A CONTRIBUTION TO OUR KNOWLEDGE OF THE WHITE FLIES OF THE SUBFAMILY ALEYRODINAE (ALEYRODIDAE).

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INTRODUCTION.

The present paper is in continuation of the writers' work on the classification of the Aleyrodidae published as Parts 1 and 2 of Bulletin 27, technical series, Bureau of Entomology, and is based on material in collections of the United States National Museum and the Bureau of Entomology. These collections during recent years have been materially augmented by the receipt of specimens from various parts of the world, especially oriental regions and tropical North America.

Recent years have witnessed considerable activity on the part of entomologists in the study of the Aleyrodidae, and the number of species at present known is considerably in excess of the number at one time thought to exist. It is certain that there are very many as yet unrecognized species, especially in tropical regions, and it is hoped that entomologists and collectors who have opportunity will interest themselves in this comparatively unworked group of insects.

Genus ALEUROCANTHUS[1] Quaintance and Baker.

Aleurocanthus Quaintance and Baker, Tech. Ser. 27, pt. 2, Bur. Ent. U. S. Dept. Agr., 1914, p. 102.

Pupa case medium in size, subelliptic in outline, usually dark brown or black in color; margin of case toothed, the wax tubes very prominent; submarginal area not separated from dorsal disk; dorsum without papillae or pores, though bearing many heavily chitinized spines variously arranged; tracheal folds usually not discernible, though evident in a few species; wax secretion usually present as a narrow fringe from marginal wax tubes. Vasiform orifice small,

[1] *Aleurodes voeltzkowi* Newstead, *Aleurodes citricola* Newstead, *Aleurodes nubilans* Buckton, and *Aleurodes banksiae* Maskell are not included in the following key. Of the first three species the descriptions are so poor that it is impossible to arrive at an understanding of the species. The last we place here doubtfully on the structure of the larva, the slide of pupa case being in such condition that it is impossible to make out any details.

rounded or subcordate in outline, situated on a tubercle-like projection of dorsum; operculum similar in shape and almost entirely filling it, obscuring the lingula.

Adult with one flexure in radial sector of forewing and no spur of media; wings usually blotched or shaded. Males much smaller than females.

Type.—Aleurocanthus spiniferus (Quaintance).

KEY TO SPECIES OF ALEUROCANTHUS.

1. Pupa case with 12 spines on anterior half of case only..... *T-signatus.*
2. Pupa case with 100 or more long spines situated close together, forming a submarginal ring; color black; size 2 by 1.6 mm..... *longispinus.*
   Pupa case with 50 or less rather long spines forming a submarginal ring.....3.
3. Pupa case with about 50 spines forming submarginal ring; color yellowish; size 1.33 by 0.99 mm..... *hirsutus.*
   Pupa case with less than 40 spines forming the submarginal ring.....4.
4. Pupa case with 30–36 spines forming submarginal ring.....5.
   Pupa case with 16–26 spines forming submarginal ring.....7.
5. Pupa case over 2 mm. long; 30 hooked spines forming a ring around the dorsum just within the margin; color black..... *bambusae.*
   Pupa case less than 2 mm. long.....6.
6. Teeth of the margin knobbed, a space of 0.1 mm. occupied by 10 teeth; size 1.39 by 0.88 mm.; submarginal area armed with 34–36 prominent spines.... *mangiferae.*
   Teeth of the margin not knobbed, but triangular and somewhat acute; space of 0.1 mm. occupied by 14 teeth; pupa case black, submarginal spines arranged in two series; adults with mottled wings..... *citriperdus.*
7. Submarginal spines extending out some distance beyond the margin of case....8.
   Submarginal spines not extending beyond the margin of the case, or but slightly beyond it.....11.
8. Teeth of the margin of case knobbed, a space of 0.1 mm. occupied by 13 teeth; size 1.09 by 0.68 mm.; color black..... *calophylli.*
   Teeth of margin not knobbed.....9.
9. Teeth of margin very large and rounded, a space of 0.1 mm. occupied by 6 or 7 teeth; spines long and prominent; color black; size of case 1.4 by 0.89 mm.; adults with dark wings and clear markings; bodies reddish brown..... *woglumi.*
   Teeth of margin not large, a space of 0.1 mm. occupied by 12 or more teeth....10.
10. Teeth of margin not acute, moderate in size, a space of 0.1 mm. occupied by 12 teeth; size of case 1.23 by 0.88 mm.; spines not long; eggs with reticulate markings..... *spiniferus.*
    Teeth of margin somewhat acute, the outer spaces shallow; a space of 0.1 mm. occupied by 16 teeth; size 1.168 by 0.75 mm.; egg striated..... *piperis.*
11. Submarginal spines not extending beyond the margin of case, or but slightly beyond it, and split at their apices into a number of fine fimbrications; submarginal area corrugated or granular.....12.
    Submarginal spines very short, becoming mere tubercles; color brown to black, marginal teeth distinctly serrated; size of pupa case 0.752 by 0.512 mm. *dissimilis.*
12. Dentition moderately acute, a space of 0.1 mm. occupied by 26 teeth; color on leaf dark brown; yellowish under the microscope..... *spinosus.*
    Dentition quite acute, a space of 0.1 mm. occupied by 26 teeth; color on leaf deep black, under microscope dark brown; spines stout, deep black at base; size 1.01 by 0.72 mm.; egg reticulate with stalk nearly twice length of egg *serratus.*

ALEUROCANTHUS BAMBUSAE (Peal).

Plate 32, figs. 1–9.

Aleurodes bambusae PEAL, Journ. Asiat. Soc. Bengal, vol. 72, 1903, p. 85.

A. bambusae is a large species, approaching in size *longispinus*. It is also found upon the same host plant which might lead one to believe that the two forms are identical. The number of spines given by Peal for *bambusae* is, however, very different from that found on *longispinus*. In clearing the case sufficiently for study many of the spines are destroyed and their position is indicated only by stubs, or even their tubercles. It is possible, therefore, that Peal may have overlooked a number of them. Since, however, his specimens were destroyed by fire, this can not now be determined, as *bambusae* has not been subsequently described.

Egg.—Length, 0.25 mm. by 0.11 mm.

Color light brown. Surface sculptured with hexagons. Attached in an upright position to leaf by a short peduncle.

Larva, first stage.—Size, 0.35 mm. by 0.2 mm.

Shape elliptical, narrow for its length. Color, deep black; dark brown under the microscope. The dorsum is completely hidden by a quantity of white fluff which is produced by a series of submarginal pores. There is an elevated mesio-dorsal ridge extending anteriorly almost to the margin and posteriorly to the vasiform orifice. Segments of abdomen fairly distinct. Margin crenulated, bearing a series of closely apposed pores which produce a regular but somewhat short horizontal fringe. Ventrad just within the margin a series of pores which produce a scanty white secretion. There are four long setae on cephalic and four on caudal margins. On the dorsum there are four long, stout curved spines which are situated a pair on the cephalic and a pair on the anterior edge of the abdominal region. They are placed on the sides of the medio dorsal ridge. The spines point backwards. Each spine is about half the length of the body, the anterior pair being slightly longer. Two short stout curved spines are situated one on each side of the vasiform orifice. Vasiform orifice large, elevated on a tubercle. It is apparently similar to that in the puparium but owing to the color is difficult to make out.

Larva, second stage.—Size, 0.55 mm. by 0.3 mm.

Similar except in size to larva, third stage.

Larva, third stage.—Size, 1 mm. by 0.55 mm.

Shape elliptical, somewhat broader proportionately than in the first stage. Color, dense black. There is a distinct mesio dorsal ridge which is somewhat slighter than in the preceding stage. Abdominal segments distinct. Area surrounding vasiform orifice

darker than the rest of the abdomen. Margin broad crenulated. Mesad the margin ends at a broad ridge which separates it from the rest of the dorsum. Along its edge are a series of large closely apposed pores which produce a short but abundant horizontal fringe of wax. The upper surface of the margin bears a large number of extremely minute pores. These pores produce a quantity of white fluffy wax filaments which curve inwards and cover the dorsum. Ventrally a little within the margin there are a series of pores which produce a small quantity of wax. The dorsum is covered with a number of stout spines. There are a pair on the cephalic region at end of mesio dorsal ridge and nearly on the margin; two pairs placed fairly close together on the cephalic region; a pair placed widely apart on the thoracic region; immediately behind this pair there are two pairs placed fairly close together on the lower edge of the mesio dorsal ridge; a pair of spines on each of the third, fourth, and fifth abdominal segments; and two stout curved spines, one on each side of the vasiform orifice. There are two short setae, one on each side of the vasiform orifice and two fairly long setae caudad on margin. The vasiform orifice as in preceding stages, but in some specimens the lingula appears large and dumb-bell shaped.

Larva, fourth stage.—Size, 1.4 mm. by 0.9 mm.

Shape elliptical, anterior edge abruptly conical. Color, dense black. Mesio dorsal ridge as in preceding stages. A broad crenulated margin which ends mesad in an elevated ridge which separates it from the rest of the dorsum. The margin ends in a series of large closely apposed pores which produce a short thick marginal fringe of white wax. The upper surface of the margin is covered with a large number of minute pores which produce a quantity of white fluff, which, curving inwards, covers the dorsum. Segments of abdomen distinct. The dorsum is covered with a large number of stout spines which lie—five pairs on the cephalic region; four pairs on the thoracic region, and five pairs on the abdominal segments. There is also a stout curved pair situated one on each side of the vasiform orifice. There are two short setae, one on each side of the vasiform orifice and a slightly longer pair caudad on margin. Vasiform orifice large in proportion to its size as compared to the vasiform orifice in the puparium.

Puparium.—Size, 2.1 mm. by 1.4 mm.

Shape elliptical, broadest caudad. Color, dense black. Distinct mesio-dorsal ridge, which is narrow and sharp anteriorly and broad and rounded posteriorly. From this ridge there are a series of five ridges which mark out the abdominal segments. Margin broad, crenulated, bearing on its upper surface a large number of minute pores which produce a quantity of white wax filaments which curling inwards conceal the dorsum. There are a series of closely apposed

marginal pores which produce a short but abundant horizontal secretion of wax. There are ventrally on margin a series of pores which produce a small quantity of wax. The dorsum is covered with a large number of short but stout spines. These spines are grouped as follows. There are 30 hooked spines forming a ring around the dorsum just within the margin. The other spines are shorter and are situated as follows. A double row of eight spines across the cephalic region; four spines on the thoracic region; 16 spines in a row down the mesio dorsal ridge on the abdominal region; two rows of three spines, one row on each side of the mesio dorsal ridge on first and second abdominal segments; two rows of two spines placed similarly on third and fourth segments and one spine on each side of the mesio-dorsal ridge on the fifth segment. A pair of short stout spines placed, one on each side of the vasiform orifice. Two long setae caudad and two cephalad on margin. The vasiform orifice is situated on a short tubercle at the posterior end of the mesio dorsal ridge; shape, oval. Operculum similar in shape but somewhat smaller, the lower half apparently slightly ridged. Lingula indistinct, shape rectangular, broader than long. It is completely covered by the operculum.

Adult.—Unknown.

This Aleurodid occurs plentifully on various species of bamboo in the vicinity of Calcutta. As a rule only a few leaves in a bamboo clump are attacked by the insect. I have, however, sometimes found it occurring in very large numbers in some bamboo clumps. It then undoubtedly is a rather serious pest as frequently most of the leaves are then killed. The insect is kept in check by a parasite, presumably a chalcidid, as large numbers of dead insects can always be found which have the minute hole on the dorsum made by the parasite for its exit. I have so far obtained no specimens of the parasite. When this Aleurodid is detached from the leaf it will be observed that the portion of the leaf beneath the insect is yellow and discolored. As a rule the exuviae of the preceding stages remains attached to the spines on the dorsum. (Peal.)

ALEUROCANTHUS BANKSIAE (Maskell).

Plate 33, figs. 1–5.

Aleurodes banksiae MASKELL, Trans. N. Zeal. Inst., vol. 28, 1896, p. 423.

It is with some hesitation that we place this species here. The type of the pupa case, which is a solitary specimen in a balsam mount, is in such condition that it is impossible to make out details. The larva possesses numerous spines and is otherwise quite similar to the forms we are placing in this group, and it is on the strength of this larval structure that we place the species in *Aleurocanthus*.

Larva.—Brown, elliptical; length about one forty-fifth of an inch. Margin distinctly crenulated, but bearing no fringe. Abdominal segments fairly distinct. Dorsum bearing, within the margin, a row of longish, strong spines, of which four, on the anterior region, extend beyond the margin; also, on the anterior thoracic region, six other spines in two rows; the extremities of all these spines are dilated into three minute spicules. Vasiform orifice with regularly convex sides and end, the anterior edge concave; operculum moderate, subcircular, lingula obsolete.

Pupa case.—Intense glossy black, flattish, elliptical; length about one twenty-fifth of an inch. Abdominal segments moderately distinct. Margin crenulated, but less conspicuously than in the larva; there is sometimes a small fragmentary waxy fringe. Dorsum bearing rows of short fine hairs in place of the strong spines of the larva.

Adult form unknown.

Habitat in Australia, on *Banksia integrifolia* and on *Callistemon linearis*. My specimens were sent from Melbourne by Mr. C. French.

Larva (fig. 5).—Size 0.64 by 0.432 mm.; shape elliptical; color light brown. The dorsum is armed with a number of spines which are narrow and slightly swollen at the distal extremity. On the submarginal area of the thorax there is an even row of 10 spines, five on each side, and on the median ridge of the thorax there are two other pairs. The abdomen has a row of six spines down each side of the subdorsal area, the most caudal pair of which is situated close to the vasiform orifice. There is also a pair of prominent spines on the median ridge of the second abdominal segment. The vasiform orifice is situated on a slight tubercle-like projection. It is subcordate in outline (fig. 3) and the operculum almost entirely fills the orifice, obscuring the lingula. Just cephalad of the orifice there is a pair of small setae, one on each side, and on the caudal margin of case there is a pair of long hair-like spines. A similar but shorter pair is situated on the latero-caudal margin. The margin of the case is dentate, the teeth being small and situated close together. (Fig. 2.) They are rounded at their tips and irregular in size, some being large and some small.

Types, one pupa and one larva on balsam mounts in the Maskell collection.

ALEUROCANTHUS CALOPHYLLI (Kotinsky).

Plate 33, figs. 6–10.

Aleyrodes calophylli KOTINSKY, Bull. 2, Div. Ent. Brd. Agr. & For. Hawaii, 1907, p. 98.

Pupa case (fig. 6).—Size 1.09 by 0.68 mm.; shape elliptic to oval, with a well-marked median ridge, particularly upon the abdomen, and the subdorsal area not greatly elevated. On the submarginal

area there is a row of spines forming a ring about the case. These are variable in length, the longest being about 0.19 mm. On the subdorsal area there is a row of smaller spines, four on each side of the thorax and four on each side of the abdomen. These are all small but the most caudal pair, which is as long as those of the submarginal ring. On or near the median ridge there are the following spines: One pair of small ones in about the middle of the thorax; one pair of very small ones on the first abdominal segment; one pair of long ones on the second abdominal segment; and just cephalad of the vasiform orifice two pairs of moderately long spines, the spines of the most caudal pair situated close together, and the other one on each side of the median ridge. The vasiform orifice (fig. 8) is situated on a well-marked tubercle which forms the caudal extremity of the median ridge. It is rounded or subcordate, and its inner margin is armed with a series of folds. The operculum almost entirely fills the orifice obscuring the lingula. Just cephalad of the orifice there is a pair of minute setae. The margin is dentate, the teeth being of moderate size and swollen at their tips; in this character resembling those of *mangiferae*. A space of 0.1 mm. is occupied by 13 teeth (fig. 7). Around the margin near the base of the teeth there is a row of minute tubercled setae. The case under the microscope is dark brown, particularly so near the margins. On the leaf it is shining black with little or no dorsal secretion and a narrow white waxen marginal fringe.

Type.—Cat. No. 19106, U.S.N.M.

Paratype material United States National Museum collection, as balsam mounts, and pupa cases upon the foliage.

Habitat.—On *Calophyllum neophyllum*, at Levuka, Fiji, Albert Koebele, collector.

ALEUROCANTHUS CITRICOLUS (Newstead).

Aleurodes citricola NEWSTEAD, Mitteilungen aus den Zoologischen Museum in Berlin, vol. 5, Heft 2, 1911, p. 173.

We have seen no examples of this species.

Puparium.—Elongate ovate; black and slightly glossy when free from exuviae of previous moults. Dorsum may or may not be keeled; with one bilateral, subdorsal row of large spines, and one submarginal row; the latter projecting beyond the secretionary margin, in some instances; these spines are generally laden at the tips with irregular nodules of almost colorless secretion. Marginal fringe broad, white, and practically homogenous. In most cases the dorsum is partly hidden by the exuviae of the previous moult; these are paler in color than the puparium of the adult, but they are free from secretionary matter. Ventral margin or flange (fig. 1) very narrow, inner edge deeply crenulated, but the crenulations are generally rendered ob-

scure by the density of the chitine; though in some instances portions of the flange become flattened out so that the crenulations appear external. Structure of the vasiform orifice doubtful, as owing to the opacity of the integument it is not possible to determine its characteristics.

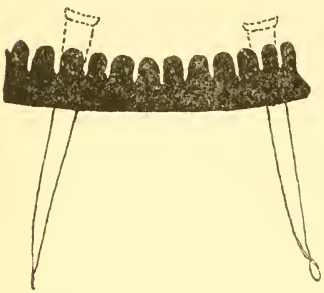


FIG. I.—MARGIN OF PUPA CASE OF ALEUROCANTHUS CITRICOLUS. (AFTER NEWSTEAD.)

Length, exclusive of fringe, 1 mm.

Ovum narrowly reniform or almost crescentic, peduncle very short; pale ochreous or straw-colored, when empty.

Habitat.—D. Ost-Afrika, Dar es Salaam, April, 1902. Auf *Citrus* sp. Prof. A. Zimmermann S. (No. 2).

The puparia occurred in large overcrowded colonies, appearing to the unaided eye as patches of soot-like deposit upon the under surface of the leaves. They were associated with the Coccid *Aspidiotus aurantii* Maskell, chiefly young forms of the female. (Newstead.)

ALEUROCANTHUS CITRIPERDUS, Quaintance and Baker.

Aleurocanthus citriperdus QUAINTANCE AND BAKER, Journ. Agric. Research, vol. 6, 1916, p. 459, fig. 1.

This species is represented in the bureau collection from Java, Ceylon, and India. It seemingly is an abundant species. It has been found on orange and on an unknown tree.

ALEUROCANTHUS DISSIMILIS, new species.

Plate 34, figs. 1–9.

Larva.—The cast larval skins are found attached to the dorsum of the pupa case, and it is therefore difficult to study them with any accuracy. They possess, however, the same serrated marginal teeth found in the pupa case and are thus easily distinguished from the larvae of other species. The spines on the larvae (fig. 9) are not as much reduced as those of the pupa case, but appear more like those normally met with in species of the genus.

Pupa case (fig. 1).—Length 0.752 mm.; width 0.512 mm.; color under the microscope dark brown to black. Dorsum armed with a series of spines, as indicated in the figure. These spines are not prominent as in other members of the genus, but are reduced to mere tubercles (fig. 2). Some of those upon the thoracic area are acute at the tip (fig. 3), while some (fig. 4) are not as much reduced as others. The abdomen is armed with a median dorsal row of twelve pairs of these

tubercles, and the pair on the first abdominal segment is often of fair size and swollen at the distal extremity (fig. 5). In other specimens, however, this pair is short like the other pairs. The thoracic suture is very distinct and curved and extends to the margin of the case. The "eye spots," which are present as in *T-signatus*, resemble quite closely those of that species. The margin (fig. 6) is armed with very prominent teeth, a space of 0.1 mm. being occupied by 6 or 7 of them. These teeth are rather long; are rounded at the tip and covered with numerous distinct serrations (fig. 7). At the base of each tooth there is a semicircular nearly transparent area, and there is an indication of the separation of the submarginal area from the dorsal disk. Caudal margin armed with a pair of long spine-like hairs. Vasiform orifice (fig. 8) situated on a prominent projection, subcircular in outline and almost filled by the operculum; lingula not observable through the operculum.

On the leaf the case is shiny black. There is a broad white lateral fringe composed of a closely appressed series of wax rods, radiating outward upon the leaf. The dorsum is more or less covered with a similar secretion, which, however, is of a more uniform texture, no visible rod structure being present.

Adult.—Unknown.

Type.—Cat. No. 19104, U.S.N.M.

The species was collected by R. S. Woglum on an unknown vine, Mirdon, Lower Burma, Dec. 1910.

ALEUROCANTHUS HIRSUTUS (Maskell).

Plate 34, figs. 10–15.

Aleurodes hirsuta MASKELL, Trans. N. Zeal. Inst., vol. 28, 1896, p. 434.

Larva.—(fig. 14).—The larva is broadly elliptical; size 0.6 mm. by 0.46 mm. The median area is evident, but not distinctly elevated. There are a number of prominent spines present, the position of which is shown in the figure. The margin is dentate, with the teeth evenly rounded; the thoracic tracheal folds are well defined (fig. 15).

Pupa.—(fig. 10).—The pupa case is broadly elliptical with indentations marking the thoracic and caudal tracheal folds. Its size is 2 by 1.6 mm. Color yellowish with a slight brownish shade. The median and subdorsal areas are evenly arched and slightly darker in color than the submarginal area, which is very flat. There is no distinct median ridge, and the vasiform orifice is but slightly elevated. The submarginal area is armed with a row of usually 50 rather long spines, arranged about the case as shown in the figure. These are about 0.2 mm. long and each is split into segments at the tip (fig. 12). On the submarginal area, between the marginal row of spines and the raised central area, there are two more pairs of spines present. The most caudal pair situated about opposite the vasiform orifice and the

other pair not far caudad of the thoracic tracheal folds. On the raised median and the subdorsal area there are about a dozen pairs of prominent spines, the arrangement of which may be seen in the figure. The vasiform orifice (fig. 13) is subcordate in outline with irregular folds showing on the margin. The operculum is of a similar shape with the lateral margins indented and it obscures the lingula. The margin is dentate, the teeth being evenly rounded at their tips (fig. 11). A space of 0.1 mm. is occupied by 24 teeth.

Habitat.—Australia, on *Acacia longifolia.*

Types on slide mounts forming part of the Maskell collection, on which the above description is based.

ALEUROCANTHUS LONGISPINUS, new species.

Plate 35, figs. 1–6.

This species was taken on bamboo at Calcutta, India, during October, 1910, by R. S. Woglum, and also on the same plant at Moulmein, Burma, in December. It is a very large species and in size agrees with *bambusae* Peal taken on bamboo in India. The larger number of spines, however, at once separates it from that species.

Egg (fig. 5).—Size 0.165 by 0.075 mm.; shape subreniform, slightly curved with the stalk situated near the larger extremity, on the concave side; surface covered with hexagonal areas (fig. 6), which are about 0.006 mm. in diameter; color light brown.

Pupa case (fig. 1).—Color black and very heavily chitinized so that it is with difficulty that the details are studied. After boiling for five minutes in aqua regia, the color is dark brown, with a darker median longitudinal area, which broadens somewhat across the abdomino-thoracic suture. Shape broadly oval, broadest across the third or fourth abdominal segment. Its size is 2 by 1.6 mm. On the submarginal area some considerable distance from the margin there is a closely set row of one hundred or more spines. These are not of a uniform length, but extend for a considerable distance beyond the margin. On the dorsum there is also a number of shorter spines, the relative average position of which is indicated in the figure. These, however, show some variation in different specimens. The abdominal sutures are fairly well defined in the aqua regia specimens, though it is almost impossible to distinguish them in other material. On each side the median area and arranged along the abdominal sutures, are a number of small circular dark pore-like areas (fig. 4). It is possible that these areas may have originally been the seats of minute bristles, but we have been unable to distinguish such in any material. The margin (fig. 2) is dentate, the teeth being blunt and evenly rounded. These teeth are situated close together and are small, a space of 0.1 mm. being occupied by 7 or 8 teeth. Just within the margin, extending inward opposite each tooth, is an elongate rounded,

faintly appearing structure of about the same size as the tooth. Within the rounded portion of the inner extremity of this structure a dark area is situated, which may represent the secreting area of the marginal tubes. On the submarginal area between these structures and the row of spines, the surface presents a granular or irregularly striated appearance. The vasiform orifice (fig. 3) is situated on a tubercle. Its shape is that of a rounded triangle and its inner margin in many specimens is irregularly waved or toothed. The operculum almost entirely fills the orifice obscuring the lingula. Near the cephalic lateral margin of the orifice a pair of small spines is situated one on either side.

On the leaf the pupa case is solid black with the spines appearing a dark brown. There is a very slight irregular waxy secretion on the dorsum, mostly on the subdorsal area. When this is present in any quantity the median ridge shines through as a jet black area. On the lateral margin there is a fringe all around of dull white wax which is not even but broken up into plates or sections, some of which are considerably longer than others. In some cases these have a slight woolly appearance, but usually are dull and waxy in appearance.

Adult.—Unknown.

Described from numerous pupa cases in balsam and dry upon the leaf.

Type.—Cat. No. 19097, U.S.N.M.

ALEUROCANTHUS MANGIFERAE, new species.

Plate 36, figs. 1–9.

This species is represented by four different lots of material. The type lot was taken on mango by R. S. Woglum at Bombay, India, in 1909. Another lot was collected from the same plant by Mr. Woglum at Saharanpur, India, in October, 1910, and a third lot was taken by him at Dehra Dun, India, on the same plant in November, 1910. Besides this material there is one slide containing eggs, larvae, and pupae, which was received from Mr. J. G. Sanders and marked "Imported plant, India, October 8, 1908." The pupa case on this slide shows a slight variation from the type in regard to the relative length of the submarginal spines, but as considerable variation occurs between specimens, and even sometimes between the two halves of the same specimen, there seems little doubt that Sanders's material is of the same species.

Egg (figs. 2 and 3).—Length 0.24 mm., width 0.128 mm. Somewhat oval in outline, and curved with the stalk situated near the larger end; color light yellowish brown; stalk short; surface covered with hexagonal markings, the average diameter of which is 0.06 mm.

Young larva (fig. 6).—Length 0.4 mm.; width at greatest diameter 0.208 mm.; shape oval, the caudal end the smaller; median dorsal portion considerably elevated; color dark brown, with here and there lighter transparent areas. On the cephalic extremity there is a pair of slightly curved spines averaging 0.076 mm. in length. Somewhat caudad is another pair of about the same length; slightly caudad of these and situated close together near the median dorsal line is a pair of spines averaging 0.2 mm. in length; caudad of these and situated well out on the submarginal area is a pair of shorter spines averaging 0.112 mm. in length; caudad of these again and situated close together near the median dorsal line there is another large pair about 0.2 mm. long; caudad of this pair is a variable number of one or two pairs of minute spines, and then two pairs of well developed ones about 0.16 mm. long. The most caudal pair of these is slightly the longer. Situated just cephalad of the vasiform orifice is a pair of small bristles, and there is a similar spine on each side of it. There is a pair of long spines, about the same length as the last pair of abdominal ones, situated a spine on either side of the orifice. Just within the caudal margin of the case there is a pair of rather long hair-like bristles, and on the caudo-lateral margin a pair of minute ones is situated. The vasiform orifice is somewhat squarish or often almost circular. It is almost completely filled by the operculum which obscures the lingula. The margin of the larva is bluntly serrate.

Late larva (fig. 4).—Length 0.8 mm.; width 0.48 mm.; shape elliptic; dorsum arched. On the submarginal area there is a row of usually 24 spines. Of these the first and third caudal pairs and the second cephalic pairs are usually considerably longer than the others. On the dorsal and subdorsal areas there are 28 spines. There are three long pairs on the abdomen and one long one on the thoracic area. On the thorax also there is a pair of setae on the dorsal area, a similar pair is situated just anterior to the vasiform orifice, and another pair on the caudal margin of the case. Some specimens show the first and second caudal pairs of submarginal spines long instead of the first and third. The vasiform orifice (fig. 8) is situated on a tubercle-like structure; broadly subcordate in outline and is almost filled by the operculum. The ventral membrane of the orifice is bilobed. The margin is armed with prominent teeth, the tips of which are knobbed. A space of 0.1 mm. is occupied by 12 or 13 teeth.

The interspaces between these are quite acute, though the distal knobbed portion is rounded; a space of 0.1 mm. is occupied by 10 teeth.

Pupa case (figs. 1 and 9).—Size, 1.39 by 0.88 mm. Shape oval; broadest across the abdomen; dorsum with a distinct elevated median

ridge. Suture separating thorax and abdomen much curved, as indicated in figure. Submarginal area armed with a series of 34-36 spines. These vary considerably in relative length, but in most specimens they are as indicated in figure 1, being of nearly equal length on the thorax, but on the abdomen having five of the spines much longer than the others. In the pupa case on slide No. 5234 there is quite a different arrangement, as is shown in figure 9. In this example the spines on the submarginal area of the abdomen are alternately long and short. Those of the long series average 0.48 mm. in length and those of the small series 0.2 mm. On the abdomen there are, as a rule, nine pairs of spines other than those of the submarginal series. Three of these are long and the remaining pairs short. The vasiform orifice (fig. 7) forms the caudal extremity of the median dorsal ridge. It is, therefore, elevated and is somewhat subcordate in outline. The operculum is straight on its cephalic margin and almost entirely fills the orifice, obscuring the lingula. Two pairs of long setae are present on the case, one pair on the caudal margin and the other pair just cephalad of the vasiform orifice. The margin (fig. 5) is armed with prominent knobbed teeth.

On the leaf the specimens are black and shiny, with the dorsum highly arched, and the abdominal segments not distinctly marked. There is almost no dorsal secretion, but occasionally there is a slight woolly patch which seems very lightly attached to the pupa. The small patches of wax are sometimes found sticking upon the spines, which are quite erect. The margin has a narrow fringe of white wax, more or less woolly in appearance, which is on the very base of the case against the leaf. In some specimens this marginal fringe is almost lacking, the cases being completely jet black.

Adult.—Unknown.

Described from numerous pupa cases, larvae and eggs in balsam mounts, and pupa cases dry upon the leaf.

Types.—Cat. No. 19098, U.S.N.M.

ALEUROCANTHUS NUBILANS (Buckton).

Aleyrodes nubilans BUCKTON, Ind. Mus. Notes, vol. 5, 1903, p. 36.

This species is unknown to us in nature and the description is so indefinite that we are unable to compare it at all satisfactorily with our material from India. We have not been able to secure any similar species from the host, betel, or other plant.

Description.—Legs long and hairy with dimerous tarsi. Antennae rather long and with seven (?) joints in the female, which is a larger insect than the male. Wings four, rounded at the apices, and fringed with minute hairs. A single unforked central nervure, not continued to the margin. Membrane smoky in patches, with a darker blurred

spot. The male smaller, with a large thorax, taper abdomen, and furcate at the apex and with hinder legs longest.

The larvae crowd the undersides of the leaves of the betel in the form of small scales very difficult to detach. They appear like scales of some Coccidae, but these showed no distinct organs such as antennae, legs, or eyes. Their outer surfaces were more or less

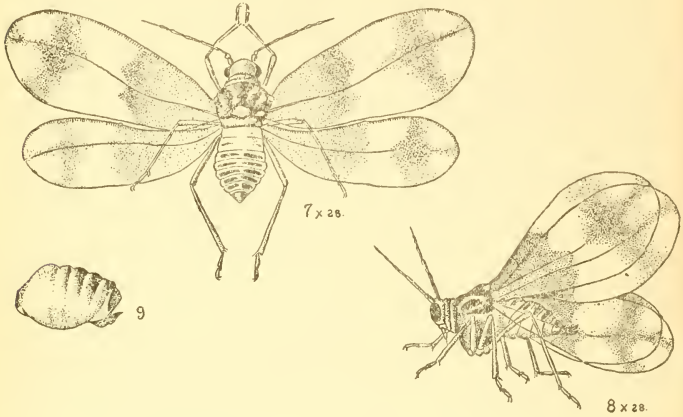


FIG. 2.—ALEUROCANTHUS NUBILANS. ADULT MALE AND FEMALE. (AFTER BUCKTON.)

spined, and some larvae were tufted with wooly matter, each thread being formed of a continuous spiracle.

This new Aleurodid was received on betel leaves from the Manager, Court of Ward's Estates, Backergunge, India, who reported that it was doing considerable damage to the plants. (Buckton.)

ALEUROCANTHUS PIPERIS (Maskell).

Plate 37, figs. 1–6.

Aleurodes piperis MASKELL, Trans. N. Zeal. Inst., vol. 28, 1896, p. 438.

Amongst the type material of the Maskell collection this species is represented by one specimen each of larva, pupa case, and pupa extracted from the case. The last is so distorted that it is of little value for descriptive purposes.

Larva (fig. 6).—Length 0.64 mm.; width about 0.5 mm.; shape broadly elliptical. Abdominal segments not distinctly marked and median ridge not pronounced. Color under the microscope brown; submarginal area with the pigmentation irregular, giving it a mottled or granular appearance. Dorsum armed with a number of prominent spines of different sizes, the position and relative sizes of which are best shown in the illustration. These spines are acute at the tip

and each of the larger ones has near its distal extremity a peculiar notch-shaped structure (fig. 4). There are also on the dorsum five pairs of setae—one pair on the caudal extremity, one pair just cephalad of the vasiform orifice, two pairs on the median dorsal portion of the thorax, and one pair, more widely separated, on the cephalic margin of case. Vasiform orifice (fig. 3) subcircular, with the operculum almost entirely filling the orifice and obscuring all but the tip of the lingula; margin armed with moderately rounded teeth.

Pupa case (fig. 1).—Length 1.168 mm.; width 0.75 mm.; shape elliptical, with a moderate median ridge. The type-specimen is much broken and so poorly preserved that it is difficult to make out the dorsal structures; color very dark brown; submarginal area with about 22 prominent spines forming a ring. These extend well beyond the margin, are acute at the tip, and each is armed a short distance from its distal extremity with the same peculiar notch-like structure found in the larva (fig. 4). The caudal pair of these spines is broken off from the type-specimen, but we have figured them longer than the others as described by Maskell. Just below this submarginal row of spines there is a row all around of very many minute, knobbed setae (fig. 5). These are very small, being no longer than the spines are thick at their bases. Each of these little setae has the knob and the distal half transparent, while the basal half is dark brown. The dorsum is armed with a number of spines, but owing to the very poor condition of the type it is impossible to say with certainty either the number or the position of these. As near as we can make out, however, they are shown in the illustration. The submarginal area is irregularly pigmented, giving a very distinct mottled appearance. The margin is dentate with the teeth moderately acute and the interspaces shallow. A space of 0.1 mm. is occupied by about 16 teeth (fig. 2).

Habitat.—Ceylon on *Piper nigrum* (?).

Since the foregoing descriptive notes were made we have received from Mr. Andrew Rutherford a slide marked "Peradeniya 9–8–13." This slide contains a pupa case which is no doubt *piperis*. It has the same knobbed setae, the same notched spines, and the same general characters. The caudal spines are, however, not longer than the others as described by Maskell, but are about the same length. The caudal setae are long, about two-thirds as long as the caudal spines. In the character of the notched spines this species is similar to *citriperdus*.

ALEUROCANTHUS SERRATUS, new species.

Plate 37, figs. 7–10.

This species occurs in two lots of material collected on an unknown tree in the Botanical Gardens, Buitenzorg, Java, by R. S. Woglum January, 1911.

Egg.—Length 0.192 mm.; width 0.15 mm.; form slightly oval; surface marked with hexagonal areas, the diameter of which is about 0.012 mm. This appears to be a network on the exterior of the egg, which may become detached from it. Stalk very long, 0.288 mm., attached evenly at the base of the egg; color light yellowish brown.

Larva.—One specimen of the larva is present, but it is in too poor condition to give any accurate details. It is 0.24 mm. long, pale yellowish, and armed with an uncertain number of long spines.

Pupa case (fig. 7).—Size 1.01 mm. by 0.72 mm.; color on leaf deep black, dark brown under the microscope; shape somewhat oval, with the margin slightly "angled" at several places, as shown in the figure. The abdomino-thoracic suture is distinct; the median dorsal area forms a slightly elevated ridge, and extending from the abdominal segments outward to the margin of the case a number of folds or ridges are noticed. The surface appears more or less unevenly pigmented, giving a granular or mottled appearance to the submarginal area. On the submarginal area, forming a ring around the case, is a row of about 20 spines, all of about the same length, averaging 0.128 mm. in length. In the cleared specimens these spines are of a deep brown color at the base and yellowish toward the tip, which is more or less jagged (fig. 10). Ten of the spines of this row are on the thoracic area and 10 on the abdominal area. On the thoracic region, more mesad than the row of spines just mentioned, are usually six pairs of very small spines forming a row down each side of the median ridge. On the abdomen there are three pairs of spines on the median ridge, two pairs of small ones close together on the cephalic extremity of the abdomen and one pair of rather large spines just anterior to the vasiform orifice. Other than these, there are five pairs of small spines situated on the subdorsal area as shown in the figure. The vasiform orifice (fig. 9) is elevated, forming the caudal extremity of the median ridge. It is somewhat circular in outline, flattened cephalad, and its anterior margin is irregular in outline. The operculum is somewhat similar in shape, though more rectangular, and almost completely fills the orifice, obscuring the lingula. The margin is dentate with the teeth very acute and regular, a space of 0.1 mm. being occupied by about 26 teeth (fig. 8). At the base of these teeth are a number of small, circular, clear pore-like areas, and arranged around the case a short distance from the margin is a series of tubercled setae. A pair of long, rather fine hair-like bristles is situated on the thoracic region near the median line, and a pair of setae is situated just cephalad of the vasiform orifice.

On the leaf the specimens are solid black and shining. There is little, if any, dorsal secretion, but the margin all around has a narrow, white, slightly flocculent waxy fringe. The cases occur very spar-

ingly over the leaf and in the material at hand are associated with a large number of coccids.

Adults.—Unknown.

Described from pupa cases and eggs in balsam mounts and pupa cases dry upon the foliage.

Type.—Cat. No. 19101, U.S.N.M.

ALEUROCANTHUS SPINIFERUS (Quaintance).

Plate 38, figs. 1–6.

Aleurodes spinifera QUAINTANCE, Can. Ent., vol. 35, 1903, p. 63.

Egg (fig. 2).—Exclusive of stalk, 0.2 mm. long by about 0.1 mm. wide; yellowish, curved, and marked with rather minute, closely set polygonal areas (fig. 3). Stalk quite short, holding egg in more or less upright position on leaf.

Larva.—Regularly elliptical, appearing brownish on leaf, varying to black, with evident, but short, cottony fringe of wax all around from marginal wax tubes; dorsum without secretion. Size probably in second stage, about 0.4 mm. by 0.3 mm. Margin distinctly crenulated all around; incisions between wax tubes short and acute. Abdominal segments quite distinct, thoracic less so. Dorsum set with very strong, heavy spines as follows: A row on each side about equidistant between the median longitudinal dorsal line and margin of case of seven spines each, or 14 in all. Eight of these occur on the abdomen and six on the thorax. More centrally on the thorax are six equally developed spines in pairs. Vasiform orifice, which is somewhat elevated on a subconical, truncated protuberance, subcircular in outline; operculum subcircular to subcordate, nearly filling orifice. Lingula short, nearly obsolete.

Pupa case (fig. 1).—As seen on leaf, with reflected light, jet black, considerably convex, the strong, dark spines plainly evident. Dorsum without secretion, but there is a compact, short, cottony fringe all around from marginal wax tubes. Size about 1.23 mm. long and 0.88 mm. wide; shape oval; dorsum considerably arched and median area prominent, especially at the vasiform orifice, which is situated on a prominent tubercle. On the submarginal area there is an even row of usually 20 spines (fig. 6) averaging 0.22 mm. in length and extending some distance beyond the margin. On the subdorsal area there is a row of similar but shorter spines, usually five pairs on the thorax and six pairs on the abdomen. On the median area there are three pairs of small spines on the thorax, three similar very small ones on the anterior part of the abdomen, and a moderately long pair a short distance cephalad of the vasiform orifice. The caudal margin of the case is armed with a pair of hairlike bristles and a pair of setae are situated near the cephalic

border of the vasiform orifice. The vasiform orifice (fig. 5) is very prominently elevated. It is subcordate, tending to circular, and is almost entirely filled by the operculum. The margin is dentate, the teeth being rounded at their tips with the interspaces acute. A space of 0.1 mm. is occupied by 12 teeth (fig. 4).

Adult.—Unknown.

Habitat.—Garolt, Java, on *Citrus* sp. and rose. Collected by C. L. Marlatt, Dec. 7, 1901.

Type.—Cat. No. 19102, U.S.N.M.

ALEUROCANTHUS SPINOSUS (Kuwana).

Plate 38, figs. 7–11.

Aleyrodes spinosus KUWANA, Pomona College Journal of Entomology, vol. 3, 1911, No. 4, p. 626.

Egg (fig. 7).—Eggs of this species were found amongst the paratype material in the United States National Museum. They are 0.192 mm. long and 0.08 mm. wide, oval, curved, and with the short stalk situated a short distance from the larger end. The surface is faintly reticulate, the reticulate areas being large, some of them measuring 0.012 mm. in diameter. The color is a light yellowish brown.

Larva.—The larvae are about 0.56 mm. long, yellowish, with brownish central area. The spines are situated in about the same position as those of the pupa, but they are proportionately longer, and often many of them are lacking.

Pupa case (fig. 8).—In general appearance this species resembles *calophylli*, though it can easily be distinguished from it by the position and number of spines and the dentition of the margin. Shape elliptic, broadest across the first or second abdominal segment; median ridge very evident on the abdomen and rather acute on the thorax. Size small, 0.88 by 0.64 mm. Color yellowish brown, darker mesad with sometimes a reddish tint. In the late pupa cases the eye spots are dark brown. Submarginal area unevenly pigmented and appearing granular. On the submarginal area there is a row of 20 spines, 10 on the thorax, and 10 on the abdomen. Those on the thorax are evenly distributed, forming a ring with 5 on each side. On the abdomen, however, this is not the case. Two of the pairs are situated near the margin on the first two abdominal segments. The other three pairs are situated more mesad and caudad, leaving a space between these and the first two, as shown in figure. Opposite the space and on the subdorsal area are two pairs of spines of the same size as the marginal ones. Cephalad of the first pair of these spines, on the subdorsal area, is a pair of smaller ones, and on the thorax there are eight pairs of minute spines, as shown in the figure. On the median abdominal ridge there are seven pairs of

spines forming two longitudinal rows. Of these the most caudal and the most cephalic pairs are longer than the others. Cephalad of the vasiform orifice there is a pair of small setae and on the caudal margin of the case a pair of rather long hair-like bristles are situated. The spines forming the submarginal ring (fig. 9) are fimbriate at their distal extremities. The margin of the case (fig. 10) is dentate, the teeth being rather evenly rounded and the interspaces acute. The teeth are rather small, a space of 0.1 mm. being occupied by about 26 teeth (fig. 10). Just within the margin all around there is a row of minute tubercled setae. The vasiform orifice (fig. 11) is subcircular in outline, with the lateral and caudal margins armed with a number of folds. The operculum is very similar in shape, but tends more to triangular. It almost entirely obscures the lingula, but as the operculum is somewhat transparent this may be seen below it. On the leaf the cases are black with almost no secretion of any kind, though a very small quantity of wax is sometimes seen about the margin.

The host of this species is unknown. It was found by Kuwana among Coccidae from Formosa in 1909.

Adult.—Unknown.

