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U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

CONTRIBUTIONS TOWARD A MONOGRAPH OF THE AMERICAN
ALEURODIDÆ.

BY

A. L. QUAINANCE, M. S.,

Biologist and Horticulturist of the Georgia Agricultural Experiment Station, Experiment, Ga.

THE RED SPIDERS OF THE UNITED STATES
(TETRANYCHUS AND STIGMÆUS).

BY

NATHAN BANKS, M. S.,

Assistant, Division of Entomology, U. S. Department of Agriculture.

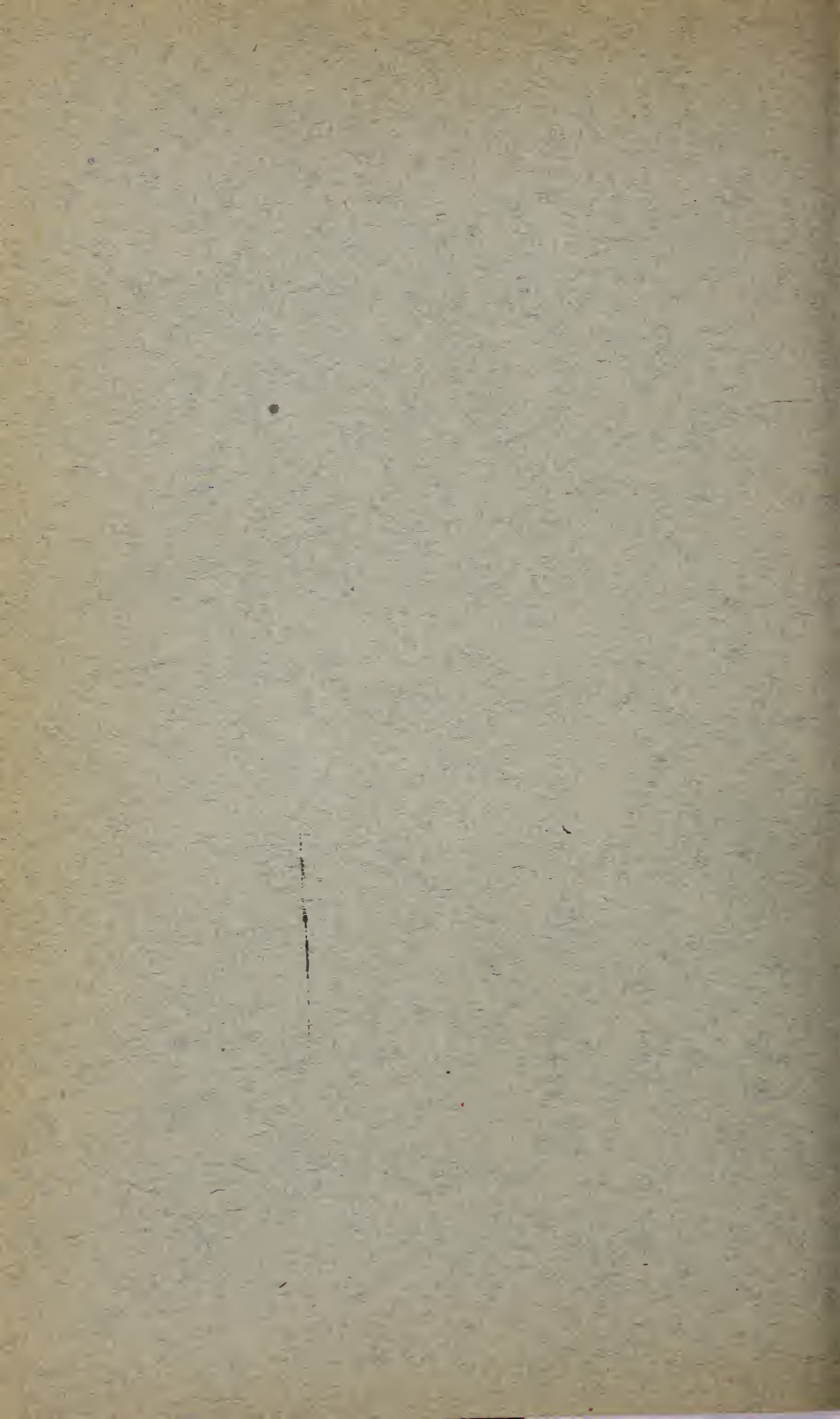
PREPARED UNDER THE DIRECTION OF THE ENTOMOLOGIST.



WASHINGTON:

GOVERNMENT PRINTING OFFICE.

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TECHNICAL SERIES No. 8.

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF ENTOMOLOGY,
Washington, D. C., April 10, 1900.

SIR: I have the honor to submit for publication No. 8 of the technical series of bulletins of this Division. It contains two articles, the one prepared by Mr. A. L. Quaintance, biologist and horticulturist, Georgia Agricultural Experiment Station, and the other, at the writer's suggestion, by Mr. Nathan Banks, of this Division. The subjects considered, namely, the so-called white flies (Family Aleurodidæ) and the so-called red spiders (the Acarid genera Tetranychus and Stigmæus), are both groups of very considerable economic importance, some of the white flies doing considerable damage to Southern horticulture, and the red spiders being known as greenhouse pests in all parts of the country and as outdoor enemies to certain crops in the warmer States. With these groups, as with the others which have been previously treated in a monographic way in the earlier bulletins of this series, there has existed, up to the present time, so much confusion as to the differentiation of forms that the economic worker has not been able to know with any certainty the exact form upon which he might happen to be at work from the remedial standpoint. It is hoped that these papers will clear the field so that this uncertainty need no longer exist.

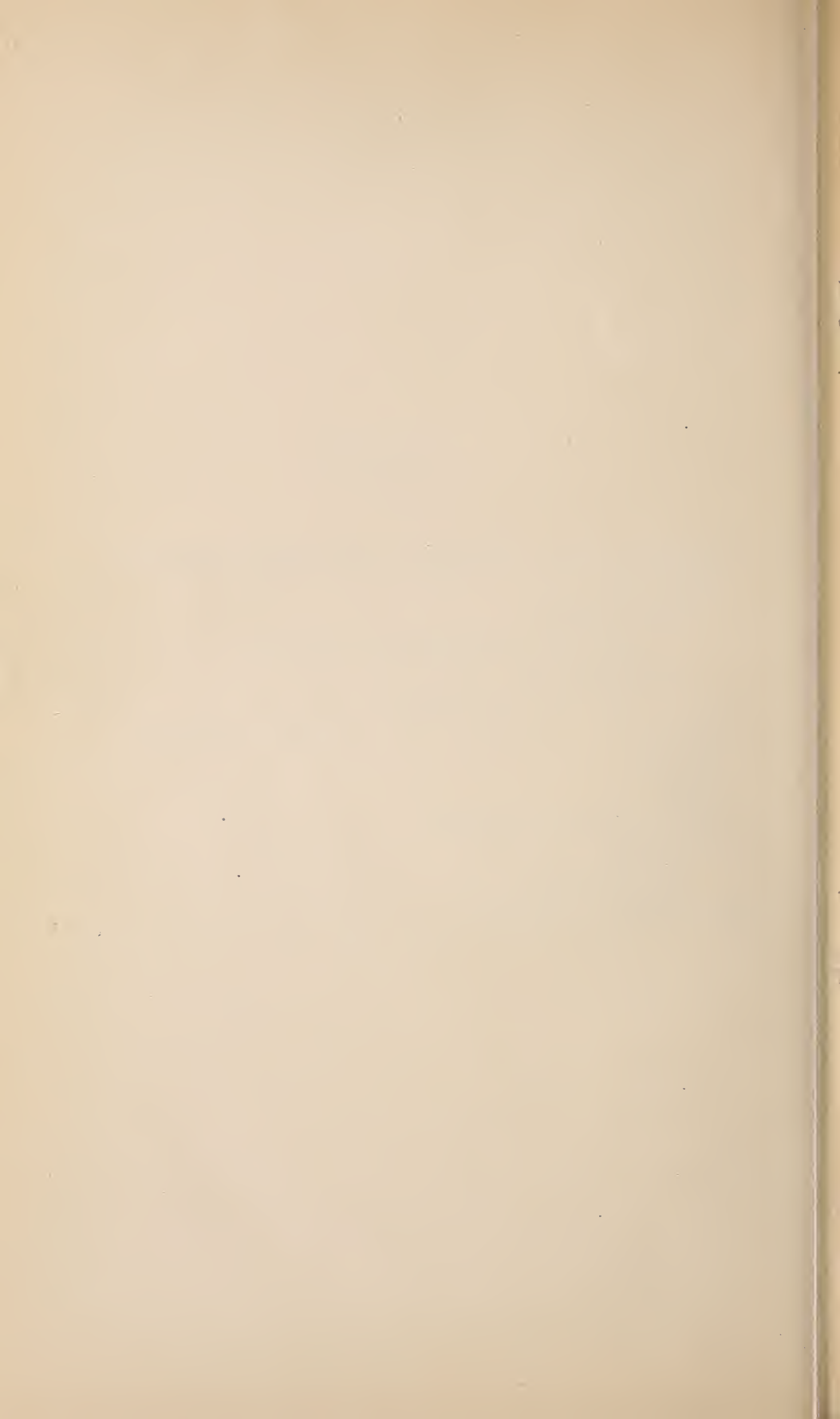
Respectfully,

L. O. HOWARD,
Entomologist.

HON. JAMES WILSON,
Secretary of Agriculture.

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CONTRIBUTIONS TOWARD A MONOGRAPH OF THE AMERICAN ALEURODIDÆ.

By A. L. QUAINANCE.

INTRODUCTION.

The writer's attention was called to this much neglected family of Homopterous insects about four years ago by Prof. T. D. A. Cockerell, since which time considerable material has been collected, or sent in by correspondents, and during the past year I have had the pleasure, through the kindness of Dr. L. O. Howard, of studying the collection of Aleurodidæ of the Division of Entomology of the United States Department of Agriculture. A considerable number of species have been met with that are undescribed, several of which are characterized in the present paper. So far as I have been able to ascertain, all American species of Aleurodidæ are indicated in the following pages; *Aleurodes vaporariorum* is included in this list; although originally described from Europe, it has now become quite common in green-houses, in various parts of the eastern United States at least. In all cases reference is made to the original description of a species, and to such other references as are of any importance from a systematic standpoint. From a study of this literature it is at once apparent that the as yet meager study of American Aleurodidæ has been, for the most part, done during recent years. In the United States, for example, there were but three species recorded previous to 1884. Forbes, in 1884, described from Illinois *Aleurodes aceris*, which, however, should now be known as *forbesii* Ashmead, since *aceris* is pre-occupied by a European species.¹ In 1893 Riley and Howard described *Aleurodes citri*, previously briefly described by Ashmead in the

¹Monograph N. Amer. Proctotrypidæ, Bul. 45, U. S. Nat. Mus., p. 294.

Florida Dispatch, November, 1885. *Aleurodes pyrolæ* Gillette and Baker, was described in 1895; *Aleurodes berbericola* Cockerell, in 1896; *Aleurodes ruborum* Cockerell, and *Aleurodes aureocincta* Cockerell, in 1897. Since 1897 to date four species have been described from the United States, giving a total of thirteen, one an *Aleurodicus* and twelve belonging to *Aleurodes*. From the West Indies, Mexico, Central and South America twenty species have been recorded, seven of which are species of the genus *Aleurodicus* and thirteen of *Aleurodes*. Of these, six were described before 1895. It is evident, therefore, to any one who has observed the variety of forms in this family that our knowledge of American Aleurodidæ is still very imperfect, and, with the exception of *Aleurodes citri*, our knowledge of their life history and habits is even more incomplete.

The specific characters in the genus *Aleurodes* are derived mainly from the pupa-case, the adults, except in species with banded or spotted wings, offering but very little of use in characterization. In *Aleurodicus*, on the other hand, the most valuable specific characters are to be found in the adults, although to me there has appeared to be more variation in the pupa-case than has been generally stated. Ordinarily, the founding of species on the characters derived from immature stages of insects is unwarranted; but with this family, however, particularly in *Aleurodes*, as has been pointed out by Maskell and others, the pupa-case offers by far the more valuable characters, and it is doubtful if species could be satisfactorily separated, except in a few cases, from adult characters alone. Moreover, it is in the pupal stage that these insects are most frequently observed and collected, the minute "white-flies" that may be flying around being usually not associated with the stationary scale-like insects on the leaves. Again, injury is caused by these insects it is likely, mainly, in their immature stages, which fact, from an economic standpoint, renders it necessary that these stages be characterized. For these reasons the writer believes that the characterization of species of *Aleurodes*, at least, should be based largely on pupal characters; there is as much variation, probably, in the pupa-case of different species of *Aleurodes* as there is in the species of *Aspidiotus*, *Mytilaspis*, *Chionaspis*, or other genera of the *Coccidæ*. The writer by no means favors the disregard of the imagoes, and especial effort should be made by collectors to secure this stage. This ordinarily may be easily done, where the pupæ are somewhat numerous, by placing the leaves in a jar for a few days, to allow the more mature pupæ to develop into adults.

To preserve Aleurodidæ satisfactorily for study it is advisable to keep two series. As soon as material is collected, specimens of all stages should be mounted in xylol balsam on slides, after careful "live notes" have been taken, particularly with reference to the coloration of the different parts, and with adults as to the division or not

of the eyes. Soon after mounting, the relative lengths of the joints of the antennæ of adults are much more readily distinguished than later. The other series should consist of adults preserved dry in vials, and the infested leaves so pinned that the waxy secretion from the larvæ and pupa-cases will not be in any way damaged.

I am under obligations to Prof. T. D. A. Cockerell for bibliographic references, numerous specimens sent, and other courtesies; and I have been much aided by the careful entry notes made by Mr. Theodor Pergande on the material received by the Division of Entomology and kindly furnished me by Dr. L. O. Howard.

Family ALEURODIDÆ.

Small to minute insects infesting the leaves of plants, usually on the lower side; the immature stages scale-like; the adults with two pairs of wings, and covered or dusted with a whitish meal-like secretion of wax.

In the immature stages the body may be more or less covered by a secretion of wax, frequently quite copious. The most distinctive Aleurodid character in the larval or pupal stages is in the presence of a subovate, triangular or semicircular opening on the dorsum of the last abdominal segment, known as the "vasiform orifice." This consists of the orifice; the operculum, a more or less lid-like structure attached to the rim of orifice cephalad, and the lingula, a more or less slender tongue or strap-shaped organ, attached cephalad within the orifice and extending frequently quite beyond its caudal margin.

In the adults the mentum is three segmented, inclosing the three rostral setæ; antennæ seven jointed, the first two joints short and thick, the others slender and numerously ringed. Eyes usually somewhat constricted near the middle, dumb-bell shape or reniform, or even completely divided. Above each eye is a single ocellus. Tarsi two jointed, with three terminal claws, the middle one of which is short and small. The wings when at rest are nearly horizontal, extending caudad considerably beyond the abdomen, rounded distally. Both fore and hind wings may be immaculate or variously spotted or banded, usually with dusky or reddish.¹

Genus ALEURODES Latreille.

With the characters of the family. Adults, with but a single basal branch to vein of fore wings; hind wings, with but a single vein.

¹For a more detailed account of the characters of Aleurodidæ, see Maskell, Trans. N. Z. Inst., 1895, p. 415.

TABLE OF THE AMERICAN SPECIES OF ALEURODES.

- I. Pupa-case usually but little hidden by secretion; with lateral fringe—*i. e.*, any secretion from marginal wax tubes.
- II. Pupa-case usually hidden by a mass of hairy, waxy or flocculent secretion.
- III. Pupa-case evident, and without lateral fringe.

- I. Pupa-case usually but little hidden by secretion; with lateral fringe—*i. e.*, any secretion from the marginal wax tubes.

Pupa-case uniformly brown or black.

With dorsal secretion of wax. Dorsal secretion cottony or mealy in appearance.

Pupa-case dark brown to black, elliptical, slightly convex, about 0.85 mm. long. Dorsum covered with white meal, frequently becoming quite solid. Lateral fringe, all around, agglomerated almost into a solid plate, of unequal length, giving a star shape of about 8 rays. Operculum subcircular, covering about one-half of orifice; *lingula* obsolete.....*stellata* Mask. (37.)

Pupa-case black, elliptical, convex, 1.8 mm. long. Margin thick with conspicuous groove on dorsal surface, and short fringe of wax on ventral surface. Around vasiform orifice, a large, nearly transparent, hemispherical area, but dusted with white secretion. Around lateral margin, a row of about 32 sharp sword-like hairs. Adult ♀ with basal half and portions of rest of wing smoky.

fumipennis Hempel (18.)

Pupa-case shiny black; size about 0.92 by 0.61 mm.; subelliptical, moderately convex; lateral fringe rather short, truncate; dorsal secretion of 3 longitudinal stripes of cottony or mealy wax.

acaciæ n. sp. (3.)

Pupa-case dull black; subelliptical; 0.81 by 0.52 mm.; the copious lateral fringe, about twice the width of case in length. A slight mealy secretion may occur on dorsum; with tube-like longitudinal medio-dorsal elevation, cephalad, arrow-shaped; along abdominal segments, suggesting a trachea, with a glottis caudad.

tracheifer n. sp. (38.)

Pupa-case shiny black, flat, subovate; 0.95 by 0.81 mm.; cephalo-lateral margins on each side with an indenture and thickening. Lateral fringe semitransparent; a very light mealy secretion of wax may occur along body segments. Dorsum with small black dots

quercus-aquaticæ n. sp. (33)

Without dorsal secretion of wax.

Lateral fringe gelatinous looking (translucent).

Pupa-case pitch black, oval, hardly one millimeter long. The gelatinous fringe extending out from case, rather more than one-half width of case, and raising it up somewhat. From cephalo-lateral margin on each side and from caudal end a pencil of white wax resting on gelatinous rim.....*gelatinosus* Ckll. (19)

quercus-aquaticæ n. sp. See above.

Lateral fringe a series of distinct radiating waxy ribbons.

Pupa-case intense black, oval, hardly over a millimeter long. The lateral fringe of 12 broad ribbon-like rays of glassy wax, yellow basally, about as long as length of case.....*vinsonioides* Ckll. (41)

Lateral fringe a narrow, continuous rim of white waxen filaments.

Pupa-case dense black, broadly elliptical, 1.2 mm. long. Moderately convex, with rounded median ridge *cockerelli* v. Ihering. (9)

Lateral fringe a more or less copious cottony secretion.

Pupa-case shiny black, elliptical, about 0.7 by 0.55 mm. A copious white cottony fringe all around, continuous basally, but ragged distally. Case moderately convex, with evident rounded median ridge. Fore-wings of adults marked with red and brownish black..... *mori* Q. (24)

“Larva (Pupa-case?) flavous, the disk of the larger individuals dark brown; the margin is ciliate with white.” Wings of adults immaculate *corni* Hald. (10)

Pupa-case shiny black, subelliptical 0.7 by 0.55 mm. Dorsal disk larger than ventral, and the marginal rim of wax tubes bent downward and inward. The scant cottony secretion from marginal wax tubes appearing as a vertical fringe. *abnormis* n. sp. (1)

tracheifer n. sp. See above.

Pupa-case yellowish, or greenish.

Dorsal secretion simply a submarginal series of brittle curved waxen rods from distinct pores or papillæ.

Pupa-case pale yellow, elliptical, about 0.56 mm. long, flattish. Margin minutely crenulated, the wax tubes bearing a short fringe of straight white tubes. Within the submarginal series of papillæ on dorsum, are 8 large circular orifices: 2 on cephalic, 4 on thoracic, and two on abdominal region..... *erigerontis* Mask. (12)

Dorsal secretion a submarginal series of curved waxen rods from distinct pores or pustules, and a more central secretion of thin, brittle, yellow wax, usually fragmentary.

Pupa-case, yellow, the median region at length darkening, elliptical, about 0.75 mm. long. With two lateral depressions on each side, similar to those in a *Lecanium*. Lateral fringe short, fragmentary. Within submarginal series of pustules on dorsum are 12 other pustules: 2 large on cephalic region, 2 large on thoracic region, 4 large on abdominal region, 2 large on caudal region, and 2 small at vasiform orifice..... *nicotiana* Mask. (26)

Without dorsal secretion.

The lateral fringe, a delicate, white, band-like secretion.

