THE ALEYRODIDS, OR MEALY-WINGED FLIES, OF CALIFORNIA, WITH REFERENCES TO OTHER AMERICAN SPECIES.

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INTRODUCTION.

This paper includes the descriptions, usually with account of egg and larval stage, of nineteen new species of North American Aleyrodidæ, or mealy-winged flies, all found in California; a catalogue with references, food-plants, and distribution of all the other American species so far described, and an analytical key of all the American species now known. This key is practically that of Quaintance (1900), expanded and modified to include the author's nineteen new species. The addition of these new forms brings the total number of species of American Aleyrodes, so far known, to sixty-six.

In beginning the study of the Californian Aleyrodidæ, it was found that but four species in this little known family of insects had been recorded from this State. The accounts of these species consist solely of the technical specific descriptions, and are mostly included in the papers of Maskell[a] and Quaintance.[b] Quaintance's Monograph enables one to become acquainted readily with our knowledge of American Aleyrodidæ up to 1900.

The insects themselves have been found to be very plentiful, the author having collected them from 30 native plants (see p. 474) and from various cultivated plants in gardens and conservatories. They are so plentiful in some cases as to vie with their near relatives, the Coccids, in economic importance; the author has found the leaves of the native live oak (*Quercus agrifolia*), the madroño (*Arbutus menziesii*), and the sow thistle (*Sonchus oleraceus*), curled, abnormally small, and incrusted on the under side with the immature stages; a cultivated fern kept in the laboratory and left to its own resources

[a] Maskell, Trans. New Zeal. Inst., 1895, p. 415.

[b] Quaintance, Contributions toward a Monograph of the American Aleurodidæ (U. S. Agri. Dept., Division of Entomology. Technical Ser., No. 8, 1900).

was almost killed by the multiplication of a few members of one species within a year. Already these insects are being fought as a pest in the conservatories. On the other hand, the author has frequently found colonies of Aleyrodes parasitized to an extent which indicates that nature herself will check the threatened danger. The chief reason why these insects might become troublesome economically is that many of them are omnivorous in food habit, and, not being capable of strong flight, would, under stress, readily become habituated to the nearest food plants.

But it is not from the point of view of the economic entomologist that the author has begun the study of the Aleyrodidæ. It is rather with the hope of throwing some light on their somewhat ambiguous zoological position through a detailed study of their structure and life history that the work has been undertaken. The curious metamorphosis of the Aleyrodids is not definitely understood; whether it should be called "complete" or "incomplete" is certainly still a mooted question. In the present paper the author uses the terminology which is already in vogue in the literature of this group, though the terms "pupa" and "pupa-case" are arbitrarily employed when applied to a family in which the metamorphosis may be incomplete.

With this structural and developmental study as an ultimate aim the author has made a beginning in the study of the Aleyrodidæ. An acquaintance with species has necessarily been the first step in the work, and this paper is therefore primarily systematic in character.

The geographical range covered in collecting the species herein described will be but briefly indicated here, as the exact localities are given in the text for each species described. It may here be said, however, that all the collecting has been confined to California, specimens having been taken in the Santa Clara Valley (Santa Clara County), on the slopes of the Santa Cruz and Sierra Morena ranges (Santa Clara and San Mateo counties), in Golden Gate Park, San Francisco, in the San Ramon Valley (Alameda County), at the base of Mount Diablo (Contra Costa County), and to a small extent in Alameda, Napa, and Mendocino counties, in southern California, and in the Yosemite Valley. King's Mountain, often referred to as a collecting ground, is in San Mateo County and Black Mountain in Santa Clara County.

The immature stages may be looked for upon either surface of the leaves, appearing upon plants as dissimilar in habit as the plantain and the oak. Most of the species are omnivorous, while a few seem to be confined to a single host. It would appear from material collected at points scattered from the base of the coast range to its summit that in the distribution of the Aleyrodidæ in this range there are no zones defined by altitude, the author having found the greater number of species collected, characteristic of the entire region from valley to summit.

The adults may readily be found resting on the under sides of the leaves. In collecting, if the adults take to flight, it is only necessary to remain quietly in wait, for they usually return from this upward flight, alighting in almost the same places from which they arose; the author has frequently thus disturbed a female in the act of egg-laying, and has seen her return to the same leaf when the disturbance ceased. The sure method of securing adults is, of course, to breed them from pupæ which have been carefully isolated.

All the species described have been placed in the genus Aleyrodes. Where the author has described species from immature forms only (a usage adopted by systematic students of this family from the beginning), there was no means of definite generic identification, as the generic characters lie in the wing venation of the adult. But as all the adults found belonged to Aleyrodes it was deemed best to place all forms examined provisionally under the one genus.

The author has had to depend on the pupa-cases for the identification of species, there being very little specific difference in the adults. True, some have such distinct characters as immaculate wings and yellow body, but there are others with similarly unmarked wings in which the abdomen is yellow and the head and thorax brownish, while still others have wings bearing dusky spots and the bodies with regular dark-brown markings. But as apparently identical adults issue from widely different pupa-cases, even the constant adult characters have no systematic value unless correlated with the pupal characters.

In the determination of the adults here described the specimens in question have in every case been bred by the author from their pupæ in the laboratory, or taken out of doors in the act of issuing from the pupa-case. In the determination of larval stages the following precautions have been taken for securing accuracy: In determining the beginning of the first stage the author has used only specimens obtained by capturing the larvæ immediately upon their issuance from the eggs. In determining later stages advantage has been taken of the insects' habit of preserving the larval moults, which may be found on the dorsum in regular succession from the first to the latest, which rests immediately upon the dorsum of the pupa-case. These moults have been removed, mounted in glycerin jelly or in Canada balsam, their characters studied and their dimensions taken from comparison with identical stages found on the same leaf.

The following new species included in this paper, all from California, are described under the following names: *Aleyrodes madroni*, *A. splendens*, *A. quaintancei*, *A. stanfordi*, *A. errans*, *A. interrogationis*, *A. maskelli*, *A. diasemus*, *A. extraneus*, *A. merlini*, *A. wellmanæ*, *A. amnicola*, *A. pruinosus*, *A. nigrans*, *A. irideseens*, *A. tentaculatus*, *A. kelloggi*, *A. hutchingsi*, and *A. glacialis*.

The Aleyrodidæ taken in California have been found on the follow-

ing native food plants: *Rhamnus californica*, *Rhamnus crocea*, *Umbellularia californica*, *Heteromeles arbutifolia*, *Quercus agrifolia*, *Quercus densiflora*, *Clematis ligusticifolia*, *Opulaster capitatus*, *Lonicera involucrata*, *Rhus diversiloba*, *Prunus ilicifolia*, *Arbutus menziesii*, *Salix lævigata*, *Washingtonia nuda*, *Symphoricarpos racemosus*, *Ribes glutinosum*, *Ceanothus californicus*, *Rubus vitifolius*, *Troximon* sp., *Sonchus oleraceus*, *Convolvulus sepium*, *Convolvulus arvensis*, *Aesculus californica*, *Plantago major*, *Solanum douglasii*, *Arctostaphylos manzanita*, *Arctostaphylos* sp. (unnamed species from the Yosemite), *Quercus chrysolepis*, and *Eriodictyon californicum*.

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The cotypes of all the species described in this paper are deposited in the collections of the U. S. National Museum.

LIFE HISTORY AND HABITS.

In a number of species there have been six stages verified, namely: Egg, three larval, a pupal, and an adult. In all the species which have been under observation, the eggs are laid in a circle or an arc of one, one or more rows deep, and three to twenty-eight eggs have been counted in a place; occasionally they are found in an irregular group, but always close together. Each is laid singly, the female standing with her wings somewhat outstretched and her head at the center of the future circle, her body forming the radius. As the eggs leave the abdomen, she raises the tip of her body above the usual level; after each is deposited, she swings the posterior part of her body laterally for a short distance and lays another. This is kept up until oviposition is completed or she is disturbed. Often several females will be seen standing near each other upon a leaf where there are no eggs; they keep moving in a restless manner, and gradually the leaf becomes coated with minute, white granules of wax similar to that which is upon their bodies and wings; where there is but one insect at work the wax is regularly circular in shape, but where there are more it is irregular. Usually the eggs are found upon these places, and are

more or less covered with wax; they are elliptical in shape and curved to a greater or less degree. At first they are white or pale yellow, but as the embryo develops the color becomes darker; the young hatch in about ten to thirteen days, the egg opening along the inner curve from the apex toward the base. The pedicel, which is such a noticeable feature of the eggs of the Aleyrodidæ, is a prolongation of the chorion, and can be seen within the body of the gravid female, frequently attracting attention by its dark brown color.

The embryo lies with its head toward the apex of the shell, and about the sixth day after being laid the reddish eyespots and orange-colored visceral mass begin to show plainly. In the eggs under observation there elapsed from forty-two minutes to three hours and eight minutes from the time that the shell began to open till the larva was free. The egg that took the greater time was upon dry material and was dark brown in color, the shell when empty keeping its upright position and shape, so that the slow hatching was probably due to the toughness of the chorion. As soon as hatched the young larva moved freely about on the leaf, but never went more than an inch from its shell and to this habit it is doubtless due that the empty shell is so often found close to the pupa-case. Specimens were seen active for eight or more hours. One lived for fifty-three hours and died without attaching itself. This may have been because the leaf was withering, although when removed to another it did not affix itself.

At first the larvæ are very convex and entirely free from secretion of any kind, but within an hour after emerging from the egg the beginning of the marginal band of wax is seen. When the food was allowed to dry somewhat so that it wilted, the young larvæ secreted a coating of wax, which was not present under other circumstances.

The author has not been able to determine the time which elapsed before the first molt or between the successive molts. From the fact that the larval exuviæ are always on the dorsum of the succeeding stage, and that they are folded back with the cephalic portion of the ventral surface uppermost, it is almost certain that the skin breaks on the ventral surface or along lateral margins. This is the reverse of the mode in the pupal stage, where the imago issues through a rent made along the longi-dorso-medial and thoraco-abdominal sutures, the flaps being folded back. When a parasite emerges from a pupa-case there is left an irregular round hole in the dorsum of the thorax and cephalic region; this characteristic opening makes it possible to determine the extent of parasitization among the empty cases. The number of larval stages has been determined from the molts, which are uniformly found upon the dorsum of the pupa-cases.

In the first stage the larvæ are always semitransparent, with functional legs and antennæ, and in the majority of species have from seven to nine latero-marginal hairs. After the first molt the cuticle may begin to grow darker in color and thicker in texture, until the culmi-

nation is reached in the thick black pupa-case, or the color and texture may remain approximately the same as in the first stage; when the latter obtains, some of the structural stages can be followed by superficial examination. The degeneration, or loss of legs and antennæ, and the permanent disappearance of the latero-marginal hairs take place with the molt of the first skin; in the second stage there is no external trace of either legs or antennæ, but in the third and beginning of the fourth stage, the reduced legs and occasionally the minute antennæ may be made out; in the fourth stage the wings are present and the legs and antennæ are more like those of the adult, but are still unsegmented; in the later part of this stage they are approximately as in the adult, and sex can be readily distinguished. The mouthparts seem to be smaller in the second and third stages; often in the latter they can not be made out, but in the late pupal stage they occupy relatively the same space as in the first larval.

All of the pupæ secrete "honeydew," sometimes in such quantities that the leaf around the case and the dorsum of the pupa is covered with it; in some species there are seen minute, blunt tubes on the apex of the lingula, through which the fluid may be excreted (fig. 47, Plate XXXIII). When the "honeydew" is emitted the operculum is lifted, the lingula is protruded, dorsally recurved, and the drop thrown with considerable force (fig. 46, Plate XXXIII). The liquid is sweet, and when exposed to the air it becomes thick and finally hardens. The frequent appearance of fungus in and about the cases is probably induced by the presence of this medium, as it is in the Coccidæ. On *Chamædorea* sp., an introduced plant from Mexico which was kept in the Golden Gate Park Conservatory, San Francisco, the author saw many large, black ants busily engaged in gathering "honeydew," acting as ants do with Aphids.

Leaving the pupa-case is a slow and toilsome process; the imago often struggles for hours before it is free and ready for flight. After leaving the case, it usually remains quiet for a few minutes. At this time it is paler in color than it will be later, and its wings are damp and crumpled; soon it begins to walk very slowly, and after going a short distance crouches upon the leaf as if exhausted; gradually its wings unfold and straighten into definite shape, the color becomes vivid and the granular secretion of wax from which the family has derived its name, begins to appear.

The adults have a peculiar manner of flight; when disturbed they rise in an almost vertical direction, and, if not further molested, alight nearly where they were in the first place. This habit may account for the females returning to the same leaf where they were laying eggs when disturbed, for on several occasions they have been observed to resume egg laying within a short distance from the place where their other eggs had been deposited.

Although the adults possess mouthparts and an alimentary canal,

close observation on the part of the author has failed to reveal them feeding; Prof. A. L. Quaintance, however, in a letter, writes that he has frequently observed adults of *A. abutilonea* Haldeman feeding. Experiments for determining the average duration of adult life were not satisfactory, as the specimens had to be confined in an artificial environment that would not give results identical with natural conditions. From data gathered, it is probable that there are at least two broods each year, the adults in this vicinity emerging from the pupa-cases and laying in April and May, and again in September, October, and November of the same year.

Family ALEYRODIDÆ.

Small to minute insects infesting plants; oviparous; metamorphosis incomplete (?); immature stages quiescent, attached by sucking mouth parts to the leaves; adults free and active, covered with granules of white wax.

Adults of both sexes with four wings, which are held horizontally and extend beyond the abdomen when the insect is at rest. Wings rounded, pure white or with dusky spots, margins golden-yellow and serrulate or "beaded" all around, each serrulation with three to five minute, delicate hairs; color and serrulations of the costal margin more pronounced; forewings with a single, median vein; costal margin bearing nine spines at base. Color of body yellow; head and thorax usually darker; the entire body occasionally with conspicuous brown markings. Head small, convex above, rounded anteriorly. Eyes two; red, brown, or black; either more or less constricted near the middle, reniform, or divided into two lobes, the lesser of which is anterior, brighter in color, and with smaller facets. Anterior to each eye is a single small ocellus. When mounted the divided eyes appear single, and only a careful inspection under a high power of microscope will show the difference in structure. Antennæ of seven segments, the first of which is shortest and the third longest; the first two segments are simple and stout; segment one, cup-shaped; segment two, subpyriform; segments three to seven, inclusive, cylindrical and closely ringed with minute hairs. Legs long and slender, feet with dimerous tarsi, terminating in three claws, of which the middle one is smaller than the other two, and bears a number of spines. Rostrum projecting from the under side of head, composed of a single segment, at the apex of which are the setæ that form the suctorial tube; from the base arises the long, 3-segmented mentum, subcylindrical in shape, free for its entire length, and inclosing the rostral setæ. Thorax with about equal distinct segments. Abdomen roundly tapering, terminating in the genitalia; the first segment constitutes a very slender peduncle; on the dorsal surface of the last segment is the vasiform orifice (fig. 41, Plate XXXIII). In the adults this characteristic organ is but little differentiated in general appearance and of no specific tax-

onomic value. Orifice subcircular; operculum more than one-half the length of orifice, deeply emarginate on the distal end; lingula longer than orifice, subcylindrical, either somewhat pointed or else enlarged at the tip, usually protruded and dorsally recurved; both operculum and lingula setose. Genitalia of female conical, in three parts, the middle one of which is the ovipositor. (Fig. 44, Plate XXXIII.) Genitalia of male forcipate, also in three parts, the outer two of which are the valves or claspers, and inclose the penis. (Fig. 57, Plate XXXV.)

Pupæ inclosed in more or less transparent, chitinous cases, usually elliptical in shape. Rudimentary legs and antennæ inclosed, but when the case is sufficiently transparent they are often visible. Pupa-case naked, or bearing hairs or spines; dorsum free from secretion, or it may have a more or less copious white wax covering, which is frequently arranged in definite patterns, and often of great beauty; margins made up of adjacent lateral wax tubes, from the ends of which may be produced a fringe of transparent wax rods, or asbestiform threads of wax, more or less covered with flocculent wax. On the dorsum, in the last segment of the abdomen, is found the vasiform orifice which is the most distinctive character in this family, and in the immature stages forms the basis of classification. It is an opening variously modified in shape, with a lid, the operculum, which is hinged to the cephalic margin; this lid ranges in size from minute to large; lying within the orifice beneath the operculum is the lingula, a strap-shaped organ, also attached to the cephalic margin; in general shape, cylindrical at base and more or less enlarged at the distal end; in some specimens it is entirely obscured by the operculum, while in others it is conspicuously long, even projecting beyond the orifice; the distal portion is frequently protruded and dorsally recurved. The operculum and the distal part of the lingula are usually setose, and the latter, as a rule, bears two long apical hairs (fig. 30, Plate XXXI). On the ventral surface of the case are four pairs of spiracles, a pair on each of the thoracic segments, and a pair on the abdomen, lateral of the vasiform orifice. In freshly mounted specimens the tracheæ are often filled with air, and consequently may be easily traced (figs. 55, 56, Plate XXXV).

Larvæ thin and usually flat; elliptical in shape; early stages semitransparent and ranging in color from white to yellow; dorsum naked, or with hairs or spines; with or without lateral fringe and dorsal secretion. Vasiform orifice as in pupæ. In the beginning of the first stage the larvæ are free and active, legs and antennæ functional; after the first moult these organs are not usually recognizable until a somewhat later stage (fig. 58, Plate XXXV).

Eggs yellow and ellipsoidal, with or without polygonal markings of shell; attached by a peduncle to leaf, usually laid in circular groups.[a]

[a] For a more detailed account of the characters of Aleyrodidæ, see Maskell, Trans. New Zealand Inst., 1895, p. 415.

Genus ALEYRODES Latreille.

"With the characters of the family. Adults, with but a single basal branch to vein of forewings; hindwings, with but a single vein."

The author has not attempted to separate the genus into subgenera as proposed by Cockerell;[a] this work can be done more satisfactorily when students have become better acquainted with more species.

TABLE OF ALL AMERICAN SPECIES.[b]

I. Pupa-case usually but little hidden by secretion; with lateral fringe—that is, 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—that is, any secretion from 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.....*stellatus* (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* (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* (47).
Pupa-case shining black, elliptical, 0.9 by 0.7 mm. Lateral fringe of transparent rods as wide as the case; dorsal secretion a narrow elliptical band mesad of the lateral wax tubes, and also a longitudinal stripe of mealy white wax..*madroni* (25).
Pupa-case shiny black, oval, convex, 0.9 by 0.6 mm. Lateral wax tubes deflexed to form the marginal rim, which is sharply demarked from dorsum by a ridge. Lateral fringe copious, at least as wide as case; dorsal secretion forming a second fringe, which rises perpendicularly above the dorsum and then curves downward and outward.....*splendens* (2).

[a] Proc. Acad. Nat. Sci. Phila., 1902, p. 282.

[b] *A. phalænoides* (No. 30) is not included in this table, as it was not included in Quaintance's key, and the writer has not had access to the original description. In Quaintance's list it is not described, simply listed with a reference to the original description.

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* (48).

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* (49).

Without dorsal secretion of wax.

Lateral fringe gelatinous looking (translucent).

Pupa-case pitch black, oval, hardly 1 mm. long. The gelatinous fringe extending out from 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* (19).

quercus-aquaticæ. 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* (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* (9).

Lateral fringe of very narrow, radiating, waxy ribbons, about 0.1 mm. long.

Pupa-case extremely dense and black, oval, 1.25 mm. long. *perilencus* (36).

Lateral fringe regular; of white, waxy ribbons, curved over so as to be strongly convex above.

Pupa-case dense black, broad-oval, about 1.5 mm. long. *melanops* (62).

Lateral fringe a continuous rim of transparent rods about width of case.

Pupa-case shiny black, oval, 0.83 by 0.6 mm. Dorsal disk larger than ventral, lateral wax tubes deflexed, making an oblique rim ..... *quaintancei* (42).

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. Forewings of adults marked with red and brownish black ..... *mori* (24).

Pupa-case as in *A. mori*, but the margin more deeply crenulated. Adults with wing-markings black ..... *mori arizonensis* (65).

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

Pupa-case shining 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 (50).

tracheifer. See above.

Pupa-case shining black, broadly elliptical, average size, 1.37 by 1.07 mm. Lateral fringe usually about one-half width of case. Dorsum with conspicuous, deflexed marginal rim, and a tube-like, longi-medial keel, arrow-shaped cephalad, along abdominal segments, suggesting a trachea with a glottis caudad ..... *stanfordi* (28).

Pupa-case shining black, elliptical, 0.9 by 0.8 mm.; with a copious, white, cottony, lateral fringe. Dorsum convex with evident median keel, arrow-shaped at the cephalic end and a reflexed marginal rim narrowed at both ends of case; body segments conspicuous ..... *errans* (16).

Pupa-case yellowish or greenish.

Dorsal secretion simply a submarginal series of brittle curved waxen rods from distal 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 2 on abdominal region.
erigerontis (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 ..... *nicotianæ* (26).

Pupa-case yellow, brown on central area.

Dorsal secretion in tufts, or pencils.

Lateral fringe gelatinous looking (translucent).

Pupa-case with gelatinous fringe wider than case, extending beyond and raising it from leaf. Dorsum with nine tufts, or pencils of white wax; a pair on the cephalic and on the thoracic regions near median line, a pair at the vasiform orifice, a pair caudad of vasiform orifice, and at caudal end of case, a long pencil resting on gelatinous fringe.. *interrogationis* (29).

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 pro-

jecting mostly beyond the margin. Wings of adults immaculate; eyes large, black, bean-shaped ..... *filicium* (13).

The lateral fringe consisting of but three curling, white waxen filaments, from long, thickened tubular pores, opening one on each side in cephalolateral 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* (8).