Paratypes.—Cat. No. 19105, U.S.N.M. Specimens in balsam mounts and on foliage.

ALEUROCANTHUS T-SIGNATUS (Maskell).

Plate 39, figs. 1–9.

Aleurodes T-signata MASKELL, Trans. N. Zeal. Inst., vol. 28, 1896, p. 443.

Egg.—No eggs of this species are present for study, excepting those found within the abdomen of the one adult female comprising the type. These are 0.23 mm. by 0.12 mm. No marking is observable on the surface, but this may be developed later. The eggs are oval tending to crescent shape, with the short stalk situated some distance from the larger end.

Early larva (fig. 5).—Length 0.352 mm.; width 0.24 mm.; color light brown with shading of a darker color; thorax armed with three pairs of rather stout, short spines and one pair of setae on the median cephalic dorsal area. Abdomen with four short, stout spines on each side of the subdorsal area. Vasiform orifice somewhat rounded and almost entirely filled with the operculum; margin minutely crenulate and armed with a pair of setae on the caudal extremity; eye spots wine colored.

Late larva (fig. 6).—Length 0.624 mm.; width 0.448 mm. Color brown, considerably darker than the early larva. Spines arranged as on the figure, 10 on the thorax and 8 pairs on the subdorsal area of the abdomen. Vasiform orifice similar to that of the earlier

larva, but narrower in proportion. Margin with prominent crenulations; the teeth rounded and approximate.

Pupa case (fig. 1).—Size 1.12 mm. by 0.768 mm.; shape oval, broadest across the second abdominal segment. There is a distinct median ridge, most pronounced upon the abdomen, and from this pass outward and caudad three narrow ridges which extend nearly to the margin. On the cephalic portion semicircular transparent "eye slits" are noticeable; color under the microscope rather dark brown. The submarginal area is unevenly pigmented, giving it a striated and more or less granular appearance. The dentate rim is slightly darker than the submarginal area. On the submarginal area of the thorax there are 10 spines forming an even row. These are short (fig. 4) and do not extend to the margin of the case. Just caudad of the thoracic suture on the submarginal area of the abdomen there is a pair of similar spines, but no others on this area. On the median ridge of the thorax there are four pairs of very minute spines and one on the median ridge on the first abdominal segment. On the subdorsal area of the abdomen there are six pairs of spines forming a row down each side near the median ridge. These are of about the same size as those forming the submarginal ring on the thorax. On each abdominal segment upon the median ridge there is a pair of small circular pore-like areas, indicating the position of setae in some of the related species. The vasiform orifice (fig. 2) is small and situated at the extremity of the median ridge. It is subcircular in outline and the caudal and lateral margins present numerous folds. The operculum is similar in shape, but comparatively broad. It fills only slightly over half of the orifice, but obscures the lingula. The margin (fig. 3) is dentate, the teeth being rather close together, making the interspaces very narrow. The extremities of the teeth are evenly rounded and at their bases all around the case there is a row of minute clear pore-like areas. A space of 0.1 mm. is occupied by about eight teeth.

Adult female.—Length from vertex to tip of abdomen 1.168 mm.; color yellowish, shaded on the head, thorax, genitalia, and appendages with dusky. Eyes dark brown; antennae broken from the type specimen; legs dark smoky, hind femur 0.208 mm., hind tibia 0.432 mm. Foot normal, with the paronychium rather broad and hairy. Ovipositor short and acute. Vasiform orifice (fig. 7) surrounded by a dark area, elliptic transverse, 0.045 mm., broad; operculum subcordate with the indentation caudad; lingula observable only near the operculum, the remaining portion having been obscured in making the mount.

Forewing (fig. 9) 1.28 mm. long and 0.49 mm. wide at its widest part. Radial sector rather prominent; cubitus distinct but fine. Wings transparent excepting for two transverse bands of a reddish color. The distal band is some distance from the extremity of the wing

and is broken where it crosses the radial sector. The proximal band consists of an irregular patch above the radial sector and a somewhat distinct T-shaped marking. The proximad portion of the cross of the T is much longer than the distal portion. The margin consists of a series of bead-like projections armed with hairs, of which one is longer than the other. The lower wing appears to be unmarked, though from the position of the mount it is difficult to determine.

This species was collected by Mr. Froggatt on *Acacia longifolia* from Botany, near Sydney, Australia.

Types in balsam mounts in the Maskel collection.

ALEUROCANTHUS WOGLUMI Ashby.

Aleurocanthus woglumi QUAINTANCE and BAKER, Journ. Agric. Research, vol. 6, 1916, p. 463, fig. 2.

A. woglumi is a very common species in the Orient and has recently been introduced into the West Indies and the Bahama Islands.

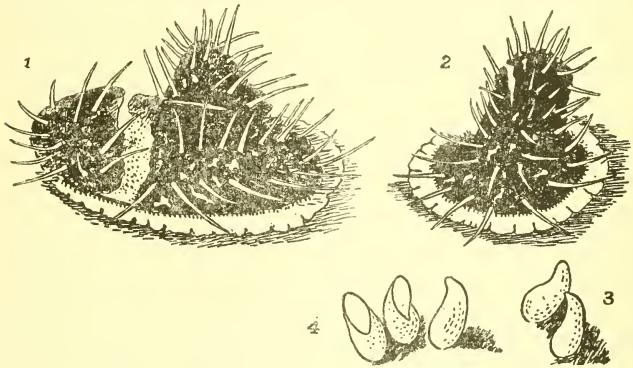


FIG. 3.—ALEUROCANTHUS VOELTZKOWI. 1, PUPA CASE; 2, PUPA CASE SHOWING DEVELOPMENT OF CENTRAL AREA; 3, EGGS; 4, EGGSHELLS SHOWING METHOD OF SPLITTING OF EGG IN HATCHING. (AFTER NEWSTEAD.)

ALEUROCANTHUS VOELTZKOWI (Newstead).

Figure 3.

Aleyrodes voeltzkowi NEWSTEAD, Quart. Journ. Liverpool Univ. Inst. Comm. Research in Tropics, vol. 3, 1908, No. 6, p. 12.

The description of *voeltzkowi* is very inadequate and we have no material of the species. It evidently, however, falls in this group.

Puparium [Fig. 3, *1*].—Ovate, black, shining, with numerous long spiniform hairs, arranged in a double row at the sides and in front, but are less regular and more numerous posteriorly. Dorsum with a large subcentral boss, thickly set with long spiniform hairs. Fringe white, broad, continuous basally, but irregularly divided at the edge. Length 1 mm.

Puparium of second stage female [fig. 3, *2*] black, shining, more or less circular, clothed with numerous long spiniform hairs, with the central spiny boss and fringe, as in the adult.

Ovum [fig. 3, *3*] yellow, pedunculate, curved, swollen basally, bluntly pointed, anteriorly, cuticle finely punctate. After the escape of the larva [fig. 3, *4*) it bears a marked resemblance to a univalve shell.

Habitat.—Sainte Marie, Madagascar, August, 1904. On an unnamed plant, the leaves of which were almost completely covered with the black puparia, larvae and eggs. Although so numerous, I failed to find a puparium which had not been ruptured by the escape of the imago. The boss-like process on the dorsum of the puparium is very remarkable, and serves at once to distinguish the species. In most instances it appears to be semidetached, so that in all probability it represents the larval exuviae, though I can not find that any previous author has discovered a similar trait in this family of the Homoptera. The test of the younger individuals are still more remarkable, in that they appear like little black spiny pillars, resembling, in form, some of the succulent Echinocacti.

This species is dedicated to its discoverer, Doctor Voeltzkow. (Newstead).

Genus ALEUROCYBOTUS Quaintance and Baker.

Aleurocybotus QUAINTANCE and BAKER, Tech. Ser. 27, pt. 2, Bur. Ent. U. S. Dept. Agr., 1914, p. 101.

Pupa case of medium size, very narrow and elongate; margin toothed, the wax tubes very poorly developed; submarginal area not separated from dorsal disk; dorsum without papillae or pores though there is present on each side of median area of abdomen a row of irregular pit-like structures; tracheal folds not discernible; secretion usually present as a short rim of wax, elevating case from leaf. Vasiform orifice subcordate, the lingula exposed caudad of operculum, usually included, but the tip sometimes exserted.

Adult with a single flexure in radial sector of forewing and no trace of media. Antennae of male with segment VII as long or longer than the other segments combined.

Type.—*Aleurocybotus graminicolus* (Quaintance).

KEY TO SPECIES OF ALEUROCYBOTUS.

1. Pupa case with a submarginal row of prominent vasiform spines..... *setiferus.*
2. Pupa case without such row of spines..... *graminicolus.*

ALEUROCYBOTUS GRAMINICOLUS (Quaintance).

Plate 40, fig. 1.

Aleurodes graminicola QUAINTANCE, Can. Ent., vol. 31, 1899, p. 89.

This species is considerably smaller than *setiferus*, from which it can be easily separated by the absence of the marginal vasiform spines.

The type is composed of eggs, larvae, pupa cases, and an adult male.

Type.—Cat. No. 1478, U.S.N.M.

ALEUROCYBOTUS SETIFERUS, new species.

Plate 40, fig. 2.

Specimens of this species have been received from two localities. The first lot was found on Imperata in Java by Edward Jacobson, 1907. The second lot was collected on a grass at Peradeniya, Ceylon, September 8, 1913, by A. Rutherford.

Pupa case.—Size 1.472 by 0.8 mm. Dorsum not arched and with the segmentation distinct; the pit-like structures forming a double row along median portion of abdomen distinct though not so prominent as in *graminicolus*. Vasiform orifice about 0.08 by 0.08 mm. and situated 0.16 mm. in from the caudal margin. Tip of lingula sometimes extending a short way beyond the vasiform orifice. Margin of case entire and just within it a row of about 32 vasiform spines situated on tubercles. Color of case yellowish with a median dark brown area, which sometimes spreads out so as to give the case a mottled appearance. Eyes showing through the case as purple spots. On the leaf there is scarcely any wax apparent, the pupa lying flat upon the surface.

Adults.—Unknown.

Described from pupa cases in balsam mounts and dry upon the leaves.

Type.—Cat. No. 20204 U.S.N.M.

Genus ALEUROLOBUS Quaintance and Baker.

Aleurolobus QUAINTANCE and BAKER, Tech. Ser. 27, pt. 2, Bur. Ent. U. S. Dept. Agr., 1914, p. 108.

Pupa case of medium size, subelliptic to oval in outline; color usually dark brown to blackish; margin toothed, the wax tubes only moderately developed; submarginal area separated from dorsal disk and much fluted by suture-like lines; dorsum without papillae, though minute pores may be present; tracheal folds evident in some species, though obscure or wanting in others; when present, terminating on margin of case in a few specialized teeth; vasiform eyespots usually present on cephalic portion of case; wax secretion usually present as a narrow fringe from marginal wax tubes and also

on dorsum. Vasiform orifice subcordate; operculum similar in shape, almost filling the orifice, obscuring the lingula; orifice surrounded by a definite trilobed figure, the lobes of which form a channel from the orifice caudad to margin of case.

Adult with a single flexure in radial sector of forewing and no spur of media; wings usually marked with reddish. Antennae of seven segments; in the female, III longest. In the male, VII often as long or longer than other segments together.

Type.—Aleurolobus marlatti (Quaintance).

KEY TO SPECIES OF ALEUROLOBUS.

1. Submarginal area of pupa case without prominent spines.....2.
   Submarginal area of pupa case with prominent spines.....*setigerus.*
2. Pupa case dark brown or black, more or less convex.....4.
   Pupa case whitish or yellowish, flat; thoracic tracheal folds distinct.....3.
3. Without waxy secretion; case broadly elliptical; size 1.28 by 0.97 mm.; marginal pore of tracheal fold armed with three prominent rounded tooth-like lobes. *flavus.*
   With sparse waxy secretion, a secretion of stout waxy filaments from marginal wax tubes spaced some distance apart, and finer and longer wax threads from submarginal pores. Size 1.86 by 1.52 mm.; marginal pore of tracheal fold armed with fine tooth-like lobes.....*simulus.*
4. Eyespots prominent.....5.
   Eyespots not present.....10.
5. Thoracic tracheal folds fairly distinct.....6.
   Thoracic tracheal folds not discernible.....7.
6. Pupa case elliptical; size about 1.35 by 1.1 mm.; a short fringe all around of glassy wax rods from marginal wax tubes, and whiter tufts of wax from pores of tracheal fold; a pear-shaped wax figure on dorsum of abdomen, from which run lines of wax along sutures to submarginal rim; marginal pores of tracheal folds on thorax armed with three rounded teeth.....*marlatti.*
   Pupa case subcircular in outline; female size 1.68 to 1.75 by 1.48 to 1.52 mm.; male smaller; a short, more or less broken fringe all around of white wax from marginal wax tubes, and two oblique transverse bands of tufted white wax on marginal part of cephalothorax and a narrow longitudinal line of white wax caudad of the operculum apparently marking position of the tracheal folds....*olivinus.*
7. Between submarginal area and dorsal disk, a band all around (narrowing at each end) of irregular dermal thickenings or markings.....8.
   Without such band between submarginal area and dorsal disk.....9.
8. Pupa case broadly oval; size about 1.1 by 0.88 mm.; a short squarely trimmed wax fringe all around from marginal wax tubes.....*taonabae.*
9. Pupa case elliptical; size about 1.08 by 0.78 mm.; dorsum completely covered with secretion of white wax; from marginal tubes there is a loose but abundant secretion of grayish wax threads, and a narrow, square cut rim all around of wax concolorous with wax on dorsum.....*philippinensis.*
   Pupa case very elongate elliptical; size about 2.25 by 1.15 mm.; dense black in color; margin bearing a fringe of rather long snowy white wax rods; dorsum sometimes dusted with white powdery meal.....*barodensis.*
10. Pupa case elliptical; size about 1.4 by 1 mm.; a fringe all around of glossy wax rods, compact basad and spreading distad; dorsum more or less covered with glossy wax scales or plates; tracheal pores on margin indicated by bilobed or trilobed structures.....*solitarius.*

ALEUROLOBUS BARODENSIS (Maskell).

Plate 41, figs. 1–11.

Aleurodes barodensis MASKELL, Trans. N. Zealand Inst., vol. 28, 1896, p. 424.
Aleyrodes barodensis COCKERELL, Proc. Acad. Nat. Sci. Phila., 1902, p. 281.
Aleurodes longicornis ZEHNTNER, Archief Java Suikerind., vol. 5, 1897, p. 381.
Aleurodes longicornis ZEHNTNER, Archief Java Suikerind., vol. 7, 1899, pt. 1, p. 445.

This species is represented in the Maskell collection by two slides—one of a pupa case and the other of a larva. The pupa case is not cleared and is of such a dense black color that it is difficult to make out any detail. The species no doubt, however, falls in this group. Also from a careful consideration of the description and figures of *longicornis* Zehntner, we believe this species to be identical with *barodensis* Maskell.

Larva (fig. 6).—Size 0.5 by 0.3 mm., elongate elliptical; dorsal disk not separated from the submarginal area, though there is a very narrow marginal region of a lighter color than the remainder of the case, which is brown. The margin is almost entire, but there are a large number of irregular indentations varying in depth. These, however, do not constitute a series of teeth. There is a pair of minute setae on the cephalo-lateral margin, and a seta is present on one side of the caudo-lateral margin (fig. 11). (There is none visible on the right side.) Scattered over the dorsum, as indicated, are a number of minute, circular, transparent, pore-like areas. These appear to be the seats of minute spines, but in the specimens at hand it is impossible to verify this excepting in a few cases.

The vasiform orifice (fig. 7) is subcordate in outline with the cephalic margin straight and the caudal extremity produced into a knob-like structure. The operculum is somewhat similar in shape to the orifice, but much shorter proportionately, and about half fills the orifice. The lingula, which is spatulate and setose, has its tip exposed caudad of the operculum. It is armed with two rather prominent spines. Two purplish eye spots are evident on the cephalic portion of case.

Pupa case (fig. 1).—Size 2.25 by 1.15 mm., very elongate elliptical, and by its shape and size easily distinguished from the other species of the group; color dense black, by transmitted light dark brown, with a lighter suture separating the dorsal disk from the submarginal area; vasiform orifice showing lighter than the remainder of the case and the eye spots almost transparent. Margin armed with a series of teeth (fig. 4) with shallow rounded incisions, from which suture-like markings extend mesad across the submarginal area. Vasiform orifice (fig. 3) subcordate, almost entirely filled by the operculum which obscures the lingula. The orifice is surrounded by a lobed area, and from its caudal extremity a furrow extends to the caudal

margin of the case (fig. 5). The distance from the caudal extremity of the orifice to the caudal margin is four and one-half times the length of the orifice. On the dorsum there are a number of minute clear circular spots, but from the condition of the specimen it is difficult to give the number or arrangement of these. The balsam mount still shows traces of a marginal wax fringe. Type in the Maskell collection.

Adult.—Unknown.

Habitat.—In India, on *Saccharum officinale*. The specimens were collected by the late Mr. Cotes, of the Indian Museum, Calcutta, from Baroda, who reported that they were rather damaging to the sugar cane in those parts.

ALEUROLOBUS FLAVUS, new species.

Plate 42, figs. 1–8.

This species was collected by R. S. Woglum on an unknown tree in the Royal Botanic Gardens, Ceylon, in October, 1910, and by A. Rutherford on *Loranthus*, Peradeniya, Ceylon, May 27, 1913. It is represented by pupa cases and eggs only.

Egg.—The egg (fig. 7) is 0.224 mm. long and 0.096 mm. wide. It is stalked at its larger end and slightly curved at the smaller end. It is yellowish brown in color and some specimens are covered with a waxy reticulation, which reticulations are 0.18 mm. in diameter. This apparently may be destroyed in preparing mounts.

Pupa case (fig. 1).—Size 1.28 by 0.976 mm.; form broadly elliptical; color light yellowish brown to almost transparent. There is no waxy secretion of any kind. Dorsal disk separated from the marginal area by a delicate line all around, just within which is a heavily chitinized wavy line (fig. 3); nearer the margin and within the submarginal area some specimens show a delicate line all around, but the presence of this is not constant. The body segments are distinct on the dorsal disk, and the median area of this disk is delineated from the lateral areas by wavy lines, as indicated in the figure. There are also upon the median area of the dorsum four longitudinal rows of minute pores and several others irregularly placed on the marginal portion of the dorsal disk. Three or four pairs of similar pores are also present on the thorax. The submarginal area is marked with a large number of irregular lines, extending mesad from the margin, which is crenulate (fig. 6). The thoracic breathing folds are quite distinct on the margin and terminate in three rather prominent rounded teeth (fig. 2). The vasiform orifice (fig. 4) is triangular, and longer than broad; its inner caudal margin is armed with a number of tooth-like projections. The operculum is similar in shape with, and almost entirely fills, the orifice. The lingula (fig. 5) is elongate, swollen toward the distal end, setose, and armed with two stout

spines. Its tip is scarcely visible caudad of the operculum. The orifice is surrounded by a differentiated lobed area, which forms a channel to the caudal margin of the case. This channel is longer, compared with the length of the orifice, than in the other species of the genus, and terminates in three rounded tooth-like projections (fig. 8). The margin of the case is armed with a caudal and a latero-caudal pair of setae.

Adult.—Unknown.

Type.—Cat. No. 19062, U.S.N.M.

ALEUROLOBUS MARLATTI (Quaintance).

Plate 43, figs. 1–16.

Aleurodes marlatti QUAINTANCE, Can. Ent., vol. 34, 1903, p. 61.

Larva, first instar (fig. 2).—Size 0.288 by 0.192 mm.; form elliptical; color yellowish brown. Margin armed with usually 16 pairs of hairs situated on small tubercles, and at each tubercle the case is marked mesad by a small fold or suture. Of the hairs present the first and third caudal pairs are the longest. On the caudal portion of the case there are seven pairs of hairs, these near the middle of the case, and the balance on the cephalic portion. On the dorsum the abdominal segments are fairly distinct. The purple eye spots are visible and there are two pairs of fine setae, one pair on cephalic portion of case, cephalad and mesad of the eye spots, and one pair cephalad of the vasiform orifice. The vasiform orifice itself (fig. 3) is somewhat triangular in shape with rounded corners; the operculum is broad and short, and nearly fills the cephalic half of the orifice. The lingula, which is visible below the operculum, is elongate, with the distal extremity slightly enlarged and setose.

Larva, second instar (fig. 4).—Size 0.416 by 0.32 mm.; shape elliptical, in some specimens regularly oval; color yellowish brown, with orange markings due to the internal structure. Margin (fig. 5) forming a narrow differentiated band which is divided into a number of irregularly sized somewhat rectangular lobes by sutures extending mesad. A pair of long caudal setae and a pair of minute latero-caudal setae are present. On the dorsum the sutures marking the abdominal segments are easily seen and there is a series of minute pores around the submarginal area. The eye spots are dark brown to black. The vasiform orifice (fig. 6) is triangular and the operculum fills about two-thirds of the orifice. The lingula (fig. 7) is almost entirely obscured by the operculum, but when this is removed it is seen to be elongate, with a slightly swollen, setose distal extremity, which is pointed and armed with two prominent spines. The operculum is darker than the rest of the case.

Larva, third instar (fig. 8).—Size 0.656 by 0.544 mm.; outline elliptical, tending to oval; color rather dark brown, with eye spots almost black.

The entire dorsum has a fine irregular mottled appearance due possibly to differences in chitinization. There is a small dorsal median ridge and the abdominal sutures are distinct. Just laterad of the median ridge on each side of the caudal edge of each suture there is a small area of a lighter brown than that surrounding it. There is also on the submarginal area a series of minute transparent pores, the location of which may be seen in the figure. On the median portion of the case several of these pores are present. The margin (fig. 9) is plainly marked off into a series of toothlike sections by sutures extending mesad. These sutures extend farther than those of the second instar, and the divisions are more prominent. Vasiform orifice (fig. 10) triangular; operculum of a similar shape and almost entirely filling the orifice, leaving only the setose tip of the lingula exposed. The differentiated area surrounding the orifice and forming the caudal channel, so distinct in the pupa case, is visible also in this instar, though is not so marked. There is a pair of caudal setae and a smaller pair of latero-caudal ones.

Pupa case (fig. 11).—Size averaging about 1.35 by 1.1 mm.; outline elliptical; color by transmitted light almost black on the dorsum, which is surrounded by a fine yellowish brown line separating this from the brown marginal rim. Eye spots crescent shaped, transparent; structure surrounding the vasiform orifice and extending to the caudal margin almost black, while the channel it forms is light brown. On the dorsum the sutures are distinct and there are scattered over the case a number of very minute transparent pores, the relative positions of which are indicated in the figure. Marginal rim broad and separated from the dorsum by a distinct light line. Marginal rim (fig. 13) marked by a large number of light transparent sutures extending mesad from the margin. The sections marked off by these sutures form by their outer extremities the rounded teeth of the margin. There are on this marginal rim a few scattered very minute transparent pores similar to those on the dorsal area. The vasiform orifice (fig. 12) is triangular, somewhat acute caudad, and the operculum is very much the same shape, nearly filling it. The lower caudal membrane of the orifice is sculptured or folded irregularly. Near the latero-cephalic margin of the orifice a pair of setae is situated, and surrounding the orifice and extending caudad to the margin of the case there is a distinct area, the outline of which is indicated in the figure. This is dark brown, leaving a median, yellowish brown caudal channel. On the cephalic portion of this structure there are three pairs of minute transparent porelike places. The waxen secretion is fully described in the original characterization.

Adult female.—Color yellowish shaded with brownish black. Length about 0.83 mm. Antennae absent in all but one specimen, and on this only distorted portions of one antenna remain. Fore-

wing (fig. 15) about 1.2 by 0.56 mm.; radial sector thick and extending almost to the tip of the wing; cubitus faint but rather long and straight. Wings marked with rusty red as indicated in the figure. In some cases the spots may almost unite to form two irregular transverse bands. Hind wing without marks, but with more or less shading along the rather thick vein. Hind legs with the femora and the proximal portion of the tibiae dusky, the remainder yellowish; tibiae 0.416 mm. long, armed with very stout spines; tarsus, proximal segment 0.096 mm., armed with a few stout spines; distal segment 0.072 mm., covered, especially on the distal portion, with many minute setae, and with a few spines. Claws 0.012 mm.; paronychium long, acute, and curved.

Adult male.—Similar to the female; length from vertex to tip of claspers about 0.79 mm.; antennae absent in the specimen at hand; legs also absent, all except the femora and tibiae of the hind legs. Those are colored as in the female, the former measuring 0.18 mm. and the latter 0.32 mm. Forewing about 0.928 mm. long, marked as in the female; hind wing 0.8 mm. long, unmarked. Claspers (fig. 16) brown in color excepting the tips, which are yellowish, 0.135 mm. long, upcurved and armed with a few small spines. Penis yellow, as long as the claspers, bulbous at the base and considerably curved upward.

Material studied, types and paratypes, and material collected by S. I. Kuwana in Japan at Fukuoka, 1907.

Type.—Cat. No. 19063, U.S.N.M.

The food plant is orange. Material was collected by C. L. Marlatt, Hokato, Japan, May 21, 1901. This same species was also taken by Mr. Marlatt at Kumomoto, Japan, May 17, 1901.

ALEUROLOBUS OLIVINUS (Silvestri).

Aleurodes olivinus SILVESTRI, Boll. Lab. Zool. Gen. Agr. della R. Scuola Superiore d' Agricoltura in Portici, vol. 5, 1911, p. 214.

We have seen no examples of this species, but the excellent description and figures given by Doctor Silvestri enable us to place it in this genus with considerable assurance. It is reported by Prof. Silvestri as occurring in central and southern Italy. The host is olive. A translation of the original description is given.

Adult female (fig. 4).—Body cream-colored or whitish ocher sprinkled with a white waxy powder, with a fulvous band upon the pronotum, two submedian bands of the same color upon the mesonotum, and two lateral bands upon the metanotum. The abdomen has upon its first tergite two submedian fulvous spots, from the third to the fifth tergite a median transverse band a little in front of the margin, and upon the sixth tergite another fulvous median spot. The fifth urosternite is almost wholly blackish. The wings are sprinkled with a white waxy powder slightly tending toward a cine-

reous tint and the forewings have fulvous spots disposed in the manner shown in figure 4, and in figure 6, No. 1. Length of body, not including the wings, from 1.60 to 1.70 mm.; with the wings from 2 to 2.10 mm. Width of the thorax 0.58 mm. Length of the abdomen 0.97 mm. and its width 0.74 mm. Length of the antennae 0.71 mm. Length of the forewing 2 mm. and its width 0.93 mm. Length of the hind wing 1.49 mm. and its width 0.71 mm. Length of the legs of the third pair 1.35 mm.

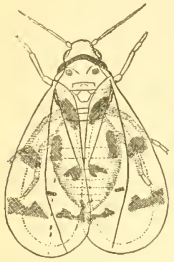


FIG. 4.—ALEUROLOBUS OLIVINUS. ADULT. (AFTER SILVESTRI.)

The head (fig. 5) is about as long (measured along the posterior margin) as it is wide. The compound eyes are well developed, and they are divided as they are in other species into an upper and a lower part. The ocelli are in contact with the upper margin of the compound eyes. The antennae (fig. 6, No. 14) consist of 7 joints, the first of these being very short, the second subcylindrical, twice as long as wide, the third much thinner than the second and a little more than three times as long as the second joint. In its distal part the third joint is furnished with four sensory organs, one represented by a somewhat thick and elongated bristle; the three others, on the other hand, by a groove with a short subconical process.

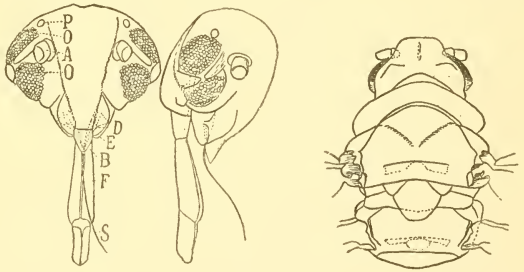


FIG. 5.—ALEUROLOBUS OLIVINUS. 1, HEAD OF ADULT, FRONT VIEW; 2, HEAD OF ADULT, LATERAL VIEW; 3, THORAX OF ADULT, DORSAL VIEW. (AFTER SILVESTRI.)

The fourth joint is short, much shorter than all the others and even than the second. The fifth joint is longer than the second and is provided with a sensory pit toward its distal part. The sixth is longer than the fifth, and the seventh about twice as long as the sixth. The seventh joint has a thickish and rather long bristle near its central portion and a slender apical bristle.

The ratio of length between one joint and the other of the antennae may vary somewhat in different specimens.

The upper labrum (fig. 5, Nos. 1 and 2) terminates in an acute and robust point. The rostrum extends with its extremity as far as the base of the third pair of legs; it has three joints, the second joint longer than the third and somewhat enlarged toward the apex. The third is narrowed at the apex and has the shape of a nipple.

The wings have the simple and straight venation characteristic of this genus, as can be seen in figure 6, Nos. 1 and 2. Their margin

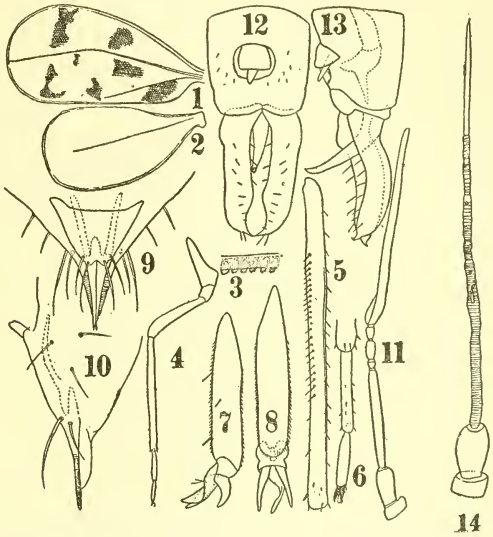


FIG. 6.—ALEUROLOBUS OLIVINUS. 1 AND 2, ANTERIOR AND POSTERIOR WINGS; 3, PORTION OF MARGIN OF ANTERIOR WING; 4, THIRD LEG OF ADULT; 5, TIBIA; 6, TARSUS; 7 AND 8, TWO VIEWS OF LAST SEGMENT OF TARSUS, MUCH ENLARGED; 9, OVIPOSITOR OF FEMALE, DORSAL VIEW; 10, LATERAL VALVE OF OVIPOSITOR OF FEMALE; 11, ANTENNA OF ADULT MALE; 12 AND 13, POSTERIOR SEGMENT AND GENITALIA OF ADULT MALE, DORSAL AND LATERAL VIEW; 14, ANTENNA OF ADULT FEMALE. (AFTER SILVESTRI.)

(fig. 6, No. 3) is finely crenulate and furnished with very short and very slender cilia.

The legs (fig. 6, Nos. 4 to 8) are rather long, the tibiae longer than the femora, cylindrical, furnished with a row of very short bristles along the inner upper margin and with six short bristles at the apex, two of which are superior, two internally lateral, one external, and one inferior. The tarsus is cylindrical, with its first joint longer than the second. The pretarsus is composed of two lateral claws and of one median appendix as long as the claws. This appendix is a little wider than the claws and not straight, but in the middle more or less curved in the shape of an arc.

The abdomen is somewhat longer than wide and oval in shape. The anal operculum (fig. 6, No. 12) is somewhat wider than long and its posterior margin is slightly sinuous. The lingula gradually increases in size toward the posterior part and terminates with a rounded margin.

The ovipositor (fig. 6, No. 9) is well developed and its two superior processes are a little longer than the inferior and lateral ones and are greatly attenuated. The lateral processes (fig. 6, No. 10) are finely crenulate.

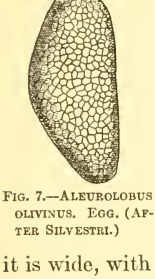


FIG. 7.—ALEUROLOBUS OLIVINUS. EGG. (AFTER SILVESTRI.)

Male.—Length of the body, including the wings, 1.49 mm.; without the wings, 1.30 mm. Length of the antennae 0.78 mm.

The antennae (fig. 6, No. 11) have their fourth joint very short; the fifth is a little thicker than and about twice as long as the fourth. The seventh joint is about twice as long as the second.

The last two segments of the abdomen are much narrower than the preceding segments, and the last segment (fig. 6, Nos. 12 and 13) is about as long as it is wide, with an operculum the width of which somewhat exceeds its length, and the "lingula" somewhat longer than the operculum.

The two posterior appendages are about one-third longer than the last segment, with an attenuated apex turned inward. The penis is shorter than the lateral appendages, gradually tapering and curved upward.

Egg.—The egg (fig. 7) is of subelliptical shape, with its free pole more attenuated than the opposite one. One side (the ventral one) is nearly straight; the other is more or less convex. It is furnished at the pole that is less attenuated with a short and thin peduncle by means of which it is fastened upon the leaf. Immediately after its deposition it is of a pale-straw color; subsequently it turns brown. Its entire surface is reticulated. Its length is from 0.247 to 0.253 mm. and its width from 0.117 to 0.123 mm.

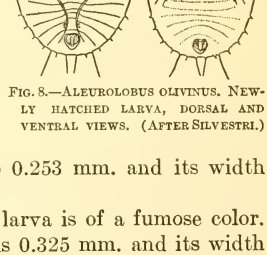


FIG. 8.—ALEUROLOBUS OLIVINUS. NEWLY HATCHED LARVA, DORSAL AND VENTRAL VIEWS. (AFTER SILVESTRI.)

Larva, first stage.—The newly hatched larva is of a fumose color. It is not covered with wax. Its length is 0.325 mm. and its width 0.234 mm. The length of the antennae is 0.074 mm. and that of the legs 0.061 mm.

Its body (fig. 8) is greatly depressed and its contour is more or less elliptical, being slightly narrower at the front than at the back.

The dorsum is provided with four long sublateral bristles, two of which are situated upon the posterior part of the head and the other two upon the second abdominal segment. The margin of the body is very finely crenulate and is provided with 16 bristles on each side and arranged as can be seen in figure 8. In the anterior submarginal part at the side of the first bristle there exists another bristle a little shorter than the adjoining one. The operculum is a little wider than it is long, and a little shorter than the lingula.

The antennae (fig. 9, No. 1) are composed of the three joints, the first of which is short and the second a little longer; the third is thin and about five or six times as long as the second, and ends in a short bristle which might also be considered as a rudimentary fourth joint. The third joint is also provided near the apex with a small external spur to the angle upon which there is attached a very short bristle. Corresponding to this part of the antennae we have not been able to distinguish a division, in contradistinction to that observed by Tullberg [1] and by Trägärdh [2] in the larvae of other Aleurodes.

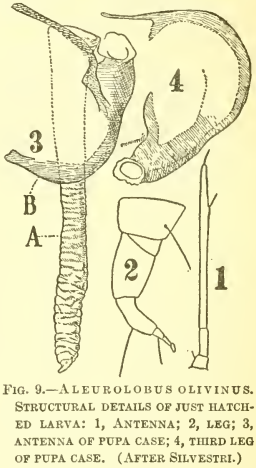


FIG. 9.—ALEUROLOBUS OLIVINUS. STRUCTURAL DETAILS OF JUST HATCHED LARVA: 1, ANTENNA; 2, LEG; 3, ANTENNA OF PUPA CASE; 4, THIRD LEG OF PUPA CASE. (AFTER SILVESTRI.)

The legs (fig. 9, No. 2) are short, scarcely reaching, if spread out, the margin of the body, with all the joints distinct. The tibia carries on its superior surface a little short of the apex a bristle which somewhat exceeds the combined length of both tibia and tarsus. The tarsus consists of one joint only, and it has always seemed to be more or less distinct from the tibia, and much shorter than the latter. The tarsus is provided with an external apical bristle which is longer than the tarsus itself. The pretarsus is short, slender, and widened at the extremity.

The larva of the first stage after it has attached itself begins to secrete white wax all along the margin of its body (fig. 10, No. 1), around the dorsal bristles, and in the space between the anterior dorsal bristles.

Around the body the marginal wax forms a fringe having a width of 0.042 mm. around the dorsal bristles; internally it forms a kind of sheath, and between the dorsal bristles a kind of small plate ("laminnetta").

Larvae of the second and third stages.—These two larvae when they have scarcely emerged from the skins respectively of the first and

[1] Arkiv for Zoologi, vol. 3, 1907, No. 26.
[2] Zeitschr. Wiss. Insectenbiologie, vol. 4, 1908, pp. 296-297.

second stages are first white, then chestnut-color, then azure black, and finally black.

The second-stage larva (fig. 10, No. 2) measures in length from 0.48 to 0.57 mm. and in width from 0.39 to 0.45 mm., and in the shape of its body comprising that of the legs is similar to the fourth stage of the larva which is described below. Around the margin of its body it has a fringe of wax formed of slender ribbon-like points whose length is 0.084 mm. and whose width is 0.009 mm. These at their apex are less separated from one another, while at the proximal part each of them is in contact with the one preceding and with the one following. The larva of the second stage differs from that of the

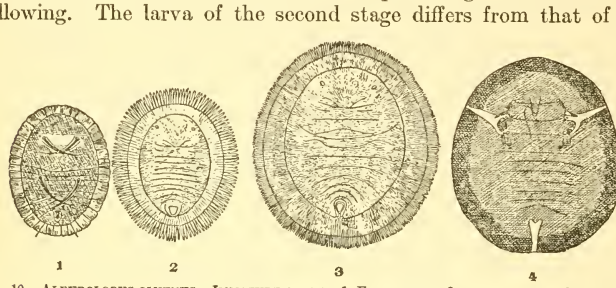


FIG. 10.—ALEUROLOBUS OLIVINUS. IMMATURE STAGES: 1, FIRST STAGE; 2, SECOND STAGE; 3, PUPA CASE; 4, VENTRAL VIEW OF PUPA CASE. (AFTER SILVESTRI.)

first stage in color, in size, in the form of the antennae and of the legs, and by the absence of the four dorsal bristles.

The larva of the third stage is similar to that of the second and of the fourth, and presents the following dimensions: Length from 0.75 to 0.93 mm., width from 0.67 to 0.81 mm.

Larva, fourth stage.—(fig. 10, No. 3.) The body is greatly depressed, almost laminate. Its length somewhat exceeds its width. The dorsum is black, provided with two tufted oblique transverse lines formed of white wax upon the marginal part of the cephalothorax some distance behind the level of the compound eyes and one narrow longitudinal line also consisting of white wax upon the median posterior part of the body behind the operculum. Around the margin there is found a fringe of wax like that found on the larvae of the second and third stages; but in this larva of the fourth stage this fringe is more or less broken up, and during the winter for the most part is lost entirely.

The color of the venter (fig. 10, No. 4) is dark green in the central portion and black in the marginal portion, with a narrow lateral waxy area at a level with the base of the second pair of legs. This area close to this same pair of legs bifurcates and its branches join the two stigmata. Another area composed of wax exists in the posterior part of the body. Length of the female from 1.68 to 1.75 mm.;

of the male from 1.20 to 1.35 mm. The width of the female varies from 1.48 to 1.52 mm. and of the male from 1.04 to 1.18 mm. Length of the antennae 0.325 mm.; of the legs 0.143 mm.

The upper part of the body is divided by a furrow into a marginal zone and a central zone. The former shows no trace of division into segments and is a little more than a third as wide as one-half of the width of the whole body. It is variously striated in the proximal part, transversely striated in the distal part, and its margin is minutely lobed, each lobe corresponding to the mouth of the wax-producing gland across which issues a marginal thread of wax. This zone, examined under a high magnifying power, shows also a circular row of small and very short cilia near the base and some small pores which are quite sparse.

The central zone is variously rugose; it shows distinctly the segmental impressions which can be seen accurately reproduced in figure 10, No. 3.

The compound eyes are dorsal; they are situated some distance behind the anterior margin of the body and are represented on the surface each by a cornea.

The antennae (fig. 9, No. 3 A) are entirely ventral, inserted at the side of the beak, scarcely in front of the first pair of legs. They are directly under the same in the rear and join a little on the outside at the level of the posterior margin of the base of the second pair of legs. They appear to be formed of a single joint (at least none can be seen distinctly); they are a little attenuated from the base to the apex and quite irregularly annulated. The apex terminates in a point a little curved, almost unguiform.

The legs (fig. 9, Nos. 3 and 4) are very short, formed of a long and rather wide base which is prolonged into a short subtriangular appendix, truncate at the extremity and provided with a concave membranous disk which constitutes a kind of pulvillus. The anterior legs are distinctly in front, the middle and the hind legs are in the rear.

The operculum is subtriangular; at its base it is a little longer than it is wide, with the apex slightly rounded and covering the whole of the lingula.

ALEUROLOBUS PHILIPPINENSIS, new species.

Plate 44, figs. 1–20.

This species has been received from Manila, Philippine Islands, on several occasions; i. e., June 3, 1904, on cultivated shade tree from Prof. C. H. Tyler Townsend; July 4, 1905, another lot, presumably of this same material, was received from Prof. T. D. A. Cockerell, who suggested that this was the first aleyrodid recorded from the Philippines. In May, 1910, we received from Mr. George Compere

an abundant sending of this species taken at Manila on an unknown tree, and finally the same insect was received June 21, 1912, from D. B. Mackie, Manila, Philippine Islands, on *Murraya exotica*. The type lot is that forwarded by Mr. Compere.

Egg.—Size 0.165 by 0.096 mm.; color yellowish; without reticulations, stalk attached at larger end (fig. 1).

Larva, first instar (fig. 2).—Size 0.165 by 0.258 mm.; shape elliptical; color, by transmitted light, light brown. Margin with usually 17 pairs of fine hairs situated on tubercles, of which the first and third caudal pairs, as well as the third cephalic pair, are longer than the others. Dorsal area with three pairs of stout short spines: One pair near the cephalic extremity between the eye spots, one pair at about the middle of the case and one pair cephalad of the vasiform orifice. Vasiform orifice (fig. 3) broad, triangular, with the anterior margin straight; operculum not half the length of the orifice, leaving the setose lingula exposed; size of orifice 0.027 by 0.024 mm. Antennae (fig. 20) composed apparently of four segments, the proximal irregular and large. The others narrow, cylindric, with the distal one very acute and placed at an angle from the others.

Larva, second instar (fig. 4).—Size 0.357 by 0.27 mm.; shape elliptical; color by transmitted light brown; margin with a series of about 15 pairs of spines, which are thick, short, and spear shaped (fig. 8). The caudal margin has a pair of rather long spine-like hairs The margin itself (fig. 7) is all around divided into a number of areas by irregular divisions extending a slight distance mesad; dorsal area with three pairs of spines similar to those present in the first instar, and also with a series of minute subdorsal pores, as well as a few other scattered ones. The area around vasiform orifice slightly indicated in this instar. Orifice itself (fig. 5) somewhat triangular, measuring 0.065 by 0.039 mm. Operculum similar in shape and extending a little over two-thirds the distance to the caudal extremity of the orifice. The inner membrane of the orifice below the operculum and lingula appears sculptured, with reticulate, circular, or irregular markings. Lingula (fig. 6) narrow; not swollen at the tip, part of which is seen below the operculum and which is setose and armed with a pair of rather long spine-like hairs.

