters to prevent the development of mosquitoes.--Henkel (192).

AZOLLA sp.

Azolla and Lemna, when grown in water where mosquitoes breed, check the breeding by preventing the larvae from getting air.--Howard (203, pp. 25, 27).

SELAGINELLACEAE
(Club-Moss Allies)

SELAGINELLA SCANDENS Spring.

The leaves of this small creeping herb were put on fires to keep ticks away from houses in the Gold Coast, Africa.--Irvine (213).

PART II--PHANEROGAMS or SPERMATOPHYTES

ACANTHACEAE
(Acanthus Family)

JUSTICIA ADHATODA L. Synonym: Adhatoda vasica Nees. Malabar nut.

This plant was fatal to flies, fleas, mosquitoes, and the pupae of aquatic insects.--Rusby (350).

This species was reported to be used as an insecticide in India.--Roark (332, p. 2).

JUSTICIA GENDARUSSA L. f. Synonym: Gendarussa vulgaris Nees.

In India the natives scattered the leaves among their clothes to preserve them from insects.--Drury (122, p. 233).

This plant is widely distributed in India. A 5-percent extract of the leaves killed 100 percent of the caterpillars of Prodenia litura (F.) and Euproctis fraterna (Moore), and a 3-percent extract killed 80 percent of E. fraterna. A 3-percent extract of the root bark killed 60 percent of E. fraterna and a 4-percent extract killed 100 percent. Powdered roots, leaves, and stems dusted upon beetles, Callosobruchus chinensis (L.), killed 75 to 80 percent of them in 5 days.--Puttarudriah and Subramanian (311).

RHINACANTHUS NASUTUS (L.) Kurz. Synonym: R. communis Nees.

In India the root bark was used as a remedy for dhobi's itch.--Watt (422, v. 3, p. 90).

RUNGIA REPENS (L.) Nees. Synonym: Justicia repens L.

In India the fresh leaves were bruised, mixed with castor oil, and applied to the scalp. The whole plant was considered a vermifuge.--Watt (422, v. 6, pt. 1, p. 593).

ACERACEAE
(Maple Family)

ACER PLATANOIDES L. Norway maple.

Acetone and water extracts of the leaves killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ACER PSEUDO-PLATANUS L. Sycamore maple.

Acetone extracts killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ACER RUBRUM L. Red maple.

ACER SACCHARIUM L. Silver maple.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ACER SACCHARUM Marsh. Sugar maple.

Acetone and water extracts of the leaves killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

AESCULACEAE
(Horsechestnut Family)

AESCULUS CALIFORNICA Nutt. California buckeye.

Observations on honeybees that visited this tree showed that the young brood was most affected. The eggs either failed to hatch or produced drones. The larvae soon died and disappeared, and the pupae were often deformed. The emerging young adults crawled from the hives, and older adults died prematurely. The queens ceased laying or became drone layers. The colonies were weakened or killed.--Burnside and Vansell (72).

This plant has taken a heavy toll from the beekeepers of California. The brood of bees was seriously affected when fed products of this tree. The eggs failed to hatch and oviposition might cease entirely. Immature and deformed dead bees accumulated at the hive entrances. On rare occasions the adult field bees feeding on buckeye blossoms became paralyzed and died in alarming numbers.--Vansell and coworkers (409).

Flours made from the nuts were toxic to the Mexican bean beetle, when applied to bean foliage. Adults and second instars died within 3 days after eating the hulls or meat, and the newly hatched larvae died 2 days after eating the meat. Neither the meat nor hull flour was a violent poison, heavy doses being required to kill the insects within 2 or 3 days.--Apple and Howard (U. S. Bur. Ent. and Plant Quar. News Letter 7(11): 23-25. 1940).

AESCULUS GLABRA Willd. Ohio buckeye.

Alcoholic extracts of the fruit and leaves and a decoction of the leaves had no effect on cotton caterpillars.—Riley (325, p. 184).

AESCULUS HIPPOCASTANUM L. Horsechestnut.

Acetone extracts of the leaves killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

AESCULUS PAVIA L. Red buckeye.

Bedsteads made of this wood were said not to be infested by bugs.—Porcher (308, p. 91).

An infusion of horsechestnuts was recommended as a spray against leaf-eating insects on vegetables.--V. (408).

A decoction of horsechestnut proved effective against aphids (Rhopalosiphum sp.) on seedlings of sugar beet near Prague.--Neuwirth (293).

AIZOACEAE
(Carpetweed Family)

MOLLUGO CERVIANA Ser.

This plant mixed with oil was made into an ointment for scabies and other cutaneous diseases.--Drury (122, p. 305).

MOLLUGO SPERGULA L.

The juice of this plant was applied as a remedy for itch and other skin diseases.—Kirtikar and Basu (230, v. 1, p. 615).

AMARANTHACEAE
(Amaranth Family)

AMARANTHUS RETROFLEXUS L. Pigweed.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

AMARYLLIDACEAE
(Amaryllis Family)

AGAVE AMERICANA L. Century plant.

The infusion of the leaves can be applied as an insecticide.—Von Mueller (414, p. 24).

In India wallpaper impregnated with the expressed juice was said to be proof against white ants.--Chopra and Badhwar (98).

AGAVE LECHEGUILLA Torr. Lechuguilla.

Infusions of the roots had only a slight effect on fly larvae.--Cook, Hutchison, and Scales (103, p. 5; 104, p. 13).

FURCRAEA HEXAPETALA (Jacq.) Urban. Synonym: F. cubensis (Jacq.) Vent.

A water extract had practically no effect on silkworms.--McIndoo and Sievers (259, p. 22).

NARCISSUS PSEUDONARCISSUS L. Common daffodil.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ANACARDIACEAE
(Sumac or Cashew Family)

ANACARDIUM OCCIDENTALE L. Cashew.

The pericarp of the nut contains a black acrid oil, which was often applied to floors or wooden rafters of houses to prevent attacks by white ants.--Drury (122, p. 33).

Oil from the shells mixed with kerosene was tested in India against the mosquito Armigeres obturbans (Wlk.). Nearly 100 percent of the larvae and pupae were killed within 2 hours in laboratory sinks.--Wats and Bharucha (420).

An emulsion of cashew-shell oil was tested in India against the coffee stem borer. It was found to be a good ovicide, provided it came in contact with the eggs.--Subramanyam (386).

BUCHANANIA LATIFOLIA Roxb.

In India this plant was believed to cure itch.--Kirtikar and Basu (230, v. 1, p. 381).

HOLIGARNA AMOTHIANA Hook. Bibo.

An extract of the seeds mixed with kerosene was tested as a larvicide against mosquitoes, but poor results were obtained.--Wats and Bharucha (420).

MANGIFERA INDICA L. Mango.

The gum resin, mixed with lime juice or oil, was used as a cure for scabies, and the powdered flowers were used for fumigating mosquitoes.--Kirtikar and Basu (230, v. 1, pp. 375-376).

PISTACIA LENTISCUS L. Mastic tree.

Various gums with oils were tested for stability as emulsifiers. Mastic gum was unsteble.--Ginsburg (158).

RHUS CANADENSIS March. Synonym: R. aromatica Ait.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

RHUS CORIARIA L. Sumac.

When grown in proximity to infested vines, sumac destroys phylloxera.--Von Mueller (414, p. 461).

Negative results were obtained upon testing infusions of the wood and leaves against phylloxera on grape vines in Italy.--Floriano (141).

A bag of sumac leaves was buried around the base of each apple tree infested with the woolly aphid. For some time aphids remained on the roots, but a year later they had disappeared, and it was thought that the tannin in the leaves killed or repelled them.--Reymond (320).

RHUS GLABRA L. Sumac.

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

RHUS sp.

Water extracts of the leaves and berries killed only 5 and 20 percent, respectively, of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SCHINOPSIS sp. Quebracho.

The commercial extract was an effective repellent against the Japanese beetle.--Metzger and Grant (277).

SEMECARPUS ANACARDIUM L.

TOXICODENDRON RADICANS (L.) Kuntze. Synonym: Rhus toxicodendron L.

Extracts tested in sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

ANNONACEAE
(Custard-Apple Family)

ANNONA CHERIMOLIA Mill. Synonym: A. tripetala Ait. Cherimoya.

The seed was used as an insecticide.--Greshoff (170, p. 12).

ANNONA GLABRA L. Synonym: A. palustris L. Alligator-apple. Pond-apple.

The powdered seeds were used as an insecticide.--Maisch (262).

Alcoholic extracts of the leaves, stems, and roots of this plant from Ceylon were tested against the chrysanthemum aphid. The stems and roots were not toxic, but the leaves were moderately toxic.--Tattersfield and Potter (395).

ANNONA MURICATA L. Sour sop.

Extracts of the leaves, stems, roots, and seeds were tested against aphid Macrosiphoniella sanborni (Gill.). The seeds were the most toxic, but not enough to make this plant of any value as an insecticide.--Tattersfield and Potter (395).

ANNONA RETICULATA L. Custard-apple.

The powdered seed was used as an insecticide.--Maisch (262).

This plant is widely distributed in India. Alcoholic extracts of the seeds and stem bark were tested against adult grasshoppers, Epacromia tamulus (F.). A 3-percent extract of the seeds killed 80 percent, a 4-percent extract 90 percent, and a 5-percent extract 100 percent. The same extracts of the stem bark killed 40, 70, and 100 percent, respectively. Alcoholic extracts of the stem bark, seeds, leaves, and root bark were tested against caterpillars, Prodenia litura (F.), Hypsa ficus (F.), Acheae janata (L.), Euproctis fraterna (Moore), Plutella maculipennis (Curt.), and Crocidolomia binotalis Zeller. The 3- and 5-percent extracts of the seeds, leaves, and root bark were always efficient while those of the stem bark were sometimes efficient. Alcoholic extracts were also tested against nymphs of the mango hopper (Idiocerus sp.). A 5-percent extract of the leaves and of the root bark each killed 100 percent of them. Powdered seeds dusted on beetles, Callosobruchus chinensis (L.), killed 80 percent of them in 42 hours.--Puttarudriah and Subramaniam (311).

This is one of three plants in Mysore, India, found to have great insecticidal value. The seed contains the insecticidal principle.--Subramaniam (385).

Alcoholic extracts of the leaves, stems, roots, and seed from Ceylon were tested against the chrysanthemum aphid. The leaves had a measure of toxicity, the stems and roots were not toxic, but the

seeds were pronouncedly toxic. In other tests, in which A. reticulata and Derris elliptica (rotenone content 9 percent) were compared, the root of Derris was decidedly more toxic to bean aphids than any part of Annona; the root of Derris paralyzed 96 percent of the beetle, Oryzaephilus surinamensis (L.), tested, while the root of Annona paralyzed only 14.5 percent. An alcoholic extract of the seed was ineffective as a stomach poison or deterrent against larvae of a moth. An ether extract of the seed was much less toxic than nicotine to aphids, but it had a delayed action which is advantageous to a contact insecticide.--Tattersfield and Potter (395).

Comments by reviewer.--More work should be done with the custard-apple.

ANNONA SPINESCENS Mart.

The seeds, either finely powdered or in the form of a decoction, were used as an insecticide.--Greshoff (170, p. 12).

The pulp was used as a fish poison and for killing noxious insects.--Dragendorff (121, p. 216).

ANNONA spp.

The seeds of A. cherimolia, A. muricata, and A. squamosa were used crushed to poison fish in rivers. The milky juice of the seeds was a remedy for scabies and was also used for destroying insect pests.--Scarone (353).

ANNONA SQUAMOSA L. Sugar-apple.

The seeds contain a highly acrid principle said to be fatal to insects, for which purpose the natives in India used them. The dried immature fruit was used for washing the hair to destroy vermin.--Murray (290, p. 72).

The seeds were used against head lice.--Greshoff (170, p. 11).

This species is cultivated in Brazil, and its leaves are used as an insecticide.--Barcellos Fagundes (51).

An extract of the seeds mixed with kerosene was tested as a mosquito larvicide, but poor results were obtained.--Wats and Bharucha (420).

Alcoholic extracts of the leaves, stems, and roots of this plant from Ceylon were tested against the chrysanthemum aphid. The stems had no toxicity, the roots a slight toxicity, but the leaves had a high toxicity.--Tattersfield and Potter (395).

Comments by reviewer.--Since the leaves appear to have a high toxicity, more work should be done testing them and the seeds against a number of insects.

ARTABOTRYS SUAVEOLENS Blume.

Artabotrine is one of three alkaloids isolated from the bark of this species. Some of this alkaloid dissolved in alcohol was sprayed on aphids, Macrosiphoniella sanborni. It was not toxic.--Tattersfield and Potter (395).

ASIMINA sp. Papaw.

Papaw trees planted to serve as a mosquito repellent were found to be of no value.--Howard (203, p. 24).

MELODORUM LATIFOLIA (Bl.) Hook & Thomas. Synonym: Uvaria latifolia Brain.

Extracts of the roots of this plant from Siam were not toxic to the bean aphid.--Tattersfield and Gimingham (391).

APIACEAE

(Carrot Family)

ANGELICA ARCHANGELICA L. Angelica.

The root was ineffective against bedbugs, roaches, and clothes moths.--Scott, Abbott, and Dudley (361, pp. 5, 13, 26).

It was found of no value against chicken lice and dog fleas.--Abbott (37, pp. 7, 11).

The root was worthless as a clothes moth control.--Back (44, p. 27).

The root was of no value as a repellent to screwworm flies.--Parman and coworkers (302).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Acetone extracts of the roots killed only 40 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ANTHRISCUS VULGARIS Pers. European chervil.

Chervil has been reported to drive away ants. A few handfuls of the leaves are placed on the anthills or scattered between rows of melons.--Lesne (246).

CARUM BULBOCASTANUM (L.) Koch.

This plant was used in India to protect clothes and skins against the ravages of insects.--Kirtikar and Basu (230, v. 1, p. 622).

CARUM CARVI L. Caraway.

Oil of caraway was one of the best cures for scaly leg of poultry. It was applied in an ointment made of 1 part of the oil to 5 parts of white vaseline. This ointment should be rubbed into the leg and foot every few days until signs of the disease disappear.--Pearl and coworkers (304, p. 222).

Carvacrol was tested against the body louse. A piece of cloth impregnated with the oil was kept for observation in a vial with lice on it. All of them were dead within 12 hours.--Moore and Hirschfelder (285, p. 55).

Oil of caraway was sometimes slightly attractive but usually fairly repellent to the oriental cockroach.--Cole (101).

Acetone extracts of the seed killed 90 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

CICUTA MACULATA L. Spotted water hemlock.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CONIUM MACULATUM L. Poison hemlock.

The action of coniine on the common blowfly was determined. Droplets of coniine were applied to various parts of blowflies, which within a minute showed signs of external irritation; there were rapid motions of the wings, and quick and aimless movements of the legs. The wings, as a rule, became completely paralyzed before the legs, and death occurred within 10 minutes to 2 hours.--Blyth and Blyth (64, p. 270).

Spray solutions of coniine hydrochloride were tested against the bean aphid. The minimum concentration required to kill about 95 percent of the aphids was greater than 0.5 gm. per 100 cc., while that of nicotine sulfate was 0.009 gm.--Richardson and Smith (322).

When coniine was tested as a contact poison, 1.0- and 0.75-percent solutions killed 90 and 60 percent, respectively, of bean aphids.--Tattersfield and coworkers (393).

In laboratory tests coniine hydrobromide used as a dust killed only 25 percent of the codling moth larvae tested.--McAlister and Van Leeuwen (249).

To prepare an extract of poison hemlock use 100 parts by weight of fresh leaves with flowers and small stalks cut into small pieces and mixed with 5 or 6 parts of water and ground in a mortar; press out the pulp and again mix with 15 parts of water; again grind and press out, adding the second liquid to the first. The extract was found effective against various insects.--Gomilevsky (164).

The powdered fruit was ineffective against fly larvae.--Cook and Hutchison (103, p. 4).

Extracts from poison hemlock were not repellent to the Japanese beetle.--Metzger and Grant (277).

Coniine is added to a drenching solution for hides to serve as a mothproofing agent (Ger. patent 595,849).--Roark and Busbey (346, p. 20).

Comments by reviewer.--Since coniine is closely related to nicotine, more work on this alkaloid should be done so that the results can be compared with those obtained with nicotine.

CORIANDRUM SATIVUM L. Coriander.

Oil of coriander was one of the best repellents tested against screwworms.--Parman and coworkers (302).

Oil of coriander, applied in 2-percent emulsion sprays, killed from 51 to 80 percent of the red spiders and cotton aphids tested within 24 hours.--Kayumov (226).

CUMINUM CYMINUM L. Synonym: C. odorum Salisb. Cumin.

Oil of cumin exhibited good repellency against screwworms for 1 or 2 days only.--Parman and coworkers (302).

It was moderately repellent to the oriental cockroach.--Cole (101).

DAUCUS CAROTA L. Common carrot.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

FERULA ASSAFOETIDA L. Asafetida.

Asafetida was ineffective against the tarnished plant bug.--Crosby and Leonard (108).

In laboratory tests tincture of asafetida was very strongly repellent to the cornfield ant.--Forbes (142, p. 465).

Asafetida was stored with grain which was kept in closed receptacles, but the grain was not protected against the weevil Sitophilus oryza (L.).--Fletcher and Ghosh (140, pp. 733-755).

Asafetida (10 percent) had no perceptible effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Asafetida, 1 ounce per marla, did not reduce the white ant attacks on sugarcane in India, but much larger doses did slightly reduce the attacks on wheat.--Chopra (97).

An alcoholic solution of asafetida was of no value as a repellent to screwworms.--Parman and coworkers (302).

Comments by reviewer.--It is not worth while to spend more time on asafetida as an insecticide.

FERULA FOETIDA Regel. Hing.

Extracts used as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

FERULA GALBANIFLUA Boiss. and Buhse

Of 20 gums tested with 4 oils to find stable emulsifiers, galbanum Indian gum was found to be the best. Only 0.5 percent of it was sufficient to produce a solid emulsion which remained stable for several weeks without the addition of a preservative.--Ginsburg (158). [This is probably not correctly classified, and amber gum, which was not classified, was found to be unstable.]

FOENICULUM VULGARE Mill. Common fennel.

Oil of fennel exhibited good repellent action against screwworms for 1 or 2 days only.--Parman and coworkers (302).

Oil of fennel was attractive to the oriental cockroach in 21 counts and repellent in 54 counts.--Cole (101).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

GARCINIA HANBURYI Hook. f.

Various gums were tested with oils to find a stable emulsifier. Ammoniac gamboge gum was one of the four efficient gums used. [This may not be correctly classified.]--Ginsburg (158).

GARCINIA MORELLA Desr.

Extracts used as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

IMPERATORIA OSTRUTHIUM L. Master wort.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

OENANTHE CROCATA L.

Alcoholic extracts of the roots were effective against larvae of Pieris brassicae (L.). This plant, which is common in England, contains a principle toxic to insects.--Tutin (403).

PASTINACA SATIVA L. Parsnip.

Extracts from parsnip were not repellent to the Japanese beetle.--Metzger and Grant (277).

PETROSELINUM CRISPUM (Mill.) Nym.

Oil of parsley was moderately repellent to the oriental cockroach.--Cole (101).

PIMPINELLA ANISUM L. Anise.

In laboratory tests anise oil was very strongly repellent to colonies of the cornfield ant.--Forbes (142, p. 465).

Anise oil, sprayed in pure form or diluted with alcohol, was used in Germany to kill lice on soldiers.--Frankel (143).

Anise oil was almost as effective as oil of bergamot against lice on soldiers.--Galewsky (150).

Anise oil in carbon tetrachloride was said to be among the most promising chemical means of controlling lice on humans.--Zucker (437).

Powdered anise seed was ineffective against roaches.--Scott and coworkers (361, p. 13).

Fructus anisi had no perceptible effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Star-anise oil plus kaolin was one of the best repellents against screwworms. There was no emergence of these flies from meat treated with this oil.--Parman and coworkers (302).

Extracts from anise were not repellent to the Japanese beetle.--Metzger and Grant (277).

Clothing treated with a soapy emulsion of anise oil will protect the wearer from the stings of gnats (Ger. patent 557,760).--Roark and Busbey (346, p. 4).

PIMPINELLA SAXIFRAGA L. Pimpinella.

Extracts from the dry rhizomes and roots were more or less effective repellents against the Japanese beetle.--Metzger and Grant (277).

PRANGOS PABULARIA Lindl.

Water in which the plant was steeped destroyed snails, and its roots were said to be a valuable remedy for itch.--Murray (290, p. 201).

In India the root was considered a valuable external application for itch and a decoction of the fruit was employed as a wash to cure "rot" in sheep.--Watt (422, v. 6, pt. 1, p. 335).

SIUM SUAVE Walt. Water parsnip.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

APOCYNACEAE
(Dogbane Family)

ACOKANTHERA LONGIFLORA Stapf.

This plant was used as an arrow poison in East Africa, but extracts of the leaves and stems had only a very slight effect on citrus aphids.--Worsley (431).

APOCYNUM ANDROSAEMIFOLIUM L.

APOCYNUM CANNABINUM L. Dogbane.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

CARISSA CARANDAS L. Synonym: C. congesta Wight.

In India this plant was used to keep off flies, and when pounded with lime juice and camphor as a remedy for itch.--Watt (422, v. 2, p. 165)

HAPLOPHYTON CIMICIDUM A. DC. Cucaracha herb. Cockroach plant.

This plant is listed as an insecticide.--Greshoff (170, p. 107).

Considerable success was had in poisoning Culex, Anopheles, various species of Instrypetas, and other Diptera, by using the juice and infusion of the leaves or of the entire plants, the macerated bark, and the concentrated alcoholic extract.--Mexico Comisión de Parasitologia Agricola (278).

This plant was reported to be used as an insecticide and as a medicine by the natives of Mexico, who gathered it in the wild state and sold it at the local markets for a few centavos a bundle.--Roark (332, p. 24).

This plant has been used in Mexico since time immemorial for killing cockroaches, flies, mosquitoes, fleas, lice, and other insects. In the campaign against the Mexican fruitfly in 1900, extracts of the plant were found effective against that insect and many trees were sprayed with it. In recent tests a spray containing 3.3 gm. of dried leaves of a good sample per 100 cc. was toxic to fruitflies. Some samples, however, were nontoxic or only slightly toxic to the flies.--Plummer (306).

Comments by reviewer.--This plant is apparently the only one in the family Apocynaceae that is worth while as an insecticide.

HOLORRHENA ANTIDYSENTERICA Wall.

Green vegetable matter decaying in water sometimes pollutes the water and thus helps to control mosquitoes. In running water, apparently not every plant is suitable. One of the best so far found in India is the above species, which contains several alkaloids.--Hacket and co-workers (175, p. 1028).

NERIUM INDICUM Mill. Synonym: N. odorum Soland. Sweet oleander.

Kaner.

Water extracts, macerated juices, and dusts of kaner leaves were tested in India against citrus psyllas, aphids, lucerne weevil grubs, and adult beetles (Aulacophora abdominalis). The extract of its roots appeared to be more poisonous than that of the leaves. In these preliminary tests this material was less effective than tobacco.--Chopra (97, pp. 106, 109).

This plant is widely distributed in India. A 5-percent alcoholic extract of the leaves caused the following mortalities of caterpillars: 80 percent of Prodenia litura (F.), Euproctis fraterna (Moore), and Pericallia ricini (F.); and 70 percent of Crocidolomia binotalis Zell.--Puttarudriah and Subramaniam (312).

NERIUM OLEANDER L. Common oleander.

The bark was frequently used for the destruction of rats and insects.--Greshoff (170, p. 105).

The powder from the leaves and stems and a decoction from this powder had no effect on aphids (Macrosiphum sp.).--McIndoo and Sievers (259, p. 23).

PLUMERIA RUBRA L. Synonyms: P. acutifolia (Poir.) Woodson; P. acuminata Roxb. Mexican frangipani.

In India the juice mixed with sandalwood oil and camphor was employed as a cure for itch.—Watt (422, v. 6, pt. 1, p. 297).

The sap mixed with cocoanut was used as a remedy for itch.--Kirtikar and Basu (230, v. 2, p. 785).

RAUVOLFIA OBSCURA K. Sch.

RAUVOLFIA VOMITORIA Afz.

The latex or a decoction of the leaves was used in West Africa as a remedy for parasitic skin diseases, yaws, and for hair lice.--Dalziel (112).

STROPHANTHUS KOMBE Oliver. Strophanthus.

Extracts were not repellent to the Japnese beetle.--Metzger and Grant (277).

THEVETIA PERUVIANA (Pers.) K. Schum. Synonym: T. nereifolia Juss.

This plant is widely distributed in India. Alcoholic extracts and water suspensions had no effect on caterpillars.--Puttarudriah and Subramaniam. (312).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Sinrh (421).

AQUIFOLIACEAE
(Holly Family)

ILEX OPACA Ait. American holly.

Extracts from the fresh leaves were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

ILEX PARAGUENSIS St. Hil. Paraguay tea.

Extracts from the dry leaves showed some repellency to the Japanese beetle.--Metzger and Grant (277).

ILEX VERTICILLATA (L.) A. Gray. Common winterberry.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ARACEAE
(Arum Family)

ACORUS CALAMUS L. Synonym: Calamus aromaticus Gueldenst. Calamus.

Sweetflag.

The leaves were said to be noxious to insects.--Drury (122, p. 14).

In India the sweetflag was used by the natives chiefly for protecting woolen and flannel clothing from insects.--Dalzell and Gibson (111, sup. p. 96).

In India the aromatic rhizome was held in high esteem as an insectifuge, especially for fleas and moths. An infusion of the roots sprinkled in infested places also drove away vermin. The rhizome was used to keep moths from woolen goods and fleas from rooms.--Watt (422, v. 1, pp. 99-101).

In Malaya and Java the roots were dried and made into powder, which was scattered around fruit trees to protect them against ants.--Ridley (324); Krausse (234, p. 158).

The aromatic rhizome was held in high esteem as an insecticide and insectifuge.--Kirtikar and Basu (230, v. 2, pp. 1350-1352).

Paper is rendered insect proof by adding a decoction of sweetflag to the pulp during the process of manufacture. Fabrics are also rendered insectproof with this preparation (Brit. patent 13,071).--Roark (333, p. 6).

Extracts of sweetflag were not repellent to the Japanese beetle.--Metzger and Grant (277).

ACORUS GRAMINEUS Soland.

In India the roots were stated to be used as an insecticide and insectifuge.--Chopra and Badhwar (98).

AMORPHOPHALLUS CAMPANULATUS (Roxb.) Blume.

As the flower stalk matures it emits an odor of putrid flesh, inviting hordes of bluebottle and other large flies, which cover the whole mass with their eggs; and the subsequent maggots, which thickly beset it for the next 4 or 5 days, render the flower stalk as disgusting to the eye and nose as carrion.--Kirtikar and Basu (230, v. 2, p. 1337).

ARISAEMA DRACONTIUM (L.) Schott. Synonym: Arum dracontium L.

Indian turnip. Dragonroot.

The corm is used to kill insects.--Pammel (299, p. 103).

ARISAEMA JAPONICUM Blume.

The roots are used in Japan as an insecticide.--Greshoff (171, p. 19).

ARISAEMA SPECIOSUM Mart.

In India this plant was considered to be insecticidal.--Chopra and Badhwar (98).

ARISAEMA TORTUOSUM (Wall.) Schott.

The roots are used as an insecticide.--Greshoff (170, p. 157).

The species was known in India to have insecticidal or repelling properties.--Roark (332, p. 3).

ARISAEMA TRIPHYLLUM (L.) Schott. Jack-in-the-pulpit.

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

CALADIUM BICOLOR (Ait.) Vent.

The powdered leaves were used as an insecticide.--Greshoff (170, p. 158).

DRACUNCULUS VULGARIS Schott. Synonym: Arum dracunculus L.

This plant bears a large flower which exhales an odor so fetid and carrion-like that blowflies, carrion flies, and other slaughter-house frequenters flock to it to deposit their eggs.--Bogert (65, p. 361).

LAGENANDRA OVATA (L.) Thw. Synonym: L. toxicaria Dalz.

This is an insecticidal plant in India.--Chopra and Badhwar (98).

ORONTIUM AQUATICUM L. Golden club.

PELTANDRA VIRGINICA (L.) Kunth. Virginia arrow-arum.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

PISTIA STRATIOTES L. Waterlettuce.

In India this plant was reported to destroy the bugs that infested a jail.--Kirtikar and Basu (230, v. 2, p. 1331).

REMUSATIA VIVIPARA (Lodd.) Scott. Synonym: Arum viviparum Roxb.

The root was made into an ointment with turmeric, and used as a remedy for the itch.--Kirtikar and Basu (230, v. 2, p. 1342).

SAUROMATUM GUTTATUM Schott. Synonym: Arum venosum Ait.

This plant was observed during its blooming period to attract in 2 days more than 100 flies, which were found dead in the bottom of the flowers.--Anonymous (15).

SYMPLOCARPUS FOETIDUS (L.) Nutt. Synonym: Spathyema foetida (L.) Raf.

Skunkcabbage.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Acetone extracts of the roots killed 65 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SYNANDROSPADIX VERMITOXICUS Engl.

The bulbs served for the destruction of injurious insects.--Greshoff (170, p. 158).

ARALIACEAE
(Ginseng Family)

ARALIA HISPIDA Vent. Bristly aralia.

ARALIA RACEMOSA L. American spikenard.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

ARALIA NUDICAULIS L. American sarsaparilla.

Acetone extracts of the roots killed only 45 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

HEDERA HELIX L. English ivy.

In England it was recommended that a solution of ivy be pumped with a garden engine upon the caterpillars of the ermine moth.--F. (132, p. 179).

In England extracts of ivy were tested against caterpillars. A 5-percent spray solution made from a commercial extract killed 43 percent of the six species tested within 7 days, and a 1-percent solution killed only 13 percent of four of these species. In other tests with decoctions of ivy leaves, fairly good results were obtained but not sufficiently so to render them preferable to various other insecticides.--Duke of Bedford and Pickering (53, pp. 83-94).

HEDERA spp.

In India ivy leaves have, from remote antiquity, been reputed to possess remedial virtues, especially as a dressing for ulcers and to destroy vermin on the body.--Watt (422, v. 1, p. 289).

In India a decoction of ivy leaves was used to kill lice.--Chopra and Badhwar (98).

ARISTOLOCHIACEAE
(Birthwort Family)

ARISTOLOCHIA BRACTEATA Retz.

In India the leaves, freshly bruised and mixed with castor oil, were considered a valuable remedy in obstinate cases of itch. The natives squeezed the juice into wounds to kill worms.--Drury (122, p. 50).

ARISTOLOCHIA BRASILIENSIS Mast.

ARISTOLOCHIA CORNUTA Mast.

ARISTOLOCHIA ELEGANS Mast.

The insects visiting these three species were killed.--Greshoff (170, p. 131).

ARISTOLOCHIA GRANDIFLORA Sw.

This species was used by certain Indian tribes for poisoning fish. The bark and seeds were macerated or an infusion was made which was very effective against cabbage butterflies.--Scarone (353).

ARISTOLOCHIA INDICA L.

This species is found in the Bangalore district of India. Alcoholic extracts killed 100 percent of the following caterpillars: Prodenia litura (F.), a 5-percent extract of the leaves; Euproctis fraterna (Moore), a 3-percent extract of leaves, stems, or fruit. A 20-percent water suspension of the powdered leaves and stems killed only 48 percent of the nymphs of the mango hopper (Idiocerus sp.).--Putterudriah and Subramaniam (311).

ARISTOLOCHIA MAXIMA L.

This plant was used as a fish poison. The bark and seeds were macerated or an infusion was made which was very effective against cabbage butterflies.--Scarone (353).

ARISTOLOCHIA ROTUNDA L. Round-rooted birthwort.

In India the roots were used by the natives in the treatment of itch and lice.--Watt (422, v. 1, p. 316).

ARISTOLOCHIA SERPENTARIA L. Virginia snakeroot.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ASARUM CANADENSE L. Canada snakeroot. Wild ginger.

This plant was of no value as a repellent or attractant to screwworms.--Parman and coworkers (302).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of the buttons killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon. (188).

ASCLEPIADACEAE
(Milkweed Family)

ASCLEPIAS CURASSAVICA L. Bloodflower.

The Indians of southern Mexico were reported to have swept the floors and walls of their huts with this plant to keep away vermin, especially fleas.--Anonymous (13).

This milkweed was reported to check the spread of fleas in houses.--Bergey (56).

Alcoholic extracts of the stems and roots of this species, called "conami," from British Guiana, were ineffective against the bean aphid, but an extract of the flowers had a slight insecticidal action.--Tattersfield and coworkers (393).

ASCLEPIAS INCARNATA L. var. of A. BULCHRA (Ehrh.) Pers.

ASCLEPIAS SYRIACA L. Milkweed.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

ASCLEPIAS TUBEROSA L. Butterflyweed.

An infusion of the roots had a considerable effect on fly larvae, but it was not efficient.--Cook and Hutchison (103, p. 14).

Extracts of the roots killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

CALOTROPIS GIGANTEA (Willd.) R. Cr.

This plant was used as an insect deterrent in India. A 5-percent alcoholic extract of the stems killed only 55 percent of the caterpillars of Plutella maculipennis (Curt.).--Puttarudriah and Subramaniam (311).

CALOTROPIS PROCERA Ait. Swallowwort.

Water extracts, macerated juices, and dusts of the leaves were tested in India against citrus psyllas, aphids, and lucerne weevil grubs, but were inefficient.--Chopra (97, p. 109).

The leaves were used in Senegal to destroy fowl lice.--Dalziel (112).

A spray consisting of a decoction of the flowers, leaves, and twigs of this plant with soap killed 86 percent of the grapevine thrips (Rhipiphorothrips cruentatus Hood) in India, but without soap not more than 25 percent. Spraying with tobacco decoction and nicotine sulfate, both with soap, gave a mortality of about 98 percent.--Rahman and Bhardwaj (314).

CYNANCHUM ARNOTTIANUM Wight.

This plant was used as an insecticide in India.—Chopra and Badhwar (98).

CYNANCHUM MACRORHIZON Carr.

The blossoms of this plant contain a viscous substance in which all visiting insects are unable to extricate themselves.--Carrière (79).

OXYSTELMA ESCULENTUM (L. f.) R. Br. Synonym: Asclepias rosea Roxb.

The milky sap in combination with turpentine was said to be a valuable cure for itch in Sind, India.--Murray (290, p. 161).

In Sind the milky sap is used as a wash for ulcers.--Kirtikar and Basu (230, v. 2, p. 810).

SARCOSTEMMA BREVISTIGMA Wight & Arn. Synonym: Asclepias acida Roxb.

In India water passed through a bundle of these plants and a bag of salt is used to extirpate white ants from a field.--Kirtikar and Basu (230, v. 2, p. 823).

TYLOPHORA ASTHMATICA (Willd.) W. & A.

This plant is widely distributed in India. A 5-percent alcoholic extract of the whole plant killed only 50 percent of the caterpillars of Achaea janata (L.), but a 10-percent extract killed 100 percent. A 20-percent water suspension of the powdered whole plant killed only 40 percent of the nymphs of mango hoppers (Idiocerus sp.).--Puttarudriah and Subramaniam (311).

TYLOPHORA FASCICULATA Ham.

This plant was used in southern Konkan (near Bombay) as a poison for rats and other vermin.--Watt (422, v. 6, pt. 4, p. 206).

Comments by reviewer.--The milkweed family does not seem to be a promising one in which to find efficient insecticides.

ASTERACEAE
(Thistle or Aster Family)

ACHILLEA MILLEFOLIUM L. Common yarrow.

A powder and a decoction had no effect on aphids.--McIndoo and Sievers (259, p. 21).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ACHILLEA NOBILIS L. Camphor yarrow.

The flower heads were reported to have insecticidal properties.--Gieseler (155).

AGERATUM sp. Ageratum.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

AMBROSIA ARTEMISIIFOLIA L. Synonym: A. elatior L. Ragweed.

An alcoholic extract or a decoction had no effect on cotton caterpillars.--Riley (325, p. 184).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

AMBROSIA TRIFIDA L. Great ragweed.

A decoction, an infusion, or an alcoholic extract had no effect on cotton caterpillars.--Riley (325, p. 184).

ANACYCLUS PYRETHRUM (L.) D.C. Pellitory.

ANTENNARIA spp. Pussytoes.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ANTHEMIS ARVENSIS L. Corn camomile.

The flowers were entirely inactive against flies.--Kalbruner (224).

The odor of this plant drove away mice and insects.--Greshoff (171, p. 157).

ANTHEMIS ARVENSIS L. Camomile.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ANTHEMIS COTA L.

The flower heads killed the dog flea, although very slowly, but had no practical effect on flies and ants.--Passerini (303, p. 42).

ANTHEMIS COTULA L. Synonym: Maruta cotula D.C. Mayweed.

In Russia the powdered flower heads were very effective against bedbugs, fleas, and flies, but ineffective against grain worms and caterpillars.--Anonymous (1).

A decoction of the leaves was said to destroy all species of insects.--Garrigues (152).

The flowers were entirely inactive against flies.--Kalbruner (224).

ANTHEMIS NOBILIS L. Synonym: Chamomilla nobilis Godr. Common camomile.

The flower heads were reported to have insecticidal properties.--Gieseler (155).

The flowers were entirely inactive against flies.--Kalbruner (224).

Camomile was ineffective against fly larvae.--Cook and Hutchison (103, p. 4).

ANTHEMIS spp.

Smoke from the burning dried flowers of camomile stunned mosquitoes in 4 minutes and killed them in 36 hours, while smoke from firewood stunned mosquitoes in 5 to 7 minutes and killed them in 12 to 48 hours.--Celli and Casagrandi (82, p. 96).

Alcoholic extracts of the flowers, leaves, and stems of camomile showed no significant toxicity to the bean aphid.--Tattersfield and coworkers (393).

ANTHEMIS TINCTORIA L. Yellow camomile.

The flowers were entirely inactive against flies.--Kalbruner (224).

The flowers were of no practical use against flies and ants, but they did kill the dog flea slowly.--Passerini (303, p. 42).

ARCTIUM MINUS Bernh. Common burdock.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Acetone extracts of the roots killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ARNICA ALPINA (L.) Olin & Ladau.

ARNICA MONTANA L. Arnica.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ARTEMISIA ABROTANUM L. Southernwood.

Extracts of the whole plant killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ARTEMISIA ABSINTHIUM L. Synonym: Absinthium vulgare Lam. Common wormwood. Absinthium.

Decoctions were recommended in France against leaf-eating caterpillars on fruit trees.--Lèsne (244, p. 511).

The odor of absinthium killed mosquitoes in 6 to 24 hours.--Celli and Casagrandi (82, p. 95).

In Siberia a decoction made from young wormwood was used as a cheap remedy for insects. A mixture containing 27 gallons of this decoction, 10 pounds of green soap or rye paste, and 27 more gallons of water, and one containing 27 gallons of decoction, 54 gallons of water, 27 gallons of poultry dung dissolved in water and 10 pounds of paste of molasses were effective as sprays against aphids and caterpillars.--Stuptchenko (376).

Various dilutions of extracts had only a slight effect on the insects tested.--Schreiber (360) and Gorianinov (166).

The powdered leaves had no effect on fly larvae.--Cook and Hutchison (103, p. 4).

Extracts killed only 5 to 15 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ARTEMISIA DRACUNCULOIDES Pursh.

An extract was not repellent to Japanese beetles.--Metzger and Grant (277).

ARTEMISIA PAUCIFLORA. Levant wormseed.

The oil was moderately repellent to the oriental cockroach.--Cole (101). [If this oil was the American oil of wormseed, it was derived from Chenopodium ambrosioides.]

Santonin (100 p.p.m.), which is derived from this species, killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ARTEMISIA SACRORUM Ledeb. Russian tarragon.

Acetone extracts of the leaves and stems killed only 15 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ARTEMISIA TRIDENTATA Nutt. Sagebrush.

Water extracts slowly killed honeybees, but had no effect on silkworms, webworms, potato beetle larvae, rose aphids, and nasturtium aphids.--McIndoo and Sievers (259, p. 21).

ARTEMISIA VULGARIS L. Mugwort.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

According to a Japanese patent, mugwort is dried in the shade, powdered, treated with kerosene, cresol, soap and menthol oil, then with water and mineral cutting oil, and filtered.--Nakamu (291).

ASTER LINOSYRIS (L.) Bernh.

ASTER TRIFOLIUM L.

The flowers were inactive against flies.--Passerini (303).

ASTER NOVAE-ANGLIAE L. New England aster.

Extracts from the fresh leaves and flowers were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

ASTER PANICULATUS Lam.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ATRACTYLIS OVATA Thunberg.

This plant is used in China for fumigating grain stores.--Scarone (353).

BACCHARIS FLORIBUNDA H. B. K. Niquitau.

Niquivau was used in Venezuela for killing insects.--Roark (332, p. 31). [Niquivau may not be identical with niquitau.]