The lateral fringe transparent, white rods of variable length; when short, so deflexed as to appear vertical.

Pupa-case pale yellow, elliptical, caudal, and truncate; 0.9 by 0.65 mm.; marginal rim wide, demarked from dorsum by a thick line. Vertical fringe common to this type of Aleurodes, absent ..... *maskelli* (44).

The lateral fringe of separate, glassy rods, or of glassy, agglomerate rods covered more or less with flocculent wax.

Pupa-case yellow, elliptical, 1.4 by 0.8 mm., raised on a vertical fringe; dorsum with 12 pairs of conspicuous spines. *diasemus* (38).

The lateral fringe very narrow, of white agglomerate rods, ragged distally.

Pupa-case yellow, when empty, a white, transparent film; elliptical, 0.9 by 0.8 mm.; dorsum with 5 pairs of spines. Lateral secretion may be fragmentary, or so short and deflexed that it similates a vertical fringe ..... *extranicus* (46).

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 median ridge, and several transverse furrows. Margin with double crenulation. Vasiform orifice and operculum hemispherical; operculum small, not filling orifice. Wings of adults immaculate ..... *parvus* (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* (20).

Larva similar to *goyabæ*, but only the caudal pair of bristles readily discernable. Pupa-case scantly covered with the unequal curling waxen threads. A submarginal series of equally placed short bristles ..... *aepim* (4).

Pupa-case covered with a mass of wool-like wax often more than twice its length. Case yellow, elliptical, 1 by 0.6 mm., raised on a short, vertical fringe; dorsum convex, covered with conspicuous papillæ ..... *merlini* (31).

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, n rly fitting orifice, the caudal end notched. Adult with wings immaculate, eyes black ..... *horridus* (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. *floccosus* (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 distant papillæ; case raised on vertical fringe ..... *pergandei* (51).

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 ..... *plumosus* (52).

The secretion a submarginal series of appressed wax rods rising almost vertically for some distance above case, then bending downward and outward to leaf, central dorsum with secretion either plate-like or granular.

Pupa-case dark to yellow-brown; elliptical; 1.3 by 0.6 mm.; the central dorsal secretion when granular, lying thicker along medio-dorsal line and mesad of submarginal fringe. *hutchingsi* (61).

111. 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* (53).

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* (54).

Pupa-case with a longitudinal medio-dorsal stripe, and a submarginal area of varying width, whitish, otherwise brown, deepest laterad of central stripe; elliptical, 0.75 by 0.52 mm. The submarginal series of waxen rods rather short. No vertical fringe ..... *rittatus* (55).

Pupa-case brown with marginal rim, sutures, and vasiform orifice transparent, yellow, elliptical, 0.93 by 0.6 mm.; dorsum flat, punctate; marginal rim with a series of large papillæ ..... *wellmani* (45).

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 wedge-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 ..... *altissimus* (56).

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* (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* (17).

Without dorsal secretion of wax.

Pupa-case yellowish brown, and with more or less interrupted stripes 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 impressions, usually a pair to each segment. In adult male wings immaculate; eyes divided; antenna with a long terminal process. *graminicola* (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." *abutiloneus* (60).

Pupa-case wholly black, or with a yellow triangular patch near the anterior margin and a small spot of the same color near the posterior margin ..... *struthanthi* (63).

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 ..... *aureocinctus* (6).

Pupa-case white, central region brown, color extending cephalad in two conspicuous prongs; each segment with a great number of black dots. Case broadly elliptical, cephalic margin truncate, 1.4 by 1.03 mm., with a short, vertical fringe ..... *amnicola* (33).

Pupa-case yellow to smoky brown, darker in central region, broadly elliptical, 1.33 by 1 mm. Dorsum with minute black spots and a longitudinal row of depressions on each side of dorsi-meson, usually a pair to each segment. Adults, wings with dusky spots ..... *pruinosus* (3).

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* (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 ..... *coronatus* (11).

Without dorsal secretion.

Pupa-case dull black, subelliptical, narrowed at both ends, and prolonged caudad into a pointed lobe; 0.9 by 0.6 mm. Dorsal disk larger than ventral, and the marginal rim of wax tubes bent downward and inward ..... *nigrans* (43).

Pupa-case iridescent-black.

The dorsal secretion a submarginal series of glassy, waxen rods from distinct pores or papillæ, with a more mesal secretion of small, stellate whorls of white, waxen ribbons in four longitudinal lines.

Pupa-case elliptical, 1.2 by 0.7 mm.; the submarginal fringe about one-half width of case. Adults with immaculate wings, eyes divided ..... *iridescens* (1).

Pupa-case uniformly yellowish or whitish.

Without waxy secretion of any kind.

Pupa-case pale straw yellow, somewhat darker toward 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 ..... *pyrolæ* (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. 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* (7).

Pupa-case whitish, elliptical, 1 by 0.61 mm. Flat, marginal wax tubes evident. Vasiform orifice sub-cordate without corrugations; lingula terminating in sub-circular lobe. *nephrolepidis* (66).

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 ..... *inconspicuus* (23).

Pupa-case light yellow. Fore-wings of adults with a dark spot at distal end of vein ..... *youngi* (64).

Secretion present.

Dorsal secretion a submarginal series of glassy, curved, waxen rods from distinct pores of papillæ, and a more dorsal secretion of very long, tapering, curved, waxen 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* (39).

Dorsal secretion a thin, white wax pellicle, to which is attached a submarginal series of long, glassy, curved, waxen rods from distinct papillæ, and a more mesal secretion of shorter, similar rods from large circular pores.

Pupa-case yellow, elliptical, 0.85 by 0.6 mm., raised on vertical fringe of white wax. Vasiform orifice with rounded indenture and finger-like process caudad; lingula with three lateral lobes and a distal lobe. In adults, wings immaculate. *glacialis* (40).

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 three prominent, more central, inward-curving columns set in a triangle. Operculum considerably broader than long; lingula spatulate, with two pairs of setæ near distal end ..... *perseæ* (57).

pergandei. See above.

Pupa-case yellow, elliptical, 1.25 by 1 mm., raised on a very short, vertical fringe of white wax, with a submarginal series of broad, downward curving, pearly white, waxen ribbons, and a more mesal secretion forming a plate over the dorsum; the secretion, as a whole, covering case. *kelloggi* (14).

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 three pairs of lateral lobes and a distal lobe. In adults, wings immaculate ..... *variabilis* (58).

rolfsii. See above.

Dorsal secretion a thin, white wax pellicle, to which is attached a single, submarginal series of broad, short, glassy, waxen rods closely appressed to margin; or longer, more slender and tapering, waxen rods with a variable number of very long rods among them; each from a distinct papillæ.

Pupa-case yellow, elliptical, 0.96 by 6 mm., raised on vertical fringe of white wax. Vasiform orifice with rounded indenture and finger-like process caudad; lingula with three lateral lobes and a distal lobe. In adults, wings immaculate ..... *tentaculatus* (5).

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* (59).

1. ALEYRODES IRIDESCENS, new species.

Plate XXVII, figs. 1–2a.

Egg.—Yellowish brown, slightly curved, unmarked; pedicel short at one side of base on the convex curve.

Larva.—(Stage 1.) Size, about 0.25 by 0.11 mm.; elliptical; pale yellow. Dorsum with a narrow, thickened, uncrenulated marginal rim which bears a series of nine pairs of short, delicate hairs set in conical base; three of these seven pairs are lateral and extend from the latero-cephalic margin about one-half the length of larva; the remaining two pairs are the usual caudal and latero-caudal hairs; besides these there are five pairs of long, tapering, hollow, dorsal spines, a pair on cephalic segment, a pair on the meso-thorax, a pair on the meta-thorax, a pair just within the caudal margin, and a pair of delicate tubercled hairs caudad of the cephalic margin. Vasiform orifice, subcircular, minute; operculum the same shape and filling the orifice; lingula minute, barely visible through the operculum. Mouth parts large, setæ more than one-half the length of the insect. Eye-spots red, divided, the posterior lobe round and the larger of the two. Legs and antennæ functional.

Larva.—(Stage 2.) Abdominal segments distinct along dorsi-meson; two crescent-shaped thickenings in tergum, cephalad of the vasiform orifice. Lateral hairs, dorsal spines, eyespots, legs and antennæ have disappeared. In other respects as in Stage 1.

Larva.—(Stage 3.) The more cephalic of the flattened filaments of each stellate whorl of the dorsal exudation much longer than the others. Smaller than the pupa-case, in other respects the same.

Pupa-case.—Length, 1.2 mm.; width, 0.7 mm.; elliptical, somewhat narrow caudad. Color, on leaf, under hand lens, shining black; under microscope, by reflected light, it shows a most exquisite iridescence. The case is flat upon the leaf and has neither lateral nor ventral secretion, but there is a long, downward-curving fringe from a series of porēs near the mesal border within the marginal rim, made up of separate, tapering, transparent rods which are more than one-half the width of the case. In dry specimens the rods are often joined together at the base, thus making a continuous fringe. The most striking characteristic of this species is the arrangement of the dorsal exudation in stellate whorls of filaments or flat rays, which form a beautiful, flower-like pattern repeated many times in four longitudinal, subparallel lines, the outer pair of which correspond to the shape of case and contain twenty-four whorls, much larger than those of the inner lines; the inner lines have about twenty whorls each; along the abdominal keel the latter are so close together that the whorls are massed, forming a single line. Dorsum flat, with a longi-medial keel, which is rounded on the abdomen and sharply ridged from there

cephalad to its arrow-shaped anterior end; between the keel and the marginal rim there is a depressed, flat space. Upon the dorsum there are rows of tubercles, or cylindrical papillæ, which correspond in position with the stellate whorls of wax. In the outer rows there are thirteen pairs; on the abdominal keel there are six pairs, very close together; caudo-laterad of these is another pair; laterad of the first pair of tubercles on the anterior abdominal segment is a pair; on the metathorax is a pair; on the prothorax near the median line is a pair, and more laterad, near the cephalic suture is another pair; on the cephalic region there are two pairs, the caudal pair more mesad; between the vasiform orifice and the caudal margin of case there is a pair, the inner borders of which form the lateral margins of the furrow. Lateral wax tubes, deflexed to meet the ventral disc, form a plainly demarked marginal rim; a second, and superimposed, row of large wax tubes seem to show in specimens which are partially cleared in Labarraque; the dorsal, submarginal fringe comes from a row of pores mesad of the latter tubes. Crenulations of the marginal rim, regular, minute, and round, with acute reentrant angles; from these thickenings extend mesad, producing a rather irregularly marked margin. At the caudal end of case and on each side between meso- and meta-thorax there are some crenulations larger than usual and altered in shape; from these points on the margin there is a furrow leading within the case; here it widens into an air-chamber from which the second and third pairs of spiracles open. Dorsum between rim and outer row of tubercles, striate, the lines formed of minute depressions, mid-dorsal area of case more or less marked with reticulated lines; abdominal segments distinct along central area.

Thorax and cephalic region with many transverse ridges; these include segmental divisions and outlines of legs; laterad of the anterior pair of tubercles is a pair of small pores, and another pair at the vasiform orifice. The usual caudal, latero-caudal, and cephalo-marginal hairs are not present. Vasiform orifice broadly ovate, cephalic margin straight, caudal end broadly rounded, emarginate at the median line; laterally there is a conspicuous, double, marginal rim, and the space not covered by the operculum is overlaid with semicircular, heavily chitinized folds; operculum about four-fifths length of orifice, subovate, distal end somewhat pointed, cephalic margin not coincident with that of orifice; lingula shorter than the operculum, cylindrical at base, broadly spatulate at distal portion, which bears three lateral lobes.

Adult female.—Length of body, about 1.4 mm.; fore wing, 1.4 by 0.5 mm.; hind wing, 1.13 by 0.5 mm.; hind tibia, 0.43 mm.; hind tarsus, 0.23; proximal segment, 0.15 mm; abdomen, pale yellow; head and thorax, deep yellow; legs, antennæ, and mentum dusky; eyes, dark red, divided. Wings, immaculate, costal margin bright yellow; main

veins about seven-eighths length of wing; in the front wing, distad of flexure, the main vein gradually becomes less distinct; the basal vein-let arises at very base of wing and is short; vein of hind wing, straight. Antennæ with segment 1, cup-shaped, as broad as long; segment 2, pyriform, slender, bearing a number of delicate hairs set in conspicuous conical bases; segments 3 to 6, inclusive, cylindrical and closely ringed with minute hairs. Genitalia usual.

Male.—Length, 1.5 mm.; fore wing, 1.6 by 0.75 mm.; hind wing, 1.33 by 0.56 mm.; hind tibia, 0.5 mm.; hind tarsus, 0.25 mm.; proximal segment, 0.16 mm. Genitalia usual. In other respects, as in the female. This is the only instance where the author has found the male uniformly larger than the female.

Cotypes.—No. 7084, U.S.N.M.

Collected on *Rhamnus californica*, *Umbellularia californica*, and *Heteromeles arbutifolia*, from the Santa Clara Valley and the slopes of the Santa Cruz Mountains; also on *Rhamnus crocea*, *Arctostaphylos manzanita* from King's Mountain, and on Arctostaphylos from the Yosemite Valley. All the immature stages are on the under sides of the leaves, while the pupa-cases are found frequently on the upper sides. In view of the fact that the larvæ are able to move about in their first stage only, it is puzzling to find a supposedly fixed stage isolated in this manner.

Eggs were collected in April and May, 1901, and again in September and October of the same year; the other stages within a week later. Verified adults not common, but a few were bred out the last week in April, 1902.

2. ALEYRODES SPLENDENS, new species.

Plate XXXVI, fig. 68, and Plate XXXVII, fig. 69.

Egg.—Size, about 0.18 by 0.98; dark yellow, unmarked, pedicel long, at one side of the base on the convex curve.

Larva.—(Stage 1.) Size, about 0.26 by 0.15 mm.; oval, pale transparent yellow; a narrow, solid band of white wax around the margin. There is an uncrenulated, thickened, marginal rim bearing nine pairs of hairs set in conical bases; of these, seven pairs are lateral and reach from the cephalic margin about one-half the distance toward the caudal end; the remaining pairs are the usual caudal and latero-caudal hairs. Dorsum free from secretion, convex, and with five pairs of spines; a pair on the cephalic region, two pairs on the thorax, and a pair on the abdomen, about midway between the first segment and the vasiform orifice. Abdominal segments barely visible. Vasiform orifice and operculum as in pupa-case; lingula minute, spatulate, hidden by operculum. Eyespots single, red. Legs and antennæ, functional.

Larva.—(Stage 2.) Size, about 0.4 by 0.27 mm.; elliptical; shining, pale golden brown; lateral fringe of white, waxen threads, ragged dis-

tally. Dorsum free from secretion, convex; no marginal rim, but the lateral wax tubes are distinct, crenulations broad and round, reentrant angles acute. There are four pairs of dorsal spines; a pair that are short and stout on the cephalic region; two pairs of long, curved ones on the thorax; and a pair that are short and slender at the vasiform orifice; caudal and latero-caudal hairs, and vasiform orifice as in pupa-case. Legs, antennæ, and eyespots not visible.

Larva.—(Stage 3.) Size, about 0.6 by 0.45 mm.; elliptical; under hand lens, shining brown-black; under microscope by transmitted light, smoky-brown with darker spots on outer part, the abdominal segments outlined with dark brown and each with many minute, transparent dots. Central dorsum very convex, no marginal rim, but the flutings of the lateral wax tubes are very prominent nearly to the body sutures, the margin is crenulated, incisions deep and acute, the ends of the tubes rounded distally. Spines as in stage 2, but short. Lateral fringe of wax rods somewhat overlaid with flocculent wax. Caudal and latero-caudal hairs, and vasiform orifice as in pupa-case. Legs, antennæ, and eyespots not evident.

Pupa-case.—Size, about 0.9 by 0.6 mm.; oval. Color, under hand lens, shining black; under microscope, deep brown, lighted by a narrow, submarginal, oval stripe of semitransparent yellow; there are also two wedge-shaped, semitransparent places on the cephalic region, through which the red coloring of the eyespots show, and a pair of small, circular spaces on the third and fourth segments of the abdomen. The copious, asbestiform, lateral fringe of white wax may extend out on leaf to more than the width of case; basally it is continuous, distally ragged, and of unequal lengths. The similar dorsal secretion forms a second fringe which rises perpendicularly to a considerable height above the dorsum and then curves outward and downward—sometimes the ends curl under, making a roll; central dorsum free from secretion. Dorsum very convex, body sutures prominent; lateral wax tubes well developed, deflexed to ventral disk, making a vertical, rather high, marginal rim, which is narrowed at the caudal end of case; crenulations rounded distally, incisions deep, reentrant angles acute; mesad of the ends of the wax tubes is a row of small openings, one on the convex side of each tube. Dorsum with a longimedial keel, crossed by a deep, transverse furrow on the thorax, on which are two pairs of small pores. The cephalo-marginal, latero-caudal, and caudal hairs are present, the latter longer than usual. Vasiform orifice small, subcircular, with cephalic margin almost straight; operculum relatively the same shape and size, filling the orifice; lingula obscured. On the ventral surface the reduced legs are evident; no trace of antennæ.

Adults.—Unknown.

Cotypes.—No. 7085, U.S.N.M.

This species is not common where collecting has been done by the author. It was found in April and May, 1902, on campus of Leland Stanford Junior University, on the under sides of leaves from *Rhamnus californica*, together with *A. iridescens* and *A. irelliana*. In July, 1902, the author collected a number of pupa-cases on an unnamed manzanita in the Yosemite Valley; in the latter place the species was much more numerous.

3. ALEYRODES PRUINOSUS, new species.

Plates XXXIII–XXXIV, figs. 40–55.

Egg.—Yellow-brown in color; subpyriform, pointed at base, which is prolonged into a long stalk; chorion firm.

Late embryo.—(Within the eggshell.) Color yellow, eyespots red, divided, the smaller of each pair round, more lateral and anterior; the larger lobe not so definite in shape. Near the basal part of egg there is a broad, irregular, orange-colored mass which extends almost the width of the shell; anteriorly it is divided into two rounded lobes; this mass corresponds to the visceral glands seen in the larvæ. Lingula distinct, agrees with older specimens. The anterior pair of legs readily made out.

Larva.—(Stage 1.) Size, 0.4 by 0.23 mm.; subelliptical, slightly pointed caudad; color, whitish yellow; lateral fringe about one-third the width of larva, continuous at base but distally divided into irregular plates. Dorsum free from wax, very convex, marginal crenulations shallow and regularly rounded; lateral margins with seven pairs of long, delicate, equally spaced hairs, which begin at cephalic margin and extend about two-thirds of the distance toward the caudal end; the caudal and latero-caudal hairs are very long, and between them is a third pair of short hairs. Vasiform orifice broadly ovate, nearly as wide as long, lateral margins straight, apex truncate at latero-cephalic margin; operculum similar in shape, not quite one-half as long as orifice, with a pair of spines on the free, distal end; lingula spatulate, nearly or quite as long as the orifice, usually protruded and dorsally recurved; dorsum convex and densely covered with minute, blunt spines, or tubes, and with a series of hairs which are much longer than usual on the lateral and caudal margins; near the apex and attached to the ventral surface is a pair of conspicuously broad and long spines; these are usually sickle-shaped and curved toward each other; on the lateral margins is a pair of spines similar to the subapical ones, while on the apex is a pair of blunt tubes and a pair of long hairs (Plate XXXIII, figs. 46–47). The abdominal sutures are distinct along the dorsi-meson, the posterior ones reflexed caudad. Eyespots large and bright red. Legs and antennæ functional.

Larva.—Size, 0.53 by 0.35 mm.; color a pale dusky brown; abdominal segments distinct along the central dorsum. Lateral hairs, legs,

and antennæ have disappeared from view, and the mouthparts are much smaller. In other respects as in stage 1.

Pupa-case.—Size, 1.33 by 1 mm.; broadly elliptical, very convex, slightly narrower at the cephalic region; caudal end truncate, emarginate, and bent abruptly to the leaf. Color smoky brown, sometimes yellow, darker over the developing pupa or parasite; leg outlines conspicuous. The entire dorsum is rugose, and marked with more or less radially arranged thickenings or reticulations, which show as minute, blackish dots; on each segment from the vasiform orifice to the mouthparts there are two parallel rows of depressions of irregular outline, bounded cephalad by the margin of the preceding segment. Case very convex and with a medio-dorsal keel; there is neither dorsal nor lateral secretion, and the vertical fringe is very short. The marginal rim is lacking, and the wax tubes are not evident except at extreme margin, crenulations shallow and irregular; abdominal sutures conspicuous, the posterior ones reflexed caudad. The cephalomarginal hairs are minute, the caudal and latero-caudal hairs are present, but their relative lengths are reversed, the latero-caudal being much the longer. Just within the caudal margin is a pair of short, delicate hairs, and a similar pair is found at vasiform orifice. Scattered over the dorsum are a number of small pores. Vasiform orifice outlined by a dark rim; subovate almost as broad as long, the distal end bluntly rounded, lateral margins with corrugations, or folds, extending downward and inward; operculum one-half length of orifice, sub-semielliptical, cephalic margin straight, caudal end usually truncate but occasionally rounded and somewhat pointed; color brown; dorsal surface covered with closely set, minute hairs; lingula nearly the length of orifice, cylindrical, the distal two-fifths somewhat enlarged and arrow-shaped, thickly setose, and terminating in two straight setæ, which reach beyond the caudal end of orifice; a pair of setæ is also found on the lateral margins. Cephalad of the orifice is a thickened prolongation of the outline of the lingula, which reaches nearly to the two crescent-shaped thickenings in tergum, and caudad a narrow furrow extends from orifice to margin of case. Rudimentary legs distinct on the ventral surface. Eyespots divided, the anterior lobe smaller, color bright red.