Pupa case (fig. 9).—Size 1.088 by 0.788 mm.; shape elliptical; color very dark brown by transmitted light, with the sutures separating the abdominal segments and a line marking off the marginal fluted area lighter. Eye spots transparent, with their broadest part caudad. Dorsum of case completely covered with layer of wax, though the body segments are evident. From the submarginal area arises a short square-trimmed fringe of wax of same color as on dorsum, which extends out over margin of case. From marginal wax tubes arises a rather light fringe all around of grayish wax fila-

ments. Dorsum covered with a large number of very minute pores, which show as transparent dots. There is a pair of setae on the second abdominal segment and a pair cephalolaterad of the vasiform orifice. Some of the pore-like spots on the other part of the dorsum may also be the seats of minute setae, but if so we are unable to observe them owing to the dark coloration of the case. The vasiform orifice (fig. 10) is triangular in outline, with the cephalic margin almost straight; the operculum is similar in shape and almost entirely fills the orifice, obscuring all but the tip of the lingula. This last is setose and armed with two spines. The caudal inner membrane of the orifice is sculptured, and this sculpturing is visible below the lingula; surrounding the vasiform orifice is a differentiated area consisting of a rounded portion directly cephalad of the orifice, from which two arms extend caudad, one on each side of the orifice, forming a caudal channel (fig. 10). The legs (fig. 11) are distinctly visible on the under surface of the case. Each is short, thick, and armed with a pad-like structure on the distal extremity. The antennae (fig. 13) are subcylindric, composed apparently of three segments, imbricated, and armed on the distal extremity with a narrow finger-like process, and a distal spine. The margin of case (fig. 12) bears a series of fairly even crenulations. These are not prominent, and the submarginal area is marked by a series of lines extending mesad, which gives it somewhat of a fluted appearance. On each of these sections a light spot may be observed near the margin, which spot seems to be the opening of a pore beneath. Scattered over the submarginal area there are a number of minute transparent spots similar to those on the dorsal area and on some of these small setae are located; on others, however, we are unable to find any.

Adult female.—Length from vertex to tip of ovipositor about 0.960 mm.; color yellowish, shaded with dusky. Eyes dark brown, constricted in the middle. Antennae (fig. 19) of seven segments; II subpyriform, 0.045 mm. long, and usually armed with three stout spines; III subcylindric, 0.114 mm. long, imbricated, and armed with a few faint transverse sensoria, and near the distal extremity there is a circular fringed sensorium with a central process; IV subcylindric, 0.024 mm. long; V similar, 0.033 mm. long; VI similar, 0.036 mm. long; VII subcylindric, tapering distally, armed at about the distal third with a number of minute circular fringed sensoria, and the distal extremity tipped with a spine. Forewing (fig. 15) about 0.95 by 0.38 mm.: radial sector curved, cubitus long, and fairly distinct; wings marked with rusty red, which forms two broken transverse bands, a distal spot over the tip of the radial sector, and a broken proximal one over the cubitus; margin beaded and bearing hairs. Hind wing with only one faint red spot in about the middle, below the vein. Vasiform orifice (fig. 16) broadly cordate, with the cephalic margin

straight; the operculum is rectangular, transverse, about half filling the orifice; lingula elongate, rounded, and slightly swollen at the tip; both operculum and lingula setose.

Adult male.—Length from vertex to tip of genitalia about 0.95 mm.; color similar to that of the female. Antennae (fig. 18) of seven segments. In the specimens at hand these segments are difficult to discover, but in all of them VII seems to be extremely long, much longer than that of the female. Segment II subpyriform, 0.045 mm. long and armed with prominent spines; III subcylindric, 0.084 mm. long, imbricated and armed with several faint, transverse sensoria and a distal fringed sensorium with a central process. Segments IV, V, and VI each about 0.012 mm. long, almost globose on account of their shortness. Segment VII tapering distally, 0.18 mm. long, armed with a number of minute transverse sensoria, and tipped with a spine. Forewing with markings similar to those of the female, length about 0.89 mm., width about 0.37 mm.; hind wing about 0.72 mm. long, with a red spot similar to that of the female. Hind tibiae 0.24 mm. long; hind tarsus, proximal segment 0.066 mm., distal 0.06 mm. Foot (fig. 17) with an acute central paronychium, which is armed near its basal portion with a rather prominent spine. Claspers (fig. 14) 0.12 mm. long and 0.066 mm. broad at the base, tapering, with distinctly curved tips and each armed on its inner margin with a few spines; penis bulbous at the base, not as long as the claspers, and upcurved.

Described from pupa cases on leaves, and other stages in balsam mounts.

Type.—Cat. No. 19061, U.S.N.M.

ALEUROLOBUS SETIGERUS, new species.

Plate 45, figs. 1–6.

Three collections made by Mr. A. Rutherford at Peradeniya, Ceylon, represent this species. The first was taken on *Harpullia pendula*, July 7, 1913, the second on an unknown host, July 25, 1913, and the third on *Harpullia*, September 7, 1913. The species is easily separated from all others in the genus by the row of prominent spines on the submarginal area of the pupa case.

Pupa case (fig. 1).—Size, 1.2 by 0.96 mm.; shape broadly elliptical, in this respect resembling *taonabae;* color black, under the microscope dark brown, with the suture separating the dorsal disk and submarginal area, the eyespots, and the bases of the spines transparent yellowish. Dorsum with the abdominal segments distinctly marked and with a broad rachis-structure on the median area quite similar to that found in *solitarius*. The dorsal disk is armed with four pairs of rather long spines, three of which pairs are on the thorax and one pair on the abdomen. The submarginal area (fig. 3)

is broad and marked with a series of suture-like lines extending mesad, which lines are puckered about the base of each spine. These spines are prominent, extending beyond the margin of the case, are yellow in color, and are situated in the middle of the submarginal area, forming a row on each side of usually eight spines. Just within the margin the submarginal area shows a band composed of minute, closely placed, pore-like structures, and mesad of these there is a series of larger paired pores (fig. 6). The vasiform orifice (fig. 2) is usual for the genus, but it and the operculum are quite acute caudad. The arms of the trilobed area extending caudad from the orifice are relatively short and are swollen near the caudal margin of the case to include a pore-like structure on each side. The central tooth of the caudal pore is a distinct piece and appears as if mosaic. The channel leading from the pore to the caudal portion of the orifice is corrugated. The thoracic pore (fig. 4) ends in a trilobed structure, suggesting that of *solitarius*. It is not, however, so distinctly separated from the submarginal area. The margin (fig. 3) is armed with very flattened divisions which can scarcely be called teeth.

Adult.—Unknown.

Described from pupa cases in balsam mounts.

Type.—Cat. No. 19128, U.S.N.M.

ALEUROLOBUS SIMULUS (Peal).

Plate 46, figs. 1–14.

Aleurodes simula PEAL, Journ. Asiatic Soc. Bengal, vol. 72, pt. 2, 1903, No. 3, p. 81.

We have not seen this species and it is with some hesitation that we include it here. From the description and figures it seems to be fairly closely related to *flavus* which undoubtedly falls within this group. It should be noted, however, that the wing as given for *simulus* is unmarked, a condition not met with in any of the other species of this genus of which the adults are known, and the antenna of the male is nearly twice as long as that of the female.

Egg.—Size, 0.2 mm. by 0.09 mm. Color, light yellow when first laid, afterwards turning brown. Peduncle about one-fourth length of egg. Examined while still within the body of the female the eggs are light yellow. The peduncle is curved inwards and pressed against the egg. Color of peduncle pink; basal end of egg fairly dark yellow.

Larva first stage.—Size, 0.25 mm. by 0.15 mm.

Shape elliptical. Color, semitransparent yellow; two yellow pigment patches in center of abdominal region. There are a series of 34 long hairs right around margin. The four hairs furthest cephalad are grouped in two pairs placed some distance apart. Of the six

hairs on caudal margin the inner pair long, the second pair short, and the third pair long. The 24 other setae are shorter than the long caudal setae; they are situated at equal distances apart on the lateral margins. Vasiform orifice as in the pupa case, but the operculum is larger proportionately, and the lateral margins of the orifice are somewhat incurved posteriorly beyond the operculum. Eyes maroon. Abdominal segments distinct. Antennae and legs present. The artist has drawn the vasiform orifice as seen by him through the transparent body.

Larva second stage.—Size, 0.45 mm. by 0.32 mm.

Shape, elliptical; color, yellow. Two yellow pigment patches in center of abdominal region. Two curved hairs caudad on margin. Vasiform orifice as in the pupa case, but the orifice is situated quite close to the margin. Abdominal segments distinct. Eyes maroon. A marginal fringe of stout, cylindrical, waxy filaments which are placed quite close together.

Larva third stage.—Size, 0.7 mm. by 0.5 mm.

Shape elliptical; margin at thorax angled slightly outwards. Dorsum almost flat. Color yellow. Two setae caudad, and two setae placed caudolaterally on margin. A marginal fringe of stout, cylindrical wax filaments. Eyes maroon. Abdominal segments distinct. Dorsum granular near margin. Margin broad, faintly demarcated mesad, and deeply striated radially. There is a distinct yellow band extending from the posterior extremity of the vasiform orifice caudad to margin. There are faint indications of the two radial thoracic bands so conspicuous in the pupa. They end, as also does the band extending caudad to margin, in five separate brown horizontal pores which secrete a small quantity of brown wax. Dorsum covered with a large number of extremely minute circular pores.

Larva fourth stage.—Size, 1.25 mm. by 1 mm.

Similar to pupa case except in size; it is also flatter.

Puparium.—Size, 1.86 mm. by 1.52 mm.

Shape oval; anteriorly the thoracic margins angled outwards, giving the anterior end a somewhat square appearance. Color bright yellow. Dorsum at first somewhat flat, later turning fairly convex. Three ridges on dorsum, two radiating from thorax to cephalothoracic margins, and one from the posterior end of the vasiform orifice caudad to margin. These ridges are dark yellow, blotched with gray. They end marginally in five stout, distinct, brown pores, which produce a small quantity of brown fluffy wax. Margin broad, demarcated mesad by a fairly broad distinct white band, the inner edge of which is dark brown. Margin with strongly marked radial striations, the dorsum also marked around the central area, but the markings are more granular than striated. A small quantity of

short, stout, waxy filaments, produced from marginal pores, spaced some distance apart. There are also a series of submarginal pores, which produce finer and longer wax filaments. They are also spaced some distance apart. There are two small slender setae on cephalic, and two similar but smaller setae on lateral margins. The surface of dorsum and especially of the margin covered with a very great number of extremely minute circular pores, which tend to form detached groups. These pores are also present over the radial patches, but the grouping does not differ from the rest of the margin, the pores not being arranged in any sort of pattern.

The margin of the pupa case turns quite white a short time before the adult emerges. Vasiform orifice conical, apex pointing caudad. Anterior margin flat. Lateral margins sloping inwards; the sloping surface with six ridges on each side. Operculum rhomboidal; the posterior margin somewhat incurved. The operculum extends to about or a little beyond the center of the vasiform orifice. Surface setose, color light brown. Lingula two-jointed, lower joint short, stout. Upper joint club-shaped. The lingula extends for one-third its length beyond operculum; the surface setose, color brown. Two long hairs spring from near the tip of the lingula and extend for some distance beyond the vasiform orifice.

Pupa extracted from puparium.

Head fairly broad, color yellow; the ocelli lighter in color. Thorax rather dark yellow, abdomen light yellow. Eyes dark maroon. Unfolded wings dark gray. Legs almost transparent, well formed, setose. Sides of abdomen flattened and spread out. Abdominal segments fairly distinct, but the vasiform orifice can not be made out. Antennae not noticeable in the specimen examined. When the adult emerges from the pupa case the dorsum splits up not only from the cephalic margin to thorax and across the thorax, but also right round the inner edge of the margin so that in empty pupal cases the anterior portion of the dorsum is usually missing. I have observed no parasites on this species.

Adult female.—Length, 1.9 mm.; wing, size 1.9 mm. by 0.85 mm.

Body light yellow; antennae and legs semitransparent white. Tip of mentum gray. A lateral gray stripe on each side of the first segment of the abdomen, and dorsally a rather broad diagonal gray patch on each side of the same segment. Dorsally each abdominal segment dark gray nearly the entire width of the body. An oval gray plate situated on the dorsal surface of the last segment of the abdomen. It incloses the vasiform orifice. Ventrally the abdomen covered with fine short hairs. Body and legs covered with white meal. Eyes reniform, almost divided; color dark maroon. Wings immaculate. Vasiform orifice broadly conical, the anterior edge somewhat produced and with a flat indenture in the center. Oper-

culum cordate, apex pointing cephalad. Posterior margin incurved; lateral margins dark and wavy. The operculum extends nearly the whole length of the orifice, but is somewhat narrower. Color dark gray. Lingula cylindrical; it projects to the posterior edge of the vasiform orifice; end almost flat. Only the part which projects beyond the operculum can be made out; color gray. Antennae, length 0.5 mm. Formula (3, 6), (2, 4, 5), 7, 1. Joint 1, short, flat; joint 2, subpyriform, about twice length of joint 1; joints 3 and 6, equal in length, each about twice the length of joint 2; joints 4 and 5, each equal in length to joint 2; joint 7, short, thin, and tapering to a point, about one-third length of joint 6.

Adult male.—Length, 1.7 mm.; wing, 1.5 mm by 0.77 mm.

Color, etc., much as in the female. The antennae, however, are enormously developed, being proportionately about twice as long as those in the female. Length, 0.9 mm. Formula, 5, 3, (6, 7,) 2, 4, 1. Joint 5 is very long, being nearly equal to all the others together. Joint 1, short, flat; joint 2, subpyriform, twice length of joint 1; joint 3, fairly long, one and a half times length of joint 2; joint 4, short, less than half the length of joint 3; joint 5, long, almost equal to all the other joints together; joints 6 and 7 equal, together about equal to joints 3 and 4. The antennae are heavily ringed, and it is extremely difficult to make out the joints. The under surface of the abdomen covered with a large quantity of white fluff.

This species occurs in great abundance on the Simul tree (*Bombyx malabaricum*) in Calcutta. The leaves are thickly covered with the insect. They become yellow and spotted wherever an insect is attached and are ultimately killed. Superficially the insect somewhat resembles *A. eugeniae* Maskell. There are the same radiating dorsal patches and the dorsum is similarly striated. They differ, however, in the shape of the pupa case and the shape of the vasiform orifice. *A. simula* has a slight marginal fringe and there are four setae on the margin. The radiating dorsal patches are quite different in the two insects. In *A. simula* these patches are not formed by closely apposed pores, but are yellow bands striated with gray. The thoracic radial patches are also true ridges, being elevated above the surface of the dorsum. All three patches in this species end not in a single aperture or pore opening dorsally, but in five stout brown horizontal pores, which secrete a small quantity of fluffy brown wax. The dorsum in this species is covered with a large number of extremely minute circular pores; the margin is also broad and clearly defined.

Mr. Maskell was mistaken in assuming that the three radial patches were sufficient evidence to prove the close relationship of *A. eugeniae* and *A. eugeniae*, var. *aurantii*. As a matter of fact, many of the Indian Aleurodidae possess this characteristic, however widely different they may otherwise be. (Peal.)

ALEUROLOBUS SOLITARIUS, new species.

Plate 47, figs. 8–13.

This species is of special interest as coming from the United States. Other members of the genus, it will be remembered, come from the Orient. Our material of *solitarius*, though limited to three examples of pupa cases in balsam mounts and one pupa case on leaf, is sufficient to warrant its description, as its characteristics are distinct. The specimens were received from H. O. Woodworth, October 17, 1901, and were sent from Champaign, Illinois, where they were supposedly collected. The host is red-bud, *Cercis canadensis*.

Pupa case (fig. 8).—Size about 1.4 by 1 mm., elliptical in shape, very dark brown to blackish in color under transmitted light. Body segments lighter and quite distinct. The transparent lunar eyespots noted in other dark-colored forms of this genus are in this species not discernible. Dorsal and submarginal areas distinctly demarked by a suture extending all around the case. On dorsal disk are a few transparent dots, as indicated in the illustration. The setae and their arrangement can not be satisfactorily determined in the specimens in hand, due to their dark color, but these are probably placed in the normal way for related forms, as *marlatti*. Vasiform orifice (fig. 12) triangular in outline, with the surrounding lobed area typical of the genus. The operculum corresponds in shape to the outline of orifice, which it nearly fills. The lingula is not observable through the dense brown operculum.

The submarginal area is quite distinct as a fluted zone all around the case. The margin is very faintly beaded by the ends of the wax tubes, the sutures between which near the margin are distinct, but are more or less anastomosed mesad (fig. 13). The marginal area shows many minute transparent dots like those present on the dorsal area. The tracheal pores on margin of case are indicated by a bilobed or trilobed structure (figs. 9, 10, and 11) which is distinct from the tracheal pores in other species of the genus thus far seen.

On the leaf the pupa case appears dense black in color. There is a fringe all around of glassy wax tubes, compact basally and spreading by groups distad. These rods have a length of about one-half of width of pupa case. Dorsal area more or less covered with scales or plates of wax of general color of marginal fringe.

Adults.—Unknown.

Type.—Cat. No. 19103, U.S.N.M.

ALEUROLOBUS TAONABAE (Kuwana).

Plate 47, figs. 1–7.

Aleurolobus taonabae KUWANA, Pomona Journ. Ent., vol. 3, 1911, p. 623.

Egg (fig. 1).—Size 0.16 by 0.99 mm., elliptical, pointed at distal end; pale yellow in color; stalk very short, dark brown. (We

notice that some of the eggs in the paratype material have a reticulate structure of wax, which mostly disappears when mounted in xylol balsam.)

Larva, first instar (fig. 2).—Length 0.03 mm., form elliptical; color pale brownish; eyespots purplish brown, and the vasiform orifice a darker brown than the remainder of larva. On the dorsum the abdominal segments are distinct. There is a pair of minute setae bordering the vasiform orifice, and there are two pairs of very long curved spines situated on tubercles, one pair on the cephalic extremity, just cephalad of the eyespots, and the other on the middle of the larva. The margin (fig. 3) is very minutely toothed, the teeth being rounded at their tips. There are 15 pairs of marginal hairs observable on the paratype specimens, though these are in such a condition that other hairs may be present and not visible. Of the marginal hairs the caudal pair is long and the third caudal pair extremely so. The others are nearly uniform in length. The vasiform orifice (fig. 4) is nearly triangular with the caudal extremity rounded. The operculum is rectangular and about half fills the orifice. The lingula is elongate, extends nearly to the caudal extremity of the orifice, and its tip is setose.

Pupa case (fig. 5).—Length about 1.28 mm., width 1.12 mm., in broad specimens. There is considerable variation in the relative lengths and widths in different specimens; some look rather long and narrow, while others are nearly as broad as long. Color of case by transmitted light very dark brown to black. There is a distinct broad marginal rim evenly marked off from the central dorsal disk. This central dorsal area is divided into two parts: First, a central area with very little sculpturing, on which the abdominal segments are distinctly visible; and, secondly, a subdorsal area forming a band all around, but narrowing at each extremity. This is covered with numerous irregular corrugations, and the sutures of the abdominal segments are not visible upon it. The transparent eyespots are more or less crescent shaped and are located within the subdorsal area. There are also upon the dorsum many minute transparent circular pore-like places arranged in irregular or broken rings about the case. There seem to be two rows of these on each side of the middle dorsal area and one row on the subdorsal area. The vasiform orifice (fig. 6) is somewhat triangular and longer than broad. The operculum is of a similar shape and fills about two-thirds of the orifice. The inner membrane is reticulate as shown in the figure. The orifice is surrounded by an area similar to that present in the other species of the group, consisting of a cephalic and two lateral lobes which form a channel caudad. The marginal rim (fig. 7) is irregularly divided by a large number of sutures extending mesad on the submarginal area. The outer extremities of these form shallow rounded teeth on

the margin. There is a pair of small setae on the cephalic margin at about the same distance from the median line as the eyespots and a similar pair of latero-caudal setae. We have been unable to find any caudal setae similar to those present in the related species, though these may normally be present and not observable in the specimens we have been able to study. On the leaf we have only two specimens. These do not show any secretion from marginal wax tubes, as stated by Kuwana, and it has doubtless been broken off in our material.

Paratype material of eggs, larvae, and pupa cases studied in balsam mounts.

Type.—Cat. No. 19107, U.S.N.M.

This species is closely allied to *marlatti*, but differs in markings of wings of adult and in markings of pupa case. It occurs on grape in Okoga and on grape and *Taonaba japonica* Szyszylowicz in Tokio.

Genus ALEUROPARADOXUS Quaintance and Baker.

Aleuroparadoxus Quaintance and Baker, Tech. Ser. 27, pt. 2, Bur. Ent. U. S. Dept. Agr., 1914, p. 104.

Pupa case medium in size, elliptic in outline, margin toothed, the wax tubes only moderately developed; submarginal area not separated from dorsal disk; just within margin a series of papilla-like pores and dorsum with numerous irregular shaped pores; tracheal folds present, terminating on margin in a comb of teeth; wax secretion brittle glass-like rods from the submarginal papillae and usually a secretion from the dorsal pores. Vasiform orifice subcordate or triangular, the operculum similar in outline, obscuring the lingula.

Adult with a single flexure in radial sector of forewing and no spur of media. Antennae seven-segmented, IV the longest; distal segments subequal. Sexes nearly equal in size.

Type.—Aleuroparadoxus iridescens (Bemis).

KEY TO SPECIES OF ALEUROPARADOXUS.

1. Median dorsal ridge of abdomen with a double row of large pore-like structures, two on each abdominal segment..... *iridescens.*
2. Median dorsal ridge with a row of small pore-like structures, 3 to 5 close together on each abdominal segment..... *punctatus.*

ALEUROPARADOXUS IRIDESCENS (Bemis).

Plate 48, fig. 1.

Aleyrodes iridescens Bemis, Proc. U. S. Nat. Mus., vol. 27, 1914, p. 487.

This species has been rather fully described by Bemis. A few details of structure may be added in order to separate *iridescens* from closely related forms. The submarginal papillae are about 0.03 mm. long and form a very even row. The pore-like structures

on the dorsum of case are about 0.32 mm. in diameter and are arranged as shown in the figure. Those forming the row of six on the abdomen between the submarginal row of papillae and the double median row are about 0.16 mm. from the outer pores of the double median row. A channel extends from the vasiform orifice to the margin of the case. On either side of the channel is a thickened wrinkled lobe-like ridge between the orifice and the margin.

We have specimens taken on *Arctostaphylos* species, near Camp Rincon, San Gabriel Mountains, California, July 4, 1911, by P. H. Timberlake. These specimens show some differences from the paratypes mentioned above. The most noticeable difference is in the submarginal papillae, which are elongate in these specimens and measure about 0.048 mm. The pores also are somewhat larger.

Paratype.—Cat. No. 7084, U.S.N.M.

ALEUROPARADOXUS PUNCTATUS, new species.

Plate 48, fig. 2.

Two collections of this species are in the Bureau of Entomology. Q. No. 1980 was taken on *Lithraea caustica*, at Santiago, Chile, by Manuel J. Rivera, October 25, 1905, and Q. No. 8821 was taken on *Quillaja sapororia* and sent from the same city by Carlos E. Porter in March, 1905.

Pupa case.—Size 1.44 mm. by 1.12 mm., subelliptical, broadly rounded at the ends. The margin of the dorsal disk shows a very irregular, somewhat thickened line. The median dorsal abdominal ridge is armed on each segment with three to five irregular pore-like areas, which are usually crowded together. These are much smaller than the corresponding ones in *iridescens*. The transverse cephalic row of pore-like areas upon the thorax consists of sometimes as many as 18. On the submarginal area of the abdomen some distance mesad and often occupying a part of the margin of the dorsal disk there is an irregular row of minute pore-like areas. This row is most often of three pores in thickness, but often is only a single irregular row. Sometimes it is scarcely visible at all. The pores forming this row are much smaller than those present on the similar region of *iridescens*. The papillae-like structures forming a row about the case just within the margin are in this species short, extending mesad only about 0.016 mm., but the suture-like markings between them extend considerably farther mesad. In *iridescens*, on the other hand, the sutures between the papillae extend scarcely mesad of the papillae themselves. Comb of the thoracic tracheal fold very similar to that of *iridescens*, consisting of three teeth. Vasiform orifice typical for the genus, about 0.112 mm. by 0.096 mm. in size and about 0.128 mm. from caudal margin. There is a channel

extending from the caudal edge of the orifice to the margin of the case. The thickened area on either side of this channel ends on the margin in two narrow irregular lobes. These differ from the corresponding lobes of *iridescens* in extending to the margin or a little beyond it. The color under the microscope is a very dark brown.

On the leaf the pupae appear as black disks without waxy secretion, excepting short pencils of wax from the pores of the tracheal folds.

Adults.—Unknown.

Described from pupa cases in balsam mounts and upon the foliage.

Type.—Cat. No. 20205, U.S.N.M.

Genus ALEUROPLATUS Quaintance and Baker.

Aleuroplatus, QUAINTANCE and BAKER, Tech. Ser. 27, pt. 2, Bur. Ent. U. S. Dept. Agr., 1914, p. 98.

Pupa case usually flat, elliptical, oval, or subcircular in outline, often notched on cephalo-lateral margins; some species are elongate; color varying from a transparent yellowish or whitish to black, but mostly dark brown; many species variously dotted with darker markings; margin toothed, wax tubes moderately developed, incisions shallow; thoracic and caudal tracheal folds present and in most cases plainly visible and ending on the margin in a distinctly differentiated comb of teeth from which arise pencils of waxy secretion, differing from the more or less amorphous secretion of wax surrounding the case, secreted by the marginal wax tubes. Dorsum with the disk not separated from the submarginal area and without prominent pores or papillae, though usually with a number of minute clear pores. (In rare exceptions there are many wax pores.) Vasiform orifice small, transverse, rounded, or elongate, the inner margin rarely armed with teeth; operculum filling from a third to all of the orifice and obscuring the lingula.

Adults with wings unmarked, clouded, or spotted; the radial sector of forewing with a single flexure; no spur of the media, but the cubitus faintly indicated. Antennae of seven segments, segment III the longest; the other distal ones subequal, with IV, however, usually the shortest. Claspers of male considerably curved at their distal extremities and possessing a number of prominent spines. Proximad of the distal spur of each clasper there is either a lobed structure or other smaller spurs.

Type.—*Aleuroplatus quercus-aquaticae* (Quaintance).

KEY TO SUBGENERA OF THE GENUS ALEUROPLATUS.

1. Vasiform orifice not armed with teeth on its inner caudo-lateral margin. Subgenus *Aleuroplatus*.

2. Vasiform orifice armed with teeth on its inner caudo-lateral margin. Subgenus *Orchamus*.

ALEUROPLATUS, new subgenus.

Pupa case flat, elliptical, oval, or subcircular, thoracic tracheal folds ending on margin of case in a comb of teeth; vasiform orifice small, usually transversely elliptic and without teeth upon its inner caudal and lateral margins.

Type.—Aleuroplatus (*Aleuroplatus*) *quercus-aquaticae* (Quaintance).

KEY TO SPECIES OF SUBGENUS ALEUROPLATUS.

1. Pupa case transparent whitish, never dark brown or black..... 2
   Pupa case not transparent whitish, but dark brown to black..... 3
2. Marginal comb of thoracic fold very faint and composed of short rounded teeth. *ficus-rugosae.*
   Marginal comb of thoracic fold very distinct and composed of long narrow teeth. *translucidus.*
3. Marginal comb of thoracic fold composed of distinct differentiated teeth..... 4
   Marginal comb and thoracic fold either scarcely distinguishable or the teeth similar to marginal teeth..... 8
4. Marginal comb of thoracic fold composed of one prominent tooth at base of prominent incision in the margin of case.....*incisus.*
   Marginal comb composed of more than one prominent tooth..... 5
5. Marginal comb of thoracic fold composed of two prominent teeth.....*gelatinosus.*
   Marginal comb of thoracic fold composed of four or five rather prominent teeth. 6
6. Suture between thorax and abdomen curved cephalad on each side beyond the third thoracic segment; body with moderately developed rhachis..*berbericolus.*
   Suture between thorax and abdomen not curved beyond the third thoracic segment; rhachis but little developed or absent..... 7
7. Abdominal segments distinct; teeth of thoracic comb with clear areas at base. *plumosus.*
   Abdominal segments faintly indicated and visible only on middle of dorsum; teeth of thoracic comb without clear areas at base.....*pictiniferus.*
8. Marginal comb of thoracic fold distinguishable, but the teeth little differentiated from adjacent marginal teeth..... 9
   Marginal comb and thoracic fold scarcely distinguishable..... 14
9. Size very large, over 2.25 mm. long; dorsum with very distinct rhachis. *sculpturatus.*
   Size medium, or small, less than 1.5 mm. long..... 10
10. Dorsum somewhat arched possessing distinct rhachis.....*cockerelli.*
    Dorsum flat, without rhachis..... 11
11. Suture between thorax and abdomen curved cephalad much beyond the third thoracic segment..... 12
    Suture not curved cephalad beyond or but slightly beyond the third thoracic segment..... 13
12. Thorax with two pairs of rather long dorsal spines.....*validus.*
    Thorax without such spines.....*quercus-aquaticae.*
13. Suture curved slightly beyond third thoracic segment; color varying in different specimens from a yellow to a smoky brown, some individuals with a yellow submarginal area and a more or less completely brown disk.....*variegatus.*
    Suture not curved beyond third thoracic segment; color uniform brown..*cococolus.*
14. Shape elongate oval, greatest width across thorax.....*ovatus.*
    Shape nearly elliptical or oval with greatest width across the abdomen..... 15

15. Shape nearly elliptical, not broader at one end than at the other; no distinct eye spots present, margin irregular, a submarginal row of small pores present..... *myricae.*
Shape oval, the greatest width across the abdomen, the reverse of *ovatus;* dorsum with a submarginal row of small pores..... 16
16. Eye spots of pupa case absent; vasiform orifice elongate, the operculum filling less than cephalic half; submarginal row of pores about 0.016 mm. from margin..... *coronatus.*
Eye spots of pupa case present; vasiform orifice of medium length, with the operculum almost filling it..... 17
17. Eye spots reniform, moderately large; area between submarginal rows of pores and margin of case not reticulate, this row of pores about 0.03 mm. from the margin..... *oculireniformis.*
Eye spots circular; area between the submarginal row of pores and margin of case reticulate..... 18
18. Eye spots extremely minute and situated on the same line with the submarginal row of pores; the pores alternating with one another to form a zigzag row around the case; row about 0.048 mm. from margin..... *oculiminutus.*
Eye spots moderate in size, not situated in the same line with the submarginal row of pores, but more mesad; pores of submarginal row not zigzag, but forming an even row about 0.064 mm. from the margin..... *vinsonioides.*

ALEUROPLATUS (ALEUROPLATUS) BERBERICOLUS, new species.

Plate 50, fig. 1; plate 49, figs. 1–4.

On January 27, 1908, J. W. Cockle collected pupa cases of this species at Kaslo, British Columbia, on *Berberis aquifolium.* Later collections by Mr. Cockle from the same plant proved to represent other species, and adults supposed to be those of *berbericolus,* and taken at another time, are those of a species of *Aleyrodes.* Specimens of *berbericolus* are also in the collection from Mexico City, collector and date unknown, and from Toluca, Mexico, on *Ilex,* collected June 24, 1897, by A. Koebele.

Pupa case (pl. 50, fig. 1).—Size 0.88 by 0.656 mm. Shape elliptical, constricted across the thoracic folds. Dorsum with the abdominal segments quite distinct, thorax with a more or less defined arrow-shaped structure resembling that found in the genus *Aleurotrachelus.* Suture separating the thorax and abdomen curved cephalad beyond the third thoracic segment. Lateral margins of the abdominal segments on the median dorsal area marked with many minute, dark, pore-like spots. These sometimes extend in a row across the edges of the segments. Margin (pl. 49, fig. 1) composed of evenly rounded, moderately shallow teeth from which there extend mesad suture-like markings. Thoracic tracheal comb (pl. 49, fig. 2) composed of three or four rather prominent teeth with serrate margins; caudal comb similar. Submarginal and subdorsal areas with irregularly scattered minute pore-like structures. Vasiform orifice (pl. 49, fig. 3) subcircular in outline with the margins thickened; operculum filling about half the orifice, subtriangular in shape, though

broad and rounded at the apex. The entire orifice is covered on its upper surface with a membrane, the opening in which is smaller than the orifice itself. Color of case yellowish brown, with the median portions darker brown. Eyespots purplish. The case is closely appressed to the leaf and surrounded with a rather narrow glossy wax fringe, in which may be distinguished the pencils of white wax from the thoracic and caudal combs; the marginal area is dark brown and the dorsal disk very dark brown or black. The disk shows a longitudinal keel, and the body segments are quite distinct.

Adults.—Unknown.

Described from pupa cases in balsam mounts. Type lot from Kaslo, British Columbia.

Type.—Cat. No. 19192, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) COCKERELLI (Ihering).

Plate 50, fig. 2; plate 49, figs. 5-6.

Aleurodes cockerelli IHERING, Rev. Mus. Paulista, vol. 2, 1897, p. 393.

Paratype material of this species in the collection of the Bureau of Entomology is composed of pupa cases only.

The description given by Hempel [1] and cited under this species by Kirkaldy in his catalogue of the family refers to quite another insect, *Dialeurodicus cockerelli* Quaintance.

Pupa case (pl. 50, fig. 2).—Size 1.36 by 1.056 mm. Shape oval, with cephalic portion the narrower. (The figure given by Ihering shows the cephalic and caudal portions equally broad. Our specimens, however, are not so shaped.) Dorsum with a distinct rhachis, the segments of the abdomen extending out from it as prominent ridges. Submarginal area with a few small, clear, circular, pore-like areas. Vasiform orifice (pl. 49, fig. 6) somewhat longer than that shown for the type and with the membrane on the inner latero-caudal part sometimes thrown into minute folds. Margin with distinct and, for the genus, rather prominent teeth, between which minute ones are often situated. Thoracic pores ending on margin in an even comb of usually four closely placed teeth (pl. 49, fig. 5). Color on the leaf brownish black; under the microscope, dark brown.

In the development of the rhachis *cockerelli* approaches *sculpturatus*, but the rhachis is not so well developed as in that species, nor is the pupa case so large or of the same shape.

Adults.—Unknown.

Paratype.—Cat. No. 20191, U.S.N.M.

[1] Ann. Mag. Nat. Hist., vol. 8, p. 387.

ALEUROPLATUS (ALEUROPLATUS) COCOCOLUS, new species.

Plate 51, fig. 1; plate 49, figs. 7–10.

Specimens of this form are in the collection of the Bureau of Entomology, as follows:

Locality.	Date.	Collector.	Host.	Bureau No.
Santiago de las Vegas, Cuba.	May 6, 1905	M. T. Cook.....	Coconut.....	Q. No. 233.
Ceara, Brazil....	Jan., 1906	F. Rocha.....	*Eugenia michelii* Lam.	Q. 748.
Santiago de las Vegas, Cuba.	Sept., 1906	C. F. Baker....	*Cocos nucifera*.....	Q. 3261.
Santiago de las Vegas, Cuba.	Mar. 28, 1908	Wm. T. Hume.	*Cocos nucifera*.....	Q. 5205.
Trinidad.....	Mar. 27, 1912	F. W. Urich....	Coconut.....	Q. 8071.
Panama.....	Mar. 7, 1913	E. Bethel.....	.....	Q. 8829.

Of this material that collected by Urich in 1912 has been taken as type, for in this lot are examples of eggs and larvae and some fragmentary adult females.

Egg (pl. 49, fig. 7).—Size 0.24 by 0.112 mm.; stalk 0.048 mm. Shape almost hemispherical, the straight side some distance from the stalk. Color yellow, stalk brownish. No sculpturing present.

Larva (second instar?).—Size 0.65 by 0.4 mm. Color light brown; eyespots transparent and near each a red pigmented area; median dorsal region with many dark pore-like markings. Abdominal segments indicated only on the median dorsal area. Thorax with a slight indication of a central ridge, and with three pairs of prominent spines; those on the last two thoracic segments are long and knobbed (pl. 49, fig. 9), while the third pair, between the eyespots, are shorter, thicker, and tapering (pl. 49, fig. 10). Laterocephalad of the vasiform orifice is another pair of these thick, tapering spines of about the same length as the orifice. The orifice itself is situated on a somewhat differentiated area, which extends to the caudal margin of the case. Two long curved spines arise from this, near the margin. The teeth of the margin are prominent.

Pupa case (pl. 51, fig. 1).—Size 0.976 by 0.736 mm. Color dark brown, usually more heavily pigmented on the thorax; yellow specimens or specimens variegated with yellow are, however, not met with as in *variegatus*. There are many black dots scattered over the dorsum, as seen in most members of this genus. The case is flat, and the abdominal segments are distinct only on the median dorsal area. Suture separating the thorax and abdomen not extending cephalad beyond the third thoracic segment, but extending about even with it. Thorax with two pairs of prominent clubbed spines as met with

in the larva, but seemingly lacking the thick tapering spines. Margin composed of moderately sized teeth which are serrate; from these there extends mesad a series of irregular suture-like markings, which, however, do not extend so far as in *variegatus*. There is, on the other hand, the same thickened area mesad of the marginal comb of the thorax, and it is covered with the same minute circular markings, but these also extend mesad from it. A similar thickened area and a similar row of markings are found caudad of the vasiform orifice. Latero-cephalad of the orifice there is a pair of rather short spines. The orifice itself (pl. 49, fig. 8) is subcircular in outline, thickened latero-caudad; the operculum nearly fills the orifice and is striate above.

On leaf the case is jet black and surrounded by a conspicuous fringe of dirty white or yellowish wax, amorphous basally in the more mature specimens, but with numerous lighter pencils or threads of wax radiating from the case, extending well beyond the amorphous portion. In less advanced pupa cases the amorphous basal wax is mostly absent, and the radiating wax pencils are very conspicuous.

Adult female.—The fragmentary condition of the available specimens of the female will not permit of a good description. They are yellow in color with dark brown eyes and unmarked wings. The body is about 0.8 mm. long and the forewings measure about 1.04 mm. in length.

Adult male.—Unknown.

Described from eggs, larvae, pupa cases, and fragmentary females in balsam mounts.

Type.—Cat. No. 19193, U.S.N.M.

The specimens on *Eugenia michelii* are somewhat lighter than typical, have a slightly more pronounced constriction across the thoracic folds, and the abdominal segments are not so distinct.

ALEUROPLATUS (ALEUROPLATUS) CORONATUS (Quaintance).

Plate 51, fig. 2; plate 49, figs. 11, 12.

Aleurodes coronata QUAINTANCE, U. S. Dept. Agr., Div. Ent., Tech. Ser. 8, 1900, p. 22.

Aleyrodes coronatus BEMIS, Proc. U. S. Nat. Mus., vol. 27, 1904, p. 497.

This species is present in the Bureau of Entomology collection as follows:

Date.	Collector.	Host.	Locality.	Bureau No.
Mar. 12, 1888	D. W. Coquillett....	*Quercus agrifoliae*.	Los Angeles, Cal	Q. 3477
Mar. 31, 1888	.....do.....	.....do.....	.....do.....	Q. 3478
Sept. 14, 1894	S. A. Pease.....	.....do.....	Pomona, Cal...	Q. 3479
Apr. 19, 1907	E. W. Ehrhorn.....	(?)	San Bernardino.	Q. 3239
May 26, 1911	P. H. Timberlake..	*Quercus agrifoliae*.	Whittier, Cal ..	Q. 8933
July 30, 1912	A. G. Smith.....	Chestnut.....	Pasadena, Cal..	Q. 8722

Pupa case (pl. 51, fig. 2).—This species has been fully described by Quaintance and by Bemis. The minute pore-like structures forming a submarginal row (pl. 49, fig. 11) as in the species related to *coronatus* are quite similar to those met with in *vinsonioides*, *oculireniformis*, and *oculiminutus*. On the mesal portion of the abdomen of *coronatus* there is usually but one row of pores on each side, and not three rows as in the species just mentioned. On the thoracic region these pores are quite scarce in *coronatus*, whereas they are numerous on the other species mentioned. The eyespots also are not clear, transparent areas as in the related species, but are pigmented and usually dark brown in color. The comb of teeth on the margin of case, at the extremity of the thoracic folds, is not distinct. The vasiform orifice (pl. 49, fig. 12) is unusual. It is very elongate, and the operculum is exceptionally small, filling not half of the orifice.

Type.—Cat. No. 4238, U.S.N.M.

ALEUROPLATUS EURYAE (Kuwana).

This species was included in the genus *Aleuroplatus* in the writers Classification of the Aleyrodidae,[1] It shows considerable variation from the type, and a study of three undescribed species undoubtedly closely related to *euryae* leads us to believe that these four species belong to a distinct genus. *Euryae* is, therefore, not here considered with the species of *Aleuroplatus*.

ALEUROPLATUS (ALEUROPLATUS) FICUS-RUGOSAE, new species.

Plate 49, figs. 13–16.

Only one collection of this species is at hand. It was taken on *Ficus rugosa* at the Royal Botanic Gardens, Calcutta, India, by R. S. Woglum, December, 1910. The pupa case is very like that of species of *Dialeurodes*.

Pupa case (pl. 49, fig. 13).—Size 1.6 by 1.32 mm. Shape elliptical, very slightly narrower on the thoracic portion. Dorsum slightly rounded, segmentation scarcely distinguishable, margin without teeth, but with a number of suture-like markings extending mesad. Thoracic tracheal fold very faintly visible (pl. 49, fig. 16), armed on the margin of case with four or five evenly rounded teeth and showing minute circular markings along the fold. Vasiform orifice (pl. 49, fig. 14) very minute, wider than long, and nearly filled with the operculum. The distal extremity of the lingula is exposed. Caudal tracheal fold (pl. 49, fig. 15) similar to those of the thorax, but broadening toward the vasiform orifice and forming an urn-

[1] Tech. Ser. 27, Pt. 2, Bur. Ent. U. S. Dept. Agr., 1914, p. 98.

shaped structure. Near the caudal margin there are two rather distinct lobes which partially inclose the fold. Color yellow.

Adults.—Unknown.

Described from pupa cases in balsam mounts.

Type.—Cat. No. 19194, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) GELATINOSUS (Cockerell).

Plate 52, fig. 1; plate 49, figs. 17–19.

Aleurodes gelatinosus COCKERELL, Can. Ent., vol. 30, 1898, p. 264.
Aleyrodes gelatinosus COCKERELL, Bemis, Proc. U. S. Nat. Mus., vol. 27, 1904, p. 502.

This species was described by Cockerell, and the different stages were described by Bemis. Several details may here be added:

Pupa case (pl. 52, fig. 1).—The suture separating the thorax and abdomen is curved cephalad to, or perhaps a little beyond, the third thoracic segment. On each of the two caudal segments of the thorax there is a pair of prominent spines situated on tubercles. On the cephalic part of the thorax about on the region where the eyespots are usually located is a pair of tubercles similar to those on which the spines just mentioned are situated. The thoracic tracheal folds are evident and the comb (pl. 49, fig. 17) consists of two prominent teeth with serrate margins, and differing somewhat from the caudal comb (pl. 49, fig. 18). The vasiform orifice (pl. 49, fig. 19) is subcircular in outline with the margin thickened. The operculum fills about half the orifice and the upper surface of the latter is covered with a membrane similar to that found in *berbericolus* and *ovatus*.

On the leaf the case appears jet black and is surrounded with a conspicuous copious secretion of gelatinous, yellowish wax.

Adults.—Unknown.

Type.—Cat. No. 8998, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) INCISUS, new species.

Plate 52, fig. 2; plate 49, figs. 20–21.

The bureau collection contains four lots of this species as follows:

Locality.	Date.	Collector.	Host.	Bureau No.
Roy. Bot. Gardens, Peradenyia, Ceylon.	October, 1910..	R. S. Woglum..	*Ostodes zeylanica.*	Q. 6731.
Do	....do.....	....do.....	Unknown tree.	Q. 6742.
Do	....do.....	....do.....	*Ostodes zeylanica.*	Q. 6752.
Do	September, 1913.	A. Rutherford..	*Garcinia specta* .	Q. 8770.