BACCHARIS SAROTHROIDES Gray. Baccharis.

Acetone extracts of the seeds killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

BAILEYA MULTIRADIATA Hary. & Gray. Baileya.

The acetone and water extracts of the flowers killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

BLUMEA AURITA DC. Pisadura.

This plant has been suggested for driving away insects in the Gold Coast, Africa, and as a possible source of insect powder.--Irvine (213).

BLUMEA LACERA (Roxb.) DC. Numurdi.

The natives of Konan, near Bombay, used this plant to drive away fleas and other insects. It was suggested as a possible source of an insect powder.--Watt (422, v. 1, pp. 459-460).

BRAUNERIA sp. (probably echinacea).

Acetone extracts of the root (N.F.) of this plant killed 100 percent of the mosquito larvae tested. A 0.2-percent concentration of the roots killed 49 and 38 percent of the bean aphids tested.--Hartzell and Wilcoxon (188).

CALLILEPIS LAUREOLA DC.

The powdered roots were used as an insecticide in Natal.--Greshoff (171, p. 155).

CARTHAMUS TINCTORIUS L. Safflower.

In Bengal the oil was considered to be a valuable remedy for itch.--Kirtikar and Basu (230, v. 1, p. 717).

CENTIPEDA ORBICULARIS Lour.

This species was said to be used in Sind, India, as an insecticide.--Roark (332, p. 8).

CHRYSANTHEMUM ACHILLEAE L. Synonym: Pyrethrum achilleae DC.

The opened flower heads had some effect on flies, fleas, and ants; they were not much inferior to those of C. cinerariaefolium.--Passerini (303).

CHRYSANTHEMUM CAUCASICUM (Willd.) Pers.

Persian insect powder was reported to be made from this species.--U. S. Commissioner of Patents (407).

CHRYSANTHEMUM CINERARIAEFOLIUM (Trev.) Vis. Synonym: Pyrethrum cinerariaefolium Trev. Dalmatian insect flowers.

CHRYSANTHEMUM COCCINEUM Willd. Synonyms: C. roseum Adam, Pyrethrum carneum Bieb. Persian insect flowers.

These two species and C. marschallii were recognized by the Insecticide and Fungicide Board of the United States Department of Agriculture in 1911 as sources of genuine [pyrethrum] insect powder.--McDonnell and coworkers (251).

The literature on pyrethrum as an insecticide is too extensive to include here.

CHRYSANTHEMUM CORONARIUM L. Crown daisy.

The flowers were entirely inactive against flies.--Kalbruner (224).

CHRYSANTHEMUM CORYMBOSUM L. Synonym: Pyrethrum corymbosum Scop.

The flowers were feebly benumbing to flies.--Kalbruner (224).

A powder made from the opened and unopened flower heads, dried in the sun, was slightly less active than genuine insect powder against ants and flies.--Böhmer (66).

The opened flower heads were not of much value against flies, dog fleas, and ants.--Passerini (303).

CHRYSANTHEMUM FRUTESCENS L. Marguerite.

The flowers could ordinarily be substituted for genuine insect powder.--Landerer (242).

Extracts of the leaves and bark from Uganda were not toxic to the bean aphid.--Tattersfield and Gimingham (391).

CHRYSANTHEMUM INDICUM L. Mother chrysanthemum.

The open and closed flower heads and the leaves of this species were entirely inactive against the insects tested.--Passerini (303).

CHRYSANTHEMUM LEUCANTHEMUM L. Synonym: Leucanthemum vulgare Lam.

Oxeye Daisy.

The flowers were entirely inactive against flies.--Kalbruner (224).

The powder, water extract, and alcoholic extract from the flower heads had no effect on cotton caterpillars.--Riley (325, p. 180).

This species had no effect on fly larvae.--Cook and coworkers (104, p. 21).

The powder and hot water extract from the flower heads had no effect on silkworms, webworms, potato beetle larvae, and rose aphids.--McIndoo and Sievers (259, p. 22).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Pyrethrins were not found in the flowers, hence their worthlessness as an insecticide.--U. S. Bureau of Entomology and Plant Quarantine (405).

The oxeye daisy was found to yield an oleoresin similar to that of pyrethrum, which, however, was found to contain no pyrethrins and was nontoxic to flies.--Shepard (363, p. 269).

CHRYSANTHEMUM MARSCHALLII Aschers. Synonym: Pyrethrum roseum Bieb.

Caucasian insect flowers.

This is one of the three species from which genuine insect powder is made (see C. cinerariaefolium and C. coccineum).--McDonnell and coworkers (251).

CHRYSANTHEMUM MYCONIS L.

The flower heads killed dog fleas, although very slowly.--Passerini (303).

CHRYSANTHEMUM PARTHENIUM (L.) Pers. Synonyms: Matricaria parthenium L., Pyrethrum parthenium J. E. Smith. Feverfew.

The dried, fresh flowers had an effect on roaches similar to that of genuine insect powder.--Glover (163, p. 133).

The flowers had a benumbing effect on flies, acting within 1 or 2 hours.--Kalbruner (224).

The flower heads were not effective against the insects tested.--Passerini (303).

Alcoholic extracts were not significantly toxic to the bean aphid.--Tattersfield and coworkers (393).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CHRYSANTHEMUM SEGETUM L. Synonym: Pyrethrum segetum Moench. Corn marigold.

This plant was used in Greece and was as effective as Persian insect powder, particularly as a fumigant.--Landerer (241).

CHRYSANTHEMUM spp. Cultivated Chrysanthemums.

CHRYSOPSIS MARIANA (L.) Nutt. Golden aster.

CICHORIUM INTYBUS L. Chicory.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

CLIBADIUM SURINAMENSE. L.

The powder had practically no effect on silkworms.--McIndoo and Sievers (259, p. 22).

CLIBADIUM SYLVESTRE (Aubl.) Baill. Synonym: C. vargesii. Nivrai.

Extracts of the leaves and stems of this fish-poison plant from Antigua were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

CNICUS BENEDICTUS L. Blessed thistle.

Extracts were not repellent to the Japanese beetle. Metzger and Grant (277).

Water extracts of the whole plant killed only 35 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

COREOPSIS GRANDIFLORA Hogg. Big coreopsis.

Extracts from the entire plant were repellent to the Japanese beetle.--Metzger and Grant (277).

ECHINACEA PALLIDA (Nutt.) Britton. Hedgehog-coneflower.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ECHINOPS ECHINATUS Roxb.

The roots are pounded and applied to the hair to destroy lice, and the powdered roots are applied to wounds in cattle to destroy maggots.--Greshoff (171, p. 160).

ERECHTITES HIERACIFOLIA (L.) Raf. Fireweed.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ERIGERON ANNUUS (L.) Pers. Daisy fleabane.

ERIGERON CANADENSIS L. Horseweed.

ERIGERON PULCHELLUS Michx. Poor-robins-plantain.

Extracts of the daisy fleabane and poor-robins-plantain were not repellent to the Japanese beetle, but extracts of the fresh leaves and heads of the horseweed were repellent.--Metzger and Grant (277).

EUPATORIUM CAPILLIFOLIUM (Lam.) Small. Dogfennel.

This plant was used to keep off insects by strewing it on the floors of cellars and dairies.--Porcher (308).

EUPATORIUM COELESTINUM L.

EUPATORIUM HYSSOPIFOLIUM L. Thoroughwort.

EUPATORIUM MACULATUM L.

EUPATORIUM PERFOLIATUM L. Synonym: E. connatum Michx. Boneset.

EUPATORIUM PUBESCENS Muhl.

Extracts of the leaves and flowers of E. hyssopifolium were repellent to the Japanese beetle while extracts of the other four species were not repellent.--Metzger and Grant (277).

The powdered leaves of E. perfoliatum seemed obnoxious to cotton caterpillars, but an infusion had no effect on them.--Riley (325, p. 184).

Extracts of the leaves and stems of E. perfoliatum killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

GALINSOGA PARVIFLORA Cav. Galinsoga.

A powder and a decoction had no effect on aphids (Macrosiphum sp.)--McIndoo and Sievers (259, p. 22).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

GNAPHALIUM OBTUSIFOLIUM L. Sweet everlasting.

GRINDELIA CAMPORUM Greene. Grindelia.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

GRINDELIA sp. (probably robusta Nutt.). Grindelia.

Acetone extracts of the whole plant (N. F.) killed 65 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

HELENIUM AUTUMNALE L. Sneezeweed.

HELENIUM TENUIFOLIUM Nutt. Bitterweed.

The decoction, infusion, and alcoholic extract did not affect cotton caterpillars.--Riley (325, p. 184).

The powdered heads of the bitterweed had only a slight effect on silkworms, flies, and aphids, and the decoction had no effect whatever on aphids.--McIndoo and Sievers (259, p. 22).

HELENIUM sp. Yerba de la pulga.

The Pan American Society of Tropical Research brought to this country nearly 3 million seeds of this plant. After extensive experiments the Society concluded that the plant possesses exceptional insect-repelling qualities, and not only contains but actually exudes sufficient quantities of rotenone to make a single growing specimen of the plant repellent to practically all forms of insect life in an area of some 15 to 20 square feet.--Anonymous (34).

HELIANTHUS ANNUUS L. Common sunflower.

HELIOPSIS HELIANTHOIDES (L.) Sweet sunflower. Heliopsis.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

HIERACIUM PRATENSE Tausch. Hawkweed.

Extracts from the entire plant were repellent to the Japanese beetle.--Metzger and Grant (277).

INULA CONYZA DC. Synonyms: I. squarrosa Bernh., Conyza squarrosa L.

Cinnamon root.

This plant is listed as an insecticide.--Lyons (248, p. 246).

INULA HELENIUM L. Elecampane.

This species was said to protect clothing from the clothes moth. Extracts of flowers collected in England did not kill the larvae of the birch mocha moth.--Tutin (403).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

A strong concentration of acetone extracts of the roots killed 100 percent of the mosquito larvae tested, and a 0.2-percent concentration killed 34 and 40 percent of the bean aphids, while an 0.18-percent concentration of steam-distilled roots killed 79 and 90 percent of these aphids.--Hartzell and Wilcoxon (188).

INULA VISCOSA (L.) Ait. Synonym: Erigeron viscosus L.

This was reported to be one of the most common plants in Greece. The fumes of the burning plant had the same stupefying effect on mosquitoes as those of Caucasian insect powder.--Landerer (240).

The flower heads were inactive against flies.--Passerini (303).

KRIGIA BIFLORA (Walt.) Blake. Cynthia.

LACTUCA CANADENSIS L. Wild lettuce.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

LACTUCA sp. Lettuce.

A spray, made by boiling 20 to 30 minutes 1 pound of lettuce plants from which the seed head has begun to shoot in 2 gallons of water and strained, was recommended for eradicating the cabbage moth and cabbage aphid in New South Wales.--Fuller (148).

LACTUCA VIROSA L. Lactucarium.

A 10-percent concentration in flour had no perceptible effect on Prodenia litura (F.).--DeBussy (76).

LEONTODON TUBEROSUS L. Synonym: Thrincia tuberosa DC.

The opened flowers and roots were inactive against flies and dog fleas.--Passerini (303).

LIATRIS SPICATA (L.) Willd. Spike gayfeather.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MATRICARIA CHAMOMILLA L. Synonyms: Chrysanthemum chamomilla Bernh., Chamomilla vulgaris S. F. Gray. German false-camomile.

The flower heads had an action similar to that of Persian insect powder.--Schenck (356).

The dried fresh flowers had an effect on the oriental cockroach somewhat similar to that of pyrethrum.--Glover (163, p. 133).

The powder was inert towards roaches.--Hirschsohn (194).

Camomile flowers were ineffective against bedbugs and roaches.--Scott, Abbott, and Dudley (361, pp. 5, 13).

The flowers kill lice, although very slowly, but have little effect on flies and ants.--Passerini (303).

Extracts from camomile were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts from the leaves and stems killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

MATRICARIA INODORA L. Scentless false camomile.

The flowers have a benumbing effect on flies, acting within 1 or 2 hours.--Kalbruner (224).

MATRICARIA MATRICARIOIDES (Less.) Porter. Synonyms: M. discoidea DC., M. suaveolens Buchenau. Rayless false-camomile.

A decoction was ineffective against Malacosoma neustria (L.).--Goriainov (166).

NEUROLAENA LOBATA (L.) R. Br. Erb-a-picque.

This plant was employed in the West Indies in conjunction with the bark of the mammee tree (Mammea americana) to make a wash for animals infested with ticks.--Anonymous (24).

Extracts of the leaves and stems of this fish-poison plant from Antigua were slightly toxic to the bean aphid.--Tattersfield and Gimingham (391).

PULICARIA DYSENTERICA (L.) Gaertn. Synonym: Inula dysenterica L.

Fleawort. Fleabane.

This plant was called an herb insecticide.--Lyons (248, p. 384).

The action of the flower heads against flies, fleas, and ants was uncertain.--Passerini (303).

The flowers have long been supposed to be poisonous to insects; hence the name of "fleabane." Extracts of flowers collected in England were found to be inactive against larvae of the early thorn moth.--Tutin (403).

Extracts from the leaves, flowers, stems, and roots of this plant from England were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

PULICARIA VULGARIS Gaertn. Synonym: Inula pulicaria L.

The flowers were entirely nontoxic to flies.--Kalbrunner (224).

RUDBECKIA HIRTA L. Black-eyed susan.

Extracts from the entire plant were repellent to the Japanese beetle.--Metzger and Grant (277).

SANTOLINA CHAMAECYPARISSUS L. Lavender cotton.

This plant is listed as an insecticide.--Greshoff (171, p. 158).

This plant killed the dog flea, although very slowly, but had practically no effect on flies and ants.--Passerini (303).

SANTOLINA sp.

Small quantities of these plants put in containers holding herbarium collections were reported to kill the insect pests.--Regel (316).

SAUSSUREA LAPPA (Decaisne) C. B. Clarke. Synonyms: Aplotaxis lappa Decaisne, Aucklandia costus Falconer. Costus root.

This plant was used as an insecticide to keep moths from cloth. The leaves were used as a wrapping for shawls.--Von Mueller (414, p. 492).

In India the roots were used as an insect repellent.--Chopra and Badhwar (98).

SCHKUHRIA ABROTANOIDES Roth.

The flowers were used in Peru for the same purpose as genuine insect powder.--Haas (174).

This annual herb yielded an insecticide powder.--Von Mueller (414, p. 497).

SCORZONERA LATIFOLIA (Fisch. & May.) DC.

An adhesive containing 38.5 percent of treated colophony, 57.5 percent of castor oil, 3 percent of beeswax, and 1 percent of water was prepared and tested. A study of the physico-chemical constants of resins extracted from certain plants occurring in Russia showed that colophony, the resin obtained from this species, may be of value in the manufacture of adhesives for use in caterpillar glue.--Ignat'eva (210).

SENECIO AUREUS L. Groundsel.

SENECIO VULGARIS L.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SERICOCARPUS ASTEROIDES (L.) B.S.P. Whitetop aster.

A powder and a decoction had no effect on the aphids tested.--McIndoo and Sievers (259, p. 23).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SILPHIUM LACINIATUM L. Compass plant.

SOLIDAGO JUNCEA Ait. Early goldenrod.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SOLIDAGO ODORA Ait. Goldenrod.

Extracts of the leaves and tops killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SOLIDAGO sp. Goldenrod.

Extracts from the fresh leaves were slightly repellent to the Japanese beetle.--Metzger and Grant (277).

SONCHUS OLERACEUS L. Sowthistle.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SPILANTES ACMELLA (L.) Murr.

The fruit was used in India as a fish poison and as an insecticide.--Roark (332, p. 37).

TAGETES ERECTA L. African marigold.

An extract of the seeds mixed with kerosene gave poor results as a larvicide.--Wats and Bharucha (420).

TAGETES MINUTA L. Synonym: T. glandulifera Schrank.

The khaki bush (T. minima= probably T. minuta), a weed common in South Africa, contains a strong-smelling volatile oil or mixture of oils in its leaves, flowers, and seeds; this can be removed by steam distillation, the yield being about 0.5 percent of the total weight. Baits treated with this oil were very repellent to blowflies. In other tests to discover a dressing for sheep infested with blowfly larvae, the most satisfactory mixture or emulsion contained 20 percent of carbon tetrachloride, 5 percent of Tagetes oil, 6 percent of wool grease, and water. The emulsion broke down soon after it was applied, the larvae were killed within a minute, and the carbon tetrachloride and water soon evaporated.--Monnig (282).

TAGETES spp.

Experiments in Natal, South Africa, to control the stalk borer in maize were conducted by applying extracts of the Mexican marigold (probably T. erecta) to the tops of the plants. Only the pure oil from this plant had any appreciable effect upon the borers. It acted as a contact poison and undoubtedly contains a toxic principle, but it is far too weak an insecticide to be used commercially against this insect.--Ripley and Hepburn (328).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

An emulsion containing 3 percent of oil of Tagetes had a repellent effect on blowflies for less than 5 days.--Hobson (196).

TANACETUM VULGARE L. Common tansy.

The heads exerted an effect on insects similar to that of pyrethrum.--Gieseler (155, p. 112).

The flowers were very feebly benumbing to flies.--Kalbruner (224).

An alcoholic extract and an infusion had no effect on cotton caterpillars.--Riley (325, p. 186).

An action similar to that of Persian insect powder was produced by the common tansy, which was sold in the north of England to replace this powder.--Kirby (229, p. 241).

Tansy plants grown near peach trees have only a very slight effect on the peachtree borer.--Slingerland (366, p. 196).

Alcoholic extracts were not significantly toxic to the bean aphid.--Tattersfield and coworkers (393).

Acetone extracts of the whole plant killed from 10 to 30 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

In laboratory tests oil of tansy was strongly repellent to colonies of the cornfield ant. Field tests with this oil, applied first to bonemeal, which was then dropped with the corn, showed a gain of 10.8 bushels per acre.--Forbes (142, p. 465).

Oil of tansy was of no value as a repellent or attractant to screwworms.--Parman and coworkers (302).

TARAXACUM PALUSTRE VAR. OFFICINALE (Lam.) Fernald. Dandelion.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

TRILISA ODORATISSIMA (Walt.) Cass. Caroline vanilla.

The leaves were used to protect woolen clothes against moths.--Jackson (218).

TUSSILAGO FARFARA L. Coltsfoot.

Water extracts of the roots killed 70 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

VERONIA ANTHELMINTICA (L.) Willd.

The bruised seeds were largely employed as a means of destroying pediculi.--Greshoff (170, p. 92).

This species was used in India as an insecticide and insect repellent.--Chopra and Badhwar (98).

VERONIA NOVEBORACENSIS (L.) Willd. Common ironweed.

The alcoholic extract and decoction were ineffective against cotton caterpillars.--Riley (325, p. 186).

Extracts of ironweed were not repellent to the Japanese beetle.--Metzger and Grant (277).

XANTHIUM STRUMARIUM L. Cocklebur.

A decoction and an alcoholic extract had no effect on cotton caterpillars.--Riley (325, p. 184).

Comments by reviewer.--None of 121 species belonging to the Asteraceae, except those from which pyrethrum is derived, serve as material for efficient insecticides.

BALSAMINACEAE

IMPATIENS BALSAMINA L. Garden balsam.

IMPATIENS BIFLORA Walt. Spotted snapweed.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

BERBERIDACEAE
(Barberry Family)

BERBERIS AQUIFOLIUM Pursh. Synonym: Mahonia aquifolium Nutt. Oregon hollygrape.

An infusion of the roots had a considerable effect on fly larvae, but it was inefficient.--Cook and Hutchison (103, p. 4).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

BERBERIS ARISTATA DC.

The bark was used in India as a fish poison and as an insecticide.--Roark (332, p. 6).

BERBERIS sp.

BERBERIS VULGARIS L. forma ATROPURPUREA Reg. Berberry.

Acetone extracts of the roots of Berberis sp. killed 70 percent of the mosquito larvae tested, and extracts of the roots and stems of B. v. atropurpurea killed only 10 percent of the larvae.--Hartzell and Wilcoxon (188).

CAULOPHYLLUM THALICTROIDES (L.) Michx. Blue cohosh.

JEFFERSONIA DIPHYLLA (L.) Pers. Twinleaf.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PODOPHYLLUM EMODI Wall. ex Hook. & Thomas.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

PODOPHYLLUM PELTATUM L. Common mayapple.

The powder from the dried roots was ineffective when dusted on cotton caterpillars.--Riley (325, p. 187).

Rhizoma podophylli had no perceptible effect on caterpillars of Prodenia litura (F.).--DeBussy (76).

Extracts from the entire fresh plant were slightly repellent to the Japanese beetle.--Metzger and Grant (277).

BETULACEAE
(Birch Family)

BETULA ALBA L. White birch.

In chemotropic tests in the field with oil of birch ter negative results were obtained.--Imms and Husain (212).

BETULA LENTA L. Sweet birch.

Water extracts of the bark killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

OSTRYA VIRGINIANA (Mill.) Koch. Hophornbeam. Ironwood.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Acetone extracts of the wood killed 65 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

BIGNONIACEAE
(Trumpetcreeper Family)

CAMPSIS RADICANS (L.) Seem. Synonym: Bignonia radicans L. Trumpet-creeper.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CATALPA BIGNONIOIDES Walt. Catalpa.

The juice, highly concentrated, from the green leaves and beans had a slight effect on honeybees.--McIndoo and Sievers (259, p. 21).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CATALPA OVATA Don. Hardy catalpa tree.

Acetone extracts killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

BIXACEAE

BIXA ORELLANA L. Anatto tree.

The seed pulp was used by the American Indians to paint their bodies for full dress, and also to prevent mosquito bites.--Kirtikar and Basu (230, v. 1, p. 118).

HYDNOCARPUS ANTHELMINTHICUS Pierre.

The seeds were listed as an insecticide.--Greshoff (171, p. 112).

PANGIUM EDULE Reinw.

Water extracts of the bark and leaves were inefficient against tent caterpillars. The extracts from the bark appeared a little better than those from the leaves.--McIndoo and Sievers (259, p. 23).

BORAGINACEAE
(Borage Family)

BORAGO OFFICINALIS L. Common borage.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CORDIA MYXA L.

In India the Santals used the powdered bark as an external application in prurigo.--Watt (422, v. 2, p. 564).

CYNOGLOSSUM OFFICINALE L. Common houndstongue.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

HELIOTROPIUM EUROPAEUM L.

HELIOTROPIUM PERUVIANUM L.

In tests against the body louse a small piece of cloth impregnated with a saturated solution containing lubricating oil and the alkaloid heliotropine was kept for observation in a vial with a number of lice on it. All the lice were dead within 12 hours. Heliotropine was one of the best chemicals tested, being apparently nontoxic to the skin and lasting as long as 168 hours when used with cocoa butter, in which it was more soluble than in other fats. Without the oil heliotropine killed just as rapidly, but it crystallized on the underwear and soon rubbed off in wearing.--Moore and Hirschfelder (285, pp. 54, 57).

HELIOTROPIUM INDICUM L. India heliotrope.

A decoction had no effect on cotton caterpillars.--Riley (325, p. 186).

This plant is widely distributed in India, where the juice of the leaves is applied for the stings of scorpions and insects. Alcoholic extracts and water suspensions had no effect on caterpillars.--Puttarudriah and Subramaniam (312).

PULMONARIA OFFICINALIS L. Common lungwort.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SYMPHYTUM OFFICINALE L. Common comfrey.

Extracts from the dry roots were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of the roots killed 45 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

TOURNEFORTIA HIRSUTISSIMA L.

This species was used as a general insecticide in Haiti.--Roark (332, p. 38).

TOURNEFORTIA VOLUBILIS (L.) R. & S.

The powdered leaves were used as an insecticide, being very effective against ticks.--Scarone (353).

BRASSICACEAE
(Mustard, Cabbage, or Cress Family)

ARABIDOPSIS THALIANA (L.) Britton. Mouse-ear cress.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ARMORACIA RUSTICANA Gaertn. Synonym: Radicula armoracia (L.) Robinson. Horseradish.

Oil of horseradish was always repellent to the oriental cockroach.--Cole (101).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

BARBAREA VULGARIS R. Br. Synonym: Campe barbarea (L.) W. F. Wight. Bitter wintercress.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

BRASSICA JUNCEA (L.) Coss.

Oil from the seeds applied in sprays against adult mosquitoes was much inferior to the standard mosquitocide.--Wats and Singh (421).

BRASSICA NIGRA (L.) Koch. Black mustard.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of the seed (U.S.P.) killed all the mosquito larvae tested.--Hartzell and Wilcoxon (188).

BRASSICA OLERACEA CAPITATA L. Cabbage, cultivated.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

BRASSICA spp. Mustard, rape, etc.

Mustard oil is derived from the seeds of various species of Brassica (Sinapis), Chinese colza oil from B. campestris L., and rape oil probably from B. napus L. These oils have often been used in emulsions as insecticides and occasionally as repellents.

CAPSELLA BURSA-PASTORIS (L.) Medic. Synonym: Bursa bursa-pastoris (L.) Britton. Shepherds-purse.

Extracts of the entire plant were repellent to the Japanese beetle.--Metzger and Grant (277).

ERYSIMUM PEROFSKIANUM Fisch. & Mey. Afghan bittercress.

Full-strength extracts from the entire plant were repellent to the Japanese beetle.--Metzger and Grant (277).

LEPIDIUM RUDERALE L. Peppergrass.

In Austria this plant was recommended as effective against flea beetles. In Japan it was dried and powdered and used as an insecticide.--Anonymous (6).

Fumigation with this plant in hothouses was recommended against aphids and mites. When the leaves were dried in the shade and burned between sheets of paper soaked in nitric acid, they caused a very dense smoke.--Binnenthal (57, p. 69).

LEPIDIUM VIRGINICUM L. Wild peppergrass.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

BROMELIACEAE
(Pineapple Family)

ANANAS SATIVUS Schult. Pineapple.

In olfactory tests to find an attractive essential oil that could be added to a poisoned bait, the oil of pineapple was found strongly attractive to the oriental cockroach. An attractive bait was made with 6 gm. of gelatin, 200 cc. of dilute beef broth, 0.5 gm. of mercuric chloride, and 1 drop of oil of pineapple.--Cole (101).

TILLANDSIA USNOIDES L.

This species contains rotenone.--Scarone (353).

BURSERACEAE

BALSAMODENDRON PLAYFAIRII Hook. f.

The opaque, whitish gum resin was used by the Arabs and Somalis as a soap to kill lice.--Watt (422, v. 1, p. 369).

BOSWELLIA CARTERI Birdw. Frankincense.

In India frankincense and resinous gums are burned in houses to keep away mosquitoes.--Ayyar (43, p. 47).

Various gums with oils were tested to find stable emulsifiers. Frankincense was unstable.--Ginsburg (158).

BOSWELLIA SERRATA Roxb.

COMMIPHORA sp.

These plants were said to be used as insecticides in Sind, India.--Roark (332, pp. 7, 10).

BUXACEAE
(Box Family)

BUXUS SEMPERVIRENS L. Box tree.

Extracts from the leaves were more or less effective repellents against the Japanese beetle.--Metzger and Grant (277).

CACTACEAE
(Cactus Family)

CEREUS sp. Cactus.

Cactus leaves, made into a sticky paste and spread over the surface of the water, killed mosquito larvae by asphyxiation.--Howard (203, p. 74).

OPUNTIA HUMIFUSA Raf. Pricklypear.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CAESALPINIACEAE
(Senna Family)

BANDEIRAEA SIMPLICIFOLIA Benth. Kagyaw.

The leaves were used to kill lice in hen houses in the Gold Coast, Africa.--Irvine (213).

CAESALPINIA CORIARIA Willd. Divi-divi.

The commercial extract was an effective repellent against the Japanese beetle.--Metzger and Grant (277).

CASSIA ALATA L.

The powdered bark of this plant was reported to destroy ticks.--Scarone (353).

CASSIA ANGUSTIFOLIA Vahl. Senna.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

CASSIA AURICULATA L. Synonym: Senna auriculata Roxb.

In India the fresh leaves were ground into a paste with water, green hall (Phaseolus radiatus), and poppy seeds and applied to the body for itch.--Mootooswamy (286).

CASSIA BACILLARIS L. f.

Sprays containing extracts of the leaves and seeds had only a slight toxic effect on citrus aphids.--Worsley (431).

CASSIA DIDYMOBOTRIA Fres.

Extracts of the roots, stems, leaves, and seeds of this fish-poison plant from Kenya were slightly toxic to the bean aphid.--Tattersfield and Gimingham (391).

This species is a fairly widespread shrub, indigenous to East Africa, and used by the natives as a fish poison. The seeds and leaves were only moderately toxic to citrus aphids. An amorphous solid and an oily resin were obtained from the alcoholic extracts. A spray containing the former killed 100 percent of the aphids treated, but a spray containing the latter killed only 37.5 percent.--Worsley (431).

CASSIA FASCICULATA Michx. Synonym: C. chamaecrista L. Partridge-pea.

CASSIA HEBECARPA Fern. Synonym: C. marilandica. Wild senna.

Extracts were not repellent to the Japanese beetles.--Metzger and Grant (277).

CASSIA FISTULA L.

This plant is widely distributed in India. Alcoholic extracts and water suspensions had no effect on caterpillars.--Puttarudriah and Subramanian (312).

CASSIA HIRSUTA L.

Extracts of the roots, stems, leaves, and seeds of this fish-poison plant from Malaya were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

CASSIA LAEVIGATA Willd.

CASSIA MULTIJUGA Rich.

Sprays containing extracts of the leaves and seeds had only a slight toxic effect on citrus aphids.--Worsley (431).

CASSIA OCCIDENTALIS L. Coffee senna.

An alcoholic extract and a decoction had a slight effect on cotton caterpillars.--Riley (325, p. 186).

CASSIA SOPHERA L. Synonyms: Senna sophera Roxb., S. purpurea Roxb.

In India both the powdered seeds made into a plaster and an ointment made of the bruised seeds and leaves with sulfur were used for itch. The sap was a good specific for dhobie itch.--Watt (422, v. 2, pp. 223-224).

CASSIA sp.

This plant was ineffective against cockroaches.--Scott, Abbott, and Dudley (361, p. 13).

CASSIA STIPULACEA Ait.

The leaves were used as an insecticide.--Greshoff (170, p. 67).

CASSIA TORA L. Foetid cassia.

In India the leaves and seeds constituted a valuable remedy for itch.--Watt (422, v. 2, p. 226).

CERATONIA SILIQUA L. Algarroba. Carob bean.

This plant was used in Venezuela for killing insects.--Roark (332, p. 8).

COPAIFERA LANSDORFII Desf. Synonym: Copaiva lansdorfii (Desf.) O. Kze.

Copaiba.

Oil of copaiba exhibited good repellent action on screwworms for 1 or 2 days only.--Parman and coworkers (302).

COPAIFERA OFFICINALIS L. Synonym: Copaiva officinalis (L.) Jacq.

African copaiba oil (66 percent) was a powerful attractant for male fruitflies (Ceratitis rosa Ksh.) in South Africa.--Ripley and Hepburn (330).

CYNOMETRA RAMIFLORA L. Synonym: C. bijuga Spanog.

In India a lotion made by boiling the leaves in cow's milk and mixing with honey was applied externally for scabies. An oil prepared from the seeds was used for the same purpose.--Watt (422, v. 2, p. 682).

GYMNOCLADUS DIOICA (L.) Koch. Synonyms: G. canadensis Lam.,

Guilandina dioica L. Kentucky coffeetree.

Insects eating the foliage of this tree are poisoned by it.--Von Mueller (414, p. 248).

The leaves and fruit pulp, when rubbed up with milk, have been used to poison flies.--Chesnut (87, p. 28).

Juice from the green leaves mixed separately with sugar sirup, molasses, and honey had no apparent effect on the many flies tested.--McIndoo and Sievers (259, p. 22).

Extracts from the fresh leaves were repellent to the Japanese beetle.--Metzger and Grant (277).

HYMENAEA COURBARIL L.

Various gums were tested with oils to find stable emulsifiers. Anime gum was unstable.--Ginsburg (158).

TRACHYLOBIUM HORNEMANNIANUM Heyne. Zanzibar copal tree.

Copal resin was used with an odorous insecticidal material in impregnating wood to form an artificial cedar board or "mothwood" (Ger. patent 470,458).--Roark (335, p. 74).

CAMPANULACEAE
(Bellflower Family)

HIPPOBROMA LONGIFLORA (L.) Presl. Synonym: Isotoma longiflora (L.) Presl.

Powdered leaves and infusions had no perceptible effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

SPECULARIA PERFOLIATA (L.) A. DC. Venus lookingglass.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CANELLACEAE
(Canella-Bark Family)

CANELLA ALBA Murr. Synonym: C. winterana Gaertn. Canella. Wild cinnamon.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Baravol, made from the roots of this South American plant, gave fairly good results with a single wash in control of ox warbles in lowland cattle.--Holmberg (199).

CANNACEAE
(Canna Family)

CANNA sp.

The stems and leaves of canna plants contain a very effective principle, which will give as satisfactory results as tobacco in greenhouse fumigation.--Anonymous (17).

CAPPARIDACEAE
(Caper Family)

CAPPARIS APHYLLA Roth. Dela.

Water extracts, macerated juices, and dusts of dela leaves had little effect on the citrus psylla, aphids, and lucerne weevil grubs in India.--Chopra (97, p. 109).

Dela was said to be used in Sind, India, as an insecticide.--Roark (332, p. 8).

CAPPARIS SPINOSA L. Synonym: C. murrayana Graham. Caper.

In India the juice of the fresh plant was dropped into the human ear to kill worms.--Watt (422, v. 2, p. 133).

GYNANDROPSIS GYNANDRA (L.) Briq. Synonym: G. pentaphylla (L.) DC.

In India the seeds were used, rubbed with oil, as a vermicide in dressing the hair.--Watt (422, v. 4, p. 192).

In India this plant was used as an insecticide.--Chopra and Badhwar (98).

CAPRIFOLIACEAE
(Honeysuckle Family)

LONICERA JAPONICA Thunb. Japanese honeysuckle.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SAMBUCUS CANADENSIS L. American elder.

A decoction made by pouring boiling water over the leaves, flowers, or berries of the elder was recommended as a wash for wounds to prevent injury from flies.--Porcher (308, p. 448).

A hot water extract from the green tops had no effect on silkworms, webworms, or rose aphids.--McIndoo and Sievers (259, p.23).

SAMBUCUS NIGRA L. European elder.

The leaves are noxious to insects, moles, etc.--Porcher (308, p. 449).

A decoction of the leaves was recommended against Cydnus bicolor (L.) on vegetables.--Henschel (193, p. 55).

In Belgium a decoction was suggested as a spray to destroy caterpillars on fruit trees.--Anonymous (20).

VIBURNUM DENTATUM L. Arrowwood.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

VIBURNUM PRUNIFOLIUM L. Blackhaw.

Extracts of the root bark (N. F.) killed only 30 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

CARYOPHYLLACEAE
(Pink Family)

AGROSTEMMA GITHAGO L. Corncockle.

An infusion has practically no effect on fly larvae.--Cook and coworkers (104, p. 13).

SAPONARIA OFFICINALIS L. Soapwort.

The action of saponin, when applied in concentrated solution to flies, was that of an intense irritant. There was protrusion of the proboscis and progressive paralysis. [Saponin is also derived from other species in this family, and even from members of other families.]--Blyth and Blyth (64, pp. 451-452).

A concoction containing soapwort has been employed in France and Germany as an external application for the itch.--Kirtikar and Basu (230, v. 1, p. 133).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SAPONARIA VACCARIA L. Synonym: Gypsophila vaccaria Sibth. & Sm.

Cow soapwort.

The mucilaginous sap was used as a soap by the natives of Sind, India, for washing clothes, and it was said to be a cure for itch.--Murray (290, p. 95).

SILENE ANTIRRHINA L. Sleepy catchfly.

STELLARIA MEDIA (L.) Cyr. Synonym: Alsine media L. Common chickweed.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CELASTRACEAE
(Staff-Tree Family)

CELASTRUS ANGULATUS Max. Bitter tree.

This plant is widely distributed in the Yangtze and Yellow River Valleys in China. Thirteen thousand plants were collected and transplanted. The powdered leaves and root bark were effective against the cabbage beetle Phaedon brassicae Baly. In field tests against the adults of another cabbage leaf beetle, Colaphellus bowringi (Baly), the powdered root bark killed 94 percent and an alcoholic extract of the bark, each in soap solution, 91 percent; powdered leaves killed 92 percent and an alcoholic extract of the leaves, 84 percent. This plant was also effective against Locusta migratoria migratorioides (R. & F.).--China National Agricultural Research Bureau (90-92).

The ground bark of this plant, common in northern China, was used as a dust or spray against garden insects in China. Extracts used as contact sprays, however, seemed to have no effect on aphids.--Shepard (363, p. 300).

CELASTRUS SCANDENS L. American bittersweet.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

EUONYMUS AMERICANA L. Brook euonymus.

EUONYMUS ATROPURPURA Jacq. Wahoo.

The seeds were used to destroy vermin in the hair.--Porcher (308, p. 154).

Extracts of the root bark (N. F.) killed only 15 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

EUONYMUS EUROPAEA L. Spindle tree.

The berries, when powdered and dusted into the hair of sheep, destroyed lice.--Green (169, v. 1, p. 529).

This plant was listed as an insecticide.--Lyons (248, p.188).

The fruit, made into an ointment, was used for the destruction of Pediculidae.--Hare, Caspari, and Rusby (183, p. 632).

GYMNOSPORIA MONTANA Benth. Synonym: Celastrus montana Roxb.

GYMNOSPORIA SENEGALENSIS (Lam.) Loes.

The bark, ground to a paste, was applied with oils to the head to destroy Pediculidae.--Kirtikar and Basu (230, v. 1, p. 330); Watt (422, v. 2, p. 239).

TRIPTERYGIUM WILFORDII Hook, f. Roy-kung-teng. Thundergod vine.

An extract of the cortex was reported to be of value against insects attacking vegetables. Descriptions of the plant and its physical and chemical characteristics are given, together with a map showing where it is produced in Chekiang, China.--Cheng (85).

Spraying cruciferous vegetables with an extract of the roots killed the larvae and adults of cabbage beetles, Phaedon brassicae Baly and Colaphellus bowringi (Baly), and farmers found the powdered root bark of value in the control of P. brassicae.--Wong and Chin (430); China National Agricultural Research Bureau (90).

In 1934 and 1935, 20,000 plants were collected in China and transplanted on the Bureau farm. In field tests against the adults of Colaphellus bowringi (Baly), the following mortalities were obtained with powdered root bark and leaves: In soap solution 95, alcoholic extract 73; in kerosene emulsion 87; as compared with pyrethrum in soap solution 98.--China National Agricultural Research Bureau (92).

This plant appears to be the most common insecticidal plant in use in southern China. It also occurs in Japan and Formosa.--Shepard (363, p. 300).

An alkaloid was isolated from the root bark, called tripterygine, which was proved to be a strong insecticidal substance.--Hwang (207).

The poison of this plant has been found in the root bark. Its chemical nature has been investigated by the U. S. Department of Agriculture, and thousands of cuttings sent from China are being grown at the Department's plant-introduction garden at Glenn Dale, Md.--Anonymous (35).

For a long time the Chinese market gardeners have made use of the powdered roots to kill insects which eat the leaves of vegetables. Seven Chinese papers are cited dealing with the insecticidal value of this plant which has been introduced into the United States. When tested against codling moth larvae, at the rate of 2 pounds per 50 gallons of solution, the root powder gave about 60 percent of clean fruit. An alcoholic extract of the fresh root, used at the rate of 2 pounds of extractives per 50 gallons, gave 90 percent of clean fruit. The root powder was also very toxic to first instars of the diamondback moth and to the cabbage worm, but caused relatively low mortalities on first instars of the southern armyworm.--Swingle and coworkers (389).

CHENOPODIACEAE
(Goosefoot Family)

ANABASIS APHYLLA L.

In the past decade this plant has become important as the commercial source of anabasine, an alkaloid closely related to nicotine. The literature on anabasine as an insecticide has been reviewed by Roark (344).

BETA VULGARIS L. Sugar beet.

Betaine hydrochloride was ineffective for mothproofing.--Jackson and Wassell (219, p. 1177). [Betaine is derived from beet juice.]

Betaine fluosulfonate was used for preserving textile fabrics (U. S. patent 1,448,276).--Roark (333, p. 27).

CHENOPODIUM AMBROSIOIDES L. Synonyms: C. anthelminticum L.,

C. ambrosioides anthelminticum A. Gray. American wormseed.

An infusion and an alcoholic extract from the blossoms and green fruit had no effect on cotton caterpillars.--Riley (325, p. 186).

A water extract from the dried leaves and seeds had no effect on bees. A strong decoction from the leaves, stems and seeds, mixed with soap, had no effect on potato aphids and nasturtium aphids. The powder used as a dust had no effect on tent caterpillars, but a considerable effect on cockroaches; and used as a stomach poison it had no effect on grasshoppers.--McIndoo and Sievers (259, p. 22).