Adult female.—Length of body, 1.8 mm.; fore-wing, 1.7 by 0.8 mm.; hind wing, 1.6 by 0.6 mm.; hind tarsus, 0.25; color, yellow with strongly chitinized places which make brown markings; segment 1 of abdomen has three longitudinal stripes; between segments 1 and 2, on line of suture, there is a transverse stripe; segment 2 has two lateral longitudinal curved bands the length of segment, between these are two sub-crescent-shaped, lighter colored patches, not as long as the lateral bands, with concave side of the crescents toward the median line; segments 3 and 4 have each two broad, transverse bands

nearly their width, these are not continuous on median line; segments 5 and 7 have transverse bands as wide as the segments; from segments 3 to 7, inclusive, the transverse bands become gradually longer; from segment 7 to genitalia, and surrounding the vasiform orifice, is a subcircular, broad band which is narrow cephalad of the orifice and much wider caudad of it; on the venter or latero-venter, there is a longitudinal stripe on segments 4 and 5, which are here curved conspicuously both cephalad and caudad, making the lateral ends of the segments very much wider than in central dorsum. On venter there is a broad subcircular band which surrounds the latero-ventral parts of base of genitalia; at the caudal end cephalad of this are two transverse dashes of brown. Thorax with transverse bands on each segment. Head also strongly marked. Legs, antennæ, and mentum dusky and marked. Operculum and lingula brown, densely setose. The eyes are red and divided, the lobes subrectangular and separated by a wedge-shaped space, which in the live insects is covered with white granules of wax; ocelli conspicuous. Fore-wing with two dusky spots; one, a narrow band on the anal side at flexure, the other larger at and including the apex of vein which is here curved toward the anal margin; basal veinlet arises near the base of main vein and is short; there is a long, oblique anal fold which reaches nearly to the margin; hindwing with but one dusky patch, this at and including the apex of vein. Antennæ about 0.5 mm. long; segment 1, cup-shaped; segment 2, pyriform; segments 3 to 7, inclusive, subcylindrical, closely ringed with minute hairs; segment 7, with finger-like process and hair at tip. Mentum with apex dark brown, median segment the shortest. Genitalia ordinary.

Male.—Length of body, 1.7 mm.; fore-wing, 1.7 by 0.7 mm.; hind wing, 1.6 by 0.6 mm.; the latero-ventral, longitudinal stripe of brown extends from the middle of the second segment partly through the seventh segment, from it toward venter the segments are outlined by dark stripes. Genitalia ordinary. In other respects as in the female.

Cotypes.—No. 7086, U.S.N.M.

Collected on *Heteromeles arbutifolia* by Mr. Edward Ehrhorn, at Avalon, Catalina Islands, Southern California; and by the auther on campus, Leland Stanford Junior University. The specimens were found on the under side of the leaves massed in large numbers, and together with the leaves were very thickly coated with granules of white wax, which readily dissolved in alcohol. The pupa-cases were conspicuously purplish in color when *in situ*. From April 16 to May 16, 1902, the adults were seen emerging from the pupa-cases in great numbers and depositing their eggs. Many of the leaves were incrusted with the immature forms and as a consequence were bent and dry.

4. ALEYRODES AEPIM Goldi.

Aleyrodes aepim GOLDI, Mittheil. Schweitz. entom. Gesellsch., VII, 1886, p. 250.

On *Manihot palmata* ("Aepim," "Mandioca doce") Rio de Janeiro.

5. ALEYRODES TENTACULATUS, new species.

Plate XXXI, fig. 26–30a.

Larva.—(Described from moult). Size, 0.3 by 0.16 mm.; thin, transparent and white; elliptical; the dorsum free from pores and papillæ; there is a pair of long, curved setæ on the caudal margin and a pair of shorter ones on the latero-cephalic margin of the operculum. Lingula as long as orifice, spatulate and enlarged distally; the lateral margins show faint traces of the three lateral lobes and the terminal lobe characteristic of the pupal stage.

Larva.—Size, 0.4 by 0.23 mm.; elliptical, whitish yellow, thin and semi-transparent; the dorsum has neither pores nor papillæ and is void of all secretion; caudal margin bears a pair of long, curved spines set in conspicuous, tubercled bases; antennæ minute, slender, and with a notch near the tip. In other respects as in pupa-case.

Pupa-case.—Size varies from 0.83 by 0.56 mm. to 0.96 by 0.7 mm.; elliptical, narrowed at thoracic region and tapering somewhat to the cephalic margin; caudad the case narrows more abruptly, and the caudal end is somewhat emarginate to meet the furrow which extends from it to the vasiform orifice; color yellow, sometimes brown from the presence of fungus or a parasite; the empty case is a white, semi-transparent film. There is no lateral fringe, but the case rests upon a rather high, vertical, ventral fringe of coalesced, white wax rods; the dorsal secretion is a submarginal series of separate, glassy, white wax rods, which are short, tapering, and flattened somewhat, as they are closely appressed to the margin of case, or it is composed of a series of longer and more slender rods, interspersed with very much longer and stouter similar wax rods; this latter type is not appressed to the margin of case, but bends downward slightly toward the leaf. The dorsum is convex and marked with more or less radially arranged thickenings, or reticulations; sutures distinct nearly, or quite, to the marginal rim, thoraco-abdominal one sinuate, posterior ones of abdomen strongly reflexed caudad. There is a well-defined marginal rim, within which is a single, usually regular, row of about one hundred closely set, large, conical papillæ, which have a diameter of nearly the width of the rim. Scattered among the papillæ, and mesad of them, are three rather definitely arranged rows of small pores; besides these there is a longitudinal row on each side of the dorsi-meson from the vasiform orifice cephalad, with a pair to each segment on the abdomen; this same order seems to obtain also on the thorax, but the segments are not well enough defined to verify it; many small pores are also

scattered over the entire dorsum. The marginal crenulations are rounded and have acute reentrant angles; at the caudal margin, on a line with the furrow, the crenulations are pointed and closely crowded together. There is a pair of short, tapering hairs cephalo-laterad of the vasiform orifice, the usual latero-caudal hairs are short, delicate, and set in tubercled bases, but the conspicuous caudal spines, usually found in Aleyrodids of this type, were not present in any of the numerous specimens examined. Within the abdomen are two large, orange-colored visceral glands. Vasiform orifice broadly conical, bounded dorsally by a dark raised rim, its inner lateral and caudal margins with conspicuous corrugations or folds, extending downward and inward; caudal end emarginate and with a median lobe or process; operculum subovate, more than one-half length of orifice; dorsum convex and covered with minute hairs; lingula well developed, spatulate, about two-thirds as long as the orifice, distal portion with three pairs of lateral lobes and a terminal emarginate lobe; on each side, in the angle between the distal lateral and the apical lobe, there is a long seta which projects caudad beyond the orifice, the entire organ densely setose; cephalad the outline is prolonged to the two pairs of crescent-shaped thickenings in the tegument of dorsum, which are more strongly chitinized and darker colored than usual. On the ventral surface the rudimentary legs are evident, but no trace of the antennæ can be seen. Eyespots dark red, divided into two round lobes.

Late pupa. (Male dissected from pupa-case). Abdomen pale yellow; head and thorax pale dusky-brown; legs and antennæ white; wings immaculate; eyes black and constricted, very broad; antennæ four-segmented; segment one, cup-shaped, broader than long; segment two, pyriform, densely setose, with stout hairs scattered over it; segment three, subcylindrical, very long and narrow, insertion with segment two very slender; central part somewhat constricted; near the distal end there is a stout rather blunt spine; segment four, closely ringed with minute hairs. Mentum very long, dusky-brown; apex darker. Wings too crumpled to describe in detail. Abdomen with two, large, orange-colored glands. Genitalia ordinary.

Adult female.—Body too distorted to measure accurately; forewing, 1.3 by 0.6 mm.; hind wing, 0.9 by 0.5 mm. Forewing with one rather large dusky spot at and including end of main vein; basal veinlet arising at some distance from the base of the wing; main vein with but a single flexure and not curved at apex; hindwing with dusky spot as in forewing, vein straight; abdomen pale yellow, head and throax darker; eyes large, reniform, by transmitted light, brown-black; antennæ usual, segment seven without notch and with an apical hair. Genitalia ordinary.

The dusky spot on wings which is present in the adult, but not seen in the late pupa, may need the action of the air to render it visible.

Cotypes.—No. 7087, U.S.N.M.

Specimens have been found on the leaves of *Quercus densiflora* and *Quercus agrifolia* together with *A. coronatus* and *A. gelatinosus;* also on *Clematis ligusticifolia*, *Opulaster capitatus*, *Lonicera involucrata*, and *Rhus diversiloba;* the latter shrub was examined in Alameda during the last week in August, 1901, many adults were flying around and resting upon it, but as there were other species of pupa-cases upon the adjacent food plants, it was deemed best not to assume that the adults were *A. tentaculu*. From the pupa-cases which were isolated, only the one female from which description was made, was bred out; also there was but one pupa-case found upon which there was a moult, although pupa-cases have been found at all seasons during a year. This species is rather common but not plentiful, seldom more than two being found upon a leaf.

6. ALEYRODES AUREOCINCTUS (Cockerell).

Aleyrodes aureocincta COCKERELL, Jn. N. Y. Ent. Soc., 1897, p. 42.

On *Aquilegia*, Organ Mountains, New Mexico.

7. ALEYRODES BERBERICOLA Cockerell.

Aleyrodes berbericola COCKERELL, Jn. N. Y. Ent. Soc., 1896, p. 207.

On a shrubby *Berberis*, Mescalero Reservation, Tularosa Creek, New Mexico.

8. ALEYRODES CITRI Riley and Howard.

Aleyrodes citri RILEY and HOWARD, Insect Life, V (1893), pp. 219–226.

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

9. ALEYRODES COCKERELLI von Ihering.

Aleyrodes cockerelli VON IHERING, "Os Piolhos Vegetaes do Brazil." Revista do Museu Paulisto, N. H., 1897, p. 393.

On *Baccharis pauciflosculosa*, São Paulo, Brazil.

10. ALEYRODES CORNI Haldeman.

Aleyrodes corni HALDEMAN, Am. Jn. of Sci. and Arts, IX (1850), p. 109.—SIGNORET, Ann. de la Soc. Entom. de France, Dec., 1867, p. 398.

"Size and general appearance of *A. abutiloneu;* 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 amomum*.

"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."

11. ALEYRODES CORONATUS (Quaintance.)

Plate XXVIII, fig. 9.

For further description see reference. Only those stages not included by Quaintance, in his paper already referred to, or variations from his description, will be given here.

Larva.—(Just from egg, April 19, 1901.) Size, 0.38 by 0.15 mm.; elliptical; semitransparent white; neither dorsal nor lateral secretion; dorsum convex and with a distinct noncrenulated, marginal rim, bearing from seven to nine pairs of delicate, lateral hairs, which extend from the latero-cephalic margin about one-half the distance to the caudal end; the usual caudal and latero-caudal hairs are present and are relatively long, and there is a pair of shorter ones at the vasiform orifice. Abdominal sutures distinct to the marginal rim. Vasiform orifice prominent, subcircular; operculum short, lingula obscured by it. Eye-spots large, single, bright red. Legs and antennæ functional, the former with digitule-like hairs on tarsi.

As the larvæ grow older they become flatter, except along the dorsi-meson. There is much variation in the lateral secretion, which is as great among larvæ of the same stage as in different stages; this fringe may be entirely wanting, some specimens have only a narrow band of solid wax closely appressed to the margin, others a narrow fringe of separate, glassy rods set far apart, while still others have a fringe one-half the width of dorsum, made up of separate rods of transparent, white wax, which taper to a point and are twisted, or even coiled upon themselves, in various directions.

Pupa-case.—Size variable, 0.9 by 0.67 mm. to 1.1 by 0.9 mm.; with a few exceptions these cases are surrounded by a broad sloping ring of gelatinous substance; this secretion melts when heated, but rehardens as soon as it begins to cool and is difficult to remove; xylol, or absolute alcohol, does not entirely dissolve it unless the cases are covered for some time; the dorsal wax can be brushed off, and is quickly melted in hot water or weak alcohol. There are three pencils of opaque, white wax lying upon the gelatinous mass and extending to its distal margin. One of these is from the median line of the caudal margin, the other two are from the meso-thorax and extend almost at right angles from the case; these pencils are very conspicuous, and have been found on every perfect specimen examined. On the dorsum of specimens which have been partially cleared in caustic potash there are many pores which vary in size with the amount of clearing. Around the case is a single, equally spaced submarginal row; mesad of this row there are scattered, single, larger ones; on the cephalic region there is a transverse row of eight pores; caudad of these is a pair, one pore on each side of the dorsi-meson; on the meta-thorax

there are two transverse lines, each containing six pores, and latero-cephalad of these are two pairs; on the abdomen, each side of the dorsal keel, are two longitudinal rows of pores, the inner row of six and the outer with five; on the second abdominal segment there is an additional pore on each side, thus making a transverse row of six pores instead of the usual number.

Adult female.—(Bred from pupa-case.) Length of body, 1.1 mm.; fore wing, 1.05 by 0.65 mm.; hind tibia, 0.4 mm.; hind tarsus, 0.2 mm. Abdomen whitish yellow, head and thorax darker, legs and antennæ white; wings immaculate, main veins to apex; in the fore wing the flexure is very slight and the veinlet arises near the base of the wing; between the veinlet and the anal margin there is a conspicuous, oblique fold; in the hind wing the vein is straight. Antennæ, length formula, 3–7–5–6–4; segment one, short, about as long as broad, cup-shaped; segment two, pyriform, densely setose and with a number of short spines set in tubercled bases. Genitalia usual.

Aleyrodes coronatus has been found in varying numbers upon every live oak examined and is widely distributed in California, specimens having been received from San Diego to Mendocino counties. It seems to be more liable to the attack of fungus than any other species which has been under observation; material from widely separated localities and from different hosts, suffering equally. Frequently the leaves are so thickly covered with the immature forms that a solid crust is made upon the underside; such leaves are abnormally small, paler in color, and curled; sometimes only individual leaves on a tree are in this condition, and again all are infested, and the tree is stunted.

Collected on the live oak (*Quercus agrifolia*) by Mr. Edward M. Ehrhorn at San Jacinto and the Santa Catalina Islands, southern California; by Mr. James McMurphy at Albion Ridge, Mendocino County; and by the author in San Ramon Valley, Santa Clara Valley, Golden Gate Park, and in Alameda County in various places. Also collected by Mr. G. H. Coleman on the tan-bark oak (*Quercus densiflora*), at the head of the Big River Canyon, Mendocino County, June 6, 1901; and by the author on the same host plant, from the slopes and ridges of the Santa Cruz and Sierra Morena Ranges. This same species has also been found on *Heteromeles arbutifolia* and *Arbutus menziesii* on Kings Mountain, and in the Santa Clara Valley. The madrones along the roads leading from the San Ramon Valley to Haywards, Contra Costa County, were carefully examined in 1901, but this species was not found upon them; also collected by the author on the leaves of *Quercus chrysolepis* in the Yosemite Valley, in July, 1902.

12. ALEYRODES ERIGERONTIS Maskell.

Aleyrodes erigerontis Maskell, Trans. N. Z. Inst., 1895, p. 429; Entom. News, VII, p. 247.

On an *Erigeron*, Escalon, Mexico.

13. ALEYRODES FILICIUM Goldi.

Aleyrodes filicium Goldi, Mittheil, Schweitz. Entom. Gesellsch., VII (1886), p. 247; 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 quadriaurita* in the fern house, Kew Gardens.

14. ALEYRODES KELLOGGI, new species.

Plate XXIX, figs. 13–16.

Egg.—Size, 0.2 by 0.09 mm.; yellowish, unmarked, pedicel short, at one side of base. The empty shells are dark brown and much crumpled.

Larva.—(Stage 1.) Size, 0.3 by 0.1 mm.; elliptical; margin with a narrow band of white wax; color, semitransparent white. Dorsum free from secretion, convex, lateral margins with pairs of short hairs set in conical bases; besides these, there are the usual caudal and latero-caudal hairs, which are conspicuously long. Abdominal segments distinct. Vasiform orifice as in pupa-case. Antennæ and legs functional, the latter with long, digitule-like hairs.

Larva.—(Stage 2.) Size, 0.4 by 0.25 mm.; elliptical; the dorsal secretion a submarginal, flat fringe, continuous at base but distally separated into irregular plates. Abdominal segments distinct, rounded along the dorsi-meson into a keel, crenulations of margin broad and shallow. Vasiform orifice subcordate; operculum short, subsemi-elliptical; dorsum setose; anterior margin straight, distal end with two conspicuous hairs on the lateral angles; lingula short, projecting beyond the operculum, strap-shaped, distal part covered with hairs. Reduced legs and antennæ evident. Eye-spots small and dark red.

Pupa-case.—Size, 1.3 by 0.87 mm.; broadly elliptical, narrowed cephalad; color, pale yellow; the central region darker. There is no lateral fringe; the case is raised some distance from the leaf upon a vertical, ventral fringe of coalesced, white wax rods and covered by the dorsal secretion with the exception of the vasiform orifice; this secretion consists of a central shell of thick, porous, pearly white wax, and a submarginal series of broad, opaque, white ribbons, which are irregular in width and raised into a high-arching, curved fringe, which entirely covers the margin of the case and, in many specimens, is curled under itself, making a roll. The ribbons are made up of from two to four thin sheets of wax closely appressed to each other; the different layers in each ribbon may come from separate sets of wax-secreting tubes; this seems extremely probable, as the yellow color of the case shows at the base between the sheets. The wax around the vasiform orifice is raised above the dorsal shell and forms a concave rim which meets the caudal ribbon and incloses the orifice. In nearly all the specimens

the wax plate is divided transversely along the thoraco-abdominal suture.

The dorsum is covered with minute pores, underlying which are relatively large, irregular, intersecting canals.[a] It has a wide, conspicuous, irregularly striate, marginal rim, which bears a row of minute, tubercled hairs. The crenulations of this rim are sharply pointed, incisions shallow and reentrant angles acute; mesad of the rim are three or four rather regular rows of small pores. The abdomen is rounded into a slight keel on the dorsi-meson, along which the sutures are distinct and the outlines of the legs are conspicuous. Vasiform orifice subcircular; its margin is a dark raised rim or fold which bounds the orifice on its lateral sides, but does not quite come together cephalad; on each inner, lateral edge of its cephalic margin, there is a short hair which projects into the open space within the orifice; the lining is laid in conspicuous, transverse folds. Operculum almost obsolete, subrectangular; cephalic margin, straight. Lingula very short, projecting slightly beyond the operculum; it is cylindrical at base and widened at the apex, which is densely setose. There is a pair of short spines latero-cephalad of the vasiform orifice; the latero-caudal hairs are present, so delicate that they are nearly invisible, but the usual caudal hairs are absent.

Adults.—Unknown.

Cotypes.—No. 7088, U.S.N.M.

Collected on the under sides of the leaves of the *Quercus agrifolia* and *Prunus ilicifolia* in the Santa Clara County, and on the slopes of the Sierra Morena Range. On the former food plant only an occasional pupa-case has been found, but the leaves of the cherry are frequently incrusted with the immature forms. Verified adults have never been secured, although many pupa-cases were isolated.

15. ALEYRODES FLOCCOSUS (Maskell).

Aleyrodes floccosa Maskell, Trans. N. Z., Inst., 1895, p. 432.

From Jamaica, on *Lignum-vitæ*, in company with *A. stellata*.

16. ALEYRODES ERRANS, new species.

Plate XXX, figs. 20–21.

Egg.—Size, about 0.21 by 0.11 mm.; yellow, curved, shell unmarked. Pedicel short, slender, and on the convex curve at one side of truncate base.

Larva.—(Stage 1.) Size 0.3 by 0.16 mm.; subelliptical, pale, semitransparent yellow. Dorsum convex and bearing five pairs of spines—a pair of very long curved ones on the cephalic region; two pairs much shorter on the thorax; a pair on abdomen cephalad of the vasiform ori-

[a] These may be spaces which, in the living insect, are filled with wax; when freshly mounted specimens are examined the spaces are seen filled with air,

fice and a pair latero-cephalad of it. The usual caudal and latero-caudal hairs are present, much longer than in other species. There is a distinct thickened marginal rim, in which are two parallel rows of minute transparent spots; the lateral wax tubes seem to be wanting and there is no wax secretion of any kind; on the lateral margins of the rim are seven pairs of delicate hairs set in conical bases. These hairs are much longer than usual, and extend from the latero-cephalic margin, about one-half the distance to the caudal end. Vasiform orifice subcircular, bounded by a dark rim; operculum relatively the same shape and size as orifice; lingula the length of orifice, enlarged distally, strap-shaped. Legs and antennæ functional. Mouth parts large, setæ more than one-half the length of larva.

Larva.—(Stage 2.) Size, 0.45 by 0.3 mm.; broadly elliptical in shape and of a yellowish-brown color mottled with dark spots. Dorsum flat, with a narrow lateral fringe of transparent rods, which are continuous at base but ragged distally; no dorsal exudation. Spines as in stage 1, except that the cephalic pair are wanting and the second and third pairs are very long. Lateral wax tubes distinct; crenulations of margin shallow and rounded; marginal rim, latero-marginal hairs, legs, and antennæ have disappeared from view.

Larva.—(Stage 3.) Size, 0.5 by 0.45 mm. to 0.7 by 0.83 mm.; color, dark brown; by transmitted light, yellow or gray-brown. No marginal rim, but the lateral wax tubes are bent downward to some extent, and the crenulations are relatively deeper than in the pupa-case. Hairs and spines as in stage 2, except that there is a pair of minute hairs on the cephalic region. Abdominal segments distinct along the dorsimeson, bearing two rows of small pores on each side of the median line, a pair to each segment; in other respects as in pupa-case.