Of these collections Quaintance No. 6752 has been selected as the type lot on account of the abundance of the material. The species is very striking on account of the large, solitary, indented tooth (comb) of the thoracic and caudal folds and on this account is very easily separated from others in the genus.

Pupa case (pl. 52, fig. 2).—Size 1.36 by 1.04 mm. Color dark brown to black; under the microscope dark brown with median darker pigmentation. The general appearance of dorsum under the microscope is quite similar to that of *coronatus*, owing to the median dark pigmentation. The margin is composed of moderate sized, evenly rounded teeth and from these flutings extend for a short distance mesad. At the base of these flutings there is a row of minute pores similar to those met with in several other members of the genus. The abdominal segments are distinct only on the median dorsal area and each segment possesses a transverse row of pores. The suture separating the thorax and abdomen is short, not extending on each side much more than halfway to the margin; it is very little if at all curved cephalad. The thoracic and caudal tracheal folds are armed at their extremities with a prominent elongate tooth (pl. 49, fig. 20) and this is situated within a distinct sinus. The latero-caudal setae are long. The vasiform orifice (pl. 49, fig. 21) is subcircular in outline with the inner rim thickened caudad, and seemingly lobed; it is nearly filled by the operculum. In some specimens the transverse row of pores on the abdominal segments are not visible and in others the thoracic area is covered with many minute pores.

Adults.—Unknown.

Described from pupa cases in balsam mounts and dry upon the foliage.

Eggs and a few larvae are present in the material, but as other species are also present it is doubtful to which species they belong.

Type.—Cat. No. 19196, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) MYRICAE, new species.

Plate 54, fig. 1; plate 53, figs. 1–4.

Specimens of this species were taken by the senior author at Griffin, Georgia, April 25, 1899. They were living on a plant believed to be a species of *Myrica*.

Pupa case (pl. 54, fig. 1.).—Size 0.832 by 0.512 mm. Shape nearly elliptical; dorsum somewhat evenly arched; suture separating the thorax and abdomen very little curved cephalad. Margin (pl. 53, fig. 4) composed of shallow rounded teeth, but somewhat irregular, several teeth or groups of teeth being extended farther than the others. Just within the margin there is a row of minute pore-like structures not unlike those of *coronatus* and related species. Ab-

dominal segments distinct on the median portion of the abdomen. Vasiform orifice (pl. 53, fig. 3) subcircular in some specimens, in others elongate, the rim thickened, particularly on the caudal margin. Operculum about half filling the orifice in some specimens, but in those with the more elongate orifice, it is smaller; caudal spines very stout. Thoracic and tracheal folds scarcely distinguishable and not armed on margin with any special comb.

Adult male.—Color yellow, shaded with brown; eyes dark brown, wings in balsam mounts transparent. Antennae (pl. 53, fig. 2) imbricated, segment III with a circular distal sensorium, and armed with a long spine. In some specimens the spine is absent. Segments IV to VII imbricated; V and VII each with a distal sensorium. Proportions of the segments as follows: I, 0.064 mm.; VI, 0.09 mm.; VII, 0.09 mm. Claspers (pl. 53, fig. 1) 0.112 mm. long, rounded at the distal extremity, and acute. Just within the distal spur there is a bilobed structure, which sometimes shows a small third lobe on the proximal part; spines few and prominent. Length of forewing 0.88 mm., length of body from vertex to tip of claspers about 0.96 mm.

On the leaf the case appears jet black, convex, and without waxy secretion.

Adult female.—Similar in color to the male, but larger. Distal segment of antennae armed with a prominent spine on its proximal third and that part of the segment distad to this tapering. Size variable, from 0.96 to 1.44 mm. Forewings from 0.96 to 1.2 mm.

Described from pupa cases, males and females in balsam mounts, and pupa cases on foliage.

Type.—Cat. No. 19198, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) OCULIMINUTUS, new species.

Plate 54, fig. 2; plate 53, figs. 5–7.

Specimens of this species were received from Mr. F. W. Urich, April, 1913, and were taken on *Ficus* species ("metapel") in Trinidad. This is the only collection of the species that we have.

Pupa case (pl. 54, fig. 2).—Size 0.832 by 0.672 mm.; shape oval, broadest across the abdomen. Suture separating the thorax and abdomen not distinct. Sutures marking off the abdominal segments very faint, not darkened in color as are those of related species. Color black; margin of case (pl. 53, fig. 5) with evenly rounded shallow teeth, each tooth with a clear pore at its base. About 0.48 mm. from the margin of case there is a submarginal row of small pores. These are arranged alternately, forming a zigzag row around the case. Between this row and the margin of the case there is a checkered area somewhat similar to that found in *vinsonioides*, but the present species shows at least two rows of inclosed areas and one

row of open marginal areas, whereas *vinsonioides* shows only one row of inclosed areas and one row of open marginal areas. On the dorsum there are also other minute pores arranged as shown in figure 5, plate 53. The arrangement of these is very similar in *oculiminutus*, *vinsonioides*, and *oculireniformis*. The eyespots are very minute, about equal in size to the pores of the submarginal area. The eyespots may be distinguished at once from the submarginal pores from the fact that they are transparent, whereas the pores are not. They are much nearer the margin than is usual, being on the same line as the submarginal row of pores, or even nearer the margin (pl. 53, fig. 5). The dorsum, mesad of the submarginal ring of pores, is without checkered markings. Vasiform orifice (pl. 53, fig. 7) of about equal width and length, the operculum filling a little more than half of it. Caudad of the orifice near the margin of the case there is a pair of thick spines close together, and the usual pair is present latero-cephalad of the orifice.

On the leaf the cases are shining black. There is no dorsal waxy secretion, but there is an irregular white waxy marginal fringe. In some specimens this mass fuses into a yellow, semitransparent wax, terminating on the periphery in numerous squarish teeth.

Adult female.—The females present are fragmentary and it is impossible to give from them a complete description. Color yellowish, with yellowish or dusky shadings. Eyes dark brown. Forewings with dusky brown markings as shown in figure 6, plate 53. Length of forewing 0.88 mm.; hind wing uniform dusky. The markings of the forewing of this species are very similar to those of *oculireniformis*.

Adult male.—Unknown.

Described from pupa cases and females in balsam mounts and pupa cases dry upon the foliage.

Type.—Cat. No. 19199, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) OCULIRENIFORMIS, new species.

Plate 55, figs. 1–10.

One lot only of this species is in the bureau collection. It was taken by F. Rocha at Ceara, Brazil, in January, 1906, on *Passiflora*. Two other species are very closely related to the present one, namely *vinsonioides* Cockerell and *oculiminutus*. The separation of these species is made on the pupa case, as adults of *vinsonioides* in the collection are fragmentary females only.

Egg (pl. 55, fig. 1).—Color yellow, in a few cases brownish; shape oval with one side flattened; stalk not exactly at the base, but farther from the flattened than the rounded side of the egg. Surface without apparent sculpturing; length 0.192 mm.

Pupa case (pl. 55, fig. 2).—Shape oval, broadest across abdomen. Size 0.912 by 0.72 mm.; some specimens smaller. Color dense black, with eyespots sometimes showing a clear transparent

area, while in other specimens these are brown in color. These eyespots are reniform and are much larger than those of the two related species (pl. 55, fig. 9). Margin (pl. 55, fig. 3) composed of closely set and evenly rounded teeth, each one with a minute circular pore at its base. Dorsum with many small circular pores arranged as shown in the figure. The submarginal row of pores forms a fairly even line around the case. That part of the dorsum between these pores and the marginal teeth is not striate (pl. 55, fig. 3), though the mesal portion of the dorsum is. Suture separating the thorax and abdomen evenly rounded on each side. Vasiform orifice (pl. 55, fig. 4) usual, longer than broad, and almost entirely filled by the operculum. On the leaf the case is jet black and there is apparently no waxy secretion of any kind.

Adult male.—Color yellowish or slightly brownish, with dusky appendages and dark brown eyes. Eyes not divided, but the upper and lower eyes joined by six or eight lenses in pairs or triplets (pl. 55, fig. 8). Antennae with proportions as shown in figure 7, plate 55; segment III imbricated and with two distal sensoria; each of these is usually armed with a central process. Segment V with a distal sensorium and segment VII with a sensorium near its middle. Forewing with smoky brown markings, as indicated in the figure (pl. 55, fig. 10). Hindwing uniform pale smoky. Claspers 0.128 mm. long, slightly curved, somewhat pubescent, and armed with a number of stout spines, as shown in plate 55, figure 6; outer distal edge forming a rather distinct prong, and the inner portion with a distinct double lobe. Penis (pl. 55, fig. 5) with a distinct shoulder. Length from vertex to tip of claspers 0.72 mm. to 1.04 mm.

Adult female.—Similar in general character to the male. Length of antennae 0.396 mm. Average length from vertex to tip of cauda 0.92 mm.; length of forewing about the same.

Described from males and females, pupa cases, and eggs in balsam mounts.

Type.—Cat. No. 19200, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) OVATUS, new species.

Plate 56, fig. 1; plate 53, figs. 8, 9.

One lot only of this species is in the collection. It was taken on *Berberis trifoliata* at College Station, Texas, by Wilmon Newell, in March, 1912.

Pupa case (pl. 56, fig. 1).—Size 0.96 by 0.624 mm. Shape oval, broadest across the thorax; caudo-lateral margins more or less straight. Abdominal segments distinct, reaching almost to the margin. Suture separating the thorax and abdomen recurved cephalad about on line with the third thoracic segment. Margin composed of evenly rounded shallow teeth; comb of the thoracic

folds scarcely separable from the adjacent teeth of the margin (pl. 53, fig. 8). Vasiform orifice (pl. 53, fig. 9) subcircular in outline, with the margin somewhat thickened, the operculum filling about two-thirds of the orifice, which latter is covered with a membrane. Color dark brown to black, darker across the sutures of the abdomen. On the abdominal segments there are also minute, dark, pore-like markings. The developing eyes within the body are seen as large black patches near the cephalic margin, and on some specimens there are small yellowish semitransparent eyespots. Cephalad of the vasiform orifice there is a thickened area darker than that which surrounds it.

On the leaf the case is surrounded with a copious secretion of gelatinous, semitransparent wax. Around margin of case the wax is whitish, and a pencil of white wax extends caudad from caudal end of case.

Adults.—Unknown,

Described from pupa cases in balsam mounts.

Type.—Cat. No. 19201, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) PECTINIFERUS, new species.

Plate 56, fig. 2; plate 53, figs. 10–14.

This species is in the collection of the Bureau of Entomology in six different collections as follows:

Locality.	Date collected.	Collector.	Host.	Bureau No.
Lahore, India	(?)	R. S. Woglum	*Morus* sp	Q. 8026
Do	July, 1911	do	Euphorbiaceous tree	Q. 8027
Do	do	do	*Morus* sp	Q. 8028
Do	June, 1911	do	do	Q. 8030
Do	July, 1911	do	do	Q. 8032
Do	June, 1911	do	do	Q. 8037

Of this material Quaintance No. 8027 has been selected as type, as it contains specimens of males and females.

Pupa case (pl. 56, fig. 2).—Size 0.912 by 0.72 mm.; many specimens considerably smaller; color dark brown or black. Outline oval, narrowest across cephalic portion, slightly constricted across the thoracic folds, and very slightly at the caudal fold. Dorsal sutures indistinctly marked. Margin with shallow rounded teeth and within margin on the submarginal area there is a series of minute pores irregularly arranged. Thoracic folds distinct, the comb on the margin of these composed of four or five long, prominent teeth (pl. 53, fig. 10). Caudal comb of a similar character. The teeth on the combs of this species are much more prominent than those of any other dark form thus far known, and are quite distinctive.

Vasiform orifice (pl. 53, fig. 11) subcircular in outline, with the rim somewhat thickened. The operculum is small and fills only about the anterior third of it in some specimens, while in others it fills about half. It tapers caudad. The usual setae latero-cephalad of orifice are absent. Color dark brown to black; under the microscope varying shades of brown.

Adult male.—Color yellowish red, shaded with black; forewings maculate as shown in plate 53, figure 14; hindwings uniform pale dusky; legs dusky, excepting the joints, which are yellowish; claspers and tip of abdomen dusky. Eyes and tip of labium brown to black. Antennae absent from the specimens in hand with the exception of one antenna of one specimen. From this it is impossible to make out the relative proportions of the segments, as the specimen is much shrunken. The condition, however, is sufficient to make out that many distinct transverse ring-like imbrications cover the segment. The third segment possesses a long, stout spine. Each clasper (pl. 53, fig. 12) is armed at its extremity with prong-like projections. The two distal ones of these are rather long and acute, whereas the more proximal one is short and conical. A number of spines are present, and the clasper is minutely pubescent. The penis (pl. 53, fig. 13) is enlarged at its distal extremity into a disk-like structure, which seems to have an opening or depression within it. Length of claspers 0.108 mm.; length of insect 0.8 mm.; length of forewing 0.64 mm.

Adult female.—Similar to the male; color of body almost wine colored; costal margin of forewing distinctly wine colored. Length of insect 0.88 mm. In some specimens the dark markings of the wings are more extended than in the figure. Antennae absent from all the specimens.

Described from pupa cases and males and females in balsam mounts.

Type.—Cat. No. 19202, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) PLUMOSUS (Quaintance).

Plate 57, fig. 1; plate 53, figs. 15–16.

Aleurodes plumosa QUAINTANCE, Tech. Ser. 8, Div. Ent., U. S. Dept. Agr., 1900, p. 33.

This species was described from Florida by the senior author and was inadvertently included in *Tetraleurodes* by the present writers in Classification of the Aleyrodidae.[1] The species is very abundant on cranberries, and many collections from these plants were received from the late Dr. C. W. Hooker, taken at Cranmoor, Wisconsin, in 1910. In these collections a large percentage of the pupa cases

[1] Bulletin 27, Tech. Ser. Bureau of Entomology.

represent a species of *Tetraleurodes*. It is evident, however, that these bear no relation to the present species. Specimens have been received also from H. B. Scammell from New Egypt, New Jersey, May 21, 1914, on cranberry, and from Pemberton, New Jersey, July 18, 1914, on blueberry.

Pupa case (pl. 57, fig. 1).—Size 0.96 by 0.704 mm. Shape oval, narrowest across the thorax. Abdominal segments not distinctly seen on account of the dark color, but in specimens which are sufficiently clear they are seen to extend almost to the margin of the case. Suture separating thorax and abdomen considerably curved cephalad, but not past the third thoracic segment. Margin composed of evenly rounded, very shallow teeth, from which suture-like markings lead mesad and give the appearance of a pore-like structure. Thoracic tracheal comb distinct; composed of usually four prominent teeth, which are evenly rounded and have at their bases clear areas similar to those at the base of the marginal teeth (pl. 53, fig. 15). Caudal tracheal fold armed with a comb similar to those on thoracic margin. Vasiform orifice (pl. 53, fig. 16) elongate, with the rim much thickened, the operculum filling about half the orifice. Setae latero-cephalad of orifice and about halfway between orifice stout and long. Dorsum with a few minute pores irregularly arranged. Transparent eyespots absent; color dark brown to black.

Adult male.—Color yellow, shaded with reddish brown on the thorax; eyes and tip of labium dark brown; wings transparent, the costal margins yellowish. Antennae imbricated; segment III 0.128 mm.; segment IV 0.02 mm.; segment V 0.032 mm.; segment VI 0.046 mm.; segment VII 0.05 mm. Segment III is armed with a distal, circular, fringed sensorium, and segment VII is armed near its middle with a prominent spine which extends beyond the distal extremity of the segment. Clasper 0.112 mm. long, slightly pubescent distad, and armed with a few stout spines; distal spur of the claspers acute, and just mesad of the spur is a double-lobed structure. Length of insect from vertex to tip of claspers 1.152 mm.; length of forewings 0.96 mm.

Adult female.—Similar to the male in general appearance. Much larger than the female characterized in the original description.

Type.—Cat. No. 19195, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) QUERCUS-AQUATICAE (Quaintance).

Plate 57, fig. 2; plate 53, figs. 17, 18.

Aleurodes quercus-aquaticae QUAINTANCE, Tech. Ser. 8, Div. Ent., U. S. Dept. Agr., 1900, p. 35.

This species was fully described by Quaintance. Several species of the genus are very closely related to it, especially *validus*, in which

the suture separating the thorax and abdomen is similarly curved. *Quercus-aquaticae,* however, has no dorsal spines on the thorax as has *validus,* and the pupa case is more constricted across the thorax.

Pupa case (pl. 57, fig. 2).—Shape oval, quite distinctly constricted across the thorax in the region of the thoracic folds. Suture separating the thorax and abdomen curved cephalad and almost reaching the margin of case on each side near the thoracic breathing pore. Abdomen on the dorsal disk with two rows of small clear pores at the lateral margins of the indications of segments. Lateral thoracic and caudal breathing folds indicated by dark areas, the combs consisting of usually four small, rounded teeth (pl. 53, fig. 17). Vasiform orifice (pl. 53, fig. 18) short and broad. Thorax with variable pigmentation, but without distinct spines. Size variable, larger specimens about 1.12 mm. long.

Type.—Cat. No. 14782, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) SCULPTURATUS, new species.

Plate 58, fig. 1; plate 59, figs. 1–4.

This remarkable species was taken on *Helicorna* at Panama by Mr. August Busck, April 5, 1911. It shows the most prominently developed rhachis in the genus, having this structure much more developed than has *cockerelli.* The pupa case is also very large, being nearly twice as long as in some other species of the genus.

Pupa case (pl. 58, fig. 1).—Size variable, about 2.4 by 1.76 mm. Shape elliptical; dorsum arched and possessing a very distinct rhachis, from which very prominent sutures extend laterad, marking the abdominal segments, and from which a large expanded portion extends cephalad. Color dark brown to black with this median area of a bright yellow, sometimes shaded with brown. Margin (pl. 59, fig. 2) composed of very shallow, evenly rounded teeth. From these suture-like markings extend for a very short distance mesad. Within these are three or four rows all around the case of small rounded papilla-like pores, mesad of which there are no pores until the edge of the rhachis is reached. On each side of the rhachis on most of the abdominal segments there is a group of three or four small circular pores (pl. 59, fig. 1), and a group of six or seven similar ones is situated on each side of the median line on the enlarged median thoracic structure. Laterad of these there is a reniform thickening of the integument. Thoracic tracheal folds evident, the combs being composed usually of two teeth (pl. 59, fig. 4). Vasiform orifice (pl. 59, fig. 3) broad and short, the operculum filling almost the entire orifice. Setae usually found latero-cephalad of the orifice absent.

Adults.—Unknown.

Described from pupa cases in balsam mounts.

Type.—Cat. No. 19203, U.S.N.M.

This species is in many ways quite different from others in the genus. The rows of papillae-like pores on the submarginal area are not met with in any other species and the huge size and prominent rhachis are very distinctive. *A. cockerelli*, however, seems to show affinities with the present species.

ALEUROPLATUS (ALEUROPLATUS) TRANSLUCIDUS, new species.

Plate 58, fig. 2; plate 60, figs. 8–14.

Two collections by R. S. Woglum prove to be this species. Both were made from orange. The first collection was made at Lahore, India, date unknown, while the second lot was taken at Wazirabad, India, in November, 1910. This species is the only one in the subgenus, so far as known, which has an almost colorless transparent case.

Pupa case (pl. 58, fig. 2; pl. 60, figs. 8 and 9).—Size 0.912 by 0.72 mm.; shape nearly elliptical, slightly constricted across the region of the thoracic folds; color semitransparent, whitish yellow; eyespots reddish brown. Dorsum with the sutures very indistinct. Margin (pl. 60, fig. 12) with evenly rounded shallow teeth, from which suture-like markings extend for a short distance mesad. Thoracic folds distinct, the comb composed of three or four rather prominent teeth (pl. 60, fig. 11). Vasiform orifice (pl. 60, fig. 10) subcircular in outline, with the latero-caudal margin thickened. These margins are covered with numerous dot-like markings or possibly very minute setae. The operculum nearly fills the orifice and is similar to it in shape, though much more compressed on the lateral margins. The pair of setae usually present near the cephalolateral margins of the orifice are in this species a pair of spines of about the same length as the orifice.

On the leaf the case is surrounded with a liberal, semitranslucent wax, in which may usually be distinguished many fine radiating lines of lighter wax. Owing to the evident adhesiveness of the wax the entire insect often becomes covered with dirt, appearing on the leaf as a dirty brown spot.

Adult male.—Color reddish, becoming yellow on the vertex, legs, and genital segments. Forewings with dark maculations as shown in figure 14, plate 60, the costal margins red. Hindwings uniform smoky; legs dusky, excepting at the joints; genitalia also dusky; eyes dark brown. Antennae absent from the specimens in hand; claspers (pl. 60, fig. 13) with numerous prominent spines, the distal extremity with two prongs, one long and one short one, and with a somewhat conical projection; proximad of these a slight pubescence visible. Penis usual; length of claspers 0.144 mm. Length of insect from vertex to tip of claspers 0.96 mm.; length of forewing 0.64 mm.

Adult female.—Similar in color to the male. The hindwings sometimes have transparent patches. Length 0.96 mm.; forewing 0.848 mm. The females, as in the males, lack the antennae.

Described from pupa cases, males and females in balsam mounts, and pupa cases dry on foliage.

Type.—Cat. No. 19204, U.S.N.M.

The adults of this species are very similar in many ways to those of *Aleurocanthus citriperdus*. The red color met with in this species as against the yellow color in *citriperdus* is not always a good distinction. In *citriperdus*, however, the claspers of the male possess fewer spines, and are less curved at their distal extremities.

ALEUROPLATUS (ALEUROPLATUS) VALIDUS, new species.

Plate 61, fig. 1; plate 59, figs. 5–7.

This species was received from Prof. S. F. Ashby on April 30, 1914, marked Hope, Kingston, Jamaica, host unknown. It is more nearly related to *quercus-aquaticae* than to any other species of the genus, but may be distinguished from it by the presence of prominent dorsal thoracic spines and by the character of the suture between the thorax and abdomen.

Pupa case (pl. 61, fig. 1).—Size 0.96 by 0.72 mm. Shape almost elliptical, with a slight constriction across the thorax at the region of the thoracic folds. Color brown, sometimes with a darker pigmentation along median area and around suture separating thorax and abdomen. Eyespots irregular, smaller than in *quercus-aquaticae;* extremities of thoracic folds not heavily pigmented. Form flat, the abdominal segments distinct only on the median dorsal area. Suture separating thorax and abdomen curved cephalad almost to the marginal extremities of the thoracic folds. In this character the species is similar to *quercus-aquaticae*. The suture is curved as far cephalad as in the type-species, but after leaving the median suture it is not curved as much caudad before its cephalic recurve as in that form. Thorax with two pairs of prominent clubbed spines, one pair on the median portion of each of the two caudal segments. Pores of the submarginal area arranged in groups very similar to those of *quercus-aquaticae*. Comb of the thoracic fold (pl. 59, fig. 7) armed with usually four teeth, which are very little larger than the other marginal teeth (pl. 59, fig. 5). Vasiform orifice (pl. 59, fig. 6) usual, if anything slightly more elongate than in *quercus-aquaticae*. Other characters, including waxy secretion, quite similar to those of that species.

Adults.—Unknown.

Described from pupa cases in balsam mounts.

Type.—Cat. No. 19191, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) VARIEGATUS, new species.

Plate 61, fig. 2; plate 59, figs. 8–11.

This species was taken in the gardens of the National Museum at San José, Costa Rica, by Ad. Tonduz, April 3, 1914. It was collected from the leaves of a species of *Psidium*. It is remarkable on account of the variegated character of several of the pupa cases.

Pupa case (pl. 61, fig. 2).—Size 0.96 by 0.72 mm. Shape tending to oval, narrowest across the cephalic portion and slightly constricted in the regions of the thoracic pores or combs, form flat. Abdominal segments distinctly separated only on the median dorsal region. Suture separating the thorax and abdomen extending in some specimens not at all and in others a very short distance cephalad of the suture of the caudal thoracic segment. Color varying from a yellow to a smoky brown. In specimens that are only partially dark this dark area is on the median dorsal region. Specimens showing the entire dorsum dark have the marginal teeth all around, the pores and the tubercles on which the spines are located transparent yellow; these structures then stand out very clearly. The thorax is armed with a pair of prominent clubbed spines on the median portion of the second and third segments (pl. 59, fig. 9), and another less prominent pair between the eyespots, which last are transparent and irregular. Scattered over the dorsum there are many minute clear pores. Vasiform orifice (pl. 59, fig. 11) subcircular in outline, with the margin thickened at its caudal part and armed within by minute striations; operculum straight on its cephalic portion, rather elongate, nearly filling the orifice. Just caudad of the vasiform orifice, and nearly to the margin of the case, there is a thickened area which extends to form the caudal comb of two teeth. On each side of this thickened area arise the spines which form the caudal pair, and the area itself is connected with the caudal margin of the orifice by a series of minute markings. In the dark specimens this small dotted region is outlined with a row of larger clear pores (pl. 59, fig. 11). The pair of spines latero-cephalad of the vasiform orifice are as long as the orifice itself. Region of the thoracic tracheal fold with a similar thickening some distance from the margin, which thickening is covered with similar minute markings (pl. 59, fig. 8). Teeth of the margin rather short, not acute, but rounded and covered with minute serrations (pl. 59, fig. 10). Extending inward from these teeth are irregular suture-like markings which meet a second series of such markings on the subdorsal area.

On the leaf the case appears black and is surrounded with a dirty white waxy secretion, with many conspicuous radiating threads of wax.

Adults.—Unknown.

Described from pupa cases in balsam mounts and dry upon foliage.

Type.—Cat. No. 19205, U.S.N.M.

ALEUROPLATUS (ALEUROPLATUS) VINSONIOIDES (Cockerell).

Plate 59, figs. 12–14.

Aleyrodes vinsonioides (Cockerell, Psyche, vol. 8, 1898, p. 225.

Two type slides of this species received under different dates are in the Bureau of Entomology collection. The species is also in the collection from Matanzas, Cuba, and was collected by N. L. Britton and Percy Wilson, September 9, 1903, and forwarded by Prof. F. S. Earle. It was taken on *Nectandra*.

Pupa case.—Size 1.056 by 0.832 mm. Shape oval, broadest across the abdomen. Abdomen distinctly marked off from the thorax, the suture separating them not curving distinctly cephalad, as in some other members of the subgenus. Abdominal segments flat. Color under microscope brownish black, with a pair of small, clear, circular eyespots on the cephalic portion of the case. Dorsum of case with a number of minute clear circular pores arranged as shown in the figure. The submarginal row of these pores is a considerable distance from the margin (0.096 mm.) and in this character is distinct from the two other closely related forms, *oculireniformis* and *oculiminutus*. The submarginal area between this row of pores and the margin of the case is marked with a series of lines and checks (pl. 59, fig. 14). The outer part of this lined area is more than twice the width of the inner, while on the cephalic portion of case there is sometimes part of a third series. Mesad of this submarginal row of pores there is no checked area as in *oculireniformis*. The margin itself is armed with a closely appressed series of evenly rounded shallow teeth, and the teeth of the comb at the ending of the thoracic folds are scarcely distinguishable from the remainder of the margin (pl. 59, fig. 13). Vasiform orifice (pl. 59, fig. 12) usual, more elongate than that of the type.

Adults.—Unknown.

Type.—Cat. No. 19207, U.S.N.M.

Orchamus, new subgenus.

Pupa case flat, thoracic and caudal folds more or less distinct; vasiform orifice rounded, and armed with a series of teeth on its inner, caudo-lateral margin. Shape of case usually elliptical, not twice as long as broad.

Type.—*Aleuroplatus* (*Orchamus*) *mammaeferus* Quaintance and Baker.

ALEUROPLATUS (ORCHAMUS) MAMMAEFERUS, new species.

Plate 60, figs. 1–7.

This species is represented in the bureau collection by only one lot of material taken on *Codiaeum variegatum* Linnaeus in January, 1911, by R. S. Woglum. It was collected at the Botanical Gardens, Buiten-

zorg, Java. So far as is known it is the only representative of the subgenus. The prominent combs on the margin of case are approached only by those of *pectiniferus*.

Pupa case (fig. 1).—Size 0.768 by 0.56 mm. Shape nearly elliptical. . Abdominal segments not distinct. Margin (fig. 6) armed with very shallow rounded teeth; just within the margin all around a row of prominent papillae is situated. These are usually knobbed (fig. 7), but some are cleft (fig. 2). Thoracic marginal comb very prominent and armed with long narrow teeth, those in the middle being longer than those at the sides of the comb (fig. 4). Caudal fold armed with a similar comb (fig. 3), the teeth of which stand out if anything more distinct on account of the fact that this comb is never depressed as is often the thoracic comb. Vasiform orifice (fig. 5) broadly rounded, with the interior margin straight and the inner, latero-caudal margins armed with a series of distinct teeth; operculum filling about one-third of the orifice. Color transparent, tinged with yellowish. On the leaf the case is dirty white or yellowish in color, and is surrounded with an irregular flat plate of translucent yellow wax.

Described from pupa cases in balsam mounts.

Type.—Cat. No. 19197, U.S.N.M.

Genus ALEUROTHRIXUS Quaintance and Baker.

Aleurothrixus QUAINTANCE and BAKER, Tech. Ser. 27, pt. 2, Bur. Ent., U. S. Dept. Agr., 1914, p. 103.

Pupa case medium to small in size, elliptic; margin sometimes angled; color variable, ranging from yellow to almost black; margin of case usually with an apparent double row of teeth, the wax tubes well developed; submarginal area not separated from the dorsal disk; dorsum without papillae or pores, but bearing along median line a few pairs of prominent spinelike hairs; tracheal folds not discernible; wax secretion usually copious, flocculent, or woolly, secreted by marginal wax tubes. Vasiform orifice small, transversely elliptic; lingula obscured by the operculum, which nearly fills the orifice.

Adult with one flexure in radial sector of forewing and no spur of media. Antennae of seven segments, of which III is longest. Sexes nearly equal in size.

Type.—*Aleurothrixus* (*Aleurothrixus*) *howardi* (Quaintance.)

KEY TO SUBGENERA OF ALEUROTHRIXUS.

1. Margin of case with apparent double row of wax pores, or teeth.....*Aleurothrixus*.
2. Margin of case without apparent double row, but with single row of wax pores, or teeth.....*Philodamus*.

Subgenus ALEUROTHRIXUS.

Pupa case with margins usually angled, color variable, margin of case with an apparent double row of teeth, wax tubes well developed; wax secretion flocculent or woolly; vasiform orifice small, transversely elliptic; lingula obscured by operculum.

Type.—Aleurothrixus (*Aleurothrixus*) *howardi* (Quaintance).

SPECIES OF SUBGENUS ALEUROTHRIXUS.

1. Pupa case with a row of distinct spines all around case on the submarginal area ..... *aëpim.*
   Pupa case without such row of spines ..... 2.
2. Pupa case with a row or comb of spinelike projections on the caudal margin of the vasiform orifice ..... *howardi.*
   Pupa case without such comb of spines ..... 3.
   Spines latero-cephalad of the vasiform orifice and on caudal margin of pupa case very long and prominent; color of case varying from yellow to brown.. *floccosus.*
3. Spines latero-cephalad of vasiform orifice and those on caudal margin of case short and vasiform; color dark brown ..... *porteri.*

ALEUROTHRIXUS (ALEUROTHRIXUS) AËPIM (Goeldi).

Plate 62, figs. 1–7.

Aleurodes aëpim GOELDI, Mitth. Schweiz. Ent. Gesell., vol. 7, 1886, p. 250.

This species was described from "mandioca doce" at Rio de Janeiro. The one character given in the description which would make the recognition of the species possible is the row of submarginal bristles. In the collection of the Bureau of Entomology there is a species showing submarginal bristles. It was taken on cassava (*Manihot utilissima* Pohl) at Rio de Janeiro by F. Noack, date unknown. There seems little doubt, therefore, that this is the species described by Goeldi.

Egg (fig. 1).—Length 0.144 mm.; considerably curved, the stalk arising near the base on the convex side; color yellowish brown, without sculpturing.

Early larva (fig. 2).—Size 0.304 by 0.176 mm.; shape elliptic; dorsum not arched, abdominal segments distinct; median dorsal area with two pairs of vasiform spines similar to those on the larvae of *floccosus;* submarginal area with a row of prominent spines which are longer than the vasiform spines on the middle of the dorsum. There are six pairs of these on the thoracic region and only three pairs on the abdominal region of the specimens we have for study. The caudal pair of these is very long and the latero-caudal pair delicate.

Pupa case (fig. 3).—Size 0.752 by 0.482 mm. Shape similar to that of *floccosus;* dorsum not arched, but vasiform orifice slightly elevated. Submarginal area with at least eight pairs of prominent spines, six pairs being situated on the thoracic region and two pairs upon the

abdominal region. It is possible that other pairs are present on the abdominal submargin, but the condition of the specimens is poor. Spines latero-cephalad of vasiform orifice and on the middle of the dorsum, as well as the caudal pair of the case, very long; vasiform orifice (fig. 7) as usual and nearly filled by the operculum; margin composed of evenly rounded teeth, though sometimes irregular, some teeth being longer than others.

Described from eggs, larvae, and pupae in balsam mounts.

ALEUROTHRIXUS (ALEUROTHRIXUS) FLOCCOSUS (Maskell).

Plate 62, fig. 14.

Aleurodes floccosa MASKELL, Trans. New Zealand Inst., vol. 28, 1896, p. 432.
Aleurodes horridus HEMPEL, Psyche, vol. 8, 1899, p. 394.
Aleurothrixus floccosus QUAINTANCE and BAKER, Journ. Agric. Research, vol. 6, 1916, p. 466, fig. 3.

In 1895 Maskell described this species from lignumvitae, from Jamaica. Three years later Hempel described his *horridus* from Guava from Brazil, and in 1907 the senior author described the woolly white fly of the orange under the name of *howardi*. Since these descriptions were made we have had an opportunity to study a large series of specimens from different regions and we have also had available Maskell's type slides of *floccosus*. There seems little doubt that Maskell's material and that described by Hempel represent the same species. With *howardi*, however, there is one point of difference. This is the comb of hair-like projections on the caudal margin of the vasiform orifice of the pupa case. In collections from orange from different regions both types are found side by side upon the same leaf. Some have the comb and some do not. The relation between these two forms, so closely associated, can be shown only by careful rearing experiments and comparison of all stages. In the meantime, therefore, we use the name *floccosus* for those pupa cases lacking the comb, and *howardi* for those cases possessing it.

Floccosus was first recorded upon orange by T. D. A. Cockerell[1] from Zapotlan, Mexico, collected by C. H. T. Townsend, July 5, 1902. This is also the first record for Mexico. It is, however, in the bureau collection from Laguna, Mexico, on orange, collected by Townsend, April 24, 1896.

Since complete descriptions of the species have been given by the authors mentioned, nothing further will be added here, excepting the records of the color phases. The typical phase and that represented by the types of *floccosus* and by *horridus* is the yellow one. All of the pupa cases are a uniform yellow. This phase is by far the most

[1] Synopsis of the Aleyrodidae of Mexico, in Mem. y. Riv Soc. Cient. "Antonio Alzate," vol. 18, p. 202.

abundant in the collections, being represented by 25 lots of material from different parts of the Americas. Two lots—one from Jamaica and one from Mexico—show a median dark brown stripe more or less developed. One collection from Brazil, of which the host is unknown, is remarkable in that the thorax of all the pupa cases is yellow, whereas the abdomen is uniform dark brown. This phase is very striking and so far has not been met with in any of the other collections. A fourth phase, and a fairly common one, has the dorsal disk dark brown and the submarginal area, together with the marginal tubes, yellow. It has been received from Florida, Brazil, and Costa Rica. Still another phase has the entire dorsum brown with the exception of the marginal tubes, which are yellow. This has been received from Argentina and Paraguay.

A. floccosus is common in the islands of the West Indies and occurs also in Florida, Mexico, British Guiana, Brazil, Argentina, Canal Zone, Chile, and Paraguay. In addition to the orange, lime, grapefruit, etc., *floccosus* has been taken on the sea grape (*Coccoloba uvifera*), *Plumeria* species, *Baccharis genistelloides*, guava, a coarse grass, and a climbing vine.

ALEUROTHRIXUS (ALEUROTHRIXUS) HOWARDI (Quaintance).

Plate 62, figs. 12, 13.

Aleyrodes howardi QUAINTANCE, Tech. Ser. 12, Bur. Ent., U. S. Dept. Agric., 1907, p. 9.

Aleurothrixus howardi QUAINTANCE and BAKER, Journ. Agric. Research, vol. 6, 1916 p. 466.

This species occurs upon the same hosts and in the same regions as *floccosus*. It was first recorded for the United States by Prof. P. H. Rolfs, September 25, 1900, at Miami, Fla., on sea grape.

Type.—Cat. No. 10823, U.S.N.M.

ALEUROTHRIXUS (ALEUROTHRIXUS) PORTERI Quaintance and Baker.

Plate 62, figs. 8, 11.

Aleurothrixus porteri QUAINTANCE and BAKER, Journ. Agric. Research, vol. 6, 1916, p. 466, fig. 3.

This species has been treated by the writers in their recent paper on the white flies attacking citrus plants. It is a common species in Chile.

Type.—Cat. No. 20190, U.S.N.M.

PHILODAMUS, new subgenus.

Pupa case with margins usually not angled; margin without an apparent double row of wax pores or teeth, but with a single row.

Type.—*Aleurothrixus* (*Philodamus*) *interrogationis* (Bemis).

ALEUROTHRIXUS (PHILODAMUS) INTERROGATIONIS (Bemis).

Aleurodes interrogationis BEMIS, Proc. U. S. Nat. Mus., vol. 27, 1904, p. 510.

This species has been fully described and figured by Bemis. The margin does not present an apparent double row of wax pores as in subgenus *Aleurothrixus*, but has a single row of teeth, the sutures between them extending a good way mesad. The operculum is very small and somewhat triangular, filling only a small portion of the orifice.

Paratype.—Cat. No. 7092, U. S. N. M.

Genus DIALEURODES Cockerell.

T. D. A. Cockerell, in his Classification of the Aleyrodidae[1] published in 1902, established the subgenus *Dialeurodes* and pointed out several important characteristics of the group. *Aleyrodes citri* Riley and Howard was indicated as type and *A. eugeniæ* and *A. aurantii* were also referred to this subgenus.

In a subsequent paper, The White Fly (*Aleyrodes citri*) and its Allies,[2] Cockerell cites as additional examples of *Dialeurodes*, *Aleyrodes croceata*, *A. fodiens*, and *A. piperis*. Some of the species referred to *Dialeurodes* by Cockerell do not belong to the group, as understood by us—i. e., *cotesii*, *piperis*, and *croceata*. The writers believe that *Dialeurodes* is of generic rank and have so indicated.[3]

While the species of *Dialeurodes* present a general uniformity in the presence of certain prominent characters, there are to be recognized several minor groups for which it has seemed necessary to erect subgenera. Species of this genus are largely oriental, and some of them are of especial interest by reason of their injuries to plants, as *D. citri*, *citrifolii*, etc.

Pupa case variable in size, elliptic to subcircular in outline; color usually yellowish, varying in some species to brownish; margin of case toothed, the wax tubes irregular in outline and but little developed; submarginal area not separated from dorsal disk; dorsum usually without papillae or pores; tracheal folds evident, in some species very conspicuous, terminating on margin of case in a pore, the folds often showing dot-like, linear, or polygonal markings; wax secretions absent or very scant. Vasiform orifice relatively small, transversely oval or subcircular, with or without comb of teeth on inner lateral and caudal margins; operculum large, mostly filling the orifice and obscuring the lingula.

Adult with one flexure in radial sector of forewing and no trace of media. Antennae of seven segments; segment VII not distinctly

[1] Proc. Acad. Nat. Sci. Phila., 1902, p. 280.
[2] Bull. 67, Fla. Agric. Exp. Sta., 1903, p. 662.
[3] Tech. Ser. 27, pt. 2, Bur. Ent., U. S. Dept. Agr., 1914, p. 97.

shorter than segments IV, V, and VI, but usually longer than these. Sexes about equal in size, the claspers of male with a few prominent spines.

Type.—Dialeurodes (*Dialeurodes*) *citri* (Ashmead).

KEY TO SUBGENERA OF DIALEURODES.

1. Vasiform orifice of pupa case armed with teeth on its inner caudal and lateral margins.....2.
   Vasiform orifice of pupa case not armed with teeth on its inner caudal and lateral margins.....3.
2. Pupa case with a distinct row of marginal spines; dorsal disk without a rhachis, but with an irregular row of pores on each side; thoracic tracheal folds distinct, often brightly colored.....Subgenus *Dialeuronomada*.
   Pupa case without a row of marginal spines; dorsal disk without rhachis or rows of pores; thoracic tracheal folds distinct, usually covered with small circular dots.....Subgenus *Dialeurodes*.
3. Pupa case without large simple pores on dorsum.....4.
   Pupa case with large simple pores on submarginal area of dorsum. Subgenus *Dialeuropora*.
4. Pupa case without a row of marginal or submarginal spines.....5.
   Pupa case with a row of marginal or submarginal spines; these often knobbed or vasiform; rhachis often very prominent.....Subgenus *Rhachisphora*.
5. Pupa case without a row of distinct small pores; rhachis not suggested.....6.
   Pupa case with a row of distinct small pores; rhachis suggested. Subgenus *Dialeuroplata*.
6. Thoracic tracheal folds not covered with polygonal markings.....7.
   Thoracic tracheal folds covered with polygonal markings, most numerous about the pores.....Subgenus *Rusostigma*.
7. Thoracic tracheal folds covered with linear ridges.....Subgenus *Rabdostigma*.
   Thoracic tracheal folds not covered with linear ridges, but usually with minute circular dots.....Subgenus *Gigaleurodes*.

Subgenus DIALEURODES Cockerell.

The first group within the genus is composed of species similar to *citri*. Two species of the subgenus were described from America, where they are orange pests of importance. The investigations of Mr. Woglum in India and Ceylon have discovered in that territory the presence of one of these forms, and it is considered probable that the second is also indigenous to those regions.

Pupa case elliptical, yellowish, with sometimes a median brownish area; marginal wax tubes represented by irregular, shallow corrugations on the submarginal area; vertical waxen fringe absent and case usually without waxy secretion of any kind; dorsal disk without sculpturing or large pores and with no development of a rhachis; thoracic tracheal folds ending on or near the margin in a pore and marked with minute circular dots; vasiform orifice broadly subcordate to subcircular, armed on its inner caudal and lateral margins with a comb of teeth.

Adult with forewings somewhat elongate, usually transparent, without thickened veins and no sensoria present; antennae with seg-

ment VII not shorter than segments IV, V, and VI, but usually longer than any of these; segments III to VII armed with a series of transverse or annular sensoria. Sexes nearly equal in size. Species tropical or subtropical, originally oriental, though now rather widely distributed.

Type.—Dialeurodes (*Dialeurodes*) *citri* (Ashmead).

KEY TO SPECIES OF SUBGENUS DIALEURODES.