Pupa-case pale greenish, oval, with margins anteriorly very sinuous; 0.5 mm. long. Within margin all around a parallel line the intervening space crossed by equidistant straight lines; a second parallel line, often faint, within the first, the space thus formed also crossed by lines closer and shorter than in first zone. On ventral surface, near middle line are five pairs of strong setaceous hairs, all very long, and projecting mostly beyond the margin. Wings of adults immaculate; eyes large, black, bean-shaped...

filiicum, Göldi (13)

The lateral fringe consisting of but three curling, white waxen filaments, from long thickened tubular pores, opening, one on each side in cephalo-lateral region, and one at caudal end of case.

Pupa-case pale greenish yellow to yellowish, broadly oval, but little convex, applied close to leaf, and inconspicuous; 1.4 by 0.8 to 1 mm.; margin minutely crenulated, and with radiating lines extending mesad. Vasiform orifice, small, subcircular; operculum short, concave distally. Adults with immaculate wings..... *citri* R. & H. (8)

II. Pupa-case usually hidden by a mass of hairy, waxy, or flocculent secretion.

The secretion white, felt-like, or hairy.

Pupa-case black, oval, 0.94 mm. long. Flat, but dorsum with a median ridge, and several transverse furrows. Margin with double crenulation. Vasiform orifice and operculum hemispherical; operculum small, not filling orifice. Wings of adult ♀ immaculate.....*parvus* Hempel. (27)

Larva yellowish green, somewhat roundish, 0.5 mm. long. Margin with double crenulations which are pointed distally. Ventral surface with five pairs of bristles along middle line, about as long as one-third width of body. Pupa case with 10 to 12 long radiating wax threads, star-like.....*goyabæ* Göldi. (20)

Larva similar to *goyabæ*, but only the caudal pair of bristles readily discernible. Pupa-case scantily covered with the unequal curling waxen threads. A submarginal series of equally spaced short bristles.....*æpim* Göldi. (4)

The secretion yellowish, long, hair-like.

Pupa-case light yellow, elliptical, 1 mm. long, flat. Denuded of the yellowish hair-like secretion, a longitudinal median, and submarginal secretion on each side of white wax is evident. Vasiform orifice subelliptical. Operculum hemispherical, nearly fitting orifice, the caudal end notched. Adult ♀ with wings immaculate, eyes black.....*horridus* Hempel. (22)

The secretion white, flocculent.

Pupa-case dull yellow, elliptical, 0.56 to 0.84 mm. long, slightly convex. Margin conspicuously crenulated, the wax tubes bearing besides the flocculent matter a moderately long fringe of straight, white wax tubes. Dorsum with six long slender cylindrical spines, the caudal pair frequently bearing a pencil of white wax. Vasiform orifice twice as broad as long; operculum short, broad; lingula obsolete.....*floccosa* Mask. (15)

The secretion of very long, curling bundles of snowy white wax in the form of a rosette.

Pupa-case yellowish, elliptical 0.78 by 0.5 mm.; the curling bundles of white wax from submarginal area, and a more or less columnar central secretion. A submarginal series of glassy, curved, waxen rods, from distinct papillæ; case raised on vertical fringe.....*pergandei* n. sp. (28)

The secretion a submarginal series of broad waxy ribbons with a more central secretion, more or less columnar in appearance.

Pupa-case shiny black, sub-elliptical; 0.72 by 0.46 mm. The copious secretion, as a whole, rosette-like, the ribbons of wax rather long, curving outward and downward. Lateral fringe semi-transparent and agglomerated.....*plumosa* n. sp. (31)

III. Pupa-case evident, and without lateral fringe.

Pupa-case more or less marked with brown or black, but not uniformly.

With dorsal secretion of wax from distinct pores or papillæ.

The secretion, a submarginal series, of brittle more or less curving waxen rods.

Pupa-case yellowish to whitish, with broad longitudinal medio-dorsal band of dark-brown; elliptical, 0.7 by 0.43 mm.; raised on vertical fringe.....*fitchi* n. sp. (14)

Pupa-case greenish white, but with a row on each side of more or less brownish spots; elliptical, 0.83 by 0.57 mm. The glassy rods,

from very closely set submarginal papillæ, and frequently as long as case is wide *floridensis* n. sp. (16)

Pupa-case with a longitudinal medio-dorsal stripe, and a sub-marginal area of varying width whitish, otherwise brown, deepest laterad of central stripe; elliptical, 0.75 by 0.52 mm. The sub-marginal series of waxen rods rather short. No vertical fringe.. *vittata* n. sp. (42)

The secretion in part a submarginal series of sheathed bundles of small, curling, white waxen rods, from distinct groups of rather small pores.

Pupa-case with marginal, somewhat wedged-shaped, dashes of brown; two broad, longitudinal, interrupted, sub-dorsal bands of brown; subovate; 1.79 by 1.26 mm. A central and two lateral longitudinal matted exudations of wax. A very high vertical fringe *altissima* n. sp. (5)

The secretion a submarginal series of glassy, curved, waxen rods from papillæ or pores, and similar rods more or less promiscuous on dorsum from circular pores.

Pupa-case yellowish to whitish, but with frequently a brownish coloration along dorsi-meson; elliptical; 0.72 by 0.45 mm. On the thorax the pores are promiscuous, but along abdomen are inclined to occur in longitudinal rows. Adults with wings marked with smoky black..... *rolfsii* Q. (34)

Dorsal secretion when present in form of a whitish, mealy exudation, or in extreme cases a matted plate of wax covering entire dorsum.

Pupa-case brown to brownish black, with 3 more or less evident transverse stripes of whitish: one at cephalic end, one at middle, and one at caudal end, crossing vasiform orifice. Ovate, to broadly elliptical, about 1.5 mm. long. Case raised quite high on vertical fringe of wax, about as high as one-half width of case. *forbesii* Ash. (17)

Without dorsal secretion of wax.

Pupa-case yellowish-brown, and with more or less interrupted strips of dark brown along dorsi-meson; oblong to elliptical; 1 by 0.46 mm. On each side of median rounded keel, along abdomen, are large, irregular, toothed depressions, usually a pair to each segment. In adult ♂ wings immaculate; eyes divided; antenna with a long terminal process *graminicola* Q. (21)

"Larva (pupa-case?) plane above and beneath; elevation about one-third the length, periphery vertical; pale flavous; the larger individuals with a conspicuous dorsal vitta" *abutilonea* Hald. (2)

Pupa-case, dorsally black but with a very broad lemon-yellow or whitish marginal area; oval, somewhat over a millimeter long. Adult ♂, with eyes completely divided; wings with suffused dusky spot, at end of vein, more evident on cephalic pair..... *aureocincta* Ckll. (6)

Pupa-case uniformly black.

The dorsal secretion, a submarginal series of glassy, curling waxen rods from distinct pores or papillæ.

Pupa-case ovate, about 0.8 mm. long. The glassy waxen rods in some cases almost if not quite as long as case is wide. Case with conspicuous vertical fringe. Adults with immaculate wings, eyes not completely divided *ruborum* Ckll. (35)

The dorsal secretion, a submarginal series of short, truncate, white, waxy ribbons, with a more central secretion of columnar appearance.

Pupa-case shiny black, subelliptical, 0.92 by 0.66 mm. The submarginal ribbons, extending out at an angle of about 45°, giving appearance of an elliptical crown*coronata* n. sp. (11)

Pupa-case, uniformly yellowish or whitish.

Without waxy secretion of any kind.

Pupa-case, pale straw-yellow, somewhat darker towards center, elliptical, 1.25 by 1 mm. Margin finely and densely wrinkled all around, the wrinkles extending radially inward to about one-half the length to the middle line, on the sides. Vasiform orifice darker than surrounding area, unequally triangular
pyrolae G. & B. (32)

Pupa-case (empty) colorless, oval, 0.75 mm. long. Margin radiately striate. Vasiform orifice an elongated triangle, the two sides nearly straight, and nearly twice as long as base. Operculum hemispherical or semilunar, concave at base. Lingula elongate, sub-spatulate. No conspicuous submarginal orifices. Adult ♀ with immaculate wings; head and entire body deep orange-yellow; legs pale lemon yellow. Eyes jet black, each one completely divided.....*berbericola* Ckll. (7)

Pupa-case whitish, elliptical, 1 by 0.61 mm. Flat, marginal wax tubes evident. Vasiform orifice sub-cordate without corrugations; lingula terminating in subcircular lobe...*nephrolepidis* n. sp. (25)

Pupa-case yellow to lighter, ovate, narrowed caudad; 0.81 by 0.55 mm. Somewhat convex, marginal wax tubes obscure. Vasiform orifice subtriangular, inner lateral margins corrugated; lingula arrow-shaped distally.....*inconspicua* n. sp. (23)

Secretion present.

Dorsal secretion a submarginal series of glassy, curved, waxy rods from distinct pores of papillæ, and a more dorsal secretion of very long, tapering, curved, waxy rods, in pairs, from large circular pores.

Pupa-case yellowish, oval to elliptical; about 0.76 by 0.48 mm. The submarginal wax tubes rather short, and blunt. The very long rods from dorsum occurring: a pair very close to cephalic margin, a pair on cephalic region, a pair on thoracic region; two pairs on abdominal region; a pair at caudal end, and a pair just within margin, from caudo-lateral region. In adults rostrum reaching nearly to abdomen. Wings immaculate.....
vaporariorum Westw. (34)

With a rather copious, white, dorsal secretion.

Pupa-case yellowish, elliptical, 0.86 by 0.53 mm. With a short, downward curving, pearly white submarginal secretion of wax, hiding margin of case, and 3 prominent, more central, inward-curving columns set in a triangle. Operculum considerably broader than long; lingula spatulate, with 2 pairs of setæ near distal end.....*perseæ* n. sp. (29)

pergandei n. sp. See above.

Dorsal secretion a variable submarginal series of glassy, curved rods from distinct pores or papillæ.

Pupa-case yellowish, elliptical, 0.65 by 0.36 mm., raised on vertical fringe of white wax. Vasiform orifice with rounded indenture caudad; lingula four-fifths length of orifice, with 3 pairs of lateral lobes and a distal lobe. In adults, wings immaculate.....

variabilis n. sp. (40)

rolfsi. See above.

Without dorsal secretion.

Pupa-case yellow, broadly elliptical, convex, 1.15 by 0.83 mm. A short, more or less slanting, fringe all around of white wax, doubtless homologous with vertical fringe. Vasiform orifice broadly ovate, lingula spatulate. Dorsum void of pores and papillæ. In adults, wings with a distal dusky spot *spiræoides* n. sp. (36)

It has not been possible to indicate in the above table, the *Aleurodes phalænoïdes* of Blanchard, reported from Chile, in 1840. The description is meager, and based on the adult. In the Division of Entomology collection, are specimens of an *Aleurodes*, received through Professor Cockerell, from Mr. F. Lataste, Chile, under the name *Aleurodes phalaroides* Lataste. Possibly this is meant for Blanchard's *phalænoïdes*. Until more information is obtained on this point, and pending the finding of Lataste's description, it may be well not to consider *A. phalaroides* Lataste, as a distinct species.

1. *Aleurodes abnormis* n. sp. (Plate I, figures 1-3.)

Pupa-case.—Size, about 0.7 by 0.55 mm.; dense black, and cleared only after prolonged boiling in KOH. Shape, subelliptical, varying somewhat in outline. There is no lateral fringe, in the ordinary sense. The pupa-case becomes at length comparatively thick, and the dorsal disk is larger than the ventral. The marginal rim of wax tubes is bent downward and inward to the ventral surface of case, thus connecting the ventral and dorsal disks by an inward slanting rim. From this reflexion of the marginal rim the lateral wax tubes open directly against the surface of leaf, and the white cottony exudation of wax appears at first sight as homologous to the vertical fringe of wax, or palisade by which, in many species, the pupa-case is elevated from surface of leaf. This exudation is light, and does not elevate the case to any extent from the leaf. On the reflexed marginal rim the flutings of the wax tubes may be observed with varying distinctness up to the dorsal surface of case. Dorsum void of exudation of any kind. In immature specimens dorsum is concave, and there is a furrow all around just within margin of dorsum, the rim being quite prominent as a raised boundary line. Case at length becomes moderately convex. There is a pair of setæ on caudal end of case, and a pair just cephalad of vasiform orifice. Under hand lens the abdominal segments appear moderately distinct, and the straight suture, extending from third thoracic segment cephalad to margin of case, is quite distinct, and the margins on either side minutely sculptured. The vasiform orifice seen in boiled specimens is small, subcircular, with semielliptical operculum and small obscure lingula.

Adult ♀.—Length, about 0.77 mm.; fore-wing, 0.89 by 0.36 mm.; hind tarsus, 0.17 mm.; hind tibia, 0.29 mm. Color of body uniformly yellow, legs and antennæ paler. Eyes not quite divided, dorsal lobe

bright red, ventral lobe very dark reddish-brown. Fore-wings with smoky markings. There are two spots near middle of length of wing, one on the vein, and the other just within caudal margin; on the distal portion of wing are three spots, one at distal end of vein just within margin, and one on each side of vein. There is usually, also, an obscure spot just caudad of basal veinlet; hind-wings without spots. Antennæ of seven joints. Joint 1, short, wider than long, cup-shaped; joint 2, of usual subpyriform shape, about one-half as broad as long; joint 3, long, equal in length to distal joints together; joint 4, short, about one-half length of 5th; 5, 6, and 7, subequal in length; joint 7, somewhat fusiform. Front tibia two-thirds length of hind tibia; hind tarsus but little longer than front tarsus; hind femur about three-fourths length of hind tibia. Genitalia ordinary. Basal veinlet of fore-wings arising at base of wing and apparently distinct from main vein.

This species has been collected from various parts of Florida by the writer, on leaves of such trees as *Quercus aquatica*, *Q. virens*, *Q. catesbaei*, *Ilex opaca*, *Magnolia glauca*, and *Persea carolinensis*. The pupa-cases are much scattered and rarely occur more than two on a single leaf, and usually but one. Adult females bred out by the writer. Type in Div. Ent., U. S. D. A. Described from numerous pupa-cases and three ♀ specimens.

2. *Aleurodes abutilonea* Haldeman.

“White, body pale flavous, with a tinge of greenish; wings each with a single nervure, the superior ones with two irregular obscure bands across them, and a circular apical spot; eyes black, double upon each side, inferior ones large and prominent; thorax above, with large irregular fuscous spots; abdomen with 3 or 4 transverse lines of the same color; rostrum as long as the head, bi-articulate, apex black; antennæ with the basal articulation robust; feet with short hairs, slender, dimerous, one-half line long.

“*Larva* oval, plane above and beneath, elevation about one-third the length, periphery vertical; pale flavous, the larger individuals with a conspicuous dark dorsal vitta.

“Found upon the lower surface of the leaves of *Sida* (*Abutilon*) *abutilon*, to which the larva is immovably attached. It is sometimes so abundant that there are from 50 to 100 in half an inch square, causing the leaf to curl and die. The perfect insect is very active, walking and flying readily, and leaping from 1 to 1½ inches. It seems nearest allied to *A. bifasciatus* Steph. When the imago first appears the wings are more translucent and the dark fasciæ are entirely wanting, so that it might be taken for a distinct species.

“Burmeister’s figure of *A. proletella* Linn. exhibits 2 nervures, probably because the wings were in contact when drawn, which, on account of their translucency, would allow the nervures of both to be

seen at the same time. Found in Pennsylvania from August to the middle of October." (Haldeman.)

Am. Jn. of Sci. and Arts., Vol. IX, 1850, p. 108. Signoret, Ann. de la Soc. Entom. de France, Dec., 1867, p. 397.

3. *Aleurodes acaciæ* n. sp. (Plate I, figures 4-7, and Plate VII, figure 68.)

Egg.—Size about 0.18 by 0.092 mm.; curved, yellowish, and marked with rather indistinct polygons. Stalk short, and attached somewhat to one side of the end, on the convex curve.

Larva.—Full-grown larvæ are difficult to separate from pupa-cases. Larvæ are brownish yellow, even when quite small, and secrete the marginal fringe of wax as in pupa-case. In older larvæ the marginal rim is quite evident, and the cylindrical tubercles are present, though not so numerous as in pupa-case.

Pupa-case.—Size about 0.92 by 0.61 mm.; shape subelliptical, narrowed somewhat, cauded and cephalad. Color on leaf, under hand lens, when wax is removed, shining black. Under microscope, by transmitted light, dark brown. In less mature specimens, case is flat, but later becomes moderately convex. There is a rather short and squarely trimmed marginal fringe all around from the lateral wax tubes, extending out flat on the surface of leaf. In the older specimens there is a dorsal white waxy secretion, which typically occurs in three longitudinal lines, a broad central one and a narrower stripe on each side. These lateral stripes may not extend but along the abdominal region, or frequently quite along the entire dorsum and more or less parallel to margin of case, forming somewhat of an ellipse. A transverse stripe of this exudation may occur on dorsum, thus uniting the three stripes.

Dorsum of case is much corrugated. In younger specimens a medio-dorsal ridge is evident, and on each side is a furrow. Centrally, the abdominal segments are quite distinct. There is a distinct and wide marginal rim, somewhat wider on the sides. This rim is plainly demarked from dorsum by a thickened line all around. The lateral wax tubes are quite prominent and extend mesad to near this thickened rim; the margin is crenulated, the incisions quite uniform and acute. There is on this marginal rim a row all around of short cylindrical papillæ. These are truncate distally and appear as short circular discs when seen from above. On caudal end of dorsum, just within margin, is a pair of slender setæ projecting somewhat beyond margin. The caudo-lateral pair is present, though slender and longer than usual. There is also on cephalic margin of case a pair of setæ quite similar to these latter.

Vasiform orifice small, tubercle like. Orifice subcircular, about as broad as long. Operculum relatively large, of the same outline as orifice, which it almost fills. Lingula about four-fifths length of orifice,

though it is made out with difficulty. On ventral surface, rudimentary feet quite distinct.

Adults unknown.

Received by the Division of Entomology at Washington from Dr. Vasey, of the Department of Agriculture, specimens on leaves of *Acacia* (mesquite) from Chilhua, Mexico, January 27, 1886; from W. E. Collins, Ontario, Cal., on *Acacia*, October 6, 1889; again on *Acacia* from Los Angeles, Cal., and on *Bensera microphylla*, Carmen Isle, off Lower California. This same species, it is stated in Mr. Pergande's notes, was found on leaves of mesquite from Bastophilus, Mexico; Div. Ent. No. 3863. No. 5876 is doubtless this same species, from Fullerton, Cal., July 30, 1893, on an undetermined plant. Type 3863, from Chilhua, Mexico. Described from numerous pupa-cases.

4. *Aleurodes aëpim* Göldi.

Mittheil. Schweiz. entom. Gesellsch., VII, 1886, p. 250.

On "Aëpim" ("Mandioca doce") Rio de Janeiro.

5. *Aleurodes altissima* n. sp. (Plate I, figures 8-12, and Plate VII, figure 70.)

Larva.—Size about 0.89 by 0.52 mm.; yellowish white. A series all around of about 30 setæ. On dorsum are 5 pairs of moderately developed setæ, a pair on cephalic segment, a pair on each of the thoracic segments, and a pair at vasiform orifice. Margin of case slightly crenulated. On the dorsum a few pores may occur somewhat promiscuously, and there are a few groups of pores around the margin. This stage in many respects approaches quite close in structure to the pupa-case.

Pupa-case.—Size about 1.79 by 1.26 mm.; subovate, narrowed cephalad. Color of younger pupæ, yellowish to white, and usually without other coloration. In more mature examples the color may vary from whitish to those more or less mottled with brownish, with extreme cases almost uniform brownish black, though in these latter cases such examples have plainly been parasitized, and this color may have resulted from this fact. Typically, this brownish coloration occurs in dashes, from the outer margin inward, varying distances, and more or less radially. Along the dorsi-meson there is a more or less clear longitudinal central stripe, with an interrupted stripe of dark brown on each side, these latter varying considerably in extent and distinctness. In well-marked specimens the radial wedge-shaped dashes may extend quite into these subdorsal bands of dark brown.

Pupa-case, when young, with moderately rounded keel, otherwise flat; at length becoming somewhat convex, and raised on an unusually high vertical fringe of white wax. There is no lateral fringe, but just within the margin all around there is a series of groups of waxen rods. These rods arise from groups of from usually 22 to 26 circular pores. Each bundle of rods is surrounded with a rather short cylin-

der of wax, forming a sheath at base. Individually, the rods are rather small, glistening white, and inclined to curl at tip. These wax bundles vary considerably in length, but are, as a whole, short, curling outward and downward from the case. Along central dorsal region is a broad and somewhat matted secretion of wax extending from vasiform orifice to cephalic end and covering the rounded keel. On each side of this central dorsal secretion is a curved and narrower secretion extending from just laterad of vasiform orifice to cephalic end. These three dorsal lines of wax may be much interrupted transversely, particularly in younger examples, but in older cases each is usually continuous.