Oil of wormseed and carbon disulfide were the best materials to use in emulsions to destroy larvae of the Japanese beetle. The principal active ingredient of this oil is ascaridole, although other ingredients are also toxic to varying degrees.--Leach and Johnson (243).

Powdered American wormseed was effective as a repellent to screwworms for only 2 days.--Parman and coworkers (302).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

The oil of wormseed (25 p.p.m.) killed 90 to 100 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

CISTACEAE
(Rockrose Family)

HELIANTHEMUM CANADENSE (L.) Michx. Sunrose.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CLUSIACEAE
(Balsam Tree Family)

CALOPHYLLUM INOPHYLLUM L. Alexandrian laurel.

The seeds or berries contained nearly 60 percent of a fixed oil, which was used for medicinal purposes, being considered a cure for the itch.--Drury (122, p. 99).

In India the fixed oil obtained from the seed kernels was said to cure scabies.--Watt (422, v. 2, p. 31).

Extracts of the bark, which are said to be used as a fish poison in East Africa, had little toxic effect on citrus aphids.--Worsley (431).

CALOPHYLLUM SPECTABILE Willd. Kulit bentangor.

A 5-percent water extract of the bark of this Malayan fish-poison tree killed none of larvae of the moth Parasa herbifera (Wlk.), and a similar extract of the roots killed only one-fifth of the larvae treated.--Gater (153).

CALOPHYLLUM WIGHTIANUM Wall. Synonym: C. spurium Chois.

In India the oil from the seeds was used in cutaneous affections, and an infusion mixed with honey was used for scabies.--Watt (422, v. 2, p. 33).

HARONGA MADAGASCARIENSIS Choisy. Synonym: H. paniculata Lodd.

Extracts of the bark of this plant from Sierra Leone were not toxic to the bean aphid.--Tattersfield and Gimingham (391).

MAMMEA AMERICANA L.

Extracts of this plant from the West Indies were not sufficiently toxic to the bean aphid to warrant further investigation.--Tattersfield, Gimingham, and Morris (393).

Extracts of the roots, shoots, and branches of this plant from Trinidad were slightly toxic.--Tattersfield and Gimingham (391).

MESUA FERREA L. Synonym: M. speciosa Chois.

The oil of the seeds was found useful in the treatment of itch.--Kirtikar and Basu (230, v. 1, p. 155).

COCHLOSPERMACEAE

COCHLOSPERMUM GOSSYPIUM (L.) DC.

The value of karaya gum to increase the effectiveness of nicotine sulfate sprays is established. A 1-400 concentration of nicotine sulfate with soap was required to control aphids, Macrosiphum ambrosiae (Thomas). The addition of 0.2 percent of karaya gum in combination with a commercial spreader-emulsifier made it effective at a dilution of 1-2,000. In similar tests on the bean aphid nicotine sulfate with soap was as effective at 1-2,000 with the addition of 0.2 percent karaya gum as at 1-800 without it.--Eddy and Meadows (127).

The addition of 0.2 percent of karaya gum considerably increased the effectiveness of all the nicotine sprays used against Frankliniella fusca (Hinds).--Eddy and Sharp (128).

When karaya was combined with nicotine sulfate plus a wetting agent, the toxicity to the bean aphid was increased 8 to 27 percent over the toxicity of the nicotine and gum alone.--Garman (151).

COMBRETACEAE
(Myrobalan Family)

CACOUCIA COCCINEA Aubl.

Extracts of the shells and kernels of the fruit from British Guiana were not toxic to the bean aphid.--Tattersfield and Gimingham (391).

TERMINALIA CATAPPA L. Synonym: T. moluccana Lam. Indian almond.

The juice of the young leaves was employed in Southern India in an ointment for scabies.--Watt (422, v. 6, pt. 4, p. 24).

The commercial extract was an effective repellent for the Japanese beetle.--Metzger and Grant (277).

CONVOLVULACEAE
(Morning-Glory Family)

ARGYREIA NERVOSA (Burm.) Bojer. Synonym: A. speciosa Sweet.

Elephant creeper.

In India the juice, mixed with an equal quantity of gingelly [sesame] oil and a little powdered dill seed, was used as an external application for scabies.--Watt (422, v. 1, p. 310).

CUSCUTA REFLEXA Roxb. Synonym: C. grandiflora Wall.

In India this plant was used externally against itch.--Watt (422, v. 2, p. 672).

IPOMOEA HEDERACEA Jacq.

IPOMOEA PURPUREA (L.) Roth.

Decoctions of the fresh leaves and young shoots were used against aphids, scale insects, caterpillars, and flea beetles.--Binnenthal (57, p. 46).

IPOMOEA JALAPA (L.) Pursh. Jalap.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

IPOMOEA MURICATA Jacq.

The juice was used to destroy bugs.--Dymock and coworkers (124, v. 2, p. 532).

IPOMOEA PANDURATA (L.) Meyer.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

IPOMOEA sp.

Alcoholic extracts of tubers from the British Solomon Islands were not toxic to the bean aphid.--Tattersfield, Martin, and Howes (394).

CORNACEAE
(Dogwood Family)

CORNUS FLORIDA L. Flowering dogwood.

NYSSA SYLVATICA Marsh. Tupelo.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Acetone extracts of the leaves of dogwood killed 60 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

CRASSULACEAE
(Orpine Family)

KALANCHOE SPATHULATA DC.

The leaves were used as an insecticide in India.--Chopra and Badhwar (98).

CUCURBITACEAE
(Gourd Family)

BRYONIA ALBA L. White bryony.

The root and other parts can be used against aphids.--Gomilevsky (164).

CITRULLUS COLOCYNTHIS (L.) Schrad. Synonyms: Cucumis colocynthis L., Colocynthis vulgaris Schrad. Colocynth. Bitter gourd.

Decoctions were recommended in France against leaf-eating caterpillars on fruit trees.--Lesne (244, p. 511).

An excellent remedy for the cactus aphid, red spider, etc., was colocynth tincture, which was applied to the infested plants with a stiff brush. This tincture was made of 2 gm. of colocynth extract, dissolved in 100 cc. of 95 percent alcohol.--Graebener (168).

The pulp was ineffective against bedbugs, roaches, and clothes moths.--Scott and coworkers (361, pp. 5, 13, 26).

Colocynth was of no value against chicken lice and dog fleas.--Abbott (37, pp. 7, 11).

A 10-percent extract in water and fructus colocynthidis had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Commercially prepared extracts of colocynth were not toxic to the bean aphid.--Tattersfield, Gimingham, and Morris (393).

The use of aqueous extracts of colocynth, or bitter gourd, for mothproofing is discussed in a patent (Ger. 488,307).--Roark (335, p. 24).

Colocynth is widely distributed in India, where the root powder is used as an insecticide. A 5-percent extract of the leaves killed 100 percent of the caterpillars of Plutella maculipennis (Curt.) and Euproctis fraterna (Moore). A 5-percent extract of the fruits killed 100 percent of P. maculipennis, and a 3-percent extract killed 90 percent of E. fraterna. A 3-percent extract of the stems killed only 50 percent of E. fraterna and a 4-percent extract killed 100 percent.--Puttarudriah and Subramaniam (311).

Comments by reviewer.--Colocynth appears to be of little value as an insecticide, but since it is one of our common poisonous drugs a more careful toxicological study of it would be worth while.

CUCUMIS SATIVUS L. Cucumber.

The juice was said to banish wood lice and to kill cockroaches. It was recommended that floors be strewn with the green peel for three or four nights.--Drury (122, p. 173).

CUCURBITA FOETIDISSIMA H.B.K. Missouri gourd.

Acetone extracts of the roots killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

CUCURBITA PEPO L. Pumpkin.

In Germany it was suggested that freshly cut pumpkin leaves be rubbed on cattle or horses as a repellent for flies.--Anonymous (8).

Acetone extracts of pumpkin seeds killed 100 percent of the mosquito larvae tested and a concentration of over 600 p.p.m. killed 85 percent.--Hartzell and Wilcoxon (188).

ECBALLIUM ELATERIUM (L.) A. Rich. Squirting cucumber.

Elaterin, derived from this plant, was ineffective for mothproofing.--Jackson and Wassell (219, p. 1177).

MICROSECHIUM HELLERI (Peyr.) Cogn. Sanacoche. Chichicamolle.

This plant, which contains saponin, was found at Villa del Carbon, Mexico. For insecticidal purposes, the fresh roots were crushed and macerated in water (1:20) and boiled for about 1 hour, but if the roots were dry the maceration was prolonged for 2 days or more before boiling. This decoction was found satisfactory as a spray against phylloxera.--Mexico Comisión de Parasitología Agricola (279).

Alcoholic and water extracts of this plant used as sprays and the powder used as a dust had almost no effect on aphids and potato beetle larvae. The powder had no effect on silkworms and fall webworms.--McIndoo and Sievers (unpublished results of tests in 1928).

MOMORDICA CHARANTIA L. Balsam-pear.

In India the whole plant mixed with cinnamon, pepper, rice, and oil of Hydnocarpus inebrians was used as an ointment for psora, scabies, and other cutaneous diseases.--Drury (122, p. 306).

This plant was used in Haiti as a general insecticide.--Roark (332, p. 30).

MOMORDICA SCHIMPERIANA Steud. Iuru.

The fruit of this plant in East Africa was listed as insecticidal.--Bally (50).

CYCADACEAE
(Fern-Palmlike Family)

CYCAS CIRCINALIS L. Sago palm.

The male bracts of this gymnospermous tree were used in southern India as a narcotic and were called "madana-kama-pu" or "flowers of Kama," which were said to contain a property that intoxicates insects that rest upon them.--Dymock and coworkers (124, v. 3, p. 383).

CYRILLACEAE
(Cyrilla Family)

CYRILLA RACEMIFLORA L. Southern leatherwood.

Honeybees were poisoned by this plant, but only the brood was affected. The larvae died usually when nearly matured, often causing the colonies to be severely weakened.--Burnside and Vansell (72).

DICHAPETALACEAE

DICHAPETALUM RUHLANDII Engl.

This bush was poisonous to cattle and goats in Africa. Sprays containing an extract of the leaves were nontoxic to citrus aphids.--Worsley (431).

DICHAPETALUM TOXICARIUM (G.Don) Engl. West African ratsbane.

In Sierra Leone this plant was used to destroy head lice.--Dalziel (112).

DILLENIACEAE

DILLENIA INDICA L.

This plant grows in India. A 5-percent alcoholic extract of the leaves killed 80 percent of the larvae of Prodenia litura (F.) and

Crocidolormia binotalis Zell., and 100 percent of Euproctis fraterna (Moore) and Epilachna sp. Five-percent extracts of the root bark and stem bark killed 100 percent of E. fraterna. A 5-percent extract of the leaves killed only 60 to 70 percent of Lecanium viride Green.--Puttarudriah and Subramaniam (312).

DIOSCOREACEAE
(Yam Family)

DIOSCOREA CYLINDRICA Burm. Synonym: D. hispida Dennst. Nami.

This tuberous vine is common in the Philippine Islands, where the roots seem to be generally used for killing maggots infesting wounds of animals. A large root is peeled, sliced, and finely crushed in a mortar to the consistency of a paste. In an experiment all the maggots were killed within 2 days.--Manresa (264).

DIOSCOREA PISCATROUM Prain & Burkill. Tuba cherok. Sakut.

A 5-percent water extract of the roots of this Malayan fish-poison plant killed four-fifths of the larvae of the moth Parasa herbifera (Wlk.) but a 0.5-percent extract of derris roots killed all the larvae in less time.--Gater (153).

The tuber was reported in North Borneo as a more potent fish poison than many species of Derris. Alcoholic and aqueous extracts of it showed only a slight insecticidal action, but the expressed sap showed more potency although not enough to warrant an extended investigation.--Tattersfield and coworkers (394).

DIOSCOREA sp.

This plant was recommended as a repellent against fleas on man.--Kisskalt (231).

DIOSCOREA VILLOSA L. Wild yam.

Extracts of the roots killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

TAMUS COMMUNIS L. Black bryony.

The powdered root has been recommended to destroy lice in children's hair.--Greshoff (170, p. 152).

DIPSACACEAE
(Teasel Family)

SCABIOSA ATROPURPUREA L. Sweet scabiosa.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

DIPTEROCARPACEAE

DIPTEROCARPUS TURBINATUS Gaertn. f. Synonym: D. laevis Ham.

In India garjin oil, obtained from this plant, was largely employed in preserving bamboo wickerwork from insect attack.--Watt (422, v. 3, p. 170).

VATERIA INDICA L.

An effective and cheap viscous adhesive for banding to prevent ants from reaching the crowns of trees was prepared with 10 ounces of powdered Manila gum copal (the gum of this species), 1 pint of castor oil, and 1 ounce of beeswax.--Costantino (107).

DROSERACEAE
(Sundew Family)

DROSERA ROTUNDIFOLIA L. Roundleaf sundew.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

EBENACEAE
(Ebony Family)

DIOSPYROS MALABARICA (Desr.) Kostel. Synonyms: D. embryopteris Pers., Embryopteris glutenifera Roxb.

The glutinous pulp surrounding the seeds was used by the Europeans in binding books, as it was obnoxious to insects.--Drury (122, p. 210).

DIOSPYROS MONTANA Roxb.

This fish-poison plant is widely distributed in India. A 5-percent alcoholic extract of the leaves killed only 40 percent of the adult grasshoppers, Epacromia tamulus F., tested, but 100 percent of the beetle grubs (Epilachna sp.). A 3-percent extract killed 70 percent of Achaea janata (L.) and 80 percent of Diacrisia obliqua (Wlk.).--Puttarudriah and Subramaniam (311).

DIOSPYROS sp.

The wood is listed as an insecticide.--Greshoff (170, p. 103).

DIOSPYROS VIRGINIANA L. Common persimmon.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

DIOSPYROS WALLICHII King & Gamble. Tuba-buah-daun.

A 5-percent water extract of the leaves of this Malayan fish-poison tree killed only one-fifth of the larvae of the moth Parasa herbifera (Wlk.) treated, but a similar extract of the roots killed none.--Gator (153).

ERICACRAE
(Heath Family)

AGAURIA SALICIFOLIA Hook. f. Mgagana.

This plant in East Africa is listed as insecticidal.--Bally (50).

ARCTOSTAPHYLOS UVA-URSI (L.) Spreng. Bearberry.

An extract (U.S.P.) was more or less repellent to the Japanese beetle.--Metzger and Grant (277).

AZALEA NUDIFLORA L. Pinxterbloom.

CHIMAPHILA UMBELLATA (L.) Nutt. Common pipsissewa.

EPIGAEA REPENS L. Trailing arbutus.

Extracts of these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

GAULTHERIA FRAGRANTISSIMA Wall.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

GAULTHERIA PROCUMBENS L. Wintergreen.

Diluted oil of wintergreen was usually attractive to the oriental cockroach.--Cole (101).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of the whole plant killed only 20 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

KALMIA ANGUSTIFOLIA L. Lambkill.

The dried leaves had no effect on fly larvae.--Cook and Hutchison (103, p. 4).

The powdered leaves had no effect on grasshoppers and honeybees.--McIndoo and Sievers (259, p. 22).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

KALMIA LATIFOLIA L. Mountain laurel.

Infusions of the dried leaves had no effect on fly larvae in horse manure.--Cook and Hutchison (103, p. 4).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

LEDUM GROENLANDICUM Oeder. Synonym: L. latifolium Ait. True Labrador-tea.

This plant was reported to kill lice and other insects.--Williams (428, p. 916).

LEDUM PALUSTRE L. Crystal-tea.

It was reported from Austria that this plant killed lice, bedbugs, fleas, moths, and other insects. It was most active when green and in blossom, but the dried material was also effective.--Anonymous (3).

The leaves and twigs were used as an insecticide.--Lyons (248, p. 266).

LEUCOTHOE GRAYANA Maxim.

Extracts of dried leaves were sprayed on larvae of various insects in Japan. Some of the samples seemed to be fairly toxic to Phaedon brassicae Baly, 50 to 80 percent being killed, but most of them were not effective enough to be promising as insecticides.--Harukawa (189).

LYONIA OVALIFOLIA (Wall.) Drude. Synonyms: Pieris ovalifolia (Wall.) D. Don., Andromeda ovalifolia Wall.

In India the young leaves and buds were used to kill insects, and an infusion was employed in cutaneous diseases.--Watt (422, v. 3, p. 90).

OXYDENDRUM ARBOREUM (L.) DC. Sourwood.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PIERIS JAPONICA (Thunb.) D. Don. Asebo, asemi, etc.

This plant is known by at least 38 common names. It was first described by Kraempfer in 1712 under the names "asjebo (asebo)" and "asjemi (asemi)." It is very common in all the mountainous regions of Japan and has been used for a long time as an insecticide. One employs, according to the circumstances, a decoction of fresh leaves (150 gm. of ground leaves per liter of water), dried leaves (30 gm. per liter), or dried branches with leaves (70 gm. per liter). The mixture is boiled for 45 to 60 minutes, and when it is ready to be used the first is diluted 10 times, the second once, and the third twice.--Motte (288).

RHODODENDRON HUNNEWELLIANUM Rehder & Wilson. Nao-yang-wha.

This plant grows in China, and the compounds (andromedotoxine and an unidentified substance) present in it are effective as insecticides. Preparations made from this plant paralyzed the insects, the injury spreading from the posterior to the anterior end. It is recommended especially as a stomach poison, and three formulas are given.--Ku (237).

This species grows wild in the Yangtze River region in China and is used there as a stomach poison for insects. The flowers are supposed to be the most valuable, but in recent tests extracts of the flowers had no value against aphids as a contact poison.--Shepard (363, p. 299).

RHODODENDRON JAPONICUM (Gray) Suring. Synonym: R. molle Sieb. & Zucc.

The powdered flowers might be used to good advantage to control the mulberry white caterpillar (Rondotia menciana Moore) in China.--Scarone (353).

RHODODENDRON MOLLE (Bl.) G. Don. Synonym: R. sinense Sw. Sheep poison.

This species has been found effective against certain insects in China.--Chiu (94).

The dried and ground flowers were commonly sold by Chinese drug stores because of their effectiveness against bugs and maggots. In 1935, 18,000 plants of this species were collected and transplanted on the Bureau farm in China. In field tests against the adults of cabbage leaf beetles, Colaphellus bowringi (Baly), the following mortalities were obtained with the powdered flowers: In soap solution 96, alcoholic extract in soap solution 92, in kerosene emulsion 81; as compared with pyrethrum in soap solution 98.--China National Agricultural Research Bureau (92).

RHODODENDRON sp.

The best results obtained against the mulberry white caterpillar (Rondotia menciana Moore) were with a pyrethrum-soap solution, which was followed in effectiveness by a rhododendron-soap solution and croton oil emulsion.--Chen (84).

VACCINIUM sp. Blueberry.

Extracts from the leaves and berries were repellent to the Japanese beetle.--Metzger and Grant (277).

ERYTHROXYLACEAE

ERYTHROXYLON COCA Lamarck. Coca.

An aqueous solution of 0.05 part of cocaine hydrochlorate mixed with 2 parts of honey did not affect ants.--Cobelli (100).

In Brazil a tincture of coca leaves was recommended as a remedy for lice on poultry.--Carneiro (78).

Folia coca and hydrochlorax cocaini (10 percent in flour) had no effect on caterpillars of Prodenia litura (F.).--DeBussy (76).

Spray solutions of cocaine hydrochloride were tested against the bean aphid. The concentration required to kill about 95 percent of the aphids was greater than 1 gm., while that of nicotine sulfate was 0.009 gm. to 100 cc.--Richardson and Smith (322).

EUPHORBIACEAE
(Spurge Family)

ACALYPHA INDICA L. Synonym: A. spicata Forsk.

In India the powdered leaves mixed with common salt were applied externally for scabies. The powder of the dry leaves was used in wounds attacked by worms.--Watt (422, v.1, pp. 63-64).

This medicinal "Indian acalypha" is widely distributed in India. A 5-percent alcoholic extract of the stem bark killed caterpillars as follows: 90 percent of Plutella maculipennis (Curt.) and Pericalia ricini (F.), 50 percent of Prodenia litura (F.), 40 percent of Crocidolomia binotalis Zeller., and 100 percent of Euproctis fraterna (Moore).--Puttarudriah and Subramanian (312).

ALEURITES FORDII Hemsl. Tung-oil tree.

Since stink bug nymphs in southern China migrate by ascending litchee trees, sticky bands composed of tung oil and resin were used to trap them.--Hartman (187).

The acids or acid compounds in oxidized or blown tung oil were used (U. S. patent 1,739,840; Brit. patent 247,242) to form salts with rare earth elements for use in mothproofing compositions.--Roark (333, p. 109).

Tests were conducted to find an adhesive for cryolite suspensions to be used against Busseola fusca (Full.) on maize in South Africa. Of the 31 materials examined, boiled linseed oil, tung oil, and fish oil, in this order, were the only ones of sufficient adhesive value to justify their use.--Ripley and Hepburn (329).

Extract of the leaves of this tree killed 40 percent of the mosquito larvae tested, but the extract of the stems killed only 5 percent and the extract of the roots killed none.--Hartzell and Wilcoxon (188).

ANDRACHNE CORDIFOLIA Muell. Arg.

This plant was used in India as an insecticide.--Chopra and Badhwar (98).

CLEISTANTHUS COLLINUS (Roxb.) Benth. and Hook.

The bark of this Indian fish-poison tree was thought to contain some poisonous property, for white ants leave it alone. The inner bark placed on the sores of sheep and goats was efficacious in healing them and in destroying infesting maggots.--Hooper (201).

CLEISTANTHUS spp.

Green vegetable matter decaying in water sometimes pollutes the water and thus helps to control mosquitoes. One of the best genera so far found in India is Cleistanthus, which is poisonous to fish.--Hackett and coworkers (175, p. 1028).

CROTON CAPITATUS Michx.

CROTON GLANDULOSUS L.

CROTON MONANTHOGYNUS Michx.

CROTON TEXENSIS (Klotzsch) Muell. Arg. Crotonweeds.

Decoctions from the leaves and blossoms of these species had no effect on cotton caterpillars.--Riley (325, p. 186).

CROTON ELUTERIA (L.) Swartz. Cascarilla.

In Bermuda fresh cascarilla bark is burned to obtain a smudge for driving away mosquitoes.--Howard (203, p. 30).

CROTON FLAVENS L.

This plant was reported to be used as an insecticide in Venezuela, but it had no effect on roaches, flies, or gnats.--Thoms (401).

CROTON OBLONGIFOLIUS Roxb.

The seeds were stated to be used as an insecticide in India.--Chopra and Badhwar (98).

CROTON sp.

Croton was used in China as an insecticide; its poison killed aphids (Jen. 1938. Univ. of Minn. Master's thesis).--Shepard (363, p. 29).

Caincanapire [a species of Croton] was used in Venezuela for killing insects.--Roark (332, p. 8).

CROTON TIGLIUM L.

In eastern China one of the control measures for larvae of Rondotia menciana Moore, attacking mulberry trees, was spraying with croton oil emulsion.--Chu (99).

The seeds of this species are the source of an important home-made insecticide in China. The methods of making and using are given.--Jung (223).

This plant has been found of insecticidal value against certain insects in southern China.--Chiu (94).

This plant is cultivated in China, where the powdered seeds soaked in water are used to destroy Rondotia menciana and aphids.--Scarone (353).

EREMOCARPUS SETIGERUS (Hook.) Benth. Turkeymullein.

Cold-water extracts of this common weed of southern Oregon were found to be toxic to goldfish, just as are extracts of derris and cube root. Extended studies were being made by the Oregon State Department of Agriculture to determine whether this plant could be developed as a source of insecticide.--Thomssen and Doner (402).

EUPHORBIA ANTIQUORUM L.

The juice was used to kill maggots in wounds.--Kirtikar and Basu (230, v. 2, p. 1131).

EUPHORBIA BICOLOR Engelm. & Gray.

EUPHORBIA MARGINATA Pursh.

The juice of these plants was used to some extent in Texas to brand cattle, it being held to be superior to a red-hot iron for that purpose, because screwworms would not infect the fresh scar and the spot healed more readily.--Chesnut (88, p. 407).

EUPHORBIA BIGLANDULOSA Desf.

EUPHORBIA DENDROIDES L.

Decoctions of these plants were recommended as insecticides.--Sprenger (373).

EUPHORBIA COTINOIDES Miquel.

A water extract had a considerable effect on silkworms.--McIndoo and Sievers (259, p. 22).

Extracts of the stems and leaves of this fish-poison plant from British Guiana were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

EUPHORBIA CYPARISSIAS L.

In Crete gardeners collected these plants, crushed them, and expressed the juice, and then diluted it with water to make a 2 to 4 percent solution. After an hour the liquid was used for watering gardens in which melons, cucumbers, etc., had been planted, in order to destroy the mole cricket.--Rastello (315).

EUPHORBIA HELIOSCOPIA L. Dodhak.

Water extracts, macerated juices, and dusts of dodhak leaves were tested against Psylla, aphids, and weevil grubs, but poor results were obtained.--Chopra (97, p. 109).

EUPHORBIA IPECACUANHA L. Spurge.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

EUPHORBIA HYBERNA L.

Extracts of the stems and leaves of this fish-poison plant from Ireland were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

EUPHORBIA MARGINATA Pursh. Synonym: Dichrophyllum marginatum Klotzsch & Garcke. Snow-on-the-mountain.

A decoction was ineffective against cotton caterpillars.--Riley (325, p. 186).

EUPHORBIA NERIIFOLIA L.

This species was said to be used as an insecticide in Sind, India.--Roark (332, p. 22).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

EUPHORBIA RESINIFERA Berg. Cactuslike plant of Morocco.

Euphorbium gum had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Various gums were tested with oils to find stable emulsifiers. Euphorbium gum was unstable.--Ginsburg (158).

EUPHORBIA sp. Spurge.

A decoction of spurge gave only 38 percent kill of Malacosoma neustria (L.).--Goriainov (166).

EUPHORBIA THYMIFOLIA L.

This plant was stated to be used as an insecticide in India.--Chopra and Badhwar (98).

EUPHORBIA TIRUCALLI L.

This species was used as a fish poison and as an insecticide in India.--Roark (332, p. 22).

All parts of this plant were said to poison fish in East Africa, but it was not widespread. A 2-percent extract of the stems killed 72.5 percent of the citrus aphids sprayed.--Worsley (431).

This tree in East Africa was said to keep away mosquitoes.--Bally (50).

EUPHORBIA VERMICULATA Raf.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Comments by reviewer.--So far this genus does not appear to be a promising one in which to find efficient insecticidal material.

EXCOECARIA AGALLOCHA L. Blinding tree. Babooter.

The Malays knew of the poisonous qualities of this tree and used the sap to kill maggots infesting sores on buffaloes.--Stevens (374, footnote, p. 107).

FLUGGEA LEUCOPYRUS Willd. Synonyms: Phyllanthus leucopyrus Roxb.; Securinega leucopyrus Muell. Arg; F. virosa (Willd.) Dals. & Gibs.

The bark was used to kill fish, and the juice of the leaves was fatal to worms in sores.--Dalzell and Gibson (111, p. 236).

In India the juice of the leaves or the leaves made into a paste with tobacco were used to destroy worms in sores.--Watt (422, v. 6, pt. 2, p. 496).

FLUGGEA MICROCARPA Blume.

The juice of the leaves or the leaves made into a paste with tobacco were used to destroy worms in sores.--Kirtikar and Basu (230, v. 2, p. 1147)

This species was used as a fish poison and as an insecticide in India.--Roark (332, p. 23).

HEVEA spp. Rubber tree.

Rubber latex was employed as an ingredient of an adhesive composition which might be used for mothproofing (British patent).--Isaacs (214).

HURA CREPITANS L. Sandbox tree.

Both 10- and 20-percent sap killed most of the aphids tested within 3 days, but both 5- and 10-percent sap mixed with soap were inefficient. The alcoholic extracts of the bark and sawdust were inefficient, but the extract of the bark seemed promising.--McIndoo and Sievers (259, p. 8).

In 1924 and 1925 the sap or latex of this tree was again tested. Both 5-percent and 10-percent latex mixed with soap were efficient against Aphis spiraecola Patch within 2 days. A 5-percent sap taken from the upper portion of the latex killed nearly all the three species of aphids sprayed within 2 days.--McIndoo and Sievers (unpublished).

HURA POLYANDRA Baill. Javillo.

In Central America this plant produces a latex of blistering properties which was used against microscopic skin parasites, especially Tunga penetrans (L.).--Scarone (353).

JATROPHA MACRORHIZA Benth.

A powder used as a dust had a slight effect on tent caterpillars and roaches.--McIndoo and Sievers (259, p. 22).

MALLOTUS PHILIPPINENSIS (Lam.) Muell. Arg. Monkeyface tree. Kamala.

In India the leaves and fruit mixed with honey were made into a cataplasm for the treatment of itch.--Watt (422, v. 5, p. 116).

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

MANIHOT DULCIS (Gmel.) Pax. Sweet cassava.

Tapioca was employed as a constituent of an adhesive composition which might be used for mothproofing (British patent).--Isaacs (214).

OLDFIELDIA AFRICANA Benth. and Hook. f. African oak.

The bark and leaves were used in Liberia as remedies for hair lice and crab lice.--Dalziel (112).

PHYLLANTHUS CONAMI Sw. Danconami.

Extracts of the roots, stems, and leaves of this fish-poison plant from British Guiana were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

PHYLLANTHUS NIRURI L.

In India the bruised leaves were applied for scabies.--Watt (422, v. 6, pt. 1, p. 222).

PHYLLANTHUS SIMPLEX Retz.

In India the fresh leaves bruised and mixed with buttermilk made a wash to cure the itch in children.--Watt (422, v. 6, pt. 1, p. 224).

RICINUS COMMUNIS L. Synonyms: R. vulgaris Mill., R. medicus Forsk.

Castor-bean plant. Castor-oil plant.

Attention is called to recent publicity on the insecticidal uses of this plant.--Haller and McIndoo (180).

SAPIUM ELLIPTICUM (Hochst.) Pax. Msharaka.

The branches of this plant in East Africa were used on maggot-infested wounds.--Bally (50).

SAPIUM INDICUM Willd.

The seeds were used in India as a fish poison and as an insecticide.--Roark (332, p. 35).

SEBASTIANA PAVONIANA Muell. Arg. Arrowwood.

This species is found in Guatemala. Its milky juice caused the death of various insects.--Scarone (353).

STILLINGIA SYLVATICA L. Stillingia.

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

TRAGIA sp.

This is one of the insecticidal plants occurring in Nicaragua.--Roark (332, p. 38).

Comments by reviewer.--Despite all the work done on the numerous species of Euphorbiaceae, none have yet furnished material for a valuable insecticide.

FABACEAE
(Pea Family)

ABRUS PRECATORIUS L. Prayer beads.

Extracts of the roots and stems killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ARACHIS HYPOGAEA L. Peanut. Groundnut.

Many published papers discuss oil of peanut or groundnut as an insecticide and repellent.

ASTRAGALUS GUMMIFER Labill.

Various gums were tested with oils to find stable emulsifiers. Tragacanth gum was unstable.--Ginsburg (158).

ASTRAGALUS spp. Locoweeds.

When honeybees were poisoned by these plants, adult workers and pupae were mostly affected, the field bees dying first and then the pupae. The queens frequently died, and the colonies became demoralized, and sometimes died.--Burnside and Vansell (72).

BAPTISIA TINCTORIA (L.) R. Br. Synonym: Sophora tinctoria L.

Yellow wild indigo.

The plants when placed in the harness kept flies from the horses.--Williams (428, p. 916).

An alcoholic extract and a decoction had no effect on cotton caterpillars.--Riley (325, p. 184).

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

BUTEA MONOSPERMA (Lam.) Taub. Synonym: B. frondosa Roxb. Butea.

Kino gum.

In India the seeds were used for the cure of dhobies itch.--Watt (422, v. 1, p. 553).

This was one of four efficient gums among those tested with oils to find stable emulsifiers.--Ginsburg (158).

The seeds were used as an insecticide in India.--Chopra and Badhwar (98).

CAJANUS INDICUS Spreng.

This species, found in Mysore, India, was of no value as an insecticide.--Puttarudriah and Subramaniam. (311).

CALOPOGONIUM VELLUTIUM Benth. Catinga de macaco.

In Brazil satisfactory results were obtained with the alcoholic extract of this fish-poison plant against lice and ticks. Chemical analysis indicated that the extract contained rotenone.--Ildefonso Ramos (211).

CLADRASTIS (MAACKIA) AMURENSIS K. Koch. Cladrastis.

Extracts of the roots and stems killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

CLITORIA MACROPHYLLA Wall.

Extracts of the roots of this plant from Siam were slightly toxic to the bean aphid.--Tattersfield and Gimingham (391).

CRACCA spp. See TEPHROSIA.

CROTALARIA PANICULATA Willd.

This plant was used in India as a fish poison and as an insecticide.--Roark (332, p. 14).

CROTALARIA spp.

In tests on the effect of poisonous plants on cane grubs in Queensland this genus was the most promising.--Jarvis (220).

CROTALARIA VERRUCOSA L. Synonym: C. angulosa Lam.

The juice of the leaves and tender stalks was used in cases of scabies.--Watt (422, v. 2, p. 614).

CYTISUS LABURNUM L. Laburnum.

Cytisine is an alkaloid showing physiological properties similar to those of nicotine. Tests with body lice, in which garments were impregnated with weak solutions of cytisine, were satisfactory from the experimental viewpoint, but this alkaloid was too toxic to the human skin to be considered as a practical louse remedy.--Bacot (48).

Cytisine is rather widely distributed in nature, being found in many species of Cytisus and also in several species of Genista, Ulex, Sophora, and Baptisia. It has been isolated from the seeds of laburnum (1.56 percent), gorse (1.03 percent), broom, Sophora speciosa Benth. (the poison bean of Mexico and Texas, 3.23 percent), S. secundiflora Lagasca (a small shrub of Texas, 3.47 percent), S. tomentosa Schrurbaum (2.06 percent), and Baptisia australia (1.56 percent). The crude cytisine, unlike nicotine, did not prove toxic to the eggs of a moth. A 5-percent chloroform extract of the seeds killed 100 percent of the bean aphid and a 2.5-percent extract killed 80 percent, while a 0.06-percent nicotine solution killed 92 percent.--Tattersfield and coworkers (393).

CYTISUS SCOPARIUS (L.) Link. Scotch broom.

An infusion made from freshly crushed broom tops was recommended for killing larvae of the cabbage butterfly. In France it had also been found effective for removing cochylis larvae from vines and various caterpillars from apple trees.--Anonymous (26).

Water extracts from the tops of Scotch broom, collected in two localities, had practically no effect on silkworms. Since this plant contains sparteine, a 0.5-percent solution of sparteine sulfate was fed to silkworms. This solution proved efficient but acted very slowly.--McIndoo and Sievers (259, p. 22).

Sparteine has a narcotic action similar to that of coniine and, to some extent, of nicotine. Sparteine was tested both as sulfate and as base. The sulfate was not found materially toxic at a concentration equal to 1 percent of the base, but the base at this concentration gave 100-percent control of the bean aphid. Sprays containing 0.35 and 0.2 percent of pure cytisine killed 100 and 80 percent of bean aphids, respectively, and sprays containing 0.5 and 0.4 percent of crude cytisine killed 98 and 80 percent. Sprays containing 2.5 and 1.0 percent of crude-chloroform extract of broom seeds killed 100 and 40 percent.--Tattersfield and coworkers (393).

DALEA VULNERARIA var. BARBATA Oerst. Synonym: Parosela barbata (Oerst.) Rydb.

Two constituents were isolated from this Florida plant, but they were nontoxic to insects.--Roark (342).

DERRIS. Synonym: Deguelia.

Since several reviews on the use of Derris as an insecticide have been published (Roark 234, 339, and 340), the reader is referred to them for digests of the literature on this group of plants. Little information is given here other than to name the species that have been tested for insecticidal value. A more recent article by Roark (343) discusses the present status of rotenone and rotenoids as insecticides.

DERRIS BENTHAMI Thw.

Insecticidal investigations on this plant, which was reputed in Ceylon to be a fish poison, were begun in 1928.--Stockdale (375, pp. 78-79).

DERRIS CHINENSIS Benth.

This species has been found by test to have insecticidal value.--Roark (334, p. 2).

DERRIS CUNEIFOLIA Benth. Synonym: Deguelia cuneifolia (Benth.) Taub.

Derris cuneifolia was the only plant used in Hong Kong, China, as an insecticide. It was imported in small quantities from Singapore.--Roark (332, p. 18).

DERRIS ELLIPTICA (Roxb.) Benth. East Indian fish poison. Derris.

This was the first species of Derris to be tested for insecticidal purposes, and it is the most important species cultivated and used in preparing commercial derris insecticides.

To control the insects infesting the nutmeg plant in 1848 it was necessary to wash the leaves with a decoction of tuba root.--Oxley (296, p. 651).

This was the species tested mostly by the United States Department of Agriculture in 1919 and 1924, although the commercial powder used was a mixture of D. elliptica and D. uliginosa.--McIndoo and coworkers (259, 260).

DERRIS HEPTAPHYLLA (L.) Merr.

This species had insecticidal value.--California Agricultural Experiment Station (77, p. 53).

DERRIS KOOLGIBBERAH F. M. Bailey.

Alcoholic extracts were generally efficient, but this species was unsatisfactory for insecticidal purposes.--McIndoo and coworkers (260, pp. 188, 199).

DERRIS MALACCENSIS (Benth.) Prain. Derris

This species is effective against lepidopterous larvae.--Gater (153, p. 322).

This species and D. elliptica are cultivated in Malaya, Philippine Islands, Sarawak, and Indo-China, and practically all the exported roots are obtained from these two species.--Holman (198, pp. 60, 69, 71, 73).

DERRIS OLIGOSPERMA K. Schum.

Alcoholic extracts were seldom efficient, and this species was unsatisfactory for insecticidal purposes.--McIndoo and coworkers (260, pp. 188, 199).

DERRIS PHILIPPINENSIS Merr.

The powdered roots of this Philippine species were effective against mosquito larvae and aphids.--Castillo (81).

DERRIS POLYANTHA Perk.

The powdered roots of this Philippine species were more effective against aphids and mosquito larvae than those of either D. elliptica or D. philippinensis.--Castillo (81).

DERRIS ROBUSTA Benth. Same as for D. oligosperma.

DERRIS SCANDENS (Roxb.) Benth.

Extracts were seldom efficient and this species was unsatisfactory for insecticidal purposes.--McIndoo and coworkers (260, pp. 188, 199).

This species, which is indigenous to Queensland, appears to be of no commercial value.--Holman (198, p. 74).

DERRIS sp.

Japanese farmers apply treatments containing a soap with rotenone derived from a species said to be Derris sekken.--Scarone (353). [This specific name could not be found by F. J. Hermann.]

DERRIS THYRSIFLORA Benth.

This species was slightly toxic to lepidopterous larvae.--Gater (153, p. 322).

DERRIS TRIFOLIATA Lour. Synonym: D. uliginosa (Roxb.) Benth.

In India this species was reported to have an insecticidal value.--Perrédès (305).

Alcoholic extracts of the stems from the Fiji Islands were generally efficient.--McIndoo and coworkers (260, pp. 188, 199).

This species, which is indigenous to Queensland, appears to be of no commercial value.--Holman (198, p. 74).

DESMODIUM LABURNIFOLIUM (Poir) DC. Synonym: Meibomia laburnifolium DC.

The leaves were used as an insecticide.--Greshoff (171, p. 72).

DESMODIUM TRIFLORUM (L.) DC. Synonym: Meibomia triflora (L.) Kuntze.

A paste of the bruised leaves with kamala was applied to indolent sores and as a remedy for itch.--Kirtikar and Basu (230, v. 1, p. 430).

DIPTERYX ODORATA Willd. Synonym: Coumarouna odorata Aubl. Tonka bean.

Coumarin, when chemically pure and used in relatively large quantities, was toxic to grain weevils.--Zacher (436, p. 152). [Coumarin is obtained from tonka beans, sweetclover, and other plants, and also made synthetically.]

An alcoholic solution of coumarin has been used for mothproofing purposes (Ger. patent 485,101).--Roark (335, p. 25).

DOLICHOS LUPINIFLORUS N. E. Brown.

Extracts of the roots of this fish-poison plant from southern Rhodesia were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

DOLICHOS PSEUDOPACHYRRHIZUS Harms. Mhayo.

The roots of this plant in East Africa are listed as insecticidal.--Bally (50).

The natives of Kenya boiled the bulbous roots of this fish-poison plant and used the liquid for removing ticks from sheep and goats. The alcoholic extracts of the roots were sometimes efficient against the bean aphid, but the results demonstrated that the roots were not of commercial interest although they might have some value for local use.--Tattersfield and coworkers (394).