1. Pupa case yellowish or whitish (without blackish coloration).....2.
   Pupa case with more or less dark brown or blackish coloration.....3.
2. The three tracheal folds covered with minute circular dots; size about 1.52 by 0.99 mm.; tracheal pores situated just within margin of case, margined mesad with a few blunt teeth and distad, with two claw-like lobes, the ends of which are almost in contact; adult with wings unmarked; eggs yellowish, without reticulations.....*citri*.
   Thoracic tracheal folds with minute circular dots, caudal fold furrowed and marked with squarish or polygonal areas; shape elliptical; size about 1.76 by 0.32 mm.; tracheal pores opening just within margin of case; forewing of adult with a distal clouded area; eggs dark, covered with reticulate waxy markings..*citrifolii*.
3. Tracheal folds faintly evident; shape broadly elliptical, pale yellowish except dorsal area, which is dark brown, with conspicuous light cross stripes along body segments; size about 0.8 by 0.74 mm.; vasiform orifice longer than broad; operculum about half filling the orifice.....*fodiens*.
   Tracheal folds and pores distinct.....4.
4. Color pale yellowish, almost transparent, with dorsal area dark brown.....5.
5. Vasiform orifice armed within with about 24–28 teeth; outline of case elliptic; size about 1.84 by 0.84 mm.; yellowish except a variable narrow longitudinal dark brown stripe on center of dorsum, more pronounced on thorax; tracheal folds well developed, covered with dot-like markings; pores opening just within margin of case, surrounded with chitinized ring; wings of adult unmarked; eggs yellowish, without sculpturing.....*kirkaldyi*.
   Color pale yellowish, almost transparent, but with a median dark gray or light-brown shading.....6.
   Color of submarginal area lemon-yellow, within this a dark irregular band; dorsal disk orange; margin white; shape subcircular, about 1.28 by 1.08 mm; tracheal folds distinct, dusky in marginal rim; pores opening within margin and surrounded with a chitinized ring; dorsum covered with granular spots, marginal rim with minute white dots; vasiform orifice armed within with about 12 prominent teeth.....*tricolor*.
6. Vasiform orifice armed within with about 12 distinct teeth; size 1.44 by 1.32 mm.; thoracic tracheal folds distinct, broadening rapidly from margin, the three folds thickly covered with rather large dots.....*radiipunctata*.

In regard to the position of the species *fodiens* Maskell, which is placed in the subgenus *Dialeurodes*, some statement is necessary. We know the species only from the one specimen in the Maskell collection, which is in rather poor condition. Two possibilities occur: First, it may not be a normal specimen of the species, and, second, it may not be the final pupal stage. In the specimen the tracheal thoracic folds and pores are hardly suggested. Since all other species similar to it show these characters very distinctly, the possibility of

the abnormality of the individual becomes greater. It seems wisest, therefore, to leave it in *Dialeurodes* until more material comes to hand for study.

The species *tricolor*, placed in this subgenus, also deserves mention. It is scarcely a typical *Dialeurodes* and possibly may represent a distinct subgenus; nevertheless, on account of the structure of the orifice and nature of the pores of the thoracic folds it is left here for the present.

DIALEURODES (DIALEURODES) CITRI (Ashmead).

Plate 63, figs. 1–14; plate 64, fig. 1.

Aleyrodes citri ASHMEAD, Florida Dispatch, new ser., vol. 11, 1885, p. —.
Aleyrodes citri RILEY and HOWARD, Insect Life, vol. 5, 1893, p. 219.
Aleurodes eugeniae var. *aurantii* MASKELL, Trans. N. Zealand Inst., vol. 27, 1896, p. 431.
Aleyrodes aurantii COCKERELL, Bull. 67, Fla. Agr. Exp. Sta., 1903, p. 666.
Dialeurodes citri (Ashmead) QUAINTANCE and BAKER, Journ. Agric. Research, vol. 6, 1916, p. 469.

The orange white fly was first described and named by Ashmead. Later a more complete and detailed description was given by Riley and Howard, and these authors have since been credited with the name. According to the rules of zoological nomenclature, however, Ashmead is to be considered as author of the species. In the same year that Riley and Howard's description appeared, H. A. Morgan published the description of another species on orange under the name *citrifolii*. This species was later confused with Ashmead's species. In 1896 Maskell published his description of *aurantii*, placing it as a variety of his *eugeniae*. As pointed out by the senior author, however, no difference can be noted between the specimens of *aurantii* in the Maskell collection and specimens of *citri;* and, subsequently, *citri* has been collected from numerous localities in India, the home of Maskell's *aurantii*. In the Florida Agricultural Experiment Station Bulletin 67 Cockerell raised *aurantii* to specific rank, and further expressed the opinion that the home of *citri* would probably be shown to be in the Orient. This has been fully substantiated by the collections of Messrs. Ehrhorn, Karnes, and Woglum. The specimens from which the original description of *citri* was made were probably secured from orange in Washington, District of Columbia, though specimens had previously been collected in several localities in the Gulf States. The species is now represented in the collection of the bureau from the following States in the United States: Alabama, California, Colorado, Florida, Illinois, Louisiana, Mississippi, North Carolina, Texas, and District of Columbia. The occurrence of the insect in Colorado, Illinois, and the District of Columbia is probably confined to conservatories. Specimens have been received from foreign countries as follows: India (Lahore; Gujranwala; Dehra Dun; Wazirabad; Am-

ritsar; Khasia Hills; Assam; Saharanpur); Japan (Nagasaki); China (Canton; Pekin; Shanghai). It is stated, on good authority, to occur in Chile; Mexico and Brazil are also given for the species by G. W. Kirkaldy.

In the original description of the first larval stage 38 marginal bristles are given. This seems evidently due to the fact that the margin possesses a series of small tubercles, some of which possess spines and some of which do not. The Riley and Howard slides of this instar show the correct number of spines for *citri*, but it was evidently supposed by those gentlemen that the tubercles not possessing spines had lost them and thus the full number of spines was described and figured. This fact led Morrill and Back to conclude that Riley and Howard's description was based on specimens of *citrifolii* (*nubifera*), for they remark:

"In the text the description of the first stage or instar of the larva was evidently based on a specimen of the spotted winged white fly and the illustration of the first instar was also based on the species with little doubt."

Egg (pl. 63, fig. 9).—The eggs are placed irregularly upon the under surface of the leaf and are greenish yellow in color, either polished or pruinose, due to the deposition of mealy wax by the adults. The surface is without the reticulate covering observed on the eggs of *citrifolii* Morgan. The stalk is situated at the larger end of the egg and is about as long as the egg is wide. Average size, 0.21 by 0.085 mm.; shape subelliptical. In hatching the egg splits almost its entire length and the two halves of the empty shell do not remain widely apart, as is the case with the eggs of *citrifolii*.

Larva, first instar.—Color light yellowish, with sometimes orange areas in the abdomen showing through; eyespots dark brown; shape oval, broadest across the anterior abdominal segments, flat upon the leaf. There is no lateral or dorsal secretion. Size 0.32 by 0.2 mm. Margin entire, armed with 17 small tubercles on each side, 14 of these bearing bristlelike hairs, as shown in figure 6, while 3 do not have these hairs. On the cephalic extremity there is another pair of short hairs situated somewhat ventrad of the margin. This makes in all a row of 30 hairs encircling the margin. Of these the second cephalic pair and the first and third caudal pairs are long, the others short. Antennae (pl. 63, fig. 8) of three segments, the third being lashlike and showing two angled spurlike portions, one at the extremity and one about a quarter of the way from the distal end. Legs (pl. 63, fig. 7) with a swollen portion at the distal extremity, the median segment and the proximal one each armed with a long curved spine.

Second instar.—Color pale yellowish, in some specimens with almost transparent areas; eyespots dark purplish brown. Shape oval, broadest across the first of the abdominal segments; size 0.4

by 0.26 mm., but varying considerably. Margin with minute irregular incisions and devoid of all hairs or bristles excepting a cephalolateral pair, one large caudal pair, and a smaller caudo-lateral pair. There is a slight constriction in the region corresponding to the tracheal pores of the pupa case, and sometimes there are a number of regular toothlike projections therein. The vasiform orifice is rounded cordate, the operculum similar in shape, with the exception that the lateral margins are somewhat constricted. The lingula is not visible. The dorsum is covered with numerous granular markings.

Third instar.—Color similar to that of the second instar; shape oval; size 0.59 by 0.432 mm. Margin with minute indentations and with three pairs of bristle-like hairs similar to those of the second instar. In this instar the three tracheal folds are evident and are marked within with a large number of minute circular transparent areas similar to those present in the folds of the pupa case. The vasiform orifice is similar in shape to that of the second instar.

Pupa case.—On the leaf the pupa cases are yellowish in color, sometimes slightly brownish. They are devoid of either dorsal or lateral secretion, are lighter toward the margin than on the median dorsal area, and the entire case when in certain lights often shows very beautiful hues and iridescent colors. The cases are placed upon the leaf without any definite arrangement as to the veins, but are nearly always situated on the under surface. There is a very narrow, acute, dorsal keel extending down the middle of the thorax and joining the transverse suture, which divides it from the abdomen. On the central dorsal area, that part immediately above the body of the developing adult, the segments of the body are distinctly marked, somewhat rounded, and the entire surface perfectly smooth and highly polished. The lateral area of the dorsal disk, however, is very minutely and irregularly striate, in some cases giving almost the appearance of minute punctures. The thoracic tracheal breathing folds are raised above the surrounding area, and the opereulum and caudal tracheal areas are usually slightly elevated. On the submarginal area the striations which show considerable irregularity on the dorsal area become more even, extending in from the margin. The marginal area is somewhat rounded, being curved downward slightly to meet the margin, which is considerably nearer the leaf than the highest point of the case. In some specimens the median area of the case collapses as the insect within dies, owing to drying upon the leaf. These are generally paler in color than those which have not shrunken.

Under the microscope (pl. 64, fig. 1) the color is pale yellowish, almost transparent on the margins and often somewhat darker on the median area, owing to the color of the viscera. In shape the case is subelliptical, tending toward oval in some specimens, and often

slightly constricted just caudad of the thoracic tracheal pores. Average length of case 1.52 mm. The margin (pl. 63, fig. 3) is armed with a series of minute tooth-like divisions from which suture-like markings extend mesad on the case. These markings are not of equal length, but usually every third one extends farther mesad than the others, giving the effect of a double series—a longer and a shorter one. The submarginal area, with the exception of that portion very close to the margin itself, is similar in structure to the dorsal disk. The sutures are evident upon the dorsum, but not strongly marked in mounted specimens. There are no dorsal spines. The tracheal folds (pl. 63, fig. 2) are prominent, their pores being situated either on the margin or very close to it. The ring of the pore is not armed with fimbriæ, or teeth, but is entire. It is, however, covered with series of minute circular markings. The fold itself is without any sculpturing of the dorsal derm, but on focusing down into the case a large number of minute transparent circular areas are visible, as shown in the figure. They are present on both of the thoracic and on the caudal tracheal folds. The vasiform orifice (pl. 63, fig. 4) is almost circular in outline; the inner caudal margin is armed with a varying number of short, acute, irregular teeth. The lingula is not visible, as it is obscured by the operculum. This latter is somewhat semicircular in outline, with the lateral margins constricted and the cephalic margin straight. The color of the orifice is somewhat darker than that of the remainder of the case, with somewhat more of a greenish cast.

Adult female.—The female is yellowish and dusted with white powdery wax. When at rest the wings are laid back against the sides of the abdomen. The head, which is covered with fine wax, is on this account white, with the exception of the eyes, which are chocolate brown. The basal segments of the antennae are white, pruinose, while the distal ones are usually yellow tinged with pale red. The wings, owing to their waxy covering, are white and opaque, the thorax and abdomen, as viewed from above, amber colored. There are occasionally seen on the thorax small brown markings. When viewed from below the body is yellow or amber colored, more or less dusted with white wax. The legs are sometimes tinged with red and the labium is tipped with dark brown. Under the microscope the color is yellow, with the eyes dark brown and the ocelli dusky. Length from vertex to tip of ovipositor 1.36 mm. The forewing (pl. 63, fig. 11) is 1.408 by 0.64 mm., clear transparent without any shading or marking; radial sector slightly curved and extending almost to the margin. Cubitus fine, but long and distinct; media rarely represented by a faint shading near the base of the radial sector; remnant of the vein as in species of *Aleyrodes*. Margin (pl. 63, fig. 14) armed with numerous teeth on which are small hairs. Hind tibia armed with a circle of prominent spines on its distal extremity and

with several longitudinal rows; length 0.48 mm. Proximal segment of hind tarsus armed with two longitudinal rows of spines, one composed of four spines and one of five spines. Other smaller hairs are present and a thicker spine is present on its distal extremity; length 0.16 mm. Distal segment armed with four spines; length 0.042 mm. Foot (pl. 63, fig. 12) with a central hairy paronychium and short curved claws. Antennae of seven segments (pl. 63, fig. 10). Segment II subpyriform, 0.06 mm. long, armed on its distal extremity with three or four prominent spines and numerous smaller hairs. Segment III subcylindric, tapering proximad and distad; the proximal half possesses imbrications, the distal half has usually six prominent transverse annular sensoria, and one distal circular fringed sensorium; length 0.114 mm. Segment IV 0.042 mm., subcylindric and armed with three or four transverse sensoria. Segment V 0.045 mm., subcylindric, and with usually four transverse sensoria. These are very fine and not prominent, as upon the other segments. Segment VI 0.054 mm., subcylindric, with four rather prominent transverse sensoria. Segment VII 0.06 mm., subcylindric, rather narrower than the other segments and armed with three or four transverse sensoria and two or three minute circular fringed ones; distal extremity tipped with a prominent bristle.

Adult male.—Similar to the female in general appearance, but smaller. Length from vertex to tip of claspers 1.28 mm. Antennae similar to those of the female. Segment II 0.054 mm.; III 0.111 mm., with usually six transverse sensoria; IV 0.045 mm., with about four transverse sensoria; segment V 0.045 mm., with three or four transverse sensoria; segment VI 0.051 mm., with five or six transverse sensoria; segment VII 0.06 mm., with four or five sensoria. Hind tibia 0.368 mm. long; hind tarsus 0.128 mm. for the proximal segment, and distal 0.08 mm. long. Claspers (pl. 63, fig. 13) 0.102 mm. from the distal extremity to the shoulder, and 0.084 mm. across to the shoulder, tapering, upcurved, and armed each with three large spines and a series of smaller hairs on its inner distal margin. Penis nearly as long as the claspers, tapering and upcurved at the tip, and bulbous at the base. Length of forewing 1.96 mm.

DIALEURODES (DIALEURODES) CITRIFOLII (Morgan).

Plate 65, figs. 1–14.

Aleyrodes citrifolii Morgan, Spec. Bull. Louisiana St. Exp. Sta., 1893, p. 70.
Aleyrodes nubifera Berger, Bull. 97, Florida Agr. Exp. Sta., 1909, p. 67.
Aleyrodes nubifera Morrill and Back, Bull. 92, Bur. Ent., U. S. Dept. Agric., 1911, p. 86.

The species described and figured by Morgan is easily separated from *citri*, redescribed by Riley and Howard in the same year, by the characters of the egg, pupa case, and of the adult. The egg in

particular easily separates the two species, and this stage was well described and figured by Morgan. It seems unnecessary, therefore, to discard Morgan's name for *nubifera*, which was proposed by Berger in 1909. In proposing this name Dr. Berger says "the reticulate egg was figured in 1893 by H. A. Morgan," but he makes no mention of the fact that descriptions of the pupa case and adults were also given. Morrill and Back in following Berger state that the description of the pupa and adult given at the same time were "evidently * * * based on specimens of *A. citri*." There seems, however, nothing in Morgan's description which would not be true for *citrifolii*, and as the egg definitely fixes the identity of the species, Morgan's name should be retained. *Dialeurodes citrifolii* is known from the following States: Florida, California, Louisiana, Mississippi, and North Carolina. No specimens of this species were taken by Mr. R. S. Woglum in the Orient, though it will probably be found to be native to that region. It is also known from Mexico and Cuba.

Egg (fig. 9).—The eggs are laid without any definite arrangement upon the under surface of the leaf. The egg is elliptical-elongate in shape, and in hatching the opening does not extend more than half way down the egg. This slit remains open, being different in this respect from the egg of *D. citri*. In size it is about 0.256 by 0.088 mm., and when first laid it is cream color, later changing to a slate or bluish black. It is pruinose and covered with a waxy coat in the form of hexagonal meshes (fig. 10). This may become dissolved in preparing mounts and is often broken from the egg in the dry state. This waxy covering and the dark color serve easily to separate the egg of *citrifolii* from that of *citri*. The stalk is attached to the base of the egg, is pale yellowish in color, and usually about as long as the egg is wide, though in some cases it is much longer.

Larva, first instar.—Color light-yellowish green, sometimes whitish, due to slight particles of wax on the ventral surface. At first there is neither lateral nor dorsal secretion, but soon an irregular waxy fringe, as wide as the length of the marginal hairs, is secreted. Shape elliptical; size 0.3 by 0.2 mm.; margin almost entire and armed with 18 pairs of hairlike bristles. Of these the first and third caudal pairs are much longer than the others, as is also the second cephalic pair. The antennae and feet are similar to those of *D. citri*.

Pupa case.—On the leaf the pupa cases are pale yellowish in color, rather white when the adult has emerged, and lack both dorsal and lateral secretion. They are much evener in shape than the cases of *D. citri*, being elliptical. They are extremely flat and thin and in this respect also differ from *citri*. In the character of the surface there is little difference between the two species, as *citrifolii* possesses the same almost smooth condition of the median portion of the dorsal disk and the same striations on the submarginal area. The

striations, however, seem to be a little more regular in most specimens of *citrifolii* than in those of *citri* and light is not so much reflected from the surface. The cases collapse when the adult has emerged. Balsam mounts by transmitted light show the cases yellowish in color, almost transparent; size 1.76 by 1.32 mm. (fig. 1). The margin (fig. 12) is very minutely serrate, and extending inward from it is a closely set series of narrow pointed wax tubes, which broaden as they extend mesad and collectively form a marginal band all around. The dorsal derm is closely set with irregular more or less circular markings which seem to be arranged more or less concentrically from the median dorsal area to the margin. On the submarginal area the thoracic and caudal tracheal folds are distinct, the openings of the thoracic pair (fig. 2) being near the margin and armed with six or eight rather distinct fimbriae. The caudal fold (fig. 3) is marked with numerous large and small irregular reticulations with differentiated centers. These are much larger and more irregular in size than the minute dots present within the folds of *D. citri*. The thoracic tracheal folds seem to lack these markings. The vasiform orifice (fig. 4) is subcordate, 0.051 mm. wide, and 0.048 mm. long. The inner caudal margin is armed with a rather large number of fairly distinct teeth directed cephalad; operculum similar in shape, with the anterior margin straight and the sides slightly compressed. It almost entirely fills the orifice. On each side of the vasiform orifice a minute seta is situated and a pair is present on the latero-caudal and cephalic margin.

Adult female.—Color very similar to that of *D. citri*, with the exception of a dusky spot on the distal extremity of the forewing, this being one of the characteristics by means of which it is easily distinguished. Length from vertex to tip of ovipositor 1.28 mm.; color in balsam mounts yellow, shaded with brown; forewing when mounted almost transparent with the exception of the shaded area before mentioned; venation similar to that of *citri;* size of the forewing 1.2 by 0.64 mm.; legs yellow in color; hind femora 0.304 mm.; hind tibia 0.432 mm.; armed with a longitudinal row of about 12 spines, with another row of similar spines placed about the same distance apart as those of the first row, and with still a third row of smaller spines placed very close together. Hind tarsus with the proximal segment 0.126 mm. long and armed with a longitudinal row of four spines, of which the distal one is the largest (fig. 13). Foot with claws not greatly curved and with the paronychium rather broad (fig. 14).

Antennae (fig. 5) of seven segments. Segment I subglobose; II subpyriform, 0.06 mm. long and armed with a few prominent spines; III subcylindric, somewhat tapering distad and proximad, 0.126 mm. long, armed with 25 or 30 very fine annular sensoria, and near

the distal extremity with two circular sensoria. These last (fig. 6) are composed of a central thumb-like process surrounded by a ring on which three or four stout bristles are situated. Somewhat proximad of these two sensoria is a rather long but not easily distinguished spine. Segment IV 0.021 mm. long, subcylindric, and armed with four or five fine transverse sensoria; segment V subcylindric, about 0.036 mm. long and armed with seven or eight transverse sensoria and a distal circular sensorium. Segment VI subcylindric, about 0.03 mm. long, armed with six or seven transverse sensoria, and at about its middle with a long spine. Segment VII 0.057 mm. long, tapering considerably distad, and armed on its proximal portion with a number of faint transverse sensoria. On the basal third there is situated a long spine, and the distal extremity is tipped with a very prominent spine measuring 0.027 mm. in length; the long spines arming the segments, with the exception of the distal spine, are very difficult to see in some specimens and in some do not appear to be present at all. The antennae of the adult are considerably different from those of *citri*—first, as regards the length of the respective segments; secondly, the sensoria are much more numerous and smaller; and thirdly, the distal spine is about as long as in *citrifolii*.

Adult male.—Similar to the female in general appearance, but somewhat smaller; length from vertex to tip of claspers from 0.88 to 1.04 mm.; forewing, length 0.96 mm.; hind tibiae 0.336 mm.; hind tarsus, proximal segment 0.112 mm., distal segment 0.08 mm. The claspers (fig. 8) are about 0.12 mm. long, and 0.075 mm. broad at the shoulder. They are tapering, upcurved, and armed with a few spines and hairs. The penis is about as long as the claspers, is curved dorsad, bulbous at the base, and narrowed distad.

DIALEURODES (DIALEURODES) FODIENS (Maskell).

Plate 66, figs. 1–4.

Aleurodes fodiens MASKELL, Trans. N. Zealand Inst., vol. 28, 1896, p. 433.

Pupa case (fig. 1).—The pupa case of this species is the smallest in the genus thus far known, measuring only 0.8 by 0.72 mm.; the margin is entire, though faint sutures are evident, extending mesad through a narrow, evident submarginal area. There are no distinct caudal or thoracic tracheal folds or pores, and in this regard it differs from the other species. The remaining characters and general appearance, however, undoubtedly place it here. The thoracic and abdominal segments are plainly marked off by light yellow sutures on a median dark brown area; derm of dorsal disk shagreened; the remaining portion of the case is yellow to almost transparent; the eyespots are large, granular, and purple in color; the vasiform orifice (fig. 2) is elongate cordate; the rim thick and the cephalic

margin slightly curved caudad. The caudal and lateral margins inside are armed with a number of short, acute fimbriae; the lower inner lining of the orifice is coarsely reticulate, giving it an irregular serrate appearance. The operculum is semicircular or slightly crescent shaped, and about half fills the orifice, obscuring the lingula, which is setose and armed with two fine bristles (fig. 3).

Represented by one pupa case in balsam in the Maskell collection.

Habitat.—New Zealand, on *Drimys axillaris*, on the leaves of which it produces a characteristic pitting.

DIALEURODES (DIALEURODES) KIRKALDYI (Kotinsky).

Plate 67, figs. 1–13; plate 64, fig. 2.

Aleyrodes kirkaldyi KOTINSKY, Bull. 2, Bd. Agr. and Forestry, Hawaii, 1907, p. 95.

Paratypes of this species are in the bureau collection and consist of eggs, larvae, and pupa cases. We have also for study specimens of pupa cases and adults taken by Mr. G. E. Bodkin, on leaves of jasmine, Georgetown, Demerara, British Guiana, February, 1912.

Egg.—Size about 0.178 mm. long by about 0.096 mm. wide a short distance from the unstalked end, narrower at the stalked end; color yellowish. In hatching the egg splits downward for 0.09 mm. and spreads open considerably; surface without sculpturing; stalk attached near the middle.

Larva, first instar (pl. 67, fig. 11).—Size 0.24 by 0.16 mm.; regularly elliptical; color light yellow, with dark brown eyespots. There are on the margin of the specimens at hand 14 pairs of hairs, the position of which is best shown in the figure. It will be noted that there are a number of marginal papillae on which no hairs are shown, while in one of our specimens there are no hairs on any of the papillae of the cephalic half. This absence of hairs from some tubercles may be due to imperfect specimens, but this occurs in *citri* Ashmead, where it is normal.

Pupa case (pl. 67, fig. 1).—Much resembles *citri;* size about 1.84 by 0.846 mm.; many of the cases, however, are smaller than the above dimensions; shape elliptical, with slight indentations on margin at the pores of the tracheal folds; form flat, thoracic sutures plainly visible as transparent lines on the dark brown median area; abdominal segments not distinct. Color transparent or yellowish, with a median brown longitudinal area. This sometimes occurs only on the thorax, and again it extends caudad to the vasiform orifice. Tracheal folds (pl. 67, fig. 3) marked with minute dots, the pore located near the margin and being without fimbriae, though with a distinct rim. Vasiform orifice (pl. 67, fig. 2) cordate, somewhat rounded, with the cephalic margin straight. The caudal margin is armed with 25 or 30 rather well-defined fimbriae or teeth; size of orifice 0.039 by 0.039 mm.

The operculum is of very much the same shape as the orifice, but indented on the lateral margins. It almost fills the orifice and obscures the lingula, which is spatulate. On either side of the vasiform orifice a small seta is situated. Margin of case marked by a large number of closely appressed sections formed by the sutures of wax tubes.

Adult male.—Length from vertex to tip of claspers 0.85 mm.; color yellowish, with a slight tinge of brown on the thorax; ocelli dusky; eyes dark brown, almost black; vertex rounded; antennae (fig. 10) of seven segments. Segment I subcylindric, short and thick, 0.018 mm. long; II 0.045 mm., subpyriform, armed on its distal extremity with a number of hairs; III 0.096 mm., subcylindric, narrow proximad, where it is covered with numerous imbrications, distal two-thirds armed with about 15 narrow transverse sensoria, or annulations, the distal extremity also armed with a circular fringed sensorium the marginal fringe of which is composed of three or four stout hairs; IV 0.012 mm., with three annular sensoria; V 0.012 mm., also with three annular sensoria, and a circular fringed sensorium; VI 0.063 mm., subcylindric, narrower and imbricated proximad, the distal two-thirds armed with 10 or 12 annular sensoria, and the distal extremity with a fringed sensorium; VII 0.06 mm., subcylindric, armed with about 10 annular sensoria, and near the distal extremity one or two small circular fringed ones; distal extremity tipped with a rather stout spine. Legs almost transparent; distal extremity of the hind tibia armed with two prominent spines on its inner edge; proximal segment of tarsus armed on its distal extremity with a large spine (pl. 67, fig. 9). Five other spines, somewhat shorter, are present on the median portion of the segment in two rows, one row of two spines and one row of three; distal segment of tarsus with three prominent spines on its inner margin, and also a large number of fine hairs; proximal segment of hind tarsus 0.088 mm.; distal segment 0.06 mm.; foot 0.015 mm. (pl. 67, fig. 8), with a median hairy paronychium. Forewing (pl. 67, fig. 6) 0.72 mm. long and 0.24 mm. wide; radial sector bent very slightly in its median part and extending almost to the distal margin; media sometimes faintly indicated by a shading, but usually this is not evident; cubitus fine and distinct, rather long and in the usual position; margin of wings with a series of bead-like structures, on which hairs are situated; color clear without spots or shading; claspers (pl. 67, fig. 7) 0.1 mm. long and 0.06 mm. broad at shoulder, tapering, upcurved, acute at the distal extremity, and armed with about five spines on each. Penis elongate, acute, and upcurved distally, bulbous at the base. The testes may be seen through the abdomen as orange-yellow masses composed of globular-like bodies. The rectum leads from the vasiform orifice as a narrow tube, which extends the full length of the genital

segment. In the next abdominal segment it is enlarged (pl. 67, fig. 13) and contracts again as it is leaving this segment.

Adult female.—Color of specimens preserved in alcohol pale yellowish to almost white, with a large dusky area on the dorsum of abdomen; wings transparent, colorless, with sometimes a faint dusky shading; eyes dark brown.

Length from vertex to tip of ovipositor 1.12 mm.; forewing 1.28 mm. by 0.56 mm.; hind tibiae 0.432 mm.; proximal segment of tarsus armed with two longitudinal rows of stout spines, of which the distal one of the rows is especially stout. There are also on the segment, particularly on the distal part, a large number of fine hairs. The distal segment is armed with two pairs of stout spines and numerous fine hairs; claws not strongly curved; paronychium long, acute, and hairy; vertex rounded. Antennae of seven segments, the first subcylindric, short, and thick; second subpyriform; third and distal ones subcylindric and armed with annular sensoria. These are more prominent on segments VI and VII than on the others. Segments III and VII are each also armed distad with a circular, fringed sensorium, and VII is tipped with a bristle. Length of segments as follows: I 0.021 mm.; II 0.048 mm.; III 0.105 mm.; IV 0.015 mm.; V 0.024 mm.; VI 0.045 mm.; VII 0.06 mm. The radial sector is prominent in the forewing and curved on its distal part, while the cubitus is faintly represented; the margin of wings is armed with knob-like projections on which minute hairs are situated. The ovipositor is acute, distinctly three-cleft, and dark in color. It is armed with stout spines, the distal ones of which are long, extending almost to the tip of the ovipositor itself.

DIALEURODES (DIALEURODES) RADIIPUNCTA, new species.

Plate 66, figs. 5–7.

Pupa cases of this species were received from Mr. A. Rutherford, and marked Memexylon, Peradeniya, Ceylon, November 10, 1913. The species is interesting as it shows the ring of teeth present on the inner margin of the vasiform orifice, as in the typical subgenus *Dialeurodes*, whereas the other characters are those of that group of the genus (*Rusostigma*) wherein these teeth are lacking.

Pupa case (fig. 5).—Size 1.44 by 1.312 mm.; color pale yellowish, almost transparent, with a median dark gray or light brown shading. Suture separating the thorax and abdomen distinct and extending to the margins; margin almost entire, the wax tubes being represented by very shallow irregular teeth; submarginal area closely striate, with suture-like markings forming a distinct zone around case. Tracheal pores (fig. 7) distinct, situated a short distance from the margin and armed within with four or five very irregular teeth; tracheal fold marked with many small circular dots forming a band,

which broadens as it reaches the subdorsal region. Vasiform orifice (fig. 6) broadly subcordate with the cephalic margin almost straight; rim of the orifice thick and its inner caudal and lateral margin armed with about 12 distinct teeth. Cephalic margin armed with a peculiar thickened area which clasps the orifice at the sides like the cup of an acorn; operculum similar in shape to the orifice and nearly filling it, obscuring the lingula; latero-caudad are two ridges which approach one another, suggesting the caudal channel present in some other forms.

Adults.—Unknown.

Type.—Cat. No. 19049, U.S.N.M. Described from pupa cases in balsam mounts.

DIALEURODES (DIALEURODES) TRICOLOR, new species.

Plate 66, figs. 8–13.

Foliage of a myrtaceous plant infested with this insect and collected at Eubato, Brazil, was received by the Bureau of Entomology in July, 1898, from Dr. F. Noack. A balsam slide mount containing five pupae is all of this material which we now have. The species, however, is quite distinct and is easily recognizable.

Pupa case (fig. 8).—Under reflected light the case appears brownish in color and is apparently void of waxy secretion. Examined under the microscope, the coloring is found to be about as follows: All around margin is a rather narrow border, the inner margin showing an interrupted line of pale yellow. The submarginal area is lemon yellow and the dorsal disk orange in color. Surrounding the dorsal disk is an irregular band of dark brown covering the vasiform orifice and extending cephalad to the transparent marginal rim, where it spreads out, forming a broad arrow-shaped figure (fig. 8). The shape is subcircular, margin flattened, and dorsum somewhat convex; size 1.28 by 1.088 mm. Margin (fig. 9) minutely incised; the sutures between wax tubes are quite distinct, extending mesad to the yellow subdorsal area. Derm thickly marked with granular spots, very evident under reflected light. Transparent marginal area with rather numerous, large, more or less circular markings. This rim is very generally sprinkled with minute lighter colored dots. On inner margin of transparent marginal rim is an interrupted row all around covered by rather prominent subcircular brown spots. Thoracic segments distinct; abdominal segments moderately so. Tracheal folds evident toward margin of case, ending just within margin in the transparent rim or band. The pore (fig. 10) is bordered all around with brownish. There appear to be no fimbriae or teeth around pore orifice, but the derm is marked with closely set radiating lines.

Vasiform orifice (fig. 11) subcordate, the inner caudal margin armed with 12–14 prominent teeth or fimbriae. Operculum about half filling orifice and of same general outline, minutely setose on caudal margin. Lingula (fig. 12) lingulate and setose, with a pair of spines on distal end.

Adults.—Unknown.

Described from 5 pupa cases in balsam mount.

Type.—Cat. No. 19050, U.S.N.M.

RUSOSTIGMA, new subgenus.

This group is represented by species from India, Japan, and the East Indies.

Pupa case broadly elliptical or subcircular, yellowish, with sometimes a median brownish or blackish area; marginal wax tubes represented somewhat as in subgenus *Dialeurodes;* wax secretion usually absent; dorsal disk without large pores or a distinct rhachis, but often marked with minute semicircular or polygonal markings in the derm; thoracic tracheal folds prominently sculptured with polygonal markings, and opening, usually a short distance within the margin, in a distinct pore which is armed with a number of teeth; vasiform orifice broadly subcordate, its inner caudal and lateral margins without a comb of teeth; adults with forewings rather broader than in *Dialeurodes,* usually somewhat heavily and more or less irregularly clouded, veins somewhat thickened and often possessing sensoria. (Antennae absent from the specimens in hand.)

Type.—Dialeurodes (*Rusostigma*) *radiirugosa* Quaintance and Baker.

KEY TO SPECIES OF SUBGENUS RUSOSTIGMA.

1. Median dorsal area without dark brown coloration.....2.
   Median dorsal area dark brown with conspicuous cross stripes along body segments; remainder of case yellowish; tracheal folds distinct and marked with polygonal areas, pores some distance within the margin; case elliptical; size about 0.8 by 0.74 mm.; margin entire; vasiform orifice longer than broad; operculum more than half filling orifice.....*eugeniae.*
2. Thoracic tracheal folds brownish, the polygonal markings broadening on the subdorsal area forming a T-shaped figure; dorsum of case with faint polygonal markings; outline subcircular; size 1.6 by 1.4 mm.; mesal margin of tracheal pores with several more or less curved fingerlike processes.....*radiirugosa.*
   Thoracic tracheal folds concolorous with case, the markings not broadening out on subdorsal area into a T-shaped area; submarginal area with semicircular, notched markings in derm which graduate into polygonal markings toward dorsal area; color of case yellowish, elliptical in outline and rather convex; size about 1.52 by 1.28 mm.; eggs small, brown.....*tokyonis.*

DIALEURODES (RUSOSTIGMA) EUGENIAE (Maskell).

Plate 68, figs. 1–5.

Aleurodes eugeniae MASKELL, Trans. N. Zealand Inst., vol. 27, 1896, p. 430.

This species is represented by one pupa case in balsam mount in the Maskell collection. It is in rather poor condition, being more or less covered with a fungous growth.

Pupa case (fig. 1).—Size 1.38 by 1.04 mm. Outline regularly elliptical; median dorsal area dark brown, on which the prominent thoracic sutures show clearly transparent. The abdominal sutures are not so distinct. The tracheal folds (fig. 3) show very prominently owing to a reticulate sculpturing with which they are covered. The pores (fig. 2) are situated some distance in from the margin and are armed with about 16 rather distinct teeth. The fold is delineated by fine ridges, which border the sculptured area and encircle the outer margin of the pore. The vasiform orifice (fig. 4) is subcordate in outline, with the cephalic margin but little rounded. The inner margin of the orifice is devoid of teeth common to *citri* and *citrifolii*. The operculum is of much the same shape as the orifice and nearly fills it. The tip of the setose lingula appears to protrude below the caudal margin of the operculum for some distance, but this may be due to the preparation of the mount. The marginal area of case is marked by sutures running a considerable distance mesad, forming a zone all around case, about one-third diameter of case.

Adults.—Unknown.

Habitat.—India, on *Eugenia jambolana*.

DIALEURODES (RUSOSTIGMA) RADIIRUGOSA, new species.

Plate 69, figs. 1–9.

This species is represented by two lots of material. One lot was taken on mango by R. S. Woglum, Brilliton Isle, Dutch East Indies, February 5, 1911, and the other was taken on a "woody shrub" by C. L. Marlatt at Gerolt, Java, December 7, 1901. The material in both cases is composed of pupa cases only. The species suggests *eugeniae*, owing to the distinct reticulate areas of the tracheal folds. It is readily distinguished from this species, however, by the extent of the reticulate area, and the unsculptured, circular area immediately surrounding the marginal pore.

Egg.—Short, ovate, with short stalk, the eggs being held upright on leaf; color dark brown, apparently without reticulation.

Pupa case (fig. 6).—As seen on leaf the color is dirty white or yellowish. The dorsal disk is but little elevated, and the submarginal area is rather clearly delineated as a radiate band all around, this appearance resulting from the sutures of the wax tubes. The case is void of any waxy secretion; under the microscope the color

is yellowish, or nearly colorless, with brownish shading over the tracheal pores; shape elliptical to subcircular; size 1.6 by 1.4 mm. (Parasitized specimens are of quite a different color, being more or less shaded with dark brown on the dorsal disk. This is often very dark and extends almost to the cephalic extremity of the case.) The dorsum is very slightly elevated, but more so in parasitized individuals, and the abdominal segments are quite distinct. The thoracic and caudal tracheal folds are very distinct; the pore itself (fig. 8) is situated a short distance mesad of the margin, and is armed with seven or eight rounded processes. Surrounding these is a clear area without sculpturing and inclosed by a distinct ring. Outside of this ring, surrounding it and extending for a considerable distance mesad, is a series of dark sculptured areas, irregular in size and shape. The band of these sculptures extending from the caudal breathing fold reaches the vasiform orifice and extends around on both sides, though the markings are not present cephalad of it. The bands extending from the thoracic breathing folds are crossed by similar longitudinal ones on the outer margin of the dorsal disk. The entire dorsum excepting the extreme central portion of the dorsal disk is covered with faint irregular coarse sculpturing (fig. 9). The vasiform orifice (fig. 7) is somewhat rounded cordate, with the cephalic margin straight. Entad of the lateral and caudal portion of rim the surface is minutely spinose. The operculum is similar in shape to the orifice and almost completely fills it, leaving the extreme setose tip of the lingula exposed. The margin of case is almost entire, being marked with minute indentations between wax tubes, the sutures extending mesad as faint markings, which gradually merge into the faint dorsal sculpturing above mentioned.

Adult female.—Color light brownish, darker on the thorax and on dorsum of abdomen. There is a dark circular marking around the vasiform orifice. The legs are brown. We are unable to give the length of the insects, as the specimens we have are shrunken and broken. The antennae, too, are either absent or so shrunken in the specimens at hand that no description can be given. Forewing (fig. 1) 1.54 by 0.80 mm., covered thickly with white meal-like powder and appearing rather bluish in color. When mounted and examined under the microscope the wing appears rather uniformly brown or smoky in color. The radial sector is thick and irregular, and on its proximal portion and in about the middle two circular sensoria (fig. 2) are noticed. Each of these is surrounded by a clear irregular transparent area. Toward the distal extremity the radial sector is strongly curved. There is a clear, unshaded, narrow band which seems to represent the cubitus and another shorter line of a similar nature. Although the body of the wing is uniform smoky, there are a number of darker areas represented. These are generally situated

about the veins, as may be seen in the figure. A distinct dark area is present between the two transparent lines before mentioned. The margin (fig. 3) is armed with a large number of toothlike projections armed with hairs. The hind wing (fig. 4) is similar in color but more uniform than the forewing. The vein is armed with one or sometimes two sensoria similar to those in the radial sector of the forewing. The proximal portion of the costal margin is armed with a series of stout hairlike spines situated on small tubercles. These are in two series—one on the outer and one on the inner portion of the vein. The vasiform orifice (fig. 5) is somewhat cordate in shape, with the anterior margin straight.

Described from specimens on foliage and in balsam mounts.

Type.—Cat. No. 19051, U.S.N.M.

DIALEURODES (RUSOSTIGMA) TOKYONIS (Kuwana).

Plate 68, figs. 6–10.

Aleyrodes tokyonis KUWANA, Pomona Journ. Entom., vol. 3, 1911, p. 622.

Egg.—Short, stout, smoky brown in color, and without reticulations; stalk quite short, holding egg on leaf in upright position.

Pupa case (fig. 6).—Size 1.52 by 1.28 mm.; outline almost entire, with slight indentures at the pores of tracheal folds; dorsum slightly rounded, with the sutures not very distinct; color transparent, slightly yellowish. The dorsal disk is granular, being covered with a series of small polygonal markings which graduate on submarginal area into more or less concentrically arranged, but disconnected, thickenings in the derm, the individual thickenings showing one or two acute incisions, as shown in figure 7. Tracheal pores covered with irregular markings quite similar to those found in *eugeniae*, but they are much more numerous toward the pores (fig. 8), which are surrounded very thickly by them. In the thoracic folds the sculptured area does not extend so far mesad as in the caudal fold, where it reaches the vasiform orifice and partially surrounds it. The pore of each fold is small and irregular and there are no distinct processes, though blunt, tooth-like projections are sometimes noticeable. The vasiform orifice (fig. 9) is subcordate in outline, with the anterior margin straight. The caudal inner margin is devoid of teeth, but is covered with a series of fine hairs. The operculum is somewhat the same shape as the orifice, though with straighter sides. It nearly altogether covers the lingula, only the tip of which protrudes from below it; both the lingula and the caudal portion of the operculum are setose. The margin is minutely serrate, but it is marked by a large number of ridges or sutures extending irregularly mesad, so that in some specimens there appears to be a marginal rim.

Host.—Ilex integra Thunberg, and the locality Shibuya, Tokyo.

The above description is based on a study of paratype material kindly furnished by Mr. Kuwana.

DIALEURONOMADA, new subgenus.

In some characters the type-species is related to those of the subgenus *Rachisphora*, and in others related to the typical *Dialeurodes*. So far as our present knowledge goes it is the only example of this type.

Pupa case elliptic or oval, pale yellowish white in color, with visible visceral markings of bright red-orange or bright yellow; marginal wax tubes evident as distinct, but shallow, irregular tooth-like divisions of the margin, the sutures between which extend a considerable distance mesad; dorsal disk without sculpturing, but near its margin all around one or more rows of moderate sized pores; no rachis present, and on submarginal area no series of large pores; margin all around armed with a series of spines; thoracic tracheal folds distinct, either unsculptured or covered with minute dots; the pore armed within with usual lobe-like projections; vasiform orifice very broadly subcordate, almost semicircular, its inner caudal and lateral margin armed with prominent teeth; operculum almost entirely filling orifice.

Type.—Dialeurodes (*Dialeuronomada*) *dissimilis* Quaintance and Baker.

DIALEURODES (DIALEURONOMADA) DISSIMILIS, new species.

Plate 70, figs. 1–4.

This species was collected by R. S. Woglum on *Phyllanthus myrtifolium* at Saharanpur, India, November, 1910. It is represented in the Bureau of Entomology collection by pupa cases only.

Pupa case (fig. 1).—Size 0.98 by 0.66 mm.; shape oval, with considerable constriction along sides of thorax, and broadened across the cephalic abdominal segments; form flat. On the leaf only a few specimens are available for study. They lack either dorsal or lateral secretion and are white or grayish in appearance. Under the microscope the cases which are empty are transparent; those, however, which contain the pupa are pale yellowish, with a large irregular central dorsal patch of bright red. A number of circular or oval areas, varying in size, some transparent and others not, are present in this red area. The margin of case (fig. 3) is composed of a series of closely placed wax tubes, from which there extend mesad suture-like markings on the derm. Some of these, on the average every third, extend much farther mesad than the others, in this respect resembling considerably those of *citri* Ashmead. A series of 12 spine-like hairs is present on each side of the case.