There is a very narrow marginal rim and the margin of case is minutely crenulated. Just within the margin all around is a series of rather long and slender tubercled setæ, about 30 in all, or 15 on each side. The pores of the submarginal groups are rather small, simple, and circular. These may vary considerably in number in the different groups, and an occasional pore occurs outside of group. These groups of pores are usually in the brownish coloration extending in from the margin. There is usually a group of very small pores on each side of vasiform orifice, and a very pretty group on each side of the second abdominal segment. This consists of an irregular circle of small pores with a central rotate figure. The usual series of brownish colored compound pores with cylindrical rim and central rod are present, though comparatively small. On caudal end 4 of these pores occur in almost a transverse row, caudad of orifice, and from this 3 extend cephalad on each side to about the fourth abdominal segment.

Vasiform orifice cordate, about as wide as long. Operculum subrectangular, about twice as wide as long. Lingula large, broad, spatulate shaped, extending quite to caudal margin of orifice and bearing the usual two pairs of subterminal setæ. Margin of orifice extended upward all round, but more pronounced caudad, into a thin and somewhat fluted rim. Operculum and lingula minutely setose or punctured. On the ventral surface the reduced legs and antennæ are quite distinct.

Adults unknown.

When the adult is discovered it will very likely prove to be an *Aleurodicus*.

Collected by Mr. C. H. T. Townsend, July, 1897, at San Francisco del Peal, Tabasco, Mexico, on a plant called "Palo de Gusano." Div. Ent., No. 7979. Described from numerous pupa cases.

6. *Aleurodes aureocincta* Cockerell.

Jn. N. Y. Ent. Soc., 1897, p. 42. On *Aquilegia*, Organ Mountains, New Mexico.

7. *Aleurodes berbericola* Cockerell.

Jn. N. Y. Ent. Soc., 1896, p. 207. On a shrubby *Berberis*, Mescalero Reservation, Tularosa Creek, New Mexico.

8. *Aleurodes citri* Riley and Howard.

Insect Life, Vol. V (1893), pp. 219-226.

Food plants: Orange, *Melia azederach*, *Viburnum nudum*, Cape jasmine, and occasionally on *Quercus aquatica*. Florida, Louisiana, and greenhouses generally.

9. *Aleurodes cockerelli* von Ihering.

"Os Piolhos Vegetaes do Brazil." Revista do Museu Paulista, N. II., 1897, p. 393. On *Baccharis paucifloscula*, São Paulo, Brazil.

10. *Aleurodes corni* Haldeman.

"Size and general appearance of *A. abutilonea*; Body pale flavous; eyes black; wings pure white, without bands. Pennsylvania in September and October; the larva and imago on the inferior surface of the leaves of *Cornus sericea*.

"Larva flavous, the disk of the larger individuals dark brown; the margin is ciliate with white. A great many are destroyed in the larva state by *Amitus corni* Hald."

Am. Jn. of Sci. and Arts, Vol. IX (1850), p. 109. Signoret, Ann. de la Soc. Entom. de France, Dec., 1867, p. 398.

11. *Aleurodes coronata* n. sp. (Plate II, figures 13-15, and Plate VII, figure 69.)

Egg.—Size about 0.2 by 0.092 mm.; yellowish, considerably convex on one side; unmarked, stalk short, attached to egg at one side of basal end.

Larva.—Size about 0.55 by 0.37 mm.; pale yellowish white; subelliptical, becoming narrower caudad; abdominal segments but moderately distinct across the middle. No distinct marginal rim. Margin crenulated, the lobes somewhat truncate, and separated by linelike incisions.

There is a pair of setæ at vasiform orifice, and a pair just within caudal margin of case. There is also a pair on caudo-lateral margin of case and on the cephalic margin. There is no dorsal exudation of wax. Vasiform orifice practically as in pupa case. Legs and antennæ obsolete. Eye spots quite small and reddish.

Pupa case.—Size about 0.92 by 0.63 mm.; shape subelliptical as a rule, somewhat pointed cephalad, and broadly rounded caudad; widest about the middle, or just caudad of middle. Under hand lens case is shiny black in color; dark brown by transmitted light under microscope. There is ordinarily no lateral fringe, but there is a beautiful ellipse of white waxy bands or ribbons from the submarginal area of the dorsum. These project from the case more usually at an angle of about 45°, and are but little curved; they are truncate distally, of varying width, and rarely as long as the case is wide. There are along the longitudinal dorsal region three distinct white waxy secretions; at vasiform orifice is a concave shell-like plume or ribbon, one on each side of orifice, forming at base a much flattened tube, the

halves of which become spread out into a continuous broad ribbon at distal end. From the middle line of abdominal segments a perpendicular exudation arises which meets cephalad, a short, transverse, but thick column arising from last thoracic segment. At cephalic end is a pair of ribbons, rather narrow, and appressed together at top. The whole appears as an elliptical rosette or crown when viewed dorsally. Some specimens have what appears to be a secretion from the lateral pores. This is closely applied to leaf all around, and of a gelatinous appearance.

Margin all around finely crenulated with a double rim, the dorsal rim much more distinct and the incisions acute; the ventral rim of wax tubes are bluntly rounded and the incisions shallow and rather wide.

There is a narrow marginal rim of varying distinctness, with a series, within the margin, of small disk-like tubercles, quite similar to those in *acaciæ*, but smaller. There is also on the dorsum, on each side of middle line, a row of these tubercles; on the abdominal sutures there is a pair to each segment of dark-brown spots. On the margin, at cephalic end, is a pair of minute setæ, and the usual caudo-lateral pair; on the dorsum, at cephalic end of vasiform orifice, there is a pair of stout setæ, and a pair about midway between orifice and caudal end of case.

Dorsum slightly raised along dorsi-meson of abdominal segments and gradually sloping to margins. There are no submarginal furrows on dorsum as in *acaciæ*.

Vasiform orifice broadly elliptical, about four-fifths as wide as long. Operculum very short and obscure. Lingula quite short, stout, almost rudimentary. Operculum and interior of orifice thickly covered with minute black dots, possibly spine-like tubercles. On ventral surface rudimentary feet very distinct.

Received by the Division of Entomology, at Washington, D. C., from D. W. Coquillett, Los Angeles, Cal., December 5, 1887, on leaves of *Quercus agrifolia*, and again from Mr. Coquillett, same locality and same host plant, March 31, 1888; also from S. A. Pease, Pomona, Cal., on same host plant, September 14, 1896. Specimens of this insect were received also from Prof. J. H. Comstock, from Santa Rosa, Cal., on leaves of "live oak," October 7, 1880. Div. Ent. Nos. 4238 and 720.

This Aleurodid occurs in great abundance on the lower surface of leaves of *Quercus agrifolia*, and an occasional specimen may be observed on the upper surface. There is considerable variation in the amount of the white waxy secretion, particularly in younger pupæ, in which the dorsum may be almost bare. Described from numerous pupa cases. Type 4238, Los Angeles, Cal., December 5, 1887.

12. *Aleurodes erigerontis* Maskell.

Trans. N. Z. Inst., 1895, p. 429. Entom. News, Vol. VII, p. 247. On an *Erigeron*, Escalon, Mexico.

13. *Aleurodes filicium* Göldi.

Mittheil. Schweitz. Entom. Gesellsch., VII (1886), p. 247. See also Ent. Mo. Mag., 1891, p. 44. On *Asplenium cuneatum* and other Brazilian ferns, in the botanic garden at Rio de Janeiro; also on *Oleandra articulata* and *Pteris quadriolata* in the fern house, Kew Gardens.

14. *Aleurodes fitchi* n. sp. (Plate II, figures 16 and 19, and Plate VII, figure 71.)

Larva.—Size about 0.49 by 0.27 mm.; subelliptical in shape, narrowing somewhat caudad. Color clear whitish, with irregular blotches of orange. Eye spots reddish. There is no marginal fringe and the lateral wax tubes seem to be wanting, though the margin is somewhat undulate. Dorsum void of tubercles and pores and without waxy exudation of any kind. Vasiform orifice practically as in pupa-case. On caudal end there is a pair of strong tubercled setæ.

Pupa-case.—Size about 0.7 by 0.43 mm.; shape elliptical. Margin of case whitish. There is a broad longitudinal dorsal band of dark brown or smoky black, which will vary somewhat in width and distinctness, usually occurring on the entire medio-dorsal area of case. In extreme cases this coloration may be all but absent. There is no marginal fringe, though there is a narrow but well-marked rim of marginal wax tubes. The incisions between wax tubes very shallow, and the tubes distally are well rounded. In immature specimens the pupa-case is applied quite closely to leaf; in older specimens the case is raised on a vertical fringe or rim of white wax, which in some cases may be 0.2 mm. high. Dorsum almost flat, except a slight medio-longitudinal rounded keel or ridge. There is a submarginal row or series of short, broadly conical papillæ all around, varying considerably in position and number. From these papillæ rather short, more or less curved, glassy, waxen rods are produced, forming a fringe all around. There is a subdorsal series on each side of very minute circular transparent spots and a row on each side of keel, of depressions of irregular outline, but bounded cephalad, usually, by the straight margin of the preceding segment. In this respect this species approaches *graminicola*, though the depressions are smaller. Just within caudal margin there is a pair of well-developed setæ and a much smaller pair at vasiform orifice. Less usually there may be a pair of small setæ on the first abdominal segment and on the cephalic segment. Vasiform orifice subovate with caudal end somewhat truncate apparently, but under high power is seen to have a rounded indenture, thus producing two rounded lobes. Operculum about one-half length of orifice, subelliptical, broader than long. Lingula about three-fourths length of orifice; distally it is lobed, and distal four-fifths setose. From caudal

end of lingula arises a pair of upward-curving setæ. A narrow furrow extends caudad from orifice to margin of case.

Adult ♀.—Length, about 0.84 mm.; fore-wing, 1.07 by 0.49 mm.; hind tibia, 0.37 mm.; hind tarsus, 0.23 mm.; color of body, uniformly yellow, except the frons, which is deep brownish black, and the caudal margin of head, and certain thoracic sclerites; antennæ and legs paler; eyes deep red, constricted in the middle. Wings marked with two irregular bands of reddish brown. The proximal band crosses the wing near the middle of its length. Caudad of vein it has an irregular V-shape, the apex of the V distad. Cephalad of vein the marking is of an irregular rhomboid shape. The distal band is somewhat narrow and interrupted as it crosses the vein. It crosses wing at about its widest part. A short distance distad of the caudal flexure of vein begins a narrow strip of this reddish-brown color, which extends along vein to its distal end, where it terminates in an enlarged spot. At base of wing, just caudad of veinlet, is also a small spot.

Antennæ 7-jointed; joint 1, short subpyriform; joint 2, also subpyriform, but much larger; joint 3, long cylindrical, four-fifths length of distal four together; joint 4, short, about one-half length of fifth; joint 6, somewhat shorter than 7. Mentum usual. Hind tarsus but slightly longer than anterior tarsus. Anterior and middle tarsi subequal in length. Operculum, when elevated and seen in lateral aspect, subconical, though somewhat more slanting cephalad than caudad. Lingula protruded, tapering, and with a sickle-like curve.

♂.—Length, about 0.67 mm.; genitalia ordinary; in other respects essentially as in female, but proportionately smaller.

Collected by Dr. C. V. Riley on cotton plant in his garden, Washington, D. C., October 4, 1879, and later at Selma, Ala. Also collected on leaves of cotton plant at Columbus, Tex., in July, 1879, and received by the Division of Entomology, United States Department of Agriculture, August 27 and September 14, 1895, from S. B. Mullen, Harrisville, Miss., also on cotton. The leaves received from S. B. Mullen are quite thickly covered on the lower surface with the pupæ-cases. Concerning what is probably this same species in Mississippi, on cotton, Mr. W. H. Ashmead says:¹

“This species lives on the leaves, and toward the latter part of July and the middle of August becomes exceedingly numerous, many hundreds occurring on a single plant, and when disturbed they fly up in powdery clouds. The eggs, from fifty to a hundred or more, are laid on the underside of a leaf without any regard to order, resembling those of the orange Aleurodes, only somewhat smaller, with a short pedicel, paler color, and with the surface perfectly smooth and shiny. These hatch in from four to five days, and the young larvæ attach themselves to the leaf and begin feeding on its juices. Although occurring by thousands, I could detect but slight injury caused by these insects.”

¹Insect Life, Vol. VII, p. 323.

I am unable to agree with Mr. Ashmead, in referring this species to Fitch's *Aleurodes (Aspidiotus) gossypii*. From a study of the single type specimen of *Aleurodes gossypii*, which was received by Dr. Fitch from Nigapo, China, certain important differences have appeared. There is no dark medio-dorsal stripe in *gossypii*, and the series all around of submarginal pores and waxen rods is also wanting. In *gossypii* the pupa-case is quite convex and the marginal area is strongly reflexed down to the margin of the leaf, much after the manner of a *Lecanium*. In *fitchi*, however, the case is scarcely at all convex, regularly elliptical in shape, and is raised on a vertical fringe all around of white wax. The two species are scarcely of the same type.

From the convexity of the single specimen of *Aleurodes gossypii*, I am inclined to regard it as representing the pupal stage, and not the larval, as regarded by Mr. C. L. Marlatt. (Ento. News, Vol. X, p. 146.) Div. Ent., Nos. 1163 and 1178. Type of larva and pupa-case, 1178, Harrisville, Miss., September 14, 1895. Described from numerous larvæ and very many pupa-cases. Type of adults, 1163, slide 2-1-47. Described from 3 ♀ and 2 ♂ specimens.

15. *Aleurodes floccosa* Maskell.

Trans. N. Z., Inst., 1895, p. 432. From Jamaica, on *Lignum vitæ*, in company with *A. stellata*.

16. *Aleurodes floridensis* n. sp. (Plate II, figures 20-22.)

Pupa-case.—Length about 0.83 mm.; width about 0.57 mm.; varying somewhat in size and the subelliptical shape. Color of fresh pupa-case, according to Mr. Pergande's note (Division of Entomology, No. 6962), "pale, semitransparent, greenish, marked on thorax and abdomen with subdorsal rows of blackish spots. Margin of body and anal plates yellowish." Dried specimens on leaf are pale lemon yellow, and the spots are deep red. In balsam the color of case is pale lemon yellow, and in more mature specimens there is more or less of orange, due, without doubt, to the developing imago.

There is no marginal or lateral fringe, in the strict sense of the word—that is, coming from the lateral pores—but on the extreme outer margin of dorsum all around there is a very closely set row of conical papillæ, from which originates a beautiful fringe composed of long, slightly curved, glassy, waxen rods—a rod from each papilla. These papillæ are very closely set, touching each other at their bases, and the rods are frequently nearly as long as the pupa-case is wide, and show basally, minute file-like serrations. The fringe is more or less separated into rays of rods extending mesad quite to case. There are usually from 3 to 8 rods in each ray, and these individual rays become somewhat curved, independent of the others.

Margin of case crenulated, the incisions between wax tubes usually quite shallow and acute. Pupa-case applied closely to leaf, and quite

flat at first, but as the pupa-case approaches maturity it becomes somewhat more convex. In dried specimens, particularly those that are immature, the dorsum shows two longitudinal ridges agreeing with the two rows of colored pustular spots. Abdominal segments distinct but not extending more than halfway to margin. The entire dorsum is marked with more or less radially arranged thickenings or reticulations. The two rows of pustular spots extend cephalad, on each side, from near caudal end to the head segment, forming an irregular ellipse, approximately parallel with margin of case. There are usually about ten of these spots on each side, though the number varies considerably, particularly in the thoracic region. In the abdominal region they are more distinct than elsewhere, where they occur approximately, one on each side, to each segment. Just within this series of spots, on the abdomen, somewhat smaller markings may occur. Dorsum with four pairs of minute tubercled setæ—one pair on cephalic portion, one pair on first abdominal segment, one pair at vasiform orifice, and one pair just within caudal margin.

Vasiform orifice cordate, but very little longer than broad. Caudal end bluntly rounded, but with a minute indenture. Operculum broadly cordate, about three-fourths as long as orifice, and minutely setose distally. Lingula moderately stout, spatulate, setose distally, and bearing on each side three small lobes, with a larger terminal one.

On ventral surface, rudimentary feet indistinct.

Adult.—Unknown.

Collected by the writer in August of 1898 on leaves of guava (*Psidium guava*) at Lakeland and Punta Gorda, Fla. Received by the Division of Entomology, United States Department of Agriculture, from H. G. Hubbard, Crescent City, Fla., January 8, 1896, and from H. J. Webber, Eustis, Fla., January 25, 1896, in both cases on leaves of guava. Also collected by J. H. Comstock, Arcadia, Fla., on "alligator pear." Div. Ent., Nos. 6962 and 413. Type 6962. Described from numerous pupa-cases.

17. *Aleurodes forbesii* Ashmead (*aceris* of Forbes).

Fourteenth Rept. Ill. St. Ent. (1884), p. 110.

This is the common large, box-like species, on leaves of *Acer dasycarpum*, in many parts of the North—Ithaca, N. Y.; Washington, D. C.; Urbana, Ill.

18. *Aleurodes fumipennis* Hempel.

Psyche, vol. 8, No. 280, p. 394. On undetermined grass growing on swampy ground, S. Paulo, Brazil.

19. *Aleurodes gelatinosus* Cockerell.

Can. Ent., Vol. XXX, p. 264. Dripping Spring, Organ Mountains, New Mexico, on what is probably *Quercus arizonica*.

20. *Aleurodes goyabæ* Göldi.

Mittheil. Schweitz. entom. Gesellsch., Vol. VII (1886), p. 248. On *Psidium goyaba* and *Laurus persia*, Rio de Janeiro.

21. Aleurodes graminicola Quaintance.

Can. Ent., Vol. XXXI, p. 89. On an undetermined grass, Lake City, Fla.

22. Aleurodes horridus Hempel.

Psyche, vol. 8, No. 280, p. 394. On *Psidium* sp., S. Paulo, Brazil.

23. Aleurodes inconspicua n. sp. (Plate II, figures 23-25.)

Egg.—About 0.17 mm. long. Oval in shape, uniformly brownish in color, unmarked. Pedicel very short.

Larva.—Size about 0.5 by 0.3 mm. Elliptical, tapering slightly caudad. In color light yellow, with a deep orange spot on each side of abdomen. Body flat, no marginal fringe, and without dorsal exudation. Margin of case practically as in pupa-case. There is a pair of well-developed setæ, projecting caudad from caudal margin of case, arising apparently on the margin. Dorsum void of setæ. Vasi-form orifice practically as in pupa-case, but the furrow extending caudad from orifice to margin in the pupa-case seems to be wanting in the larva. There are two small reddish-brown pigment spots in cephalic region, marking the eyes.

Pupa-case.—Size about 0.83 by 0.55 mm. but varying somewhat. Oval in shape, broadest cephalad, and light yellow in color, the coloration deepening as the developing insect approaches maturity. Empty pupa-case colorless. On each side of abdomen in younger pupa-cases there is an irregular, oblong spot of deep orange yellow, evidently glands, within the body. As the pupa develops these spots tend to disappear. Case applied closely to leaf, at first flat, but later becoming somewhat convex. From its flatness and color it is quite inconspicuous on the leaf. There is apparently no lateral fringe, and the vertical fringe raising the case from the surface of leaf, so common in aleurodids of this type, is in this species absent. Marginal wax tubes but little evident, and the incisions usually short and acute. From these incisions thickenings extend mesad some distance, producing an irregularly marked margin. There is a pair of small setæ on the caudo-lateral margin of case. Dorsum without exudation of wax; there is a more or less evident dorsal keel along dorsi-meson, more pronounced along abdomen. Some specimens show three rows of large circular pores; a row along dorsi-meson and a subdorsal row on each side. These pores vary much in position and number, and are more frequently not discernible. Dorsum without setæ, except a well-developed pair, arising from tubercles just within caudal margin of dorsum.