DREPANOCARPUS LUNATUS (L. f.) Mey.

Extracts of the leaves, stems, roots, and fruit of this plant from British Guiana were nontoxic to the bean aphid.--Tattersfield and Gimingham. (391).

ERIOSEMA PSORALEOIDES Don. Synonym: E. cajanoides Hook. f.

In tropical West Africa the leaves were used to rub on dogs as a remedy for or preventive of lice, etc.--Dalziel (112).

ERYTHRINA VARIEGATA Stickm. Synonym: E. indica Lam.

In the Concan, India, the juice of the young leaves was used to kill worms in sores.--Kirtikar and Basu (230, v. 1, p. 440).

GALEA OFFICINALIS L. Common goatsrue.

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

GENISTA GERMANICA L. European broom.

The control of cabbage worms in France was the spray made from an infusion of this shrub. It might be retained as useful for it had repeatedly been reported as very satisfactory, acting both as an insecticide and insectifuge.--Blanchard (60).

In France an infusion of the European broom was recommended as a spray against the larvae of cochylis and the cabbage butterfly. A bundle of the fresh twigs was kept in water for 10 days, preferably broken in short fragments, before use.--Anonymous (25, 26).

GENISTA sp. Broom.

Sparteine and other extracts of broom seeds have been used for mothproofing purposes (Ger. patent 421,100).--Roark (333, p. 31).

GENISTA TINCTORIA L. Woadwaxen.

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

GLIRICIDIA SEPIUM (Jacq.) Steud. Madriado.

This species was considered one of the insecticidal plants occurring in Nicaragua.--Roark (332, p. 23).

GLYCYRRHIZA GLABRA L. Common licorice. Same as for Genista tinctoria.

HAEMATOXYLON CAMPECHIANUM L. Logwood.

Two commercial extracts were effective repellents against the Japanese beetle.--Metzger and Grant (277).

INDIGOFERA TINCTORIA L. Synonym: I. indica Lam. True indigo.

In Jamaica this plant was employed to destroy vermin.--Porcher (308, p. 205).

A strong infusion of indigo roots was said in India to destroy vermin in the hair.--Watt (422, v. 3, p. 86).

The seeds yielded a tincture which was used to destroy lice.--Greshoff (170, p. 52).

Wool dyed with indigo was badly damaged by larvae of Tinea pellionella L. and Attagenus piceus (Oliv.).--Minaeff (280).

LONCHOCARPUS spp.

In 1924, when McIndoo and Sievers (259) first reported on the insecticidal use of cube, it was impossible to give the botanical name of this plant. Since 1924 the botanists have become greatly interested in the South American fish-poison plants. Up to 1937 there was still confusion concerning the correct botanical names for the plants known locally as cube, haiari, and timbo, but more definite information on this subject was had when Krukoff and Smith (235) in 1937 reported that they had studied 11 species of South American rotenone-yielding plants, including three new species (Lonchocarpus sylvestris, L. martynii, and L. utilis), with special reference to native names, distribution, economic importance, and specimens examined. The literature was reviewed by Roark (336, 338) in 1936 and 1938.

The six species that have been tested for insecticidal properties are reported below.

LONCHOCARPUS CHRYSOPHYLLUS Kleinh. Black haiari (British Guiana).

Nekoe (Surinam).

The species appears well distributed in British Guiana and Surinam. The rotenone content of the roots averaged 2.1 percent, and the

extractives content 9.4 percent. The natives use the roots as a fish poison more extensively than those of the white haiari (L. martynii), as the plant is more common. The plant is not yet used for commercial purposes, although it is under experimental cultivation in British Guiana and the Federated Malay States.--Krukoff and Smith (235).

Alcoholic extracts were tested against the bean aphid.--Tattersfield and coworkers (393).

LONCHOCARPUS LATIFOLIUS (Willd.) H. B. K. Acurutu.

Extracts of this species from Trinidad were slightly toxic to the bean aphid.--Tattersfield and Gimingham (391).

LONCHOCARPUS MARTYNII A. C. Smith. White haiari.

This species appears to be found throughout British Guiana. The rotenone content of the roots averaged only 2.3 percent, and the extractives content 10.1 percent. The plant is not used for commercial purposes, although it is under experimental cultivation in British Guiana and the Federated Malay States.--Krukoff and Smith (235).

Alcoholic extracts were tested against the bean aphid.--Tattersfield and coworkers (393).

LONCHOCARPUS RARIFLORUS Mart.

This species has a wide range, being found throughout Amazonian Brazil and in British Guiana. The roots are not collected commercially, as they contain only traces of rotenone and an average of 7 percent of extractives. An extract of the roots is often used by the natives for exterminating "sauba" ants.--Krukoff and Smith (235).

LONCHOCARPUS URUCU Killip and Smith. Timbo vermelho (Amazonian Brazil).

Timbo urucú (Pára).

This species is widely distributed throughout Brazil and it was found often in large clumps several acres in extent. The roots often are 3.5 inches in diameter and extend from 65 to 82 feet in length, resembling garden hose, and confined to the upper 12 inches of the soil. The rotenone content averaged 4.4 percent, and the extractives content 17 percent. The bulk of roots and powder now exported from Pára and Manaos is from this species.--Krukoff and Smith (235).

During the past decade this species has strongly competed with the L. utilis as an insecticide, but L. utilis was tested as an insecticide long before timbo was known to have insecticidal properties. Both species have recently been given new botanical names.

LONCHOCARPUS UTILIS A. C. Smith. Synonym: L. nicou (Aubl.) DC. Cube and barbasco (Peru). Barbasco (Ecuador). Timbo (Brazil).

This species is found throughout the Amazon Basin, in Ecuador, Peru, and Brazil, and the natives generally recognize it as a very effective fish poison. Since all the specimens seen by collectors were either of cultivated plants or of plants growing in secondary forests on the sites of old Indian plantations, it is doubtful whether this species grows wild. The rotenone content of the roots averaged 12 percent and the extractive content 25 percent. The bulk of cube or barbasco roots now exported from Peru (Iquitos) is this species. The roots are seldom collected in Brazil, as no large quantities of them appear to exist either in Amazonas or Pará.--Krukoff and Smith (235).

This is the species that W. J. Dennis, head of the missionary school at Huancayo, Peru, first purchased at a shop in Huancayo for Dr. Eigenmann to use in catching fish. Some of the roots were brought to the United States in 1920 by Dr. Allen, a student at Indiana University. These were later ground into powder, some of which was sent by Dr. Eigenmann to the writer who first tested it on March 23, 1921.

LUPINUS ALBUS L.

LUPINUS ANGUSTIFOLIUS L.

LUPINUS LUTEUS L.

LUPINUS NIGER L. Lupine.

Six patents (Brit. 230,203, Can. 247,378, Ger. 421,100 and 488,307, U. S. 1,610,167 and 1,885, 292) have been granted in which the alkaloidal extract of the seeds of these plants are used for mothproofing.--Roark (333, p. 56; 335, p. 38); Roark and Busbey (346, p. 29).

LUPINUS PERENNIS L. Sun-dial lupine.

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

LUPINUS spp.

A quantity of yellow lupine was grown but an extract of the roots gave negative insecticidal results.--Durham (123).

The leaves, stems, and roots of the three species of Lupinus tested had no marked poisonous action. Alcoholic extracts of the seeds of a perennial and of an annual blue lupine were toxic, but the toxicity of these plants was not of the same order as that of Tephrosia toxicaria and T. vogelii.--Tattersfield and coworkers (393).

MELILOTUS ALBA Desr. White sweetclover.

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

MELILOTUS ALTISSIMA Thuill. Clover.

Mosquitoes in Egypt fed on the juice of the highly scented blossoms, which contain coumarin. It was suggested that coumarin might have a similar action in the mosquito to that which quinine had in man and that the wealth of leguminous crops, especially of clovers, occurring in the cultivated areas of Egypt, might be responsible for the immunity from malaria in these areas.--Willcocks (426).

Inasmuch as synthetic coumarin had no deleterious influence on adult mosquitoes (Anopheles spp. and Culex fatigans Wied.), it was believed that coumarin taken with the liquid extracted from clover blossoms would have no deterrent action on malarial parasites in the mosquito.--Mayne (273).

MELILOTUS OFFICINALIS (L.) Lam. Yellow sweetclover.

The natives of Bessarabia kept their houses free of moths by keeping bunches of this plant in all the rooms. This effect was confirmed by experiment.--Ossipov (295).

A saturated solution of coumarin in sugar solution was ineffective against the housefly.--Jackson and Lefroy (217).

MILLETTIA AURICULATA Baker.

In India the roots were applied to sores on cattle to kill vermin.--Watt (422, v. 3, p. 89).

The roots were used as an insecticide.--Greshoff (171, p. 69).

MILLETTIA PACHYCARPA Benth. Fish-poison climber.

Extracts of the bark from Burma were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

This plant has been found of insecticidal value against certain insects in south China.--Chiu (94).

This plant is widely distributed in the mountains of Kwangsi Province in China. It contains a large amount of saponin and possibly considerable rotenone. Mixed with soap it acted both as a contact and a stomach poison, being as efficient as derris and far cheaper.--Chen (83).

The best method of cultivating this insecticidal plant in China is described.--Ku (236).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

An alcoholic extract of roots from China was tested against the bean aphid. Concentrations of 1, 0.5, and 0.25 percent each paralyzed 100 percent of the aphids sprayed, but a 0.1 percent concentration paralyzed only 55 percent. In toxicity these roots were better than the leaves of Tephrosia vogelii and equal to the roots of T. macropoda which were tested at the same time, but not equal to the rotenone-rich roots of Derris elliptica. Unless greatly improved by selection it could not commercially compete with D. elliptica, but where locally available it should prove of value.--Tattersfield and coworkers (394).

The seeds are toxic to several species of insects. Further studies on this plant offer a fertile and promising field.--Chiu and coworkers (95).

Comments by reviewer.--More work on this promising plant should be done using insects other than aphids and caterpillars.

MILLETTIA PISCIDIA (Roxb.) Wight.

The powder of the bark and flowers was used as a fish poison and as an insecticide in India.--Roark (332, p. 30).

MILLETTIA RETICULATA Benth. Roy-teng.

This plant was especially efficient for the large cabbage beetle, Colaphellus bowringii (Baly), in China.--China National Agricultural Research Bureau (91).

This plant grows in China, where the farmers obtained good results with the powder against cabbage pests. In laboratory tests the powdered roots dusted on food plants killed only 33 percent of the nymphs of a grasshopper but 100 percent of the adults of Colaphellus bowringii (Baly).--China National Agricultural Research Bureau (92).

MILLETTIA TAUWANIA Hayata.

This species is found in Formosa. The crushed fresh roots provided a liquid having insecticidal properties due to rotenone. This plant served for the preparation of medicaments used against scab.--Scarone (353).

MUNDULEA SERICEA (Willd.) A. Cheval. Synonym: M. suberosa (Roxb.) Benth. Mundulea.

Preparations of this plant were effective against aphids, mango hoppers, and mosquito larvae but not more than 50 or 60 percent of

the other insects tested were killed. Laboratory results indicated that it might prove to be a cheap larvicide locally available and easily handled. The treatment of pieces of wood with varnishes to which an alcoholic extract of Mundulea had been added rendered them fairly immune from the attacks of termites.--Kunhikannan (238, 239).

The seeds and inner layer of the bark were used as a fish poison and as an insecticide in India.--Roark (332).

Mundulea grows wild over large areas in Mysore, India. The laboratory and field tests, against a mango hopper, grasshoppers, cattle lice and fleas, a potato beetle (Epilachna sp.), a beetle store pest, and mosquito larvae, were so encouraging as to warrant an intensive chemical study of its active principles, one of which had previously been called derrin (rotenone). In a laboratory test a water extract of the powdered bark with soap killed 100 percent of potato beetles, and in the field the powder applied as a dust killed 70 percent.--Subramaniam (377, 378).

Mundulea is common in most parts of tropical and subtropical Africa, Madagascar, India and Ceylon. It has long been cultivated, and the seeds and bark have been used as fish poisons. Extracts of the stems, bark, cork, and leaves from South Africa showed no appreciable toxicity to the bean aphid. Alcoholic extracts of the stems, seeds, and pods from India were toxic to this aphid, but extracts of the roots and leaves had no appreciable action at a concentration equivalent to 1 percent of the plant material. The stems were the most active part of the plant.--Tattersfield and Gimingham (391).

A powder made from the dried bark gave complete protection against bruchids when it was scattered thinly over grain in bins. A half-inch layer of fine sand or powdered bark laid on top of pulses in the receptacles prevented infestation by bruchids.--Subramaniam (380, 382).

The powdered root bark, spread thinly over grain in basket bins, kept it free from bruchid attack in Mysore, India. All the insects coming to the surface from infested grain were killed, and no further breeding took place. A 5-percent water extract of this powder killed 95 percent of the green scale of coffee in about 6 days. A 10-percent kerosene extract made into an emulsion and diluted to 50 times with water killed more than 75 percent of this pest in 3 days.--Subramaniam (381).

This fish-poison plant is available in large quantities in the jungles of India. A 5-percent alcoholic extract of the stem bark killed 100 percent of the caterpillars (Hypsa ficus (F.)) and beetle grubs tested in 24 hours. A 0.12-percent alcoholic extract killed 90 to 100 percent of culicine mosquito larvae. A 20-percent water suspension killed 100 percent of the mango hoppers, and the powdered stem bark dusted on bruchids killed 80 to 100 percent of them.--Puttarudriah and Subramaniam (311).

Mundulea has been recognized as an efficient fish poison for many years in East Africa. In tests with sprays and dusts against aphids, caterpillars, bugs, psylla, cockroaches, and houseflies, the bark from the Moa district (rotenone 0.9 percent) was as toxic as the Amani derris (rotenone 5.4 percent), but bark obtained from two other districts (rotenone 0.5 percent) was only about half as toxic. The powder dusted on cockroaches and flies, although having a much smaller initial effect than pyrethrum and not causing any rapid knock-down, yet caused death in about half the time; derris had the same action. The seeds were about three-quarters as toxic as the bark, but were unlikely to be of any commercial value on account of their scarcity.--Worsley (432, 433).

Samples of Mundulea bark from various localities in Tanganyika and Zanzibar, when examined chemically and biologically, fell into two main divisions, (1) those with smooth barks, which were toxic, and (2) those with rough, corky barks, which were nontoxic. No correlation existed between toxicity and the amount of ether-extractable material. A fair correlation was found between toxicity and rotenone content, the toxicity being about 1.6 times as great as for pure rotenone. The mortality of the aphids tested ranged from 0.0 to 85 percent. The 12 samples analyzed ranged in rotenone content from 0 to 0.55 percent and the ether extract from 4.1 to 8.9 percent.--Worsley (433).

Extracts of Mundulea applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

Mundulea was one of three plants found to compare favorably with standard insecticides. It is largely obtained in Mysore, India, and the stem bark contained the insecticidal principle.--Subramaniam (385).

A sample of Mundulea from the Union of South Africa contained no rotenone, but it was slightly toxic to the bean aphid. A sample of stems from another source in South Africa was nontoxic, whereas a sample of stems from India was toxic. A 1-percent extract of leaves from India proved completely toxic.--Anonymous (36).

The genus Mundulea contains 20 species, the majority of which are recorded from Madagascar. At one time included under Tephrosia, it is now regarded as a connecting link between that genus and Millettia. Mundulea sericea has been found in India, Ceylon, Madagascar, and in Africa from the Sudan to Natal. The seeds and bark have been used in India and the bark in East Africa for poisoning fish. An erect shrub or a slender tree up to 25 feet tall, it shows either a smooth, greenish yellow-brown bark or a rough, longitudinally fissured, very corky yellowish-brown bark. The leaf, bark, and root of the Indian variety possessed marked insecticidal properties against aphids and beetles, in contrast to the African variety, the leaf and root of which were reported as distinctly less potent than the bark. The toxicity of none of these parts was of the same order as that of the root of Derris elliptica (rotenone about 9 percent).--Tattersfield and Potter (395).

Comments by reviewer.--This is the most promising insecticidal plant discovered during the 1930's. Although a rotenone-yielding species, thus far it does not compete favorably with the best samples of Derris. Work with it should be continued.

NEORAUTANENIA FISIFOLIA (Benth.) C. A. Sm. Synonym: Rhynchosia fisifolia Benth.

This plant occurs in eastern South Africa, particularly in the Transvaal and Natal, and in southern Rhodesia. Alcoholic and aqueous extracts of the ground roots were toxic to the bean aphid, a 1-percent alcoholic extract killing all the aphids sprayed.--Tattersfield and Gimingham (391).

OSTRYODERRIS GABONICA Dunn. Bolemba.

Alcoholic extracts of the roots, stems and leaves of this climbing shrub from the Belgian Congo were tested against the bean aphid. Five-percent extracts of the stems and roots paralyzed 100 percent of the aphids sprayed; a 2-percent extract of the stems paralyzed 70 percent, and of the roots, 90 percent; but the leaves were nontoxic. No part of this plant was comparable in insecticidal activity with Derris elliptica.--Tattersfield and coworkers. (394).

OUGEINIA DALBERGIOIDES Benth.

Extracts of the leaves and bark of this plant from India were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

This fish-poison plant is widely distributed in India. A 5-percent alcoholic extract of the stem bark killed 75 percent of Plutella maculipennis (Curt.), 80 percent of Prodenia litura (F.) and Crocidolomia binotalis Zeller., and 100 percent of Euproctis fraterna (Moore). A 5-percent extract of the leaves killed 100 percent of the first, third, and fourth species, and 90 percent of the second species. The powdered stem bark dusted upon beetles (Callosobruchus shinensis (L.)) killed only 60 percent of them in 72 hours, but the powdered leaves killed 100 percent.--Puttarudriah and Subramaniam (312).

PACHYRHIZUS ANGULATUS Rich.

The ground seeds had a slight effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

PACHYRHIZUS EROSUS Urban. Yam bean.

The portion of the bean most toxic to insects gives positive reactions for rotenone by the Gross-Smith and Durham tests.--Hwang (208).

The seeds have long been used as an insecticide and fish poison in various tropical countries. The toxic principle is called pachyrhizid, and the ground seeds had a high efficiency against the striped flea beetle and aphids in China. During the summer of 1942 yam bean seeds were widely used there in the control of several insect pests of staple food crops. Tests conducted in New York State gave promising results against the bean aphid and Mexican bean beetle.--Hansbery and Lee (181).

PACHYRHIZUS TUBEROSUS (Lamb.) Spreng.

The seeds were used in Venezuela for killing vermin.--Greshoff (170, p. 57).

PHYSOSTIGMA VENENOSUM Balf. Calabar bean.

Semen physostigmatis had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Eserine (physostigmine), the alkaloid in calabar beans, is very poisonous to higher animals. In some respects its physiological action is similar to that of nicotine. A 0.2 and a 0.1 percent emulsion of eserine killed 100 and 56.6 percent of the bean aphids, respectively.--Tattersfield and coworkers (393).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PISCIDIA ERYTHRINA L. Synonyms: Ichthyomethia piscipula (L.) Hitchc.; P. piscipula Sarg. Jamaica fish poison. Jamaica dogwood.

The powdered bark had considerable effect on fly larvae.--Cook and Hutchison (103, p. 4).

The Jamaica dogwood is used by the Carib Indians as a fish poison, and a decoction of the bark as a cure for mange on dogs.--Gifford (156).

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the Jamaica dogwood, daisy flowers, and Tephrosia piscatoria were tested against codling moth larvae, but none of them appeared promising.--Siegler and Munger (unpublished report).

PITHECELLOBIUM ELLIPTICA Hassk.

Extracts of the leaves and bark of this fish-poison plant from Malaya were slightly toxic to the bean aphid.--Tattersfield and Gimingham (391).

PONGAMIA GLABRA Vent. Synonym: Galedupa indica Roxb. Hongay.

In India a fixed oil was prepared from the seeds, which was supposed to be an efficacious application for itch.--Mootooswamy (286). [This oil is called hong oil or Pongamia oil.]

This species grows in Mysore, India. It was fairly effective against aphids. Extracts of the powdered root bark killed only 15 to 20 percent of the leafhoppers sprayed. Spraying with hongay oil-resin soap was effective against several species of mango hoppers and scale insects and against lepidopterous larvae.--Subramaniam (377-383).

A 5-percent alcoholic extract of the roots killed 10 percent of Prodenia litura (F.) and 80 percent of Plutella maculipennis (Curt.). A 10-percent extract killed 100 percent of P. litura. A 3-percent extract killed 100 percent and a 2 percent extract killed 80 percent of Euproctis fraterna (Moore).--Puttarudriah and Subramaniam (311).

PONGAMIA PINNATA (L.) W. F. Wight. Synonym: P. glabra Vent.

The oil of the seeds was an excellent remedy for itch or mange.--Dalzell and Gibson (111, p. 77).

In India a poultice of the leaves was applied to ulcers infested with worms, and the oil was one of the best native remedies for cutaneous diseases.--Watt (422, v. 3, p. 90).

A decoction from the green leaves had no effect on nasturtium aphids.--McIndoo and Sievers (259, p. 23).

PSORALEA CORYLIFOLIA L. Babchi.

An extract of the seeds mixed with kerosene gave poor results as a mosquito larvicide.--Wats and Bharucha (420).

PSORALEA PEDUNCULATA (Mill.) Vail. Sampson snakeroot.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PUERARIA THUNBERGIANA (Sieb. & Zucc.) Benth. Kudzu vine.

Extracts killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ROBINIA PSEUDACACIA L. Common locust.

Infusions of the powdered bark mixed with manure were slightly effective against fly larvae.--Cook and Hutchison (103, p. 4).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SESBANIA ACULEATA Poir.

In West Africa the natives claimed that animals washed in water in which the leaves of this shrub had been pounded could safely traverse a tsetse fly belt.--Dalziel (112).

SESBANIA AEGYPTIACA Pers. Synonym: Aeschynonmene sesbania L.

In the Punjab the seeds mixed with flour, were applied externally, as a remedy for itch.--Kirtikar and Basu (230, v. 1, p. 418).

SESBANIA PUNCTATA DC. Sabral.

The natives in Africa used a decoction of the leaves for washing animals to prevent bites of the tsetse fly.--Holland (197, p. 198).

SOJA MAX (L.) Piper. Soybean.

Many papers discuss soybean oil as an insecticide, but since this oil is not poisonous, it is effective in other ways, chiefly mechanically. A review of it will not be given here.

SOPHORA FLAVESCENS Ait.

A decoction of the stems and leaves is used in Japan as an insecticide.--Greshoff (171, p. 65).

SOPHORA GRIFFITHII Stocks. Synonym: Keyserlingia griffithii Boiss.

The powdered seeds mixed with oil kill lice in the hair.--Greshoff (171, p. 65).

SOPHORA JAPONICA L. Pagoda tree.

Extracts of the roots killed 20 percent of the mosquito larvae tested but extracts of the stems killed none.--Hartzell and Wilcoxon (188).

SOPHORA MOLLIS R. Graph.

This plant was used as an insecticide in India.--Chopra and Badhwar (98).

SOPHORA PACHYCARPA Schrenk.

This species grows wild in central Asia and is a rich source of an active alkaloid, pachicarpine, which might be used as a contact insecticide. Sophodust has been proved effective in controlling aphids.--Anonymous (33).

The alkaloids are intermediate between anabasine and lupine in insecticidal power. d-Sparteine, contained in the vegetative parts of this species, is the most toxic alkaloid.--Sokolov and Koblova (372).

SOPHORA TOMENTOSA L.

Extracts of the seeds showed little toxic action to the bean aphid. Crude extracts of cytisine-containing seeds such as these, with the possible exception of laburnum, are not likely to prove of practical importance. Cytisine itself, if it could be prepared cheaply, would be worth further consideration. Cytisine showed no action as a stomach poison against larvae of the moth Selenia tetralunaria Hufn.--Tattersfield and coworkers (393).

SPATHOLOBUS ROXBURGHII Benth.

A sample of roots of this fish-poison plant from Burma contained about 1 percent of rotenone. An extract was highly toxic to goldfish and larvae.--Jones (221).

STYLOSANTHES BIFLORA (L.) B. S. P. Pencil flower.

Extracts from this plant were not repellent to the Japanese beetle.--Metzger and Grant (277).

TEPHROSIA. Synonym: Cracca.

For a long time it has been known that Tephrosia possesses insecticidal properties, but a serious study of it was not undertaken prior to the work done in 1925 by Tattersfield and coworkers (392). Since that date it has been studied considerably and if it had not been for a more lively interest in Derris and Lonchocarpus, Tephrosia might now be one of our commercial insecticides instead of being still in the experimental stage. However, progress with it has been handicapped by the fact that the most promising species do not contain so much toxic of the principles as do certain species of Derris and Lonchocarpus.

In 1937 the literature on Tephrosia as an insecticide was reviewed. Of 35 species listed 19 were reported to have insecticidal value.--Roark (337).

TEPHROSIA AMBIGUA M. A. Curtis.

Extracts from the roots and seeds collected in North Carolina were slightly toxic to houseflies, but were not promising.--Jones and coworkers (222).

TEPHROSIA CANDIDA Roxb.

Alcoholic extracts of the roots and stems were moderately toxic to the bean aphid.--Tattersfield and coworkers (393).

The insecticidal value of alcoholic extracts of the seeds was equal to that of nicotine sulfate.--Subramaniam (384).

TEPHROSIA DIFFUSA (E. Mey.) Harv.

The Zulus used a decoction of the roots to destroy head lice.--Bryant (70, p. 74).

TEPHROSIA GRANDIFLORA (Vahl.) Pers.

The Thongas used a decoction of a root of a species of Tephrosia (probably T. grandiflora) as a parasiticide.--Watt and Breyer-Brandwijk (423).

TEPHROSIA HECKMANNIA Harms.

Infusions of the fresh leaves were reported to be toxic to bedbugs and to larvae of the maize stalk borer, but extracts of the dry material were harmless to the bean aphid.--Tattersfield and Gimingham (391, p. 255).

TEPHROSIA HISPIDULA (Michx.) Pers.

An extract from the roots collected in North Carolina was slightly toxic to houseflies, but was not promising.--Jones and coworkers (222).

TEPHROSIA HOOKERIANA Wight & Arn.

Extracts of the roots, stems, leaves, seeds, and fruits were slightly toxic to the bean aphid.--Tattersfield and Gimingham (391).

TEPHROSIA LATIDENS (Small) Standl.

An extract from the roots collected in Florida was considerably toxic to houseflies.--Jones and coworkers (222).

TEPHROSIA LINDHEIMERI A. Gray.

Extracts of the roots and seeds collected in Texas were considerably toxic to houseflies.--Jones and coworkers (222).

TEPHROSIA MACROPODA (E. Mey.) Harv.

The Zulus used a decoction of the roots to destroy head lice.--Bryant (70, p. 74).

TEPHROSIA NOCTIFLORA Boj.

Extracts of the leaves and seeds had no insecticidal value against the citrus aphids.--Worsley (431).

TEPHROSIA NYIKENSIS. Bak.

Extracts of the leaves, seeds, and pods were much less toxic to the citrus aphid than were those of T. vogelii.--Worsley (431).

TEPHROSIA PISCATORIA (Ait.) Pers.

An ether extract of the roots of a barbasco (thought to be this species) killed flies, but was much less effective than pyrethrum flowers.--Gstirner and Hünerbein (172).

TEPHROSIA PURPUREA (L.) Pers. Synonym: Cracca villosa purpurea.

(L.) Kuntze.

Extracts of the stems of this fish-poison plant had no effect on tent caterpillars.--McIndoo and Sievers (259, p. 22).

Extracts of the roots, stems, and leaves were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

TEPHROSIA SPICATA (Walt.) Torr. & Gray.

An extract from the roots collected in North Carolina was not toxic to houseflies.--Jones and coworkers (222).

TEPHROSIA TOXICARIA Swartz.

The roots were more toxic to the bean aphid than the stems when tested as extracts, while the leaves possessed only slight insecticidal properties.--Tattersfield and coworkers (393).

TEPHROSIA VILLOSA (L.) Pers.

Same as for T. candida.--Subramaniam (384).

TEPHROSIA VIRGINIANA (L.) Pers. Devil's shoestrings.

The most toxic samples were slightly more poisonous than pyrethrum, but less toxic than derris. The plant showed considerable promise as a contact spray against five species of agricultural insects, but it possibly had greater promise for the control of various animal parasites, such as fleas, lice and cattle grubs.--Little (247).

TEPHROSIA VISTITA Vog.

In Holland dusts made from this plant did not injure an ant (Myrmica rubra (L.)) or larvae of Phalera bucephala (L.), but derris was fatal to them. In spraying tests a few were killed.--Anonymous (32).

TEPHROSIA VOGELII Hook.

Aqueous and alcoholic extracts of the leaves and seeds were shown to be highly toxic to the bean aphid, the toxicity being of the same order as that of nicotine. Extracts of the stems were not so poisonous.--Tattersfield and coworkers (392).

TRIFOLIUM AGRARIUM L. Hop clover.

TRIFOLIUM ARVENSE L. Rabbitfoot clover.

TRIGONELLA FOENUM-GRAECUM L. Fenugreek.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

ULEX EUROPAEUS L. Gorse.

A 2-percent and a 1-percent crude alcoholic extract of gorse seeds killed 100 and 55 percent, respectively, of bean aphids, while an 0.08 percent of nicotine solution killed 98 percent.--Tattersfield and coworkers (393).

URARIA PICTA Desv.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

VICIA VILLOSA Roth. Hairy vetch.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

FAGACEAE
(Beech Family)

CASTANEA DENTATA (Marsh.) Borkh. American chestnut.

The commercial extract was an effective repellent against the Japanese beetle.--Metzger and Grant (277).

FAGUS GRANDIFOLIA Ehrh. American beech.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

QUERCUS ALBA L. White oak.

Extracts of the leaves killed 25 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

QUERCUS COCCINEA Muench. Scarlet oak.

Extracts of the leaves killed 35 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

QUERCUS RUBRA L. Common red oak. Same as for Fagus grandifolia.

QUERCUS spp.

Tannin was ineffective for mothproofing.--Jackson and Wassell (219, p. 1177).

Woolen fabrics were protected from moths by treatment with a 3-percent tannin solution and then a bath of antimony salt.--Roark (333, p. 103).

The commercial extracts of gallnut and valonia were effective repellents against the Japanese beetle.--Metzger and Grant (277).

QUERCUS VELUTINA Lam. Black oak. Quercitron.

Extracts of the fresh leaves and a commercial extract were effective repellents against the Japanese beetle.--Metzger and Grant (277).

Extracts of the leaves killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

FLACOURTIACEAE

GYNOCARIDA ODORATA R. Br. Chaulmoogra.

The fruit was used as a fish poison and as an insecticide in India.--Roark (332, p. 23).

Rare earth salts of chaulmoogric acid were claimed for mothproofing (Brit. patent 247,242; Fr. patent 603,552; U. S. patent 1,738,340).--Roark (333, p. 37).

HYDNOCARPUS VENENATA Gaertn.

The fruit was used as a fish poison and as an insecticide in India.--Roark (332, p. 25).

HYDNOCARPUS WIGHTIANA Blume. Maravitti tree.

In India the oil, beaten up with the kernels and shells of castor oil seeds, was used as a remedy for itch.--Watt (422, v. 4, p. 309).

The use of the powdered cake of the fruit in India checked the cocoanut rhinoceros beetle.--Ayyar (43, p. 48).

This tree was claimed to be a fish poison in East Africa, but extracts of the leaves and bark had no appreciable toxic effect on citrus aphids.--Worsley (431).

FUMARIACEAE
(Fumitory Family)

DICENTRA CANADENSIS (Goldie) Walp. Synonym: Bikukulla canadensis.

(Goldie) Millsp. Squirrelcorn.

FUMARIA OFFICINALIS L. Common fumitory.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

GENTIANACEAE
(Gentian Family)

CENTAURIUM UMBELLATUM Gilib. Centaury gentian.

A decoction of the whole plant destroyed lice and cured the itch.--Green (169).

GENTIANA LUTEA L. Yellow gentian.

Radix gentianale had no effect on caterpillars of Prodenia litura (F.).--DeBussy (76).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MENYANTHES TRIFOLIATA L. Bogbean.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the leaves killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SABBATIA ANGULARIS (L.) Pursh. Rose gentian.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SWERTIA CHIRATA Buch.-Ham.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

SWERTIA CHIRAYITA (Roxb.) Lyons. Chiretta.

Extracts were repellent to the Japanese beetle.-- Metzger and Grant (277).

GERANIACEAE
(Geranium Family)

GERANIUM CAROLINIANUM L. Cranebill geranium.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

GERANIUM MACULATUM L. Wild geranium.

Extracts of the roots killed 20 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PELARGONIUM ODORATISSIMUM (L.) L'Herit.

Aroma-rosa, which is probably this species, was used in Venezuela for killing insects.--Roark (332, p. 4).

PELARGONIUM spp. Geraniums.

Rose geranium oil was considered one of the best repellents against the screwworm.--Parman and coworkers (302).

The feeding of Japanese beetles on cultivated geraniums caused paralysis, and about 35 percent of them died within 4 days. The flowers appeared to be more attractive and more toxic than the foliage.--Ballou (49, p. 293).

The essential oil from geraniums was applied as emulsion sprays in Russia against the common red spider and the cotton aphid. A 2-percent concentration killed from 51 to 80 percent of them.--Kayumov (226).

PELARGONIUM ZONALE Willd. Horseshoe geranium.

Extracts of the leaves and stems killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

TROPAEOLUM MAJUS L. Common nasturtium.

This plant was reported to have some insecticidal value and was planted around apple trees to rid them of woolly apple aphids.--Von Mueller (414, p. 543).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

GINKGOACEAE
(Ginkgo Family)

GINKGO BILOBA L. Synonym: Salisburia adiantifolia Smith.

Maidenhair tree. Ginkgo tree.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the leaves killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

GNETACEAE
(Joint-Fir Family)

EPHEDRA ALTISSIMA Desf.

EPHEDRA PROCERA C. A. Mey.

EPHEDRA sp.

Extracts of the stalks of the first species killed only 5 percent of the mosquito larvae tested, but extracts of the other species killed none.--Hartzell and Wilcoxon (188).

HAEMODORACEAE
(Bloodwort Family)

LACHNANTHES TINCTORIA (Walt.) Ell. Synonym: Gyrotheca tinctoria

(Walt.) Salisb. Redroot.

Full-strength extracts from the entire plant were repellent to the Japanese beetle.--Metzger and Grant (277).

HAMAMELIDACEAE
(Witch-Hazel Family)

HAMAMELIS VIRGINIANA L. Common witch-hazel.

LIQUIDAMBAR STYRACIFLUA L. Sweet gum.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

HYDRANGEACEAE
(Hydrangea Family)

HYDRANGEA ARBORESCENS L. Hydrangea.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Acetone extracts of the root (N. F.) of hydrangea killed 90 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

RIBES GROSSULARIA L.

Extractum thebi (10 percent in water) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

HYDROPHYLLACEAE
(Waterleaf Family)

ERIODICTYON CALIFORNICUM (Hook. & Arn.) Greene. Yerba santa.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the leaves killed none of the mosquito larvae tested, but extracts of the stems killed 35 percent.--Hartzell and Wilcoxon (188).

HYDROLEA ZEYLANICA Vahl.

The leaves beaten into a pulp and applied as a poultice were considered efficacious in cleaning and healing bad ulcers, particularly those in which maggots had begun to breed.--Drury (122, p. 267).

HYPERICACEAE
(St. Johnswort Family)

HYPERICUM PERFORATUM L. St. Johnswort.

IRIDACEAE
(Iris Family)

CROCUS SATIVUS L. Crocus.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

GLADIOLUS spp. Gladiolus.

Extracts of the leaves killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

IRIS GERMANICA L. Orris root.

Orris root was of no value against chicken lice and the dog flea.--Abbott (37, pp. 7, 12).

Dusting orris root over garments did not protect them against clothes moths.--Mullin (289).

IRIS VERSICOLOR L. Blueflag iris.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the roots (N. F.) killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SISYRINCHIUM sp. Blue-eyed-grass.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

JUGLANDACEAE
(Walnut Family)

CARYA GLABRA (Mill.) Sweet. Synonym: Hicoria glabra (Mill.) Britton; Juglans glabra Mill. Pignut.

An infusion of the leaves rubbed on a horse prevents the annoyance of flies.--Williams (428, p. 920).

Extracts from the pignut were not repellent to the Japanese beetle.--Metzger and Grant (277).

CARYA sp. Hickory.

Extracts from the fresh leaves were repellent to the Japanese beetle.--Metzger and Grant (277).

JUGLANS CINEREA L. Butternut.

Extracts from the butternut were not repellent to the Japanese beetle.--Metzger and Grant (277).

An extract of the root bark killed 55 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

JUGLANS NIGRA L. Black walnut.

Infusions or decoctions of walnut leaves were recommended for controlling the striped cucumber beetle, flea beetles, coleopterous larvae, and a bug.--Harris (185, pp. 101, 106, 107, 163).

A decoction of walnut leaves applied to the skins of horses and other animals prevents their being bitten or worried by flies.--Porcher (308, p. 362).

A decoction and an alcoholic extract had no effect on cotton caterpillars, but the insects avoided the sprayed leaves whenever possible.--Riley (325, p. 186).

JUGLANS REGIA L. Synonym: J. regia var. kumaonica C. DC. Persian walnut.

In India a walnut twig, kept in a room, was recommended to dispel flies.--Honigberger (200, p. 293).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

JUNCACEAE
(Rush Family)

JUNCUS EFFUSUS L. Common rush.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

LAURACEAE
(Laurel Family)

CASSYTHA FILIFORMIS L.

This plant was used as an insecticide in India.--Chopra and Badhwar (98).

CINNAMOMUM CAMPHORA (L.) Nees & Eberm. Camphor-tree.

The following statements include the best results obtained by using camphor as an insecticide.

Camphor preserved clothing and other articles against insects and worms.--Watt (422, v. 2, p. 93).

In Belgium it was suggested to burn camphor over charcoal or place a piece of camphor on a hot iron to fumigate flies.--Anonymous (14).

The fumes stunned mosquitoes in 4 to 5 minutes and killed them in 4 or 5 hours.--Celli and Casagrandi (82, p. 95).

Adult silverfish were killed by the vapors in a confined space, but bits of camphor scattered among papers or in book shelves did not keep them away.--Cornwall (106, p. 121).

The larvae and eggs of the clothes moth Tineola biselliella (Hum.) can be killed by placing camphor or naphthalene in closed places.--Benedict (54).

Camphor was ineffective against bedbugs, cockroaches, clothes moths, and carpet beetles. Naphthalene and camphor prevented infestation of clothing by Attagenus piceus (Oliv.), and killed all stages of the beetle, though the action of camphor was very slow.--Scott and coworkers (361).

Camphor-oil byproduct plus bonemeal was considered one of the best repellents against the screwworm. There was no emergence of flies from meat treated with camphor oil.--Parman and coworkers (302).

To destroy body lice in military camps apply a mercurial ointment of camphor oil.--Beaulieu and Maheux (52, p. 175).

There are at least 26 patents which describe the use of camphor as an insecticide or insect repellent.--Roark (333, 335, 346).

Gum camphor, used in the manner recommended for naphthalene and paradichlorobenzene, will kill all stages of the clothes moth. While it does kill some eggs and larvae when sprinkled upon infested cloth in open containers, it is not to be depended upon except where the fumes can be closely confined with the clothing.--Back (44).

CINNAMOMUM CASSIS Blume.

Oil of cassia exhibited good repellent action against the screwworm for 1 or 2 days only.--Parman and coworkers (302).

Oil of cassia was moderately repellent to cockroaches.--Cole (101).

CINNAMOMUM ZEYLANICUM Nees. Cinnamon.

Cinnamon oil was considered one of the best repellents against the screwworm. There was no emergence of flies from meat treated with it. Cinnamon powder was effective for only 2 days.--Parman and coworkers (302).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

LAURUS NOBILIS L. Noble laurel.

In Belgium it was suggested to rub all wood work and furniture with laurel oil to repel flies.--Anonymous (14).

The butchers of southern Switzerland painted the doors and windows of their shops with juice obtained from crushed leaves to keep away houseflies and bot flies.--Rehnelt (318).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

LINDERA BENZOIN (L.) Blume. Synonym: Benzoin aestivale (L.) Nees.

Spicebush.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Acetone extracts of the buds killed 65 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

LITSEA GLAUCESCENS H. B. K.

LITSEA GUATEMALENSIS Mez.

The powdered leaves of these species were used against ants.--Scarone (353).

SASSAFRAS ALBIDUM (Nutt.) Nees. Synonyms: S. variifolium (Salisb.)

Kuntze; S. sassafras Karst. Sassafras.

An alcoholic extract of the dried root bark had no effect on cotton caterpillars.--Riley (325, p. 186).