The suture separating the abdomen from the thorax is not distinct in all specimens and the thorax is remarkable in being of about the same length as the abdomen. On the outer margin of the dorsal disk, extending all around the case, there is a ring composed of one or two rows of papilla-like pores (fig. 1). The vasiform orifice (fig. 2) is considerably broader than long, measuring the orifice proper, but the outer margin of the orifice extends cephalad, making the depth of the entire structure almost equal to the width. The inner lateral and caudal margin of the orifice is armed with usually 16 prominent rounded fimbriae, or teeth. The cephalic margin of the orifice proper is straight; the operculum almost entirely fills the orifice, being somewhat triangular in shape. The tracheal pore (fig. 4) has no distinct fimbriae, but has an irregular rim. The fold is marked with a number of suture-like markings extending mesad, and a large number of dots similar to those on the folds of *citri* are visible. These, however, are not upon the dorsal derm of the fold, but on the ventral portion as seen by focussing through.

The species can be easily distinguished from others in the genus by the marginal hairs, the ring of papilla-like pores on the border of the dorsal disk, and by the large bright red dorsal marking.

Adults.—Unknown.

Type.—Cat. No. 19052, U.S.N.M.

RABDOSTIGMA, new subgenus.

Somewhat related to the subgenus *Rusostigma* is the species *radiilinealis* from Ceylon. This species is as yet the only example of this type, wherein the polygonal areas of the tracheal fold, as shown in the species of *Rusostigma*, are replaced by linear thickened lines.

Pupa case.—Subcircular, usually yellowish, margin almost entire, the wax tubes being merely portions of the margin which are separated by sutures extending mesad; waxy secretion usually absent; dorsal disk without sculpturing or large pores and with no development of a rhachis; thoracic tracheal fold ending near the margin in a pore which is armed within with several teeth; fold marked with thickened linear lines; vasiform orifice roundly subcordate to subcircular; comb of teeth absent; operculum similar in shape and almost entirely obscuring the lingula.

Type.—Dialeurodes (*Rabdostigma*) *radiilinealis* Quaintance and Baker.

DIALEURODES (RABDOSTIGMA) RADIILINEALIS, new species.

Plate 70, figs. 5–8.

This form is represented in the Bureau of Entomology collection by the pupa case only, which was taken by Mr. C. L. Marlatt, on mistletoe, at New Ava Eliya, Ceylon, January 26, 1902. The species

is quite distinct by the presence on the tracheal folds of long, linear thickenings of the derm. The immature stages make pits on the lower surface of the leaf, resembling in this way *fodiens* and some psyllids.

Pupa case (fig. 5).—Size 1.76 by 1.6 mm.; outline almost circular, form flat; color in normal specimens almost transparent, but in parasitized individuals there are often two brown areas, extending over the thorax and abdomen on each side of the median area, which latter is pale transparent yellowish white, like the submarginal area. The suture separating the thorax and abdomen is very distinct and transparent. It does not extend to the margin, but curves cephalad and joins two somewhat similar transverse sutures, the three all being very prominent and inclosing two elongate transverse areas. The abdominal segments are not distinctly marked off. The tracheal folds (fig. 6) are easily distinguished, and are marked by a series of fine longitudinal ridges. The pore is situated a slight distance in from the margin of case, and is armed with eight or nine rather distinct projections. The ridges which mark the fold encircle this opening on its outer edge, but leave a small, smooth area mesad of it. The vasiform orifice (fig. 7) is subcordate in outline, tending to circular; the cephalic margin is almost straight and the inner caudal margin is without the fine teeth. The operculum is similar in shape to the vasiform orifice, but the sides are compressed. It almost entirely fills the orifice and almost altogether obscures the lingula. The margin (fig. 8) is entire, but the marginal area is marked off by a series of fine sutures extending mesad.

Type.—Cat. No. 19053, U.S.N.M.

GIGALEURODES, new subgenus.

Related to subgenus *Rabdostigma* in several characters is a small group of species for which is erected the above-named subgenus. Two of the largest known species of the subfamily belong here.

Pupa case.—Oval to subcircular, color usually yellowish; marginal wax tubes represented by irregular, somewhat shallow corrugations; waxy secretion usually absent; dorsal disk without distinct sculpturing and without large pores though numerous minute ones may be present; no rhachis development; thoracic tracheal folds ending on or near the margin in a pore the inner margin of which is often irregularly notched or toothed; fold not sculptured, or sometimes covered with minute circular dots; vasiform orifice small, subcordate, without a comb of teeth; operculum similar in shape and obscuring the lingula.

Type.—Dialeurodes (*Gigaleurodes*) *maxima* Quaintance and Baker.

KEY TO SUBGENUS GIGALEURODES.

1. Pupa case yellowish, without dark coloration on median dorsal area..... 2.
   Pupa case with more or less dark brown coloration on dorsum..... 3.
2. Subcircular in outline, very large, 2.4 by 2.4 mm.; dirty yellowish white; tracheal folds well developed, marked with minute white dots; tracheal pore surrounded by a distinct chitinized circular ring within which are several blunt tooth-like projections; vasiform orifice relatively small, about one-fourth length of case from caudal margin; eggs dark brown with coarse polygonal markings.. *maxima.*
   Oval or elliptic in outline, medium in size, 1.59 by 1.28 mm.; yellowish in color; tracheal folds well developed, marked with minute dots; pore opening just within margin, armed with a few acute teeth or lobes (much resembling *citri*, except as to character of vasiform orifice)..... *buscki.*
3. Size large, 2.20 by 1.9 mm.; margin of case all round dark brown in color; subcircular in outline; a broad semicircular or linear spot of light yellow on cephalic end, remainder of case brown; tracheal folds not discernible; pores distinct and within margin of case, armed with several blunt stout processes; each pore surrounded by a conspicuous oval light yellow area; margin of case entire, but wax tubes conspicuous as corrugations on submarginal area..... *struthanthi.*
   Size medium, 1.6 by 1.3 mm.; broadly elliptical in outline, flat; entire surface brownish, the dorsal region dark brown; pore a deep sinus on the margin; margin of case crenulated; the lobes rounded; incisions acute; immature stages secreting from marginal pores a rim of wax..... *cerifera.*

DIALEURODES (GIGALEURODES) CERIFERA, new species.

Plate 71, figs. 1–4.

This species was received by the Bureau of Entomology April 10, 1901, from Mr. C. W. Mally, Cape Town, South Africa. The host is *Celastrus buxifolius.*

Egg.—Length 0.24 mm., elongate, curved; stalk shorter than width of egg at point of attachment; dirty white to brownish in color; surface densely covered with minute sculpturing.

Pupa case (fig. 1).—As seen on leaf the pupa case is yellowish brown, with dorsal disk dark brown, and is quite conspicuous in contrast with the light-colored lower surface of the leaf of the host plant. There is a fringe all around of glossy wax rods from marginal wax tubes, compact basally, but the rods separating distally. On numerous specimens this fringe is absent, having apparently weathered off. The dorsum is without secretion. The case is flattish and closely applied to leaf, there being no vertical wax fringe; dorsum slightly raised. This species, though plainly of the *citri* type, differs in the development of the marginal wax tubes and the presence of the fringe of wax rods.

Under the microscope the dorsal disk is brown in color, the balance of case being rather uniformly yellow; the shape is broadly elliptical to subcircular; size 1.6 by 1.3 mm.; margin of case beaded by the distinct and functional wax tubes; the incisions shallow and acute. Thoracic and caudal tracheal folds fairly evident, the latter fur-

rowed. The pores of these folds open close to margin and have the appearance shown in figure 2. There are no dorsal wax pores, but on each side of median line of each abdominal segment are a few clear white dots. From the region of the dorsal disk to the periphery a radiate pattern is evident, due to the mesal extension of the marginal wax tubes.

Vasiform orifice (fig. 3) subcordate in outline, the cephalic margin straight. The caudal rim is without teeth or fimbriae as are present in *citri*. Operculum with about the same outline as orifice, which it nearly fills, almost obscuring the lingula, the tip of which protrudes (fig. 4).

Adults.—Unknown.

Type.—Cat. No. 19054, U.S.N.M.

DIALEURODES (GIGALEURODES) BUSCKI, new species.

Plate 71, figs. 5–12.

Several leaves infested with this species were collected by Mr. August Busck, January 15, 1899, at Bayamon, Porto Rico. The host plant is stated as "a climbing vine." The immature stages occur on both surfaces of the leaf.

Pupa case (fig. 5).—The insect in this stage much resembles in general appearance *citri*. Many of the individuals, however, have the dorsal disk dark brown. However, this character appears not to be constant, as many colorless specimens are to be found from which the adults have emerged. There is no waxy secretion evident. As observed under hand lens, the dorsum is seen to be much wrinkled by the body sutures and the submarginal area is marked with fine radiating lines extending from dorsal disk all around to margin of case.

The margin is marked with many minute, acute incisions between the wax tubes, the sutures between which are more or less evident well toward the dorsal disk and give the radial appearance noted under the hand lens. All around margin there is a narrow and not well delineated light-colored band. Many apparently normal individuals have the dorsal disk brown in color, and there are gradations from this condition to individuals colorless throughout; the shape is oval and flattened, broadest across the second and third abdominal segments; size about 1.59 by 1.28 mm. The three tracheal folds evident marked with minute dots, as in *citri*. Tracheal pore opening almost on margin of case (fig. 6), the opening with a few teeth or fimbriae; body sutures distinct; along each side of median line of abdomen, a pair to each segment, and here and there on the thorax, are minute white dots in the derm, quite evident against the surrounding dark brown color of this region. The case is quite void of

wax pores, though the derm shows the granular appearance usual in these forms.

Vasiform orifice subcordate in outline (fig. 7); the anterior margin almost straight. The inner caudal margin is a thickened rim and is without the teeth so usual in species of this type. The operculum is similar in shape to orifice, almost completely filling it and covering the lingula. This latter (fig. 8) may be seen through the operculum and is elongate, slightly enlarged distally, setose, and bearing two long spines. On ventral surface the antennae (figs. 9 and 10) are quite evident, subcylindrical, and armed distally with a prominent stout spine (fig. 11); legs plainly visible, the feet (fig. 12) terminating in a disk-like structure usual for species of this type.

Adults.—Unknown.

Type.—Cat. No. 19055, U.S.N.M.

DIALEURODES (GIGALEURODES) MAXIMA, new species.

Plate 72, figs. 6–9.

Specimens of this very large species were collected by Mr. George Compere, at Manila, Philippine Islands, in 1910. The host is *Ficus* species.

Egg.—Length 0.21 mm. by about 0.1 mm., wide, subovate; stalk very short; color dark brown; covered with coarse polygonal markings.

Pupa case (fig. 6).—General color dirty yellowish white on leaf, without secretion; quite flat, infesting both upper and lower leaf surfaces. Shape circular or nearly so; in size very large, measuring about 2.4 by 2.4 mm. By transmitted light the color is yellowish, the evident marginal rim transparent. Dorsal area more or less marked with orange, which color is faintly present on the breathing folds. The margin is practically entire, though somewhat incised by the irregular ending of wax tubes. From the margin extend inward the usual sutures marking the position of the functionless wax tubes. A marginal area all around is faintly evident. Dorsum but little convex; the derm is figured with a network of polygonal markings; sutures not distinct; the tracheal folds are quite evident, tinged with yellow, and marked with minute dots; tracheal pores opening just within the margin of case, each with a subcircular chitinized ring, within which the margin is serrated (fig. 9), there being no distinct finger-like processes or fimbriae; vasiform orifice (fig. 7) subcordate in outline, the cephalic margin straight, about as broad as long, and distant from the caudal margin about 0.592 mm. The rim of the orifice is thickened, and the inner lateral and caudal margin is minutely setose; the operculum has about the shape of the orifice, which it nearly fills, its caudal portion and protruding tip of lingula setose. On the ventral surface the legs are distinct and normal.

This species is noteworthy by reason of its large pupa case, in this respect resembling *struthanthi* Hempel, but easily separated from that species by its coloration, shape, and other details, as will be noted on comparison. This species is freely parasitized, four to five parasites being found in a single individual—a degree of infestation unusual in related forms.

Adults.—Unknown.

Type.—Cat. No. 19056, U.S.N.M.

DIALEURODES (GIGALEURODES) STRUTHANTHI (Hempel).

Plate 72, figs. 1–5.

Aleurodes struthanthi HEMPEL, Ann. Mag. Nat. Hist., (7) vol. 8, 1901, p. 387.

Pupa case (fig. 1).—Size 2.08 by 2 mm.; form almost circular; dorsum not greatly elevated; thorax marked off by a fine but very distinct suture; abdominal segments marked off only on the median area and there not distinctly so; color light yellowish brown, marked with dark brown. The subdorsal area is dark brown and this color extends more or less over the dorsal region. A band of dark brown extends across the thorax just cephalad of the suture separating it from the thorax, and is particularly dark just caudad of the opening of the thoracic tracheal folds. A band of dark brown extends around the margin, but this is sometimes broken by lighter areas. The pores of the tracheal folds are situated in the center of somewhat oval yellow areas. The surface of the case is corrugated, and the dark markings follow these corrugations, or sometimes take the form of reticulate areas. The pore of the tracheal folds (fig. 4) is situated almost on the margin and is armed with about nine rather blunt teeth. The fold itself is without sculpturing, but is irregularly wrinkled. The vasiform orifice (fig. 2) is very small, not much larger than the pores of the breathing folds. It is somewhat semicircular in outline, with the cephalic margin straight. The operculum is of the same shape, and almost fills the orifice, obscuring the lingula, which, when the operculum is removed, is seen to be elongate, setose, and armed with two spines (fig. 5). Submarginal area of case prominently fluted by sutures of wax tubes, the sutures extending well mesad (fig. 3).

The above description is based on material received from Dr. H. von Ihering and collected at Saõ Paulo, Brazil.

Habitat.—Parnahyba and Saõ Paulo, Brazil, on *Struthanthis flexicaulis*, orange, *Mechilia flava*, and on an unidentified forest tree.

RHACHISPHORA, new subgenus.

Within the genus *Dialeurodes* there are a few species which differ from all others in having a marginal row of spines, and this character is united with others which easily distinguish these forms from the

typical *Dialeurodes*. Such species fall into two groups. Those of the first group lack teeth on the vasiform orifice and a rhachis is more or less prominent. At first glance the most extreme of these shows little relation to the typical *Dialeurodes*. There is no doubt, however, that *fijiensis* is so related, and this species shows the first indication of the development of a rhachis, which has reached its culmination in *trilobitoides*. In *fijiensis* there is a marginal row of 26 vasiform spines and other intermediate smaller ones. In *trilobitoides* there is the same row of spines similarly placed, though they are not swollen to the same extent, and the presence of the rhachis suggested in *fijiensis* is here very strongly marked. In *rutherfordi* the same vasiform spines are present as in *fijiensis*, though they are not so numerous, and the dorsal structure is midway between *fijiensis* and *trilobitoides*. These species are evidently closely related and may well form a distinct subgenus.

Pupa case.—Elliptical or oval, light brown to blackish in color; marginal wax tubes represented by rounded or irregular short tooth-like projections; waxen secretion usually absent, though sometimes peculiar waxen dorsal figures present; dorsal disk with a more or less prominent rhachis and often with thickened ridges radiating from it, representing the body segments; no large pores present. Thoracic tracheal folds distinct; the pore area is composed of an outer ring, and within this is the smaller pore opening, which is usually armed with teeth; vasiform orifice broadly subcordate, without comb of teeth, but its caudal margin sometimes showing a projection; submarginal area armed with a row of spines, and other spines also sometimes present on the margin.

Type.—Dialeurodes (*Rhachisphora*) *trilobitoides* Quaintance and Baker.

KEY TO SPECIES OF RHACHISPHORA.

1. Spines on margin of case only about 26 in number and of uniform character, ... *trilobitoides.*
   Spines very numerous and differing in character, some slightly knobbed and others somewhat vasiform..... 2.
2. Vasiform spines about 26 in number and prominent, remaining spines not distinctly knobbed; color pale brown and dark brown; no distinct rhachis evident..... *fijiensis.*
   Vasiform spines about 14–16 and not prominent; remaining spines distinctly knobbed; color dark brown; distinct rhachis present..... *rutherfordi.*

DIALEURODES (RACHISPHORA) FIJIENSIS (Kotinsky).

Plate 73, figs. 1–4.

Aleyrodes fijiensis KOTINSKY, Bull 2, Bd. Agr. and Forestry, Hawaii, 1907, p. 100.

Paratypes of *Dialeurodes fijiensis* are in the collection of the Bureau of Entomology. This species forms a connecting link between those

species exhibiting the typical dorsal structures of the genus and such species as have a prominently developed rhachis.

Pupa case (fig. 1).—Size 1.5 by 0.95 mm.; outline oval, rather flat; abdominal segments distinct and indicating the development of a rhachis so prominent in other species of the subgenus; color straw yellow or pale brownish; margin (fig. 2) almost entire, the wax tubes being represented by irregular flattened tooth-like sections separated from one another by lines extending mesad; submarginal area armed with a series of spines composed of two kinds: The first large and vasiform, the second small and lanceolate. The vasiform spines form a row about the case as shown in the figure and are 26 in number. The smaller spines are placed in several more or less concentric rows around the margin. The vasiform orifice (fig. 3) is roundly subcordate, with the margin rather heavily chitinized; the operculum somewhat similar in shape, though narrower caudad; lingula almost obscured by the operculum. Thoracic tracheal pores very prominent, composed of a distinct, even, and heavily chitinized ring, which is present upon the dorsum, and within this ring is the rather elongate irregular opening of the pore proper. Tracheal folds quite distinct, extending mesad from the opening of the pore and not from the margin of the ring. The caudal pore is similar in construction to the thoracic marginal ones (fig. 4), but the dorsal ring is not so distinct. A rather well differentiated area extends from the vasiform orifice to the caudal margin, and on the median dorsal area there are a number of vasiform spines similar to, though smaller than, those upon the submarginal area.

On the leaf the cases are light to dark brown in color and without marginal secretion of any kind. Dorsal waxen secretion very peculiar, forming, according to Kotinsky, a perpendicular column. It is fragmentary in the specimens at hand.

Adult female.—According to Kotinsky this is as follows:

Body (excepting head, which was bent under), 1.12 mm. long. Forewing, 1,406 microns long, 700 microns wide. Immaculate, mealy, yellowish white. Abdomen, legs, and antennae, except first two joints of the latter, testaceous; thorax, head, and first two antennal joints, straw color. Eyes slightly constricted, upper lobe considerably broader; reddish brown in color. Abdomen with about a dozen eggs distinctly seen ventrally; abdomen 750 microns long by about 325 microns wide.

Only pupa cases are available to us for study.

Habitat.—Rewa, Fiji, on pods and leaves of a leguminous plant.

DIALEURODES (RACHISPHORA) RUTHERFORDI, new species.

Plate 75, figs. 1–5; plate 74, fig. 1.

A collection of this species on *Loranthus* was made by A. Rutherford, at Peradeniya, Ceylon, in June, 1913. The species is remarkable in the character of the dorsum of the pupa case. In this respect it

is a connecting link between *fijiensis* and that very peculiar aleyrodid *trilobitoides*.

Pupa case (pls. 74 and 75, fig. 1).—Size 1.731 by 1.44 mm., elliptic in outline; dorsum with a distinct but broad rhachis; transverse ridges of the abdomen representing the sutures between the abdominal segments; color of case under the microscope yellowish brown, the ridges showing dark brown with lighter yellowish areas between them. Dorsum covered with a large number of minute transparent tubercle-like structures, on which spine-like projections are situated, and also very many minute, more or less circular, dark brown markings. The margin is covered with numerous irregular tooth-like projections, many of which are armed with knobbed spines (pl. 75, fig. 5). Just within the margin there is a series on each side of seven or eight spatulate spines, like those seen in *fijiensis*, one spine being situated near where each dorsal ridge reaches the margin. The vasiform orifice (pl. 75, fig. 2) is subcordate in outline, with the anterior margin straight and the caudal portion of the rim extended. A very distinct furrow extends from the caudal extremity of the orifice to the margin of case, and here there is no distinct pore as is usual in the genus, but a comb of teeth (pl. 75, fig. 4). This character approaches very closely the condition met with in species of the genus *Aleuroplatus*. Thoracic tracheal folds distinct and ending in a faint, somewhat circular pore (pl. 75, fig. 3). On the margin of the case adjacent to the pore there is a semicircular sinus, which is armed with about a dozen minute teeth.

Adults.—Unknown.

Type.—Cat. No. 19057, U.S.N.M.

DIALEURODES (RACHISPHORA) TRILOBITOIDES, new species.

Plate 75, figs. 6–11; plate 74, fig. 2.

Pupa case.—Pupa cases of this species were taken by Mr. A. Rutherford on *Harpullia* at Peradeniya, Ceylon, August, 1913. What seems to be the same species was taken by Mr. Rutherford on *Eugenia operculata* at the same place July 27, 1913, and also by Mr. R. S. Woglum, at Royal Botanic Gardens, Ceylon, on an unknown plant, October, 1910. The species shows a remarkable dorsal structure. The ridges of the abdominal segments have become interrupted, leaving a distinctly elevated and entire rhachis-shaped structure not unlike that met with in certain trilobites. The species show affinity with *rutherfordi*, and through this with *fijiensis*.

Pupa case (pl. 75, fig. 6).—Size 1.04 by 1 mm.; shape oval, broadest across the second abdominal segment; color brown to almost black, darker along the median dorsal area; dorsum with numerous prominent ridges, as shown in the figure. These ridges are covered with fine hexagonal dark areas, and the submarginal area and the spaces

between the ridges are covered with irregular rows of semicircular dark markings. Submarginal area armed with 26 spines mounted on tubercles, 13 on each side (pl. 75, fig. 7). Thoracic tracheal folds covered with small, dark, somewhat hexagonal markings similar to those present in other species of the subgenus; tracheal pore apparently composed of two parts—a dorsal, which is evenly pyriform in outline, and a ventral, which is contained within it, and is subcircular and toothed (pl. 75, fig. 9). Pore of the caudal tracheal fold appearing as a mere slit-like structure, having lost nearly all the characters shown by the thoracic pores (pl. 75, fig. 11). Vasiform orifice (pl. 75, fig. 10) subcordate in outline, with the cephalic margin straight. It is situated in the caudal angle of a somewhat heavily chitinized U-shaped structure; its rim well chitinized and armed at its caudal extremity with a prominent nipple-shaped projection. Operculum similar in shape to the orifice and almost entirely filling it, obscuring the lingula. On the leaf the pupa case shows no waxy secretion, appearing as shining, brownish-black disks, much ridged on the dorsum.

Adults.—Unknown.

Type.—Cat. No. 19058, U.S.N.M. Described from pupa cases in balsam mounts, and dry upon the foliage.

DIALEUROPORA, new subgenus.

There is in the collection an aleyrodid from India and Ceylon which is quite similar to the typical *Dialeurodes* in regard to the structure of the tracheal folds and pores, and which has an orifice resembling that met with in some of the other subgenera of this genus. This form is remarkable, however, in possessing on the submarginal area a series of very large pores. On account of this and other noticeable characters it is placed in a separate subgenus.

Pupa case elliptical in shape, yellowish or transparent whitish in color; marginal wax tubes represented by irregular, somewhat flattened, shallow, tooth-like corrugations; vertical waxen fringe absent; dorsal disk without sculpturing or rhachis; submarginal area with a series all around of a few very large simple pores; thoracic tracheal folds without sculpture or with a few minute dot-like markings; pore a ring-like opening near the margin; vasiform orifice broadly subcordate, the inner lateral and caudal margins without a comb of teeth; operculum similar in shape and nearly filling the orifice.

Type.—Dialeurodes (*Dialeuropora*) *decempuncta* Quaintance and Baker.

DIALEURODES (DIALEUROPORA) DECEMPUNCTA, new species.

Plate 76, figs. 1–7.

This species was taken by R. S. Woglum, in the Royal Botanic Gardens, Ceylon, on cinnamon, October, 1910, and also on mulberry at Lahore, India.

Egg (fig. 4).—Elongate elliptical, yellowish in color, without reticulations; size 0.17 by 0.077 mm.; stalk about one-half as long as the egg.

Pupa case (fig. 1).—Color on leaf dirty yellow; dorsum moderately convex; no dorsal or lateral secretions, except from submarginal area usually some 10 to 12 short waxen rods.

Under the microscope the case is seen to be almost transparent, the segments moderately distinct. Size about 0.95 by 0.65 mm., subelliptic in outline, narrowing cephalad. Margin of case faintly crenulate (fig. 3), surrounded by a narrow zone paler than adjacent submarginal areas and separated from it by a more or less evident yellowish, thickened line. Within the margin there is a series of rather short spines, and along median line of case are several pairs of setae, as shown in figure 1. On each side of case, in submarginal area, are five large pores (figs. 1 and 2). Tracheal folds fairly evident and sparsely marked with dots (figs. 2 and 3). Vasiform orifice broadly subcordate, without teeth on inner margin. Operculum similar in outline, nearly filling orifice (figs. 2 and 6).

Adult.—Unknown.

Type.—Cat. No. 19059, U.S.N.M. Described from numerous specimens on foliage and in balsam mounts.

DIALEUROPLATA, new subgenus.

This species was taken by C. H. T. Townsend in 1904, in the Philippine Islands. In general appearance it has many of the characters of typical species of the genus *Aleuroplatus*. It has somewhat the same shape and color. It possesses numerous minute pores in the same regions, and the abdominal divisions are somewhat similar. It is much more completely a *Dialeurodes*, however, than it is an *Aleuroplatus*, and we erect for it the above subgenus. It seems further to confirm the apparently close relation of the two genera, *Dialeurodes* and *Aleuroplatus*.

Pupa case.—Elliptical, broadest across the abdomen, slightly constricted at the thoracic tracheal pores; color brownish; marginal wax pores represented by shallow somewhat irregular tooth-like corrugations; submarginal area with an irregular series of minute, circular, pore-like structures; dorsum with a slight rhachis development, particularly upon the abdomen, and with a number of minute pores. Thoracic tracheal folds not distinct; tracheal pores irregularly lobed or toothed within; vasiform orifice broadly subcordate, inner caudal and lateral margins without teeth; operculum similar in shape, nearly filling the orifice.

Type.—Dialeurodes (*Dialeuroplata*) *townsendi* Quaintance and Baker.

DIALEURODES (DIALEUROPLATA) TOWNSENDI, new species.

Plate 73, figs. 5–9.

Specimens of this species are in the collection of the Bureau of Entomology from Lucerna, Tayabas, Philippine Islands, and were collected by C. H. T. Townsend on April 24, 1904. They were forwarded to the Bureau by T. D. A. Cockerell. The host is stated to be a "fern."

Egg (fig. 5).—Size 0.144 by 0.112 mm.; oval in shape with a short, curved stalk. Surface rugose and marked with peculiar circular areas giving it a very beautiful appearance. This egg sculpturing is different from that of any other in the family so far observed.

Pupa case (fig. 6).—Size 1.39 by 1.12 mm.; shape oval, flat, with a somewhat distinct median ridge; color yellowish brown with the median ridge dark brown. All about the submarginal area of the case and longitudinally along either side of the median ridge there are a large number of small transparent pores. The abdominal segments are well marked off, and the sutures separating them unite to form a distinct rhachis. A distinct suture from the middle of each segment of the rhachis extends across the dorsal disk. The margin is divided by a large number of fine lines extending a short distance mesad. The vasiform orifice is broadly subcordate in outline and is almost completely filled by the operculum, which is setose on its distal extremity (fig. 7). Cephalad of the orifice there is a pair of minute setae and caudad of it the integument is thrown into a large number of fine transverse ridges. These merge into elongate polygonal markings which extend to the caudal pore along the tracheal fold (fig. 8.) The pores of the thoracic tracheal folds are small and irregularly lobed (fig. 9), and mesad of each is a large pyriform structure, the interior of which is divided into a number of areas. The cephalic margin of case is armed with a pair of small setæ.

On the leaf there appears no waxy secretion, the insects showing as yellowish or brownish disks.

Adults.—Unknown.

Type.—Cat. No. 19060, U.S.N.M. Described from pupa cases and eggs in balsam mounts and dry upon the leaf.

Genus NEOMASKELLIA Quaintance and Baker.

Neomaskellia Quaintance and Baker, Tech. Ser. 27, pt. 1, Bur. Ent. U. S. Dept. Agric., 1913, p. 91.

Neomaskellia was erected by the writers to include an aleyrodid found in the Maskell collection of Aleyrodidae which presents numerous points of difference from other groups in the family, as will be noted from the generic diagnosis. Further study of the material in the collection of the Bureau of Entomology permits us to add another

species to the genus—namely, *Aleyrodes bergii* Signoret. A comparison of the type of *Aleyrodes sacchari* Maskell with *bergii* leads us to believe that Maskell's species is the same as *bergii* Signoret. Below are given the characteristics of *Neomaskellia* and a key to the two known species of the genus, followed by a description of *bergii*. A revised description of *comata* was given in Technical Series 27, part 1, of the Bureau of Entomology, United States Department of Agriculture, on page 92.

Pupa case.—Elliptic, with reflexed edges; margin with row of prominent spines. Papillae and dorsal pores absent. Vasiform orifice on a tubercle-like elevation, transverse, elliptical; operculum short and broad, about half filling the orifice; lingula similar in shape and visible caudad of the operculum. Adult males much smaller than the females; forewing with only radial sector present. Females with radial sector and traces of the cubitus; vertex depressed mesad and with the lateral margins elevated. Antennae short, thick, and hairy, composed of seven segments, of which the third is the longest; second segment spherical; claspers of male short, thick, and hairy.

Type.—*Neomaskellia comata* (Maskell).

KEY TO SPECIES OF NEOMASKELLIA.

1. Pupa case with 12 pairs of spines arising from submarginal area, the cephalic two pairs short and hair-like. Forewing of adult with four faint brownish patches ..... *comata.*
2. Pupa case with 16 pairs of spines arising from submarginal area, the cephalic two pairs equally developed with the others. Forewing of adult mottled and dotted with dark brown..... *bergii.*

NEOMASKELLIA COMATA (Maskell).

Aleurodes comata MASKELL, Trans. N. Zealand Inst., vol. 28, 1896, p. 426.
Neomaskellia comata (MASKELL) QUAINTANCE AND BAKER, Tech. Ser. 27, pt. 1, Bur. Ent., U. S. Dept. Agric., 1913, p. 91.

NEOMASKELLIA BERGII (Signoret).

Plate 77, figs. 1–14.

Aleurodes bergii SIGNORET, Ann. Soc. Ent. France, (4) vol. 8, 1867, p. 395.
Aleurodes sacchari MASKELL, Trans. N. Zealand Inst., vol. 22, 1890, p. 171.

We have specimens of this species from Java, received from Dr. L. Zehntner, February 1, 1897 (host not stated), and also specimens collected by Mr. George Compere at Manila, Philippine Islands, on a wild grass.

Egg (fig. 1).—Length 0.272 mm.; form oval, with the stalk attached a short distance from the base and about half as long as the egg itself. We are unable to make out any surface sculpturing in the specimens at hand.

Pupa case (fig. 2).—Length from 0.72 to 0.8 mm.; width from 0.432 to 5.52 mm.; shape elliptic, rather strongly arched; abdom-

inal segments distinct; median ridge not plainly evident excepting at vasiform orifice, which is situated on a prominent tubercle. Color varying from a dark to a very pale brownish, with the median area in some specimens more deeply shaded than the remainder of the case. Submarginal area armed with a row of prominent, curved spines situated on tubercles. These are usually 32 in number, but there are sometimes fewer. The margin itself (fig. 4) is rolled under the case somewhat after the manner of the species in the subgenus *Lecanoideus*. It is very minutely and irregularly serrate, but there are nothing like the prominent teeth which are present in some other forms. Vasiform orifice (fig. 3) strongly elevated upon a tuberclelike structure, subcircular to elliptic in outline, with the longest axis lying transversely. Operculum somewhat semicircular in outline, the caudal margin straight or irregularly curved; lingula very broad, with only the distal extremity showing below the operculum; both operculum and lingula setose. On each side of the orifice there is a large spine similar to those upon the margin, and there is a pair of spines on the cephalic portion of the thorax on the lower surface. Antennae and legs evident.

Adult female.—Length from vertex to tip of ovipositor 1.84 mm.; color brown, deeper on the thorax, appendages and ovipositor, lighter on the abdomen. Eggs in the abdomen appearing yellowish brown and numerous small bright red areas visible. Vertex as viewed from above rounded, rather broad, covered with a number of small, clear papillae or porelike structures, from below (fig. 7) depressed, with lateral elevations and the median area covered with numerous bristles. Ocelli rather large, clear, and situated close to the compound eyes. These latter have large facets, are constricted in the middle, and are deep brown in color. Antennae (fig. 8) short, thick, strongly imbricated, and covered with numerous fine hairs. Segment I 0.036 mm. in length, subcylindric; II 0.055 mm., almost globose, and covered with many bristles and many fine hairs; III 0.1 mm., subcylindric, strongly imbricated and covered with transverse rows of fine hairs; IV 0.03 mm., similar; V 0.055 mm., imbricated, hairy, and with a few small distal sensoria; VI 0.033 mm.; VII 0.033 mm., with a few sensoria near distal extremity. Thorax dark brown, covered all over with very many minute fine dots, which may be punctures, and with several small, clear, pore-like areas similar to those on the head. Legs brown; fore tibiae 0.32 mm. in length; fore tarsi, proximal segment 0.095 mm., distal segment 0.096 mm.; hind tibia 0.448 mm., armed on its distal extremity with a ring of rather stout spines and along its inner margin with a double row of similar ones; hind tarsus, proximal segment, 0.112 mm., distal segment 0.065 mm. Foot (fig. 13) about 0.032 mm. long; claws curved; paronychium narrow and generally curved. Forewing (fig. 5) 1.36 mm. long and

0.608 mm. wide at its greatest width; radial sector rather thick, sometimes almost straight and in other specimens with one or two curves; cubitus present only at the very base of the wing, its position, however, being indicated by a light area; wings mottled and spotted with dark brown, as shown in the figure. This is most prominent in two transverse areas, one near the distal extremity of the wing and the other a little proximad of the middle. Margin (fig. 12) armed with a series of rather broad teeth, on which minute hairs are situated. Hindwing (fig. 5) 1.088 mm. long and 0.48 mm. wide; vein almost straight; color uniform smoky. Abdomen broad and large; ovipositor dark brown, armed with numerous prominent spines; vasiform orifice (fig. 6) elliptic, transverse, and surrounded by a dark area which extends back to the ovipositor. Operculum somewhat semicircular, about half filling the orifice; lingula very broad and long, exserted for some distance; both operculum and lingula with numerous fine hairs.

Adult male.—Much smaller than the female, being 0.84 mm. long. Color much the same, but with more of a reddish tint on the abdomen. Antennae (fig. 10) similar to those of the female. Segment I 0.03 mm. long, subcylindric; II 0.045 mm.; III 0.08 mm.; IV 0.03 mm.; V 0.036 mm., with two small distal sensoria; VI 0.02 mm.; VII 0.021 mm., and armed near its distal extremity with a long, spiked sensorium and two circular ones (fig. 14). Segments III to VII strongly imbricated and covered with transverse rows of minute hairs. Forewing (fig. 9) straight, with radial sector straight and thick; cubitus not present, though in some specimens there is a faint shading indicating it. Length of wing 0.64 mm.; width 0.208 mm.; marking very similar to that of the female, as shown in the figure. Hind wing 0.48 mm. long and 0.24 mm. wide; vein straight, uniform dusky in color. Hind tibiae 0.35 mm. long; hind tarsi, proximal segment 0.08 mm., distal segment 0.064 mm. Abdomen very long in some specimens as compared to the wings and claspers, measuring, exclusive of claspers, 0.512 mm. in length. Claspers (fig. 11) 0.144 mm. long, dark brown in color, not acutely pointed at distal extremity, thick and armed with numerous hairs.

EXPLANATION OF PLATES.

PLATE 32.

Aleurocanthus bambusae.—1, insects in place on plant; 2, larva, first stage; 3, ventral pores near margin of larva, first stage; 4, larva, second stage; 5, larva, fourth stage; 6, margin of case of fourth-stage larva; 7, pupa case; 8, margin of pupa case; 9, vasiform orifice of pupa case. (After Peal.)

PLATE 33.

Aleurocanthus banksiae.—1, outline of pupa case; 2, margin of pupa case; 3, vasiform orifice; 4, spine of larva; 5, larva.

Aleurocanthus calophylli.—6, pupa case; 7, margin of pupa case; 8, vasiform orifice; 9, egg; 10, polygonal markings of egg.

PLATE 34.

Aleurocanthus dissimilis.—1, pupa case; 2–5, different types of spines of pupa case; 6, margin of pupa case; 7, marginal tooth of pupa case, greatly enlarged; 8, vasiform orifice; 9, spine of larva.

Aleurocanthus hirsutus.—10, pupa case; 11, margin of pupa case; 12, enlarged spine of pupa case; 13, vasiform orifice; 14, larva; 15, thoracic tracheal pore of larva.

PLATE 35.

Aleurocanthus longispinus.—1, pupa case; 2, margin of pupa case; 3, vasiform orifice; 4, showing spines and dermal markings on abdominal segments; 5, egg; 6, polygonal markings of egg.

PLATE 36.

Aleurocanthus mangiferae.—1, pupa case; 2, egg; 3, polygonal markings of egg; 4, late larva; 5, margin of pupa case; 6, early larva; 7, vasiform orifice of pupa case; 8, vasiform orifice of late larva; 9, showing variation in spines in pupa case of other individuals of this species.

PLATE 37.

Aleurocanthus piperis.—1, pupa case; 2, margin of pupa case; 3, vasiform orifice of pupa case; 4, tip of spine of pupa case; 5, minute knobbed spine occurring in row within margin of pupa case; 6, larva.

Aleurocanthus serratus.—7, pupa case; 8, margin of pupa case; 9, vasiform orifice of pupa case; 10, spine of pupa case.

PLATE 38.

Aleurocanthus spiniferus.—1, pupa case; 2, egg; 3, polygonal markings of egg; 4, margin of pupa case; 5, vasiform orifice; 6, spine of pupa case.

Aleurocanthus spinosus.—7, egg; 8, pupa case; 9, spine of pupa case; 10, margin of pupa case; 11, vasiform orifice of pupa case.

PLATE 39.

Aleurocanthus T-signatus.—1, pupa case; 2, vasiform orifice of pupa case; 3, margin of pupa case; 4, spine of pupa case; 5, early larva; 6, late larva; 7, vasiform orifice of adult; 8, claw of adult; 9, forewing of adult.

PLATE 40.

1. *Aleurocybotus graminicolus*, pupa case. 2. *Aleurocybotus setigerus*, pupa case.

PLATE 41.

Aleurolobus barodensis.—1, pupa case; 2, latero-cephalic margin of pupa case; 3, vasiform orifice and surrounding trilobed area; 4, margin of pupa case; 5, caudal margin of pupa case; 6, young larva; 7, vasiform orifice of larva; 8, lingula of larva; 9, portion of submarginal area of larva showing pore; 10, submarginal area of larva; 11, caudo-lateral margin of larva showing spine.

PLATE 42.

Aleurolobus flavus.—1, pupa case; 2, thoracic tracheal pore of pupa case; 3, thickened lines separating submarginal and dorsal areas of pupa case; 4, vasiform orifice and surrounding trilobed area of pupa case; 5, lingula of pupa case; 6, margin of pupa case; 7, egg; 8, caudal margin of pupa case.

PLATE 43.

Aleurolobus marlatti.—1, egg; 2, larva, first instar; 3, vasiform orifice of larva, first instar; 4, larva, second instar; 5, margin of case of larva, second instar; 6, vasiform orifice of larva, second instar; 7, lingula of larva, second instar; 8, larva, third instar; 9, margin of case of larva, third instar; 10, vasiform orifice of larva, third instar; 11, pupa case, dorsal view; 12, vasiform orifice and surrounding trilobed area of pupa case; 13, margin of pupa case; 14, thoracic tracheal comb of teeth of pupa case; 15, forewing; 16, male genitalia, lateral view.

PLATE 44.

Aleurolobus philippinensis.—1, egg; 2, early larva; 3, vasiform orifice of early larva; 4, late larva; 5, vasiform orifice of late larva; 6, lingula of late larva; 7, margin of late larva; 8, spine of late larva; 9, pupa case; 10, vasiform orifice and surrounding trilobed area of pupa case; 11, leg of pupa case; 12, margin of pupa case; 13, antenna of pupa case; 14, genitalia of male adult; 15, forewing of adult; 16, vasiform orifice of adult; 17, claw of adult; 18, antenna of adult male; 19, antenna of adult female; 20, antenna of early larva.

PLATE 45.

Aleurolobus setigerus.—1, pupa case; 2, vasiform orifice and surrounding trilobed area of pupa case; 3, Margin of pupa case; 4, thoracic pore of pupa case; 5, lingula of pupa case; 6, paired pores of submarginal area.

PLATE 46.

Aleurolobus simulus.—1, egg as seen in body of female; 2, peduncle of egg; 3, larva, first stage; 4, antenna of larva, first stage; 5, pupa case; 6, vasiform orifice of pupa case; 7, thoracic tracheal pore or comb of pupa case; 8, margin of pupa case showing circular pores on dorsum; 9, pupa extracted from pupa case; 10, genitalia of male; 11, wing of female; 12, vasiform orifice of male; 13, antenna of male; 14, antenna of female. (After Peal).

PLATE 47.

Aleurolobus taonabae.—1, egg; 2, early larva; 3, margin of case of early larva; 4, vasiform orifice of early larva; 5, pupa case; 6, vasiform orifice and trilobed area of pupa case; 7, margin of pupa case.

Aleurolobus solitarius.—8, pupa case; 9, thoracic tracheal pore of pupa case showing trilobed structure; 10, same showing structure with but two lobes; 11, caudal tracheal pore of pupa case; 12, vasiform orifice and surrounding trilobed area of pupa case; 13, margin of pupa case.

PLATE 48.

1, *Aleuroparadoxus iridescens*, pupa case; 2, *Aleuroparadoxus punctatus*, pupa case.

PLATE 49.

Aleuroplatus berbericolus.—1, margin of pupa case; 2, comb of thoracic tracheal fold of pupa case; 3, vasiform orifice of pupa case; 4, variation in comb of thoracic tracheal fold of pupa case.

Aleuroplatus cockerelli.—5, comb of thoracic tracheal fold of pupa case; 6, vasiform orifice of pupa case.

Aleuroplatus cococolus.—7, egg; 8, vasiform orifice of pupa case; 9, clubbed spine of larva; 10, tapering spine of larva.

Aleuroplatus coronatus.—11, margin of pupa case; 12, vasiform orifice of pupa case.

Aleuroplatus ficus-rugosae.—13, pupa case; 14, vasiform orifice of pupa case; 15, comb of caudal tracheal fold of pupa case; 16, comb of thoracic tracheal fold of pupa case.

Aleuroplatus gelatinosus.—17, comb of thoracic tracheal fold of pupa case; 18, comb of caudal tracheal fold of pupa case; 19, vasiform orifice of pupa case.

Aleuroplatus incisus.—20, comb of thoracic tracheal fold of pupa case; 21, vasiform orifice of pupa case.

PLATE 50.

1, *Aleuroplatus berbericolus*, pupa case: 2, *Aleuroplatus cockerelli*, pupa case.

PLATE 51.

1, *Aleuroplatus cococolus*, pupa case; 2, *Aleuroplatus coronatus*, pupa case.

PLATE 52.

1, *Aleuroplatus gelatinosus*, pupa case; 2, *Aleuroplatus incisus*, pupa case.

PLATE 53.