Vasiform orifice, subtriangular about three-fourths as wide as long; cephalic and lateral margins nearly straight lines. Lateral margins, with corrugations or folds, extending downward and inward. At caudal end of orifice there is a decided ental bend, or loop, of the rim, the orifice thus opening into a furrow which extends caudad to margin of case, between the two tubercled setæ.

Operculum subelliptical, about three-fourths as long as wide, and not quite one-half length of orifice. Lingula about five-sixths length of orifice, the distal two-fifths somewhat enlarged, and arrow-shaped, thickly setose, and terminating in two straight setæ, which reach quite to caudal end of orifice. Rudimentary feet on ventral surface quite distinct.

Adult ♀.—Length, about 0.74 mm.; fore-wing, 0.846 by 0.35 mm., hind tibia, 0.32 mm.; hind tarsus, 0.17 mm.; color, bright yellow, abdomen paler, with a deep reddish-orange spot, due to visceral gland; legs and antennæ pale yellow. Wings immaculate. Eyes undivided, but somewhat constricted above the middle; dark brownish-red in color. Mentum usual; first joint, long, slender, widening gradually distad; second joint, short, thick, about one-third length of distal joint; distal joint, stout, gradually tapering from second joint to the blunt, brownish-colored point. Fore-tibia, six-elevenths length of hind-tibia; middle tarsus, four-fifths length of hind tarsus.

Vasiform orifice triangular. Operculum, when elevated and seen in lateral aspect, bluntly conical, and the caudal margin appears minutely setose. Lingula long, subcylindrical, tapering abruptly to an acute point; slightly curved, the convexity cephalad. Lingula apparently somewhat serrate, due doubtless to obscure setæ. In fore-wing, main vein nearer cephalic than caudal margin, extending distally about eight-ninths length of wing. Basal veinlet arising at very base of wing, apparently distinct from main vein, and extending obliquely caudad to margin of wing. Genitalia ordinary.

♂.—Unknown. Collected by the writer on leaves of a species of *Physalis* at Bartow, Fla., July, 1897, and again in August of 1898 on leaves of cultivated okra at same place. Received by the Division of Entomology, United States Department of Agriculture, from Mr. E. L. Eames, Pomona, Fla., on leaves of sweet potato; Div. Ent. No. 6421. Adult females were bred out by the writer from pupæ collected on okra in 1898. Type of immature stages 6421, described from numerous specimens. Type of adult ♀, specimens bred out by writer from okra, August 15, 1898, 8 specimens. Types in Div. Ent. collection.

24. *Aleurodes mori* Quaintance.

Can. Ent., Vol. XXXI, pp. 1-4. On *Morus* sp. at Tampa, Fla., and at Lake City, Fla., on *Tilia americana*, *Callicarpa americana*, *Liquidamber styraciflua*, *Ilex opaca*, and less frequently on *Persea carolinensis*.

25. *Aleurodes nephrolepidis* n. sp. (Plate III, figures 26-30.)

Egg.—Size about 0.21 by 0.092 mm.; subelliptical. Stalk attached to one side of center of basal end, scarcely as long as egg is wide; stalk appears to be jointed, and barbed at basal end. Egg unmarked, yellowish.

Pupa-case.—Size about 1 by 0.61 mm.; elliptical; color, dirty white to yellowish. Empty cases in balsam are very pale yellow; eyes of

developing pupa bright red. There is no marginal fringe, or but very rudimentary. Margin of case crenulated, the wax tubes bluntly rounded; the incisions between tubes are but moderately deep and acute; rather light thickenings extend in from margin, and the thickened margins of the wax tubes may be discerned extending a short distance mesad. There is no distinct marginal rim. Pupa-case applied quite closely to leaf, and there is no vertical fringe. Dorsum almost flat, and void of waxy exudation, tubercles, or pores. Abdominal segments rather obscure, evident only about the middle one-half of case. There is a pair of well-developed setæ arising within caudal margin of case, extending dorso-caudad some distance beyond the margin. There is a pair of small setæ on cephalic margin of case, and a pair on caudo-lateral margin.

Vasiform orifice subelliptical in outline, and comparatively small. Operculum medium, subcircular, broader than long, about one-half length of orifice; cephalic margin straight. Lingula quite as long as orifice, frequently protruded, with distal subcircular enlargement, which is minutely setose; on ventral surface, legs moderately distinct.

Adult ♀.—Length about 0.97 mm.; length of hind tibia, 0.38 mm.; size of fore-wing, 1.12 by 0.43 mm.; length of hind tarsus 0.22 mm. Color, pale yellowish; eyes brown, slightly constricted at middle. Wings unspotted. Antennæ of seven joints. Joint 1 small, cup-shaped; 2, unusually long, somewhat more than three times length of first, pyriform; joint 3, slightly more than twice the length of second. Mentum, slender at base; first joint comparatively long, longer than 2 and 3 together; second short, not quite one-half length of third; third gradually tapering distad, but slightly constricted just proximad of the brownish black point.

Vasiform orifice cordate. Operculum not one-half length of orifice, convex dorsally, and on caudal margin concave, the margin thickly set with rather long setæ. Lingula protruded, and strongly bent as it extends out of orifice, gradually tapering from base to the strap-like distal portion, very thickly set with setæ.

In fore-wing, basal veinlet rather obscure, and arising apparently distinct from main vein. Margin of wings all around yellowish, but deepest on cephalic margin, where the color becomes somewhat reddish.

Received by the Division of Entomology at Washington from George C. Butz, Pennsylvania State College, November 19, 1898, on *Nephrolepis* with the statement that hundreds of the winged form are flying around in the conservatory of the college. A few of the imagos were bred out November 25 from the pupæ sent, by Mr. Pergande, from which the description of the adult stage has been made. This species is interesting as occurring on a fern. Div. Ent. No. 8210. Pupa-case described from numerous specimens; adult ♀, from 3 specimens.

26. *Aleurodes nicotianæ* Maskell.

Trans. N. Z. Inst., 1895, p. 436; Entom. News, VII, p. 247. On *Nicotiana tabacum*, Guanajuato, Mexico.

27. *Aleurodes parvus* Hempel.

Psyche, vol. 8, No. 280, p. 395. On *Maytenus* sp., S. Paulo, Brazil.

28. *Aleurodes pergandei* n. sp. (Plate III, figures 34-37, and Plate VII, figure 72.)

Pupa-case.—Size about 0.78 by 0.5 mm.; regularly elliptical in shape; pale yellow in color, but the empty case almost colorless. The most striking character of this species is the exudation from the dorsum of long, white, curled filaments or bundles of wax, forming a beautiful and relatively large rosette. Near the margin on dorsum is a series of long, curled, and slightly flattened bundles, which, extending outward and downward, touching surface of leaf, becoming irregularly coiled at the free end. So copious is this exudation that it may have a diameter of 3 mm., although the pupa-case itself is but 0.78 mm. long. From the central dorsum there is usually a stouter form of exudation, somewhat columnar, but not extending very high from case.

These bundles of wax are composed of many very minute glassy threads of wax, which in the longer lateral bundles become quite loose and separated on the lower surface of bundle.

On the dorsum, but very close to margin all around, is a series of rather closely set, more or less circular, pores. These occur about the diameter of a pore apart. From this series of pores is produced a fringe of rather long, tapering, and somewhat curved glassy rods. These project out laterally, around the pupa-case, as is usual in species of this type, but are hardly discernible until after the removal of the copious rosette of white wax from the dorsum. There is no fringe from the marginal wax tubes, although these form a distinct lateral rim. The margin is crenulated, with the incisions acute. There is a moderately developed vertical fringe, raising the pupa case up somewhat from surface of leaf. On caudal margin there is a pair of moderately developed setæ, and the usual small caudo-lateral pair of setæ is present. There is a pair of small setæ also at vasiform orifice. Vasiform orifice broadly ovate, almost as broad as long; cephalic margin straight, caudal end very broadly rounded. Operculum but little more than one-half the length of orifice, and wider than long; cephalic margin straight, and almost coincident with margin of orifice. Lingula about five-sixths length of orifice, stout, and broadly spatulate. Distal portion with three pairs of lateral lobes and a terminal lobe; also bearing a pair of setæ, which project caudad out beyond orifice. Distal portion of lingula setose in the usual way.

Adult ♀.—Length about 0.77 mm.; fore-wing 1.07 by 0.5 mm.; length of hind tibia 0.37 mm.; length of hind tarsus 0.23 mm. Color

of body light yellow, legs and antennæ paler. Eyes reddish brown, and apparently barely divided, each part subequal and subcircular in outline. Wings immaculate. Antennæ of 7 joints: Joint 1, short, usual; joint 2, subpyriform and obliquely truncated distally; joint 3, long, subcylindrical, about four-fifths as long as joints 5, 6, and 7 together; joints 5 and 6, subequal, and somewhat longer than joints 4 and 7, which are subequal. In hind legs, femur about three-fifths length of tibia, middle tarsus three-fourths length of hind tarsus. In fore-wing, basal veinlet arising at very base of wing, and apparently distinct from median. Genitalia usual.

Collected on the grounds of the Department of Agriculture at Washington, D. C., by Mr. Theodor Pergande on *Bignonia radicans*, September 3, 1881; at Washington, D. C., *Crataegus*, September 22, 1882; in Virginia, on *Hydrangea*, September 27, 1897. This same species was collected by the writer on plum, at Pomona, Ga., May 20, 1899, and on *Crataegus*, Flint River, Spalding County, Ga., during August, 1899.

This insect occurs either singly or in groups of three or four on the under surface of the leaves. It is at once one of our prettiest and most striking Aleurodids. I have pleasure in naming this species for Mr. Pergande. Div. Ent., Nos. 1002, 2861, and 7800. Type, No. 1002. Pupa-case described from numerous specimens; adult ♀ from 3 specimens; slide 1-32-39.

29. *Aleurodes perseæ* n. sp. (Plate IV, figures 38-40.)

Larva.—(Very young, probably in first stage.) Size about 0.338 by 0.18 mm.; subelliptical, very slightly narrowed caudad. Pale yellowish white, with more or less rectangular spots of orange in the abdominal region. Eye spots reddish. On the margin, cephalad of eyes, are six setæ, and on lateral margins of thoracic region are three on each side. On caudal margin are six setæ, the middle pair of which is considerably longer than others. On ventral surface, just within margin, all around, is a series of sparsely set small tubercled setæ. Legs and antennæ well developed. Vasiform orifice practically as in pupa-case.

Pupa-case.—Size about 0.86 by 0.53 mm.; shape subelliptical, with slightly undulate outline. Color under hand lens, yellowish brown; empty pupa-case practically colorless. There seems to be no lateral fringe, and the margin is not perceptibly crenulated, or but very indistinctly; no lateral wax tubes are to be observed, though there is a thickened line on the margin. There is a profuse dorsal exudation: First, a rather short, downward-curving fringe of pearly white wax, all around, arising from just within margin, and curling outward and downward over margin to near surface of leaf. This fringe is hardly continuous but is more or less split apart into ribbons or bands. Sec-

ond, a more dorsal exudation, composed of three thick, inward, and, at the tip, downward-curving columns. These occur in a triangle, one on each side and one at end. These columns of white wax are about as high as pupa-case is wide. The pupa-case is almost obscured by this exudation, when viewed from above. There is a short vertical fringe elevating the case somewhat from the surface of leaf. On the dorsum are 5 pairs of cup-shaped compound pores, four pairs on caudal third of case, and the fifth pair on cephalic segment, one near each cephalo-lateral margin of case. The margin or rim of each cup is thickened, and from within the cup there arises a rather large fluted cylindrical tube, extending upward, about one-half its length beyond rim of cup. Within tube at base is a short conical elevation. The entire structure is brownish in color. Dorsum void of well-developed setæ save a pair just within caudal margin. A pair of minute setæ occur on margin, near caudal end of case. There is, however, just within margin of case, all around a sparsely set row of minute, brownish colored, tubercled setæ. Vasiform orifice subcordate, about as long as wide, cephalic margin straight, coinciding with cephalic margin of operculum. Operculum subrectangular, the lateral margins somewhat rounded; considerably wider than long, and with caudal margin almost straight. Lingula relatively large, particularly distally, where it becomes broadly spatulate; longer than orifice, and bearing distally two pairs of setæ, the smaller pair proximad. Abdominal segments moderately distinct. Rudimentary feet and antennæ very evident.

Adult.—The following note is by Mr. Pergande, made at the time of receiving the material at the Division of Entomology at Washington: "Wings of insect, of which one was found, transparent, colorless, without any marking, and they are covered with a white secretion, which gives them a milk-white appearance. The body is yellow, slightly reddish toward the tip of abdomen. Eyes dark brown." This specimen, mounted on a tag, had, unfortunately, become detached before it came into the writer's hands, but from the general structure of the pupa-case, particularly the vasiform orifice, and in the presence of the dorsal cup-shaped compound pores, it will probably prove to be an *Aleurodicus*.

On *Persea carolinensis*, from Dr. R. S. Turner, Fort George, Fla., April 22, 1880. Div. Ent. No. 495. Larva described from numerous specimens; pupa-case from three specimens.

30. *Aleurodes phalænoides* Blanchard.

Ins. Voy. du Chile, de Gay., 1840, p. 319. Also, see Ann. de la Soc. Ent. de France, Dec., 1867, p. 399.

31. *Aleurodes plumosa* n. sp. (Plate III, figures 31-33.)

Pupa-case.—Size about 0.72 by 0.46 mm.; shape subelliptical, but somewhat variable in outline. The shiny, black case, as seen under a

hand lens, is much hidden by the dorsal exudation of whitish waxen ribbons or plumes. Under microscope the case is very dark brown. These waxy ribbons, in perfect specimens, are quite twice as long as the case is wide; these occur usually from 3 to 4 on each side of dorsum and more or less continuous at base, extending upward and outward. There is also a central, upright, thick column, composed of the united exudations from the more cephalic of the abdominal segments. In the caudal pair the plumes are semi-tubular. From the suture extending cephalad to margin of case from the third thoracic segment, there arises on each side a thin ribbon of wax, the two united cephalad, and spreading distally into a broad wavy plume, and from between which arises a thin but broad plume. There is a lateral fringe of amorphous wax extending out in considerable quantity on the leaf, all around margin of case. Margin of case crenulated with a double row of wax tubes, the dorsal series somewhat within the lower. Just within the rim all around is a series of small dark-colored disc-like tubercles or dots, and small dots of this character may occur in transverse rows across the dorsum at about the middle of the segments. There are two pairs of well-developed, brownish-colored setæ at caudal end, a pair just within caudal margin, and a pair at vasiform orifice; on the margin of case there is a small pair in the usual caudolateral region, and a pair at cephalic end. Under high power of microscope the subdorsal area is seen to be covered with minute pores, from which is exuded the ribbons of wax. These pores also occur along the central abdominal line. Vasiform orifice subcordate, almost as broad as long; cephalic margin nearly straight, caudal end bluntly rounded. Operculum about one-third the length of orifice; lingula quite rudimentary, short, not more than half the length of operculum. Pupa-case but little convex, even at maturity. Body segments moderately distinct. On ventral surface, feet quite distinct.

Adult ♀—Length about 0.86 mm.; fore-wing 0.95 by 0.33 mm.; length of hind tibia 0.24 mm.; length of hind tarsus 0.17 mm.; color, lemon yellow, legs and antennæ paler. Eyes but little divided, dorsal portion reddish; ventral, deep brownish red; wings immaculate. Joint 1 of antennæ short, not quite one-half length of second; joint 2, pear-shaped, about one-half as wide as long; joint 3, about as long as the four remaining joints together; joint 4, about two-thirds length of fifth; joints 5, 6, and 7, subequal in length; joint 5, somewhat swollen distally; joint 7, with a stricture on one side about the middle of its length, tapering to an acute point. Mentum of three joints, usual. Operculum seen in lateral aspect and when elevated, subconical; lingula considerably protruded subcylindrical, with an upward bend near middle, and nearer end there is another bend, but down to the horizontal.

A rather common species in Florida hammocks and higher woodlands; on leaves of various plants, as *Persea carolinensis*, *Magnolia*

grandiflora; *M. glauca*; *Ilex opaca*; *Viburnum nudum* and *Vaccinium* spp. Adults have been bred out by the writer. Pupa-case described from numerous examples; adult ♀ from two specimens. Types in Div. Ent. collection.

32. *Aleurodes pyrolæ* Gillette and Baker.

Prelim. Rep. Hemip. Colo., p. 125 (Colo. Agrl. Exp. Sta., Bul. 31, Tech. Ser.).
On *Pyrola rotundifolia*, Four Mile Hill, 8 miles south of Steamboat Springs, Colo.

33. *Aleurodes quercus-aquaticæ* n. sp. (Plate IV, figures 41-44.)

Pupa-case.—Size about 0.95 by 0.81 mm.; shape very broadly sub-ovate, broadest about the middle. On the margin of case, on each side, in the cephalo-lateral region, there is an indenture, and a thickened and darker colored area on the marginal wax tubes. Cephalad from this rounded indenture the case is considerably narrower. Color under hand lens, shining black; under microscope by transmitted light, the color is brown, with the sutures dark brown. Pupa-case very flat, scarcely at all convex. There is a lateral continuous fringe all around somewhat longer than one-half the width of case. This fringe is applied closely to leaf, and is semi-gelatinous in appearance, the rods more or less indistinct basally, and frequently appearing as a structureless semi-transparent rim. From the indentures on the cephalo-lateral margin, on each side, and from the caudal end of case, pencils of white wax are exuded out into the semi-gelatinous fringe, and by contrast are somewhat conspicuous. On the dorsum, there may be a light and fragmentary exudation of wax along the body segments, but this is frequently absent. Margin of case, distinctly crenulated, and there are two series of wax tubes all around on the margin; these are quite close together, the dorsal series being almost superimposed. The somewhat transparent lines between the dorsal series of wax tubes, extend mesad with varying distinctness to a very faint line all around, morphologically equal to the inner margin of rim. Light-colored lines may extend mesad from this line, laterally, to the body segments, but hardly continuous with the lines between wax tubes. Dorsum with very small black dots, occurring in a broad and loose band on each side of dorsum, the bands of each side terminating cephalad at the transparent eye spots, and coalescing caudad at the vasiform orifice. Along the sutures of body segments narrow lines of these dots occur, usually on both sides of the suture.

Centrally, the body segments are quite distinct; the third thoracic segment bends cephalad on each side to near the thickened areas on the marginal indentures of case. On the dorsum, near the outer limit of the abdominal segments, is a row on each side of very small transparent spots. There is a pair of small setæ just cephalad of vasiform orifice, and a pair just within caudal margin of case, a seta on each side of the thickened marginal patch of tubes, from which orig-

inates the caudal pencil of white wax previously mentioned. Vasi-form orifice can not be made out with certainty, but it is relatively small, short, and about twice as wide as long, and is surrounded with an obscure fluted rim.

Adult ♂.—Length about 0.86 mm.; fore-wing 1 by 0.46 mm.; immaculate. Body yellow, eyes reddish and dumb-bell shape, not divided. Antennæ, joint 1, short, cup-shaped; joint 2, subpyriform, about two-thirds as wide as long; joint 3, quite long and relatively large, cylindrical, except at base, where it is tapering, not quite as long as joints 5, 6, and 7 together; joint 4, short, about one-half length of fifth; joints 5 and 6, subequal in length; joint 7, slightly longer than joint 4. Mentum much reduced in size, plainly abnormally reduced. Genitalia usual; valves strong and clasping at tip; penis curved upwards, tapering, and enlarged at base.

This species occurs more or less singly on leaves of *Quercus aquatica*, on the campus of the Florida Agricultural College, at Lake City. Pupa-case described from numerous specimens; adult bred out by the writer, from one specimen. Types in Div. Ent. collection.

34. *Aleurodes rolfsii* Quaintance.

Can. Ent. Vol. XXXI, p. 90. From Upola, Fla., on cultivated Geranium.

35. *Aleurodes ruborum* Cockerell.

Jn. N. Y. Ent. Soc., Vol. V., No. 11, p. 96. See also Ann. Rept. Fla. Agr. Expt. Sta., 1898, p. 66. On cultivated *Rubus*, Lake City, Fla. Also occurs on *Rubus cuneifolius* at Lake City and San Mateo, Fla.

36. *Aleurodes spiræoides* n. sp. (Plate IV, figures 45–49, and Plate VIII, figure 74.)