Pupa-case.—Size, from 0.75 by 0.5 mm. to 1.03 by 0.7 mm.; shape, broadly subelliptical, widest across the abdomen, narrow on thorax, and tapering to the caudal end; color, shining black. There is a profuse lateral exudation in the form of a fringe made up of thread-like, white, wax rods which have many minute projections, the whole interlaced into a mass which varies considerably in width. Dorsum keeled for entire length, body segments conspicuous; on the third and fourth abdominal segments are a pair of small pores; the thoraco-abdominal suture is very sinuate and extends to the marginal ridge. There is a distinct and wide marginal rim somewhat wider on the sides, which is demarked from the dorsum all around by a sharp ridge; the lateral wax tubes are quite prominent and extend mesad about one-half the width of the rim; the margin is crenulated, incisions irregular, and the ends of the tubes truncate and notched. On the cephalic region there are a pair of wedge-shaped or triangular transparent places, the acute angle toward the median line, the outer edge parallel with the marginal ridge; between the transparent places is a pair of small pores,

and near to the median line are several longitudinal dashes. Vasiform orifice small, tubercled, and subcircular; operculum heavily chitinized, approximately the same shape and size as the orifice; lingula obscured by the operculum. On the ventral side the reduced legs can be made out; antennæ not visible.

Adult female.—Body so distorted that accurate measurements could not be made; fore-wing, 1.4 by 0.65 mm.; hind tibia, 0.5 mm.; middle tibia, 0.35 mm.; fore tibia, 0.3 mm.; hind and middle tarsi, 0.25 mm.; proximal segments, 0.15 mm.; fore tarsus, 0.21 mm. Color, bright yellow, legs and antennæ white. Wings immaculate, thickly coated with white wax granules; costal margins golden yellow; main vein of both wings extending to apex; in fore-wing the flexure is at the middle of length, beyond it the vein becomes gradually less evident; the basal veinlet arises at base of wing and extends obliquely caudad to margin of wing. Mentum yellow, with proximal segment longest; this is slender and tapers to the middle segment, which is shorter than the others; distal segment gradually tapering to the apex, which is dark brown at extreme tip. Eyes divided into two lobes, of which the anterior lobe is smaller, more transparent, and glowing red; the facets are also much smaller and of a different shape from those of the posterior one, which is subrectangular in shape and of a dark, reddish-brown color. (See drawing of *A. pruinosus.*) Genitalia ordinary, brown in color and acute conical.

Adult male.—Fore-wing, 1.23 by 0.6 mm.; hind tibia, 0.6 mm.; middle tibia, 0.33 mm.; proximal tibia, 0.3 mm.; tarsi, proximal and middle, 0.21 mm., hind 0.26 mm., the proximal segment of latter 0.15 mm. Genitalia ordinary. The body very much smaller than that of the female, in other respects essentially the same.

Cotypes.—No. 7089, U.S.N.M.

Collected on *Umbellularia californica* on campus, Leland Stanford Junior University; in various places in the Santa Clara Valley; on the lower slopes of the Santa Cruz Mountains, and along the San Ramon Creek at the base of Mount Diablo, Contra Costa County. Also collected on *Arbutus menziesii* on King Mountain, on the Ceanothus, near Usal, Mendocino County, July 6, 1901, and on *Umbellularia californica* at Redwood Creek, Napa County, June 6, 1901, by Mr. George Coleman.

The pupa-cases are common all the year. The eggs and young larva were collected from the middle of March to May, and again found in October and November. April 28, 1902, the adults emerged from segregated cases. This species is common in the above localities. Often the leaves are incrusted with the pupa-cases, which are always on the under sides of the leaves. Frequently *A. inconspicuus*, *A. nigrans*, *A. quaintancei*, and *A. pruinosus* are collected from the same leaves with *A. errans.*

17. ALEYRODES FORBESII Ashmead.

Aleyrodes forbesii Ashmead, Fourteenth Rept. Ill. St. Ent. (1884), p. 110 (*aceris* Forbes).

This is the common, large, box-like species, on leaves of *Acer dasycarpum*, in many parts of the North—Ithaca, New York; Washington, District of Columbia; Urbana, Illinois.

18. ALEYRODES FUMIPENNIS Hempel.

Aleyrodes fumipennis Hempel, Psyche, VIII, No. 280, p. 394.

On undetermined grass growing on swampy ground, S. Paulo, Brazil.

19. ALEYRODES GELATINOSUS (Cockerell).[a]

Egg.—Size, 0.2 by 0.1 mm.; oval, yellow, curved, unmarked, pedicel short, at one side of center of base.

Larva.—(Stage 1). Size, 0.27 by 0.1 mm.; subelliptical; wax secretion a narrow, white band of coalesced rods closely appressed to the margin; color, pale-yellow to yellowish-brown; dorsum convex, abdominal sutures distinct along the dorsi-meson; vasiform orifice subcircular; operculum relatively the same shape and size, nearly filling the orifice; lingula not seen.

Larva.—(Stage 2). Size, 0.5 by 0.4 mm.; broadly elliptical; wax secretion a continuous dorso-submarginal fringe about width of larva, made up of crystalline rods coalesced nearly to distal end, where it is separated into irregular plates; cephalad of the vasiform orifice on each side of the dorsi-meson is a small knob-like portion of flocculent wax. Color, yellow-brown. In other respects as in stage 1.

Larva.—(Stage 3). Size, 0.6 by 0.43 mm.; there is a long caudal pencil of cottony white wax projecting from the median line for some distance; sometimes the caudal pencil is divided into two plume-like parts, the dorsal knobs found in previous stage present, but the fringe is wanting. Color, dark brown; dorsum finely punctate, bearing a pair of long, tapering, caudo-submarginal spines and a pair of stout, shorter spines, latero-cephalad of the vasiform orifice. Vasiform orifice tubercled. In other respects essentially as in previous stages.

Pupa-case.—Size, 0.9 by 0.7 mm.; broadly elliptical, caudal end truncate; secretion in form of a gelatinous ring upon which the case rests and which projects beyond it for a considerable distance. The secretion is a translucent, brownish mass of wax, which under the high power of the compound microscope shows its rod-like origin. This wax is difficult to remove; when heated it melts, but as soon as cooled it quickly re-forms. It can be dissolved by xylol or in absolute alcohol, if allowed to remain covered for some time. On some specimens

[a] Contributions toward a Monograph of the American Aleurodidæ (U. S. Agri. Dept., Division of Entomology, Technical Ser. 8, p. 27).

there is found a dorsal, submarginal fringe of very small crystalline, coalesced rods, which overlie the gelatinous wax. From the thoracic margins there issues a long, white pencil of cottony wax; these project almost at right angles from the case and rest upon the underlying ring of dark wax. From the median line of the caudal margin there projects a third pencil similar in structure and position; these pencils often are spiral in arrangement. Color of pupa-case, iridescent, or shining black. Dorsum finely punctate; sutures distinct, the longimedial and thoraco-abdominal ones conspicuous, the latter sinuate; abdominal keel distinct, ending caudad in the tubercled vasiform orifice. There is no marginal rim, but the lateral wax tubes are evident; crenulations rather deep, broad, and rounded, the reentrant angles acute, each crenulation minutely recrenulated. There are many small dorsal pores. Among the striations which extend mesad from the marginal crenulations are from two to four irregular rows, mesad of these on each side of case, extending caudad of thoraco-abdominal suture is a longitudinal row containing four pores; laterad of the anterior margin of the vasiform orifice is a pair; cephalad of the thoraco-abdominal suture there is a transverse row of four, two on each side of the dorsi-meson; cephalad of the meso- and the metathoracic sutures there are two, one each side of the dorsi-meson; near the latero-cephalic margin there is a pair on each side, and in line with them are four circular light spaces; scattered over the dorsum are many smaller pores. When the pupa-case is cleared in caustic potash many more pores become evident.

Late pupa.—(Female dissected from case.) Body too distorted to measure accurately. Abdomen deep yellow and containing two large, orange-yellow visceral glands. Head and thorax darker colored, legs white. Antennæ: Segments 1 and 2 dark brownish yellow; segments 3 to 7, inclusive, white. Legs, ordinary; claws, 3, the middle one more slender and longer than the other two. Segment 1, cup shaped, broader than long; segment 2, pyriform, densely setose; segment 3, long and slender, sub-cylindrical, enlarged near the basal end; at insertion with segment 2, very slender; segments 4 to 7, inclusive, subequal and slender; segment 7, sub-fusiform, notched on each side near apex; segments 3 to 7, inclusive, closely ringed with minute hairs. Eyes reniform, broad, and dark red. Genitalia ordinary.

The pupa-case of this species agrees in the main with the brief description given by Cockerell, but as the author has secured other stages it has been thought best to give a full description here.

Collected from *Quercus agrifolia*, together with *A. coronatus*. It is common wherever the author has found the accompanying species, and from a general similarity the author has been led to believe that the two species are nearly related, or that *A. gelatinosus* is a variety of *A. coronatus*.

20. ALEYRODES GOYABÆ Goldi.

Aleyrodes goyabæ Goldi, Mittheil. Schweitz. entom. Gesellsch., VII (1886), p. 248.

On *Psidium guajava* and *Persea gratissima*, Rio de Janeiro.

21. ALEYRODES GRAMINICOLA Quaintance.

Aleyrodes graminicola Quaintance, Can. Ent., XXXI, p. 89.

On an undetermined grass, Lake City, Florida.

22. ALEYRODES HORRIDUS Hempel.

Aleyrodes horridus Hempel, Psyche, VIII, No. 280, p. 394.

On *Psidium* sp., São Paulo, Brazil.

23. ALEYRODES INCONSPICUUS (Quaintance).[a]

Plate XXXII, figs. 34–37a.

Although there are a number of differences between the above and the specimens from which these descriptions were taken, they agree in essentials sufficiently to justify placing them together. Only those stages not previously described and the variations from Quintance will be included here.

Larva.—(Stage 1.) Size, 0.26 by 0.13 mm.; elliptical; pale yellow. Dorsum convex, with a distinct marginal rim, in which are two parallel rows of minute, transparent dots, and which bear fifteen pairs of short, tubercled setæ on its lateral margins; of these the third cephalic pair is much the longest; besides these setæ there are the usual caudal and latero-caudal pairs both of long spines; a pair of delicate, minute hairs on the cephalic margin; a pair of long spines at the vasiform orifice and cephalad of these, a shorter pair. Abdominal sutures distinct, the posterior ones reflexed caudad. The last segment is narrowed and prolonged into a small lobe; marginal crenulations very shallow. Vasiform orifice cordate, almost as wide as long, the caudal end broadly rounded, cephalic margin straight; operculum subrectangular, about one-third as long as it is broad, distal margin truncate and densely setose; lingula spatulate, as long as the orifice, setose, and with a pair of long, sub-terminal setæ. Legs functional, tarsi with digitules as in the Coccidæ; antennæ long and slender, only the first segment defined.

Larva.—(Stage 2.) Size, 0.3 by 0.2 mm.; the marginal hairs and rim and the antennæ are not visible. The dorsum bears three pairs of long spines: A pair on the meso-thorax; a pair on the meta-thorax, and a pair at the vasiform orifice; the usual caudal hairs are present. Vasiform orifice small and subcircular, caudal end truncate; operculum

[a] Contributions toward a monograph of the American Aleurodidæ (U. S. Agri. Dept., Division of Entomology, Technical Ser. 8, p. 22).

end lingula not distinct. Reduced legs seen on the ventral surface; eyespots single, color bright red. In other respects essentially as in stage 1.

Larva.—(Stage 3.) Size, 0.9 by 0.75 mm.; narrowed caudad. Essentially as in pupa-case.

Pupa-case.—Size, 1.16 by 0.8 mm.; shape broadly elliptical, slightly narrowed cephalad, with caudal margin truncate, and emarginate to meet the furrow. There is neither lateral nor dorsal secretion, but when case is removed from the leaf, there is left a narrow, vertical, ventral fringe. Color from pale to deep yellow. Dorsum convex with many small pores scattered over it and covered by faint polygonal markings, the outer third is also covered with minute markings, or, it may be, transparent papillæ. Mesad of these on the abdomen are three parallel rows, each with five large, nearly circular transparent places, in each of which are a number of irregular spots, folds, or wrinkles, a row along the dorsi-medial line and a row each side of it;[a] after the specimens have been mounted for some time in Canada balsam, these have a tendency to disappear; these "spaces" are probably the "pores" of Quaintance. Marginal rim varies in width and distinctness, crenulations wide and shallow. Abdominal and thoraco-abdominal sutures well defined along the dorsi-meson. The usual caudal, latero-caudal, and cephalo-marginal hairs are present. There is also a pair of hairs at the vasiform orifice and a pair cephalad of these. Vasiform orifice characteristic of this species, conspicuous both in shape and color; elongate-subtriangular, the posterior end merged into the furrow which leads from it to the caudal end of case; operculum a broad, short semi-ellipse with caudal, free end somewhat pointed and densely setose along the margins; color, dusky brown; lingula somewhat darker, dorsum convex, lateral margins with five pairs of long setæ and a row of short hairs. Eyespots reniform, large and reddish. On the ventral surface are seen the reduced legs, but there is no trace of antennæ.

Adult female.—Unknown.

Adult male.—Length of body, 1.13 mm.; head and thorax, pale dusky-brown; abdomen, legs, and antennæ, paler. Eyes large, reniform, and black; by transmitted light, they are the same color but the outer rows of facets are colorless. Antennæ: Segment 1, cup-shaped, diameter and length equal; segment 2, subpyriform, densely setose; segments 3 to 6, inclusive, cylindrical; segment 7, subfusiform, with an apical hair; segment 3 is the length of segments 4, 5, 6, and plus one-half the length of segment 7; segments 4 and 5 are equal in length; segment 7 is slightly longer than segments 4 or 5. Segments 2, 3, and 7 have each a number of hairs set in conical bases; segments 3 to 7, inclusive, closely ringed with minute hairs.

[a] On the thorax and cephalic region there are found similar spaces, which vary in number and position.

Collected on *Arbutus menziesii* near Haywards, Contra Costa County, March 6, 1901, and later near Los Gatos, through the adjacent valleys, and on the slopes of the Santa Cruz and Sierra Morena mountains. Also collected on leaves of *Umbellularia californica*, *Heteromeles arbutifolia*, *Rhamnus californica*, *Rhamnus crocea*, *Clematis ligusticifolia*, *Quercus agrifolia*, and *Quercus densiflora* in the same localities. The species are found together with *A. coronatus*, *A. gelatinosus*, *A. stanfordi*, *A. iridescens*, *A. nigrans*, *A. tentaculatus*, and *A. glacialis*. Pupa cases are found upon both sides of the leaves, the earlier stages only upon the under sides; usually there is but one or two on a leaf. Eggs were often seen, but as there were other species of pupa-cases upon the same leaf, it was impossible to determine if they belonged to *A. inconspicua*. The same difficulty obtained with reference to the adults, and only one male was bred in the laboratory.

24. ALEYRODES MORI Quaintance.

Plate XXXII, fig. 39.

Aleyrodes mori Quaintance, Can. Ent., XXXI, pp. 1–4.

On *Morus* sp. at Tampa, and at Lake City, Florida, on *Tilia americana*, *Callicarpa americana*, *Liquidambar styraciflua*, *Ilex opaca*, and less frequently on *Persea borbonia*.

25. ALEYRODES MADRONI, new species.

Plate XXVIII, figs. 7–8.

Pupa-case.—Size about 0.9 by 0.7 mm.; broadly elliptical; lateral fringe nearly as wide as the case; dorsum covered with thinly scattered, minute, semitransparent granules of white wax; between the margin of the case and the central region, the granules form a narrow ellipse in which the wax is thicker; the same wax is also distributed in transverse lines along the abdominal sutures. Dorsum of case shining black, with a slight longitudinal keel, between which, and the marginal rim the case is covered with minute depressions arranged in somewhat irregular, radiating lines, giving a striate appearance to the case; the dorso-medial and the thoraco-abdominal sutures are distinct, the latter reaching to the margins. There is no marginal rim, but the lateral wax tubes are slightly bent downward, the incisions shallow and acute, the ends of the tubes reflexed and rounded; mesad of the margin there is a row of highly chitinized, large, conical papillæ whose tips point outward; at base of, and inclosed by each of the tubercles, is a transparent space, or it may be, an opening; mesad of the tubercles is a row of minute pores and on each side of the median line are two parallel rows; there is also a pair of pores latero-cephalad of the vasiform orifice in place of the usual hairs. On each side of the abdomen within the body, there is a large, oblong, orange-colored

mass which is probably a visceral gland. The vasiform orifice is elongate-ovate, cephalic margin straight and not as wide as the broadest part of the orifice, caudal end broad and acute-emarginate on the median line; the orifice is bounded by a dark rim, the inner margin of which is strongly chitinized and in folds; deeper within the cavity, it is semitransparent; operculum subsemielliptical, more than half the length of the orifice and not quite as wide, free and somewhat pointed; entire organ densely setose; lingula about four-fifths as long as the orifice, convex dorsally, cylindrical at base but becoming broadly spatulate at the distal end, on which are three pairs of lateral lobes and a terminal lobe. Eye-spots small and undivided.

Adults.—Unknown.

Cotypes.—No. 7090, U.S.N.M.

This species is neither plentiful nor omnivorous, being restricted to the *Arbutus menziesii* in the districts where the author has found it; on this host it inhabits the under sides of the leaves in common with *A. errans*, and because of the presence of the latter it has not been possible to verify the larval stages, as all found were apparently of *A. errans*. Collected during June, 1901, on the slopes of King's Mountain.

26. ALEYRODES NICOTIANÆ Maskell.

Aleyrodes nicotianæ Maskell, Trans. New Zealand Inst., 1895, p. 436; Entom. News, VII, p. 247.

On *Nicotiana tabacum*, Guanajuato, Mexico.

27. ALEYRODES PARVUS Hempel.

Aleyrodes parvus Hempel, Psyche, VIII, No. 280, p. 395.

On *Maytenus* sp., São Paulo, Brazil.

28. ALEYRODES STANFORDI, new species.

Plate XXX, figs. 22–25.

Eggs.—Size, 0.23 by 0.1 mm.; length of pedicel, 0.04 mm.; oval; color yellow, shell marked with irregular polygons; this character often seems to be wanting, but when the shell is examined by transmitted light it has always been present. Pedicel on convex curve at one side of center of base. The chorion is so firm that empty shells retain their shape.

Larva.—Size, 0.35 by 0.2 mm.; oval; the margin has a narrow, lateral fringe of white wax rods somewhat covered with flocculent wax; color shining black, sometimes iridescent by transmitted light, yellowish brown. The dorsum is free from secretion, convex, and sculptured; it has a distinct, thickened, deflexed marginal rim, which is sharply demarked from the dorsum by a ridge; this rim is formed of closely set, adjacent, cylindrical tubes, the ends of which form deep

crenulations, and from which issues the lateral fringe; near the mesal border of this rim there is found a row of seven or more pairs of short hairs set in conspicuous, tubercled bases; these extend about two-thirds the distance from the cephalic margin toward the caudal end of case. On the dorsum there are five pairs of conspicuous spines: A pair on the cephalic region, a pair on the meso- and a pair on the meta-thorax, a pair cephalo-laterad of the vasiform orifice, and a pair caudad of it; besides these are the usual caudal and latero-caudal pairs of hairs. All sutures distinct, the abdominal ones reaching nearly to the marginal rim and strongly reflexed caudad. Vasiform orifice subcordate, broad, and cephalad; operculum relatively the same shape, nearly filling the orifice and obscuring the lingula, which is spatulate and setose distally. Cephalad of the vasiform orifice are four crescent-shaped thickenings in the tergum. The dorsal keel, which is so prominent in the pupa-case, is not well developed at this stage, but the arrow-shaped outline on the cephalic region is distinct; laterad of it are two pores or light spaces. Eye-spots divided, the smaller part anterior. Legs and antennæ functional.

Larva.—Size 0.5 by 0.4 mm.; broadly elliptical; the marginal rim conspicuous, width 0.07 mm.; the tubercled hairs seen on the rim of the younger larva have disappeared and their places are occupied by pores; at the caudal end of the rim, there are also two pores and around the rim is a row of minute ones set close together. The legs and antennæ are much reduced in size.

Pupa.—Size from 1.14 by 0.83 mm. to 1.6 by 1.3 mm.; broadly elliptical. The case is similar to the larval stages with the following exceptions: The dorsum has a characteristic keel extending from near the cephalic margin to the tubercled vasiform orifice, at the anterior end it is arrow-shaped and from there to the thoraco abdominal suture, sharply ridged, on the abdomen it is conspicuously rounded and broader, and the segments are markedly distinct. On the thorax there are deep, curved depressions which extend caudad to the third abdominal segment; these furrows correspond in position to the leg markings in more transparent and thinner pupa-cases. The dorso-submarginal pair of spines are not present, but on the ventral surface, just cephalad of the mouthparts, there are two transverse rows of four hairs each; laterad of the dorsi-meson on each side there is usually two parallel rows of minute hairs; these are frequently wanting, and in their stead are large pits or pores. The wax tubes of the marginal rim extend about two-thirds its width, the crenulations are distinct, rounded, about as broad as long and with the reentrant angles blunt. Around the margin of case, there is a lateral fringe of white wax rods more or less overlaid with flocculent wax, which varies in length from a narrow, flat band to a mass as high and as wide as the case; when wide it is usually ragged distally. On the ventral side, the somewhat reduced legs are distinctly seen, but the antennæ are not visible.

Adults.—Unknown.