Aleuroplatus myricae.—1, clasper of male; 2, antenna of male; 3, vasiform orifice of pupa case; 4, margin of pupa case.

Aleuroplatus oculiminutus.—5, margin of pupa case showing reticulate area; 6, wing of adult; 7, vasiform orifice of pupa case.

Aleuroplatus ovatus.—8, margin of pupa case; 9, vasiform orifice of pupa case.

Aleuroplatus pectiniferus.—10, comb of thoracic tracheal fold of pupa case; 11, vasiform orifice of pupa case; 12, clasper of male; 13, penis; 14, wing of adult.

Aleuroplatus plumosus.—15, comb of thoracic tracheal fold of pupa case; 16, vasiform orifice of pupa case.

Aleuroplatus quercus-aquaticae.—17, comb of thoracic tracheal fold of pupa case; 18, vasiform orifice of pupa case.

PLATE 54.

1, *Aleuroplatus myricae*, pupa case; 2, *Aleuroplatus oculiminutus*, pupa case.

PLATE 55.

Aleuroplatus oculireniformis.—1, egg; 2, pupa case; 3, margin of pupa case; 4, vasiform orifice of pupa case; 5, penis; 6, clasper of male; 7, antenna of adult; 8, portion of compound eye of adult showing lenses; 9, eye spots of *oculiminutus*, *vinsonioides*, and *oculireniformis*, showing relative size; 10, wing of adult.

PLATE 56.

1, *Aleuroplatus ovatus*, pupa case; 2, *Aleuroplatus pectiniferus*, pupa case.

PLATE 57.

1, *Aleuroplatus plumosus*, pupa case; 2, *Aleuroplatus quercus-aquaticae*, pupa case.

PLATE 58.

1, *Aleuroplatus sculpturatus*, pupa case; 2, *Aleuroplatus translucidus*, pupa case.

PLATE 59.

Aleuroplatus sculpturatus.—1, dorsal pores of pupa case; 2, margin of pupa case; 3, vasiform orifice of pupa case; 4, comb of thoracic tracheal fold of pupa case.

Aleuroplatus validus.—5, margin of pupa case; 6, vasiform orifice of pupa case; 7, caudal comb of pupa case.

Aleuroplatus variegatus.—8, comb of thoracic tracheal fold of pupa case; 9, clubbed spine of pupa case; 10, margin of pupa case; 11, vasiform orifice of pupa case.

Aleuroplatus vinsonioides.—12, vasiform orifice of pupa case; 13, margin of pupa case; 14, margin of pupa case showing reticulate areas.

PLATE 60.

Aleuroplatus mammaeferus.—1, pupa case; 2, submarginal protuberances of pupa case; 3, comb of caudal tracheal fold of pupa case; 4, comb of thoracic tracheal fold of pupa case; 5, vasiform orifice of pupa case; 6, margin of pupa case; 7, knobbed protuberance of pupa case.

Aleuroplatus translucidus.—8, pupa case showing adult within; 9, pupa case; 10, vasiform orifice of pupa case; 11, thoracic tracheal fold of pupa case; 12, margin of pupa case; 13, clasper of male; 14, wing of adult.

PLATE 61.

1, *Aleuroplatus validus*, pupa case; 2, *Aleuroplatus variegatus*, pupa case.

PLATE 62.

Aleurothrixus aepim.—1, egg; 2, early larva; 3, pupa case; 4, dorsal spine of larva; 5, submarginal spine of larva; 6, spine of pupa case; 7, vasiform orifice of pupa case.

Aleurothrixus porteri.—8, clasper of male; 9, early larva; 10, vasiform spine of pupa case; 11, vasiform orifice of pupa case.

Aleurothrixus howardi.—12, vasiform orifice of pupa case; 13, spine of pupa case.

Aleurothrixus floccosus.—14, vasiform orifice of pupa case.

PLATE 63.

Dialeurodes citri.—1, pupa case, dorsal view; 2, thoracic tracheal fold and pore; 3, margin of case; 4, vasiform orifice of pupa case; 5, larva, third instar; 6, larva, first instar; 7, leg of larva, first instar; 8, antenna of larva, first instar; 9, egg; 10, antenna of adult; 11, wing; 12, claw of adult; 13, male genitalia; 14, margin of forewing.

PLATE 64.

1, *Dialeurodes citri*, Pupa case; 2, *Dialeurodes kirkaldyi*, Pupa case.

PLATE 65.

Dialeurodes citrifolii.—1, pupa case, dorsal view; 2, thoracic tracheal pore; 3, sculpturing on caudal tracheal fold; 4, vasiform orifice; 5, antenna of adult; 6, circular sensoria of segment III of antenna; 7, wing of adult; 8, male genitalia; 9, egg; 10, sculpturing of egg; 11, larva; 12, margin of pupa case; 13, hind tarsus of female; 14, hind claw of female.

PLATE 66.

Dialeurodes fodiens.—1, pupa case; 2, vasiform orifice; 3, lingula of pupa case; 4, margin of pupa case.

Dialeurodes radiipuncta.—5, pupa case; 6, vasiform orifice; 7, thoracic tracheal pore.

Dialeurodes tricolor.—8, pupa case; 9, margin of pupa case; 10, thoracic tracheal pore; 11, vasiform orifice; 12, lingula of pupa case; 13, caudal margin of pupa case.

PLATE 67.

Dialeurodes kirkaldyi.—1, pupa case; 2, vasiform orifice; 3, thoracic tracheal pore; 4, pupa case showing pupa within; 5, egg; 6, wing; 7, male genitalia; 8, claw of adult; 9, distal extremity of tarsus; 10, antenna of adult; 11, larva, first instar; 12, testes of male; 13, vasiform orifice of male showing rectum.

PLATE 68.

Dialeurodes eugeniae.—1, pupa case; 2, margin of pupa case; 3, thoracic tracheal pore and sculpturing of adjacent area; 4, vasiform orifice; 5, tracheal pore on caudal margin of pupa case.

Dialeurodes tokyonis.—6, pupa case; 7, sculpturing of derm of pupa case; 8, thoracic tracheal pore and sculpturing; 9, vasiform orifice; 10, polygonal markings on dorsal disk of pupa case.

PLATE 69.

Dialeurodes radiirugosa.—1, forewing of female; 2, sensoria on radial sector of forewing; 3, costal margin of forewing; 4, hind wing of female; 5, vasiform orifice of female; 6, pupa case; 7, vasiform orifice of pupa case; 8, thoracic tracheal pore and sculpturing of tracheal fold; 9, polygonal sculpturing of dorsum of pupa case.

PLATE 70.

Dialeurodes dissimilis.—1, pupa case; 2, vasiform orifice; 3, margin of pupa case; 4, thoracic tracheal fold and pore.

Dialeurodes radiilinealis.—5, pupa case; 6, thoracic tracheal pore and sculpturing of tracheal fold; 7, vasiform orifice; 8, margin of pupa case.

PLATE 71.

Dialeurodes cerifera.—1, pupa case; 2, thoracic tracheal pore of pupa case; 3, vasiform orifice; 4, lingula.

Dialeurodes buscki.—5, pupa case; 6, thoracic tracheal pore; 7, vasiform orifice; 8, lingula; 9, ventral aspect of pupa case showing organs; 10, antenna of pupa case; 11, distal end of antenna of pupa case; 12, distal end of leg of pupa case.

PLATE 72.

Dialeurodes struthanthi.—1, pupa case; 2, vasiform orifice; 3, margin of pupa case; 4, thoracic tracheal pore; 5, lingula.

Dialeurodes maxima.—6, pupa case; 7, vasiform orifice; 8, margin of pupa case; 9, thoracic tracheal pore and sculpturing of tracheal fold.

PLATE 73.

Dialeurodes fijiensis.—1, pupa case; 2, margin of pupa case; 3, vasiform orifice; 4, thoracic tracheal pore.

Dialeurodes townsendi.—5, egg; 6, pupa case; 7, vasiform orifice; 8, caudal margin of pupa case; 9, thoracic tracheal pore.

PLATE 74.

1, *Dialeurodes rutherfordi*, pupa case; 2, *Dialeurodes trilobitoides*; pupa case.

PLATE 75.

Dialeurodes rutherfordi.—1, pupa case; 2, vasiform orifice; 3, thoracic tracheal pore; 4, caudal margin of pupa case; 5, margin of pupa case.

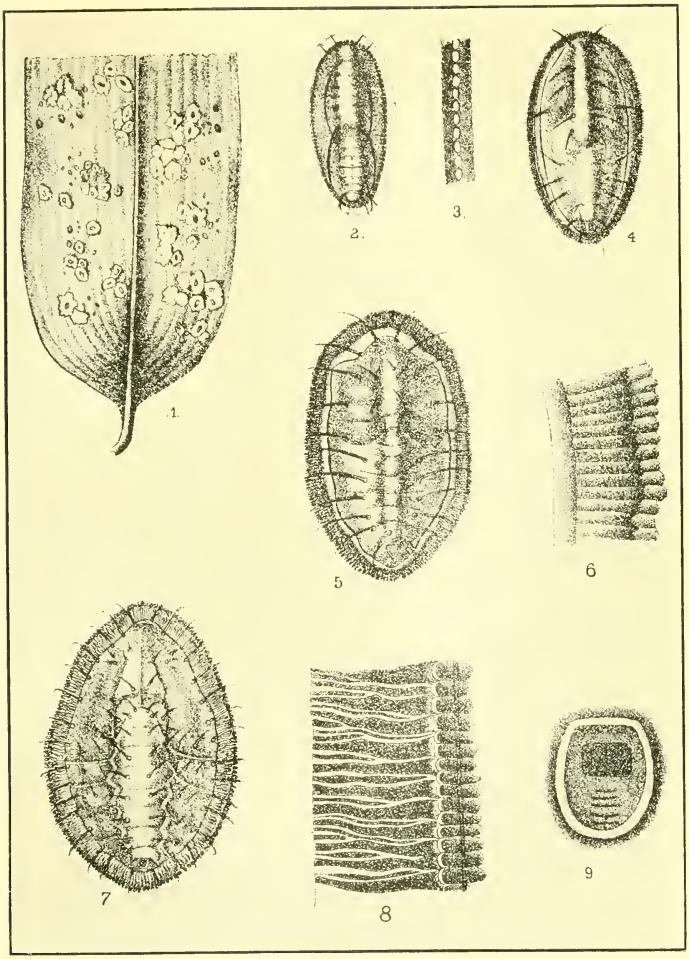
Dialeurodes trilobitoides.—6, pupa case; 7, marginal spine of pupa case; 8, sculpturing on dorsum; 9, thoracic tracheal pore and sculpturing of tracheal fold; 10, vasiform orifice; 11, pore of caudal tracheal fold.

PLATE 76.

Dialeurodes decempuncta.—1, pupa case; 2, caudal segment of pupa case; 3, thoracic tracheal pore and margin of pupa case; 4, egg; 5, larva; 6, vasiform orifice; 7, larva, first instar.

PLATE 77.

Neomaskellia bergii.—1, egg; 2, pupa case; 3, vasiform orifice of pupa case; 4, margin of pupa case; 5, wings of female; 6, vasiform orifice of adult; 7, head of adult; 8, antenna of female; 9, wings of male; 10, antenna of male; 11, genitalia of male; 12, margin of wing; 13, claw of adult; 14, distal end of antenna.



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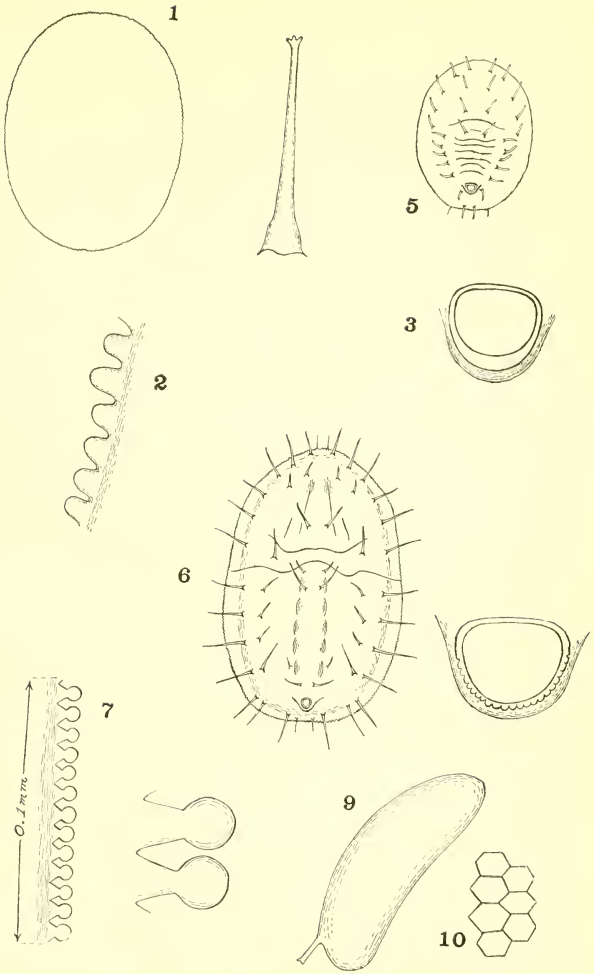

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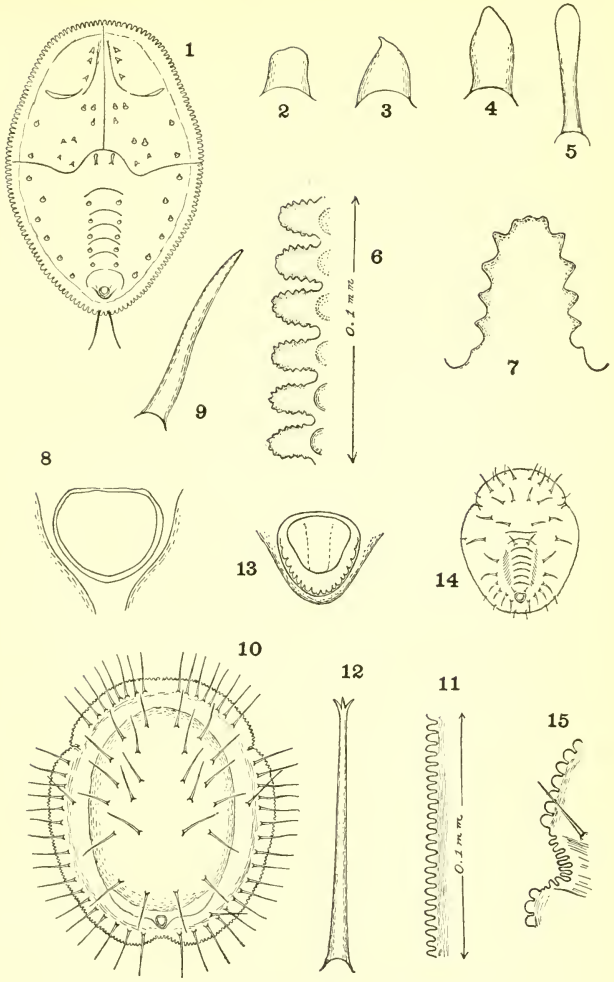

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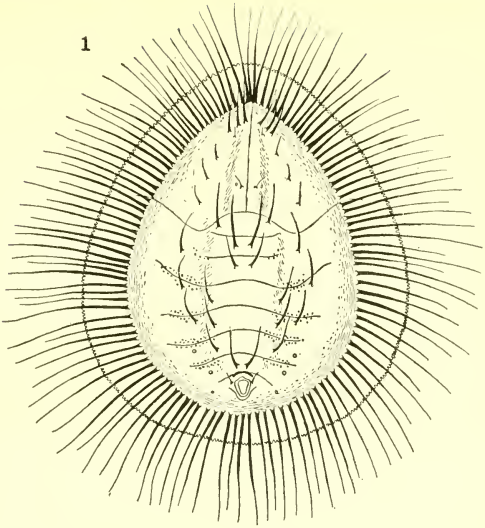

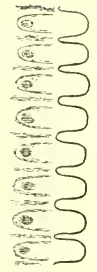

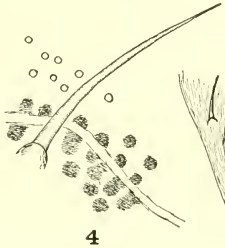

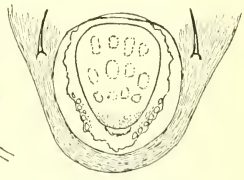

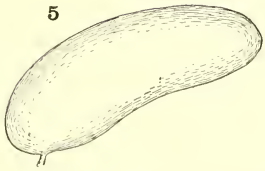

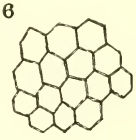

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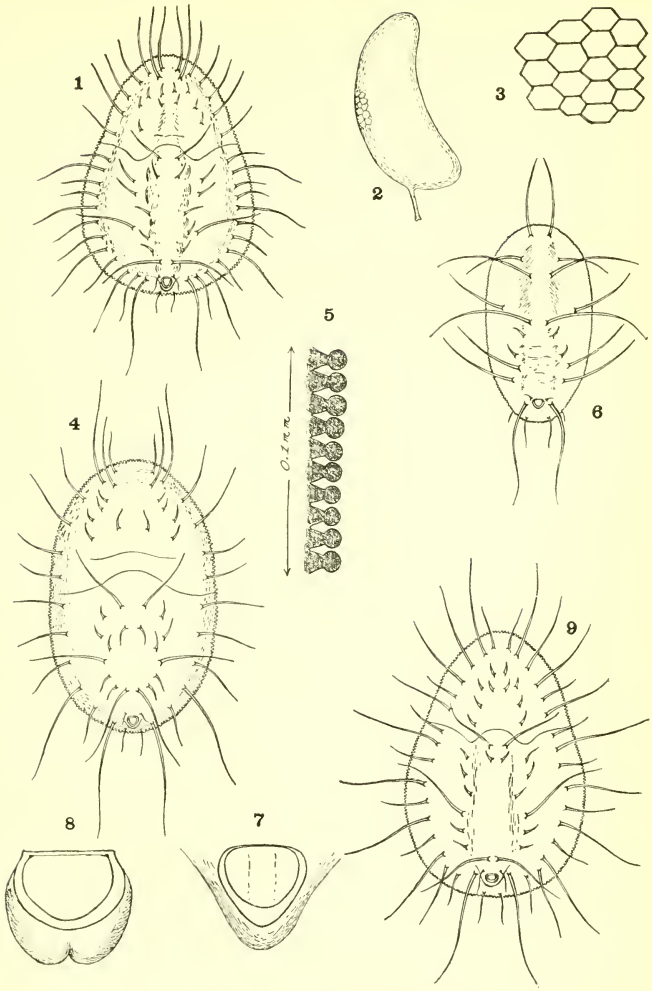

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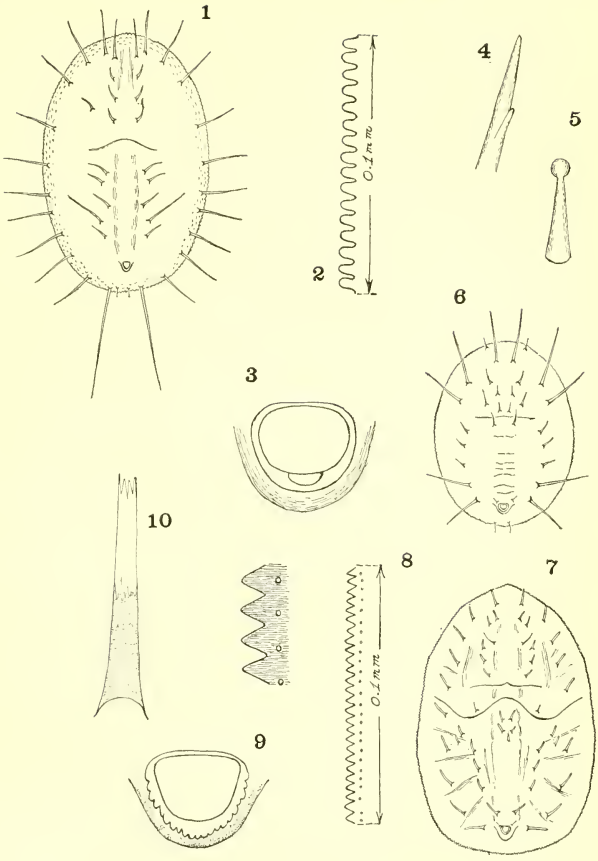

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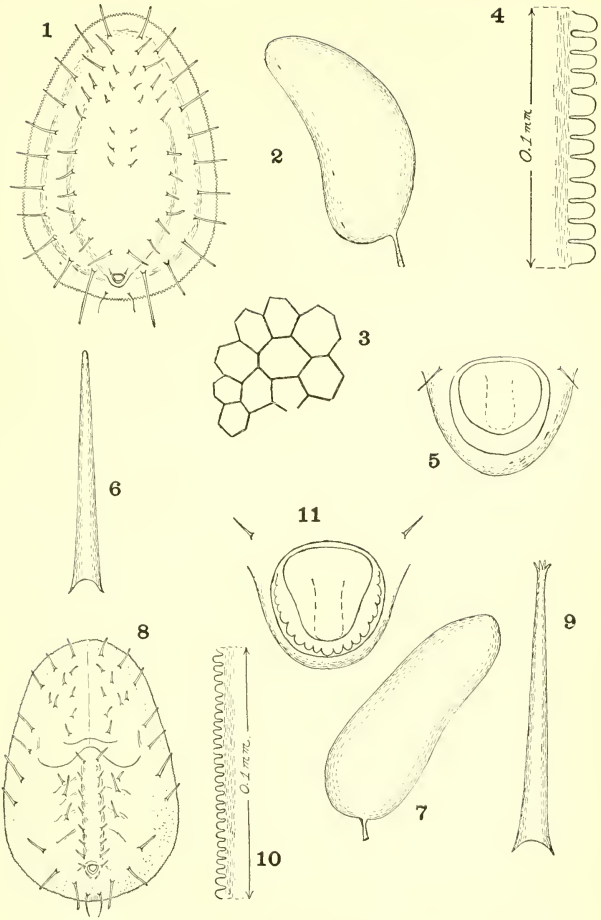

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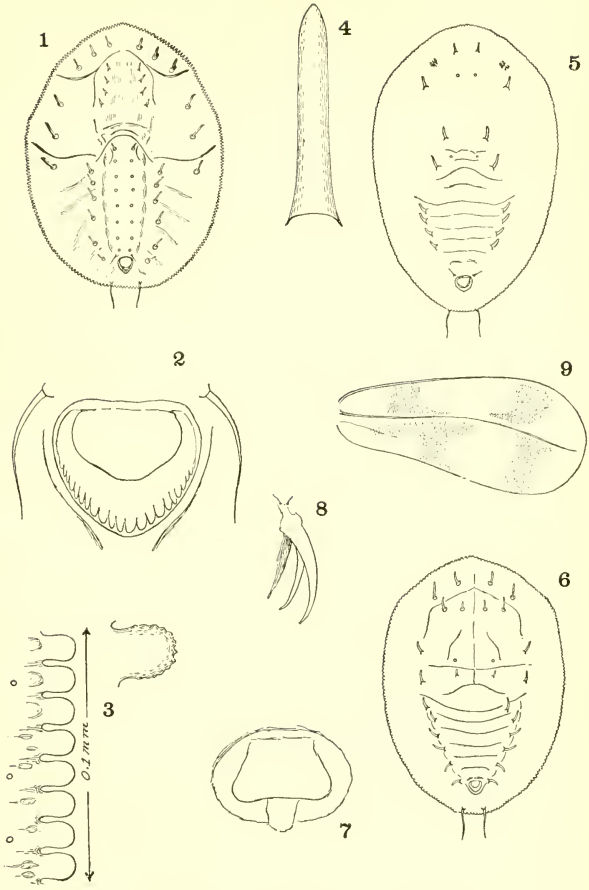

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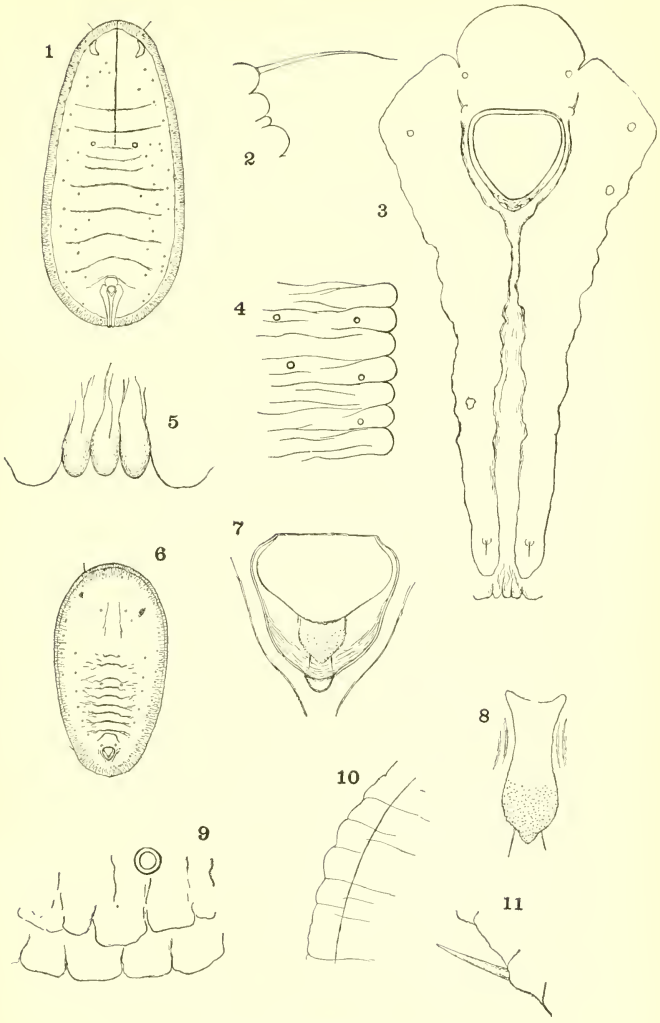

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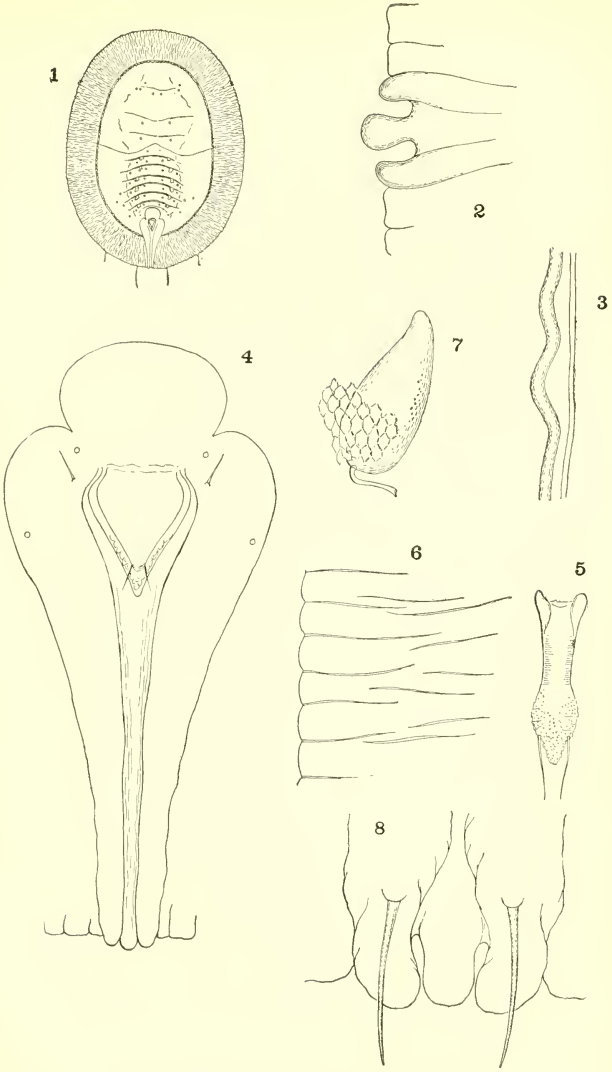

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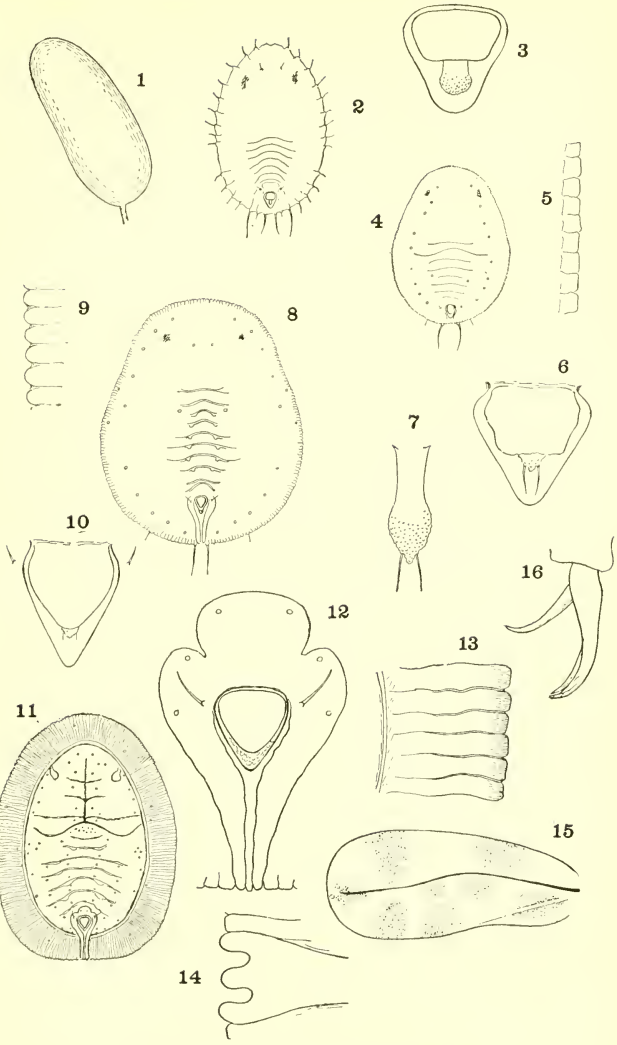

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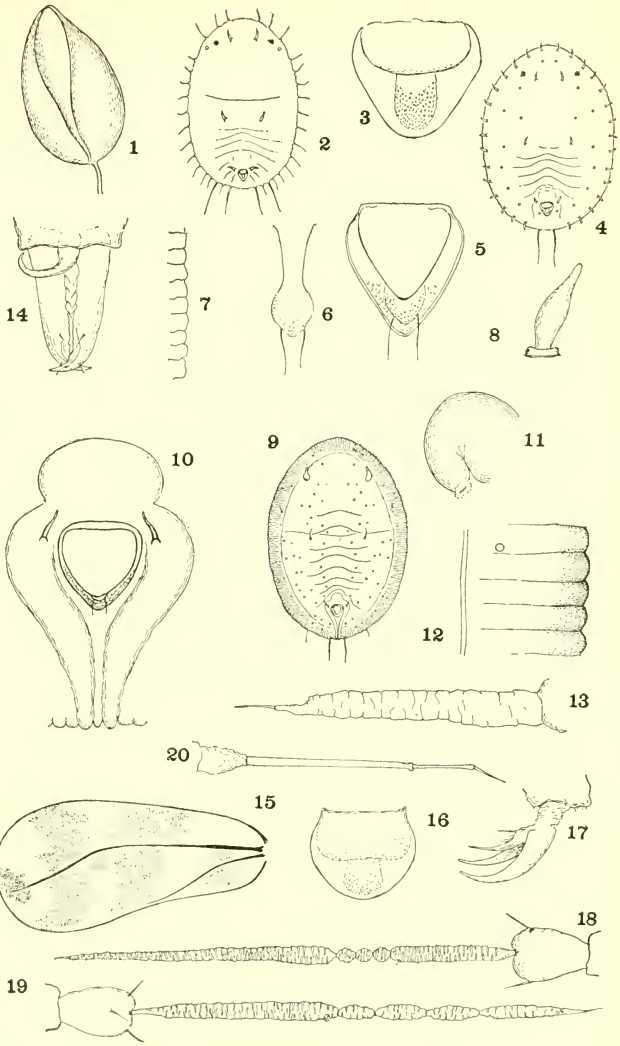

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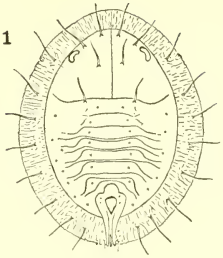

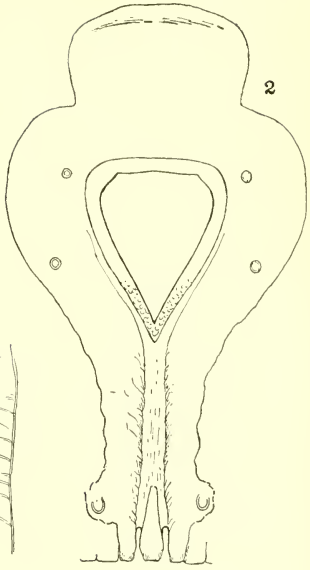

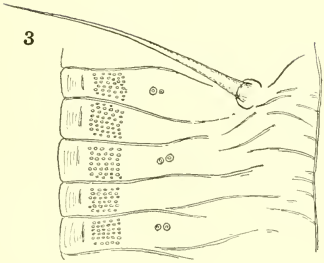

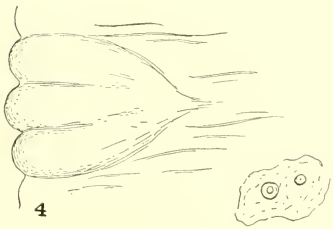

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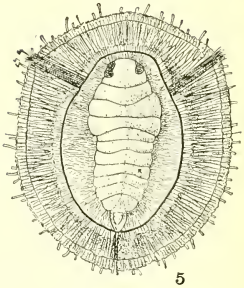
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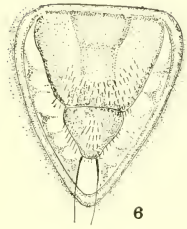
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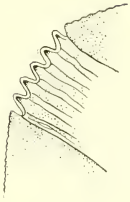
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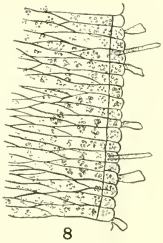
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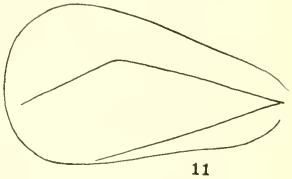
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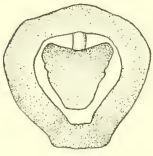
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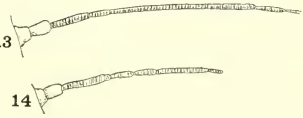
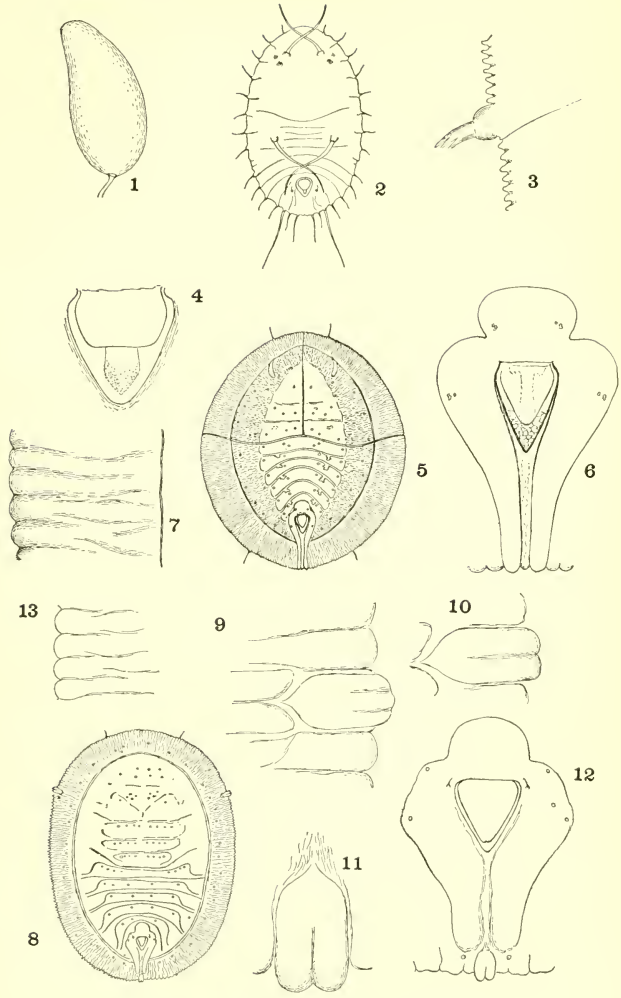

13 14

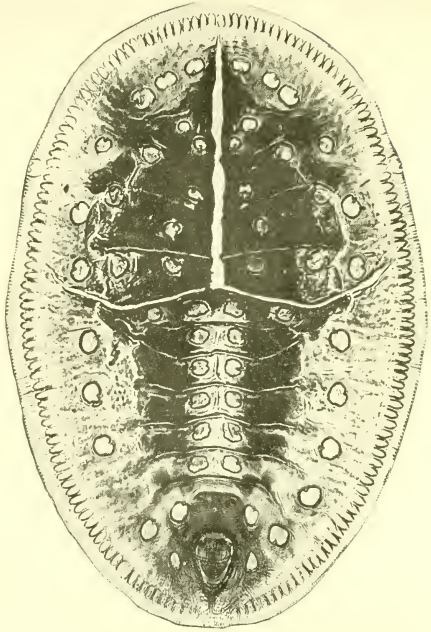
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 441.



WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 441.



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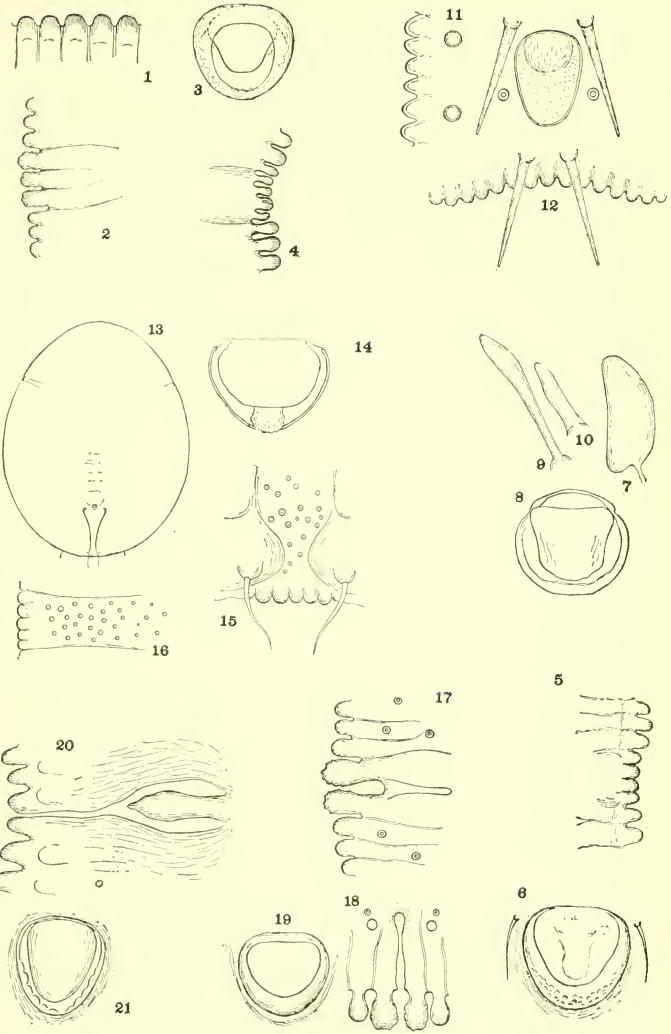
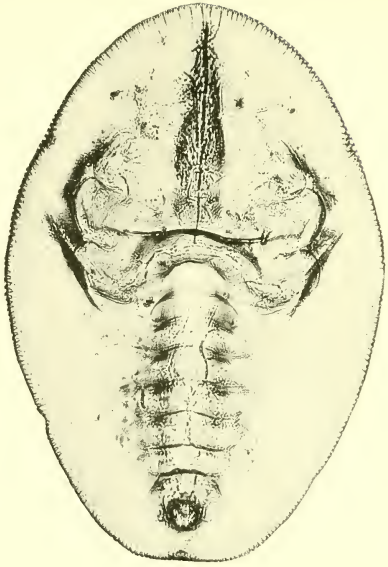
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 441.



WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 442.



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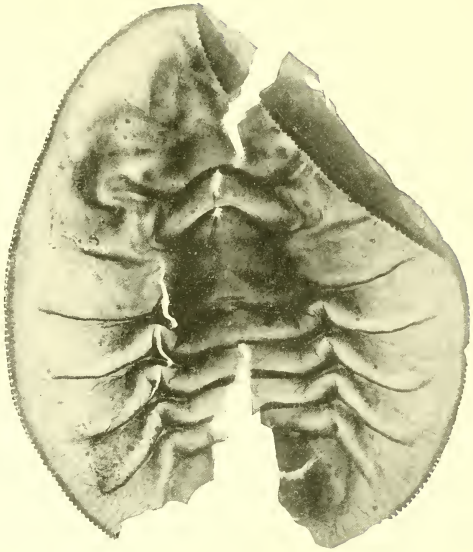

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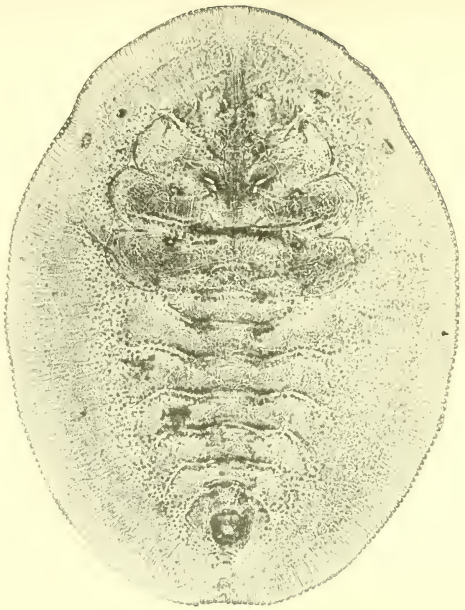
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 442.



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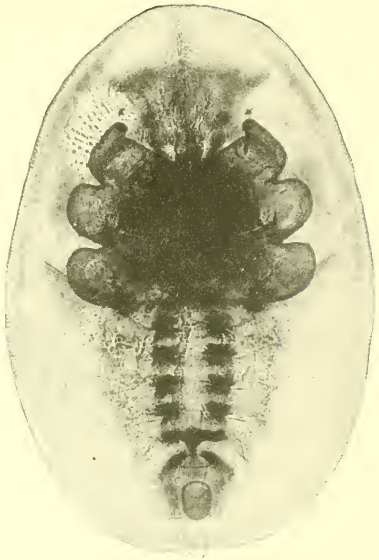

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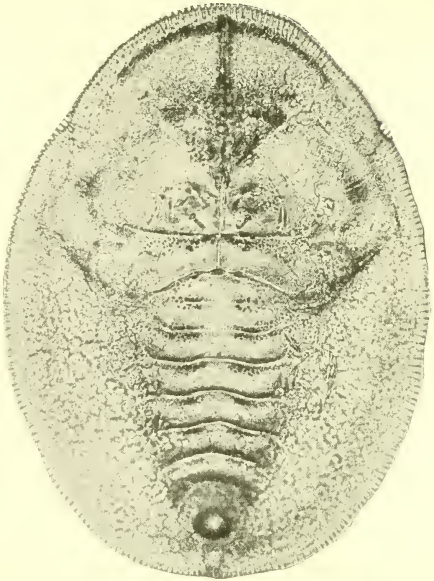
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 442.