Larva.—Size about 0.78 by 0.52 mm.; subelliptical in shape, becoming narrower caudad. Color, light yellow. In very young larvæ there is a rather narrow cottony marginal fringe, but in older specimens this is in most cases wanting. The margin is flat and closely applied to leaf. Abdominal segments moderately distinct; thoracic segments obscure. Margin of case delicately crenulated, the ends of the wax tubes rounded, and the shallow indentures acute. Dorsum void of pores, papillæ, and setæ. There are, however, three pairs of setæ on margin: A small pair at cephalic end, a well-developed pair at caudal end, and a small pair at caudal end, a seta on each side of larger pair. There is no marginal rim. Vasi-form orifice essentially as in pupa-case. On ventral surface the legs are quite obscure. The small eye spots are reddish.

Pupa-case.—Size, about 1.15 by 0.83 mm.; broadly elliptical in shape, and bright lemon-yellow in color. In the more mature specimens there is more or less of reddish coloration, due to the developing pupa within. Pupa-case rather strongly convex, and but little flattened at the margin. There is no lateral fringe, but a more or less slanting waxen rim is present in older specimens, raising the case a short distance from

surface of leaf. This waxen rim is doubtless homologous to the vertical fringe of certain species, and may vary in direction from vertical, underneath the case, to a lateral fringe, having the general appearance of a true lateral fringe. In the removal of dried specimens, this waxen rim usually remains attached to the leaf. Margin of case crenulated by a narrow rim of closely set wax tubes. On cephalic margin a pair of small setæ may occur, and a pair also on caudal margin. Just within caudal margin on dorsum, caudad of vasiform orifice, there is a somewhat larger pair. Dorsum without pores and papillæ, and there is no dorsal waxy secretion. The abdominal segments are but moderately distinct; thoracic segments obscure.

Vasiform orifice broadly ovate, almost as broad as long. Operculum less than one-half length of orifice, subtrapezoidal, cephalic margin straight, caudal end truncate. Lingula extending nearly the length of orifice, spatulate, the enlarged distal portion minutely setose. Distal end bearing two small lobes. Two long setæ arise from ventral surface of distal end of lingula and project caudad out beyond the orifice. Just cephalad of vasiform orifice is a bow-shaped thickening of the tegument of case.

Adult ♂.—Length about 0.95 mm.; fore-wing, 1.38 by 0.56 mm.; length of hind-tibia, 0.46 mm.; length of hind tarsus, 0.3 mm. Color, as given by Mr. T. Pergande, on fresh material: "The winged insects are covered with a white bloom; the front wings have two rather indistinct dusky spots, one a little beyond the middle and the other near the apex, and one near apex of posterior wings; this bloom is easily rubbed off, and the insect appears then to be yellow or greenish-yellow. The eyes are reddish-brown and the legs and antennæ more or less dusky. The thorax is marked with blackish, and the abdominal segments 3 to 7 have each a blackish transverse band, which becomes gradually broader toward the end of the body. Vertex and front of head blackish. Veins slightly yellowish."

Antennæ of 7 joints: Joint 1 short, subglobular; 2, about twice length of 1, and subpyriform, obliquely truncate distally; 3, long, subcylindrical, as long as joints 4, 5, and 6 together. Joints 5, 6, and 7 subequal. Joint 4, slightly shorter than 5. Mentum with three joints, usual. Tibia of second pair legs two-thirds length of tibia of third pair, the latter about equal in length to an antenna. Operculum convex, more than twice as broad as long. Lingula protruded, rather swollen, cylindrical, and bluntly rounded, protruding about one and one-third times the length of operculum.

Eyes much constricted near the middle, but hardly divided. Wings obscurely marked with dusky: On fore-wing an obscure spot may occur along main vein at its distal end, and another spot a little distad of middle. On hind-wing there is an obscure spot at distal end of vein. In fore-wing, basal veinlet arising from base of wing, and apparently

distinct from main vein. Genitalia forcipate; valves rather short and stout. Penis about four-fifths length of valves, somewhat enlarged at base, where it curves upward; distally it becomes abruptly narrowed to an acute and curved point.

Insects received by the Division of Entomology at Washington, from several correspondents in California, as: Alexander Crow, Los Angeles, October 23, 1880, on leaves of *Fuchsia*, which, it is reported, were badly infested; D. W. Coquillett, Los Angeles, October 21, 1887, on *Sonchus*; A. Koebele, Alameda, during November of 1887, on *Convolvulus occidentalis*; A. Koebele, Alameda, November 5, 1885, on *Malvia rotundifolia*. Specimens also collected by Prof. J. H. Comstock, on *Iris*, October 20, 1880 (locality not given). Div. Ent. Nos. 750 (on *Iris*); 741 (on *Fuchsia*); 328 (on *Convolvulus occidentalis*); 4218 (on *Sonchus*), and 37 (on *Malvia rotundifolia*).

Pupa-case approaches *citri* in color and outline, but is much more convex, and differs in having a vertical fringe, in the absence of the cephalo-lateral and caudal indentures and thickenings of the margin, and the vasiform orifice is widely different. It also approaches *spiræae* of Douglas, but differs in the absence of abdominal rows of tubercles and in the presence of setæ at vasiform orifice. (Div. Ent. Nos., 37, 328, 741, 750, and 4218.) Type of all stages 741. Immature stages described from numerous specimens; adult ♂, from six specimens.

37. *Aleurodes stellata* Maskell.

Trans. N. Z. Inst. 1895, p. 442. On *Lignum vitæ*, in company with *A. floccosa*, Jamaica.

38. *Aleurodes tracheifer* n. sp. (Plate V, figures 50-52, and Plate VIII, figure 73.)

Pupa-case.—Size about 0.81 by 0.52 mm.; subelliptical, slightly narrowed cephalad. Color, under hand lens, rather dull black; under microscope, deep brownish in color, with the narrow marginal rim all around much lighter. There is a copious, white, somewhat cottony, lateral fringe, which may extend out, flat on the leaf, quite twice the width of pupa-case. Basally this forms a continuous fringe all around, but becomes separated into several lobes from about the basal third out. Lateral wax tubes very prominent, rounded distally; the incisions about as deep as tubes are wide and rounded at base. On the dorsum there may occur, along the middle line, a light mealy exudation. There is along the dorsi-meson an evident rounded keel extending cephalad from vasiform orifice to margin of case, but not so pronounced in the thoracic region, where cephalad, it becomes widened out suddenly into an arrow-shaped figure. Along the abdominal segments it is semitubular, and merges caudad into an ovate rim around the vasiform orifice, the whole producing somewhat the appearance of a trachea (windpipe), with voice box (the vasiform orifice) attached. There is in the thoracic region on each side, a short distance within the margin, a curved, depressed line, extending caudad to about the sec-

ond abdominal segment. Abdominal segments distinct, extending out to marginal rim, and strongly reflexed caudad.

Dorsum with four pairs of well-developed setæ; a pair on cephalic region; a pair on metathorax; a pair at vasiform orifice, a seta on each side, and a pair on the caudal end of the large, thickened, subovate rim, surrounding the vasiform orifice. There is a pair of minute white setæ on the cephalic margin of case, and the usual caudo-lateral pair is present. Vasiform orifice semicircular, as broad as long; cephalic margin almost straight. Operculum subsemicircular, but broader than long, minutely setose distally. Lingula moderately developed, reaching caudal margin of operculum; enlarged distally and minutely setose. The operculum and lingula are made out with difficulty.

Adults.—Unknown.

Sent to the Division of Entomology at Washington, June 2, 1897, on "Escabillo," collected at Las Minas, Tobasco, Mexico, by Mr. C. H. T. Townsend; Div. Ent. No. 7817. Described from 6 specimens.

39. *Aleurodes vaporariorum* Westwood.

Gard. Chron., 1856, p. 852; Signoret, Ann. de la Soc. Ent. de France, Dec., 1867, p. 387; W. E. Britton, Ninth Ann. Rept. Conn. Agr. Expt. Sta., 1895, Pt. II, p. 203.

A species widely distributed in Europe, and has been recorded on *Gonolobus*, *Tecoma*, *Bignonia*, *Aphelandra*, *Solanum*, Tomato, *Salvia splendens*, and *Lantana Commara*. Specimens have been received by the Division of Entomology, United States Department of Agriculture, of what appears to be this species, from the following localities in the United States: Freehold, N. J., on *Fuchsia*; Fairburg, Ill., on *Fuchsia*; Boston, Mass., on *Fuchsia*, *Pelargonium*, and other plants; New Haven, Conn., on Tomato; Storrs, Conn., on house plant; West Grove, Pa., on *Oxalis*, and what is probably the same species, from Goshen, Ind. These insects, to a considerable extent, occur on greenhouse plants, which fact probably has a bearing on their present distribution.

Div. Ent. Nos. 1192, 2124, 2224, 4354, 4590, 4895, and 6755.

40. *Aleurodes variabilis* n. sp. (Plate V, figures 53-55.)

Egg.—Length, exclusive of stalk, 0.2 mm.; width one-fifteenth mm.; shape oblong, tapering toward apical end, which is bluntly rounded, and about one-half the width of egg at widest part; unmarked; color whitish when fresh; with advanced embryo, yellowish. Stalk about one-sixth length of egg, attached to center at base, bearing several short irregular prongs.

Larva.—Length, 0.5 mm.; width, 0.3 mm.; regularly elliptical in outline, flat. Color, uniformly light yellowish. Wax tubes, seen from above, rounded distally. No marginal fringe. Abdominal segments moderately distinct; thoracic, less so. No pores or papillæ, as in pupa-case. There is a pair of well-developed, brownish-colored setæ arising from caudal margin, and extending dorso-caudad, as in pupa-case;

a pair of minute setæ is sometimes present on second abdominal segment and on prothorax near dorsi-meson. Vasiform orifice practically as in pupa-case.

Pupa-case.—Length, 0.65 mm.; width, 0.36 mm., varying somewhat; regularly elliptical. Under hand-lens on leaf, small, yellowish, due to developing pupa within; more or less mottled with orange. Empty case, clear white. Very young pupa-case flat; after drying, may become concave. Older pupæ raised on vertical fringe of white waxen rods, the length of which varies with the age of the pupa. Mature pupa-case, somewhat convex above; inclosed pupa bright yellow, with the eyes brownish red. Margin of case crenulated, somewhat irregularly, by shallow incisions between the wax tubes. No marginal fringe; a pair of small setæ near caudo-lateral region. A narrow marginal rim may be distinguished. Abdominal segments moderately distinct; those of thorax less so. Four pairs of brown setæ may occur near dorsi-meson. These may be all long and equally developed, or any or all pairs may be reduced to mere traces. Usually the caudal pair is well developed; it is situated within the caudal margin and extends dorso-caudad some distance beyond case. The first pair, situated on thorax, is usually reduced, or quite obliterated, as may be also, but less frequently, the second pair on the second abdominal segment. The third pair is situated near the vasiform orifice, a seta on each side, near its cephalic margin. This pair is not infrequently as well developed as caudal pair, but usually less so. There may be a submarginal row all around of rather closely set papillæ, each bearing a white, waxen, curved rod. Circular pores may also occur in this row of papillæ, the two intergrading. Just mesad of this row of papillæ, pores may occur irregularly, similar to those in the submarginal row, and from which also arise white, waxen, curved rods. Usually these papillæ and pores are not discernible, or but faintly; those of the caudal and cephalic margins persist longest. When but discernible, there are no rods. All gradations may occur from the entire absence of pores and papillæ to a complete set, bearing rods.

Vasiform orifice large, ovate, broad end cephalad; a rounded indenture on caudal end. Orifice about four-fifths as wide as long. From the inside of the lateral and caudal margin distinct corrugations, or folds, extend downward and inward in the orifice cavity. Operculum somewhat semielliptical in outline, about two-fifths the length of orifice and about twice as wide at base as long. Lingula well developed, about four-fifths as long as orifice; the basal part is about one-fifth of its length, with thickened, centrally curving margins; the succeeding two-fifths is subrectangular in outline as seen from above; distal two-fifths enlarged, with three lobes on each side and a distal lobe; distal four-fifths, setose, thicker on distal portion; from distal end arises below a pair of well-developed upward curving setæ, pro-

jecting caudad to margin of orifice. Just cephalad of orifice are two sets of crescent-shaped thickenings. A shallow furrow extends caudad from orifice to margin of pupa-case. On ventral surface, the reduced legs may be made out with difficulty.

Adult ♀.—Length about 0.833 mm.; length of front wing, 0.95 mm.; width, 0.33 mm.; length of antennæ, about 0.25 mm.; length of hind tibia, 0.3 mm.; length of hind tarsus, 0.216 mm.; color, lemon yellow; feet and antennæ, lighter; wings, immaculate, anterior margin of both pairs, reddish. Eyes, brownish black. Antennæ, seven jointed; joint 1, very short, about one-third as long as second, subconical, distally somewhat obliquely truncate; joint 2, pear shaped, not quite twice as long as wide, oblique distally; joint 3, long, slender, as long as 4, 5, 6, and 7 together, subcylindrical, bearing distally on outer side a group of setæ; 5 and 6, club-shaped; 7, somewhat fusiform, but tapering abruptly, distally bearing a terminal seta on distal oblique margin. Joints 3 and distad, coarsely ringed.

Hind femur two-thirds length of tibia; tarsus about two-thirds length of tibia; distal joint of tarsus, excluding claw, two-thirds length of proximal; trochanter bearing two long setæ on caudal side. Mentum, three jointed; basal joint about as long as other two, gradually widening distally; second joint about one-half as long as third; third joint tapering gradually to blunt point, which is tipped with black.

Vasiform orifice, subcircular, as seen from above; operculum slightly convex; concave on caudal margin, which is minutely setose; lingula protruding, gradually enlarged distally, minutely setose. Genitalia, usual. Eyes oblong, somewhat constricted near middle. In first pair of wings the main vein is long, extending nearly to tip, becoming gradually fainter from distal half. A basal veinlet arises from base of wing, and extends obliquely backwards to margin. Margins of both pairs of wings delicately beaded all around. A short row of setæ on cephalic margin of second pair at base, the distal two of which are three or four times longer than the others.

♂.—Length about 0.5 mm.; proportionately smaller than female. Genitalia forcipate, the valves strongly curved at tip; penis tapering, a little more than one-half the length of valves, strongly curved upward, the strongest curve near base.

This species is exceedingly abundant on the common papaw (*Carica papaya*) at Miama, Florida. The under surface of the leaves of the plant are frequently quite covered with the pupa-cases, larvæ, and eggs. The adults are also exceedingly abundant, usually resting on the under surface of the younger leaves. The different stages described from numerous specimens. Types in Div. Ent. Collection.

41. *Aleurodes vinsonioides* Cockerell.

Psyche, Vol. 8, No. 266, p. 226; Frontera, Tabasco, Mexico.
On undetermined tree.

42. *Aleurodes vittata* n. sp. (Plate V, figures 56-58.)

Egg.—Size 0.25 by 0.09 mm.; slightly curved; color, pale yellow, unmarked. Stalk very short.

Larva.—Size 0.52 by 0.33 mm.; shape subelliptical, somewhat narrowed caudad. Color whitish, very flat, and closely applied to leaf. No lateral fringe; margin finely crenulated, but without distinct marginal rim. Dorsum void of waxy exudation. From caudal end projects a pair of moderately stout tubercled setæ. Vasiform orifice practically as in pupa-case.

Pupa-case.—Size about 0.75 by 0.52 mm.; shape elliptical. Color dark brown, with the margin of dorsum all around, and a broad stripe down dorsi-meson, whitish. The coloration is usually deepest just laterad of the central dorsal stripe, and gradually fading toward the margin.

Body segments quite distinct, the thoracic more so than abdominal, appearing as white lines extending across the dorsum.

There is no marginal fringe, although the lateral wax tubes are well developed. Just within the margin, all around on the dorsum, is a closely set series of short papillæ, or pores, from which is produced a fringe of rather short, slightly curved, glassy waxen rods. These are longest on cephalic and caudal margins. Along lateral margin, at more or less regular intervals, longer and stouter wax rods are produced. Just within this submarginal series of papillæ is an irregular row all around of small transparent spots, and these may also occur somewhat promiscuously over the dorsum, but are most numerous over the central dorsal portion. Around the sub-dorsal area the case is marked with more or less reticulated lines, which extend out plainly to the sub-marginal series of pores. Pupa-case applied quite closely to leaf, and there seems to be no vertical fringe. On the margin, at caudal end of case, there is, on each side of the furrow from the vasiform orifice, a moderately stout seta, and the usual caudo-lateral pair is present on margin of case. Vasiform orifice subovate, about four-fifths as wide as long; the inner lateral margin much corrugated. Operculum subelliptical, scarcely one-half the length of orifice. Lingula about three-fourths length of orifice, subspatulate, the distal part with three pairs of lateral lobes and a terminal lobe. Two setæ arise from caudal end of lingula, and project caudad to margin of orifice. Both operculum and lingula minutely setose distally.

Adults.—Unknown.

This species occurs on leaves of chaparral, and has been received by the Division of Entomology at Washington, D. C., from W. E. Collins, Ontario, Cal., July, 1894; A. J. Cook, Claremont, Cal., August 14, 1894; and from S. A. Pease, Pomona, Cal., August 30, 1894. Div. Ent. No. 6311. Described from three eggs, three larvæ, and numerous pupa-cases.

Genus **ALEURODICUS** Douglas.

With the general characters of the family, but differing from *Aleurodes* in having the vein in both pairs of wings with a distal and basal branch.

TABLE OF SPECIES OF ALEURODICUS.¹

Wings of adults immaculate.

♀—Length 2.1 mm.; wing expanse 4.1 mm.; length hind tibia 0.78 mm.; length hind tarsus 0.36 mm.; dull honey yellow with eyes darker. Joint 3 of antennæ as long as the three distal joints together, and twice as long as joints 1 and 2 together. Pupa-case secreting an abundance of white wax and very long glassy filaments, ovate, or very broadly elliptical; compound pores smaller than in *anonæ*; operculum but moderately concave on caudal margin; lingula broad, tapering to rounded end; not notched distally.....*cocois* Curtis (4)

Similar to preceding, but larger. Length of fore-wing 3 mm.; length hind tibia 0.96 mm.; length hind tarsus 0.47 mm. Pupa-case more nearly elliptical and the compound pores larger than in *cocois*; operculum on caudal margin suddenly indented and then straight; lingula comparatively narrow, notched distally, and tapering to rather acute point.

anonæ Morgan (1)

Wings with a dark spot in angle of distal bifurcation of vein.

Head, thorax, and abdomen pale yellowish white. The dark spot of fore-wings, an obtuse angle, opening distally. Posterior wings with similar but fainter spot. Eyes brown, two-parted. Tarsi long, exceeding two-thirds length of tibia. Pupa-case secreting a white downy wax.

asarumis Shimer (2)

Similar to *asarumis*, but with body and legs of deep chrome yellow; eyes not divided, but dumb-bell shape. Fore-wing 2 mm., noticeably iridescent; spot on fore-wings of rather indistinct outline, and extending cephalad to margin of wing as a very dilute clouding. Hind-wings unspotted. Pupa-case dark gray or plumbeous, varying to brownish, surrounded by abundant cottony secretion; along midrib of leaf, as in *pulvinata*; operculum very broad, broadly truncate distally; lingula spatulate, tapering to a rather rounded point.....*iridescens* Cockerell (6)

♂—Both pairs of wings with a distinct brownish-black spot; fore-wings with an ill-defined clouding all around margin, appearing centrally as an oblique, very obscure band. Length 0.86 mm.; fore-wing 1.1 by 0.52 mm. Eyes reddish, not divided. Genitalia very much reduced, valves short and stubby. Pupa-case subelliptical; cephalic and caudal pairs of compound pores largest; operculum well rounded on caudal margin; lingula spatulate, gradually tapering to somewhat rounded point.

minima n. sp. (7)

Wings variously spotted or banded with gray or blackish.

Wings with more or less rounded spots.

Color bright yellow, legs and antennæ paler. Length, 1.23 mm.; length fore-wing, 2.4 mm.; with submarginal series of blackish spots, and more circular

¹*Aleurodicus* (*Aleurodes*) *pulvinata* Maskell is not indicated in the table, and is referred to *Aleurodicus* on the authority of Cockerell (*Psyche*, v. 8, No. 266, p. 226). If a description of the adult stage of this species has been made, I have not been able to find it.

spots between forkings of vein. Vertex of head acute and margined with brownish-red, continuous with eyes of same color. Pupa-case very flat, subovate and with but little secretion of wax.....*cockerilli* n. sp. (3)

Wings banded with gray.