The powdered bark was effective against chicken lice and the dog flea, but it was not recommended against these insects.--Abbott (37, pp. 7, 11).

Oil of sassafras plus petrolatum was considered one of the best repellents against the screwworm. There was no emergence of flies from meat treated with it. The powdered bark was effective for only 2 days.--Parman and coworkers (302).

Oil of sassafras was always attractive to cockroaches.--Cole (101).

Extracts of sassafras leaves killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

UMBELLULARIA CALIFORNICA (Hook. & Arn.) Nutt. Synonym: Oreodaphne californica Nees. California laurel.

The leaves appeared to be a valuable repellent for fleas.--Chesnut (89, p. 531).

LECYTHIDACEAE

BARRINGTONIA ACUTANGULA (L.) Gaertn.

The juice of the leaves mixed with oil was made into an ointment for scabies.--Drury (122, p. 65).

BARRINGTONIA ASIATICA Kurz. Synonym: B. speciosa Forst.

BARRINGTONIA CAREYA F. Muell. Synonym: Careya australis F. Muell.

Alcoholic extracts of the bark of these fish-poison trees from Australia were not toxic to the bean aphid.--Tattersfield and coworkers (394).

BARRINGTONIA EXCELSA Blume. Synonym: Chydenanthus excelsus Mayr.

Water extracts of the seed kernels had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

BARRINGTONIA RACEMOSA (L.) Roxb.

This species was used in India as a fish poison and as an insecticide. The seeds were mixed with bait.--Roark (332, p. 6).

The bark is reported to be used as a fish poison. A 2.5- and a 2-percent alcoholic extract of the bark killed 100 and 98 percent, respectively, of the aphids sprayed, while a 0.5 percent of a 40-percent nicotine sulfate solution killed 95 percent.--Worsley (431).

The natives of Kenya used the bark as a fish poison. A sample of bark from Kenya showed no toxicity to the bean aphid.--Tattersfield and coworkers (394).

BARRINGTONIA spp.

A 5-percent water extract of the bark of a Malayan fish-poison tree (B. speciosa) killed only one-fifth of the moth larvae tested.--Gater (153).

Fish-poison plants, which might be of value as insecticides in the Solomon Islands, included the seeds of this tree.--Pagden (298).

LENTIBULARIACEAE
(Bladderwort Family)

PINGUICULA VULGARIS L. Butterwort.

The juice of the leaves destroyed lice.--Green (169, v. 2, p. 321).

LILIACEAE
(Lily Family)

ALETRIS FARINOSA L. True unicorn.

Extracts of the roots killed only 15 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ALLIUM AMPELOPRASUM var. PORRUM (L.) Regel. Leek.

In Belgium an infusion, made by keeping small pieces of the plant for 1 week in water, was said to repel flies.--Anonymous (14).

ALLIUM CANADENSE L. Meadow garlic.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ALLIUM CEPA L. Onion.

The odor of onions stunned mosquitoes in 4 to 6 hours but they recovered.--Celli and Casagrandi (82, p. 95).

ALLIUM SATIVUM L. Garlic.

The odor of garlic stunned mosquitoes in 5 to 10 minutes and killed them in 5 hours.--Celli and Casagrandi (82, p. 95).

Garlic bulbs stored with grain which was kept in closed receptacles did not protect it from weevil (Calandra) Sitophilus oryza (L.) attacks.--Fletcher and Ghosh (140, pp. 734, 753).

ALLIUM SCHOENOPRASUM L. Chive.

A water extract of the whole plant killed 70 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ALOE BARBADENSIS Mill. Synonyms: A. perfoliata var. vera L.;

A. vera L., of authors. Barbados aloes.

Powdered aloes was on one occasion found as effective as insect powder.--Kirby (229, p. 241).

Aloin, which is derived from this plant, was ineffective for mothproofing.--Jackson and Wassell (219, p. 1177).

Extracts from the dry leaves were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

ALOE FEROX Mill. Cape aloe.

The bitter sap, used for dressing wounds, keeps off flies.--Von Mueller (414, p. 34).

Of various gums tested with oils to find stable emulsifiers, aloes cape was unstable.--Ginsburg (158).

A spray of 2.5-percent sodium arsenite gave better protection to sun-dried hides attacked by the skin beetle than one consisting of 2 ounces of bitter cape aloes, 5 ounces of sodium arsenite, and 5 ounces of washing soda in 4 gallons of water, a mixture commonly applied to the hides just before they are exported.--Smit (367).

ALOE spp.

A strong decoction with soap gave good results against certain lepidopterous larvae and aphids.--Schreiber (360).

A 2-percent tincture was recommended against lice on cattle or other domestic animals.--Martini (269, p. 425).

ALOE STRIATULA Haw.

In India this species was often found suspended from the roofs of native apartments, as it was said to attract fleas.--Dalzell and Gibson (111, p. 91).

ALOE SUCCOTRINA Lam.

In Germany a weak solution of tincture of aloes was recommended to rid plants of scale insects.--Anonymous (2).

AMIANTHIUM MUSCAETOXICUM (Walt.) A. Gray. Synonyms: Melanthium muscaetoxicum Walt.; Chrosperma muscaetoxicum Ktze. Amianthium. Crow poison.

This plant is employed against the housefly. The bulbs are triturated and mixed with molasses or honey, and the preparation is spread upon plates and placed in parts of the house most infested. The flies

are soon attracted and the poison takes effect while they are sipping it. The flies must then be destroyed or they will revive in the course of 24 hours.--Elliott (129, v. 1, p. 421).

The powdered bulbs and leaves used as dusts were efficient but slow against cockroaches, grasshoppers, flies, and bees, but inefficient against aphids and tent caterpillars. As a stomach poison these powders were efficient against grasshoppers, silkworms, and flies, but had no effect on large webworms. The water extracts from the leaves and bulbs, used as sprays, had considerable effect on cockroaches, potato beetle larvae, and silkworms, but none on webworms and aphids. Apple trees bearing tent caterpillars were sprayed with 10-percent solutions of water extracts from the leaves and bulbs. A week later the caterpillars were shrunken and had not eaten the sprayed leaves.--McIndoo and Sievers (259, pp. 5-6).

ASPARAGUS OFFICINALIS L. Asparagus.

In laboratory tests asparagin used as a dust had no effect on codling moth larvae.--McAlister and Van Leeuwen (249).

COLCHICUM AUTUMNALE L. Meadow saffron.

A decoction made from the seeds or roots with vinegar or alcohol was recommended against aphids on rose bushes.--Binnenthal (57, pp. 45, 46).

Tincture of colchicum mixed with honey had no effect on ants (Lasius emarginatus (Oliv.)).--Cobelli (100).

An extract of meadow saffron contains the poisonous alkaloid colchicine, the solution of which is facilitated by the addition of alcohol; molasses may be added to the liquid to make it adhesive.--Gomilevsky (164).

Tuber colchici (100 and 10 percent in flour) was fed to caterpillars of Prodenia litura (F.). Those fed 100-percent tuber did not eat while those fed 10-percent tuber ate slightly and a few died.--DeBussy (76).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

CONVALLARIA MAJALIS L. Lily-of-the-valley.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ERYTHRONIUM AMERICANUM Ker. Trout lily. Deer's tongue.

The powdered leaves were considered one of the best repellents against the screwworm.--Parman and coworkers (302).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

GLORIOSA SUPERBA L.

In India the juice of the leaves was used for the destruction of lice in the hair.--Chopra and Badhwar (98).

HELONIAS BULLATE L. Swamp pink.

Extracts were repellent to the Japanese beetle.--Metzger and Grant (277).

HEMEROCALLIS FULVA L. Day lily.

HYACINTHUS ORIENTALIS L. Common hyacinth.

LILIUM SUPERBUM L. Turkscap lily.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

MAIANTHEMUM CANADENSE Desf. Synonym: Unifolium canadense (Desf.) Greene.

Extracts were repellent to the Japanese beetle.--Metzger and Grant (277).

MEDEOLA VIRGINIANA L. Cucumber root.

Extracts were not repellent to Japanese beetle.--Metzger and Grant (277).

MELANTHIUM VIRGINICUM L. Bunch flower.

The roots were used as a fly poison.--Lyons (248, p. 296).

The bunch flower has long been used to poison flies.--Pammel (299, p. 380).

ORNITHOGALUM UMBELLATUM L. Star-of-Bethlehem.

POLYGONATUM BIFLORUM (Walt.) Ell. Hairy solomonseal.

POLYGONATUM COMMUTATUM Dietz. Great solomonseal.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

SANSEVIERIA ROXBURGHIANA Schult.

In India this plant was prescribed for itch.--Kirtikar and Basu (230, v. 2, p. 1271).

SCHOENOCAULON OFFICINALE (Schlecht. & Cham.) A. Gray. Synonyms:

Veratrum officinale Schlecht. & Cham.; Helonias officinalis Don.;

Asagraea officinalis Lindl.; Sabadilla officinarum Brandt & Ratzeb.

Sabadilla. Covadilla. Cebolleja.

The use of sabadilla as an insecticide has been known since the sixteenth century and 76 references on this subject have recently been cited by Dicke (118). The following are a few of them.

Sabadilla seeds used as a fumigant had a slight effect on flies and clothes moths and a considerable effect on mosquitoes.--McClintock and coworkers (250, p. 233).

A mixture of sabadilla seeds and vinegar was recommended as a wash to destroy body lice on human beings.--Hase (190, p. 7); Martini (269, p. 424).

Powdered sabadilla seed used as a dust killed 95 to 100 percent of the bedbugs treated within 48 hours, and used as a stomach poison (1 part to 9 parts of corn meal) it killed 70 to 100 percent of the cockroaches treated within 19 to 34 days.--Scott and coworkers (361, pp. 5, 12).

The powdered seed was effective against chicken lice but was not recommended because it was too expensive and not readily available in large quantities.--Abbott (37, p. 7).

The powdered seeds (oil extracted), used as a dust, were efficient against grasshoppers, cockroaches, honeybees, silkworms, and webworms, but they had practically no effect on five species of aphids. The powder (oil not extracted), used also as a dust, was efficient against silkworms, but had practically no effect on the aphids. The powder,

used as a fumigant, had only a slight effect on silkworms and webworms, but was efficient against aphids and the only ladybeetle tested. The powder, used as a decoction, had no effect on aphids. A soda extract, used as a spray, had no effect on nasturtium and cabbage aphids, but was efficient against grasshoppers, bees, and small webworms. Hot- and cold-water extracts, used as sprays, had no effect on nasturtium and cabbage aphids, but were efficient against grasshoppers, bees, and silkworms. An oil, extracted by petroleum ether and used as a spray suspended in water, was efficient against grasshoppers. The alcoholic and benzene extracts were inefficient against three species of aphids. The alcoholic extract was efficient but very slow against silkworms.--McIndoo and Sievers (259, p. 9).

Extracts from sabadilla seeds were not repellent to the Japanese beetle.--Metzger and Grant (277).

An efficient method of preparing kerosene extracts of sabadilla seed was standardized and the spray tested against the housefly. All extracts of this plant, except those of the mature seed, were nontoxic. At room temperature only the commercially powdered seed was found to be toxic. All samples of seed observed to be relatively inactive when extracted at 25° C. increased considerably in toxicity when they were extracted at 75° or higher. Heating the dry ground seed before extraction and soaking the ground seed in kerosene at 100° for several days increased its toxicity.--Dicke (118).

The following papers pertain to the alkaloids veratrine and cevadine found in sabadilla seeds:

A solution of veratrine caused a slight trembling of the larva of Corethra plumicornis, but the heart activity was little changed.--Dogiel (120, p. 27).

Finely ground, dry powders of sabadilla seed, cevadine, and insect powder affected the motor nerve system of the insect.--DeWaal (416).

Larvae of Prodenia litura (F.) that ate cevadine (10, 2, and 1 percent in flour) were slightly affected while those fed veratrine only nibbled and all died.--DeBussy (76).

Veratrine (0.005 pound per 50 gallons) applied as a spray killed none of the Japanese beetles tested.--Moore and Campbell (284, p. 400).

In laboratory tests veratrine used as an undiluted dust killed 100 percent of codling moth larvae, and used as a 10-percent dust killed 88.8 percent.--McAlister and Van Leeuwen (249).

SMILACINA TRIFOLIA (L.) Desf. Synonym: Vagnera trifolia (L.) Morong.

False solomonseal.

SMILAX ROTUNDIFOLIA L. Common greenbrier.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

TRILLIUM ERECTUM L. Purple trillium.

Extracts from the dry rhizomes and roots were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

TULIPA GESNERIANA L. Common tulip.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

URGINEA MARITIMA Baker. Synonyms: Scilla maritima L.; U. scilla Steinh.

Squill. Sea onion.

Sprays containing extracts of squill and a male fern were effective against moth larvae (Cochylis and Eudemis) on grapevines in France.--Marchal (266, p. 250).

Extractum scillae (10 percent in water) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

This plant was common in northern Africa, particularly Tripoli. The Arabs were said to keep mosquitoes and other troublesome insects away with one or two bulbs of the plant.--Martelli (268).

Extracts of the bulbs of red squill killed only 20 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

UVULARIA PERFOLIATA L. Wood merrybells.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

VERATRUM.

The literature on hellebore as an insecticide is very voluminous and has never been fully reviewed. Only a few of the papers will be discussed here. There are three plants which are popularly called

hellebore--Veratrum album, V. viride, and Helleborus niger. The term "hellebore" is correctly applied to H. niger, which grows in Europe and is not a commercial product in this country. V. album and V. viride are the two commercial species, the former being largely imported, and the latter the American plant. As insecticides these two species are considered equally valuable.

Powdered hellebore roots (V. album and V. viride) have been proved to prevent the emergence of houseflies from horse manure, killing on an average 95.5 percent of the maggots exposed to its action. For use, 1/2 pound of powder must be mixed with 10 gallons of water and, after standing 24 hours, applied to every 8 bushels of manure on its removal from the stable.--Austen (42, p. 48).

VERATRUM ALBUM L. White false-hellebore.

The powdered rhizomes and rootlets constitute the hellebore most generally used as an insecticide.

The commercial powder, used as a dust, was efficient but slow against cockroaches and silkworms, and had a slight effect on honeybees, tent caterpillars, and aphids; used as a decoction, it has no effect on the same species of aphids; used as a fumigant, it was inefficient against these insects; and used as a stomach poison, it was efficient but slow against grasshoppers and silkworms. Extracts and the distillate were efficient but slow against silkworms, but a 0.5-percent solution of veratrine in weak sulfuric acid killed them more quickly. The alcoholic and benzene extracts were inefficient against four species of aphids. The powdered roots and the hot-water extract of these roots (not commercial) were efficient but very slow against silkworms, although they had no effect on rose aphids.--McIndoo and Sievers (259, pp. 9-10).

Commercial extracts of hellebore were not significantly toxic to the bean aphid.--Tattersfield and coworkers (393).

VERATRUM CALIFORNICUM Durand. California false-hellebore.

The powdered roots had no effect on grasshoppers.--McIndoo and Sievers (259, p. 23).

Honeybees visiting the flowers are poisoned. The field bees die in large numbers between the plants and the hives.--Burnside and Vansell (72).

VERATRUM NIGRUM L.

This species seemed to be as good as V. album for insecticidal purposes.--Schreiber (359, 360).

In China this plant was used against the mulberry worm (Rondotia menciana Moore).—Scarone (353).

VERATRUM VIRIDE Ait. Synonym: V. album viride Baker. Green hellebore.

The green or American hellebore (V. viride), called "swamp hellebore," "Indian poke," and "itch-weed," is a common plant in wet ground and grows over a considerable area of the United States. The properties of this are said to be similar to those of white hellebore (V. album).--Cook and coworkers (104, p. 17).

Experiments showed that certain extracts from this species possessed considerable toxicity to several insects, either as stomach or contact insecticides. Poor results with the whole powdered drug, however, were readily explained by the fact that the toxic alkaloids are present in the drug in proportions too small to be effective. For general insect control it would appear necessary to extract the alkaloids, and to employ them in a more concentrated form. Perfection of practical methods of extraction may again make this drug economically important as a source of insecticidal material. Standardization of the drug should be based upon the fraction of alkaloids soluble in ether and not upon the total alkaloid content, since the fraction of alkaloids insoluble in ether is nontoxic.--Fisher (138).

XANTHORRHOEA HASTILIS R. Br. Black-boy tree.

An Australian patent recommends washing sheep with a mixture of 100 parts of oil obtained by the destructive distillation of black-boy or yacca-gumi, and 50 parts of fish oil.--Harrison (186).

ZIGADENUS VENENOSUS S. Wats. Zigadenus.

Powders from the roots, stems, and leaves and extracts from them had no effect on grasshoppers, webworms, and potato beetle larvae, and only a slight effect on silkworms.—McIndoo and Sievers (259, p. 24).

Comments by Reviewer.—Despite the numerous poisonous species among the Liliaceae, only Veratrum album and V. viride can truly be called insecticidal, and they are much inferior to derris and cube.

LINACEAE
(Flax Family)

LINUM USITATISSIMUM L. Flax.

A large number of papers deal with linseed oil as an ingredient in insecticides, but these will not be reviewed. Linseed oil is derived from flax seeds which are nonpoisonous, although when the oil is properly used it has some insecticidal properties.

LOBELIACEAE
(Lobelia Family)

LOBELIA CARDINALIS L. Cardinal flower.

LOBELIA INFLATA L. Indian-tobacco.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

L. inflata contains the alkaloid lobeline, the physiological effects of which closely resemble those of nicotine. A 0.5- and a 0.25-percent solution of lobeline killed 100 and 70 percent of bean aphids, respectively, but a 5-percent crude alcoholic extract of the leaves and seeds proved only slightly toxic.--Tattersfield and coworkers (393).

LOGANIACEAE
(Logania Family)

GELSEMIUM ELEGANS Benth.

In China this plant was used against all kinds of insects.--Scarone (353).

GELSEMIUM SEMPERVIRENS (L.) Ait. Yellow jessamine.

Honeybees visiting the flowers are poisoned, but only the young workers were affected.--Burnside and Vansell (72).

SPIGELIA MARILANDICA L. Maryland pink.

Extracts of the roots killed only 30 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

STRYCHNOS IGNATII Bergius. Ignatia.

Extracts from the dry beans were not repellent to Japanese beetle.--Metzger and Grant (277).

A mothproofing composition, containing an alkaloid or alkaloids from the seeds of this species, was claimed in a British patent by Ritter (No. 327,009).--Roark (335, p. 82).

STRYCHNOS NUX-VOMICA L. Nux vomica. Strychnine tree.

An extract was tested against four species of caterpillars. A 5-percent spray killed on an average only 21 percent of the insects tested within 7 days, and a 1-percent spray killed only 12 percent.--Duke of Bedford and Pickering (53, p. 84).

This plant was used in India as a fish poison and insecticide.--Roark (332, p. 37).

Extracts from nux vomica (N. F.) were not repellent to the Japanese beetle.--Metzger and Grant (277).

STRYCHNOS spp.

The following abstracts pertain to the alkaloids brucine and strychnine found in the seed and bark of nux vomica and in other species of Strychnos:

Plants dipped in 300 cc. of water containing 0.3 gm. of brucine or strychnine were fed to caterpillars. The strychnine killed them in 46 hours, but brucine killed in an average of 67 days.--Maxwell-Lefroy and Finlow (272, pp. 278, 280, 281, 314).

Brucine (10 percent in flour), extract of strychnine (10 percent in water), semen strychni (100 percent and 20 percent in flour), and nitras strychni (10 percent in flour) were tested against the caterpillars of Prodenia litura (F.). The first three materials had no perceptible effect on the insects while the fourth material proved rapidly fatal.--DeBussy (76).

Spray solutions of brucine sulfate and strychnine sulfate were tested against the bean aphid. In both cases the minimum toxic concentration required to kill about 95 percent of the aphids was greater than 0.5 gm. per 100 cc., as compared with 0.009 gm. per 100 cc. of nicotine sulfate.--Richardson and Smith (322).

Brucine has some mothproofing value but insufficient for practical use.--Minaeff and Wright (281, p. 1190).

In laboratory tests brucine used as a dust killed 41 percent of codling moth larvae. Strychnine killed 52.8 percent.--McAlister and Van Leeuwen (249).

There are three patents (Brit. 327,000, Ger. 526,611 and 595,849) in which brucine and strychnine are used as insecticides in mothproofing.--Roark (335, pp. 21, 82) and Roark and Busbey (346, pp. 11, 85).

A solution of strychnine increased the heart activity as well as the movement of the larvae of Corethra crystallina (Deg.).--Dogiel (120, p. 26).

Strychnine sulfate had no effect on wireworms.--Comstock and Slingerland (102, p. 210) and Hyslop (209, pp. 30-32).

Solutions of strychnine nitrate and tincture of nux vomica, both mixed with honey, did not affect ants.--Cobelli (100).

Strychnine was tested against the body louse. Only 11 percent of the adults died within 120 hours, but 78 percent of the eggs did not hatch.--Moore and Hirschfelder (285, p. 50).

A large tomato hornworm drank 0.8 cc. or more of 1 percent of strychnine sulfate without being harmed, but when 0.5 cc. was injected into a caterpillar violent convulsive movements, with incoordinated trembling of legs and prolegs, were produced, followed by quiescence and often a strong ventral flexure and paralysis of the appendages. Full recovery was obtained in 12 hours.--Crozier (110, pp. 240-242).

Strychnine sulfate (0.002 pound per 50 gallons) in a water spray killed none of the Japanese beetles tested within 6 days.--Moore and Campbell (284, p. 400).

Corn boiled in a solution of strychnine and then scattered thinly over the ground or plowed or spaded under the soil was a control for mole crickets.--Schlosser (357).

A Canadian patent describes the following poisonous mixture for noxious insects: 3 ounces of strychnine, $\frac{1}{4}$ gallon of vinegar, 1.5 gallons of water, 1.5 gallons of oats and barley mixed with water, $\frac{1}{4}$ gallon of corn sirup, 3 ounces of sodium bicarbonate, 3 ounces of bacterial dregs; to which after the mixture has fermented is added 34 pounds of grain, 3 ounces of potassium nitrate, and 2 ounces of sodium chloride, and finally the entire mixture is dried.--Erickson (131).

In a United States patent a parasiticidal oil is described. Strychnine, nicotine, and many crystalline poisons may be added to a non-volatile viscous oil which is dispersed in water. Certain scale insects and mealybugs are to be sprayed with this mixture.--Knight (232).

In the laboratory not more than 10 percent of the wireworms tested were killed by feeding on linseed cake poisoned with strychnine. They were not affected by eating grains of wheat soaked in a saturated solution of strychnine.--Masaitis (270).

Strychnine sulfate was as toxic as rotenone to young screwworms.--Bushland (75, p. 671).

STRYCHNOS TOXIFERA Schomb. ex. Benth.

A weak concentration of curare [an alkaloid of this species] increased the heart activity of the larva of Corethra crystallina (Deg.).--Dogiel (120, p. 32).

The minimum toxic concentration required to kill about 95 percent of the bean aphids sprayed was greater than 0.5 gm. per 100 cc. while

that of nicotine sulfate was 0.009 gm. to 100 cc.--Richardson and Smith (322).

Comments by Reviewer.--Since the alkaloids of Strychnos are very poisonous to animals, it is surprising that they are not also extremely poisonous to insects.

LORANTHACEAE
(Mistletoe Family)

PHORADENDRON FLAVESCENS (Pursh.) Nutt. American mistletoe.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

LYTHRACEAE
(Loosestrife Family)

LYTHRUM SALICARIA L. Purple loosestrife.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MAGNOLIACEAE
(Magnolia Family)

LIRIODENDRON TULIPIFERA L. Tuliptree.

Extracts from this tree were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of the leaves killed 85 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

MAGNOLIA VIRGINIANA L. Sweetbay.

Extracts from the fresh leaves were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

MICHELIA CHAMPACA L. Synonym: M. aurantiaca Wall.

The flowers were useful in leprosy, boils, and itch.--Kirtikar and Basu (230, v. 1, p. 41).

MALACEAE
(Apple Family)

MALUS SYLVESTRIS Mill. Apple.

Oil of apple was strongly attractive to cockroaches (Blatta orientalis L.). An attractive bait was made from 6 gm. of gelatin,

200 cc. of dilute beef broth, 0.5 gm. of mercuric chloride, and 1 drop of oil of apple.—Cole (101).

SORBUS AMERICANA Marsh. Mountain-ash.

Extracts of the berries killed only 20 percent of the mosquito larvae tested and extract of the bark killed only 10 percent.--Hartzell and Wilcoxon (188).

MALPIGHIACEAE

HIPTAGE BENGHALENSIS (L.) Kurz.

This plant is listed as an insecticide.--Greshoff (171, p. 84).

MALVACEAE
(Mallow Family)

GOSSYPIUM BARBADENSE L. Sea-island cotton.

GOSSYPIUM spp. Cotton plants.

Many papers deal with cottonseed oil as an ingredient in insecticides but a review will not be given here. Cotton seeds are not poisonous but cottonseed oil has insecticidal value.

HIBISCUS ABELMOSCHUS L. Synonym: Abelmoschus moschatus Moench.

In Bombay the seeds are rubbed to a paste with milk and used to cure itch.--Kirtikar and Basu (230, v. 1, p. 183).

HIBISCUS TRIONUM L. Flower-of-an-hour.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

HIBISCUS VITIFOLIUS L.

In Africa a preparation from the roots was used to kill head lice.--Dalziel (112).

THESPESIA POPULNEA (L.) Soland. Portia tree. Tuliptree of India.

In India both the flowers and the yellow juice of the fruit were employed as an external application for itch.--Watt (422, v. 6, pt. 4, p. 46).

MELIACEAE
(Mahogany Family)

AZADIRACHTA INDICA A. Juss. Synonym: Melia azadirachta L. Nim or neem tree.

The leaves were mixed with grain that was kept in closed receptacles but the grain was not protected from the attacks of beetles (Calandra) Sitophilus oryza (L.) and Rhizopertha dominica (F.).--Fletcher and Ghosh (140, pp. 736-737).

Watery extracts, macerated juices, and dusts of the leaves were tested in India against a psylla, aphids, and lucerne weevil grubs. The extracts in concentrated form gave 25-percent mortality as a contact poison against the weevil grubs and when sprayed on food plants acted as a positive repellent. Against the other insects the results were very indefinite.--Chopra (97, p. 109).

A light coating of oil of neem applied to the forehead and around the eyes of bullocks in India was of little value as a fly repellent.--Cherian and Kylasam (86).

Extracts of the leaves of this plant from India were slightly toxic to the bean aphid.--Tattersfield and Gimingham (391).

A 5-percent extract of the stem bark killed 60 percent of the adult grasshoppers (Epacromia tamulus (F.)) and a 6-percent extract killed 100 percent.--Putturudriah and Subramaniam (311).

Neem cape, a cheap indigenous material in India, appeared to be an effective repellent against weevils.--Pruthi (310).

Oil of margosa did not repel blowflies on sheep, but a 3-percent oil emulsion repelled them for 8 days.--Hobson (196). [This oil is derived from the fruit and seeds of neem.]

CARAPA GUIANENSIS Aubl. Synonym: Xylocarpus carapa Spreng. Crabwood.

The seeds yield an oil known in commerce as crab oil, which is reputed to be a powerful insecticide. Insects are said not to go near trees daubed with the oil. A solution of soap made from the oil is an efficient insecticide for greenhouse or outdoor plants.--Holland (197, p. 148).

The decoction is used as an insecticide.--Greshoff (171, p. 84).

CARAPA PROCERA DC. Crabwood.

The seeds contain a large percentage of crab oil which is used as an insecticide in the Gold Coast, Africa.--Irvine (213).

GUAREA RUSBYI (Britton) Rusby. Cocillana.

Extracts from the dry bark were repellent to the Japanese beetle.--Metzger and Grant (277).

MELIA AZEDARACH L. Synonym: Azedarach commelini Medic. China berry.

Dharek.

Much has been written on the China berry as an insecticide, but only a few abstracts will be given here.

Decoctions and alcoholic extracts from the leaves, twigs, and berries had considerable effect on cotton caterpillars but were not efficient.--Riley (325, p. 185).

Water extracts of the berries were efficient against honeybees and had a slight effect on cockroaches. The powdered leaves and water extracts (not filtered) of this powder were efficient against silkworms, but had only a slight effect on aphids and tent caterpillars. The alcoholic, ether, and petroleum-ether extracts were lethal to bees, but a strong alcoholic extract did not kill any of the silkworms tested. The alcoholic and benzene extracts, used with soap, were inefficient against aphids.--McIndoo and Sievers (259, p. 8).

Water extracts, macerated juices, and dusts of the leaves had some effect on a psylla, aphids, lucerne weevil grubs, and adult beetles (Aulacophera abdominalis F.) but were inferior to tobacco.--Chopra (97, pp. 106, 109).

In soil treatment of wheat plots in India, leaves of dharek applied at the rate of 7 tons to the acre reduced the termite attack to 0.7 percent as compared with 8 percent in the untreated plots.--Husain (206).

In Russia neutral, acid, and alkaline alcoholic extracts of the fruits were prepared at the rate of 32 gm. of fruits per 100 cc. and tested as sprays on the cabbage aphid. The alkaline extracts were the most effective, giving 97 to 98 percent mortality 48 hours after application. An alcoholic extract of the seeds (oil extracted) gave 33.6-percent mortality.--Astrakhantzev and coworkers (41, pp. 455-457).

In Algeria the China berry is not touched by locusts, and cultivated plants sprayed with extracts prepared from its leaves are repellent to them. The active principle can be extracted with hot water, alcohol, chloroform, or benzene, but not with petroleum ether. The extract from 2 pounds of dry leaves in 10 gallons of water afforded effective protection against four species of grasshoppers.--Volkonsky (412, 413).

MELIA DUBIA Cav. Synonyms: M. superba Roxb.; M. robusta Roxb.

In the Concan, India, the juice of the green fruit, with one-third of its weight of sulfur and an equal quantity of curds, heated together in a copper pot, was used as an application for scabies and for sores infested with maggots.--Dymock and coworkers (124, v. 1, p. 333).

TRICHILIA CUNEATA Radlk.

The fruit and leaves were reputed to be toxic. An infusion of the leaves was used for the destruction of itch mites and other parasites of the skin.--Scarone (353).

WALSURA PISCIDIA Roxb. Synonym: Trichilia trifoliata Wall.

The Arabs used the fruit in a hair wash to kill vermin and in an ointment to cure itch.--Watt (422, v. 6, pt. 4, p. 299).

MENISPERMACEAE
(Moonseed Family)

ANAMITRA COCCULUS (L.) Wight & Arn. Synonyms: Menispermum cocculus L.

Cocculus suberosus DC. Fruit = Cocculus indicus or fish berries.

In India this plant was used in an ointment to destroy lice.--Watt (422, v. 3, p. 87).

In the Philippines the fruit was used in an antiparasitic ointment.--Greshoff (171, p. 46).

The extract of 10 gm. of cocculus indicus in 500 cc. of water had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

A. cocculus was used as a fish poison and as an insecticide in India. The seeds were boiled in rice and made into a paste.--Roark (332, p. 3).

This fish-poison plant is found in India, and the juice of the fruit is used to destroy body lice. A 5-percent alcoholic extract of the fruit killed 100 percent of Euproctis fraterna (Moore), 50 percent of Plutella maculipennis (Curt.), 60 percent of Crocidolomia binotalis Zeller., 30 percent of Prodenia litura (F.) and 100 percent of mango hopper nymphs. A similar extract of the leaves killed 80 percent of P. maculipennis, and a 3-percent alcoholic extract of the leaves, roots, and stems each killed 100 percent of E. fraterna.--Puttarudriah and Subramaniam (311).

This climbing shrub is well known in Europe, and grows wild in southern India. The berries contain picrotoxine, which is used in England in an ointment against body lice.--Scarone (353).

COSCINIUM BLUMEANUM Miers. Tuba kupak.

A 5-percent water extract of the bark and stems of this Malayan fish-poison plant failed to kill any of the larvae of Parasa herbifera (Walk.) that were treated.--Gater (153).

MENISPERMUM CANADENSE L. Yellow parilla.

Extracts of the roots killed only 35 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PACHYGONE OVATE (Poir.) Miers.

This species is used as an insecticide in India.--Chopra and Badhwar (98).

MENTHACEAE
(Mint Family)

AJUGA BRACTEOSA Wall.

In India on the Salt Range it was used to kill lice.--Watt (422, v. 1, p. 153; v. 3, p. 86).

This plant was known to have insecticidal or repelling properties.--Roark (332, p. 2).

COLLINSONIA CANADENSIS L. Citronella horsebalm.

CUNILA ORIGANOIDES (L.) Britton. Stonemint.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

DRACOCEPHALUM MOLDAVICA L.

The essential oil was tested against cotton pests in Russia. When applied in 2-percent emulsion sprays more than 90 percent of the red spiders and cotton aphids were killed within 24 hours.--Kayumov (225, 226).

GLECOMA HEDERACEA L. Synonym: Nepeta hederacea (L.) Trevisan.

Ground ivy.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of the whole plant killed only 30 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

HEDEOMA PULEGIOIDES (L.) Pers. Synonym: Cunila pulegioides L.

American pennyroyal.

The infusion, decoction, and alcoholic extract were ineffective against cotton caterpillars.--Riley (325, p. 185).

Oil of pennyroyal has been widely used to drive away fleas. It is applied to the shoe tops, hose, and trousers, or placed elsewhere on the body or clothing, and its use on bedding and floors has been advocated in flea-infested regions. The pennyroyal plant has been used for the same purpose.--Bishopp (58, p. 30).

Oil of American pennyroyal, smeared over fresh beef liver in a pint Mason jar, was a good repellent to the screwworm. There was no emergence of flies from meat treated with it.--Parman and coworkers (302).

The oil was moderately repellent to the oriental cockroach.--Cole (101).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the leaves killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

Oil of pennyroyal killed all the screwworm eggs treated.--Bushland (74).

HYPTIS SPICIGERA Lam.

In Africa the whole plant, which is strongly scented, is burned in rooms to get rid of mosquitoes, and is placed in a layer below bundles of millet to keep away termites.--Dalziel (112).

HYSSOPUS OFFICINALIS L. Hyssop.

LAMIUM AMPLEXICAULE L. Dead nettle.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

LAVANDULA OFFICINALIS Chaix. Synonyms: L. spica L.; L. vera DC.

Lavender.

The flowers were ineffective but the oil protected flannel from clothes moth infestation.--Scott and coworkers (361, p. 28).

Lavender flowers, scattered on clothes, are worthless for clothes moth control, although they have often been recommended.--Back (44).

Oil of lavender was strongly repellent to cockroaches.--Cole (101).

The essential oil from this plant was tested in Russia against the red spider and cotton aphid. When applied in 2-percent emulsion sprays, 51 to 80 percent of these species were killed within 24 hours.--Kayumov (226).

LAVANDULA spp.

In Belgium a branch of lavender placed on the pillow and above the head while one sleeps was suggested to repel mosquitoes.--Anonymous (12).

Lavender was the basis of certain sulfonated products that were used with success in war time against infestations of lice and mites.--Gattefosse (154).

LEUCAS CEPHALOTES (Roth) Spreng. Synonym: L. capitata Desf.

In India the fresh juice was used as an external application for scabies.--Watt (422, v. 4, p. 633).

LEUCAS MARTINICENSUS R. Br.

In Nigeria this plant, which has a mintlike odor, is burned for the purpose of driving away mosquitoes.--Dalziel (112).

LEONURUS CARDIACA L. Common motherwort.

LYCOPUS VIRGINICUS L. Bugle weed.

Extracts of these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the bugle weed killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

MARRUBIUM VULGARE L. Common hoarhound.

The decoction and alcoholic extract had no effect on cotton caterpillars.--Riley (325, p. 185).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of the whole plant killed 30 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

MELISSA OFFICINALIS L. Common balm.

This plant was cultivated in the Crimea both for medical uses and also for use as a bait to attract swarms of bees.--Parfentjev (300).

Torongil (balm-gentil) was used in Venezuela for killing insects. It was grown in La Guaira.--Roark (332, p. 38). [This plant is probably M. officinalis.]

Extracts of the leaves and stems killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

MENTHA ARVENSIS L. Field mint.

MENTHA CANADENSIS L. American wild mint.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MENTHA LONGIFOLIA (L.) Huds. Synonym: M. sylvestris L.

The essential oil from this plant was tested in Russia against the red spider and the cotton aphid. The toxicity increased with the concentration, and the oil was repellent to the aphids.--Kayumov (225).

MENTHA PIPERITA L. Peppermint.

Oil of peppermint was of no value as a repellent or attractant to the screwworm.--Parman and coworkers (302).

Diluted oil of peppermint was usually attractive to the oriental cockroach, but the concentrated oil was always repellent.--Cole (101).

Extracts of the whole plant killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

There are many references to menthol and menthone, both of which are constituents of oil of peppermint, but these will be omitted.

MENTHA PULEGIUM L. Synonym: Pulegium vulgare Mill. European pennyroyal.

This plant served as an insecticide.--Von Mueller (414, p. 308).

Smoke from the burning dried leaves stunned mosquitoes in 5 minutes and killed them in 8 hours.--Celli and Casagrandi (82).

MENTHA SPICATA L. Synonym: M. viridis L. Spearmint.

An alcoholic extract had no effect on cotton caterpillars.--Riley (325, p. 186).

Oil of spearmint was considered one of the best repellents to the screwworm.--Parman and coworkers (302).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the leaves and stems killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

MONARDA PUNCTATA L. Spotted beebalm. Horse mint.

An alcoholic extract from the leaves had no effect on cotton caterpillars.--Riley (325, p. 185).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

NEPETA CATARIA L. Catnip.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the leaves and stems killed 30 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

OCIMUM BASILICUM L. Common basil. Sweet basil.

In Sind, India the powdered dried leaves were said to dislodge maggots.--Murray (290, p. 173).

Sweet basil was used in Venezuela for killing insects.--Roark (332, p. 31).

The essential oil from this species in Russia gave irregular results against the red spider and the cotton aphid.--Kayumov (225).

In a patent an insecticide was claimed as prepared from a plant known as habak which is a native of Persia but also grows in the United States. The leaves and flowers have the most active properties, but the whole plant may be employed after the fibrous tissues are removed from the powder, which is treated with various solvents. The insecticide has been used successfully as a contact insecticide in the destruction of flies, potato bugs, and many other injurious insects.—Hively (195).

The oil of sweet basil (50 p.p.m.) killed 95 percent of the mosquito larvae tested. Extracts of the whole plant killed none.--Hartzell and Wilcoxon (188).

OCIMUM CANUM Sims.

In India this plant was used against fleas. In tests a 5-percent alcoholic extract of the whole plant killed 50 percent of the caterpillars of Euproctis fraterna (Moore) treated.--Puttarudriah and Subramaniam (311).

OCIMUM GRATISSIMUM L.

This plant was used in Haiti as a general insecticide.--Roark (332, p. 31).

OCIMUM SANCTUM L. Sacred basil.

The dried leaves were an effectual means of dislodging maggots in India.--Watt (422, v. 5, p. 444).

OCIMUM VIRIDE Willd. Basil. Mosquito plant.

As the result of a large number of experiments it was concluded that (1) The growing of this plant has little or no effect in driving away mosquitoes; (2) fresh leaves have no effect on mosquitoes when placed in close contact with them; and (3) the fumes of burnt leaves have a stupefying and eventually a destructive effect on mosquitoes, but to obtain this action the air must be so saturated that it is impossible for an individual to remain in the room. It is probable, however, that burning cones made of the powdered leaves will drive mosquitoes away.--Anonymous (16).

A report from northern Nigeria stated that the presence of one of these plants in a room undoubtedly drove out mosquitoes and when three or four of them were put around a bed at night a man was able to sleep unmolested without a mosquito net.--Howard (203, p. 26).

This plant was believed to be a mosquito repellent, and this property was thought to be due to the thymol given off by the leaves. Evidence of its being a valuable repellent was not convincing.--Anonymous (21).

This plant has been said to keep away mosquitoes, but experiments have given negative results.--Dalziel (112).

ORIGANUM HIRTUM Link.

Oil of origanum was of no value as a repellent or attractant to the screwworm.--Perman and coworkers (302).

ORIGANUM MAJORANA L. Sweet marjoram.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

The oil of sweet marjoram (100 p.p.m.) killed 95 percent of the mosquito larvae tested. An extract of the whole plant killed only 5 percent.--Hartzell and Wilcoxon (188).

PERILLA FRUTESCENS (L.) Britton. Perilla.

One of the constituents of a patented insecticide was the dried ground parts of this plant.--Kimura (228).

PLECTRANTHUS RUGOSUS Wall.

In India this plant was used as bedding to keep off fleas.--Watt (422, v. 6, pt. 1, p. 291).

POGOGYNE PARVIFLORA Benth.

Indians placed the culled plants in or about their houses to drive away fleas.--Chesnut (89, p. 384).