In this species, the pupa-case can easily be distinguished by the unaided eye as a black object surrounded by a white ring. The immature forms are found on the under sides of the leaves of *Quercus agrifolia* and *Quercus densiflora;* as a rule, they are confined to a single tree in each neighborhood where the author has collected them and are not plentiful. The eggs are laid very closely together in irregular patches, each of which contains a greater number than is usual among other species. Apparently fresh eggs and very small larvæ were collected in the Arboretum, Leland Stanford Junior University, on January 23, 1901, but no adults were seen; eggs were again found, together with small larvæ, during the last week in May and in June. The writer has kept the pupa-cases in the laboratory for various times since the date of first collection, but has never succeeded in securing the adults, and it has been impossible to obtain verified adults in the field, as the oaks have so many species of Aleyrodes upon them.

Cotypes.—No. 7091, U.S.N.M.

Collected by Mr. G. H. Coleman near the head of Big River, Mendocino County, June 6, 1901, and by the author in the Santa Clara Valley and on the slopes of Black and King's mountains at various times during 1901 and 1902.

29. ALEYRODES INTERROGATIONIS, new species.

Plate XXVIII, figs. 10–12.

Egg.—0.15 by 0.07 mm.; oval; yellow; unmarked. Pedicel at one side of center of base.

Larva.—(Stage 1.) Elliptical; brownish yellow; margin with lateral hairs; dorsum convex.

Larva.—(Stage 2.) Color yellow; dorsum convex; marginal crenulations irregular, shallow, and rounded; abdominal segments distinct; vasiform orifice as in pupa-case, but the operculum is nearly circular. On the dorsum, the submarginal hairs, the bases of the caudo-lateral, and the cephalic pairs of spines are present.

Larva.—Size, 0.57 by 0.35 mm.; essentially as in pupa-case.

Pupa-case.—Size, 0.7 by 0.4 mm.; elliptical; the outer part of the case pale amber; over the body of the developing pupa the color is a deeper yellow, sometimes brownish. There is no lateral fringe, in the usual sense of the term, but around the case is a wide, sloping ring of white or yellowish, translucent, gelatinous substance upon which the case rests. In the mass, the substance seems structureless, but when it is mounted in Canada balsam and examined under the microscope while it is dissolving, the rod-like structure is plainly seen. In a few specimens there seemed to be a true fringe overlying the gelatinous wax; this was transparent and apparently of separate,

glassy rods, but every effort to detach it was unsuccessful; from this it was assumed that if it were a true lateral fringe, it had adhered to the underlying ring, or, if it were a constituent part of the mass, then the gelatinous rim was a lateral and not a ventral secretion.

The dorsal secretion is of white, flocculent wax, in tufts or pencils attached to and enwrapping stout spines. Upon the cephalic region, near the mouth parts, there are found two small tufts or knobs; on the meso-thorax are two similar tufts, both sets near the dorso-median line; at the vasiform orifice are two pairs of short pencils; between the more caudal pair is a long pencil, which is prolonged for some distance caudad of the base and rests upon the gelatinous wax. This pencil has no underlying spine nor any visible pore from which it might issue; there are a number of pointed folds lying close together around the place of issuance, but these are probably a part of the ventral furrow. There is considerable variation from the usual arrangement given above, any or all of the pairs of tufts may be more or less pencil-like, this seeming to depend upon the length of the spine to which any tuft is attached; at the vasiform orifice the two pairs of pencils are sometimes curved and rim-like in their arrangement.

The dorsum is covered with large polygonal markings and has a large number of small pores more or less regularly arranged; of the latter there is a row of closely set ones near the margin of case, three subparallel rows each side of dorsi-meson on the abdomen, and a number placed irregularly on the thorax and cephalic region. The abdomen has a well-rounded keel along which the sutures are distinct; the dorsi-medial and thoraco-abdominal sutures are conspicuous, the latter very sinuate and extending to the lateral margins. Margin all around crenulated with a double rim, the ends of the tubes of the dorsal rim sharply deflexed downward, and the crenulations irregular; in places they are rounded, with the incisions between the tubes about the width of the crenulations; in other places they are crowded and almost form serrations. From these incisions thickenings extend mesad some distance, producing an irregularly-marked margin. Vasiform orifice subcircular, bounded on the cephalic and lateral margins by a straight perpendicular rim, which becomes very sloping at caudal margin; here its inner margin is chitinized or thickened for some distance within the cavity and at the bottom of the orifice it is thickly covered with transparent dots; operculum short, seldom more than one-half as long as orifice, broadly ovate, with cephalic margin not coincident with margin of orifice; lingula reduced, only the incised basal portion present. Legs rather long and stout, nonsegmented, but with folds indicating future joints. Antennæ not evident. Eye-spots very large; by transmitted light, brown, with reddish margin.

Adult male.—Length of body, 0.97 mm.; hind tarsus, 0.15 mm.; hind tibia, 0.25 mm.; proximal tarsus, 0.15 mm.; hind tibia, 0.17 mm.;

wings too crumpled to measure accurately. Color of body, dusky white, frons slightly darker; legs and antennæ white; mentum white with brown tip; wings immaculate; the almost entire lack of color is unusual. Eyes, large, reniform in shape, apparently black, but by transmitted light, reddish on the edges. Antennæ with segments four to seven inclusive, shorter than usual; segment seven, sub-fusiform, with a hair at tip and a conspicuous spine at about mid-length.

Cotypes.—No. 7092, U.S.N.M.

Collected by the author on the leaves of *Ceanothus californicus* at Pacific Congress Springs, Santa Clara County, April 16, 1901, and during June, 1901, on King's and Black mountains. The specimens are not plentiful and there is seldom more than one on a leaf. It is sometimes found together with *A. glacialis*. Many pupa-cases have been isolated, but only two adult males have been secured.

30. ALEYRODES PHALÆNOIDES Blanchard.

Aleyrodes phalænoides Blanchard, Ins. Voy. du Chile, de Gay., 1840, p. 319; Ann. de la Soc. Ent. de France, Dec., 1867, p. 399.

31. ALEYRODES MERLINI, new species.

Plate XXIX, figs. 17–19.

Egg.—Size, 0.22 by 0.1 mm.; pale yellow; unmarked; pedicel at one side of base.

Larva.—(Stage 1.) Size, 0.33 by 0.183; elliptical; pale yellow; dorsum convex, void of pores, papillæ and secretion, but with a narrow marginal band of white wax. Margin with fifteen pairs of equally spaced hairs, which are extremely long. Eye-spots single, large and light red. Specimens so filled with fungus that further detail was impossible.

Larva.—Size, 0.63 by 0.43 mm.; elliptical; the dorsal secretion is usually separated into several irregular plates at the caudal margin, while it is continuous around the remainder of the margin. In some specimens the dorsal wax is disposed in a somewhat confused pattern in which two parallel rows near the lateral margin and a central, transverse row can be made out. Color, pale semi-transparent yellow; dorsum convex, and covered with pores of several sizes; those nearest the margin are largest and are arranged in rather definite lines; each of the abdominal segments has a transverse row; the smaller pores are scattered irregularly. There is no marginal rim nor crenulations, and the wax tubes are not evident; abdomen with distinct segments and two crescent-shaped thickenings in tegument of dorsum cephalad of the vasiform orifice; laterad of the anterior margin of the vasiform orifice is a pair of small hairs; the usual latero-caudal and caudal hairs are present, the latter short. Vasiform orifice broadly ovate, anterior margin as broad as orifice is long; operculum a little more than one-

half length of orifice and wider than long, with a pair of short spines on the latero-cephalic angles; lingula as long as the orifice, spatulate, the distal part with three pairs of lateral lobes and a terminal lobe; the entire organ densely setose and with two pairs of long hairs—a pair from the angles between the distal-lateral and the terminal lobes projecting caudad beyond the orifice, and a pair on the lateral margin. On the ventral surface the reduced legs are distinct, but only faint outlines of the antennæ can be made out.

Pupa-case.—Average size, 1 by 0.6 mm.; elliptical, narrowed cephalad, caudal end truncate; dorsal secretion usually a confused mass of white wax; under a lens it is seen to be made up of numerous long, delicate, asbestos-like wax filaments, which are from two to four times the width of case and matted together, forming the very characteristic covering of this species. This secretion can be easily brushed off and quickly dissolves in alcohol. When the case is removed from the leaf there is left a short, vertical fringe. Color of case a dull amber-yellow to dark brown. The latter color is probably due to parasitization; dorsum convex and covered with papillæ and pores of various sizes; near the margin they are more numerous and closer together. On the central region they are not so evident, but each segment has a transverse row; scattered among the papillæ are many small pores. On the abdomen, each side of the dorsi-meson, there is a longitudinal row of large, semitransparent spaces. The thoracic and abdominal segments are distinct, the posterior abdominal sutures strongly reflexed caudad, the thoraco-abdominal suture sinuate and extending to margin of case; the longitudinal cephalo-thoracic suture is also evident; cephalad of the vasiform orifice are two strongly chitinized thickenings in tergum which are darker and broader than usual, and within the abdomen are seen two large, orange-yellow visceral glands. There is a pair of short, delicate hairs on the cephalic margin of case, a pair of somewhat stouter ones laterad of the anterior margin of the vasiform orifice, and the usual caudal and latero-caudal setæ, the former reduced to minute hairs. Vasiform orifice subcordate, anterior margin straight. On the inner lateral and caudal margins there are corrugations or folds, which extend downward and inward; operculum not as broad as the orifice and more than half its length, rounded on the anterior-lateral angles. Near the lateral margins of the free, distal end is a long, stout spine, which projects beyond the margin of the orifice; lingula spatulate, as long as orifice, distal part enlarged and with three lateral and two terminal lobes, apex bearing a pair of long hairs. Eye-spots large, constricted, and dark red; legs reduced, unsegmented; antennæ short, stout, unsegmented and tapering to a slender point.

Adult female.—Bred from segregated pupa cases. Length of body, 1.6 mm.; wings, too crumpled to measure; hind tarsus, 0.23 mm. Color of abdomen, pale yellow; head and thorax darker, frons brown-

ish; legs and antennæ white. Within the abdomen are two large, yellow glands. Eyes large, slightly constricted; color, black, reddish at the edges. Attennæ, as in *A. prunosus*. Genitalia, ordinary.

The larvæ vary much in the amount and arrangement of the dorsal secretion; some are entirely covered with the matted wax, others have but a scant, fragmentary secretion, while still others are surrounded by a mass which rises almost perpendicularly above the dorsum, and then bends downward and outward, forming a continuous ring at margin of case, but distally separated into irregular plates.

Cotypes.—No. 7093, U.S.N.M.

Collected by the writer on King's Mountain, on *Arbutus menziesii* only, during May, June, and July, 1901.

32. ALEYRODES PYROLÆ Gillette and Baker.

Aleyrodes pyrolæ Gillette and Baker, Prelim. Rep. Hemip. Colo., p. 125. (Colo. Agri. Exp. Sta., Bul. 31, Tech. Ser.).

On *Pyrola rotundifolia*, Fourmile Hill, 8 miles south of Steamboat Springs, Colorado.

33. ALEYRODES AMNICOLA, new species.

Plate XXVII, figs. 4–4a.

Egg.—Size, 0.21 by 0.1 mm.; oval; yellow; unmarked; pedicel at center of base.

Larva (fig. 4).—Size, 0.3 by 0.1 mm.; elliptical; color glistening white to pale yellow; there is a lateral fringe which varies greatly, many specimens have none, while others have a long fringe continuous at base and separated distally into irregular plates; some have granules of wax upon the dorsum, but as the leaf is also coated with similar wax it may be extraneous matter. Dorsum convex, lateral margins with thirteen rather long, delicate hairs set in tubercled bases; the third cephalic pair are much longer than the others; the caudal and latero-caudal hairs are present, longer and stouter than the lateral ones and inserted in conspicuous, conical bases. Abdominal segments distinct to margin and reflexed caudad. Vasiform orifice as in pupa case, the lingula sometimes longer than orifice.

Larva (fig. 4a).—Size, 0.73 by 0.5 mm.; broadly elliptical; there is no lateral secretion, but the dorsum bears an irregular, interrupted series of long, tapering, glassy rods; dorsum very convex and with minute depressions forming somewhat irregular striations to the central region; abdominal sutures distinct along dorsi-meson; crenulations of margin regular, rounded, and shallow, the reentrant angles acute; caudal and lateral hairs as in smaller larva.

Pupa-case.—Size, 1.3 by 0.9 mm. to 1.4 by 1.03 mm.; broadly elliptical, cephalic margin truncate, the caudal margin slightly emarginate at furrow; neither lateral nor dorsal secretion, but when the case is

removed from leaf there is left a narrow, white, vertical fringe; the outer part of case is transparent white, central region brown, laterally shading to yellow; this contrast in coloration renders the case very conspicuous; on the cephalic region the color is projected cephalad in two prong-shaped markings; near the anterior end of the dark space there is a pair of small pores, one each side of the dorsi-meson; on each segment of the case there are a number of small pores, usually arranged in a group at each end, with a transverse row between the groups; all of these pores lie within the space covered by the dark color; there are also many small pores outside this color limit, but the case is so transparent that they are nearly invisible. The dorsum is convex and has no marginal rim, crenulations of the margin itself are irregular, broadly rounded, and shallow, reentrant angles acute; abdomen keeled on dorsi-meson, the segments distinct along the keel; the thoraco-abdominal suture and the dorso-medial suture, which meets it at right angles, are also evident; cephalad of the vasiform orifice are two conspicuously chitinized, crescent-shaped thickenings in the tergum. Vasiform orifice subovate, caudal end broadly rounded, bounded by a slightly raised rim, deeper yellow than surrounding dorsum, the inner lateral and caudal margins of the orifice much corrugated or folded; operculum not one-half the length of orifice, and in width not quite filling the open space, distal, free end truncate; dorsum setose; lingula well developed, nearly or quite as long as the orifice, spatulate, distal portion convex, enlarged, rather bulbous, apex with a pair of long and caudally projecting hairs at its lateral angles, the portion which projects beyond the operculum setose. Latero-cephalad of orifice is a pair of short, delicate setæ.

Adults.—As in *A. prunosus*.

Cotypes.—No. 7094, U.S.N.M.

This species is found only on the willow and is peculiar to it; a great number of specimens were collected on November 4, 1901, from *Salix lævigata* at Stevens Creek, Santa Clara Valley; the immature stages were on the under sides of the leaves, which were frequently encrusted with them. Adults were issuing from the pupa-cases, and many had settled upon the under sides of leaves of *Washingtonia nuda*, which was growing under the host plants. The coloration of the pupa-cases is rather characteristic of parasitized cases in general; but as adults were seen issuing in numbers from the cases which were darkest, the coloration must be normal.

34. ALEYRODES ROLFSII Quaintance.

Aleyrodes rolfsii Quaintance, Can. Ent., XXXI, p. 90.

From Upola, Florida, on cultivated geranium.

35. ALEYRODES RUBORUM Cockerell.

Aleyrodes ruborum Cockerell, Jn. N. Y. Ent. Soc., V., No. 11, p. 96; Ann. Rept. Fla. Agr. Expt. Sta., 1898, p. 66.

On cultivated *Rubus cuneifolius* at Lake City and San Mateo, Florida.

36. ALEYRODES PERILEUCUS (Cockerell).

Aleyrodes perileuca Cockerell, Proc. Acad. of Nat. Sci. Phila., May, 1902, p. 283, and in an as yet unpublished bulletin written for the Florida Exper. Station, by T. D. A. Cockerell, who kindly furnished the author the description.

Pupa-case.—Oval in shape; extremely dense in texture; color perfectly black. Lateral margins with a fringe of very narrow; regular, white waxen ribbons regularly and strongly beaded. Dorsum free from secretion; it has a sharp, submarginal keel and a distinct longitudinal keel, which is sharp on the thorax and broad and rounded on the abdomen, where it is crossed by six narrow, transverse longitudinally corrugated bands. Abdomen with transverse ridges marking the segments. Vasiform orifice shovel shaped; marginal area with very numerous radiating furrows, the areas between them minutely punctured. Margin of case very regularly crenulate. The conical, black, larval skin was found in one example on the back of the pupa, but ordinarily it is lost.

Adults.—Unknown.

It occurs at La Jolla, California (Cockerell), and Cuero, Texas (Townsend), on leaves of *Quercus*, solitary on the upper side.

37. ALEYRODES STELLATUS (Maskell).

Aleyrodes stellata Maskell, Trans. New Zealand Inst., 1895, p. 442.

On *Lignum-vitæ*, in company with *A. floccosa*, Jamaica.

38. ALEYRODES DIASEMUS, new species.

Larva.—Size, 0.3 by 0.2 mm.; elliptical; no dorsal secretion, lateral fringe approximately one-sixth the width of larva. It is made up of opaque wax rods coalesced at base, but distally divided into irregular plates, sometimes ragged at the ends. Color, transparent white, slightly yellow around the mouth parts and in the central abdominal region. Dorsum convex and with a longi-medial carina; lateral margins with 14 pairs of equally spaced hairs, with the exception of the difference between the ninth and tenth pairs, which is much greater. Each hair is set in a conical base, and from each there is a distinct oblique fold extending mesad; the usual caudal and latero-caudal hairs are present. Immediately caudad of the eye-spots there are a pair of large circular pores, which may be the anterior pair of spiracles; the case is so thin and transparent that it could not be determined whether

the pores were dorsal or ventral; abdominal segments distinct; crenulations of the margins minute; vasiform orifice as in pupa case; the antennæ are not visible; the legs are distinct, though reduced; this is not the usual condition of these organs at this stage or size; eye-spots single and red.

Pupa-case.—Size, 1.4 by 0.84 mm.; elliptical, case flat; there is considerable variation in the amount and kind of secretion; specimens may have both lateral and dorsal wax, or either alone, or none; when present the lateral fringe is of coalesced crystalline wax rods either free from or covered by flocculent wax; the dorsal secretion is in the form of a submarginal series of separate crystalline wax rods, rather long and curved downward; when the case is lifted there remains a short vertical fringe of coalesced, opaque white wax rods. Color, glistening yellow. Dorsum convex and bearing 12 pairs of extremely long, stout spines—a pair of caudo-submarginal, a pair of latero-caudo-submarginal, a pair mesad of the latter, a pair caudad of vasiform orifice, a pair laterad of these, and a pair laterad of the anterior margin; a pair of abdomino-submarginal, a pair of extremely long ones on first abdominal segment near median line; two pairs on thorax close to median line; a pair of cephalo-submarginal. On the cephalic region near the dorsi-meson and caudad of the first pair of spines is a pair of small pores; mesad of the first pair of thoracic spines is another pair; on the abdomen there are two parallel rows on each side of the dorsi-meson. Abdomen with a slight longi-medial keel, along which the sutures are distinct, the posterior ones reflexed caudad. Vasiform orifice a brighter yellow than the surrounding dorsum, broadly ovate, as wide as long, apex broadly rounded; operculum, subrectangular, about one-half length of orifice, distal margin truncate; lingula nearly as long as the orifice, spatulate, often dorsally recurved; setose for about four-fifths of its length, with two terminal lobes and a pair of long latero-apical hairs which project caudad beyond the orifice. Marginal crenulations vary from shallow to deep, but they are always broad, round, and with acute reentrant angles. On the ventral surface the reduced legs are seen, apparently with all the parts except the tarsi present; antennæ nonsegmented, base broad, apex abruptly narrowed into a slender, finger-like process; eye-spots large and red.

Adults.—Unknown.

Cotypes.—No. 7096, U.S.N.M.

Collected on campus, Leland Stanford Junior University, along San Francisquito Creek, September 18, 1901, and at various other dates, from the under sides of the leaves of *Symphoricarpos racemosus*. Also collected on leaves of *Ribes glutinosum*, near Menlo Park, September, 1901, and on the same host in Alameda, June, 1901, and on Kings Mountain, August, 1901.

39. ALEYRODES VAPORARIORUM Westwood.

Aleyrodes 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. 2, p. 203.

40. ALEYRODES GLACIALIS, new species.

Plate XXXI, figs. 31–33.

Larvæ.—The dorsum lacks the curved mesal wax filaments which are found on the pupa case; in other external respects as in the pupa case.

Pupa-case.—Size, 0.85 mm. by 0.6 mm.; elliptical; color, with inclosed pupa, yellow; when the case is empty, semitransparent white; occasionally the color may vary from yellowish-brown to a more or less mottled brown, or, in extreme cases, to an almost uniform brownish-black; this color variation is due to parasitization or to the presence of fungus. There is no lateral fringe, but just inside the dorso-lateral margin there is a continuous submarginal fringe, made up of an irregular series of tapering crystalline rods of about equal length and more than one-half the width of case. These issue from large conical papillæ, which are arranged around the case in a row of from one to three deep, except caudad and latero-caudad of the vasiform orifice, where there are an irregular number. Mesad of the submarginal fringe there are a variable number of shorter tapering rods of wax, which are curved or even coiled upon themselves; these are arranged with reference to the segments and issue from large circular pores, which constitute the most conspicuous dorsal character of this species and which may vary from one on each side of the segment to groups of from three to five. Besides these pores there are others, so scattered that no definite place can be assigned them, and also many small pores scattered among the papillæ and over the dorsum. Dorsum convex, finely punctate, and with a pair of long tapering caudo-marginal spines set in conspicuous conical bases, and a pair of very long spines laterad of the anterior margin of the vasiform orifice; the usual caudal pair are wanting; the latero-caudal pair are short and the cephalo-marginal pair are minute. Crenulations of margin of case broad and very shallow; where the caudal furrow meets the margin the crenulations are distinctly different, being deeper and more pointed in outline and closer together (Plate XXXI, fig. 33). Abdominal sutures faintly defined, the posterior ones strongly reflexed caudad; in the abdomen two large yellow visceral glands show through the body wall. Vasiform orifice broadly ovate, almost as broad as long; cephalic edge straight, caudal end with a fine acute emargination with a small finger-like process. Operculum subsemielliptical, much broader than long, and less than one-half the length of orifice. Lingula nearly the length of orifice, subspatualate, densely setose with minute hairs, and bearing three pairs of lateral lobes and a terminal lobe. Cephalad

of vasiform orifice are two crescent-shaped thickenings of tergum, and between it and the caudal margin of case there is a shallow furrow. On the ventral surface the unsegmented reduced legs are seen; the antennæ are short, stout, unsegmented, and with a spine at apex; eye-spots large, dark red.