Length from head to tip of wings somewhat over 2 mm. Forewings with 5 broad transverse bands of gray and a longitudinal band extending from the outermost band to margin of wing, a little below the apex. On cephalic margin of wing the bands are mostly straight and equi-distant, but mostly enlarged about middle of wing. The third and fourth bands are joined together by inward prolongation of longitudinal band. Third band interrupted below its middle, and its lower part is joined to second band, of which it appears an oblique branch. The true prolongation of second band bends obliquely inward, and is joined at one point to the first band. The second band is also joined to first by a thin process in the region of the central nervure.....*ornatus* Cockerell (9)

Length, 1.66 mm.; forewing, 2.25 by 1.5 mm.; similar to *ornatus*, but markings of forewings of different pattern. There are four gray bands crossings the wings, of which only the third and fourth are joined by a longitudinal band. The basal band bends abruptly inward caudad of main nervure, which branches so near base of wing that there are practically 2 nervures, the first gray band failing in the angle between them but strong again before the second. Second band broad as far as the cephalic nervure; just beyond it interrupted broadly, but continued as a large nearly circular gray patch, the greater part of which is cephalad of caudal nervure, and passing thence as an oblique narrow band to the margin. Third band resembling second as far as cephalic nervure, which it meets at its fork; after that failing, but reappearing a little way down the lowest branch of the nervure, and thence passing downward, becoming very faint. Fourth band broad, passing across end of fork, bent inward, joining continuation of third band after the break, itself forking at its lower end. The curve of fourth band leaves a white apical area in which there is a gray spot. There is also a gray spot at tip of second nervure.....*dugesi* Cockerell. (5)

Body of male about 2 mm. exclusive of forceps. Fore-wing slightly over 2 mm. long by about 1.33 mm. broad, white, with 2 very pale gray bands, the first crossing wing just before fork of median vein, but interrupted for a space below the vein. The second a dilute transverse cloud not far from apex of wing. Externally pupa-case appears as a large mass (5 to 10 mm. long) of snowy white cottony tufts, irregularly disposed, from which spring very long curved white waxen threads.....*mirabilis* Cockerell. (8)

1. *Aleurodicus anonæ* Morgan.

Ent. Mo. Mag., Second Series—Vol. III (1892), p. 32. On *Anona muricata*; *A. squamosa*, *Ficus*, and *Richardia pacifica*, Demerara. Received by the Div. Ent., U. S. Dept. Agric., on *Anona*, from Pernambuco, Brazil, and on *Anona reticulata*, Port-of-Spain, Trinidad.

2. *Aleurodicus* (*Aleurodes*) *asarumis* Shimer.

“Whitish, farinose, downy, especially on the wings. Head, thorax, and abdomen pale yellowish-white. Wings laid flat on the back in repose, short and broadly rounded at the apex; near the extremity, where the strong central vein branches, a dark macula in the form of an obtuse angle, opening posteriorly toward the apex of the wing. The posterior wing has a similar but fainter spot. Antennæ six-

jointed, first thick, clavate. Eyes brown, two-parted. Tarsi long, exceeding two-thirds the tibiæ. I find these insects during the entire summer on the under side of *Asarum canadense* (wild ginger). In September I have seen them very numerous in all stages, the larva and pupa presenting the usual scale-like form of this family; at this time the under side of the leaf that has reared a good colony is covered with a white downy secretion. The imago when slightly disturbed flies away, acting not much like small *Tineina*, hence it may often be found on trees, etc., but I have observed the larva only on the above-named plant, and believe it to be entirely confined to it."

Mt. Carroll, Ill., August 24, 1867, Shimer. Trans. Am. Ent. Soc., Vol. I, p. 281.
See also *Insect Life*, 1893, p. 219.

3. *Aleurodicus cockerellii* sp. (Plate VI, figures 59-62).

Pupa-case.—Size about 1.63 by 1.23 mm.; subovate in shape, smaller end cephalad. Color uniformly yellowish. There is but slight waxy exudation from dorsum, which is more or less mealy. No wax rods have been observed. Dried specimens separate easily from leaf, leaving usually a ring of white mealy wax of the size and shape of case; extending from the periphery inward are light lines of this mealy wax, more or less distinctly marking the position of the abdominal sutures of the case. Dorsum of pupa-case almost flat, but as seen under a hand lens is much wrinkled transversely in dried material. These folds or ridges occur mainly along the body segments, and posteriorly become much curved around the vasiform orifice. Under the microscope the abdominal segments are indistinct and scarcely elevated, except in the medio-dorsal line, where a slight rounded keel may be observed. Margin of case practically entire. Very slight furrows or thickenings extend mesad a short distance from margin of case, rather marking the margin into more or less distinct rectangular figures. Just within the margin all around is a series of very small disc like pores, usually one to each of these marginal rectangles. Dorsum void of well-developed setæ, except a pair just within the caudal margin; but there is a pair of small setæ at vasiform orifice, and very minute setæ occur here and there on the dorsum. The five or more pairs of large compound pores, so usual on dorsum of pupa-case of *Aleurodicus*, seem to be absent in this species, but very many minute transparent pores may be detected on dorsum under high power of microscope.

Vasiform orifice subcordate, somewhat longer than wide; cephalic margin straight; at caudal end there is a short, stout, spine-like protrusion. Operculum subrectangular, about half length of orifice; cephalic and caudal margins practically straight, lateral margins rounded; lateral and caudal margins thick; minutely setose. Lingula quite as long as orifice, very broad, and bearing distally two pairs of setæ, the smaller pair proximad; minutely setose.

Rudimentary legs and antennæ on ventral surface quite distinct.

Distal joint of legs with a straight and truncate spine. Antennæ usual, minutely ringed.

Adult ♀.—Length, about 1.96 mm.; fore-wing, about 2.4 by 1.6 mm.; length of hind tibia, 0.8 mm.; length of hind tarsus, 0.56 mm.; length of front tarsus, 0.32 mm.; color, bright yellow, legs and antennæ paler; wings very broad, and rounded distally. Wings marked with more or less circular spots of brownish black. In fore-wings, along cephalic margin, are three spots about equidistant, and farther distad, on curve of wing, is a spot somewhat farther from the third spot than are two and three from each other. There is a spot on the margin of outer caudal curve of wing and three spots on the caudal margin, which, however, are not equidistant, as in the spots on cephalic margin. Within the area bounded by the distal fork of the vein are two spots, and within the area bounded caudad by the proximal branch are from three to five spots. In hind-wings there is a spot on outer cephalic margin, and on the outer caudal margin are two spots. There are two spots in the area bounded by the distal fork of vein, and likewise two spots in the area bounded caudad by the proximal branch of vein. Head as seen from above acute cephalad, and margined with deep reddish or brownish black, continuous with eyes which are of same color. Joint 1 of antennæ short, subcylindrical, distal end irregularly notched or toothed. Joint 2, thick, club-shaped, about three times longer than basal and bearing two or three setæ on outer lateral surface. Joint 3 quite long—quite twice the length of fourth. Distal joint short, terminating in a single seta.

Received by the Division of Entomology at Washington from Dr. F. Noack, Instituto Agronomico, Campinas, Estado de S. Paulo, Brazil, on leaves of a myrtaceous plant, March 30, 1898, and again from Dr. Noack, on same plant, June 14, 1898. The writer has also received specimens of this insect from Prof. T. D. A. Cockerell, to whom they had been sent by Dr. Noack. The adults are unique, in the genus *Aleurodicus*, from the more or less circular spots on the wings. Div. Ent., Nos. 8010 and 8115. Type pupa-case, 8010, described from nine specimens, and specimens on leaf, from Professor Cockerell. Type, adult ♀, 8115, described from two specimens.

4. *Aleurodicus* (*Aleurodes*) *cocois* Curtis.

Gard. Chron., 1846, p. 284. A good description by Riley and Howard, with figures, occurs in *Insect Life*, Vol. V (1893), p. 314. On cocoanut trees, in Barbados and Demerara; on guava, Isle of Trinidad; on guava, Caracas, Venezuela; on guava, Para, Brazil.

5. *Aleurodicus dugesii* Cockerell.

Can. Ent., vol. 28 (1896), p. 302. On *Hibiscus rosa-sinensis*, *Begonia*, and other plants, Guanajuato, Mexico.

6. *Aleurodicus iridescens* Cockerell.

Psyche, vol. 8, no. 266, p. 226.

7. *Aleurodicus minima* n. sp. (Plate VI, figures 63-67.)

Pupa-case.—Size about 1.17 by 0.71 mm., subelliptical, many specimens are somewhat narrowed cephalad. Case usually widest across region of second abdominal segment. Color yellowish, varying to brownish. Empty case semi-transparent, except for the irregular brown coloration on margin, and at the dorsal pores. Margins slightly crenulated, with very shallow indentures between the lateral wax tubes. There is no marginal rim. Just within the margin, all around, is a closely set row of short disk-like tubercles or papillæ, from which is produced a fringe of almost straight, tapering, glassy waxen rods from one-third to one-half as long as pupa-case is wide. On the more central dorsal region a light mealy waxen exudation may occur. Pupa-case slightly raised from surface of leaf by vertical fringe of wax, which usually remains attached to leaf on removal of dried specimens. On the dorsum, nearer the margin than center, is a row on each side of seven round and well-defined compound pores. Considered transversely, these occur in pairs; a pair on cephalic segment; a pair on metathorax; three pairs along the abdominal segments, and two pairs in the region latero-caudad of the vasiform orifice. The caudal pair is somewhat the largest, with the cephalic pair next in size; the rest are subequal. These pores, individually, consist of a cylindrical, brownish-colored rim with a central, white, rod-like structure. On cephalic margin of case is a pair of setæ and a pair on the caudo-lateral region, a seta on each side. There is a pair of small, tubercled setæ just within caudal margin. Around the margin, just within the submarginal series of papillæ, is a row of small tubercled setæ, usually from 24 to 28 in all.

Vasiform orifice elongate-cordate; about three-fourths as broad as long; cephalic margin straight, caudal end bluntly rounded. Operculum, subelliptical, cephalic margin straight, about one-third as long as orifice. Lingula usual, broad, extending quite to caudal end of orifice, bearing two pairs of setæ distally. On ventral surface, rudimentary feet and antennæ quite distinct.

Adult ♂.—Length, about 0.86 mm.; fore-wing, 1.1 by 0.52 mm.; length of hind tarsus, 0.21 mm.; length of hind tibia, 0.38 mm.; length of hind femur, 0.26 mm.; color, yellowish white, with dorsum of thorax brownish. Eyes reddish, undivided, though with a pronounced constriction. Joint 1 of antennæ short, not one-half the length of second. Joint 2, narrow at base, truncate at distal end, widest centrally. Joint 3 long, longer than remaining joints together, distal joint ending in an attenuated process, bearing a terminal seta. Anterior tarsus about three-fourths length of posterior. Distal tarsal joint of first pair legs two-thirds length of distal joint of mentum. Wings slightly clouded around margin and with a very dilute oblique transverse band centrally; at fork of distal branch of vein is a pronounced spot of brownish-black

coloration, otherwise wings without spots. Margins of wings and the veins somewhat yellowish. Genitalia quite short for this genus; valves short and stout.

Adult ♀.—Unknown.

This species approaches in some particulars quite close to Cockerell's *iridescens*, but it is much smaller, and the pupa-case differs in several particulars. It is quite similar also to Shimer's *asarumis*. His description is so meager that it will hardly be possible to locate his species unless, peradventure, the type has been preserved.

Specimens received by the Division of Entomology at Washington, January 28, 1889, on "Guayaba," from A. Busck, Bayamon, Puerto Rico. Mr. Pergande remarks that quite a large number of the insects (pupæ?) had been killed by a very curious fungus. Div. Ent., No. 8422. Pupa-case described from numerous specimens; adult ♂ from two specimens.

8. *Aleurodicus mirabilis* Cockerell.

Psyche, vol. 8, No. 266, p. 226; also Psyche, vol. 8, No. 277, p. 360. On a plant called "laurel," at Boca del Lestumacinta, Tabasco, Mexico; also on *Anona*, Minatitlan, Mexico.

9. *Aleurodicus ornatus* Cockerell.

Ent. Mo. Mag., 1893, p. 105. On Capsicum, Kingston, Jamaica.

10. *Aleurodicus* (*Aleurodes*) *pulvinata* Maskell.

Trans. N. Z. Inst., 1895, p. 439. On *Jatropha* sp., Trinidad.
Psyche, vol. 8, No. 266, p. 226.

EXPLANATION OF PLATE I.

Aleurodes abnormis.

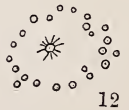
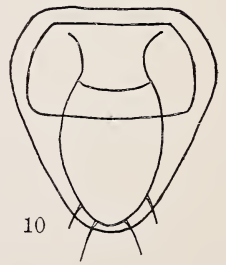
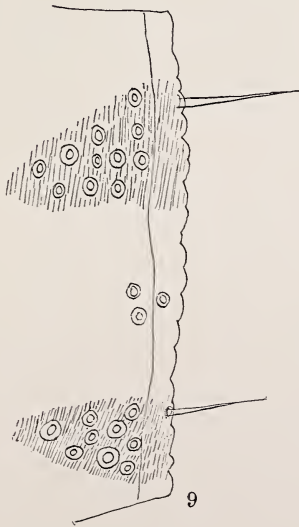
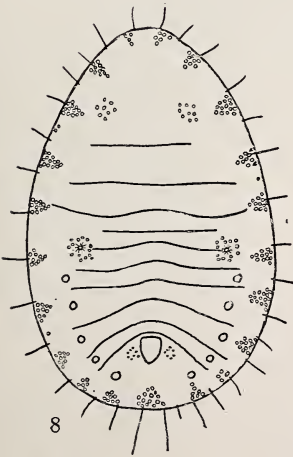
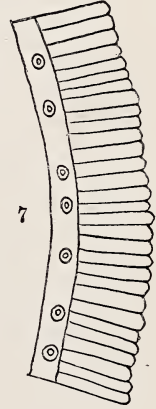
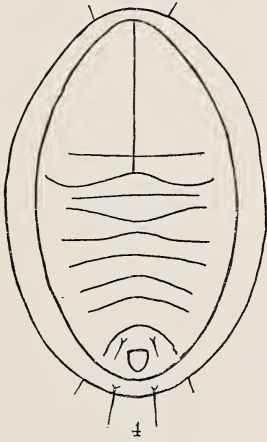
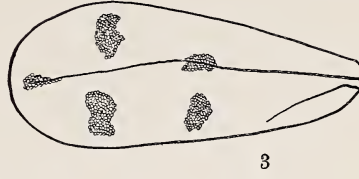
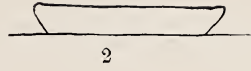
1. Pupa-case.
2. Diagram of cross section of pupa-case, to illustrate the downward and inward curved marginal rim.
3. Fore-wing of adult.

Aleurodes acaciæ.

4. Pupa-case.
5. Egg.
6. Vasiform orifice, operculum, and lingula of pupa-case.
7. Portion of marginal rim of pupa-case.

Aleurodes altissima.

8. Pupa-case.
9. Portion of margin of pupa-case.
10. Vasiform orifice, operculum, and lingula of pupa-case.
11. A compound pore, from dorsum of pupa-case.
12. Circle of pores, and rotate figure on dorsum of pupa-case.



A. L. Q. ad nat del.

EXPLANATION OF PLATE II.

Aleurodes coronata.

13. Pupa-case.
14. Portion of margin of pupa-case.
15. Vasiform orifice of pupa-case.

Aleurodes fitchi.

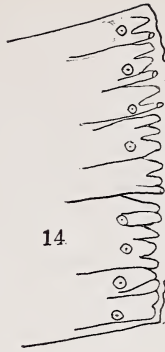
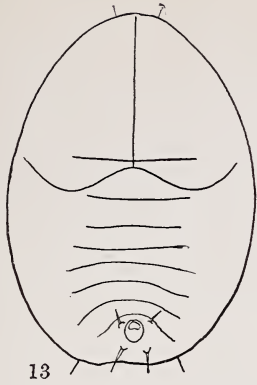
16. Pupa-case.
17. Fore-wing of adult.
18. Vasiform orifice, operculum, and lingula of pupa-case.
19. Portion of margin of pupa-case.

Aleurodes floridensis.

20. Pupa-case.
21. Portion of margin of pupa-case.
22. Vasiform orifice, operculum, and lingula of pupa-case.

Aleurodes inconspicua.

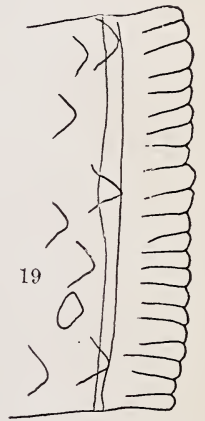
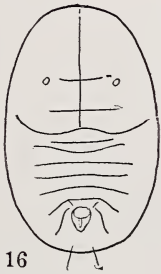
23. Pupa-case.
24. Vasiform orifice, operculum, and lingula of pupa-case.
25. Portion of margin of pupa-case.



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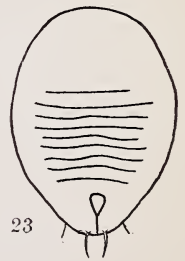
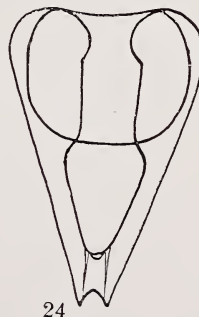
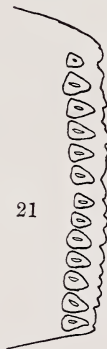
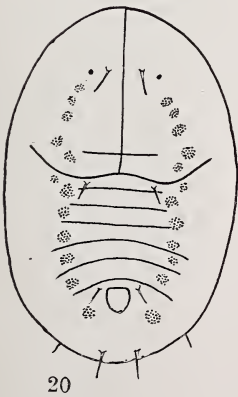
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A. L. Q. ad nat. del.



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EXPLANATION OF PLATE III.

Aleurodes nephrolepidis.

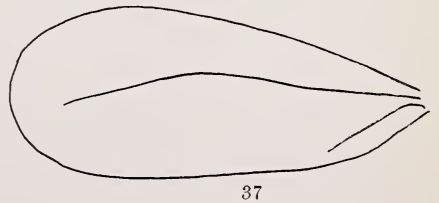
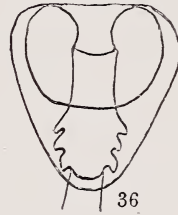
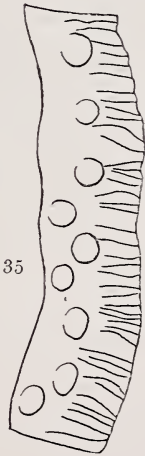
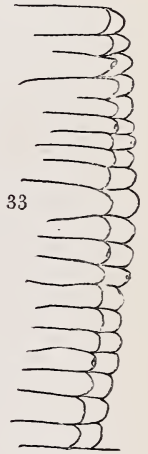
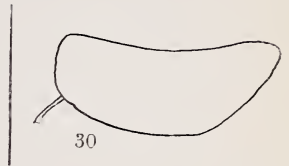
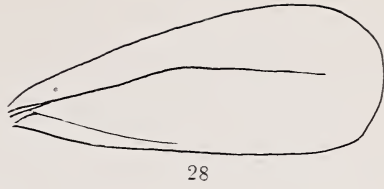
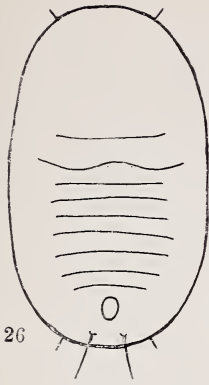
26. Pupa-case.
27. Portion of margin of pupa-case.
28. Fore-wing of adult.
29. Vasiform orifice, operculum, and lingula of pupa-case.
30. Egg.

Aleurodes plumosa.

31. Pupa-case.
32. Vasiform orifice, and operculum of pupa-case.
33. Portion of margin of pupa-case.

Aleurodes pergandei.

34. Pupa-case.
35. Portion of margin of pupa-case.
36. Vasiform orifice, operculum, and lingula of pupa-case.
37. Fore-wing of adult.



A. L. Q. ad nat del

EXPLANATION OF PLATE IV.

Aleurodes perseæ.