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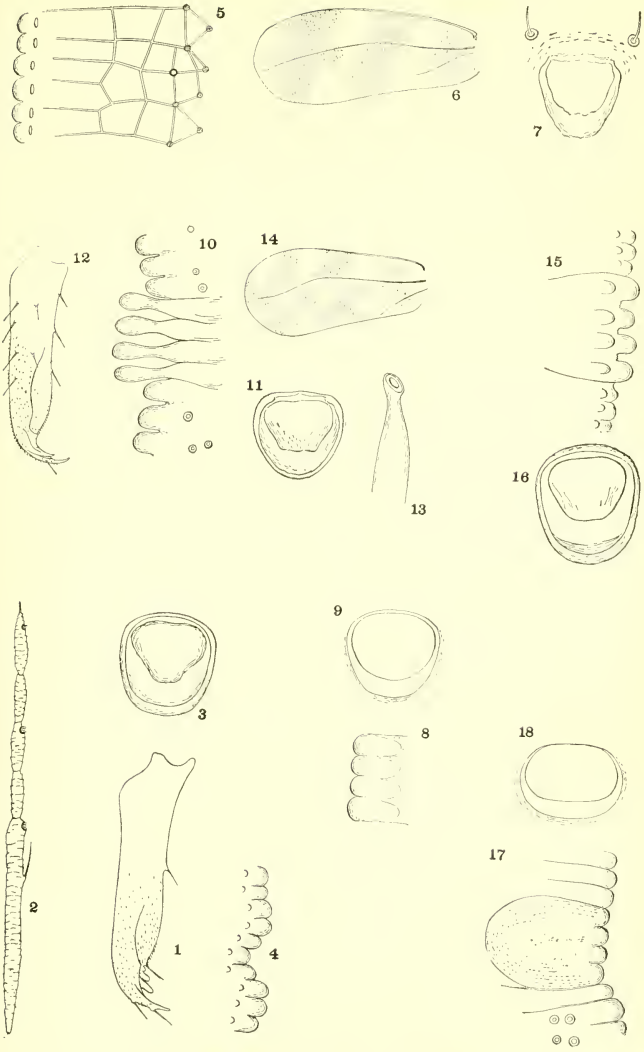
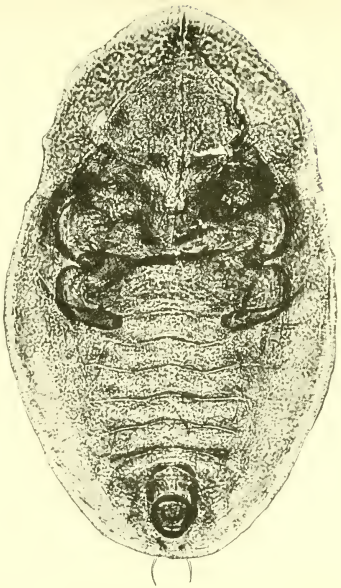
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 442.



WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 442.



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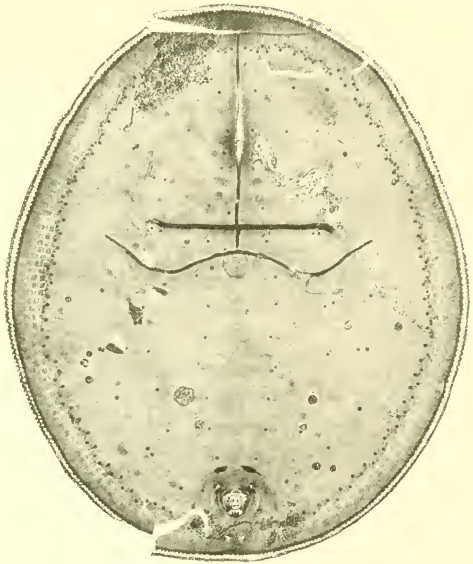

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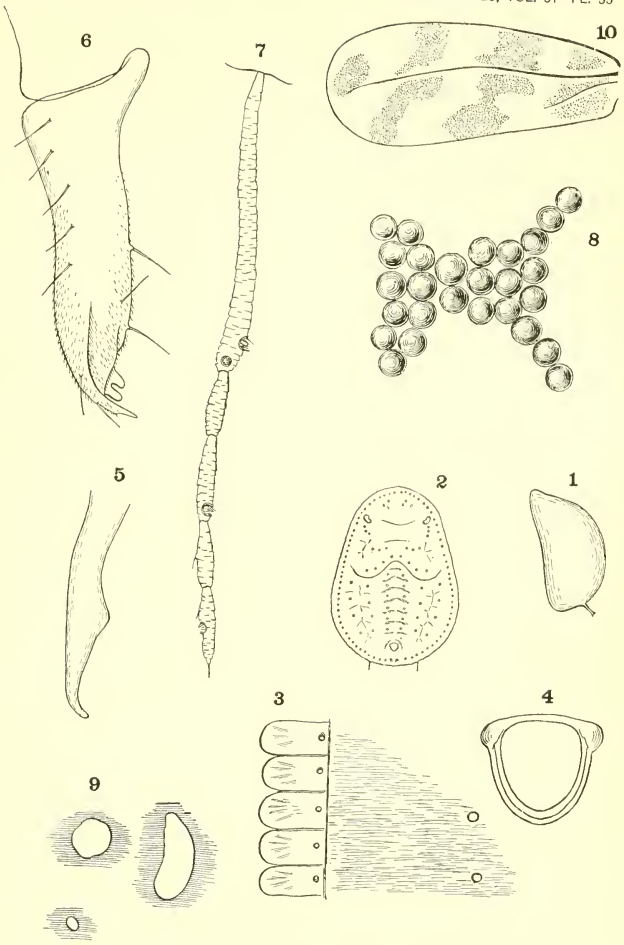
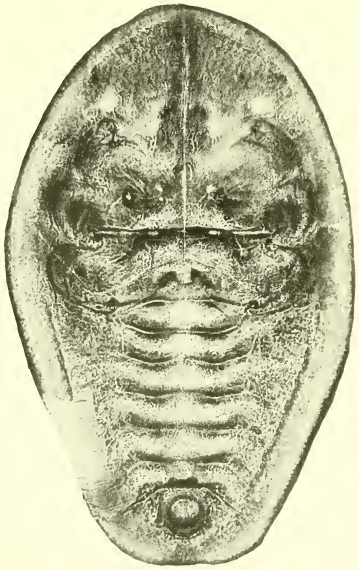
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 442.



WHITE FLIES OF THE SUBFAMILY ALEYRODINAE

FOR EXPLANATION OF PLATE SEE PAGE 442.



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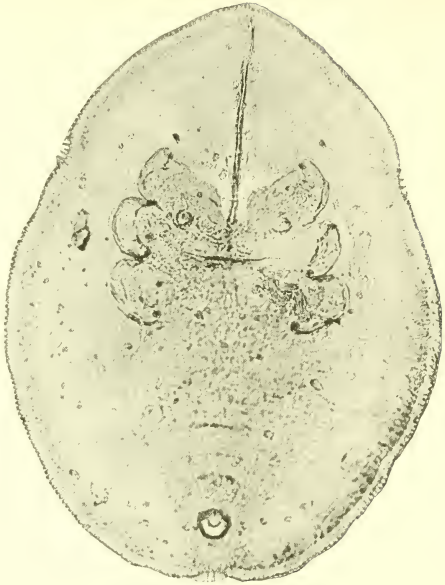

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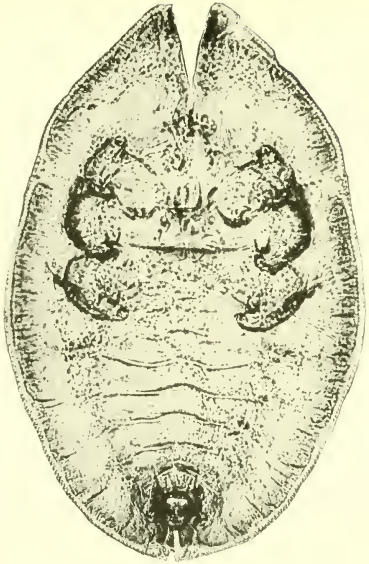
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 442.



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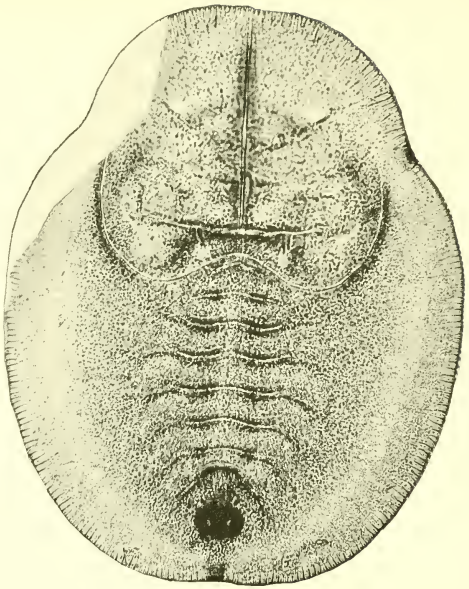

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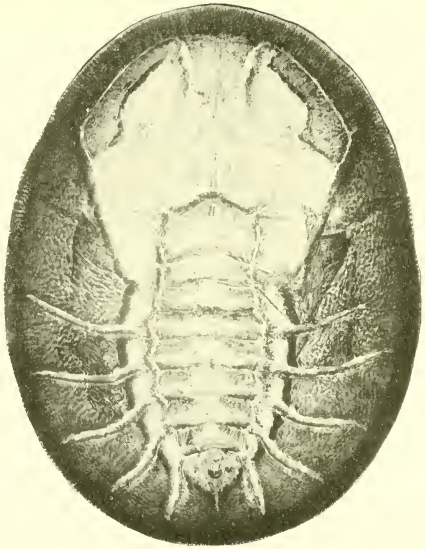
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 443.



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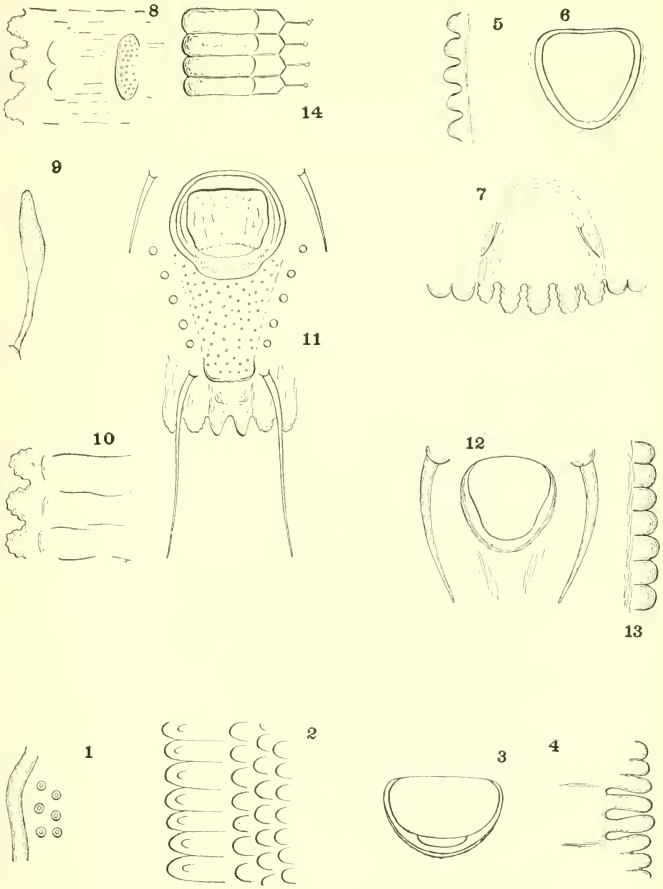
2

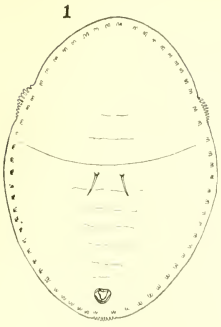
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

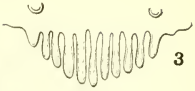
FOR EXPLANATION OF PLATE SEE PAGE 443.

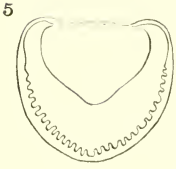


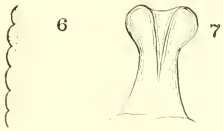
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

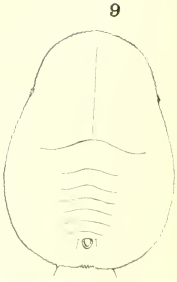
FOR EXPLANATION OF PLATE SEE PAGE 443.

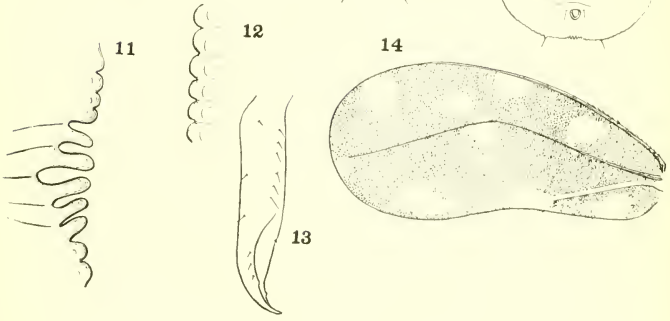






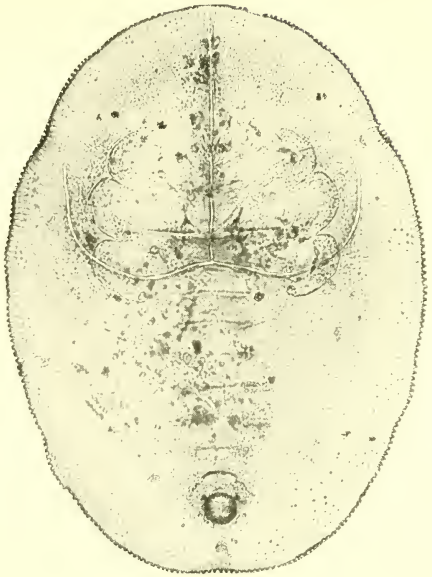






WHITE FLIES OF THE SUBFAMILY ALEYRODINAE

FOR EXPLANATION OF PLATE SEE PAGE 443.



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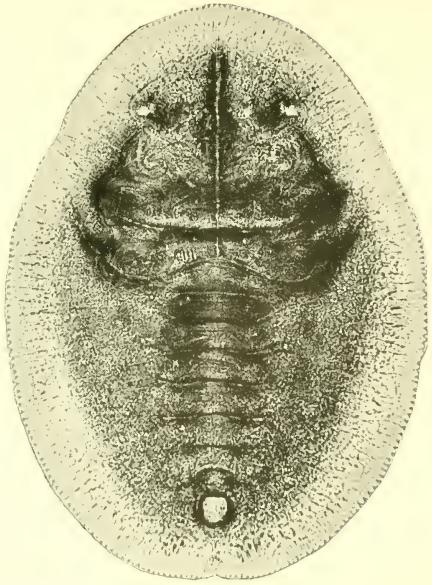

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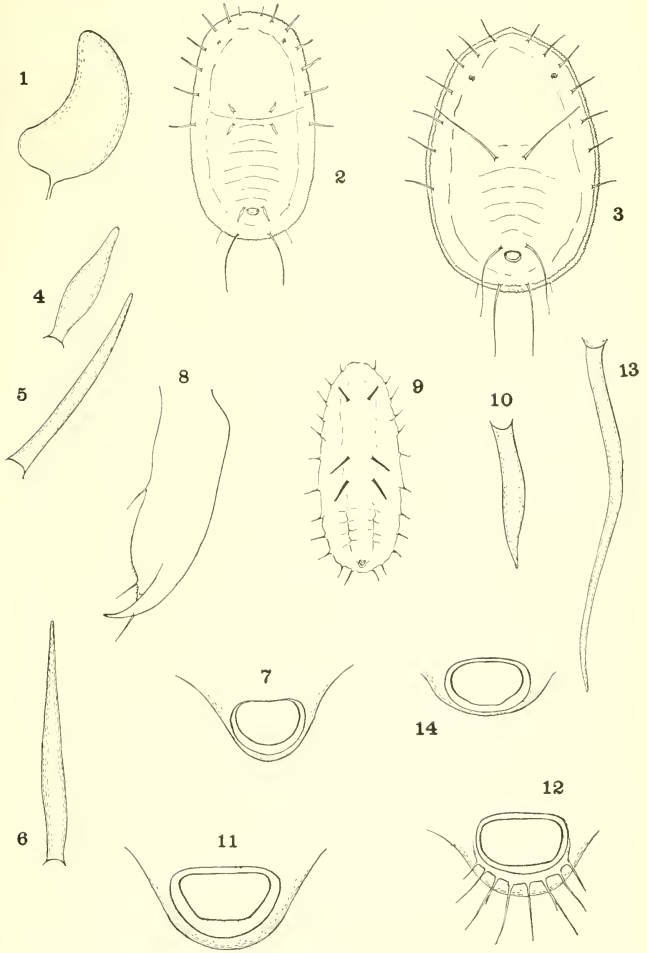
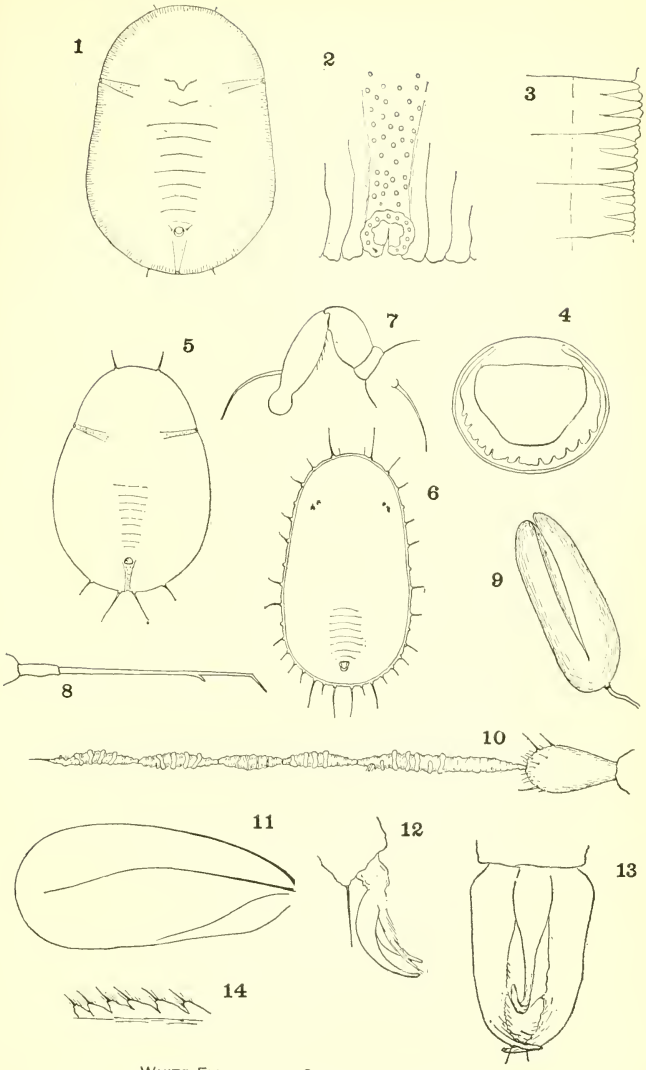
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 443.



WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 443.



WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

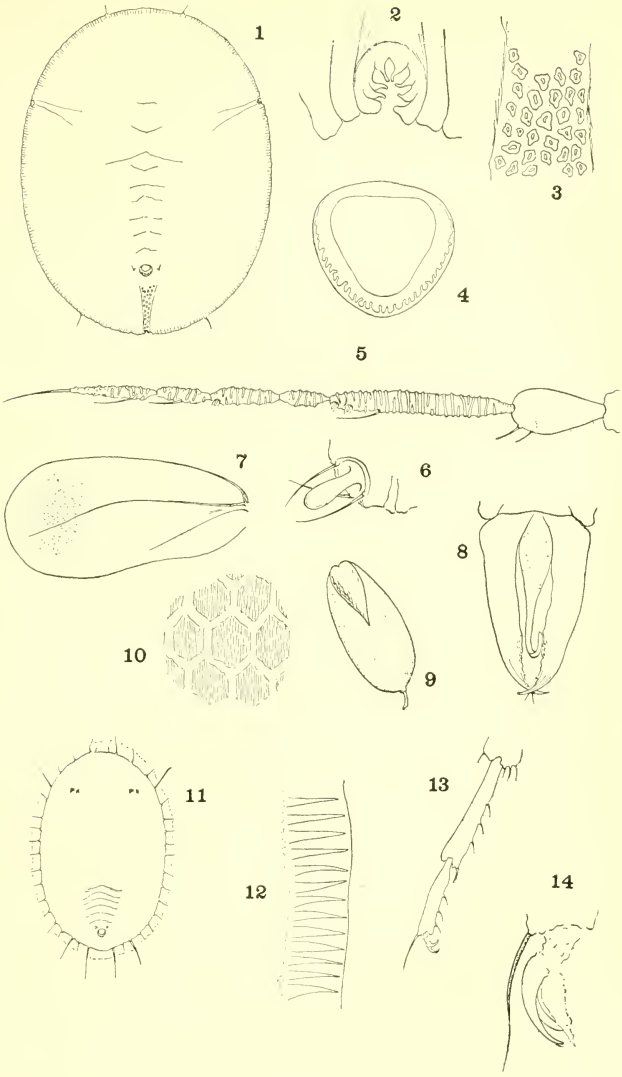
FOR EXPLANATION OF PLATE SEE PAGE 443.

1

2

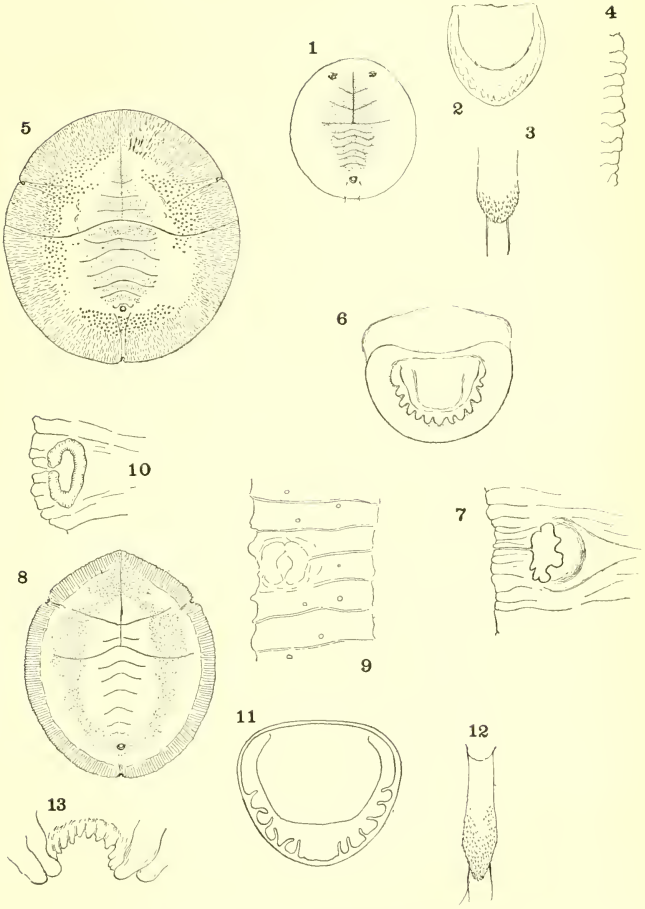
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 443.



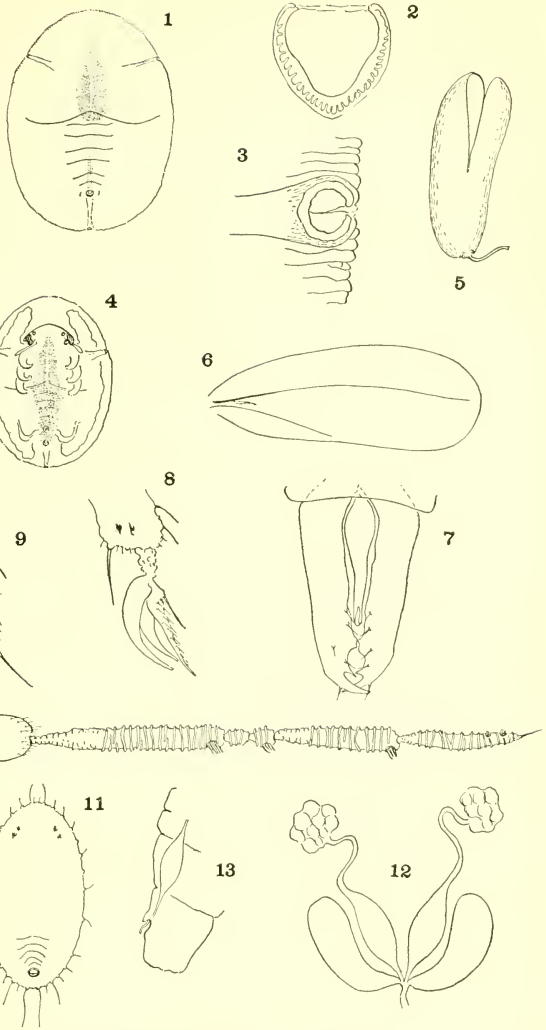
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 443.



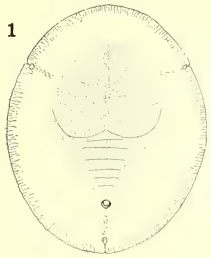
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

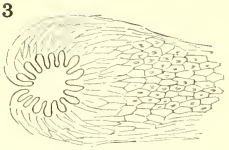
FOR EXPLANATION OF PLATE SEE PAGE 444.

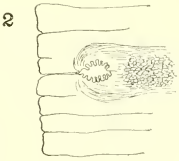


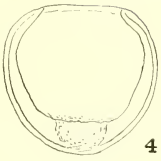
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

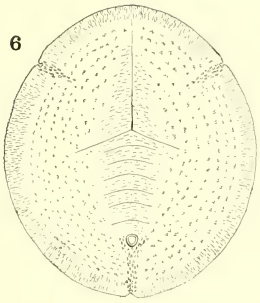
FOR EXPLANATION OF PLATE SEE PAGE 444.

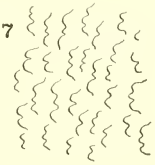


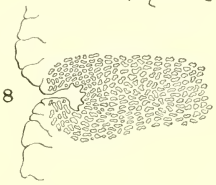






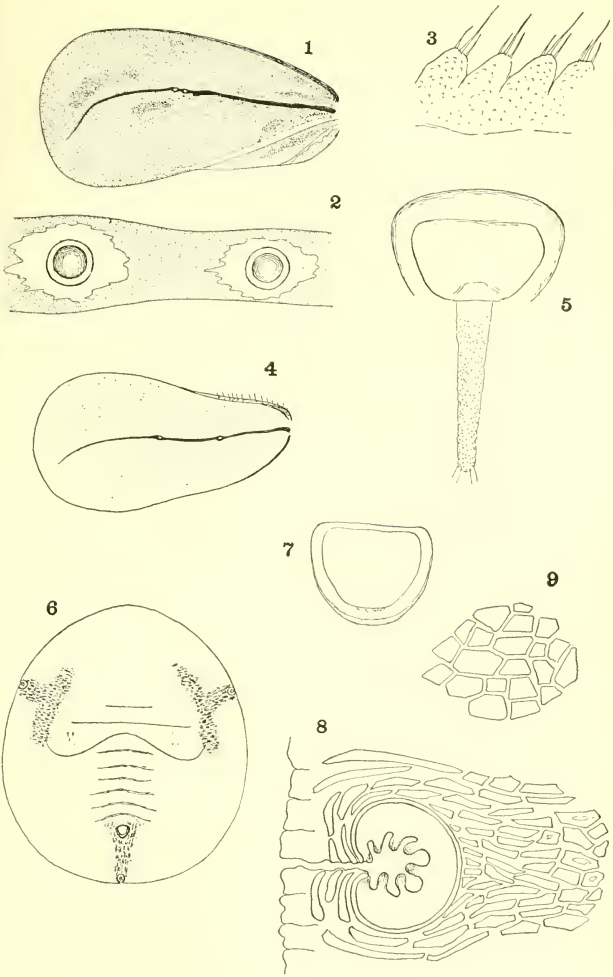






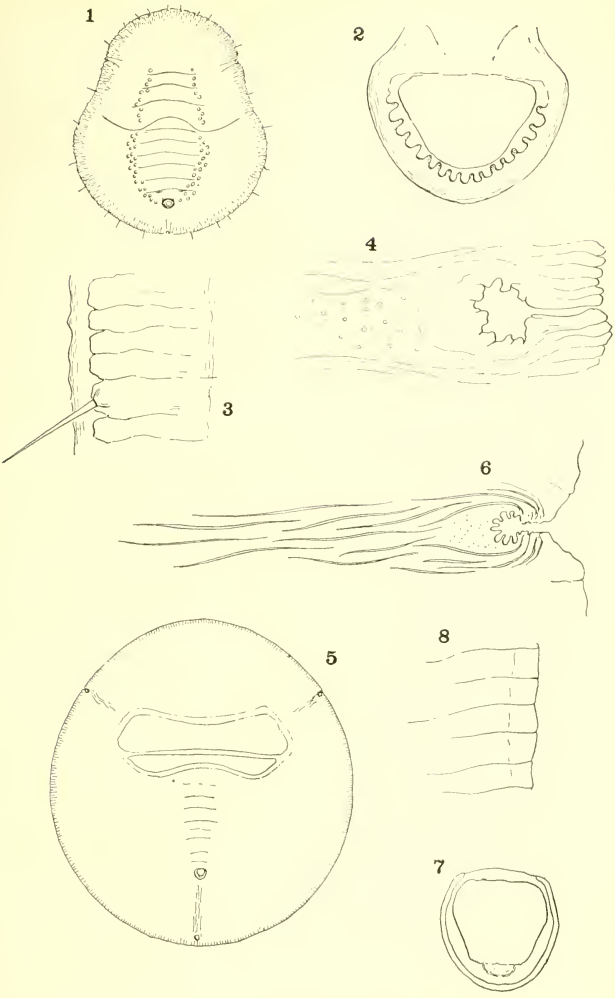
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 444.



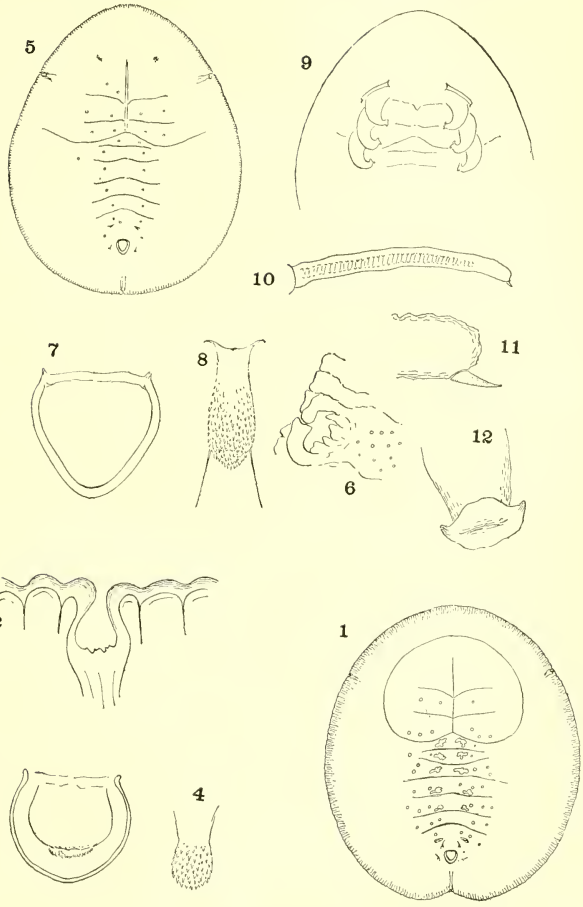
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 444.



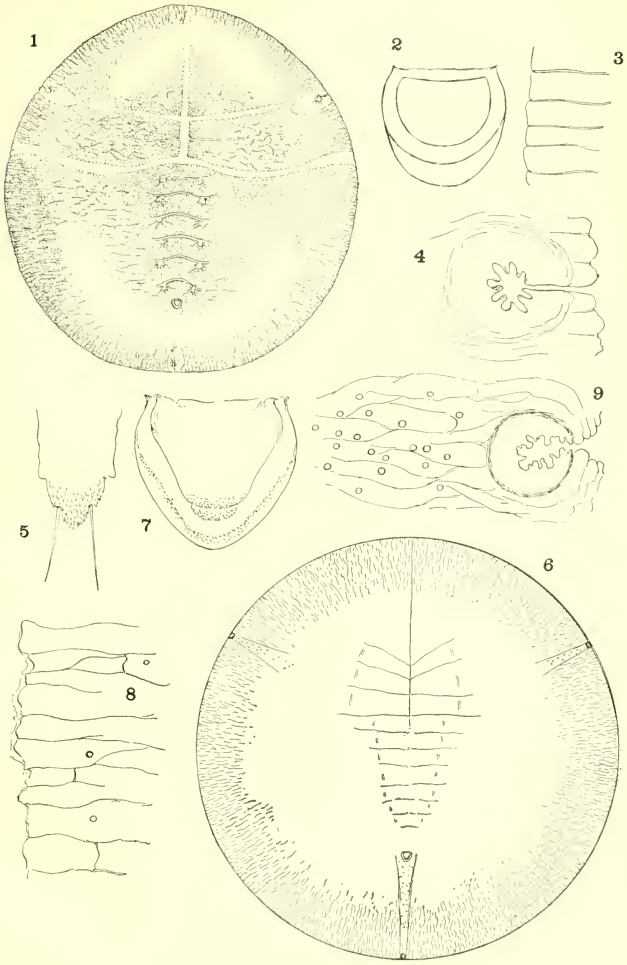
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 444.



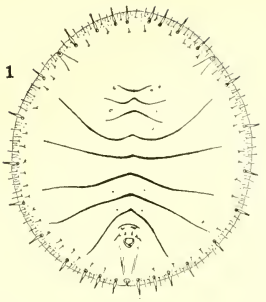
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

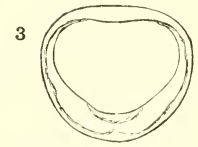
FOR EXPLANATION OF PLATE SEE PAGE 444.

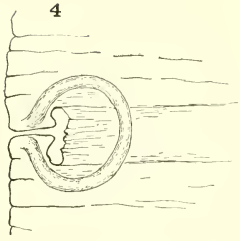


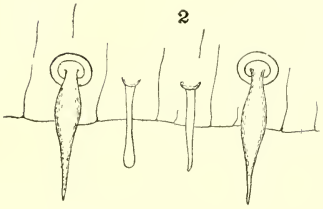
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

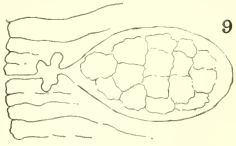
FOR EXPLANATION OF PLATE SEE PAGE 414.

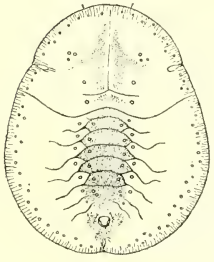


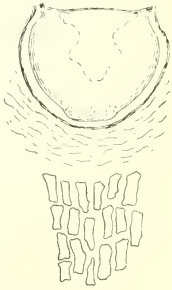






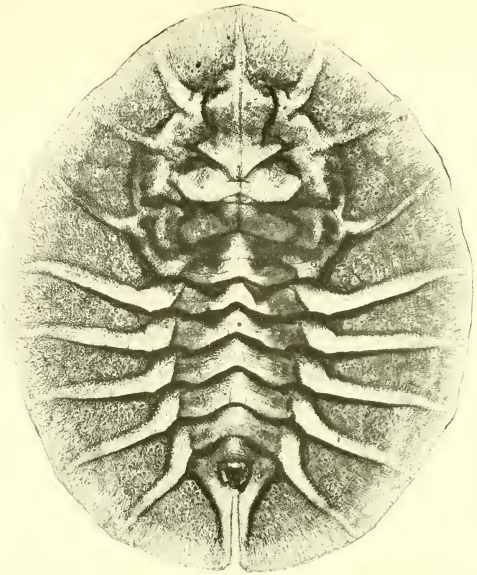






WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 444.



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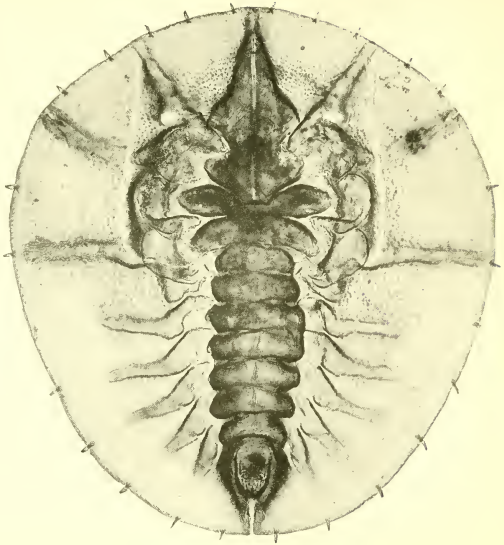

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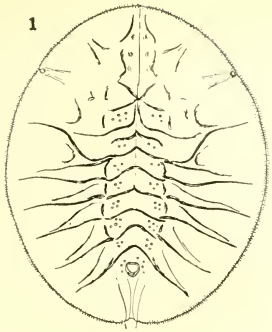
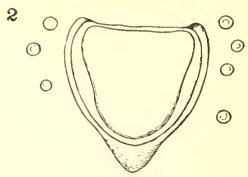
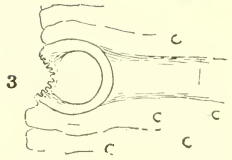
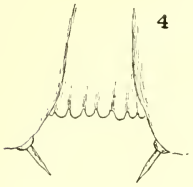
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

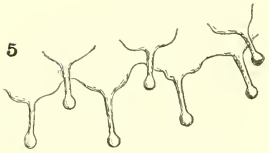
FOR EXPLANATION OF PLATE SEE PAGE 445.

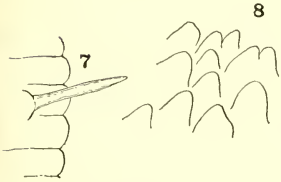


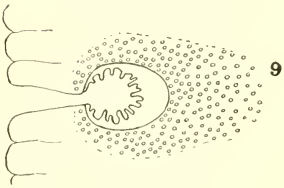


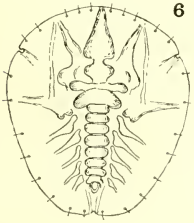


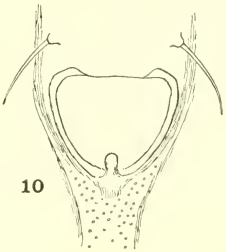


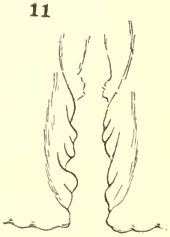






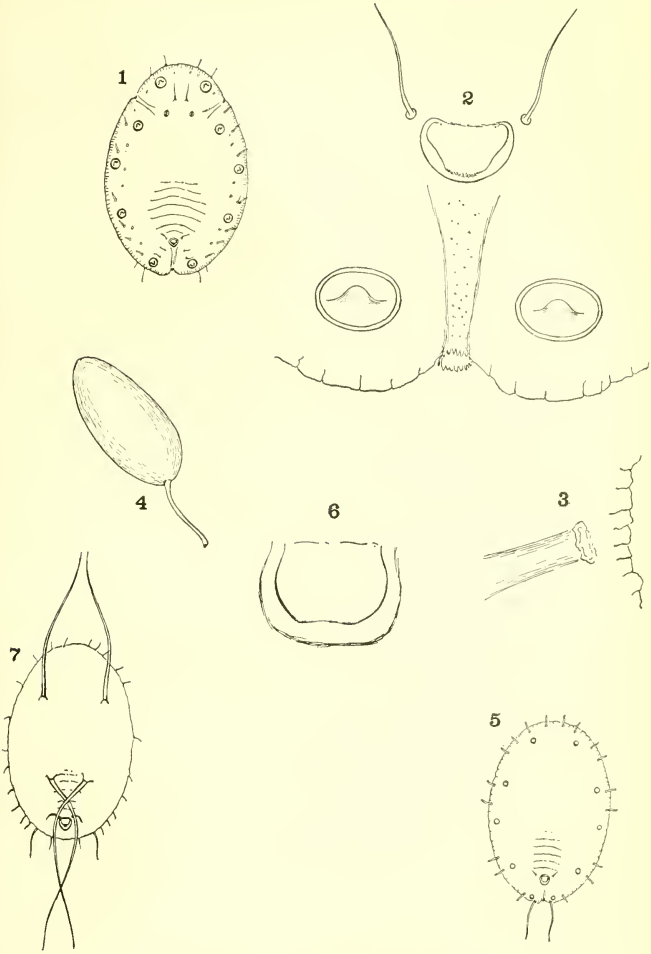






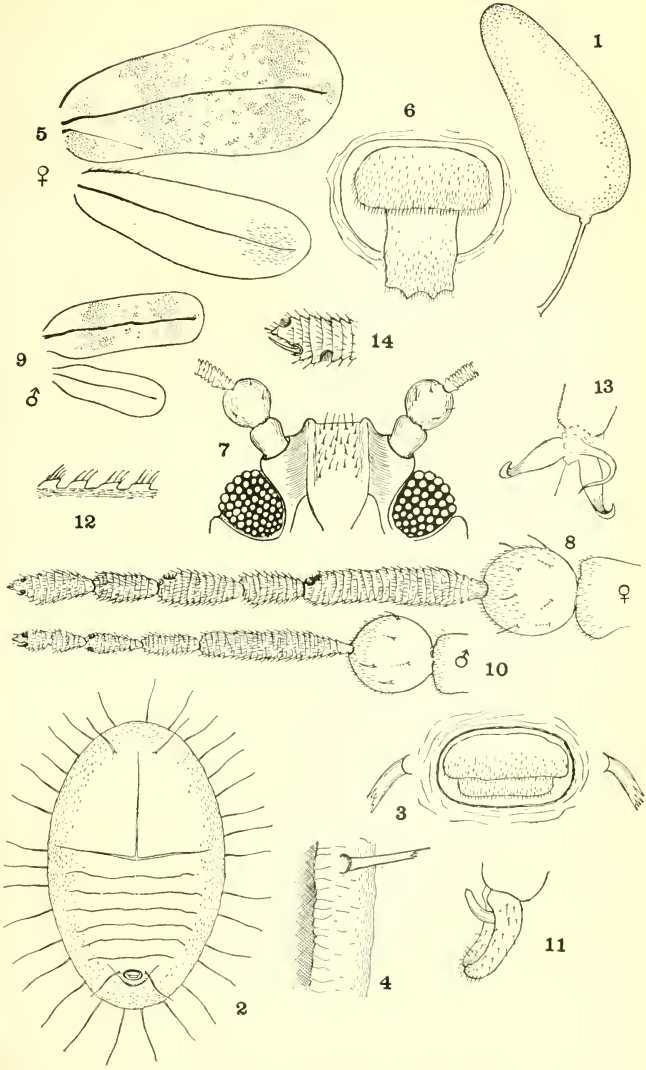
WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 445.



WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 445.



WHITE FLIES OF THE SUBFAMILY ALEYRODINAE.

FOR EXPLANATION OF PLATE SEE PAGE 445.