POGOSTEMON HEYNEANUS Benth. Synonym: P. patchouli Pellet. Patchouli.

The leaves when strewed among woolen clothes were said to keep away insects.--Dalzell and Gibson (111, sup., p. 66); Holland (197, p. 535).

A mixture of 3 ounces of oil of patchouli and 16 ounces of alcohol was claimed as an insecticide (U. S. patent 1,605,202).--Roark (333, p. 70).

This plant, which is widely distributed in India, is kept among clothes as an insecticide. A 6-percent alcoholic extract of the stems killed 90 percent of Prodenia litura (F.) and 100 percent of Crocidolomia binotalis Zeller. A 6-percent extract of the leaves and of the roots killed 100 percent.--Putterudriah and Subramaniam (311, 312).

Oil of patchouli (50 p.p.m.) killed 85 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PYCNANTHEMUM FLEXUOSUM (Walt.) B. S. P. Synonym: Koellia flexuosa.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ROSMARINUS OFFICINALIS L. Rosemary.

Branches of this shrub packed away with wearing apparel will keep off moths.--Von Mueller (414, p. 472).

The odor of rosemary had no effect on mosquitoes, but when the dried leaves were burned the smoke stunned them in 7 to 12 minutes and killed them in 24 hours.--Celli and Casagrandi (82, pp. 95-96).

Oil of rosemary was of no value as a repellent or attractant to the screwworm.--Parman and coworkers (302).

Rosemary, or romero, was used in Venezuela for killing insects.--Roark (332, p. 35).

Oil of rosemary was moderately repellent to cockroaches.--Cole (101).

Extracts from the dried leaves were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

Oil of rosemary (100 p.p.m.) killed 90 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ROYLEA ELEGANS Wall.

The leaves were used as an insecticide.--Greshoff (171, p. 138).

SALVIA MOORCROFTIANA Wall.

The leaves were used for itch.--Kirtikar and Basu (230, v. 2, p. 1033).

SALVIA OFFICINALIS L. Sage.

Acetone extracts of the leaves killed 80 percent and extracts of the roots killed 95 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SALVIA PLEBEIA R. Br.

The seeds were used for killing vermin.--Dalzell and Gibson (111, p. 210).

SALVIA SCLAREA L.

The essential oil from this plant was tested against cotton insects in Russia. When applied in 2-percent emulsion sprays, 51 to 80 percent of the red spiders and cotton aphids were killed within 24 hours.--Kayumov (225, 226).

SALVIA sp. Sage.

The odor of sage had no effect upon mosquitoes, but smoke from the burning leaves stunned them in 8 to 10 minutes and killed them in 36 hours.--Celli and Casagrandi (82, pp. 95-96).

SALVIA SPLENDENS Ker. Scarlet sage.

SALVIA TRILOBA L. Green sage.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

SATUREIA HORTENSIS L. Summer savory.

Smoke from the burning dried leaves stunned mosquitoes in 4 minutes and killed them in 36 hours.--Celli and Casagrandi (82, p. 96).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

The essential oil from this species was tested against cotton pests in Russia. The toxicity of the oil increased with the concentration in the spray, and it was repellent to the cotton aphids.--Kayumov (225).

SCUTELLARIA LATERIFLORA L. Mad-dog skullcap.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the whole plant (N. F.) killed only 25 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

STACHYS OFFICINALIS (L.) Franch. Common betony.

TEUCRIUM CANADENSE L. American germander.

Extracts from the entire plant of the common betony were more or less repellent to the Japanese beetle, but extracts of the American germander were not repellent.--Metzger and Grant (277).

THYMUS SERPYLLUM L. Mother-of-thyme.

In France a decoction of this plant has been used to cure itch and some other skin disorders.--Kirtikar and Basu (230, v. 2, p. 1028).

THYMUS VULGARIS L. Common thyme.

There are many papers dealing with the oil of thyme and thymol used as insecticides, although these will not be reviewed here. Thymol is derived from the essential oils of T. vulgaris and the horse mint (Monarda punctata).

Comments by Reviewer.--Menthaceae is not a promising family in which to find insecticidal material, but the essential oils from several species have been found efficient as repellents and attractants.

MIMOSACEAE
(Mimosa Family)

ACACIA CATECHU Willd. Cutch. Catechu.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

A patented insect repellent was described. It contained catechu-tannic acid as obtained from the catechu or cutch, which was obtained from the wood and pods of A. catechu and from the beetle nut or wood and fruit of Areca catechu, a species of palm. This liquid was to be used in a paint or coating for application to underwater structures to prevent decay and ravages by marine life, insects, vermin, and rodents.--Cross (109).

ACACIA FALCIFORMIS DC.

Extracts of the leaves and bark of this plant from Australia were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

ACACIA LONGIFOLIA Willd. Sydney wattle.

The commercial extract was repellent to the Japanese beetle.--Metzger and Grant (277).

ACACIA NILOTICA (L.) Willd. Synonyms: A. arabica (Lam.) Willd.; A. scorpioides (L.) W. F. Wight. Babool tree.

The leaves mixed with coconut oil were applied externally in cases of itch.--Drury (122, p. 5).

ACACIA PENNATA Willd.

ACACIA PRUINESCENS Kurz.

ACACIA SALICINA Lindl.

Extracts of the leaves and bark of these fish-poison plants from Australia and Burma were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

ACACIA SENEGAL Willd.

Various gums were tested with oils to find stable emulsifiers. Arabic gum was efficient.--Ginsburg (158). [This gum might also have been obtained from Acacia nilotica.]

ACACIA sp.

Acacia gum was unstable.--Ginsburg (158).

ALBIZZIA PROCERA (Roxb.) Benth.

ALBIZZIA STIPULATA (Roxb.) Boiv.

These species were used as fish poisons and insecticides in India.--Roark (332, p. 2).

Extracts of the leaves and bark of these fish-poison plants from India were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

DICHROSTACHYS CINEREA Wight & Arn. Synonym: Mimosa cinerea L.

In India the leaves mixed with corn were given to horses to free them of bots and worms.--Watt (422, v. 3, p. 109).

MONIMIACEAE

PEUMUS BOLDUS Mol. Boldo.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MORACEAE
(Mulberry Family)

ARTOCARPUS INTEGRA (Thunb.) Merrill. Synonym: A. integrifolius L. f.

Indian jack tree.

The juice of the root mixed with the pulp of the fruit and some sugar was made into a plaster and applied to obstinate herpes.—Drury (122, p. 53).

CANNABIS SATIVA L. Common hemp.

Hemp combings or leaves, scattered among bags and heaps of grain in India, were effective against weevils.--Riley and Howard (326, p. 223).

A 2-percent extract of hemp in sugar solution was ineffective agains the housefly.--Jackson and Lefroy (217).

Commercially prepared extracts of this species, called Cannabis indica, were not significantly toxic to the bean aphid.--Tattersfield and coworkers (393).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

In a patent (Ger. 485,101) reference was made to the use of alcoholic solutions of hemp constituents for mothproofing wool.--Roark (335, p. 35).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

In India hemp plants were spread on beds to drivo away bugs.--Chopra and Badhwar (98).

CHLOROPHORA TINCTORIA (L.) Gaud. Fustic.

The commercial extract was an effective repellent against the Japanese beetle.--Metzger and Grant (277).

FICUS RELIGIOSA L. Synonym: F. affinior Griff. Peepul tree.

In India an infusion of the bark was given internally for scabies.--Watt (422, v. 3, p. 359).

HUMULUS LUPULUS L. Hop.

Lupulin powder, which is obtained from hops, was repellent to the screwworm for 3 days.--Parman and coworkers (302).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MACLURA POMIFERA (Raf.) Schneid. Synonym: Toxylon pomiferum Raf.

Osage-orange.

MORUS sp. Mulberry.

The commercial extract of the osage-orange was repellent to the Japanese beetle, but extracts of the mulberry tree were not repellent.--Metzger and Grant (277).

MUSACEAE

MUSA SAPIENTUM L. Banana.

Oil of banana was always strongly attractive to cockroaches (Blatta orientalis). An attractive bait was made from 6 gm. of gelatin, 200 cc. of dilute beef broth, 0.5 gm. of mercuric chloride, and 1 drop of oil of banana.--Cole (101).

MYRICACEAE
(Bayberry Family)

MYRICA CERIFERA L. Southern waxmyrtle.

The Welsh people laid the branches upon and under the beds to keep off fleas and moths.--Porcher (308, p. 355).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the root bark killed 35 percent and extracts of the wax killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

MYRICA CAROLINENSIS Mill. Northern bayberry.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MYRICA GALE L. Candleberry myrtle.

The Swedes employed a strong decoction of this plant to kill bugs and lice, and to cure the itch.--Green (169, v. 2, p. 152).

MYRICA PEREGRINA (L.) Kuntze. Synonym: Comptonia peregrina (L.) Coult. Sweetfern.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MYRISTICACEAE
(Nutmeg Family)

MYRISTICA FRAGRANS Houtt. Common nutmeg.

The odor stunned mosquitoes in 10 minutes and killed them in 2 hours.--Celli and Casagrandi (82, p. 95).

Nutmeg oil was considered one of the best repellents to the screw-worm. There was no emergence of flies from meat treated with it.--Parman and coworkers (302).

Oil of nutmeg was always attractive to cockroaches.--Cole (101).

MYRTACEAE
(Myrtle Family)

ANGOPHORA LANCEOLATA Cav.

Various gums were tested with oils to find stable emulsifiers. Orange gum, which comes from this species, was unstable.--Ginsburg (158).

EUCALYPTUS GLOBULUS Labill. Blue gum.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts tested as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

EUCALYPTUS spp.

A few twigs or leaves laid on the pillow at night were said to keep away mosquitoes, but eucalyptus trees are probably of no value as mosquito repellents.--Riley and Howard (327, p. 268); Howard (203, p. 62).

Smoke from the burning fresh leaves stunned mosquitoes in 3 to 5 minutes and killed them in 3 hours.--Celli and Casagrandi (82, p. 96).

The leaves were ineffective against bedbugs, roaches, and the larvae of clothes moths.--Scott and coworkers (361).

When the attack of the woolly apple aphid is confined to a few parts of the tree these may be painted with kerosene or eucalyptus oil, which act more quickly and are more deadly than the best sprays used.--Farrell (133).

The leaves of eucalyptus were ineffective against chicken lice and the dog flea.--Abbott (37, pp. 7, 11).

Eucalyptus leaves, dusted on clothes, are worthless as a clothes moth control, although they have often been recommended for this purpose.--Back (44).

Oil of eucalyptus was of no value as a repellent or attractant to the screwworm.--Parman and coworkers (302).

Oil of eucalyptus was strongly repellent to the oriental cockroach.--Cole (101).

Oil of eucalyptus has been used in two patented insecticides (Ger. 577,760, U. S. 1,630,836).--Roark (333, p. 45) and Roark and Busbey (346, p. 25).

EUGENIA CARYOPHYLLATA Thunb. Synonym: E. aromatica Baill.

Clove tree.

Powdered cloves were ineffective against cockroaches, but efficient against carpet beetle larvae.--Scott and coworkers (361, pp. 13, 34).

Eugenol tested on a piece of cloth against body lice killed all of them within 12 hours.--Moore and Hirschfelder (285, p. 55). [Eugenol is the chief constituent of oil of cloves and also occurs in the oils of pimento, star anise, etc. There are other references in the literature dealing with eugenol, chiefly as attractants and repellents.]

Cloves were efficient against chicken lice and the dog flea, although they were not recommended on account of their high cost.--Abbott (37, pp. 7, 11).

Oil of clove buds and clove powder were strong repellents to the screwworm.--Bishopp and coworkers (59).

Cloves were a preventive against clothes moths.--Mullin (289, p. 163).

Clove-bud oil and clove powder, each plus petrolatum, were considered two of the best repellents to the screwworm. There was no emergence of flies from meat treated with oil of clove bud. Clove powder was an effective repellent for a 5-day period.--Parman and coworkers (302).

Oil of clove in bait pans hung in apple trees to attract the codling moth showed some attractive value, but captured few moths compared with the ferments tested.--Yothers (435).

Cloves and oil of clove have been used in two patented repellents (Brit. 347,783, Ger. 557,760).--Ito (216); Roark and Busbey (346, p. 16).

Oil of clove applied as a spray was tested against adult mosquitoes. It was found to be much inferior to the standard mosquitocide.--Wats and Singh (421).

Oil of clove was tested against blowflies on sheep. A 3-percent oil emulsion had a repellent effect for 8 days, and a 10-percent emulsion for 12 days, but these were not considered successful repellents.--Hobson (196).

EUGENIA CUMINI (L.) Druce. Jambolan plum.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MELALEUCA LEUCODONDRON (L.) L.

Oil of cajuput, which is obtained from this species, was of no value as a repellent or attractant to the screwworm.--Parman and coworkers (302).

The essential oil of this plant was used as a mosquito repellent in India.--Chopra and Badhwar (98).

PIMENTA OFFICINALIS Lindl. Synonyms: P. pimenta Karst.;

P. vulgaris Lindl. Allspice.

Powdered allspice was ineffective against bedbugs, cockroaches, clothes moths, and carpet beetles.--Scott and coworkers (361, pp. 5, 13, 26, 34).

Allspice was of no value against the dog flea.--Abbott (37, p. 11).

Allspice, dusted on clothes, was worthless as a control for clothes moths, although it has often been recommended for this purpose.--Back (44).

Oil of pimento was moderately repellent to the oriental cockroach.--Cole (101).

PIMENTA RACEMOSA (Mill.) Moore. Synonym: P. acris. Bayberry.

Bay rum was used in Venezuela to kill insects.--Roark (332, p. 33).

To protect persons wearing summer clothes from the stings of gnats, the garments are treated in a bath containing several substances including bay oil (Ger. patent 557,760).--Roark and Busbey (346, p. 5).

The oil of the leaves (50 p.p.m.) killed 100 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

NYCTAGINACEAE
(Four-o'clock Family)

BOERHAVIA DIFFUSA L.

The use of this plant in the Gold Coast, hung in the house to keep away lice, was probably an instance of sympathetic magic.--Dalziel (112).

MIRABILIS JALAPA L. Marvel of Peru.

The odor of the flowers was said to keep mosquitoes away at night.--Dalziel (112).

NYMPHAEACEAE
(Waterlily Family)

NELUMBO LUTEA (Willd.) Pers. Synonym: Nelumbium luteum Willd.

American lotus.

This plant was said to destroy cockroaches.--Pammel (299, p. 108).

NUPHAR ADVENA (Ait.) Ait. f. Synonym: Nymphaea advena Ait.

Spatterdock.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

OLACACEAE

XIMENIA AMERICANA L. Synonym: X. inermis L. Wild lime.

In Africa the crushed rind is frequently applied to the sores of domestic animals to keep off insects.--Greshoff (170, p. 32).

OLEACEAE
(Olive Family)

CHIONANTHUS VIRGINICA L. White fringetree.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the root bark killed 65 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

FRAXINUS AMERICANA L. White ash.

LIGUSTRUM VULGARE L. European privet.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

OLEA EUROPAEA L. Olive.

There are many papers dealing with olive oil as an insecticide, but these will not be reviewed here.

SYRINGA VULGARIS L. Common lilac.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

ORCHIDACEAE
(Orchid Family)

CYPRIPEDIUM sp. Ladyslipper.

Extracts of the roots killed only 30 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

HABENARIA BLEPHARIGLOTTIS (Willd.) Torr. White fringe-orchid.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

VANILLA PLANIFOLIA Andrews. Vanilla bean.

Vanillin tested on a piece of cloth against the body louse killed only 20 percent within 120 hours.--Moore and Hirschfelder (285, p. 54).

OXALIDACEAE
(Wood-Sorrel Family)

OXALIS STRICTA L. Yellow wood-sorrel.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PALMAE
(Palm Family)

ARECA CATECHU L. Betel nut. Betel palm.

Arecoline is one of the alkaloids of the betel nut, in which it is said to occur to the extent of 0.07 to 0.1 percent. A 0.6- and 0.4-percent solution of arecoline hydrochloride killed 100 and 50 percent of the bean aphids, respectively, and 0.75 and 0.5 percent solutions of arecoline killed 100 and 90 percent.--Tattersfield and coworkers (393).

Extracts from the betel palm were not repellent to the Japanese beetle.--Metzger and Grant (277).

BORASSUS FLABELLIFER L.

In India this plant is used to relieve itch.--Kirtikar and Basu (230, v. 2, p. 1319).

COCOS NUCIFERA L. Coconut.

The following are only a few of the references dealing with coconut and palm oils in insecticides.

A black oil extracted from the shell was used for itch and other parasitic affections.--Watt (422, v. 2, p. 447).

Stored grain was coated with coconut oil and kept in closed receptacles. The oil retarded attacks of weevils (Calandra) Sitophilus oryza (L.) as long as the grain remained moist, but the grain was attacked after a few months.--Fletcher and Ghosh (140, pp. 733-755).

Good control of the cranberry fruitworm was obtained with derris and cube sprays containing coconut oil soap.--Franklin (144).

COPERNICIA CERIFERA Mart. Carnauba palm.

Carnauba wax was used (Ger. patent 470,458) with an odorous insecticidal material in impregnating wood to form an artificial cedar board or "moth wood."--Roark (335, p. 95).

ELAEIS spp.

Thosea asigna van Eecke was the chief pest of oil palm in Sumatra. A mixture of lead arsenate and boiled linseed oil remained fairly well on the leaves for 2½ months. Palm oil was less effective as an adhesive and when mixed with lead arsenite it showed no ovicidal effectiveness when applied at low concentrations.--Gonggrijp (165).

SERENOA REPENS (Bart.) Small. Saw palmetto.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PANDANACEAE
(Screwpine Family)

PANDANUS TECTORIUS Parkins. Synonym: P. odorifera (Forsk.) Lyons.

Breadfruit tree.

The odoriferous flowers of the male trees were placed among clothes by women in the Moluccas (in Dutch East Indies) to repel clothes moths and similar insects, as well as to perfume the clothes.--Engelhardt (130).

PAPAVERACEAE
(Poppy Family)

ARGEMONE FRUTICOSA A. Gray.

Oil extracted from this plant destroyed larvae attacking lumber.--Scarone (353).

ARGEMONE MEXICANA L. Mexican or pricklepoppy.

In Mysore, India, the juice was much used for itch and scabies. The yellow juice and cold-drawn oil of the seeds was also useful for scabies.--Watt (422, v. 1, pp. 308-309).

Oil from the seeds was useful in preventing attacks of white ants and borers.--Holland (197, p. 54).

Oil from the seeds was used by the tribes in Nigeria as a preventive of white ants.--Dalziel (112).

BOCCONIA CORDATA Willd. Synonym: Macleaya cordata R. Br. Pink plume poppy.

A decoction was used in Japan as an insecticide.--Greshoff (170, p. 18).

BOCCONIA FRUTESCENS L.

The juice was very effective against injurious insects and ticks.--Scarone (353).

CHELIDONIUM MAJUS L. Celandine. Swallow wort.

A decoction killed 4 percent of the larvae of Malacosoma neustria (L.) and 44 percent of the larvae of Aglais urticae (L.) tested.--Gorlainov (166).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PAPAVER SOMNIFERUM L. Opium poppy.

The following abstracts pertain to opium, codeine, morphine, and narcotine. Opium is the milky exudation of the poppy, and the other three substances are the chief alkaloids derived from opium.

Pure tincture of opium, aqueous solution of hydrochlorate of morphine, and aqueous solution of codeine, each mixed with honey and fed to ants, had no effect.--Cobelli (100).

Plants dipped in 300 cc. of water containing 0.3 gm. of morphine were fed to caterpillars, 50 percent of which were killed in 84 hours.--Maxwell-Lefroy and Finlow (272, p. 277).

Morphine tested on a piece of cloth against the body louse killed only 30 percent of them within 120 hours, but 77 percent of the eggs did not hatch.--Moore and Hirschfelder (285, p. 50).

Spray solutions of codeine sulfate and narcotine sulfate were tested against the bean aphid. The minimum concentration of each required to kill about 95 percent of the aphids was greater than 0.5 gm.

to 100 cc. of liquid, as compared with 0.009 gm. for nicotine sulfate.--Richardson and Smith (322).

Morphine sulfate (0.005 pound per 50 gallons of water) was tested in a spray against the Japanese beetle. In one test none were killed within 6 days, but in a second test 20 percent were killed.--Moore and Campbell (284, p. 400).

Narcotine was found to be of no value against the bean aphid. It was not materially toxic at or below a concentration of 1 gm. per 100 cc. of liquid.--Tattersfield and coworkers (393).

Comments by reviewer.--It is surprising that the opium alkaloids are not more toxic to insects. More work should be done with them.

SANGUINARIA CANADENSIS L. Bloodroot.

Extracts of the root killed only 35 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PASSIFLORACEAE
(Passionflower Family)

PASSIFLORA INCARNATA L. Passionflower.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the whole plant killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PEDALIACEAE

CERATOTHECA INTEGRIBRACTEATA Engl.

A decoction was used in West Africa as an insecticide.--Greshoff (171, p. 145).

SESAMUM INDICUM L. Synonym: S. orientalis L. Sesame.

Stored grain was coated with sesame oil and kept in closed receptacles. The oil retarded attacks of weevils (Calandra) Sitophilus oryza (L.) as long as the grain remained moist, but the grain was attacked after a few months.--Fletcher and Ghosh (140, pp. 733-755).

An insecticide consisting of pyrethrins or rotenone, with sesame oil added as a synergist, is described in a patent. The concentration of the insecticide required to cause 100 percent mortality of houseflies was reduced, and the paralysis of the insects not hit with sufficient insecticide actually to kill was prolonged.--Eagleson (125).

Sesame oil killed only 2 percent of the houseflies tested; pyrethrins plus this oil killed 57 percent; pyrethrins plus fractions I and II of the oil killed 100 and 91 percent, respectively; pyrethrins plus sesamin (crystalline fraction) and the noncrystalline residue killed 85 and 89 percent, respectively; therefore, the sesamin isolated from the sesame oil increased the toxicity of pyrethrum to flies.--Haller and coworkers (179).

PHYTOLACCACEAE
(Pokeweed Family)

PETIVERIA ALLIACEA L.

This plant was used in Haiti as an insecticide against bedbugs and plant lice.--Roark (332, p. 33).

This Guatemalan plant was used as an insecticide in Nicaragua and Haiti.--Pacheco Herrarte (297).

This species was employed as an insecticide in Central America.--Barcellos Fagundes (51).

PHYTOLACCA AMERICANA L. Synonym: P. decandra L. Common pokeberry.

The root, either fresh or dried, was poisonous to cockroaches.--Glover (163, p. 133).

A weak decoction of the leaves and berries and an alcoholic extract of the dried roots had no effect on cotton caterpillars, but a very strong decoction killed the young worms and seriously affected the older ones.--Riley (325, p. 187).

The powdered roots had no effect on fly larvae.--Cook and Hutchison (103, p. 4).

As a remedy for cockroaches: "Make a strong decoction of poke roots, when the strength is out of the roots, mix the liquor with molasses and spread it on large plates in the places they frequent. They may be thus slain by the thousands."--Scheib (355, p. 116).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PINACEAE
(Pine Family)

ABIES BALSAMEA (L.) Mill. Balsam fir.

Canada balsam, which is obtained from this species, is mentioned in a patent as a constituent of an adhesive composition to be used in mothproofing.--Isaacs (214).

ABIES CONCOLOR (Gord. & Glend.) Hoopes. White fir.

ABIES VEITCHII Lindl. Veitch fir.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

ABIES spp.

Rare-earth salts of abietic acid (derived from fir trees) were patented for mothproofing (Brit. 247,242; Fr. 603,552; and U. S. 1,739,840). For example, woolen rugs might be protected from attack by carpet beetles by spraying or dipping with a 5-percent solution of titanium abietate.--Roark (333, p. 2).

CALLITRIS QUADRIVALVIS Vent. Sandarac tree.

Various gums were tested with oils to find stable emulsifiers. Sandarac gum was unstable.--Ginsburg (158).

CHAMAECYPARIS THYOIDES (L.) B. S. P. White cedar.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CUPRESSUS sp. Cypress.

Oil of cypress (50 p.p.m.) killed 90 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

JUNIPERUS COMMUNIS L. Juniper.

Two formulas were recommended for aphids and coccids having a cottony coat: (1) flour 5 pounds, soft soap 10 pounds, juniper oil 6 to 8 gallons, and water 100 gallons; (2) flour 5 pounds, soft soap 10 pounds, juniper oil 4 to 6 gallons, alcohol 2 to 4 gallons, and water 100 gallons.--Benlloch (55).

Juniper oil was strongly repellent to cockroaches.--Cole (101).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Acetone extracts of mature juniper berries killed 70 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

JUNIPERUS OXYCEDRUS L.

A spray recommended for phylloxera on grapevines in France contained oil of cade, obtained from this species.--Cornu and Dumas (105, p. 29).

Oil of cade was considered one of the best repellents for the screwworm. There was no emergence of flies from meat treated with it.--Parman and coworkers (302).

Oil of cade was used in a mothproofing agent (Brit. patent 399,938).--Roark and Busbey (346, p. 12).

JUNIPERUS SABINA L. Synonym: Sabina officinalis Garcke. Savin.

A decoction of the tops of the plants served as an insecticide.--Greshoff (170, p. 161).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Reference was made to the use of aqueous extracts from the young shoots of savin for mothproofing (Ger. patent 488,307).--Roark (335, p. 76).

JUNIPERUS VIRGINIANA L. Red cedar.

There are many papers on the uses of cedar chests and oil of cedar wood, but all of them should not correctly be discussed under this species, although since cedar chests are usually constructed of red cedar and as oil of cedar is largely obtained from J. virginiana the following abstracts will nevertheless be arranged under this species.

In England it was reported in 1758 that no moth or other mischievous insect ever came into chests made of cedar.--Hale (176, p. 401).

Red cedar chips and shavings, while not entirely effective in keeping the adult moths from laying eggs on the flannel treated, appeared to protect it from appreciable injury when used liberally. The chips and shavings showed practically no killing effect against moth eggs or against larvae that were one-fourth grown.--Scott and coworkers (361, p. 28).

Cedar chests exert no noticeable effect upon the adult clothes moths, but they kill the young larvae. The volatile oil contained in the wood is probably the insecticidal principle.--Back and Rabak (47).

Closets lined with red cedar were of doubtful value in protecting clothing from moth attack. The mere odor of cedar did not keep moths from entering a closet. Well-made chests of red cedar heartwood could be depended on for protection against clothes moths for they would kill all the newly hatched or young larvae.--Back (44).

Oil of cedar sprinkled between the sheets gives a degree of protection to people compelled to sleep in flea-infested places.--Bishopp (58, p. 30).

Spray solutions containing oil of cedar wood were tested against the bean aphid. The minumum concentration required to kill about 95 percent of the aphids was 1 gm. in 100 cc. of liquid while that for nicotine sulfate was 0.009 gm.--Richardson and Smith (322).

There was no emergence of screwworm flies from meat treated with oil of cedar leaf.--Parman and coworkers (302).

The use of cedar wood and oil of cedar is referred to in four patents for mothproofing (U. S. 1,610,167; 1,620,587; 1,630,836; and Ger. 470,458).--Roark (333, pp. 36-37; 335, p. 23).

PICEA ABIES (L.) Karst. Norway spruce.

Extracts of the leaves and small branches killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PICEA ORIENTALIS (L.) Link. Oriental spruce.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PINUS LONGIFOLIA Roxb. Pine.

In India the crude oleoresin was useful in the preparation of plasters, ointments, and pastilles for fumigations. Turpentine oil was used as a remedy for mange in horses.--Watt (422, v. 6, pt. 1, p. 245).

Extracts of pine applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

PINUS RIGIDA Mill. Pitch pine.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PINUS spp. Pines.

The references included under this heading pertain mostly to various pine products, including pine oil or pine-tar oil, turpentine and its constituents, rosin or resin and resin acid, creosote of wood tar, and pine extracts. The exact species of pines are unknown to the writer and only a few of the numerous papers will be cited.

Pine oil, pine tar, pine-tar oil, crude turpentine, and rosin residue plus pine oil, smeared over fresh beef liver in pint Mason jars, were among the best repellents used against the screwworm. In view of the cheapness, availability, nontoxicity, and adhesiveness of pine-tar oil, it was considered the best material among the 353 compounds and mixtures tested to use upon wounds of domestic animals to protect them against this fly.--Parman and coworkers (302).

In comparative tests treated pine-tar oils showed greater fungicidal value than refined petroleum oils and might also act as carriers for copper resinate, which they dissolved readily, giving an insecticidal effect as well.--DeOng (117).

Certain combinations of fractions of pine oils, when sprayed on the bark of rustic furniture and log cabins made of white cedar, were very efficient in killing the larvae of wood borers.--Thompson (400).

A new spreader for nicotine was prepared by using combinations of pine-tar oil. The toxicity of nicotine to aphids was greater with the new spreader than with soluble tar oil containing 10 percent of potassium oleate. It was also tested for 2 years against aphids, leafhoopers, and thrips on peaches, apples, grapes, and vegetable crops.--Eddy (126).

In comparative tests against Aphrophora parallela (Say) on pines a pine-oil emulsion (Palustrex) with nicotine sulfate (2:1:800) gave complete control, but summer oil with nicotine sulfate (4:1:800) gave only partial control.--Felt and Bromley (134).

In India the litchi bark borer (Arbela tetraonis Moore) and the mango tree borer (Rhytidodera simulans) were destroyed by injecting turpentine oil into the boreholes, but this was not practicable with very big trees.--Hector (191).

Spray solutions containing oils were tested against the bean aphid. The minimum concentrations (per 100 cc. of liquid) required to kill about 95 percent of the aphids follow: Turpentine spirits (technical) greater than 5 gm., terebene (U.S.P.) about 2 gm., and pine oil greater than 1 gm. The figure for nicotine sulfate, used as a standard, was only 0.009 gm.--Richardson and Smith (322, p. 7).

One patent (U. S. 1,630,836) refers to pine oil with carbon disulfide for fumigating clothing (Roark 333, p. 82); five (U. S. 1,610,167, Brit. 221,599 and 230,203, Ger. 470,458 and 481,679) to turpentine as an insecticide or repellent (Roark 333, p. 110; 335, pp. 7, 90); five (Brit. 247,242, Fr. 603,552, Ger. 470,458, U. S. 1,739,840 and 1,884,367) to resin acid and rosin for mothproofing and termite-proofing (Roark 333, p. 88; 335, p. 74; and Roark and Busbey 346, p. 74); and two patents (U. S. 369,739 and 1,620,587) to creosote of wood tar for mothproofing (Roark 333, p. 42).

Extracts from pine needles were repellent to the Japanese beetle.--Metzger and Grant (277).

PINUS STROBUS L. White pine.

PINUS SYLVESTRIS L. Scotch pine.

Water extracts of the needles of the white pine killed only 10 percent of the mosquito larvae tested and acetone extracts of the needles of the Scotch pine killed 25 percent.--Hartzell and Wilcoxon (188).

PINUS VIRGINIA Mill. Scrub pine.

THUJA OCCIDENTALIS L. Arborvitae.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of the leaves killed only 25 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

TSUGA CANADENSIS (L.) Carr. Hemlock. Hemlock spruce.

Oil of hemlock, which is probably obtained from this and related species, exhibited good repellent action against the screwworm for 1 or 2 days only.--Parman and coworkers (302).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of hemlock needles killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PIPERACEAE
(Pepper Family)

PIPER ADUNCUM L.

This plant was used in Haiti as an insecticide, particularly against ants in seed beds.--Roark (332, p. 33).

PIPER ALBUM Vahl. White pepper.

This pepper (10 percent in flour) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

PIPER CUBEBA L. f. Cubeb pepper.

Oil of cubeb was moderately repellent to the oriental cockroach.--Cole (101).

Oil of cubeb (100 p.p.m.) killed 100 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PIPER ELONGATUM Vahl. Matico.

Extracts of matico were not repellent to the Japanese beetle.--Metzger and Grant (277).

PIPER NIGRUM L. Black pepper.

A strong extract killed cotton caterpillars within 12 hours.--Riley (325, p. 187).

Black pepper was a very satisfactory repellent to ovipositing moths of the corn ear worm.--Freeborn and Wymore (146).

Pepper was mentioned as a clothes moth repellent in three patents (U. S. 1,562,510; Brit. 173,536; and Ger. 344,266).--Roark (333, p. 70).

SAURURUS CERNUUS L. Common lizardtail.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PLANTAGINACEAE
(Plantain Family)

PLANTAGO LANCEOLATA L. Buckhorn plantain.

PLANTAGO MAJOR L. Common plantain.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

PLANTANACEAE
(Planetree Family)

PLATANUS OCCIDENTALIS L. American planetree.

PLATANUS ORIENTALIS L. Oriental planetree.

Extracts of the American planetree killed only 5 percent of the mosquito larvae tested while extracts of the oriental planetree killed 20 percent.--Hartzell and Wilcoxon (188).

PLUMBAGINACEAE
(Plumbago Family)

LIMONIUM CAROLINIANUM (Walt.) Britton. Sea lavender.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PLUMBAGO ROSEA L. Synonym: P. coccinea (Lour.) Boiss.

PLUMBAGO ZEYLANICA L. Synonym: P. auriculata Blume.

In India the milky juice was used for ulcers and scabies.--Watt (422, v. 6, pt. 1, pp. 295-296).

This plant is widely distributed in India. A 5-percent alcoholic extract of the roots killed 100 percent of the caterpillars, Euproctis fraterna (Moore), and 80 percent of beetle grubs, Epilachna sp. A 5-percent extract of the stem bark killed 100 percent of each species.--Puttarudriah and Subramaniam (312).

POACEAE
(Grass Family)

AGROPYRON REPENS (L.) Beauv. Quackgrass.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the roots killed only 35 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

BAMBUSA ARUNDINACEA Retz. Synonym: B. orientalis Nees. Spiny bamboo.

In India the most efficacious application for dislodgment of worms in ulcers was a poultice made by pounding the young shoots of the bamboo.--Watt (422, v. 1, p. 391).

CYMBOPOGON CITRATUS (DC) Stapf. Lemon grass.

Oil of lemon grass was of no value as a repellent or attractant to the screwworm.--Parman and coworkers (302).

In Africa it has been suggested that this grass be planted as a local deterrent to the tsetse fly.--Dalziel (112).

In Russia when oil of lemon was applied in 2-percent emulsion sprays, more than 90 percent of the red spiders and cotton aphids were killed within 24 hours.--Kayumov (226).

CYMBOPOGON NARDUS (L.) Rendle. Citronella grass.

For a long time oil of citronella has been used as a repellent and attractant. The following abstracts are only a few of those in the literature.

Oil of citronella is the most effective repellent for mosquitoes and has been used since 1897 on all the author's insect-collecting trips.--Smith (369, p. 542).

The following formula is the most effective mosquito repellent tried: Oil of citronella 1 ounce, spirits of camphor 1 ounce, and oil of cedar 0.5 ounce. This mixture is effective against all mosquitoes tested except the yellowfever mosquito. The following formula is used against mosquitoes and black flies: Mutton tallow 2.5 pounds, black Canadian tar 0.5 pound, oil of citronella 3 ounces, and oil of pennyroyal 1.5 ounces.--Howard (203, p. 13).

In India fly papers treated with oil of citronella were exposed in an orchard from March to June. The number of Dacus fruitflies caught was about 18,000.--Howlett (205, p. 413).

Several oils were tested in pans as traps to capture the adult Mediterranean fruitfly. Of the vegetable oils tried, oil of citronella captured the most fruitflies, but of the oils used kerosene caught the most.--Severin (362).

Oil of citronella (Ceylon) smeared over fresh beef liver in a pint Mason jar was a good repellent to the screwworm. There was no emergence of flies from meat treated with it.--Parman and coworkers (302).

The following formulas are used as mosquito-repellent salves: Bamber oil, used in the Orient, consists of oil of citronella 1.5 parts, kerosene 1 part, coconut oil 2 parts, and carbolic acid 1 percent. More lasting and more effective is Sierra oil, which consists of oil of citronella 3 ounces, spirits of camphor 1 ounce, oil of tar 1 ounce, oil of pennyroyal 0.25 ounce, and castor oil 4 ounces.--Freeborn (145).

Oil of citronella was always repellent to the oriental cockroach.--Cole (101).

Oil of citronella mixed in equal parts with spirits of camphor or oil of lavender gives good protection against mosquitoes for limited periods. The time of effectiveness can be extended by adding an equal quantity of castor oil.--Twinn (404).

CYNODON DACTYLON (L.) Pers. Synonym: Capriola dactylon Kuntze.

Bermuda grass.

In India the fresh juice was applied for scabies.--Watt (422, v. 2, p. 680).

HOLCUS LANATUS L. Velvet grass.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

MELINIS MINUTIFLORA Beauv. Molasses grass.

This grass appears to be widely distributed and has many common names, such as capim, efwatakala grass, gordura grass, kifuta, melado, molasses grass, and stink grass. Some of the following reports are doubtless greatly exaggerated.

This grass was observed in Africa, particularly the Congo. Owing to its strong odor it might be employed as a possible means of controlling the tsetse fly. The leaves are covered with glandular hairs which contain a viscid oil and which probably act as fly traps. In Portuguese Congo the natives use the grass for making beds for sitting fowls, or for dogs when about to give birth to young, to prevent them from being attacked by fleas. In Brazil and Colombia it is believed that ticks cannot exist in pastures of this grass, doubtless because of the oil the leaves contain. It is further affirmed in South America that cattle that have fed on the grass, when moved to other pastures infested with ticks, are not attacked by these parasites for some time.--Dawe (115).

A microscopic examination of the molasses grass showed that the leaves were covered with two kinds of hairs, blunt and sharp ones, most of which bore droplets of oil, although the oil probably escaped only from the blunt hairs. A chemical examination showed that the fresh plant yielded only 0.001 percent of volatile oil, which consisted largely of free acids and esters.--Kew Royal Botanic Gardens (227).

In San Salvador the planting of this grass was suggested to destroy weeds and prevent the propagation of mites [chiggers].--Renson (319).

Tests at the Puerto Rico Experiment Station showed that molasses grass did not destroy ticks (Boophilus (Margaropus) annulatus australis Fuller), but repelled them. In a pasture sown exclusively with it and where no other plants of about the same height occur, ticks that fall from animals are likely to die, being unable to reach new hosts.--Menéndez Ramos (275).

This grass was reported in Guatemala to possess marked adhesive properties and to be capable of trapping only small insects. Newly hatched ticks were trapped and killed as they attempted to climb up the stems, and cattle pastured exclusively on this grass were reported to become entirely free from ticks within a year. It should also be useful planted between sugarcane fields to control leafhoppers or bordering sugar beet fields where curly top is a danger, while as a trap crop for aphids it is ideal.--Smyth (370).

This plant has been planted in both Florida and Puerto Rico, where Smyth (370) indicated its probable usefulness as a tick eradicator. Its sticky excretion did not kill young ticks, but simply deterred their crawling upward to contact an animal.--Rosenfeld (348).

This species has the odor of cumin and is said to repel mosquitoes and tsetse flies. The fresh leaves are covered with glandular hairs, which exude a viscid oil.--Finnemore (137, p. 151).

The whole plant is reported in East Africa as insecticidal.--Bally (50).

Experiments in West Africa proved it to have no deterrent effect on mosquito breeding. The effect on tick larvae can be observed in a test tube, the action of the glandular hairs being purely mechanical. That tsetse flies can be so repelled is open to doubt.--Dalziel (112).

During the last 10 years in Venezuela paddocks for domestic animals have been planted with a coarse grass. In such paddocks, when the grass was green, mosquitoes, snakes, etc., were almost extinct. Cattle covered with ticks when entering such planted areas would be free of these parasites after a few weeks, provided they were kept entirely on this grass in the green stage. It has a peculiar penetrating and pleasant odor. When walking through the damp pasture one's boots appear as to have been greased. This probably is the principal secret of its antiverminous effect, for any kind of oily or greasy substance is fatal to ticks. We have cultivated this insectproof grass even on anthills. The ants, especially the large Venezuelan "bachacos," often destroy a field of green maize and other foliage in a very short time; yet they avoid destroying the M. minutiflora. We consider it the most useful of all the pasture grasses in the Tropics, and recommend planting it around all dwellings in the country.--Morgan (287).

ORYZA SATIVA L. Rice.

Oil of rice was attractive to the oriental cockroach in 35 counts and repellent in 40 counts.--Cole (101).

PANICUM ANTIDOTALE Retz. Synonym: P. subalbidum Kunth.

In India the smoke of the burning plant was used for fumigating wounds.--Watt (422, v. 6, pt. 1, p. 7).

STIPA VIRIDULA Trin. Sleepy grass.

The powder from this grass, used as a dust, had no effect on tent caterpillars but had a slight effect on cockroaches.--McIndoo and Sievers (259, p. 23).

TRITICUM sp. Wheat.

There are many references on wheat flour as an insecticide, but instead of being poisonous it acts mechanically. Only three references will be cited here.