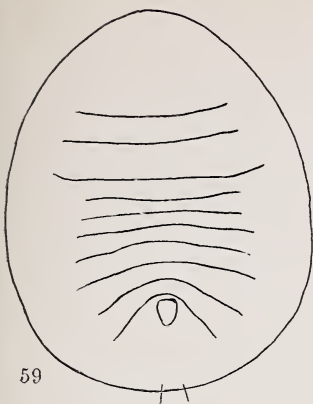
- 38. Pupa-case.
- 39. Vasiform orifice, operculum, and lingula of pupa-case.
- 40. Portion of margin of pupa-case.

Aleurodes quercus-aquaticæ.

- 41. Pupa-case.
- 42. Portion of margin of pupa-case.
- 43. Outline of vasiform orifice, with the surrounding fluted rim.
- 44. Fore-wing of adult.

Aleurodes spiræoides.

- 45. Pupa-case.
- 46. Portion of margin of pupa-case.
- 47. Vasiform orifice, operculum, and lingula of pupa-case.
- 48. Fore-wing of adult.
- 49. Hind-wing of adult.



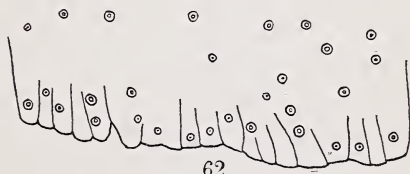
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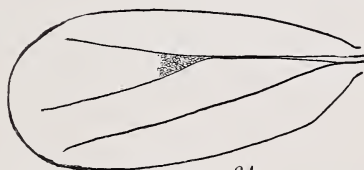
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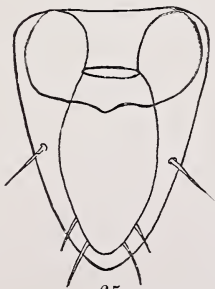
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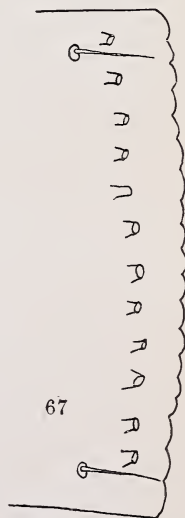
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A.L.Q. ad nat. del.

EXPLANATION OF PLATE V.

Aleurodes tracheifer.

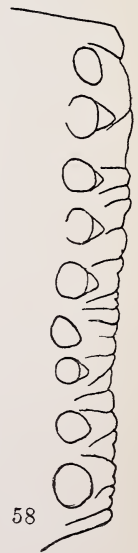
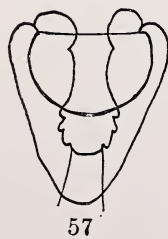
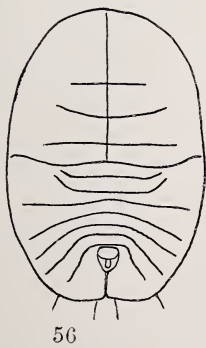
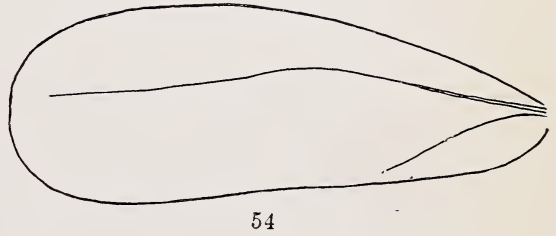
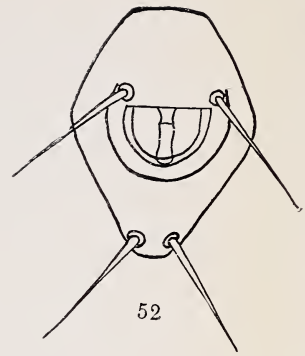
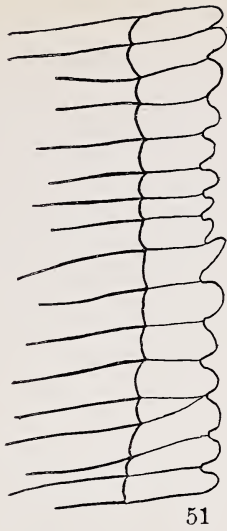
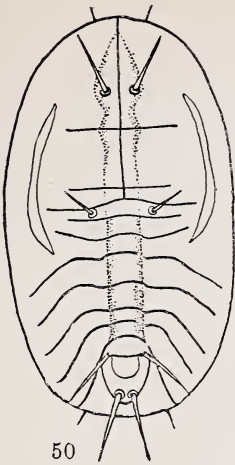
- 50. Pupa-case.
- 51. Portion of margin of pupa-case.
- 52. Vasiform orifice, operculum, and lingula of pupa-case with the surrounding rim, and spines.

Aleurodes variabilis.

- 53. Pupa-case.
- 54. Fore-wing of adult.
- 55. Vasiform orifice, operculum, and lingula of pupa-case.

Aleurodes vittata.

- 56. Pupa-case.
- 57. Vasiform orifice, operculum, and lingula of pupa-case.
- 58. Portion of margin of pupa-case.



A. P. Q. ad nat del.

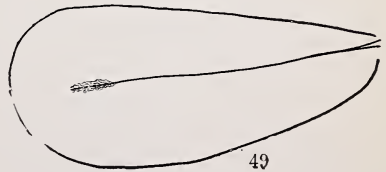
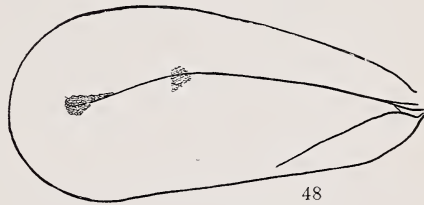
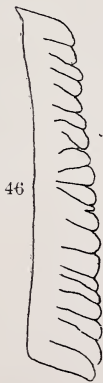
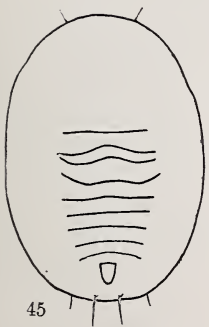
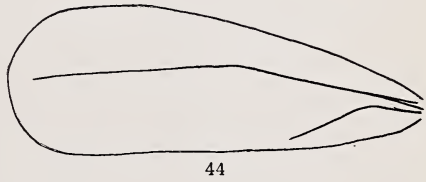
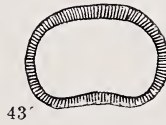
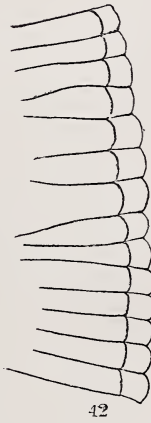
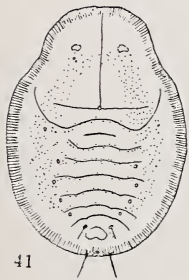
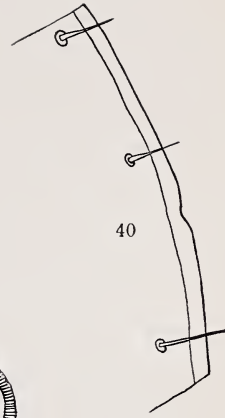
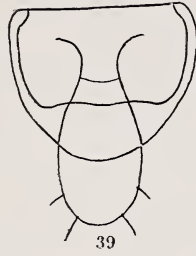
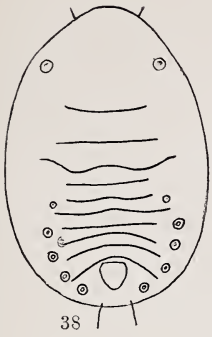
EXPLANATION OF PLATE VI.

Aleurodicus cockerelli.

- 59. Pupa-case.
- 60. Fore-wing of adult.
- 61. Vasiform orifice, operculum, and lingula of pupa-case.
- 62. Portion of margin of pupa-case.

Aleurodicus minima.

- 63. Pupa-case.
- 64. Fore-wing of adult.
- 65. Vasiform orifice, operculum, and lingula of pupa-case.
- 66. A compound pore from dorsum of pupa-case.
- 67. Portion of margin of pupa-case.



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EXPLANATION OF PLATE VII.

- 68. *Aleurodes acacia*.
- 69. *Aleurodes coronata*.
- 70. *Aleurodes altissima*.
- 71. *Aleurodes fitchi*.



68



69



70



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EXPLANATION OF PLATE VIII.

- 72. *Aleurodes pergandei*.
- 73. *Aleurodes tracheifer*.
- 74. *Aleurodes spiræoides*.



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74

THE RED SPIDERS OF THE UNITED STATES.

(*Tetranychus* and *Stigmaeus*.)

By NATHAN BANKS.

HISTORY.

The genus *Tetranychus* was established in 1832 by Dufour for a small mite found living gregariously on clumps of gorse. He noticed that there was a milky whitish irregular web or mesh of threads upon which crawled tiny red objects, which, by the aid of a glass, he discovered were mites. He kept specimens in a bottle, and saw them produce a similar web. Since then these creatures have been known as "spinning mites." Similar mites were known from the time of Linnæus, and one described by him as *Acarus telarius* is considered identical with Dufour's form. These spinning mites were found on a great variety of plants, and showed differences in size and color, which, coupled with their different habitat, led the naturalists of that day to consider these forms as separate species. Gradually, it was discovered that certain species were extremely variable in color, and occurred on more than one plant. This overthrew the old classification, and since then it has never been determined what was a species in this genus. The best two modern authorities working on the same (Italian) fauna reach quite different results. Certain forms of these mites have caused considerable injury to plants, especially in greenhouses, and from the red color of most of them, have been termed "red spiders." As some of the early accounts considered the common red species as *T. telarius* Linn., this name has been applied indiscriminately to all red spiders, both in Europe and

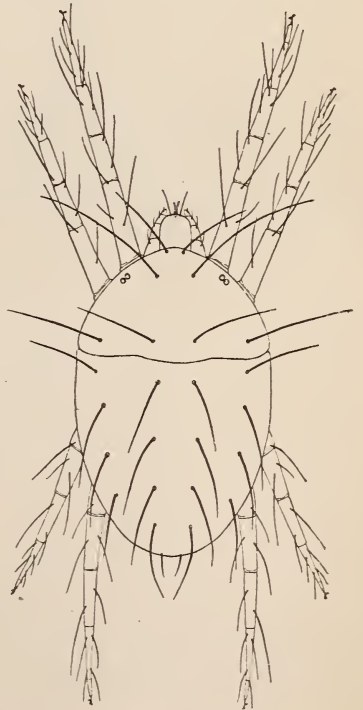


FIG. 1.—*Tetranychus bimaculatus*—enlarged (original).

this country. So it happens that throughout our economic literature there occur accounts of *Tetranychus telarius* without any consideration as to whether the form mentioned was identical with the European species of that name. The first break from this custom was made by Dr. Riley, who, in 1889, recognized that the form occurring on oranges was different from *T. telarius*. In 1893 Professor Harvey described a form found in greenhouses in Maine and New York as *T. bimaculatus*. With these two exceptions *Tetranychus telarius* is still considered responsible for all "red spider" damage. In 1877 Prof. A. Targioni Tozzetti, in a paper on the mouth and feet of *Tetranychus*, showed that the form known as *T. socius* differed from *T. telarius* in the nature of the tarsal claws. In the latter, as in many other forms, the claw is suddenly bent before the middle and the apical part four-cleft; in *T. socius* the claw is less curved and simple. Similar differences obtain in certain of our species, as will be noticed below. In Prof. A. Berlese's recent work, *Acari Italiani*, he draws attention to a hitherto unused character, namely, the small projections on the tip of the "thumb" of the palpus. These vary in number, size, and shape, and, I believe, form good characters for the discrimination of species.

STRUCTURE.

The mites are an order in the class Arachnida. In this order there have been various divisions, yet *Tetranychus* has always been kept in association with certain other well-known forms, as *Trombidium*, *Bdella*, *Eupodes*, *Erythraeus*, etc. This association or group of forms has received various names, such as *Trombididae* and *Prostigmata*. With *Tetranychus* has been associated certain other genera to form a family—*Tetranychidae*—the limits of which are uncertain, and according to Canestrini (*Pros. Acarofauna Ital.*) can not be defined. But the genus *Tetranychus* can be separated on fairly definite characters. They are spinning mites; the body is ovate, roughly oblong, or pyriform; clothed above with about 24 to 36 bristles, usually long, and arranged somewhat roughly in four rows. The legs are never much longer than the body, and the joints are never enlarged. The anterior third of the body shows a slight constriction, which marks the division of the body into cephalothorax and abdomen. On the underside there is no division, but if the natural division is vertical (which I think improbable) the third and fourth pairs of legs arise from the abdomen. The body is broadest at the base of the abdomen. The cephalothorax is somewhat semicircular in outline. On each side about half way and near the margin is an eye-spot, containing usually, possibly always, two ocelli. Some authors have figured but one ocellus each side. The fore part of the cephalothorax incloses the mouth-parts. Above, there is a plate about twice as long as broad, and

broader behind than in front; it can be retracted into the cephalothorax just below the dorsal surface. This plate is divided by a median line or sulcus; on each side below and toward the tip there arises a long and slender curved stylet. This plate appears to be formed by the union and flattening of the basal joints of the mandibles.

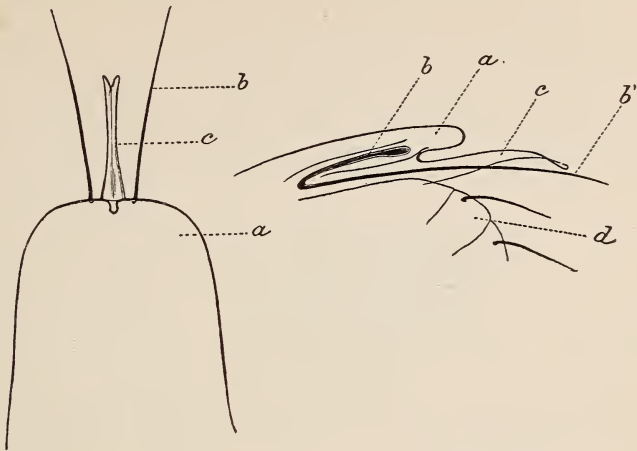


FIG. 2.—*Tetranychus*: mandibular plate, dorsal and lateral views: *a*, plate; *b*, stylet; *c*, spina; *d*, palpus—highly magnified (original).

Below this plate is a rather large and conical rostrum, from each side of the base of which arises a palpus, each composed of five joints. The penultimate joint ends in a large claw; the last or "thumb" projects little if any beyond this claw, and bears one or more projections or "fingers" on its tip or sides. In some species, perhaps all, the palpus of the male has a short, curved spine on the tip of the upper side of the third joint. The rostrum at tip has a cylindrical projection, rather enlarged at the end, consisting of a piece each side, which is possibly the maxilla. The opening between the two is the mouth. At the tip of the abdomen on the ventral surface is the anal opening, often showing from above at the tip of a median pointed projection. On the venter slightly in front of the anal orifice is the genital opening. In the female it is surrounded with variously curved striæ; in the male it is much less conspicuous—a simple slit inclosing a rather slender curved penis. The vulva in the various forms appears somewhat different, although on the same plan. But the difficulty of examin-

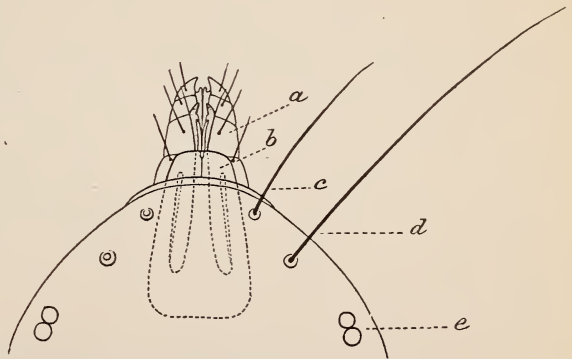


FIG. 3.—*Tetranychus*: cephalothorax from above: *a*, palpus; *b*, mandibular plate; *c*, frontal bristle; *d*, subfrontal bristle; *e*, eyes—highly magnified (original).

ing these organs in a large series of specimens as well as in the various species precludes the present possibility of using them for specific distinction. I am inclined to believe that there is some variation in the form of the vulva, due to the condition of the specimen. The lines and ridges are in a soft tissue, and so are liable to modification and distortion.

There are four pairs of legs in the adult; in the young, as in the young of most other mites: but three pairs are present. Each leg consists of at least six joints, a coxa, more or less anchylosed to the body; a small trochanter; a femur, the longest joint; a patella, about one-half the length of the femur; a tibia, slightly longer than the patella; a tarsus, longer than the tibia and tapering to a fine point. The tarsus, near its tip, has a division more or less distinct, the small terminal piece being called the onychium; from the tip of this arises the claw, which is usually cleft into four slender parts, whence the name of the genus—*Tetranychus*—four-claw. The first pair of legs is the longest, though often scarcely longer than the fourth pair; the second and third pairs are plainly shorter than the other two and sub-

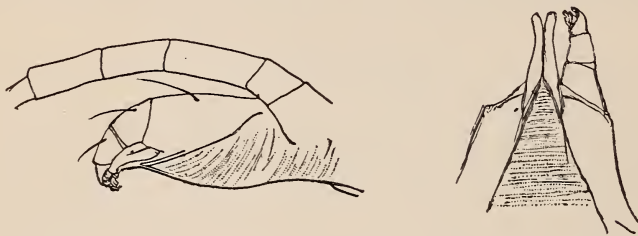


FIG. 4.—*Tetranychus*: mouth parts, lateral and ventral views—highly magnified (original).

equal in length. On the ventral surface the basal limits of the coxæ are not well defined, but the coxæ are rather widely separate.

The surface of the body is very finely and often regularly striate, mostly in a transverse manner. The hairs or bristles are minutely serrate, those on the anterior part of body curve forward, those on the posterior portion of body bend backward; the long ones on the legs appear to stand nearly erect in life, and doubtless have some sensory function.

There appears to be much uncertainty regarding the spinning apparatus, and an examination of a large number of specimens does not throw much light on the subject. Dujardin, Pagenstecher, and Donnadieu believed that the thread issued from the mouth or in its close vicinity. Dufour and Dugès assert that it comes from the anal end of the body. Claparède found some glands opening on the tips of the palpi which he considered as silk glands. The thread is not produced during the ordinary wanderings of the mite, but at certain times. When mites first attack a leaf there are only a few scattered threads lying close to the surface of the leaf, which are attached here and there

to the leaf and to the eggs. The mites walk about without using them. As the leaf curls by loss of juices the threads become more separated from the leaf, so that some mites are under and some on the web, which seems to be in their way. Since the thread seems to be of use at first in keeping the eggs in place, it may be that it issues from the genital opening at about the time of oviposition.

HABITS.

Attention is usually drawn to these mites when they become excessively numerous during a drought in summer. Little is known about the other portion of their lives. They are supposed to pass the winter in the adult condition under and among dead leaves; in the spring ascending trees and starting new colonies. It is quite probable that only

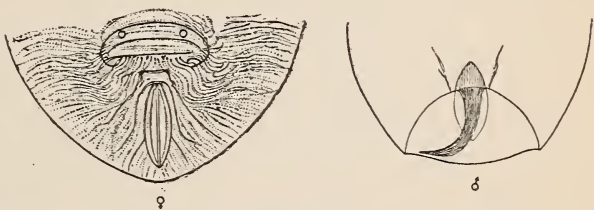


FIG. 5.—*Tetranychus*: genital organs—highly magnified (original).

females hibernate; if these females have not been fertilized the first eggs they lay produce only males, which when adult will pair with the females, and the latter will then lay eggs producing both sexes. Various observations have been made on the rapidity of their increase. The general results are that the female lays from five to ten eggs per day for a period of eight to twelve days; the eggs hatch in about two to seven days (three days is probably the most common period); the young at first have but six legs; after a few days they molt and have eight legs; two more molts occur a few days apart, and then they are adult.