There is considerable variation in amount of dorsal secretion and in the number of pores and papillæ.

Adult female.—Length, about 1.83 mm.; fore wing, 1.27 mm. by 0.5 mm.; hind wing, 1.03 by 0.43 mm.; hind tarsus, 0.25 mm.; proximal segment, 0.15 mm.; tibia, 0.45 mm.; main vein, seven-eighths length of wing; flexure, about midway between base and apex of wing; beyond the flexure the vein fades out. Color, abdomen, pale yellow, head and thorax darker yellow to pale dusky; legs, antennæ almost white; wings immaculate, folded so that basal veinlet is not seen; fore wing with a conspicuous anal fold. Eyes dark reddish brown; in live specimens each is separated into two parts by a wedge-shaped band of white wax granules; in the mounted specimen the wax is dissolved away and the eyes are apparently only constricted. Antennæ and mentum usual. Vasiform orifice obscured. Genitalia sharply conical, brownish in color, otherwise ordinary. Insect bred from pupa case on *Ceanothus californicus*.

Male.—(Bred from pupa case on *Rubus vitifolius*.) Length, 1.1 mm.; fore wing, 1.1 mm. by 0.44 mm.; hind wing, 0.9 mm. by 0.37 mm.; hind tarsus, 0.25 mm.; middle tarsus, 0.21 mm.; proximal tarsus, 0.23 mm.; hind tibia, 0.43 mm.; middle tibia, 0.3 mm.; proximal tibia, 0.03 mm.; proximal segment, 0.16 mm.[a] Color as in female. Mentum dusky, nearly black. Genitalia, usual. In other respects essentially as in female.

The pupa cases were first collected in March, larvæ on April 16. Adults were seen flying at this time, but the first to emerge from the segregated cases came out on May 29.

Cotypes.—No. 7095, U.S.N.M.

This species is found on the under sides of the leaves and has been collected in the following localities: On *Ceanothus californicus*, from the Santa Cruz and Santa Moreno ranges; on Yerba Santa, from King's Mountain; on *Rubus vitifolius*, from the Santa Clara Valley and Alameda; on *Rhamnus californica*, from the Santa Cruz and Santa Moreno ranges and Santa Clara Valley; on *Clematis ligusticifolia*, *Opulaster capitatus*, and *Symphoricarpos racemosus*, from the Santa Clara Valley, and from *Quercus densiflora*, from Kings Mountain. There are seldom more than two or three specimens on a leaf; they are usually found together with *A. coronatus* and *A. gelatinosus*.

[a] There is considerable variation in the number of large dorsal pores and papillæ.

41. ALEYRODES VINSONOIDES Cockerell.

Aleyrodes vinsonoides COCKERELL, Psyche, VIII, No. 266.

Frontera, Tabasco, Mexico. On undetermined tree.

42. ALEYRODES QUAINTANCEI, new species.

Plate XXXVII, figs. 70–73.

Eggs.—Type; unmarked, pedicel at one side of base.

Larva.—(Stage 1.) Size, 0.33 by 0.2 mm.; elliptical; wax secretion wanting; color, white; the abdominal segments distinct to margin; neither marginal rim nor lateral wax tubes evident, but short lateral hairs set in conical bases extend around the entire margin; the usual caudal and latero-caudal hairs are very long, the former set in conspicuously large conical bases. Vasiform orifices broadly ovate, truncate at caudal end, lateral margins straight; operculum less than one-half length of orifice, rectanguiar, squarely notched at the latero-cephalic angles and with a minute spine mesad of the notch; lingula about two-thirds length of orifice, spatulate covered with transparent dots, which are probably minute hairs; apex setose, the hairs much longer than usual. Within the body two large dark-yellow visceral glands are conspicuous. Eye-spots large, dark red.

Larva.—(Stage 2, studied from molt.) Size, 0.35 by 0.26 mm.; shape broadly elliptical; wax secretion wanting. Color, a semitransparent whitish yellow. There is no marginal rim and the lateral wax tubes are evident; crenulations large, rather pointed, reentrant angle acute; abdominal sutures barely visible. No lateral hairs, but the dorsum bears three pairs of long and tapering spines—a pair on the cephalic region, a pair on thorax, and a pair latero-cephaled of the vasiform orifice; the latter are shorter and more delicate than the others; the usual caudal and latero-caudal hairs are present. Vasiform orifice as in pupa case. No traces of legs, antennæ, or eye-spots.

Larva.—Stage 3 (studied from moults). Size, 0.44 by 0.2 mm., broadly elliptical, truncate at the caudal end; color, brown; by transmitted light, a pale smoky shade; there are transverse bands of darker color on each of the abdominal segments, which are also covered with transparent dashes. Body segments distinct. The marginal rim is wanting, but the lateral wax tubes are slightly bent downward. Crenulations of margin, vasiform orifice, and lateral fringe as in pupa-case. Dorsal spines as in younger stage, but much reduced.

Early pupa-case.—Size, about 0.56 by 0.15 mm., measured within marginal rim; shape subovoid, prolonged caudad, extreme caudal end lobe-like; on each side of this part of case there is a short blunt spine. Color black, case highly chitinized, crenulations of rim as in pupa-case.

Pupa-case.—Size, about 0.83 mm. by 0.6 mm.; measured within the marginal rim, the dorsum is 0.7 mm. by 0.46 mm.; the outside measurement are variable and not exact, as the angle at which the rim bends varies continually; shape of dorsum oval, prolonged caudad until it is lobe-like at end, dorsal and ventral secretion wanting; lateral fringe, flat upon the leaf, made up of transparent wax rods, coalesced nearly to the distal ends and about the width of case. Dorsum with a sharp keel extending its entire length; within the ridge formed by marginal rim there is a sunken line extending around case; abdominal segments conspicuously set off to this sunken space; cephalo-thoracic region deeply sculptured. Color, shining black by transmitted light, with golden brown colorations; of these there is a continuous line around dorsal ridge of marginal rim; three pairs of transverse portions of case on the thoraco-cephalic region, occupying almost the entire space; latero-cephalad of the most cephalic of these and adjacent to marginal rim is a large pair of conspicuous wedge-shaped places; near cephalic end of case, on each side of the dorso-median suture, there are two small circular places; caudad of these and nearer the suture there is a pair of short oblique lines on each side, caudad of these is a pair of small circular places, caudad of these is a broken oblique line on each side of the suture; on the abdomen, caudad of each suture, is a narrow space; cephalad of the vasiform orifice is a large crescent-shaped place the central portion of which is continued to the vasiform orifice, and the vasiform orifice is of the same color. This coloration is probably due to unequal chitinization of the case. Body segmentation distinct; median and thoraco-abdominal sutures conspicuous, the latter very sinuate and extending to the marginal ridge. The dorsal disk is slightly larger than the ventral, and they are connected by the marginal wax tubes, which are bent downward and inward, thus making an oblique rim. Crenulations of margin deep and round, as wide as long; mesad of the end of each wax tube is a large pore. The usual caudal hairs are long and delicate, the latero-caudal pair shorter. Vasiform orifice small, tubercled, subcircular; operculum relatively the same shape, filling the orifice; lingula minute, strap-shaped, obscured by the operculum. There are a pair of pores latero-cephalad of orifice, which are probably the follicles of the hairs usually present at this place. Eye-spots black, situated mesad of the wedge-shaped transparent spot on cephalo-dorsum.

Adults.—Unknown.

Cotypes.—No. 7097, U.S.N.M.

Collected at Stevens Creek, October, 1901; found upon the under sides of the leaves of *Rhamnus crocea* together with *Aleyrodes iridescens.*

43. ALEYRODES NIGRANS, new species.

Plate XXVII, fig. 3.

Egg.—Size, 0.23 by 0.11 mm.; dark yellow to a dusky-brown in color, empty shells uniformly brown; the chorion is firm, and the egg, in consequence, keeps its shape and position when empty. Egg elliptical in shape, more curved than usual, apex rather pointed; shell unmarked; pedicel short and at one side of base on the convex curve. Eggs always found in an upright position on the under side of the leaf.

Larva.—When first hatched about 0.3 mm. by 0.08 mm.; elongate, elliptical, with dorsum very convex, and having a narrow band of semitransparent wax closely appressed to the margins. Under the lens it is semitransparent and pale yellow in color. Dorsum void of pores, setæ, or exudation; marginal rim distinct, thickened, narrow, noncrenulated, and with two parallel rows of minute transparent spots which extend around it. Lateral margins with seven pairs of short, delicate hairs set in tubercled bases; these extend from the latero-cephalic margin about two-thirds the distance toward the caudal end; the usual caudal and latero-caudal hairs are present, very minute. No trace of segmentation except along dorsi-meson of abdomen. Vasiform orifice subcircular, bounded by a conspicuous raised rim; operculum the same shape, filling the orifice; lingula not seen. Antennæ and legs functional; eye-spots red, divided, circular and subequal in size.

Just after the first moult the larva is about 0.4 mm. by 0.27 mm.; broadly elliptical in shape. The insect is flatter and has a narrow lateral fringe of glassy rods, which are continuous at base, but are divided distally into irregular plates; all lateral hairs have disappeared, and there are faint, irregular crenulations around the margin; abdominal segments distinct along the dorsi-meson; the caudal hairs are much longer than in the first stage, and the beginning of the mediocaudal lobe, which is characteristic of the pupal stage, is evident; dorsum with 4 pairs of long, tapering spines. A pair on the cephalic region, a pair on the meso-thorax, a pair on the meta-thorax, and a pair on the abdomen, laterad of the cephalic margin of the vasiform orifice. Lingula short, strap-shaped, and densely setose. Eye-spots single, bright red in color. No trace of legs or antennæ. In other respects essentially as in the first stage.

In the third stage the larva is the same as in the preceding, with the exception that it is darker yellow in color and has a dorso-median keel.

Pupa-case.—Size, about 0.9 mm. by 0.6 mm.; shape, oval, prolonged caudad into a conspicuous pointed lobe, on the lateral margins of which are the caudal hairs. The dorsal disk is much larger than the ventral, and the marginal wax tubes are bent downward and

inward to the ventral surface of case, thus connecting the two disks by an oblique rim on which the flutings of the wax tubes are very distinct; they also extend for a short distance on the dorsal disk, and then fade out. Dorsum void of exudation of any kind and without setæ. There is also no lateral fringe, but an occasional specimen has a little fragmentary wax around the ventral border of the case upon the leaf. Case dull black in color, and so thick that it is cleared only after prolonged boiling in caustic potash, or immersion in labarraque. Abdominal segmentation distinct along the median portion of case; second thoracic segment distinct near the dorsi-meson; third thoracic segment distinct, extending nearly to the marginal rim; thoraco-abdominal suture sinuate; a rounded keel reaches from the vasiform orifice to the thorax, and from this point, extending nearly to the cephalic margin, there is a sharp ridge; in partially cleared specimens the usual dorso-medial suture shows instead of the cephalic portion of the keel. Crenulations of the marginal rim irregular and notched; the openings are mesad of the ends of the tubes, and form a regular row of minute round pores. When a portion of the reflexed marginal rim is partially cleared in caustic potash and examined by transmitted light, there are seen irregular transverse rows of groups of minute black spots along the wax tubes. Vasiform orifice tubercled, subcircular; operculum relatively the same shape and filling the orifice; lingula not seen; when examining the cases the operculum was often seen to be raised while a drop of "honey dew" was being emitted, after which it was again lowered into the orifice.

Adult female.—Length, 1.3 mm.; forewing, 1.3 by 0.53 mm.; hind wing, 1.08 by 0.4 mm.; color uniformly a deep golden yellow, legs and antennæ paler; mentum yellow, the tip dusky. Wings somewhat dusky at distal end; this is caused by a structural thickening; the costal margins are a conspicuous golden yellow; main veins distinct to apex; flexure of forewing not acute; basal vein long—it arises from the very base of the wing, apparently distinct from the main vein, and extends obliquely caudad to anal margin. Eyes dark red, constricted to dumb-bell shape. Antennæ usual. Genitalia acute conical, ordinary.

Male.—Length, 0.83 mm.; forewing, 1 mm. by 0.4 mm. Genitalia ordinary. Very much smaller than the female; in other respects essentially the same.

Cotypes.—No. 7098, U.S.M.M.

Collected on *Clematis ligusticifolia*, *Rhamnus californica*, *Arbutus menziesii*, *Arctostaphylos manzanita*, *Umbellularia californica*, *Heteromeles arbutifolia*, *Eriodictyon californicum*, *Ceanothus californicus*, *Symphoricarpos racemosus*, *Prunus ilicifolia*, and *Lonicera involucrata* in the San Ramon Valley at the base of Mount Diablo, in the Santa Clara Valley, on Black and on King's mountains, and on the slopes of the Santa

Cruz Range near Los Gatos, Pacific Congress Springs, and along Stevens Creek, and on the slopes of Sierra Morena Range. Eggs were found in April and May, the early larval stages in April, May, June, and September and the first week of October, while pupa cases have been plentiful every month of the year on all except the deciduous host plants. Adults emerged April 22, 1902, from segregated cases kept in the laboratory.

44. ALEYRODES MASKELLI, new species.

Plate XXXVII, fig. 74.

Egg.—Size, about 0.27 mm. by 0.13 mm., exclusive of the pedicel which is nearly one-half the length of the egg, and placed at one side of center of the base; the egg is more pointed at the apex and longer and narrower than usual. Color, deep yellow, entire shell covered with polygonal markings.

Larvæ.—All stages are in external appearance essentially the same as in pupa case except that the caudal setæ are much longer.

Pupa case.—Size about 0.9 mm. by 0.65 mm., but varying somewhat; elliptical in shape, slightly narrowed caudad and with posterior end of case truncate. Case closely applied to leaf, at first flat, but later becoming somewhat convex. The vertical fringe so common in aleyrodids of this type is absent in this species. Dorsum without secretion, but there is a lateral fringe which varies in length and position, in some specimens being long and flat upon the leaf, in others it is short and so deflexed that it looks like the usual vertical fringe; it is about one-sixth the width of case and made up of very small crystalline coalesced rods, which are distally divided into irregular plates. The case is pale yellow in color, the coloration deepening as the developing insect approaches maturity, empty pupa case colorless; on each side of abdomen, within the body, there is an irregular oblong spot of deep orange-yellow, evidently a visceral gland. A majority of the late pupa cases show a closely striate, wide, marginal rim plainly demarked from dorsum all around by a thick line; the lateral wax tubes are not evident, but the crenulations of the marginal rim are rounded points about as long as they are broad at base; the incisions are quite uniform and acute. There is the usual pair of long setæ on the caudo-lateral margin of case, and a pair of short, delicate ones on the cephalo-lateral margin. The dorsum has a number of minte hairs scattered over it; in the marginal rim they are arranged in a row extending around the base; besides these it bears a pair of short setæ arising within the caudal margin of case, and a pair of well-developed spines laterad of the anterior margin of the vasiform orfice. Abdominal segments distinct on middle one-half of case and somewhat keeled along the dorsi-meson.

Vasiform orifice small, with a heavy yellow rim that is darker than the surrounding dorsum; the inner lateral and caudal margins with conspicuous folds or corrugations, which extend into the cavity of the orifice; operculum less than one-third length of orifice, subtrapezoidal, cephalic margin straight, caudal truncate, setose on distal margin; lingula short, projecting beyond the operculum, distal end enlarged, dorsally convex and densely setose. Cephalad of the vasiform orifice there are two crescent-shaped thickenings in the tegument of case, and a shallow furrow extends caudad to margin of case. On the ventral surface the unsegmented reduced legs are distinctly seen; the antennæ are nonsegmented, broad, reduced, and end in a finger-like process. Eyespots of the younger pupa are a bright dark red in color and are not facetted; in the older specimens they are large, very dark in color, with the edges reddish, and are strongly constricted in the middle.

Adults.—(Male and female, bred from segregated pupa cases.) Abdomen, legs, and antennæ whitish-yellow in color, head and thorax darker yellow. Wings immaculate, but so crumpled that they can not be accurately described in detail. Eyes undivided, strongly constricted through the middle; color, by transmitted light, black with reddish edges.

Male.—Length, 0.95 mm.; hind femur, 0.25 mm.; hind tibia, 0.33 mm.; hind tarsus, 0.183 mm. Fourth antennal segment much shorter than usual, about four-fifths length of segment seven.

Female.—Length, 1.1 mm.; antennæ about 0.4 mm.; the fourth and seventh segments equal, each approximately 0.07 mm.

Cotypes.—No. 7099, U.S.N.M.

Collected on under sides of the leaves of *Quercus densiflora* at La Honda, April 13, 1901, and again on King's Mountain, May 16, 1902; only a few isolated specimens found.

45. ALEYRODES WELLMANÆ, new species.

Plate XXVII, figs. 5, 5a, and Plate XXXV, fig. 61.

Pupa case.—Size, 0.93 mm. by 0.6 mm.; shape subelliptical, slightly narrowed cephalad and frequently truncate on caudal margin; color, by reflected light, dark brown with yellowish margin, by transmitted light the marginal rim, vasiform orifice, the furrow to caudal margin, and the sutures are a semitransparent yellow. There is no lateral fringe; the vertical, ventral fringe is short and usually remains upon the leaf when the pupa case is removed.

The dorsal secretion consists of a submarginal series of small crystalline rods, usually more than half width of case, which may be separate or more or less coalesced. Case rather flat; dorsum punctate, the minute depressions in the outer portion taking the form of irregular somewhat radiating striations. Scattered over the entire dorsum

of some specimens, but more usually found upon the cephalic and thoracic regions, are a number of large yellow semitransparent spaces; besides these there are a variable number of small pores, arranged in nearly parallel longitudinal lines or groups. The number of these pores is considerably increased when the case is slightly cleared in caustic potash. The median thoraco-cephalic suture and the thoraco-abdominal suture are conspicuous because of their color and semitransparency; the latter of these sutures is sinuate and extends to the lateral margins of the case. There is a dorsi-median longitudinal keel extending length of abdomen; upon this the sutures are distinct; the last three are strongly reflexed caudad. Within the marginal rim is a row of large conical papillæ, from which issues the dorso-submarginal waxen rods; mesad of the papillæ are several irregular rows of minute blunt spines. The marginal crenulations are shallow and irregular and the wax tubes indefinite in outline.

Vasiform orifice subovate, about four-fifths as wide as long, the inner lateral and caudal margins much corrugated, giving the impression of being toothed, and the folds darker in color than the surrounding surface. Operculum broadly ovate, scarcely one-half length of orifice and not as wide, the cephalic margin straight, dorsum convex and covered with minute hairs. Lingula about three-fourths length of orifice, cylindrical to enlarged distal portion, which has three pairs of lateral lobes and a terminal lobe; arising from the apex laterad of the terminal lobe is a pair of long stout setæ which project caudad; the enlarged portion is densely and minutely setose. From the apex of the vasiform orifice to the caudal margin there extends a distinct furrow. The margin of the pupa case bears a pair of delicate latero-caudal hairs; the usual caudal pair are wanting.

This Aleyrodid is found on the under sides of the leaves of *Rhamnus californica*, together with *A. iridescens* and *A. splendens*. The species is not plentiful; usually not more than a single specimen is found on a leaf. Only the pupal stage has been verified.

Cotypes.—No. 7100, U.S.N.M.

Collected by the author in April and May, 1902, on the campus, Leland Stanford Junior University, and at Stevens Creek November 12, 1901.

46. ALEYRODES EXTRANIENS, new species.

Plate XXXVI, figs. 65–67.

Egg.—Size, 0.2 mm. by 0.08 mm. Unmarked, deep yellow; apex pointed, pedicel to one side of base. Shell thick and so firm that it retains its shape when empty.

Larva.—(Stage 1.) Size about 0.4 mm. by 0.25 mm.; shape, elliptical; color, pale yellow; dorsum, convex. There is neither dorsal nor lateral exudation of wax, but most of the specimens show a slight

ventral secretion which may form a narrow base upon which the larva rests. The latero-marginal hairs and the marginal rim, usually present at this stage, are wanting. Crenulations indistinct; segmentation of abdomen distinct on central region; on each side of abdomen, about midway between the lateral margins and median line, there is a row of pores which extend from vasiform orifice cephalad to the thoraco-abdominal suture, one pore to each segment; these pores are distinct in the majority of specimens.

The dorsum bears five pairs of conspicuous long tapering spines; the cephalic pair is the longest; it is about two-thirds as long as the larva is wide and arises mesad of the eyespots; the metathoracic pair is the shorter and more slender, the pair on first abdominal segment is similar to the second pair; the fourth pair is the shortest and is laterad of the cephalic margin of the vasiform orifice; the fifth pair is caudo-submarginal in position, is stout, and projects caudad beyond the margin. The margin bears one pair of latero-cephalic hairs and one pair of latero-caudal ones; both are short and delicate; the usual pair of caudo-marginal setæ are wanting.

Vasiform orifice subcircular and bordered by a narrow, raised rim of deeper yellow color than the remaining dorsum. Operculum relatively the same shape and nearly filling the orifice, the cephalic margin straight; dorsum apparently setose. Lingula about length of orifice, cylindrical at base, with enlarged distal portion, the entire organ densely setose. Eye-spots single, large, of irregular shape, and bright red in color. Legs functional; antennæ not seen.