Flour was found to kill the red spider. It glued the mites fast to the foliage, thus causing death mechanically rather than by poisoning them.--McGregor and McDonough (253, p. 65).

Wheat flour was ineffective against cockroaches.--Scott and coworkers (361, p. 14).

It was of no value against chicken lice.--Abbott (37, p. 7).

VETIVERIA ZIZANIOIDES (L.) Nash. Synonym: Andropogon zizanioides Urb.

Cuscus grass. Vetiver.

An ointment prepared with the oil was employed in removing pediculi from the hair.--Drury (122, p. 39).

In the Gold Coast, Africa, the dried roots of this grass, when placed among clothes, prevented insect attack.--Irving (213).

This species was used in Haiti against bedbugs, plant lice, etc. The roots were placed in clothing wardrobes to keep away the insects.--Roark (332, p. 39).

This grass is cultivated in Brazil, and its roots were used as an insecticide.--Barcellos Fagundes (51).

ZEA MAYS L. Indian corn. Maize.

The following are a few of the references pertaining to corn meal, oil of corn (maize), and hordenine.

Corn meal, dusted on cabbage plants in the morning while the dew was on, caused the imported cabbage worm to drop off and thus protected the plants till it was washed off by the rain.--Chittenden (93, p. 8).

Corn meal was ineffective against cockroaches and the dog flea.--Scott and coworkers (361).

The effect of oil emulsions on the foliage of young peach and apple trees was studied. The oils of corn and peanut were the least injurious of the vegetable oils tested.--Ginsburg (159).

Corn oil, linseed oil, and cottonseed oil were tested as solvents for paradichlorobenzene against the lesser peach borer. Crude cottonseed oil was the most suitable solvent used.--Snapp and Thomson (371).

Oil emulsions were tested in South Africa against various insects and mites on fruit trees. Maize oil was slightly inferior to raw linseed oil or seal oil.--Mally (263).

Hordenine methiodide was of no insecticidal value against the bean aphid. It was not materially toxic at or below a concentration of 1 gm. per 100 cc.--Tattersfield and coworkers (393). [Since hordenine is an alkaloid found in malt culms and mescal, this material may have been derived from fermented corn.]

Comments by reviewer.--The family Poaceae so far has not furnished good material for insecticides, but it has furnished oil from citronella grass, which is one of our standard repellents. We should have further results on molasses grass to determine whether or not its sticky oil is really toxic, or kills mechanically, or is merely repellent.

POLEMONIACEAE
(Phlox Family)

PHLOX PANICULATA L. Garden phlox.

PHLOX SUBULATA L. Moss phlox.

Extracts of these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

POLYGALACEAE
(Milkweed Family)

POLYGALA SENEGA L. Seneca snakeroot.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the roots (N. F.) killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

POLYGONACEAE
(Buckwheat Family)

ANTIGONON LEPTOPUS Hook. & Arn.

Parts of this plant from Port-of-Spain, Trinidad, were tested in 1929. The powder, used as a dust, and the petroleum ether extract, used as a spray, killed only a small percentage of the currant worms and the four species of aphids tested.--Sievers and McIndoo (unpublished notes).

FAGOPYRUM SAGITTATUM Gilib. Buckwheat.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

POLYGONUM FLACCIDUM

This plant, which contains saponin, was used in Assam as a vermicide and fish poison. It exudes a greenish mucilaginous juice, which had only a slight effect on mosquito larvae.--Manson (265).

POLYGONUM HYDROPIPER L. Synonym: Persicaria hydropiper Opiz.

Water pepper.

This plant was used for driving flies from wounds on cattle.--Porcher (308, p. 409).

A decoction of the leaves and an alcoholic extract had no effect on cotton caterpillars.--Riley (325, p. 185).

POLYGONUM PENSYLVANICUM L. Smartweed.

A decoction had no effect on the horn fly.--Washburn (419, p. 35).

POLYGONUM ORIENTALE L. Synonym: P. hispidum.

POLYGONUM PUNCTATUM Ell. Synonym: P. acre H. B. K.

These species in Guatamala were used to cure skin diseases of dogs and as an insecticide.--Pacheco Herrarte (297).

P. punctatum was used as an insecticide.--Barcellos Fagundes (51).

POLYGONUM sp. Persicary.

A decoction of this plant repelled grain weevils in France.--Lesne (245).

This plant has been found of insecticidal value against certain insects in South China.--Chiu (94).

RHEUM RHAPONTICUM L. Rhubarb.

Radix rhei had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Water extracts of the roots killed 70 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

RUMEX ACETOSA L. Garden sorrel.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

RUMEX sp.

An alcoholic extract was ineffective against cotton caterpillars.--Riley (325, p. 186).

PONTEDERIACEAE
(Pickerelweed Family)

PONTEDERIA CORDATA L. Pickerelweed.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PORTULACACEAE
(Purslane Family)

CLAYTONIA VIRGINICA L. Virginia springbeauty.

Extracts from the entire plant were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

PRIMULACEAE
(Primrose Family)

ANAGALLIS ARVENSIS L.

This plant was known to have insecticidal or repelling properties in India.--Roark (332, p. 2).

CYCLAMEN ELEGANS Boiss.

An infusion of the fresh or dried bulbs, which contain a saponin, was very active against parasites on fruit trees.--Pylnov (313).

LYSIMACHIA NUMMULARIA L. Moneywort.

The leaves and flowers, steeped in oil, destroyed insects infesting granaries.--Porcher (308, p. 509).

LYSIMACHIA TERRESTRIS (L.) B. S. P. Swampcandle.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PROTEACEAE
(Protead Family)

LOMATIA SILAIFOLIA (Sm.) R. Br. Parsley fern.

In New South Wales it was reported that the flowers were poisonous to flies, the number in a room being greatly diminished when a bunch of the flowers was put in the fireplace.--Anonymous (10).

PUNICACEAE
(Pomegranate Family)

PUNICA GRANATUM L. Pomegranate.

A 0.75- and a 0.5-percent solution of pelletierine killed 90 and 70 percent of bean aphids, respectively, and similar concentrations of pseudopelletierine killed 100 and 90 percent.--Tattersfield and coworkers (393). [These substances are derived from pomegranate.]

PYROLACEAE

CHIMAPHILA UMBELLATA (L.) Nutt. Pipsissewa.

Extracts of the whole plant killed none of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

RANUNCULACEAE
(Crowfoot Family)

ACONITUM COLUMBIANUM Nutt. Columbia monkshood.

The roots, leaves, and stems had no effect on grasshoppers and honeybees.--McIndoo and Sievers (259, p. 21).

ACONITUM NAPELLUS L. Aconite. Monkshood.

A weak concentration of the alkaloid aconitine caused the larva of Corethra crystallina (Deg.) to tremble and increased its heart activity.--Dogiel (120, p. 32).

A tincture of aconite mixed with honey had no effect on ants.--Cobelli (100).

If a drop of the concentrated tincture is placed upon the head of a blowfly, marked symptons of muscular weakness result, with inability to fly or to walk up perpendicular surfaces. A progressive paralysis terminates in death after 4 to 5 hours.--Blyth and Blyth (64, p. 367).

Extracts were tested against four species of caterpillars. Within 7 days a 5-percent spray killed only 17 percent of the insects and a 1-percent spray only 13 percent.--Duke of Bedford and Pickering (53, p. 84).

A few drops of a strong water extract dropped upon the body of a stag beetle were fatal.--Gomilevsky (164).

Aconitine (1 percent in flour), extract of aconitine (10 percent in water), and tuber aconite (100 percent and 10 percent in flour) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Spray solutions of aconitine sulfate were tested against the bean aphid. The minimum concentration required to kill about 95 percent of the aphids was greater than 0.5 gm. to 100 cc. of liquid, while that of nicotine sulfate was 0.009 gm.--Richardson and Smith (322).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

In Russia aconite was found ineffective against aphids.--Goryainovui and Koblova (167).

In Russia cabbage aphids were sprayed with extracts of aconite prepared by infusing the dried roots in 70-percent alcoholic or 3-percent water solutions of sodium hydroxide or sulfuric acid. The sodium hydroxide extracts were the most effective, killing 49 percent of the aphids at a concentration equivalent to 40 mg. of dry root to 1 cc.--Blumberg and coworkers (63, pp. 457-459).

Extracts from aconite applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

ADONIS VERNALIS L. Spring adonis.

ANEMONE PULSATILLA L. European pasqueflower.

ANEMONE QUINQUEFOLIA L. American wood anemone.

CALTHA PALUSTRIS L. Marsh marigold.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

CIMICIFUGA FOETIDA L. Fetid bugbane.

The root was said to be poisonous. In Siberia it was used to drive away bugs and fleas.--Watt (422, v. 2, p. 288).

In India this plant was known to have insecticidal or repelling properties.--Roark (332, p. 9).

CIMICIFUGA RACEMOSA (L.) Nutt. Cohosh bugbane.

The powdered roots, used as a dust, had no effect on crickets; and used as a fumigant, an alcoholic extract, and an aqueous extract, they had little or no effect on these insects.--Sayre (352).

Extracts (U.S.P.) were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts (N. F.) of the roots killed only 25 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

CLEMATIS DIOICA L. Honduras fish poison.

A water extract was efficient against silkworms.--McIndoo and Sievers (259, p. 22).

CLEMATIS VITALBA L.

In France it was reported that this plant repelled weevils from stored grains. Twigs of clematis with leaves and flowers were placed on the bags of grain. Grains thus treated were free from infestation while weevils were plentiful in the vicinity.--Anonymous (19).

COPTIS GROENLANDICA (Oeder) Fern. Gold thread.

Acetone extracts of the whole plant killed 55 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

DELPHINIUM AJACIS L. Rocket larkspur.

This plant is listed as an insecticide.--Greshoff (170, p. 8).

The insecticidal value against bedbugs was due mostly to the oil extracted from the seeds, while the alkaloid extracted played an insignificant part.--Williams (427).

DELPHINIUM BICOLOR Nutt. Low larkspur.

Powders from the roots, leaves, stems, and blossoms, and extracts from these powders had no effect on webworms, silkworms, grasshoppers, and potato beetle larvae, the one exception being a slight effect on silkworms caused by the extract from the blossoms.--McIndoo and Sievers (259, p. 22).

DELPHINIUM BRUNONIANUM Royle. Musk larkspur.

In India the juice of the leaves was used to destroy ticks on sheep.--Watt (422, v. 3, p. 64).

This plant was used in India to destroy maggots in wounds.--Chopra and Badhwar (98).

DELPHINIUM COERULEUM Jacqem.

In India the roots were applied to kill maggots in the wounds of goats.--Watt (422, v. 3, p. 88).

DELPHINIUM CONSOLIDA L. Field larkspur.

A tincture of the seeds kills lice on the human head.--Williams (428, p. 875).

The common larkspur was an effective insect poison.--Riley (325, p. 114).

Oil from larkspur seed was tested as a contact spray. A 2-percent oil emulsion was effective against red spiders and aphids, but of little value against thrips, potato beetle larvae, and cabbage worms. Young larvae of white flies were killed, but other stages proved resistant. It was of greater value against red scale than against San Jose scale. The alkaloids delcosine and delsoline [from this plant] were tested as sprays, with and without soap, both as contact and stomach insecticides. A 0.042-percent solution of delcosine was effective against aphids and of value against thrips but not against red spiders. A 0.085-percent solution controlled aphids and thrips, but was of no value against mealybugs and white flies. Larvae of fall webworms put on apple foliage sprayed with 0.042- and 0.085-percent solutions of delcosine failed to feed normally and subsequently died, and larvae of imported cabbage worms put on cabbage foliage sprayed with 0.085 percent died. A 0.042-percent and a 0.085-percent solution of delsoline were effective against aphids but ineffective against red spiders and white flies. The latter solution was effective against thrips. Fall webworms and cabbage worms died after feeding on sprayed foliage, but large larvae of a tiger moth were unhurt.--Davidson (113).

DELPHINIUM ELATUM L.

This plant was used to destroy maggots in wounds in India.--Chopra and Badhwar (98).

DELPHINIUM spp. Larkspur.

In New South Wales in 1892 it was suggested that larkspur be planted in small patches near the breeding ground of grasshoppers to destroy this pest.--Anonymous (9).

A decoction of the seed was recommended as an insecticide against the short-nosed ox louse.--Osborn (294, p. 175).

The foliage was found to poison locusts that fed on it.--Gurney (172, p. 418).

A sulfuric acid extract of the ground seed had a considerable effect on fly larvae.--Cook and coworkers (104, p. 14).

Many reports have been received of the poisonous effect of delphiniums on locusts. In one instance, where the entire crop of other flowers had been destroyed, fields of delphiniums remained almost uninjured and wherever the locusts had nibbled these plants they died.--Anonymous (29).

DELPHINIUM STAPHISAGRIA L. Stavesacre. Lousewort.

The powdered seeds were used chiefly to destroy lice on children's heads.--Green (169, v. 1, p. 443).

Stavesacre was largely used in Europe and was employed both by the Greeks and Romans to destroy vermin.--Watt (422, v. 3, p. 64).

This species was employed in medicine solely as a local application for the destruction of lice and the itch mite.--Hare and coworkers (183).

Oil from stavesacre seed was tested as a contact emulsion spray against many insects, and the results were the same as given for Delphinium consolida. The alkaloid delphinine of stavesacre seed was tested in the form of delphinine hydrochloride dissolved in alcohol, with or without soap. At concentrations up to 0.16 percent of alkaloid it was inefficient against aphids (Myzus persicae (Sulz.)), mealybugs, red spiders, and thrips, and did not prevent fall webworms from feeding normally. A 0.085-percent solution was of value against the onion thrips. It was also effective as a stomach poison against cabbage worms.--Davidson (113).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

DELPHINIUM VESTITUM Wall.

This plant was used in India to destroy maggots in wounds.--Chopra and Badhwar (98).

DELPHINIUM ZALIL Aitch. & Hensl.

In India the ashes of this species were useful for itch.--Watt (422, v. 3, p. 70).

HELLEBORUS FOETIDUS L. Fetid hellebore.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

HELLEBORUS NIGER L. Black hellebore.

The powdered roots were inefficient against fly larvae.--Cook and Hutchison (103, p. 4).

Extractum hellebori (10 percent in water), rhizoma hellebori (100 percent), and rhizoma hellebori (10 percent in flour) were tested against the caterpillars of Prodenia litura (F.). The first had no effect on the insects, the insects did not eat the second, but they ate a little of the third.--DeBussy (76).

Extracts from the dried rhizomes were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

HELLEBORUS ORIENTALIS Lam.

This species was used by the ancient Greeks and Romans in treating mania, skin diseases, etc.--Webster's Dictionary (424).

HEPATICA AMERICANA (DC.) Ker. or H. NOBILIS Schreb. Hepatica.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

HYDRASTIS CANADENSIS L. Goldenseal.

Hydrastine and hydrastinine, alkaloids of goldenseal, had no insecticidal value. These two substances were not materially toxic to the bean aphid at or below a concentration of 1 gm. per 100 cc.--Tattersfield and coworkers (393).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Water extracts of the root (N. F.) killed 70 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

NIGELLA SATIVA L. Fennel flower.

The natives of Hindustan sprinkled the seeds among woolen cloths, shawls, etc., as a preservative against destructive insects.--Honigberger (200, p. 317).

It was used to protect linen against insects.--Dymock and coworkers (124, v. 1, p. 28).

Extracts of the dried seeds were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

This plant is widely distributed in India, where the seeds are mixed with camphor and scattered between the layers of woolen clothes, etc., to preserve them from insects. Alcoholic extracts and water suspensions had no effects on caterpillars.--Puttarudriah and Subramanian (312).

RANUNCULUS SEPTENTRIONALIS Poir. Buttercup.

THALICTRUM POLYGAMUM Muhl. Meadowrue.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

XANTHORRHIZA SIMPLICISSIMA Marsh. Synonym: X. apiifolia L'Her.

Yellow root.

Extracts of the roots killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

RESEDACEAE
(Mignonette Family)

RESEDA ORORATA L. Mignonette.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

RHAMNACEAE
(Buckthorn Family)

CEANOTHUS AMERICANUS L. Jersey-tea.

Extracts from the leaves and flowers were repellent to the Japanese beetle.--Metzger and Grant (277).

GOUANIA LUPULOIDES (L.) Urban.

GOUANIA POLYGAMA (Jacq.) Urban.

These plants were used as insecticides.--Greshoff (171, p. 107).

KARWINSKIA HUMBOLDTIANA Zucc. Margarita.

The powder and water extract were efficient but very slow against silkworms, and they had no effect on tuliptree aphids. The powder had

a slight effect on catalpa caterpillars, while an alcoholic extract had no effect on small webworms and tuliptree aphids.--McIndoo and Sievers (259, p. 22).

RHAMNUS CATHARTICA L. Common buckthorn.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

RHAMNUS FRANGULA L. Alder buckthorn.

RHAMNUS PURSHIANA DC. Chittim-wood bark.

The cortex of these plants had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

VENTILAGO MADRASPATANA Gaertn.

The powdered bark, mixed with gingelly oil, was used in southern India as an external application for itch and other skin diseases.--Kirtikar and Basu (230, v. 1, p. 333).

ROSACEAE
(Rose Family)

AMYGDALUS COMMUNIS L. Synonyms: A. amara Hayne; Prunus amygdalus Batsch. Bitter almond.

In the East [India] a twig of an almond tree kept in a room was said to dispel flies.--Honigberger (200, p. 227).

Bitter almonds applied to the head are reported to kill lice.--Kirtikar and Basu (230, v. 1, p. 514).

Amygdalin (10 percent in flour) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Oil of almond was of no value as a repellent or attractant to the screwworm.--Parman and coworkers (302).

Oil of bitter almond was strongly repellent to the oriental cockroach.--Cole (101).

AMYGDALUS PERSICA L. Peach.

Decoctions of peach leaves had no effect on the rose chafer.--Smith (368, p. 33).

Peach leaves, wet with the juice of mulberry leaves, were fed to silkworms, and within 24 hours practicially all the insects were dead.--McIndoo and Sievers (259, p. 21).

Oil of peach kernel was a good repellent for 2 days only, but it did prevent infestation by screwworms.--Parman and coworkers (302).

HAGENIA ABYSSINICA J. F. Gmel. Kousso.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

KERRIA JAPONICA (L.) DC.

Kerria powder (20 percent in flour) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

POTENTILLA ARGENTEA L. Silver cinquefoil.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PRUNUS SEROTINA Ehrh. Wild black cherry.

Extracts of the leaves killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

PRUNUS sp. Cultivated cherry.

Various extracts were of no value as attractants to the cherry fruitfly in Germany.--Thiem (399).

PYRUS COMMUNIS L. Kiefer pear.

PYRUS sp. Common pear.

Extracts from these trees were not repellent to the Japanese beetle.--Metzger and Grant (277).

QUILLAJA BRASILIENSIS Mart.

This plant was used as an insecticide.--Barcellos Fagundes (51).

QUILLAJA SAPONARIA Molina. Soap bark. Panama wood.

Only a few of the references on this plant are given here.

An emulsion meriting attention contained 3 pounds of benzine, 3 pounds of ammonia, and a decoction made by boiling 1 pound of Panama wood in 10 gallons of water. It killed 50 to 80 percent of the cater-

pillars of Phalonia and Polychrosis. Another emulsion containing 1 pound of rectified benzine in 2 gallons of this decoction killed 60 to 90 percent of the caterpillars.--Vezin and Gaumont (411).

Soap bark never killed more than 21 percent of the prune aphids sprayed with it.--Parker (301, p. 7).

In France scale insects are controlled on the vine with Barsacq's formula--8 pints of petroleum, 1 1/8 pints of 90 percent alcohol, and 4 1/2 ounces of Panama wood. For use, it is diluted with 10 times its volume of water.--Feytaud (136).

A substitute for nicotine in France consisted of the following formula: Petroleum 5 pounds, Panama bark 1 pound, and water 3 gallons. The bark was crushed and boiled in the water until about 2.5 gallons of liquid was obtained; this was strained through a fine cloth, and the petroleum was added gradually with constant beating. This emulsion was diluted with 50 gallons of water.--Blin (62).

Ten grams of cortex quillajae in 500 cc. of water and saponin (10 percent in flour) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

There are at least seven patents (Brit. 230,203 and 327,009; Can. 247,378; Ger. 419,463 and 421,100; U. S. 1,610,167 and 1,885,292) in which soap bark is used as an insecticide.--Roark (333, p. 85; 335, p. 73) and Roark and Busbey (346, p. 73).

Extract of soap bark (N. F.) was not repellent to the Japanese beetle.--Metzger and Grant (277).

RUBIACEAE
(Madder Family)

ADINA CORDIFOLIA (Roxb.) Benth. & Hood. ex Brandis. Synonym: Nauclea cordifolia Willd.

In India the bark, ground into a paste with water, was considered to be antiseptic and prevented the generation of worms in sores.--Dymock and coworkers (124, v. 2, p. 171).

The juice was used as an insecticide in India.--Chopra and Badhwar (98).

CEPHAELIS IPECACUANHA (Brot.) A. Rich. Synonym: Psychotria ipecacunha Stokes.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

CEPHALANTHUS OCCIDENTALIS L. Buttonbush.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

CINCHONA OFFICINALIS L. Cinchona. Peruvian bark.

CINCHONA PUBESCENS Vahl.

Quinine and the other cinchona alkaloids are largely derived from these two species, which are more commonly called C. ledgeriana and C. succiruba. The cinchona bases are quinine, quinidine, cinchonine, and cinchonidine. The cinchona alkaloids, their salts, or their derivatives are much used for mothproofing, which will not be fully discussed here.

Cinchonine (1 ounce to 1 pound of flour) applied to cotton plants did not injure large cotton worms, but the smaller ones were usually killed in about 24 hours.--Davis (114).

Plants dipped in 300 cc. of water containing 5 gm. of quinine were fed to caterpillars, which were not appreciably affected.--Maxwell-Lefroy and Finlow (272, pp. 278, 313).

Powdered cinchona bark gave a fairly high mortality against fly larvae but it did not seem entirely efficient.--Cook and Hutchison (103, p. 4).

Cinchonine tested on a piece of cloth against body lice killed only 30 percent of them within 120 hours, and 37 percent of the eggs did not hatch.--Moore and Hirschfelder (285, p. 50).

Hydrochloras chinini, hydrochloras cinchonini, and sulfas chinini (each 10 percent in flour) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Spray solutions of four alkaloids of cinchona were tested against the bean aphid. The minimum concentrations required to kill about 95 percent of the aphids follow: Quinine hydrochloride greater than 1 gm.; cinchonine sulfate, cinchonidine sulfate, and quinidine sulfate each greater than 0.5 gm. per 100 cc. The concentration for nicotine sulfate was 0.009 gm. to 100 cc.--Richardson and Smith (322).

An aqueous spray containing 1 percent of quinine sulfate and 25 percent of starch was markedly deterrent to larvae of the cabbage butterfly, but killed only 40 percent of them in 7 days.--Hargreaves (184, p. 53).

Of all the chemicals and mixtures studied for mothproofing clothes, only one group constantly passed all the tests. These substances were

the cinchona alkaloids and their derivatives (total about 24). Quinidine sulfate showed marked mothproofing properties. Pieces of wool treated with it withstood moth attack for 4 years.--Anonymous (30); Jackson and Wassell (219).

Solutions consisting of cinchona alkaloids dissolved in naphtha were of value when the fabrics were treated by thorough drenching.--Back and Cotton (46, p. 466).

Quinine was one of the alkaloids having some mothproofing value, but it was insufficient for practical use. The salts of quinine (sulfate, oxalate, salicylate, and sulfosalicylate) were useless as mothproofing agents. Oleic acid combined with quinine was less effective than oleic acid alone.--Minaeff and Wright (281, p. 1190).

In laboratory tests cinchonine used as a dust killed 36 percent of the codling moth larvae tested, while quinine alkaloid killed only 15.5 percent.--McAlister and Van Leeuwen (249).

Extracts of dried cinchona bark were not repellent to the Japanese beetle.--Metzger and Grant (277).

Konate, a proprietary compound containing cinchona alkaloids, was very effective in Petri dish tests against larvae of the webbing clothes moth.--Britton (69, p. 252).

When alkaloids and their salts were fed to silkworms, the following percentages were dead in 3 days: Cinchonine 60, cinchonine hydrochloride and cinchonine sulfate 0, cinchonine salicylate 30, and cinchonidine 15, 8-hydroxyquinoline 0, 2-quinoline 40, isoquinoline 60, quinoline salicylate 30, quinoline tartrate 0. and quinoidine 15. There was much feeding in most of the tests.--Ginsburg and Granett (161).

Quinine sulfate applied as a spray against adult mosquitoes was much inferior to the standard mosquitocide.--Wats and Singh (421).

There are at least nine patents in which the cinchona alkaloids and their derivatives are used in mothproofing.--Roark (333, pp. 8, 39, 86; 335, p. 73), and Roark and Busbey (346, pp. 16, 73).

Comments by reviewer.--It thus appears that the cinchona alkaloids have little or no practical value as insecticides except as mothproofing agents.

COFFEA ARABICA L. Coffee.

COFFEA LIBERICA Hiern.

The toxic principle in the coffee berry is the feebly basic alkaloid caffeine. This alkaloid is also found in tea and other plants, but the papers dealing with caffeine will be discussed here.

Plants dipped in 300 cc. of water containing 0.3 gm. of caffeine were fed to caterpillars, 70 percent of which were killed after a long period.--Maxwell-Lefroy and Finlow (272, pp. 277, 313).

Caffeine (2 and 5 percent) in sugar solution was ineffective against houseflies.--Jackson and Lefroy (217).

Caffeine (10 percent in flour) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Spray solutions of caffeine were tested against the bean aphid. The minimum concentration required to kill about 95 percent of the aphids was greater than 0.5 gm. to 100 cc. of liquid, while that of nicotine sulfate was 0.009 gm.--Richardson and Smith.(322).

Caffeine solutions mixed with equal parts of honey were fed to honeybees. A 1:100 dilution killed all the bees tested within 24 hours, a 1:200 dilution within 48 hours, and a 1:400 dilution 34 percent within 48 hours. Arsenious oxide (dilution 1:10,000) killed all the bees within 5 hours.--Ginsburg (160).

Caffeine had some mothproofing value but insufficient for practical use. Goods treated with a combination of caffeine with oleic acid were quickly damaged by clothes moth larvae.--Minaeff and Wright (281, p. 1190).

In laboratory tests caffeine used as a dust killed only 15.5 percent of the codling moth larvae tested.--McAlister and Van Leeuwen (249).

When alkaloids and their salts were fed to silkworms, the mortalities in 3 days were as follows: Caffeine benzoate 0, caffeine citrate 20, caffeine hydroxide 15, caffeine salicylate 30, and caffeine tannate 40 percent. There was much feeding in each case.--Ginsburg and Granett (161).

Comments by reviewer.--These abstracts show that caffeine has no practical value as an insecticide or as a mothproofing agent.

GALIUM APARINE L. Bedstraw.

GALIUM TRIFLORUM Michx. Fragrant bedstraw.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

GARDENIA CAMPANULATA Roxb. Bihmona.

This fish-poison plant grows profusely in Assam. The juice was evidently an efficient larvicide in dilution up to 1 in 80. The larvicidal action was due to a saponin.--Manson (265).

GARDENIA GUMMIFERA L. f.

In India this plant was used for keeping flies off putrid sores.--Dalzell and Gibson (111, p. 120).

In India the gum was used to keep insects from sores on cattle. The strong-smelling gum resin, not unlike myrrh in appearance, was used extensively in European hospitals and veterinary work to keep flies from sores.--Watt (422, v. 3, pp. 89, 481).

GARDENIA LUCIDA Roxb.

A strong smelling gum resin from wounds in the bark and from leaf buds of this tree was used in cutaneous diseases and to keep off flies and worms.--Kirtikar and Basu (230, v. 1, p. 652).

MITCHELLA REPENS L. Partridgeberry.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

RANDIA DUMETORUM Lam.

In India the bruised roots and unripe fruit were thrown into ponds to poison fish. In the Konkan, India, they were mixed with grain to preserve it from the attacks of insects.--Watt (422, v. 6, pt. 1, p. 391).

Extracts of the fruit in Mysore were more or less toxic to aphids.--Subramaniam (377).

Water extracts of the powdered fruit (1 pound to 10 gallons of soapy water) killed only 10 percent of the leafhoppers treated, and extracts of the roots, used at 10 percent strength, killed 80 percent of Coccus viridis (Green) on coffee plants in 4 days, but were not very effective against grasshoppers.--Subramaniam (379, 383).

This fish-poison plant is commonly found in coffee-growing areas of India. A 5-percent alcoholic extract of fruit skin killed 90 percent of grasshoppers Epacromia tamulus (F.), and caterpillars of Euproctis fraterna (Moore), but had no effect on caterpillars of Crocidolomia binotalis Zeller. A similar extract of the root bark killed 100 percent of E. fraterna. An 1/8-percent alcoholic extract of the root bark killed only 50 percent of mosquito larvae in 19 hours.--Puttarudriah and Subramaniam (311).

UNCARIA GAMBIR Roxb. Synonym: Ourouparia gambia (Hunter) Baillon.

Gambier.

The commercial extract was repellent to the Japanese beetle.--Metzger and Grant (277).

RUTACEAE
(Rue Family)

BAROSMA BETULINA (Thunb.) Barth. & Wendl. Buchu.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

BOENNINGHAUSENIA ALBIFLORA (Hook.) Heynhold.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

CITRUS AURANTIUM L. Synonym: C. bergamia Risso.

A mixture of oil of bergamot [derived from this species] and kerosene (1:16) was used in the Philippine Islands as a mosquito repellent.--Howard (203, p. 14).

Prisoners in an army camp in Germany in 1914-15 found that oil of bergamot acted most promptly of all the oils against vermin, but was generally effective only a few days. The oils were applied in 10 to 15 percent alcoholic solutions. The following mixture seemed to be the most effective: 10 gm. of oil of bergamot, 30 gm. of tincture of calamus, and sufficient alcohol to make up to 100 gm.--Anonymous (23).

Oil of bergamot was considered one of the best repellents of the screwworm. There was no emergence of flies from meat treated with it.--Parman and coworkers (302).

CITRUS MEDICA L. Citron.

The fruit was put among clothes to keep away moths.--Watt (422, v. 2, p. 351).

CITRUS MEDICA var. LIMONUM (Risso) Hook. Lemon.

Treatment of maize seed with a mixture of oil of lemon and wood alcohol prevented brown ants and lice from attacking the seed.--Swenk (388).

Oil of lemon was very strongly repellent to the cornfield ant.--Forbes (142, p. 465).

A mixture of lemon juice and gun powder was used externally for scabies.--Kirtikar and Basu (230, v. 1, p. 267).

Oil of lemon was of no value as a repellent or attractant to the screwworm.--Parman and coworkers (302).

A 2-percent emulsion of citral [a constituent of the oils of lemon and orange] killed 95 percent of the bean aphids sprayed.--Richardson and Smith (323, p. 608).

CITRUS SINENSIS (L.) Osbeck. Orange.

Orange poultice was recommended in some skin affections, such as psoriasis.--Watt (422, v. 2, p. 344).

Oil of orange was strongly attractive to the oriental cockroach. A bait was made of 6 gm. of gelatin, 200 cc. of dilute beef broth, 0.5 gm. of mercuric chloride, and 1 drop of oil of sweet orange.--Cole (101).

CITRUS sp.

This plant was used in Haiti as an insecticide against mosquitoes.--Roark (332, p. 9).

CLAUSENA ANISATA Hook. f. Samanobere.

In the Gold Coast, Africa, this plant was commonly hung in houses to keep away mosquitoes.--Irvine (213).

PHELLODENDRON AMURENSE Rupr. Amur corktree or velvet tree.

Petroleum-ether extracts of this tree showed considerable toxicity to mosquito larvae and when tested in acetone solution to adult houseflies. When dissolved in high-boiling kerosene, such as is used in fly sprays, the extracts showed practically no toxicity. The commercial use of these extracts for controlling houseflies therefore does not seem practical. Chemical fractionation of the extract gave fractions that were much more toxic to houseflies when tested in acetone than the original extract.--Sullivan and coworkers (387).

The residue of the fruit, after removal of the oil, showed considerable toxicity against mosquito larvae, houseflies, and codling moth larvae (apple-plug method). The extract was more toxic than derris (5.2 percent rotenone) to mosquito larvae, and to houseflies about as toxic as derris. In a single spray test the material showed low toxicity to southern armyworms, but this also applied to derris and pyrethrum. Like pyrethrum and nicotine, the material is a fast-acting poison.--Haller (178).

The fruit of this tree of Japan was toxic to codling moth larvae and mosquito larvae in laboratory tests.--Roark (341; 342, p. 14).

The Amur corktree, native to several Asiatic countries, was introduced into this country in 1856. Specimen trees may be found in Washington, D. C., and Boston, Mass. The unsaponifiable portion of the oil of

the fruit was very toxic to houseflies in acetone solution but not in high-boiling kerosene.--Schechter and Haller (354).

PHELLODENDRON LAVALLI

The fruit was found to have insecticidal properties. An acetone solution of the petroleum ether extractive at a concentration of 50 mg. per milliliter was about as toxic to houseflies as an extractive of P. amurense.--Sullivan and coworkers (387).

PILOCARPUS JABORANDI Holmes. Jaborandi.

An aqueous solution of hydrochlorate of pilocarpine, an alkaloid obtained from the leaves, mixed with honey (0.05:2) was fed to ants, which were apparently unaffected.--Cobelli (100).

The powdered leaves had a slight effect on fly larvae.--Cook and Hutchison (103, p. 4).

The minimum concentration of pilocarpine hydrochloride required to kill about 95 percent of the bean aphids was greater than 0.5 gm. to 100 cc. of liquid, while that of nicotine sulfate was 0.009 gm.--Richardson and Smith (322).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

RUTA GRAVEOLENS L. Common rue.

A strong decoction obtained by macerating the leaves in soap and water was a successful remedy for the insects causing American blight.--Roark (331, p. 102).

Extracts from the entire plant exhibited repellent qualities to the Japanese beetle.--Metzger and Grant (277).

ZANTHOXYLUM AMERICANUM Mill. Prickly-ash.

Extracts from the dried bark were repellent to the Japanese beetle.--Metzger and Grant (277).

Acetone extracts of the berries (N. F.) killed 60 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

ZANTHOXYLUM CLAVA-HERCULIS L. Synonym: Fagara clava-herculis Small (U.S.P.) Hercules-club.

The powdered leaves seemed to repel cotton caterpillars.--Riley (325, p. 185).

ZANTHOXYLUM HAMILTONIANUM Wall. Tez-moora.

The roots of this plant, which grows profusely in Assam, were used as a fish poison. In the laboratory a boiled fresh solution of the roots killed mosquito larvae in 7 minutes. In field experiments all larvae were killed in a very short time in dilutions up to 1 in 50. The larvicidal action is due to a saponin.--Manson (265).

ZANTHOXYLUM PIPERITUM DC. Japanese pepper.

The upper layer of a pyrethrum extract, mixed with creosote or camphor oil, paradichlorobenzene, and the seed oil of this plant, was used as an insecticide.--Akita (38).

SALICACEAE
(Willow Family)

POPULUS sp., probably candicans Ait. Balm-of-Gilead.

Acetone extracts of the buds of this tree killed 95 percent of the mosquito larvae tested. There appeared to be no correlation between resistance to insect attack and toxicity to mosquito larvae.--Hartzell and Wilcoxon (188).

POPULUS NIGRA L. Black poplar.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SALIX NIGRA Marsh. Black willow.

Extracts of the bark killed only 5 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SANTALACEAE
(Sandalwood Family)

COMANDRA UMBELLATA (L.) Nutt. Comandra.

Extracts from the entire plant were repellent to the Japanese beetle.--Metzger and Grant (277).

SANTALUM ALBUM L. Sandalwood.

Oil of sandalwood was of no value as a repellent or attractant to the screwworm.--Parman and coworkers (302).

Oil of sandalwood was usually repellent to cockroaches (Blatta orientalis L.).--Cole (101).

Oil of sandalwood (50 p.p.m.) killed 100 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SAPINDACEAE
(Soapberry Family)

CUPANIA sp. Moroballi. Muraballi.

Extracts of the wood and bark of this fish-poison plant from British Guiana were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

PAULLINIA PINNATA L.

The leaves were reported to contain tephrosin. An extract of them was not appreciably toxic to citrus aphids, and a 2-percent concentration killed only 47.5 percent to the aphids sprayed.--Worsley (431).

SAPINDUS MARGINATUS Willd.

In a patent an insecticide or insectifuge was claimed for the use of the berries of this tree. Three berries had been found sufficient to preserve a bushel of wheat against infestation and in the powdered or liquid form was mixed with dried foodstuffs to repel weevils and other insects.--Hoover (202).

SAPINDUS MUKOROSSI Gaertn.

The green peach aphid was controlled with a spray consisting of $\frac{1}{4}$ pound of powdered soap nut (fruit of this plant) in 2 gallons of water in which $\frac{1}{2}$ pound of soap was dissolved.--Fletcher (139).

SAPINDUS UTILIS Trab.

An emulsion made of 5 pounds of saponin (extract of fruit), 5 gallons of paraffin, and 25 gallons of water was recommended against the olive scale in Algeria.--Delassus (116).

The saponin patents (Brit. 230,203; Can. 247,378; Ger. 421,100; U. S. 1,610,167 and 1,901,960) will be mentioned here, although the saponin glucosides are also derived from the families Rosaceae and Caryophyllaceae. An improved insecticide consisted of an alkaloidal extract of lupine in combination partly with an inorganic acid and partly with an extract of quillaja bark or other source of saponin glucosides. Saponins may be employed in a soluble fluoride mothproofing liquid to lower the surface tension and to facilitate the penetration of the liquid into the fibers to which it is applied.--Roark (333, p. 92; 335, p. 75); Roark and Busbey (346, p. 76).

Lapin was effective in combating various pests in the fruit regions of Azerbaidzhan. The basic poisonous substance in Lapin is a saponin. The Lapin solution is markedly opalescent and forms on shaking a stable foamy mass which hardens on the leaves after spraying.--Vel'tishchev (410).

SCHLEICHERA TRIJUGA Willd.

In India the natives rub up the bark with oil and use it as a remedy for itch.--Drury (122, p. 398).

The seeds are used as an insecticide in India.--Chopra and Badhwar (98).

SERJANIA PAUCIDENTATA DC.

This plant was tested in a preliminary manner for insecticidal value.--Fryer and coworkers (147, p. 18).

SERJANIA sp. Hebitchioahabu.

Extracts of the stems of this fish-poison plant from British Guiana were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

SAPOTACEAE
(Sapodilla Family)

MADHUCA BUTYRACEA (Roxb.) Macbride. Synonym: Bassia butyracea Roxb.

The bark was used in India as a fish poison and as an insecticide.--Roark (332, p. 29).

MADHUCA LATIFOLIA (Roxb.) Macbride. Synonym: Bassia latifolia Roxb.

Mahua. Mohwa.

A preparation from this tree was rubbed on the body as a cure for itch. The smoke produced in burning the residue after extraction of the oil was reputed to kill insects and rats.--Watt (422, v. 1, p. 408).

Stored grain was coated with mohwa oil and kept in closed receptacles. The oil retarded attacks of weevils as long as the seeds remained moist, but the grain was attacked after a few months.--Fletcher and Ghosh (140, pp. 733-755).

This species is widely distributed in India. A 5-percent alcoholic extract of the stem bark killed 100 percent of Plutella maculipennis (Curt.), 70 percent of Prodenia litura (F.) and Crocidolomia binotalis Zeller., and 100 percent of Euproctis fraterna (Moore). A 5-percent

extract of the leaves killed 100 percent of the first species, 65 percent of the second species, and 100 percent of the third and fourth species. The powdered stem bark dusted upon beetles, Callosobruchus chinensis (L.), killed only 80 percent of them in 72 hours.--Puttarudriah and Subramaniam (312).

This plant was said to be used as an insecticide and mohwa meal to kill worms on lawns in India.--Chopra and Badhwar (98).

MADHUCA LONGIFOLIA (L.) Macbride. Synonym: Bassia longifolia L.

Mowa-mahua tree.

A decoction of the bark was used as a remedy for itch.--Kirtikar and Basu (230, v. 1, p. 750).

MADHUCA sp.

A commercial powder made from the seeds was efficient but slow against silkworms, although within 48 hours it killed only 35 percent of the aphids tested. A decoction of the powder had only a slight effect on the aphids.--McIndoo and Sievers (259, p. 23).

SIDEROXYLON BORBONICUM A. DC.

This plant is listed as an insecticide.--Greshoff (170, p. 101).

SAXIFRAGACEAE
(Saxifrage Family)

PHILADELPHUS CORONARIUS L. Sweet mockorange.

An infusion, a decoction, and an alcoholic extract had no effect on cotton caterpillars.--Riley (325, p. 186).