Their movements are ordinarily slow, but when disturbed they sometimes stir quite rapidly. For the greater part of the time they remain in one place sucking the juices from the leaf. But migration

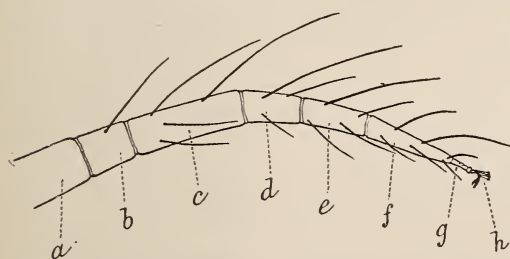


FIG. 6.—*Tetranychus*: leg, a, coxa; b, trochanter; c, femur; d, patella; e, tibia; f, tarsus; g, onychium; h, claw—much enlarged (original).

is probably not wholly dependent on food supply, since plants are found scantily infested in various parts and the mites are not abundant anywhere. Although they spin threads they have never been observed to hang by or climb up one. The thread is extremely fine and not perceptible to the unaided eye. Yet a web or mesh of threads is so dense as to form a tissue plainly visible at a considerable distance. The web is usually upon the under side of the leaf, attached here and

there to projecting hairs, veins, and the edges of the leaf. Many exuviae of the mites are found entangled in this web, and certain authors think that the mites molt while on the web, but such is certainly not always the case with all species. The mites usually show a preference for the under side of the leaf, but in some cases they are more abundant on the upper side. Occasionally in the spring they attack the opening buds.

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TETRANYCHIDÆ.

As previously indicated, this family includes a number of genera; only a few of them, however, are known as “red spiders.” But two genera have been observed in material collected in this country as red spiders. These two genera are abundantly distinct in many points.

In *Tetranychus* the body is subpyriform, in *Stigmæus* elongate and subcylindric, in the former with many long, stiff bristles, in the latter provided with only a few short hairs.

Tetranychus Dufour. Ann. Sci. Nat., XXV, 274, (1832).

Distigmatus Donnadieu. Rech. Hist. Tetr., (1875).

Phytocoptes Donnadieu. Rech. Hist. Tetr., (1875).

Heteronychus Can. et Fanz. Acari Ital., (1877).

Oligonychus Berlese. Acari dann. piante colt., (1886).

The principal characters lie in the general shape of the body; clothed with bristles, with simple, moderate legs—with mandibles having the bases flattened and united in a retractile plate, with distal joints extremely long and slender, and with a palpus having the penultimate joint ending in a claw, while the last joint forms a “thumb” bearing one or more “fingers.”

Our species as far as known may be tabulated as follows:

- | | |
|---|---------------------|
| 1. Bristles of body arise from prominent tubercles..... | 2 |
| Bristles of body do not arise from tubercles..... | 3 |
| 2. Legs of average length, apparently two claws at tip of each tarsus.... | <i>mytilaspidis</i> |
| Legs very slender, one claw, four-cleft beyond the middle | <i>gracilipes</i> |

- | | |
|---|---------------------|
| 3. Tarsus with but one claw, which is only slightly curved and simple, legs rather short | 4 |
| Tarsus with but one claw, which is strongly bent near its middle and beyond is four-cleft | 5 |
| 4. A plate or lamella at inner base of thumb, the thumb with several fine hairs on tip (often indistinct), mandibular plate emarginate at tip | <i>bicolor</i> |
| No such plate or lamella, tip of thumb with three fingers | <i>modestus</i> |
| 5. But one finger on tip of thumb, and one toward the base on the upper side.... | 6 |
| Three fingers on tip of the thumb | 7 |
| 6. The finger at tip of thumb is very stout, almost as broad at base as is the thumb at the tip, palpi rather short | <i>tumidus</i> |
| The finger at tip of thumb is much more slender | <i>bimaculatus</i> |
| 7. Seen in side view the lower finger appears the largest, not yellowish, with six dark spots | <i>telarius</i> |
| Seen in side view the middle finger appears the largest | 8 |
| 8. Yellowish, with six dark spots, on orange | <i>sexmaculatus</i> |
| Not so marked | 9 |
| 9. Mandibular plate tapers considerably toward the tip; on desert plants | <i>desertorum</i> |
| Mandibular plate less tapering; on cotton | <i>glaveri</i> |

Tetranychus mytilaspidis Riley.

Penthulodes mytilaspidis Riley.—Hubbard, Orange Insects (1885), p. 216.

Rather larger than most species; body quite broad behind; bristles stout, each arising from a prominent tubercle; the subfrontal pair are very long, more than twice (nearly three times) longer than frontal pair and farther apart; they have the usual arrangement. The palpi are short and stout, the last joint very short, with a short thumb, upon which is a rather clavate finger, a smaller finger near base on the upper side, and a hair at the upper tip. The mandibular plate is broad, broadly rounded at tip, scarcely emarginate in the middle, with the stylet beneath. Legs rather short, bristles not especially long; the femur of leg I is longer than usual, fully twice the length of the patella; tibia I only a little longer than patella. The tarsus terminates in a claw which, seen from below, appears simple; seen from the side, shows two claws, the principal one but little curved, the other much more curved and arising (apparently) from below and near the middle of the principal one; these two claws appear to lie in the same plane.

Color blood red, dark spots each side; legs paler red; bristles pale reddish; eggs globular, reddish.

This species is a true *Tetranychus* and not a *Penthulodes*. It is closely related to the European *T. pilosus* C. & F. Specimens come from several parts of Florida on orange and on *Limonium trifoliatum*, also on peach from Marshallville, Ga. Riley states that there are three claws, and Berlese figures the European *T. pilosus* with the lower claw cleft; but on careful observation I can not discern any division to the lower claw in the many specimens examined, some of which are evidently Riley's types. Little is known of the habits of this species.



FIG. 7.—*Tetranychus mytilaspidis*: claws, much enlarged (original).

Hubbard believed that it fed on scale insects or their eggs. It is undoubtedly a *Tetranychus*, and probably feeds, like the other species of the genus, on plant juices. Hubbard says (*Orange Insects*, p. 83): "The eggs are sherry-brown color, quite large and globular, and are usually deposited singly upon the leaf or strung like amber beads upon strands of spider's silk, which harbor the mites and their young."

***Tetranychus gracilipes* n. sp.**

Body with the usual bristles stouter than in most of the species, the lateral ones extending more outwardly than usual; all are situated on the elevated tubercles. Body a little broader than usual. The beak is more elongate than in any other species, which is also the case with the palpi, which are rather closely applied to the beak, the last joint very slender, ending in a stout claw; thumb stout, truncate, with one finger. The legs are slender, especially the first pair, which is much longer than the body; femur I fully five times as long as broad; on the joints above, toward the tip, is a stout bristle-like spine; very few other bristles on legs except close to the tip of tarsus. The claw is at first simple, strongly bent near the middle, and then four cleft (similar to *T. bimaculatus*). The mandibular plate is longer and more slender than usual, tapering slightly to the tip, where it is broadly rounded, and apparently without a median notch.

Phoenix, Ariz. Prof. Cockerell found this on the leaves of a species of *Sphaeralcea*. The leaf bears stellate hairs, to which the mite has a deceptive resemblance.

***Tetranychus bicolor* Banks.**

Tetranychus bicolor Banks.--*Trans. Amer. Ent. Soc.*, 1894, p. 218.

Body mostly red, often pale in front, and with some dark marks each side on abdomen; legs pale yellowish; eyes red; bristles white.

Body (♀) rather broader than usual, the legs plainly shorter than in most of the species; cephalothorax and abdomen with bristles in the usual positions and of ordinary length; mandibular plate broad, scarcely tapering toward tip, which is broadly rounded and usually distinctly emarginate in the middle. Palpi short, male with a tooth above on inner tip of tibia; the thumb has several fine hairs on its tip (but indistinct); the claw is thick and much curved, and at inner base of thumb



FIG. 8.—*Tetranychus bicolor*: claws, enlarged (original).

there is a thin plate or lamella (not seen in any other species). The tarsus is short; there is but one claw, which is long, curved only toward the tip, and not cleft.

The typical specimens were found on the upper side of chestnut and oak leaves in the woods near Sea Cliff, N. Y. Other specimens have been seen from oak at Washington, D. C., and from Geneva, N. Y., on a Norway spruce hedge.

Tetranychus modestus n. sp.

Head, palpi, and legs are brownish, the body yellowish, with quite large blackish irregular spots across middle of thorax, a large lateral spot in region of last pair of legs, and a broad irregular border around end of body. Body rather more elongate than usual; bristles in the usual arrangement; legs short; femur I fully twice as long as broad; tibia I only a trifle longer than patella I; tarsus short, ends in a long, simple claw, curved only toward tip, in all respects like that of *T. bicolor*. Mandibular plate of moderate length, not much narrowed toward tip, which is broadly rounded. Palpi short, thumb not as long as claw, with three nearly equal fingers on the tip; there is no plate or lamella. On each side of the anal opening there is a pair of fine hairs.

Found in August at Washington, D. C., causing a rust-like appearance on the blades of corn. Closely allied to the preceding, but distinct by characters of palpi.

Tetranychus tumidus n. sp.

Dark red and somewhat pruinose, marked across the thorax with a dusky band, terminating each side in a rather large dusky spot, a similar spot on each side near end of body; in some specimens there is an additional spot each side between the two; legs and mouth parts pale reddish. Young specimens are paler, with spots more distinct and confluent. Eggs are pale red. Body moderately broad; bristles rather longer than usual, quite stout, all in the usual arrangement, subfrontal pair not twice as long as the frontal pair. Palpi of average length, thumb is short and stout, on its tip is a large short cylindrical finger whose base is not much smaller than the tip of thumb, at the inner upper corner is a short hair, and on the upper side near base is a slender finger. Mandibular plate about twice as long as broad, narrowed toward tip, the sides before tip slightly concave, broadly rounded at tip, with a small yet distinct emargination in the middle. Legs moderate; femur I fully twice as long as broad; tibia I plainly longer than patella; tarsus of moderate length, terminating in a claw which is strongly bent near middle and four-cleft beyond.

Collected at Eustis, Fla., on the leaves of water-hyacinth, by H. J. Webber. It is closely allied to *T. bimaculatus* Harv., but distinguished by the very large finger on the tip of thumb.

Tetranychus bimaculatus Harvey.

Tetranychus bimaculatus Harvey.—Ann. Rept. Me. Agric. Exp. Sta. f. 1892 (1893), p. 133, Pl. III.

There are several styles of coloration, one is pale greenish yellow, with a large group of blackish dots each side on base of abdomen, sometimes a median group of dots; another style is dark crimson red, with black spots along each side of the body; legs, and hairs pale red-



FIG. 9.—*Tetranychus tumidus*: palpus—enlarged (original).

dish, almost colorless. Body broadest at shoulders, tapering behind; bristles long and fine, in the usual arrangement, subfrontal pair not twice as long as frontal pair. Thumb of palpus rather long; on its tip is a cylindrical finger; on its upper corner is a hair, and on the upper side toward base is a small finger; in male above on inner tip of tibia of palpus is a spine or spur. Mandibular plate about twice as long as broad, tapering forward, broadly rounded at tip, with a small although distinct notch in the middle. Legs of moderate length, femur I fully twice as long as broad, tibia a trifle longer than patella, tarsus rather slender, terminating in a claw which is suddenly and strongly bent near the middle and four-cleft beyond.



FIG. 10.—*Tetranychus bimaculatus*: palpus—enlarged (original).

It is quite probable that this species is the one called by Boisduval (*Entom. Horticole*, p. 84) *Tetranychus cucumeris*, but the descriptions of that author in this genus are useless for identification. Quite possibly several of his names apply to this species. The forms found in the greenhouse do not appear to differ from

those on garden vegetables and horticultural plants. It appears to be abundant all through the Eastern States and in several localities in the West. Specimens have been studied from Orono, Me., on various greenhouse plants; from Washington, D. C., on violets in greenhouse, on peach (curling the leaves), on *Datura*, on squash, on corn, and on strawberry; from Punta Gorda and Key Largo, Fla., on eggplant; on watermelon from Eustis, Fla.; on beans at Auburn, Ala.; and on roses from Weiser, Idaho. Professor Harvey records it from greenhouses in Ithaca, N. Y., New York City, and Westgrove, Pa.

The color and size are extremely variable. Yet in a lot from one plant and one region the adults are usually of one coloration and one size. Other lots from other localities have a much different appearance, but when mounted and examined do not disclose any structural difference. The specimens from Florida and those on *Datura* and violets from Washington, D. C., are red; those from Orono, Me., on squash and peaches from the District of Columbia, and on rose from Idaho are greenish, more or less marked with dark. The specimens from squash and *Datura* had made a considerable amount of web, much more than those on greenhouse plants.

This species has, more than any other, stood for the "red spider," *Tetranychus telarius*. Harvey remarks that specimens sent to him as the genuine "red spider" did not differ structurally from his species.



FIG. 11.—*Tetranychus bimaculatus*: claws—enlarged (original).

Tetranychus telarius Linn.

Acarus telarius Linn.—Fn. Suec., 481, No. 1974. (1761).

Tetranychus lintearius Dufour.—Ann. Sci. Nat., XXV, p. 276.

Color variable, often yellowish green, with black spots at sides of body, and sometimes at tip; legs pale; eyes red. Body rather broad in ♀, considerably tapering behind in the ♂. Bristles in the usual arrangement, the frontal and subfrontal pair as near the front margin as in other species (Berlese figures them much farther back), subfrontal pair twice as long as frontal. The palpi are quite prominent, the male has a spur above on tip of the tibia, the thumb bears on its tip three fingers; seen from the side the lower one is plainly larger than the others—those nearer the claw. The mandibular plate is about twice as long as broad, not much tapering toward tip, broadly rounded at tip, and with a faint median notch; the stylet is split nearly to plate. The legs are moderately long; femur I over twice as long as broad; tibia I plainly longer than patella I; tarsus quite long, ending in a claw strongly bent near middle and four-cleft beyond. I am not certain that this is the European species, but it has the characters of *T. telarius*, and does not differ, so far as I can see, from a specimen of *T. telarius* from Italy. The legs are a trifle more slender than in our other species. Specimens have been studied from Melrose Highlands, Middlesex County, Mass., on ash; from Waterville, N. Y., on hops; and from Fort Collins, Colo., on maple. Apparently it is not a very common species with us.

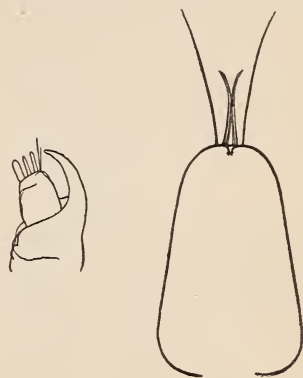


FIG. 12.—*Tetranychus telarius*: palpus and mandibular plate—enlarged (original).

Tetranychus sexmaculatus Riley.

Tetranychus sexmaculatus Riley.—Insect Life, Vol. II, p. 225.

Pale greenish-yellow, with six usually large dusky patches above, three on each side; legs and palpi pale. Palpi of moderate length: in male with a spur above on inner tip of tibia. The thumb is quite stout and bears on its tip three fingers, of which the middle one (seen from the side) is the largest. Mandibular plate rather slender, narrowed toward tip, which is broadly rounded, scarcely a trace of the median notch; bristles of body in the usual arrangement, the subfrontal pair scarcely twice as long as the frontal pair. Legs rather shorter than in *T. telarius*, the tibia I plainly longer than patella I; tarsus I shorter than usual, the claw strongly bent near middle and four-cleft beyond.



FIG. 13.—*Tetranychus sexmaculatus*: palpus—enlarged (original).

Specimens from various parts of Florida on orange, and some marked San Diego, Cal., on orange. This species appears to be smaller

than the other species of this group. It has at times been extremely abundant and an orange pest of much importance. An article on the species from an economic view is found in the Report of the Entomologist for 1889. They occur on the under surface of the leaves; the eggs are colorless or pale greenish-yellow

***Tetranychus desertorum* n. sp.**

Dark red, with black spots along each side, and a central spot before the middle; legs pale. Body quite broad, with the usual bristles, the frontal pair about one-half as long as the subfrontal. The palpi are longer than usual; there is a spur on the tibia of male as usual; the thumb not as long as claw and with three slender fingers on the tip, the middle one (seen from the side) is the largest. The mandibular plate is long and slender, narrowed toward tip; at middle of tip a small but distinct deep notch; stylet below the plate appears to be cleft only for a short distance. The legs are quite stout, the femur I more than twice as long as broad; tibia I plainly longer than patella I; tarsus slender, ending in a claw, which is strongly bent near middle and four-cleft beyond.

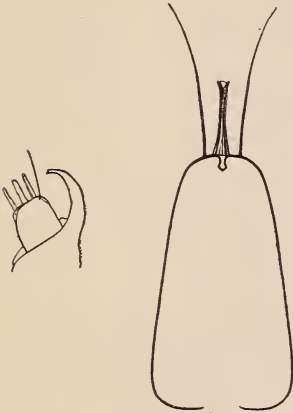


FIG. 14.—*Tetranychus desertorum*: palpus and mandibular plate—enlarged (original).

Specimens come from Mesilla Park, N. Mex., on *Larrea tridentata* and *Phacelia crenulata*. It is closely allied to the other species of this group, but the plate is more tapering than usual.

***Tetranychus gloveri* n. sp.**

Red, with irregular dark confluent spots each side of body; legs yellowish. The body, though broad at the shoulders, tapers behind even in the female; bristles long and fine, the subfrontal pair more than twice the length of the frontal pair; all in the usual arrangement. The palpi are of average length, the thumb not so long as claw; on its tip are three fingers, the median one (seen from the side) plainly larger than the others. The mandibular plate is rather broad, its sides concave near the tip, and almost truncate, sometimes apparently broadly, though not deeply, emarginate; the median notch is scarcely visible. The legs are quite slender, femur I more than twice as long as broad; tibia I plainly longer than patella I; tarsus quite long, ending in a claw, which is strongly bent near its middle and four-cleft beyond.



FIG. 15.—*Tetranychus gloveri*: palpus and mandibular plate—enlarged (original).

This species was figured by Glover in his *Cotton Insects*, and has been treated recently by Professor Morgan. Specimens have been examined from Baton Rouge, La.

Stigmæus Koch.—Uebersicht des Arachnidensystems, III, p. 53, 1842.

This genus differs much from *Tetranychus* in structure, but is closely allied in habits, the species living in colonies on leaves. The anterior and posterior pairs of legs are more widely separated than in *Tetranychus*; the body is more elongate and is usually more or less constricted near the middle; there are no rows of long bristles above; the tarsus ends in two equal claws, which in our species are deeply cleft. The mandibles in our species appear to be extremely long and styliform. The palpi seems to be simple, the last joint very slender. But one species has been observed in our country.

Stigmæus floridanus n. sp.

Body elongate, more than twice as large as broad, blunt-pointed at each end, constricted somewhat before the middle, the posterior part rather broader than the anterior, constricted slightly between the III and IV legs, four short curved bristles near apex, one on each anterior side of the posterior part and one on each side near the apical third of the anterior part. The legs are short and stout, scarcely as long as the width of body, the anterior pairs rather longer than the hind pairs; the tarsus ends in a pair of double claws, the outer branch longer and less curved than the inner branch.

Living in colonies upon the bases of the imbricated leaves of the pineapple in Florida. A species of considerable economic importance owing to the fact that its punctures give certain destructive fungi access to the tissue of the leaf. In Australia Mr. H. Tryon has recorded a quite different mite affecting the pineapples in that colony. He claims that it often carries the spores of the fungous disease. He calls the mite *Tarsonemus ananas*.¹ Professor Rolfs has published² on the habits of this *Stigmæus* and the damage it leads to in Florida.

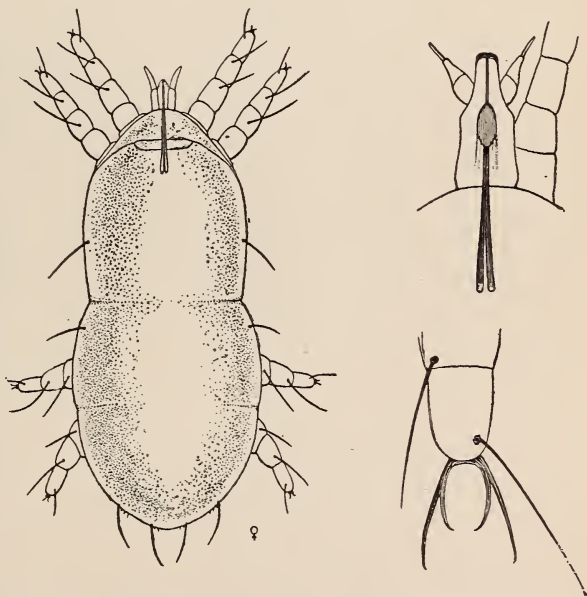


FIG. 16.—*Stigmæus floridanus*: mite, mouth parts, and claws—enlarged (original).

¹ Queensland Agric. Jour., 3 (1898), No. 6, pp. 458–467.

² Bul. No. 50, Fla. Agric. Exp. Sta., May, 1899.

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