The older larval stages differ from the foregoing only in greater size and in the color being a brighter yellow. The second and third pairs of dorsal spines equal the cephalic pair in length, the fourth pair are approximately longer. The marginal crenulations and wax tubes are more evident. The legs are reduced, only the large, upper part being present. In a larva whose size was 0.6 mm. by 0.4 mm. minute antennæ were seen.

Pupa-case.—Size, 0.9 by 0.56 mm.; shape, elliptical; color, with inclosed pupa, a bright yellow; when empty, translucent white; texture, film-like. The vertical, ventral secretion of wax is sometimes flattened out and assumes the appearance of a lateral fringe. General characters as in later larval forms; the dorsum bears three longitudinal parallel rows of pores, one on median line and the remaining two rows about midway between the median row and the lateral margins. Marginal crenulations broad and rounded; the reentrant angles acute; the lateral wax tubes distinct and bent downward. Cephalad of the vasiform orifice there are two crescent-shaped thickenings in dorsum.

The distal portion of the lingula is conspicuously rounded and setose, and the apex is divided into two minute pointed lobes, laterad of which are two blunt tubes. In living specimens the lingula is frequently protruded and dorsally retracted.

On the venter of case, laterad of the cephalic margin of vasiform orifice, there are a pair of tapering hairs.

Legs distinct, apparently unsegmented. Antennæ not visible. Eyes single, large, and dark red in color.

Adult female.—Length, usually about 1 mm., but sometimes varies to 0.83 mm. Fore wing, 1.07 mm. by 0.47 mm. to 1 mm. by 0.4 mm., hind wing on same insect, 0.9 by 0.33 mm.; front tibia, 0.17 mm.; front tarsus, 0.2 mm.; hind tibia, 0.3 mm.; hind tarsus 0.2 mm.; color of body, uniformly pale yellow, legs and antennæ white; entire insect thickly coated with white granules; wings immaculate, entire wing with a narrow sculptured border, which is wider on the costal margin, each of the minute divisions with from three to five delicate hairs; margin of very bright yellow; main vein about seven-eighths length of wing, well defined to, and somewhat beyond the flexure and then fading out. Flexure of main vein of front wing at about one-half its length; basal half of main vein nearer the costal margin, the apex of vein in middle line of wing. The veinlet arises at base and varies in length with different specimens; in some it is very short; in others it turns abruptly and is continued to the anal margin of wing. Eyes, large; by transmitted light, reddish black; by reflected light, dark red. Each is divided into two distinct regions by a wedge-shaped white mass of wax, which dissolves in Canada balsam; the more dorsal region is subpyriform in shape and much the smaller; the facets are minute, and the color is bright red; the ventral region is crescent shaped on dorsal side, and the facets are much larger than those of the dorsal portion; color, brownish red. When the insect is mounted in Canada balsam there is no perceptible division of the compound eyes, and the general shape is either reniform or oblong, constricted about the middle.

Antennæ with segment one cup-shaped, short, as broad as long; segment two about twice as long as segment one, pyriform, and bearing a clavate process, which is tipped with a hair; segment three subcylindrical, long, and tapering considerably at point of insertion with second segment; near the distal end there are two clavate processes; segment four very short and cylindrical; segment five longer than fourth segment, cylindrical to near the distal end, where there is a notch from which arises a clavate process; segment six, subequal with fifth segment, cylindrical; segment seven, subequal with fifth and sixth segments. At one-half length it abruptly narrows to a point and ends in a finger-like process, which is tipped with a hair; at the place where segment is narrowed is seen one or more minute, clavate processes; segments three to seven, inclusive, are closely ringed with short hairs. Genitalia acutely conical.

Male.—Unknown. Of the very many adults collected at various times all proved to be females.

Cotypes.—No. 7101, U.S.N.M.

This is an introduced species and is a common pest in the conservatories of San Francisco, California. The described specimens were reared on a fern, *Acrostichum capense*, which was given to the author by Superintendent McLaren, of Golden Gate Park, San Francisco. When the plant was removed to the laboratory it had only a very moderate number of the Aleyrodes upon it, but within a year the under surfaces of the fronds were incrusted. The plant had from 14 to 30 fronds, some of which were over 3 feet in height and divided into innumerable leaflets, altogether making considerable space to be covered.

Observation of this plant was kept from February 2, 1900, to May 28, 1901, and during that time all stages could be found. In December and January there were but few adults. At this time the pupal stages were most in evidence, while in March, April, September, and October the adults arose in clouds whenever the plant was disturbed. It was not possible to determine the number of broods as the leaflets were so minute and withered as soon as taken from the plant; when dry they rolled up tightly and could not be examined without breaking into bits.

Specimens were taken from various plants in the conservatories mentioned as well as from the laboratory plant.

Upon the *Acrostichum capense* kept in the laboratory there were also found at various times a few minute larvæ which were very different in appearance from those of *A. extraniens*. Although a careful watch was kept for other stages, none were found which differed from *A. extraniens*, though the young larvæ were in evidence during the entire time the plant remained under observation (fig. 67, Plate XXXVI).

Larva.—Length, about 0.25 mm.; width, about 0.15 mm. Shape, subelliptical, narrowed at both ends, broadest across the mouth parts. Color, an opaque, grayish green. Dorsum convex, and with a pair of tapering, sharply pointed spines nearly one-half as long as larva. These spines are inserted meso-cephalad of the antennæ, and in the living larvæ are borne in an almost upright position. There is a narrow marginal rim which bears seven pairs of rather long lateral setæ, one pair of longer latero-caudal setæ, and one pair of long, tapering, stout spines, all of which are inserted in conspicuous tubercled bases. The lateral setæ extend caudad about two-thirds the length of the larva, and with the exception of the first two pairs, which are closer together, they are evenly spaced. On the ventral surface opposite the point of insertion of the latero-cephalic spines, there arises a similar pair of setæ. Abdominal segmentation distinct, the sutures extending to margin, the more caudal ones strongly reflexed.

Vasiform orifice subcircular and with a straight cephalic margin caudally bounded by a dark, raised rim. Operculum relatively the

same shape and nearly filling the orifice. Lingula spatulate, about length of orifice, enlarged at distal end, which is densely setose. Latero-cephalad of the vasiform orifice are a pair of minute spines.

Eye-spots large, bright red. Legs functional. Antennæ as long as one-half width of larva; segment 1, short, about as broad as long; segment 2, about the same length and tapering slightly; the remaining portion is unsegmented, slender, closely ringed with minute hairs and ends distally in a finger-like process tipped with a hair.

47. ALEYRODES ACACIÆ Quaintance.[a]

Plate XXVII, fig. 6.

Collected by the author on *Rhamnus californica*, Campus, Leland Stanford Junior University, immature stages found on the under sides of the leaves, together with *A. iridescens*, *A. splendens*, and *A. errans* during April and May, 1902. Adults unknown.

48. ALEYRODES TRACHEIFER Quaintance.[b]

49. ALEYRODES QUERCUS-AQUATICÆ Quaintance.[c]

50. ALEYRODES ABNORMIS Quaintance.[d]

51. ALEYRODES PERGANDEI Quaintance.[e]

52. ALEYRODES PLUMOSUS (Quaintance).[f]

53. ALEYRODES FITCHI Quaintance.[g]

54. ALEYRODES FLORIDENSIS Quaintance.[h]

55. ALEYRODES VITTATUS (Quaintance).[i]

56. ALEYRODES ALTISSIMUS (Quaintance).[j]

57. ALEYRODES PERSEÆ Quaintance.[k]

58. ALEYRODES VARIABILIS Quaintance.[l]

59. ALEYRODES SPIRÆOIDES Quaintance.[m]

Plate XXXV, figs. 56–60.

Egg.—Size, 0.3 by 0.13 mm.; pedicel, 0.083 mm.; shell covered with polygonal markings; oval, base more pointed than usual; when first laid it is white, but as the embryo develops the color becomes gradu-

[a] Contributions toward a Monograph of the American Aleurodidæ (U. S. Agr. Dept., Division of Entomology. Technical Ser. 8, p. 19.)

[b] Idem p. 38. [f] Idem p. 35. [j] Idem p. 20.

[c] Idem p. 33. [g] Idem p. 24. [k] Idem p. 32.

[d] Idem p. 71. [h] Idem p. 26. [l] Idem p. 39.

[e] Idem p. 31. [i] Idem p. 42.

[m] Contributions toward a Monograph of the American Aleurodidæ. (U. S. Agr. Dept. Division of Entomology. Technical Ser. 8), p. 36.

ally more yellow; from the first there can be seen a large, roundish, yellow body within the shell. This is at first pale in color, but also grows darker until near time of hatching, when it is orange. The pedicel is at center of base of shell and is divided at distal end into two or more prongs. The shell is densely covered with the wax granules, which are found upon the leaf.

Adult female.—Length of body, 1.5 mm.; fore wing, 1.6 by 0.83 mm.; hind wing, 1.08 by 0.63 mm.; hind femur, 0.33 mm.; hind tibia, 0.53 mm.; hind tarsus, 0.3 mm.; proximal segment, 0.18 mm. Antennæ: Segment 1, cup-shaped, about one-half the length of segment 2; segment 2, subpyriform, one-half as long as third segment; segment 3, 0.166 mm. long; segments 4, 6, and 7 equal 0.066 mm.; segment 5, slightly longer than segment 4; segments 3 to 7, inclusive, closely ringed with minute hairs. Fore wings with two dusky spots, one at the flexure of main vein, which is here curved toward the anal margin; hind wings with only the more distal spot. Basal veinlet of fore wings arises independently of main vein and at some distance from base of wing; between the veinlet and anal margin there is a heavy oblique fold, which is about one-half the length of wing and which curves nearly to the anal margin; main veins of both wings about seven-eighths length of wing; mentum dusky brown, the apex dark brown, median segment brown; ocelli conspicuously large; eyes red-black, divided; vasiform orifice subcircular; operculum brown, very convex dorsally, and about one-half length of orifice; lingula brown, very long, subcylindrical, with distal part somewhat enlarged and bilobed, densely covered with minute hairs; genitalia acute, conical, ordinary.

Male.—Length of body, 1.5 mm.; fore wing, 1.63 by 0.7 mm.; hind femur, 0.3 mm.; hind tibia, 0.45 mm.; hind tarsus, 0.26 mm.; proximal segment, 0.17 mm. Antennæ: Segment 2, 0.07 mm.; segment 3, 0.186 mm.; segments 4, 5, and 7 equal, 0.07 mm.; segment 6, 0.04 mm. Genitalia usual. Brown line on venter of abdomen, 0.3 mm. long.

For detail of body coloration, etc., see drawing of adults of *A. pruinosus*, which agrees closely with the markings of this species.

This species is very plentiful in all parts of California where the author has collected or from which specimens have been received. There are some minor variations in external characters, but these do not differ more from Quaintance's species than they do from one another. It is omnivorous, the number of host plants being greater than that of any other Aleyrodes known to the author. The exact number of broods has not been ascertained, but females were seen laying on February 22, 1901, again during May, October, and November of the same year on the campus of Leland Stanford Junior University; in 1902 the spring was cold and wet, and the first egg laying observed in the same locality was on March 29; the females are still

laying on May 27. Pupa-cases have been found at all seasons of the year during the time the leaves remained upon the host plants, the greater number of which are deciduous herbs.

The females are gregarious when egg laying, frequently seven to ten being on one leaf within a small radius. The habit of making a circular disk of granular wax upon which to deposit the eggs is noticeably marked in this species, and the leaves, even when large, are often covered with these disks which may overlap each other, thus confusing the different sets of eggs.

Collected by Mr. Kuwana at Wright's, in the Santa Cruz Range, on *Troximon sp.;* by Mr. Edward M. Ehrhorn, in the foothills near Mountain View, Santa Clara County, on the same plant and also on *Sonchus oleraceus;* by Miss Isabella McCracken, in Oakland, on *Convolvulus sepium;* by Mr. W. S. Atkinson, on horse chestnut (*Aesculus californica*), San Francisquito Creek, campus, Leland Stanford Junior University, and by the author on cultivated fuschia in Golden Gate Park, San Francisco, and on the campus, Leland Stanford Junior University; also found on *Plantago major*, *Sonchus oleraceus*, *Solanum douglasii*, *Nicotiana glauca*, and cultivated iris in the same locality; on cultivated dahlia, iris, and Cherokee rose, in Alameda; on *Opulaster capitatus*, *Sonchus oleraceus*, *Lonicera involucrata*, and *Solanum douglasii* along the banks of Stevens Creek, from the valley to the lagoon at its head in the Santa Cruz Range (or Sierra Morena Range), and along the banks of San Francisquito Creek on the same food plants.

The leaves of the plantain and *Sonchus oleraceus* (sow thistle) are more thickly covered than are those of the other hosts; frequently they are solidly incrusted with the immature forms; the leaves in such cases are usually paler and thinner.

The author has carefully observed this species on its many food plants with a view of ascertaining if there was constant variation in gross external structure caused by a great range of food plants, but this experiment has shown only trivial differences, such as are common among nearly all species. The test may have more result if made seasonal.

60. ALEYRODES ABUTILONEUS (Haldeman).

Aleyrodes abutilonea Haldeman, Am. Jn. of Sci. and Arts, IX (1850), p. 108.—Signoret, Am. de la Soc. Entom. de France, Dec., 1867, p. 397.

61. ALEYRODES HUTCHINGSI, new species.

Plate XXXVI, figs. 62–64.

Pupa-case.—Size about 1.3 by 0.6 mm.; elliptical; without lens, the case is brownish in color, but when mounted in Canada balsam and viewed by reflected light it ranges from a dense brown-black to semitransparent, pale, yellow-brown. The former color when found in semitransparent, yellowish species is usually the result of parasitization.

The dorsum bears a conspicuously long submarginal fringe, which rises almost perpendicularly from the case to a considerable distance; it is then curved outward and downward until the distal portion rests upon the leaf. This fringe is made up of appressed, slender, crystalline rods which form a solid ring above the case, but is broken into irregular plates after curving downward. The arrangement and length of this fringe is characteristic of *A. hutchingsi*, and makes it one of the most unique and beautiful of the Californian Aleyrodidæ.

Within the circle of submarginal fringe the dorsum is sometimes covered with a thin, pellucid coat of wax; this coating frequently extends over the lateral and ventral portions as well, thus completely inclosing the case. This wax covering is probably protective, as the author found it on a number of species collected in Yosemite Valley, which in lower altitudes and a warmer climate were without it. This dorsal wax is filled with minute dots, which doubtless is but an impression of the underlying wax-secreting tubes.

On the majority of the specimens the dorsal wax coat was granular; usually this granular wax was thicker in a strip along the dorso-medial line and in a ring inclosed by the submarginal fringe.

The dorsum has a narrow marginal rim, within which the lateral wax tubes are evident; the outer margin of the case is but slightly and irregularly crenulated; inside of the marginal rim, and extending around the case, there are about three irregular rows of closely set papillæ from which issues the submarginal dorsal fringe; scattered among the papillæ are a large number of small pores. Between the dorso-submarginal papillæ and the central dorsum the case is covered with minute papillæ. The abdomen has a slight keel, along which the segmentation is distinct. On each of the abdominal segments there are two small pores; these are arranged in two parallel lines, one each side of the dorsi-meson. Lateral of these pores there are occasionally seen irregular groups of from two to three pores; on the meta-thorax there is a transverse row of small pores. Caudad of each abdominal suture there is a pair of subcircular spaces which are somewhat more highly chitinized than the surrounding dorsum; these spaces are also usually slightly wrinkled in appearance. The thoraco-abdominal suture is distinct and extends to the submarginal papillæ.

The vasiform orifice is distinctly outlined by a dark rim, shape, subovate, the inner lateral and caudal margins much corrugated, the caudal end broadly rounded, or, in some specimens, indented and with a finger-like process projecting caudad from center. Operculum, subsemielliptical, about one-half length of orifice. Lingula, about four-fifths the length of orifice, subspatulate, the distal portion with three pairs of lateral lobes and a terminal lobe. Just cephalad of the vasiform orifice there are two crescent-shaped thickenings of the tergum of dorsum. Latero-cephalad of the orifice on each side is a small pore.

Cotypes.—No. 7102, U.S.N.M.

Collected by the author on an unnamed species of *Arctostaphylos* in Yosemite Valley, July, 1902; only a few pupa-cases found.

62. ALEYRODES MELANOPS Cockerell.

Aleyrodes melanops Cockerell, Proc. Acad. Nat. Sci. Phila., May, 1902, p. 283, and in an unpublished bulletin written for the Florida Exper. Station, by T. D. A. Cockerell.

Pupa-case.—Length about 1.5 mm., broad-oval, black, similar in structure to *A. perileucus*, but larger and with the fringe much longer and curled over, so as to be strongly convex above.

Adults unknown.

A. melanops is possibly only a variety of *A. perileucus*.

Found by T. D. A. Cockerell at Alpine Tavern, Mount Lowe, California, on upper sides of leaves of Quercus.

63. ALEYRODES STRUTHANTHI Hempel.

Aleyrodes struthanthi Hempel, Annals & Mag. Nat. Hist., sec. 7, VIII, pp. 385–387. (1901.)

On *Struthanthus flexicaulis*, Mart., orange, *Tichilia flava*, and an unidentified forest tree.

Habitat.—Paruahyba and São Paulo, Brazil.

64. ALEYRODES YOUNGI Hempel.

Aleyrodus Youngi Hempel, Annals & Mag. Nat. Hist., sec. 7, VIII, pp. 385. (1901.)

On cabbage and collards, Ignape and Campinas, State of São Paulo, Brazil.

65. ALEYRODES MORI ARIZONENSIS Cockerell.

Plate XXXII, figs. 38–38a.

Aleyrodes mori arizonensis Cockerell, Science Gossip, 1900, p. 366.

Pupa case.—Size about 0.7 by 0.55 mm.; elliptical, shiny black. Margin with a copious white, cottony fringe all around; continuous basally but ragged distally. Case moderately convex, with evident, rounded median ridge. The pupa is like that of *A. mori* Quaintance, but the lateral margins of case are more deeply crenulated. The adult has the wings white, with black markings, which show considerable variation in arrangement (Plate XXXII, fig. 38). This species occurs on orange trees in the Southwest. Collected at Mesa, Arizona, by T. D. A. Cockerell, and at Zapotlan, Mexico, by Prof. C. H. T. Townsend.[a]

[a] The above description is from a letter by Mr. Cockerell, the writer not being able to get access to references.

66. ALEYRODES NEPHROLEPIDIS Quaintance.

Aleyrodes nephrolepidis Quaintance, Bull. 8. Tech. Ser., Div. Ent., U. S. Dept. Agric., 1900, p. 29.

On *Nephrolepis*. Pennsylvania.

EXPLANATION OF PLATES.

[These plates were drawn by Mary H. Wellman.]

Plate XXVII.

Fig. 1. *Aleyrodes iridescens*, pupa-case.
2. *Aleyrodes iridescens*, same with wax removed, showing arrangement of wax-secreting pores.
2a. *Aleyrodes iridescens*, pore of same, enlarged.
3. *Aleyrodes nigrans*, pupa-case, cleared and mounted to show vertical, oblique rim.
4. *Aleyrodes amnicola*, pupa-case.
4a. *Aleyrodes amnicola*, vasiform orifice of same; *a*, operculum; *b*, lingula.
5. *Aleyrodes wellmanæ*, pupa-case with dorso-submarginal wax removed.
5a. *Aleyrodes wellmanæ*, vasiform orifice; *a*, operculum; *b*, lingula.
6. *Aleyrodes acaciæ*, pupa-case.

Plate XXVIII.

Fig. 7. *Aleyrodes madroni*, pupa-case.
8. *Aleyrodes madroni*, same showing a common variation in arrangement of dorsal and lateral wax.
9. *Aleyrodes coronatus*, pupa-case.
10. *Aleyrodes interrogationis*, pupa-case.
11. *Aleyrodes interrogationis*, caudal end of pupa, spines in detail and vasiform orifice with marginal rim; *a*, operculum; *b*, base of lingula; *c*, corrugated inner parts.
12. *Aleyrodes interrogationis*, pupa-case, showing dorsal spines, pores, and lateral wax tubes.

Plate XXIX.

Fig. 13. *Aleyrodes kelloggi*, pupa-case cleared of wax.
13a. *Aleyrodes kelloggi*, detail of minute dorsal wax-pores.
14. *Aleyrodes kelloggi*, pupa-case.
15. *Aleyrodes kelloggi*, young larva.
16. *Aleyrodes kelloggi*, vasiform orifice; *a*, operculum; *b*, lingula; *c*, marginal rim.
17. *Aleyrodes merlini*, pupa-case.
18. *Aleyrodes merlini*, same, cleared of wax, showing dorsal papillæ.
19. *Aleyrodes merlini*, vasiform orifice; *a*, operculum; *b*, lingula.

Plate XXX.

Fig. 20. *Aleyrodes errans*, pupa-case, with molt on dorsum.
21. *Aleyrodes errans*, pupa-case with molt removed.
22. *Aleyrodes stanfordi*, pupa-case.
23. *Aleyrodes stanfordi*, late larva or early pupa.
24. *Aleyrodes stanfordi*, detail of marginal rim of fig. 23.
25. *Aleyrodes stanfordi*, egg showing marking.

PLATE XXXI.

FIG. 26. *Aleyrodes tentaculatus*, pupa-case, dorsal view.
27. *Aleyrodes tentaculatus*, pupa-case from side to show vertical wax base, and variation from fig. 26.
28. *Aleyrodes tentaculatus*, pupa-case cleared of wax, showing marginal rim with papillæ.
29. *Aleyrodes tentaculatus*, portion of marginal in detail.
30. *Aleyrodes tentaculatus*, vasiform orifice of pupa-case with surrounding marginal rim; *a*, operculum; *b*, lingula.
30a. *Aleyrodes tentaculatus*, same showing crescent-shaped thickenings of dorsum cephalad of vasiform orifice.
31. *Aleyrodes glacialis*, pupa-case.
32. *Aleyrodes glacialis*, same with wax removed, showing dorsal pores and papillæ.
33. *Aleyrodes glacialis*, detail of caudal end of pupa-case, dorso-caudal furrow.