SCROPHULARIACEAE
(Figwort Family)

ANTIRRHINUM sp. Snapdragon.

AUREOLARIA PEDICULARIA (L.) Raf. Gerardia.

Extracts from the snapdragon were not repellent to the Japanese beetle, but extracts of the leaves and flowers of gerardia were repellent.--Metzger and Grant (277).

AUREOLARIA VIRGINICA (L.) Pennell. Synonym: Dasystoma flava.

This plant was reputed to prevent attacks of flies on horses.--Porcher (308, p. 509).

BRAMIA MONNIERI (L.) Pennell. Synonym: Herpestis monnieria H. B. K.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

CHELONE GLABRA L. Turtlehead.

Extracts from the dried leaves were more or less repellent to the Japanese beetle.--Metzger and Grant (277).

DIGITALIS AMBIGUA Murr. Synonym: D. grandiflora Lam.

The leaves of this plant yield digitalin, which was as powerful as nicotine and served admirably against aphids and flea beetles. To prepare the decoction 30 pounds of stems with the leaves are boiled for 30 minutes in 20 gallons of water, and when used it is diluted with an equal quantity of water. It is less liable to injure foliage than nicotine and was used as a substitute for nicotine in France.--Blin (62).

DIGITALIS PURPUREA L. Foxglove.

A solution of the alkaloid digitalin materially increased the heart activity of the larva of Corethra crystallina (Deg.).--Dogiel (120, p. 27).

The tincture of digitalis mixed with honey was fed to ants, which were apparently unaffected.--Cobelli (100).

Digitalin made into a thin paste with water and applied to the head of the common blowfly caused great irritation at once, followed by weakness and paralysis, and death occurred within 10 to 24 hours.--Blyth and Blyth (64, p. 442).

A decoction of 15 kg. of leaf stems in 100 liters of water, diluted for spraying with 100 additional liters of water, was effective against aphids on nut trees.--Arranger (40); Blin (61).

A spray containing an extract of Digitalis was ineffective against the larvae of vine moths in France.--Marchal (266, p. 250).

Extract of Digitalis (10 percent in water) and folia digitalis had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Commercially prepared extracts of Digitalis were not significantly toxic to the bean aphid.--Tattersfield and coworkers (393).

Extracts of the foxglove (N. F.) were not repellent to the Japanese beetle.--Metzger and Grant (277).

Comments by reviewer.--More work should be done using various extracts of Digitalis against a wide range of insects.

EUPHRASIA OFFICINALIS L. Eyebright.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

LINARIA VULGARIS Mill. Toadflax.

MELAMPYRUM LINEARE Desr. Cowwheat.

The juice of L. vulgaris mixed with milk is poisonous to flies and the smell of the flower also kills them.--Williams (428, p. 917).

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

RHINANTHUS CRISTA-GALLI L. Rattlebox.

This plant is listed as an insecticide.--Lyons (248, p. 395).

SCROPHULARIA MARILANDICA L. Figwort.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SCROPHULARIA NODOSA L. Figwort.

Extracts of the whole plant killed only 25 percent of mosquito larvae tested.--Hartzell and Wilcoxon (188).

VERBASCUM BLATTARIA L. Moth mullein.

The powder, used as a dust, had a slight effect on cockroaches and tent caterpillars; used as a stomach poison, it had a very slight effect on grasshoppers and flies, but none at all on cockroaches, silkworms, and webworms. The water extract had no effect on webworms, potato beetle larvae, and rose aphids, but a slight effect on honeybees and silkworms. An alcoholic extract was fatal to bees.--McIndoo and Sievers (259, p. 24).

VERBASCUM THAPSUS L. Common mullein.

VERONICA OFFICINALIS L. Speedwell.

An alcoholic extract of V. thapsus and a decoction of the leaves were ineffective against cotton caterpillars.--Riley (325, p. 185).

Extracts from both plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

VERONICASTRUM VIRGINICUM Farw. Synonym: Veronica virginica L.

Culver's root.

Extracts of the roots (N. F.) killed only 15 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SIMARUBACEAE
(Ailanthus or Quassia Family)

AESCHRION EXCELSA (Swartz) Kuntze. Synonyms: Picrasma excelsa Planch.; Picraena excelsa Lindl.; Simaruba excelsa DC.; Quassia excelsa Swartz.

Jamaica quassia.

The use of this quassia wood as an insecticide is well known. The literature was briefly reviewed by McIndoo and Sievers (258) in 1917 and Busbey (73) in 1939 gave a complete review of the papers pertaining to the various quassia woods.

AILANTHUS ALTISSIMA (Mill.) Swingle. Synonym: A. glandulosa Desf.

Ailanthus.

A decoction and an infusion of the leaves had no effect on cotton caterpillars.--Riley (325, p. 184).

In India the bark was an active vermifuge.--Watt (422, v. 1, p. 151).

This plant checked the spread of the rose bug.--Von Mueller (414, p. 27).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the leaves killed only 20 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

BALANITES ROXBURGHII Planch.

This plant was used in India as a fish poison and as an insecticide.--Roark (332, p. 4).

In tests against aphids with extracts of the crude powders of six fish-poison plants, the bark powder of this species gave the best results.

Extracts of the different parts of the plants with methyl alcohol, chloroform, ether, etc., were about 10 times as toxic to insects as were the crude powders.--Subramaniam (379).

This fish-poison plant is found in India. A 5-percent alcoholic extract of the stem bark killed 70 percent of adult grasshoppers and a 6-percent extract killed 80 percent of the caterpillars tested in 24 hours. Powder (1/8 percent) on water killed 80 to 100 percent of mosquito larvae in 60 hours.--Puttarudriah and Subramaniam (311).

PICRAMNIA PENTANDRA Swartz.

This plant was used as a general insecticide in Haiti.--Roark (332, p. 33).

PICRASMA NAPALENSIS Benn.

Powdered leaves and twigs of this plant were used to kill mosquito larvae in Assam, India.--Chopra and Badhwar (98).

PICRASMA QUASSIOIDES (Ham.) Bennett. Synonyms: P. ailanthoides Planch.; Nima quassioides Ham.

A decoction of the bark was used to kill lice.--Greshoff (170, p. 30).

This species possesses insecticidal properties.--Lyons (248, p. 356).

QUASSIA AMARA L. Surinam quassia.

This species has been largely replaced in use by the Jamaica quassia, which occurs in much greater abundance.--Busbey (73).

SAMADERA INDICA Gaertn.

This plant is listed as an insecticide.--Greshoff (170, p. 30).

SIMARUBA VESICOLOR St. Hill.

The bark reduced to a powder was used as an insecticide.--Barcellos Fagundes (51).

SMILACACEAE
(Smilax Family)

SMILAX BONA-NOX L. Synonym: S. tamnoides L. Bamboo brier.

Extracts of the roots killed only 30 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SOLANACEAE
(Nightshade or Potato Family)

ATROPA BELLADONNA L. Belladonna. Deadly nightshade.

In 1915 and 1916 McIndoo and Sievers did considerable work with the powders and extracts of belladonna but the results were not published. The various preparations had little or no effect on houseflies, German cockroaches, fall webworms, catalpa caterpillars, silkworms, and honeybees.

An alcoholic extract and a decoction of the leaves had no effect on cotton caterpillars.--Riley (325, p. 184).

Extract of belladonna (10 percent in water) had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

Commercially prepared extracts were not significantly toxic to the bean aphid.--Tattersfield and coworkers (393).

In India belladonna was reported to have insecticidal or repelling properties.--Roark (332, p. 4).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

The alkaloid atropine is found in Atropa belladonna and in the seeds of Datura stramonium, but the following papers on atropine will be discussed here.

A weak concentration of atropine after an hour had a tendency to reduce the heart action of the larva of Corethra crystallina (Deg.).--Dogiel (120).

An aqueous solution of atropine sulfate and tincture of belladonna, each mixed with honey, did not affect ants.--Cobelli (100).

Hypodermic injections of atropine sulfate produced in large caterpillars loss of creeping ability, segmental tremblings, and contractions, with slight stimulation of the dorsal muscles.--Crozier (110, pp. 242-246).

The minimum concentration of atropine sulfate required to kill about 95 percent of bean aphids was 5 gm. to 100 cc. of liquid, while that of nicotine sulfate was 0.009 gm.--Richardson and Smith (322).

Atropine sulfate (0.001 pound per 50 gallons of water) in a spray did not kill Japanese beetles within 6 days.--Moore and Campbell (284, p. 400).

A solution of atropine was used for mothproofing wool (Hungarian patent 96,941).--Roark (335, p. 7).

The effectiveness of arsenicals against resistant caterpillars might be increased by the addition of atropine, pilocarpine, or adrenaline, which reduce the contractions of the intestinal tract or prevent regurgitation.--Voskresenskaya (415, pp. 380-383).

CAPSICUM ANNUM L. Cayenne or red pepper.

The odor of ground pepper stunned mosquitoes in 20 minutes and killed them in 6 hours.--Celli and Casagrandi (82, p. 95).

An extract of capsicine, an alkaloid from Capsicum, was tested against four species of caterpillars. A 5-percent spray killed within 7 days only 21 percent of the insects tested, and a 1-percent solution killed only 13 percent.--Duke of Bedford and Pickering (53, p. 84).

Red pepper was ineffective against bedbugs and cockroaches, and of no value against the dog flea.--Scott and coworkers (361, pp. 5, 14; 37, p. 12).

Cayenne pepper is worthless as a control for clothes moths, although it has often been recommended for this purpose.--Back (44).

A patented insecticide, consisting of wine dregs, cayenne pepper, African bitter gourd juice (Cucurbita), nicotine, strong alkali soap, fish oil, and water will kill grasshoppers, plant lice, caterpillars, Japanese beetles, locusts, and all types of vegetable and flower insects when they are sprayed with it.--Proetto (309).

CAPSICUM FRUTESCENS L.

This species was said to be used in Sind as an insecticide.--Roark (332, p. 8).

This plant in China was used as an insecticide for the fumigation of grain stores.--Scarone (353).

DATURA FASTUOSA L.

A 5-percent alcoholic extract of the leaves of this Indian species killed 100 percent of Prodenia litura (F.), Euproctis fraterna (Moore), and Pericallia ricini (F.), and 85 percent of Crocidolomia binotalis Zeller. A 5-percent extract of the fruits killed 100 percent of the first species, 95 percent of the second and third, and 55 percent of the fourth.--Puttarudriah and Subramaniam (312).

Poor results were obtained with extracts of this species against adult mosquitoes.--Wats and Singh (421).

DATURA METEL L. Angel-trumpet.

This shrub or small tree was commonly pounded and used to smear the floors of houses to kill lice and other vermin, especially the dreaded "jiggers," in the Gold Coast, Africa.--Irvine (213).

This species was said to be used in Sind as an insecticide.--Hoark (332, p. 17).

DATURA STRAMONIUM L. Jimsonweed. Thorn apple.

Neither the alcoholic extract from the dried seed or leaves nor a decoction from the leaves was effective against cotton caterpillars.--Riley (325, p. 184).

A strong infusion of the leaves had no effect on potato beetles, rose beetles, or the larvae of a butterfly.--Fernald (135, p. 10).

The leaves, used as a fumigant, were inefficient against bedbugs, cockroaches, flies, clothes moths, and mosquitoes.--McClintock and coworkers (250, p. 233).

The decoction was recommended as an insecticide in Germany.--Sprenger (373).

An extract of the leaves was of no value against fly larvae.--Cook and coworkers (104, p. 14).

An insecticide prepared in Russia from the ripe and dried plant, consisting of stalk, leaves, and seed, was effective against aphids, various caterpillars, cockchafers, etc., killing them in a very short time.--Medynsky (274).

Extractum stramonii (10 percent in water) and folia stramonii had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

A water extract had no effect on small webworms and small catalpa caterpillars, and a highly concentrated water extract had only a slight effect on honeybees. The water extract, used as a fumigant, had no effect on small webworms. The powder, used as a stomach poison, had a slight effect on silkworms, and used as a dust, it had a slight effect on cockroaches and tent caterpillars.--McIndoo and Sievers (259, p. 22).

Commercially prepared extracts were not significantly toxic to the bean aphid.--Tattersfield and coworkers (393).

Dusts of the leaves killed 100 percent of the adult beetles Aulocophora abdominalis F. tested in India.--Chopra (97, p. 109).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

DUBOISIA HOPWOODII F. Muell. Pituri.

This species is often mentioned in papers on nicotine although only one paper on nornicotine obtained from this tree was found.

A sample of d-nornicotine, obtained from this plant in Australia, was found to have about the same toxicity to the bean aphid as the l- and dl-nornicotines. Extracts of this species might yield an insecticide superior to nicotine against some insects.--Hansberry and Norton (182), and Richardson (321, p. 83).

HYOSCYAMUS ALBUS L.

A decoction was recommended as an insecticide in Germany.--Sprenger (373).

HYOSCYAMUS NIGER L. Henbane.

A decoction was recommended against aphids on rose bushes.--Binnenthal (57, p. 46).

A decoction was recommended as an insecticide in Germany.--Sprenger (373).

A strong decoction was effective against aphids only.--Schreiber (360).

A decoction was inefficient against two species of caterpillars but efficient against a third species.--Goriainov (166).

A 10-percent water extract and folia hyoscyami had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

The minimum concentration of hyoscyamine sulfate required to kill about 95 percent of bean aphids was greater than 0.4 gm. to 100 cc. of liquid, while that of nicotine sulfate was 0.009 gm.--Richardson and Smith (322). [Hyoscyamine is an alkaloid obtained from henbane, belladonna, and jimsonweed.]

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

HYOSCYAMUS spp.

Extracts were tested against four species of caterpillars. Within 7 days a 5-percent spray killed only 20 percent of the insects and a 1-percent spray only 15 percent.--Duke of Bedford and Pickering (53, p. 84).

Commercially prepared extracts were not significantly toxic to the bean aphid.--Tattersfield and coworkers (393).

An extract was used for mothproofing wool (Hungarian patent 96,941).--Roark (335, p. 37).

According to a Russian report, henbane and probably another species of Hyoscyamus grow wild in the environs of Astrakhan. A concentrated infusion made of a mixture of dry, chopped inflorescences, leaves, stems, and roots (1 pound to 1 gallon of water) rapidly killed aphids on cabbage and watermelons, as well as other Rhynchota. It was equally effective at one-half or one-quarter this concentration. The strongest and most rapid action was obtained when the infusion was prepared from fresh winter henbane that had sprouted and developed rosettes in the autumn, the roots being particularly effective.--Anonymous (31).

LYCIUM HALIMIFOLIUM Mill. Matrimony-vine.

The powder used as a dust affected cockroaches considerably, but tent caterpillars only slightly, and used as a stomach poison it has a considerable effect on grasshoppers. The water extract did not affect honeybees.--McIndoo and Sievers (259, p. 23).

LYCOPERSICON ESCULENTUM Mill. Synonyms: L. lycopersicum Karst.;

Solanum lycopersicum L. Tomato.

In Belgium tomato leaves macerated in water were said to make an excellent insecticide. Peach and orange trees and rose bushes sprayed with this preparation were freed of aphids, and an infestation of kermes was often prevented.--Anonymous (11).

Decoctions of tomato leaves and stems were recommended against aphids and spinning mites, but they were no good in the control of caterpillars.--Binnenthal (57, p. 45).

In Algeria a tomato decoction was recommended as an insecticide. The best method was to boil 20 gm. of dried leaves in a liter of water down to a sirupy consistency, and apply with a brush to branches infested with aphids.--Anonymous (18).

In France it was suggested that decoctions of tomatoes be sprayed on vegetables infested with aphids. Formerly decoctions of the leaves and stems of tomato plants were used as an insecticide, which proved as active as nicotine and materially cheaper. Lye of wood ashes was added to increase the toxicity of these decoctions.--Anonymous (22); Blin (62).

A concentrated extract of tomatoes was very effective against aphids and various other market-garden pests.--Schreiber (360).

A decoction of tomatoes gave only insignificant results against Malacosoma neustria (L.).--Goriainov (166).

In experiments in Austria with tomato decoctions against aphids the dried leaves gave less favorable results than did fresh ones.--Kornauth (233).

In Italy an insecticide superior to tobacco was made from a decoction of fresh tomato stems and leaves, mixed with wood ashes, leached with water, and sifted.--Anonymous (28).

Ground tomato vines, applied as dusts, were ineffective on webworms, silkworms, potato beetle larvae, rose aphids, and tent caterpillars, but they had a considerable effect on cockroaches; mixed with food, they had a slight effect on grasshoppers and cockroaches and seemed efficient against flies. Used as a fumigant, the powder was practically ineffective against the green peach aphid. The water extracts had practically no effect on honeybees and tent caterpillars, but affected grasshoppers and flies considerably. The alcoholic and ether extracts were very effective on flies and bees.--McIndoo and Sievers (259, p. 8).

Alcoholic extracts of the leaves and stems of tomato were not significantly toxic to the bean aphid.--Tattersfield and coworkers (393).

Tomato plants were used in Haiti against caterpillars on eggplant.--Roark (332, p. 29).

In Cuba it was reported that tomato leaves contain an alkaloid more active than nicotine and analogous to digitalin. The following directions were given to prepare an alcoholic extract which was very efficacious against the green aphid, rose and pear aphids, as well as aphids on beans. Into a 2-liter flask that can be hermetically closed put 500 gm. of well-crushed tomato leaves, taking care not to lose any of the juice, and all a liter of alcohol. Allow to macerate for 8 days, and then strain through a cloth, wringing the cloth thoroughly to extract the maximum quantity of liquid. Pour the liquid into bottles and keep closed tightly. For use dilute it at the rate of 250 cc. of juice to 10 liters of water. 500 gm. of tomato leaves yield 50 liters of insecticide.--Castaneda de Ramero (80).

Comments by reviewer.--In view of all the good insecticides we now have it seems a waste of time to continue investigations on the tomato plant.

NICANDRA PHYSALODES (L.) Gaertn. Synonyms: Physalodes peruvianum (Mill.) Kuntze; Atropa physalodes L. Peruvian ground cherry. Shoofly plant.

This plant was used as a fly poison in sections of the United States.--Pammel (299, p. 131).

The shoofly is an insect-repelling plant. To repel flies distribute five or six plants about the room. A few dozen plants evenly distributed in the greenhouse will cause the white fly to disappear. Planted out of doors, the shoofly will grow rank. Several hundred planted near a barn, where cows were milked out of doors, apparently kept the animals from being bothered by insects.--Altrichter (39).

This species was used in India as an insecticide.--Chopra and Badhwar (98).

NICOTIANA spp.

Tobacco and its chief alkaloid, nicotine, have been used as insecticides since 1690, the literature of which was reviewed up to 1934. Only three species (N. glauca, rustica, and tabacum) had been tested insecticidally up to this date.--McIndoo and coworkers (256, 257).

During the present search for insecticidal plants one more species (N. sylvestris) has been added to the list. The literature on nicotine and tobacco has been reviewed through 1942, but no other species were used against insects, although 29 or more species of Nicotiana have been analyzed by chemists.

NICOTIANA GLAUCA Graham. Tree tobacco.

This species of tobacco was recommended as an insecticide.--Sprenger (373).

An infusion and a decoction of the leaves with soap had only a very slight effect on nasturtium aphids, while the powdered leaves had no apparent effect on them. An analysis of the leaves showed that the nicotine content was only 0.18 percent.--McIndoo and Sievers (259, p. 23).

The tree tobacco in the southwestern part of the United States contains anabasine, an alkaloid similar to nicotine but even more potent as an aphicide. There was evidence that anabasine might prove as valuable an insecticide as nicotine.--Roark (341).

NICOTIANA RUSTICA L. Wild tobacco.

This species of tobacco was also recommended as an insecticide.--Sprenger (373).

Apple trees were sprayed twice in 1 day with an extract prepared by boiling 1 pound for 15 minutes in 3 gallons of water and diluting with 6 gallons of water. This spray destroyed Psylla mali (Schmb.), young caterpillars of Cheimatobia brumata (L.), Tortricidae, and similar pests in Russia.--Glasenapp (162).

A decoction of this species was an effective stomach poison against Malacosoma neustria (L.) in Russia. A tobacco decoction prepared as given by Glasenapp killed 62.5 percent of the cabbage worms tested.--Goriainov (166).

A 5:5:3 mixture of tobacco, hydrated lime, and water proved a very efficient insecticide against currant worms, various aphids, leafhoppers, and many other insects under both laboratory and field conditions.--Haley and coworkers (177).

In Russia a tobacco-extract spray (0.3 percent nicotine) paralyzed flea beetles in 15 minutes. Applied undiluted, tobacco dust was very effective in protecting radish and cabbage seedlings against flea beetles, but it proved of little value against lepidopterous larvae and various Rhynchota or against Bruchus pisorum (L.) on peas.--Bondarovich (67).

NICOTIANA SYLVESTRIS Speg. & Comes.

This weed contains nornicotine, an alkaloid of proved insecticidal value and of greater potency than nicotine for the control of certain insects.--Roark (341).

l-Nornicotine obtained from the leaves of this species grown at Ithaca, N. Y., was tested against the bean aphid. The plants yielded 1.4 percent of crude alkaloids, of which 57 percent was nicotine and 43 percent nornicotine. All the nornicotines tested seemed more toxic than natural nicotine, substantiating earlier work with the racemic compound. l-Nornicotine is doubtfully more toxic than the dextro or inactive form. The d-nicotine is much less toxic than the levo form, but no such pronounced difference exists between the two forms of nornicotine. The data indicated that extracts of this plant might yield an insecticide superior to nicotine in toxicity to some insects.--Hansberry and Norton (182).

NICOTIANA TABACUM L. Common tobacco.

Most, if not all, of the commercial nicotine is derived from this species.

PETUNIA HYBRIDA Vilm. Common petunia.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

PETUNIA sp.

A decoction of petunia was recommended as an insecticide.--Sprenger (373).

In tests with Petunia plants in pots, adults of Meloë violaceus Marsh., larvae of Pieris brassicae (L.), and larvae of Diloba caeruleocephala (L.) died immediately after eating the leaves. Epicometis hirta (Poda) and Cetonia aurata (L.) died after eating the leaves, but they succumbed more quickly after eating the flowers. Centoptera americana (L.) was more resistant, but died in 5 or 6 days after feeding on the leaves, and 2 or 3 days after feeding on the flowers.--Borg (68).

PHYSALIS ANGULATA L. Cut-leaved ground cherry.

Extracts of the entire plant from British Guiana were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

SOLANUM AURICULATUM Ait.

A decoction of the berries were used as an insecticide.--Greshoff (171, p. 141).

SOLANUM CAROLINENSE L. Horsenettle.

A decoction was ineffective against cotton caterpillars.--Riley (325).

Water extracts had no effect on small webworms and small catalpa caterpillars. The powder, used as a fumigant, had no effect on small catalpa caterpillars; used as a stomach poison, it had no effect on silkworms and webworms, but had a slight effect on grasshoppers; and used as a dust, it had a slight effect on tent caterpillars and cockroaches.--McIndoo and Sievers (259, p. 23).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the berries killed 40 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

SOLANUM DULCAMARA L. Bitter nightshade.

Infusions of the entire plant mixed with manure killed 26 percent of the fly larvae in one test and 82 percent in a second test.--Cook and Hutchison (103, p. 4).

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

SOLANUM INDICUM L.

In India the leaves and fruit, rubbed up with sugar, were used as an external application for itch.--Kirtikar and Basu (230, v. 2, p. 895).

SOLANUM JAMESII Torr.

After eating leaves of this species, potato beetle larvae turned black and died.--Marchal and coworkers (267).

SOLANUM NIGRUM L. Black nightshade.

A remedy for the woolly aphid in Europe is a decoction of the fresh plant, which is brushed on the infested parts of the trees.--Regel (317).

A decoction used as a spray against aphids was only partly effective.--Thiele (398, p. 155).

An infusion or extract of the unripe fruits was toxic to insects, the toxic principle being solanine, an alkaloid present in a number of solanaceous plants. It was cheap, and a 0.05-percent aqueous solution was used for spraying.--Pollacci and Gallotti (307).

SOLANUM TUBEROSUM L. Potato.

Concentrated potato water rubbed on cattle slowly rid them of lice.--Gillette (157, p. 185).

Potato starch was ineffective against cockroaches.--Scott and coworkers (361, p. 14).

Extracts of potato plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

Comments by reviewer.--There is no scientific basis for the early reports that the potato plant is poisonous. When starch, which is obtained from the potato and other plants, is used in connection with insecticides, it acts mechanically, as does flour.

WITHANIA SOMNIFERA Dunal.

This plant is listed as an insecticide.--Greshoff (171, p. 143).

SPARGANIACEAE
(Bur-Reed Family)

SPARGANIUM AMERICANUM Nutt. Bur reed.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

STEMONACEAE

STEMONA COLLINSAE Craib.

Extracts of the tubers of this plant from Siam were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

STEMONA TUBEROSA Lour. Paipu.

Decoctions of the dried roots in Indo-China gave 90 percent mortality of crickets in 5 days, 40 percent mortality of weevils in 6 days, and 100 percent mortality of lepidopterous larvae. Extracts of the roots made with carbon tetrachloride, chloroform, ether, alcohol, and benzene extracts, when tested against the rice weevil, gave mortalities of 77, 70, 62, 53, and 33 percent, respectively, when used alone, and 81, 57, 60, 57, and 23 percent, when used with 2 percent of saponin.--Nanta (292).

This plant has long been recognized in China as an insecticide and six references are cited. As early as A. D. 960 the drug was recommended for killing lice and fleas, and the present experiments conclusively proved that a 50-percent alcoholic extract of the raw drug, obtained from a Chinese drug store, was very effective against the body louse, the pubic louse, and certain sucking lice on animals. The drug was also effective in killing the eggs of lice.--Wang (418).

STERCULIACEAE
(Cola-Nut Family)

PTEROSPERMUM ACERIFOLIUM (L.) Willd. Synonym: P. aceroides Wall.

In India the flowers were used as a disinfectant and to keep insects away from bed clothes.--Watt (422, v. 6, pt. 1, p. 362).

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

THEOBROMA CACAO L. Cacao. Cocoa.

A chocolate manufacturer mentioned an odd experience in connection with disposal of the cocoa shells. Some of the shells were used as bedding for dogs. Later the keeper credited the shells with having caused the disappearance of fleas that had infested the dogs.--Walton and Gardiner (417).

STYRACACEAE
(Storax Family)

HALESIA CAROLINA L. Silverbell tree.

Dead Japanese beetles were found under this tree.--Metzger (276).

STYRAX BENZOIN Dryand. Kemenyan.

A 5-percent water extract of the roots of this Malayan fish-poison tree killed three-fifths of the moth larvae (Parasa herbifera (Walk.)) treated, while a 0.5-percent extract of derris roots killed all the larvae treated in less time.--Gater (153).

STYRAX OFFICINALIS L. Storax tree.

In Austria it was suggested that powdered snail shells be burned with storax and the ashes scattered over nests of ants as a repellent.--Anonymous (4).

A solution of styrax (storax) containing sulfur or tar was recommended as a remedy for mites (Sarcoptes) on man and animals.--Martini (269, p. 262). [According to Hill, Economic Botany, p. 188, storax comes from Liquidambar orientalis Mill., family Hamamelidaceae.]

STYRAX spp.

Benzoin derived from one or more species of Styrax was one of the mothproofing materials claimed in a German patent (346,597).--Roark (333, p. 27).

SYMPLOCACEAE
(Sweetleaf Family)

SYMPLOCOS PANICULATA (Thunb.) Miq. Sweetleaf.

Extracts of the roots killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

TAMARICACEAE
(Tamarisk Family)

REAUMURIA HYPERICOIDES Willd.

In India this plant was used for the treatment of itch, the bruised leaves being applied externally.--Watt (422, v. 6, pt. 1, p. 399).

TAXACEAE
(Yew Family)

TAXUS CUSPIDATA Sieb. & Zucc. Japanese yew.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

THEACEAE
(Tea Family)

CAMELLIA SINENSIS (L.) Ktze. Synonym: Thea sinensis L. Tea.

The addition of oil of teaseed increased the toxicity of derris to the squash bug.--Fulton and Howard (149).

CAMELLIA spp.

In China the toxic property of the seeds of camellia was due entirely to a saponin, which was about one-fiftieth as toxic as rotenone to goldfish. The larvae of a sawfly, tent caterpillars, and silkworms refused to eat leaves with the saponin on them.--Wilson and coworkers (429).

CARAIPA FASCICULATA Camb.

This species furnished one of the resins used as an insecticide and as a cure for itch.--Barcellos Fagundes (51).

THEOPHRASTACEAE

JACQUINIA RUSCIFOLIA Jacq.

Extracts of the stems and leaves of this plant from British Guiana were nontoxic to the bean aphid.--Tattersfield and Gimingham (391).

JACQUINIA, probably SPRUCEI Mez.

Fruit of this bushy tree from Ecuador is used as a fish poison but was not toxic to the bean aphid.--Tattersfield and coworkers (394).

THYMELEACEAE
(Mezereum Family)

AQUILARIA AGALLOCHA Roxb.

In India the powerful wood was preventive against fleas and lice.--Kirtikar and Basu (230, v. 2, p. 1112).

DAPHNE MEZEREUM L. Spurge laurel.

This plant, which is well known in medicine, was observed never to have insects on it, but frequently dead beetles, flies, and wasps were found beneath it. Extracts of various parts of it should be tried on forest pests.--Gomilevsky (164).

Ten grams of cortex mezerei in 500 cc. of water had no effect on the caterpillars of Prodenia litura (F.).--DeBussy (76).

LASIOSIPHON ERIOCEPHALUS Decaisne.

The bark was used as a fish poison and as an insecticide in India.--Roark (332, p. 27).

Extracts of the fruit in Mysore had varying toxic properties against aphids.--Subramanian (377).

This fish-poison plant is common in high-rainfall areas of India. It was apparently of no value as an insecticide.--Puttarudriah and Subramaniam (311).

TILIACEAE
(Linden Family)

GREWIA CARPINIFOLIA Juss.

Women in west tropical Africa used the sap in washing the hair to remove or prevent lice.--Dalziel (112).

GREWIA TILIAEFOLIA Vahl.

In India the bark was employed externally to remove the irritation in cow itch.--Watt (422, v. 4, p. 183).

TILIA EUROPAEA L. European linden tree.

Acetone extracts of the flowers and leaves killed 50 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

TYPHACEAE
(Cattail Family)

TYPHA ANGUSTIFOLIA L. Narrowleaf cattail.

TYPHA LATIFOLIA L. Common cattail.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

ULMACEAE
(Elm Family)

CELTIS CINNAMOMEA Lindl.

GIRONNIERA RETICULATA Thwaites.

These plants, scraped fine and mixed with lemon juice, were used in India to anoint the body to cure itch.--Watt (422, v. 2, p. 243).

ULMUS AMERICANA L. American elm.

Extracts of this tree killed only 10 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

URTICACEAE
(Nettle Family)

GIRARDINIA PALMATA (Forsk.) Gaudich.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

PARIETARIA PENSYLVANICA Muhl. ex. Willd. Pellitory.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

VALERIANACEAE
(Valerian Family)

VALERIANA OFFICINALIS L. Valerian.

The root was of no value against the screwworm either as a repellent or an attractant.--Parman and coworkers (302).

VERBENACEAE
(Vervain Family)

CLERODENDRON INERME Gaertn.

This common ornamental hedge plant in India is a deterrent to honeybees, the odor causing them to desert the combs. A 20-percent water suspension of the powdered stems killed only 80 percent of the nymphs of mango hoppers.--Puttarudriah and Subramaniam (311).

CLERODENDRUM INFORTUNATUM Gaertn. Synonym: Volkameria infortunate Roxb.

In India the natives believed that the presence of this plant cured scabies.--Watt (422, v. 2, p. 373).

CLERODENDRUM PHLOMOIDES L. f.

The bitter juice of the leaves of the white-flowered variety was much used in Sind, India, as a remedy for itch.--Murray (290, p. 174).

DURANTA REPENS L. Synonym: D. plumieri Jacq.

This large woody shrub grows profusely in Assam. Its berries, when macerated, exude a juice lethal to all anopheline and culicine

mosquito larvae in dilutions up to 1 in 100. The poison appeared to be an alkaloid analogous to narcotine.--Manson (265).

GMELINA ARBOREA Roxb.

The Hindus used the juice of the leaves to remove fetid discharges and worms from ulcers.--Kirtikar and Basu (230, v. 2, p. 996).

LANTANA CAMARA L.

Extracts applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

LIPPIA DULCIS Trevir. Lippia.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

LIPPIA TRIPHYLLA (L'Her.) Kuntze. Synonym: L. citriodora H. B. K.

The essential oil from this plant, applied in 2-percent emulsion sprays, killed more than 90 percent of the red spiders and cotton aphids tested within 24 hours. A 1-percent emulsion killed 67 percent of the red spiders and 92.7 percent of the aphids.--Kayumov (226).

TECTONA GRANDIS L. f. Teak.

A tar extracted from the wood was applied to the sores of draft cattle to destroy maggots. As a rule white ants would not touch teak wood, and the use of teak-wood tar had been suggested as a remedy for these destructive pests.--Dymock and coworkers (124, v. 3, p. 62).

VERBENA HASTATA L. Blue vervain.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

Extracts of the whole plant killed only 30 percent of the mosquito larvae tested.--Hartzell and Wilcoxon (188).

VITEX AGNUS-CASTUS L. Lilac chaste tree.

Since flies were believed to avoid this tree, branches of it were hung in the huts.--Greshoff (171, p. 136).

VITEX NEGUNDO L. Negundo chaste tree. Nochi

The leaves were used to preserve rice and clothes from insect attack. In India the leaves were often placed between the leaves of books for the same purpose.--Dymock and coworkers (124, v. 3, p. 74).

Leaves mixed with stored grain in closed receptacles did not protect the grain from attacks of weevils.--Fletcher and Ghosh (140, pp. 734, 753).

In India stored products were preserved in bins with the leaves of this plant, but it is doubtful whether the leaves had any insecticidal value.--Ayyar (43, p. 48).

The leaves of this plant, which is widely distributed in India, are scattered among clothes to preserve them from insects. A 5-percent alcoholic extract of the leaves killed 90 percent of Plutella maculipennis (Curt.), 50 to 75 percent of Prodenia litura (F.), 20 percent of Crocidolomia binotalis Zeller., and 100 percent of Euproctis fraterna (Moore), Pericalia ricini (F.), and Achaea janata (L.).--Puttarudriah and Subramaniam (312).

VIOLACEAE
(Violet Family)

VIOLA PAPILIONACEA Pursh. Butterfly violet.

VIOLA TRICOLOR L. Common pansy.

Extracts from these plants were not repellent to the Japanese beetle.--Metzger and Grant (277).

VITACEAE
(Grape Family)

PARTHENOCISSUS QUINQUEFOLIA (L.) Planch. Synonyms: Hedera quinquefolia L.; Vitis hederacea Willd. (Kew). Virginia creeper.

A bunch of leaves was rubbed on an infested area of an apple tree, crushing all the woolly aphids on this spot. A week later the tree was entirely free of aphids, whereas formerly the tree could not be kept free from infestation for any length of time.--Bürger (71).

VITIS SETOSA Wall.

Extracts of this plant applied as sprays against adult mosquitoes were much inferior to the standard mosquitocide.--Wats and Singh (421).

XYRIDACEAE
(Yellow-eyed-Grass Family)

XYRIS INDICA L.

In India this plant was used for itch.--Kirtikar and Basu (230, v. 2, p. 1306).

ZINGIBERACEAE
(Ginger Family)

ALPINIA OFFICINARUM Hance. Galangal.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

AMOMUM MELEGUETA Rosc.

A decoction was rubbed on the skin of domestic animals in Africa to repel tsetse flies.--Sander (351, p. 367).

CURCUMA AROMATICA Salisb.

CURCUMA LONGA L. Turmeric.

In India C. aromatica was used externally for scabies and smallpox. Pure turmeric was useful for scabies and other skin diseases.--Watt (422, v. 2, pp. 657, 669).

CURCUMA ZEDOARIA Rosc. Zeoary.

Extracts were not repellent to the Japanese beetle.--Metzger and Grant (277).

HEDYCHIUM SPICATUM Hamilt.

In India this plant was said to protect clothes from insect attacks.--Watt (422, v. 4, p. 207).

ZYGOPHYLLACEAE
(Caltrop Family)

GUAIACUM OFFICINALE L. Guallacan tree.

Guaiacol, which is derived from this tree, was considered one of the best repellents to the screwworm.--Parman and coworkers (302).

LARREA DIVARICATA Cav. Synonym: Covillea tridentata (DC.) Vail.

Creosotebush.

Extracts of the leaves killed only 20 percent of the mosquito larvae tested, and extracts of the stems and roots killed none.--Hartzell and Wilcoxon (188).

PEGANUM HARMALA L.

In India the roots were used to kill lice in the hair.--Watt (422, v. 3, p. 86).

UNIDENTIFIED PLANTS

The following common, local, or native names have not been identified botanically.

AÑILITON.

This might be anilito, which is Indigofera mucronata.--Roark (332, p. 3).

A water extract had no effect on small webworms and small catalpa caterpillars. Water and alcoholic extracts were efficient against honeybees. The powder, used as a fumigant, had no effect on small webworms; used as a dust, it had a slight effect on tent caterpillars and cockroaches; and used as a stomach poison, it had no effect on webworms and flies and only a slight effect on cockroaches and silkworms.--McIndoo and Sievers (259, p. 21).

BALBEC.

A water extract killed silkworms quickly.--McIndoo and Sievers (259, p. 21).

BALEKATTU.

This plant was found in Coorg, India. A 7.5-percent alcoholic extract of the creeper killed 100 percent of the adult grasshoppers (Epacromia tamulus (F.)) treated, and a 3-percent extract killed 70 percent of one species of caterpillars and 100 percent of another species.--Putterudriah and Subramaniam (311).

CHURIMULLU.

This plant was found in Coorg, India. A 7.5-percent alcoholic extract of the stems killed 100 percent of the adult grasshoppers treated and a 5-percent extract killed 80 percent of one species of caterpillars (Crocidolomia binotalis Zeller) and 100 percent of another species (Euproctis fraterna (Moore)). Powdered stems dusted upon beetles killed 100 percent of them in 30 hours.--Puttarudriah and Subramaniam (311).

CONAMI CLIBODIUM.

Extracts of the roots, stems, leaves, flowers, and fruit of this fish-poison plant from British Guiana were nontoxic to the bean aphid.--Tattersfield and Gimingham (391). [This may be a species of Asclepias.]

DACRA.

The powdered stems, mixed with grain in closed receptacles, did not protect the grain from weevil attacks. This plant was said to have insecticidal properties.--Fletcher and Ghosh (140, pp. 733-734).

EMBOY.

HARAHARA.

Emboy was very poisonous to fish in Ethiopia. The natives were said to have used the juice against scabies and other dermal afflictions. Harahara was the only vegetable insecticide found in Madagascar. A decoction from the roots of this tree was stated to be an excellent insecticide and much employed by the natives to destroy parasites of the scalp.--Roark (332, pp. 21, 24).

HOLESAMPIGE.

This plant was found in Coorg, India. A 5.7-percent alcoholic extract of the stem bark killed 100 percent of the adult grasshoppers (Epacromia tamulus (F.).--Puttarudriah and Subramaniam (311).

HOOROOASHA.

A decoction of the bark was employed to destroy pediculi.--Anonymous (7).

MOETOEPOE or KOETOEPOE.

A water extract of the wood was efficient but an extract of the leaves was inefficient against silkworms.--McIndoo and Sievers (259, p. 23).

MOWRAH.

The seeds were tested in a preliminary way for insecticidal value.--Fryer and coworkers (147, p. 18).

NECOETAE.

SUMA RUBRA.

A water extract of the leaves of necoetae killed silkworms very slowly, and an extract of the bark of suma rubra had a slight effect on them.--McIndoo and Sievers (259, p. 23).

TALABALLI.

Alcoholic extracts and water suspensions of this plant from Coorg, India, had no effect on caterpillars.--Puttarudriah and Subramaniam (312).

TSSIKOENA.

A water extract had a slight effect on silkworms.--McIndoo and Sievers (259, p. 23).

TUBA HANTU, TUBA JANIROK, TUBA RIAM, TUBA SASAN, TUBA TAPAH.

Five-percent water extracts of the roots of these Malayan fish-poison plants were tested against moth larvae (Parasa herbifera (Wlk.)). An extract of the first plant killed 40 percent of the larvae, an extract of the second, 100, extracts of the third and fifth 0, and an extract of the fourth 20 percent.--Gater (153).

WEEDS.

Powder made from weeds and grasses in the neighborhood was found to be an efficient mosquito larvicide when spread on the surface of the water. Powders thus used killed mechanically, rather than by poisoning the larvae.--Thibault (397).

YAHOOT.

The roots were tested in a preliminary manner for insecticidal value.--Fryer and coworkers (147).

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