PLATE XXXII.

FIG. 34. *Aleyrodes inconspicuus*, pupa-case.
35. *Aleyrodes inconspicuus*, detail of dorsum of same.
36. *Aleyrodes inconspicuus*, vasiform orifice with surrounding rim; *a*, operculum; *b*, lingula of pupa-case.
37. *Aleyrodes inconspicuus*, parasite, dissected from pupa-case.
37a. *Aleyrodes inconspicuus*, last abdominal segment of male, showing genitalia.
38. *Aleyrodes mori arizonensis*, diagram showing variation in wing marking.
38a. *Aleyrodes mori arizonensis*, diagram showing crenulation of pupa-case.
39. *Aleyrodes mori*, diagram showing crenulation of pupa-case.

PLATE XXXIII.

FIG. 40. *Aleyrodes pruinosus*, adult, showing position of wings when at rest.
41. *Aleyrodes pruinosus*, male, cleared of wax, showing markings.
42. *Aleyrodes pruinosus*, abdomen of female, showing the variation from male in latero-ventral markings and width of segments 4 and 5.
43. *Aleyrodes pruinosus*, dorso-abdominal markings of female.
44. *Aleyrodes pruinosus*, last abdominal segments of female with vasiform orifice; *a*, operculum; *b*, lingula; and *c*, genitalia.
45. *Aleyrodes pruinosus*, detail of wing marking and main vein.
46. *Aleyrodes pruinosus*, caudal end of larva, showing spines, lateral view of vasiform orifice; *a*, operculum; *b*, lingula.
47. *Aleyrodes pruinosus*, dorsal view of larval vasiform orifice; *a*, operculum; *b*, lingula; *c*, minute, blunt tubes at apex of lingula.

PLATE XXXIV.

FIG. 48. *Aleyrodes pruinosus*, fore wing.
49. *Aleyrodes pruinosus*, hind wing.
50. *Aleyrodes pruinosus*, border of wing.
50a. *Aleyrodes pruinosus*, same, showing hairs, highly magnified.
51. *Aleyrodes pruinosus*, head of adult; *a*, compound divided eye; *b*, ocellus; *c*, mentum; *d*, rostral setæ; *e*, antennæ.
52. *Aleyrodes pruinosus*, mentum of same showing suctorial tube.
53. *Aleyrodes pruinosus*, antennæ of same, highly magnified.
54. *Aleyrodes pruinosus*, tarsi of same, front and side view.
55. *Aleyrodes pruinosus*, diagram showing typical alimentary tract and mouth parts of Aleyrodes.

PLATE XXXV.

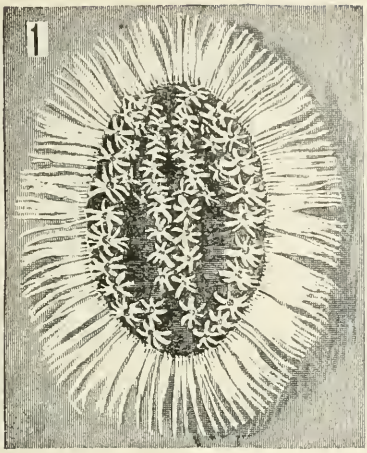
FIG. 56. *Aleyrodes spiraoides*, pupa case, ventral surface showing tracheal system and position of spiracles.
57. *Aleyrodes spiraoides*, same, showing transverse tracheal trunks.
58. *Aleyrodes spiraoides*, male, genitalia, vasiform orifice; *a*, operculum; *b*, lingula.
59. *Aleyrodes spiraoides*, vasiform orifice of pupa-case with surrounding marginal rim; *a*, operculum; *b*, lingula; *t. l.*, terminal lobes of lingula.
60. *Aleyrodes spiraeoides*, detail of marginal rim of pupa-case
61. *Aleyrodes wellmanæ*, pupa-case.

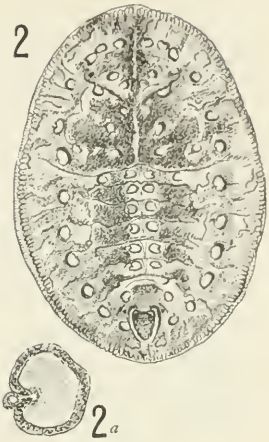
PLATE XXXVI.

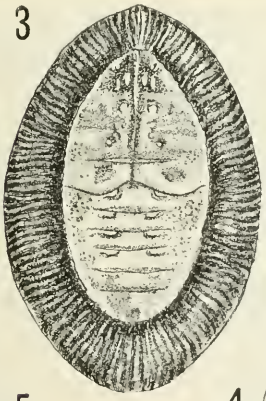
FIG. 62. *Aleyrodes hutchingsi*, pupa-case.
63. *Aleyrodes hutchingsi*, same, with wax removed, showing dorsal pores and papillæ.
64. *Aleyrodes hutchingsi*, detail of margin of case, submarginal papillæ and pores, and minute dorsal papillæ.
65. *Aleyrodes extraniens*, female, with granular wax removed.
66. *Aleyrodes extraniens*, egg.
67. *Aleyrodes extraniens*, young larva.
68. *Aleyrodes splendens*, young larva.

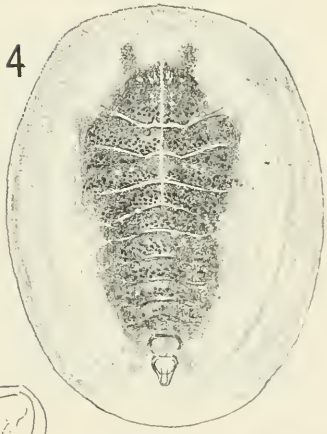
PLATE XXXVII.

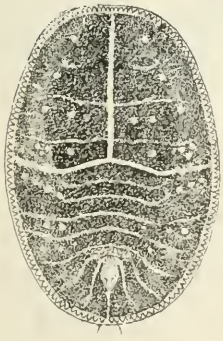
FIG. 69. *Aleyrodes splendens*, pupa-case.
70. *Aleyrodes quaintancei*, pupa-case mounted to show marginal rim and coloration of dorsum.
71. *Aleyrodes quaintancei*, early pupa-case, outline to show shape.
72. *Aleyrodes quaintancei*, young larva.
73. *Aleyrodes quaintancei*, vasiform orifice of pupa-case and portion of case directly cephalad.
74. *Aleyrodes maskelli*, vasiform orifice of pupa-case with marginal rim.

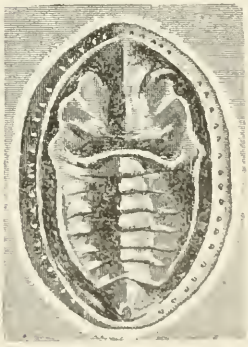












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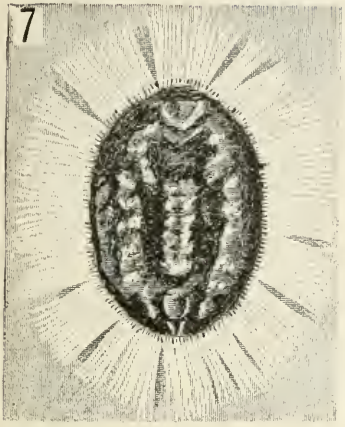

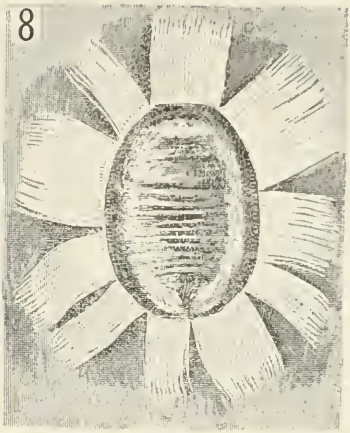

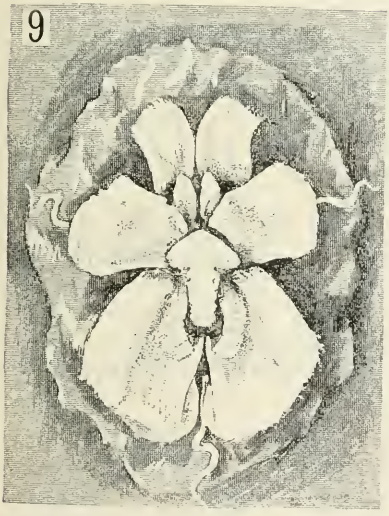

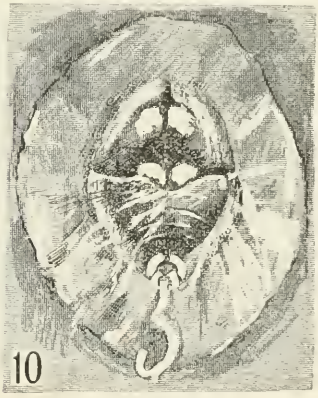

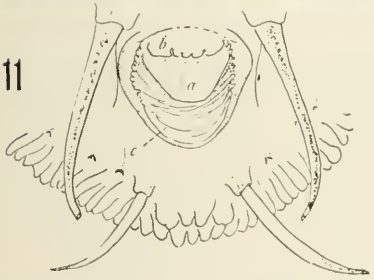

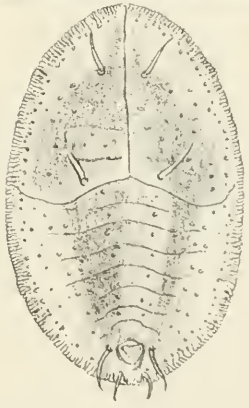

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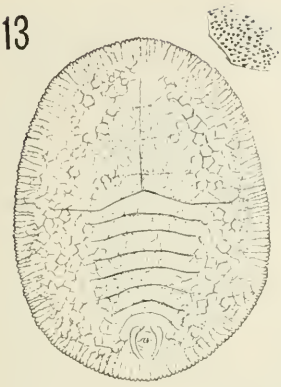

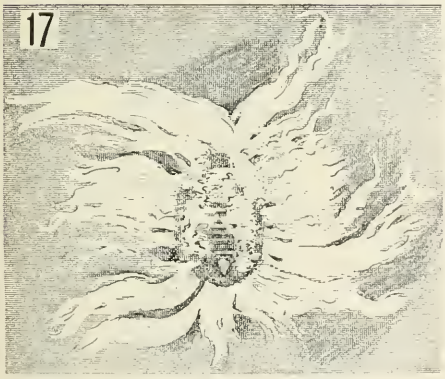

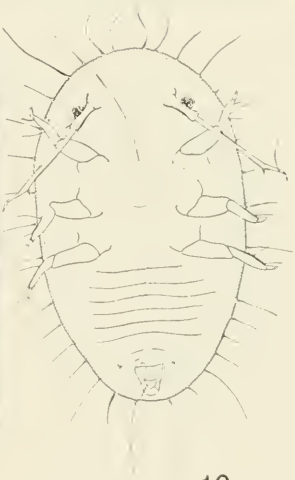

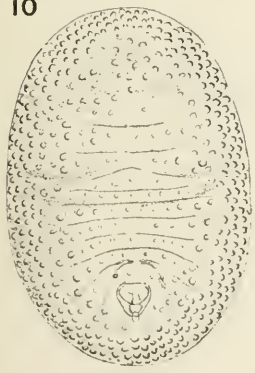

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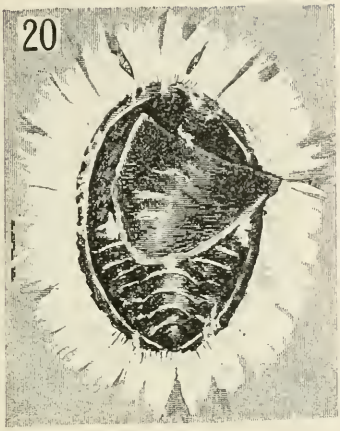

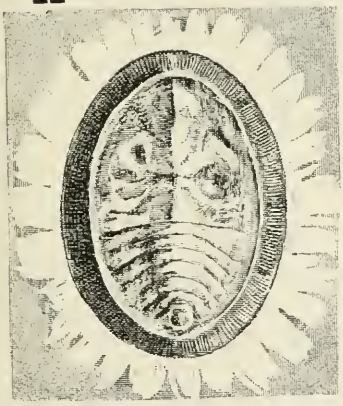

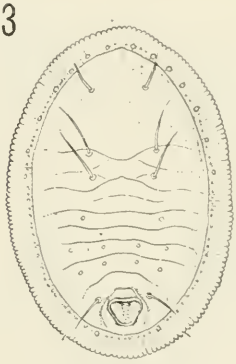

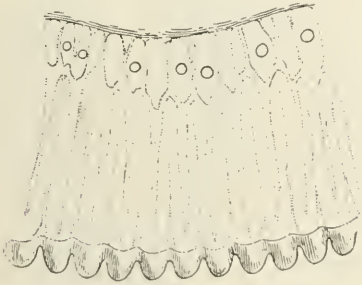

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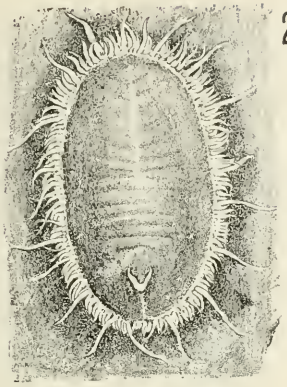

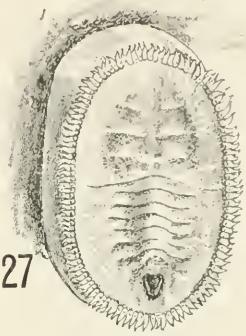

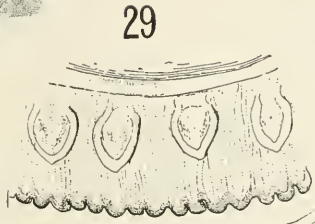

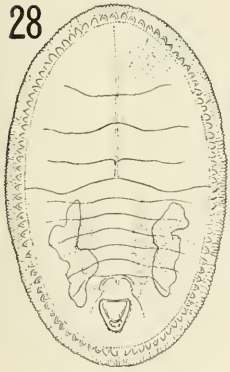

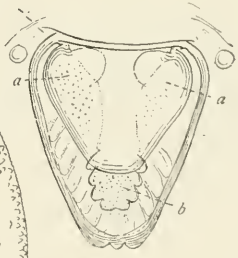

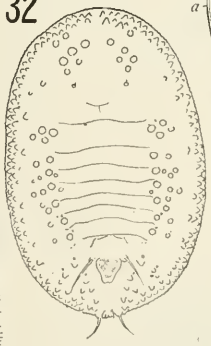

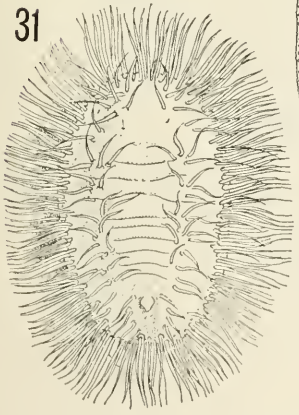

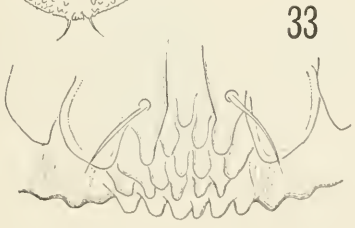

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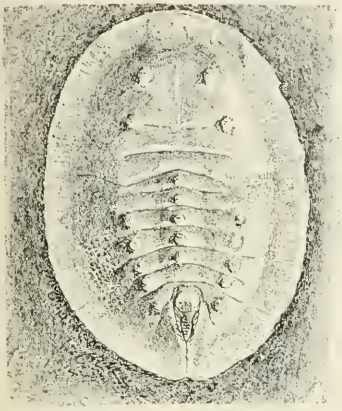

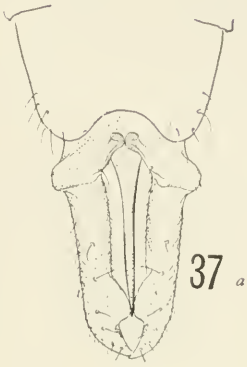

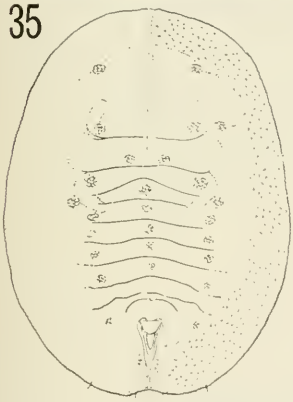

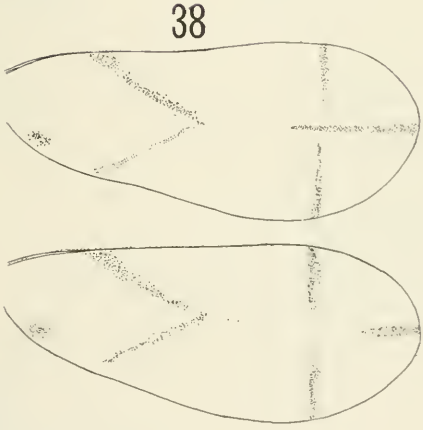

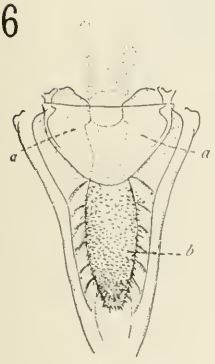

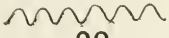

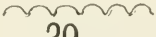

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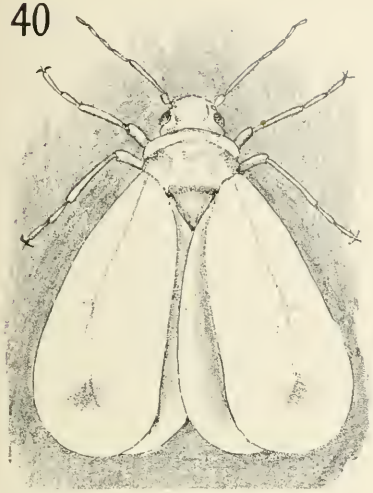

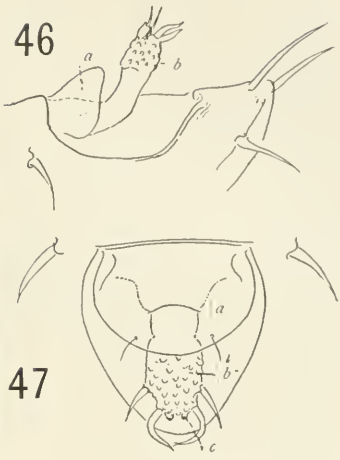

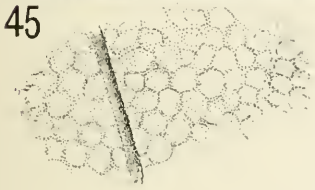

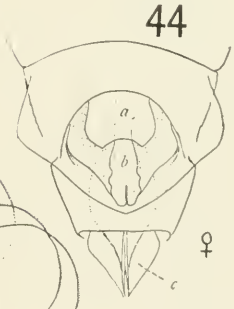

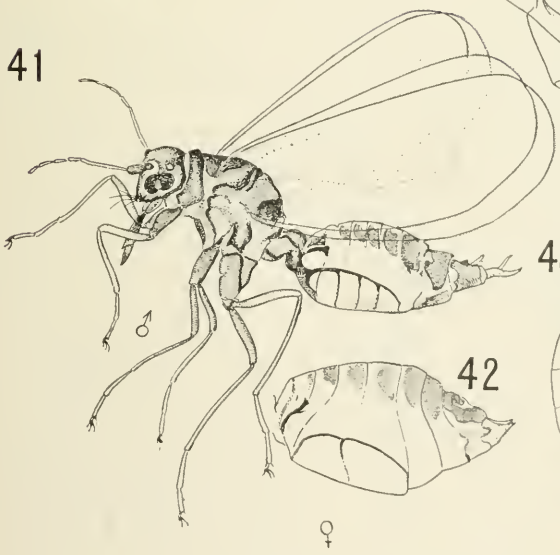

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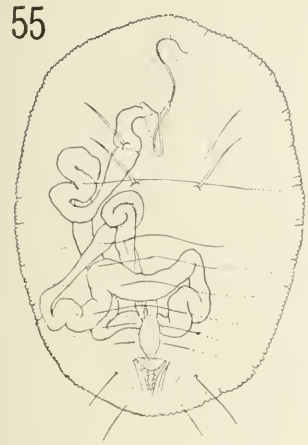

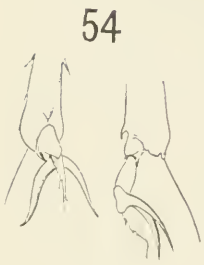

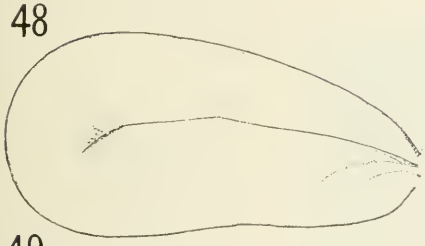

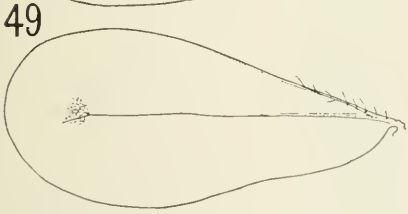

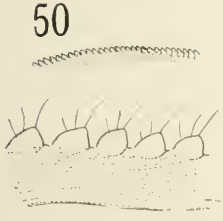

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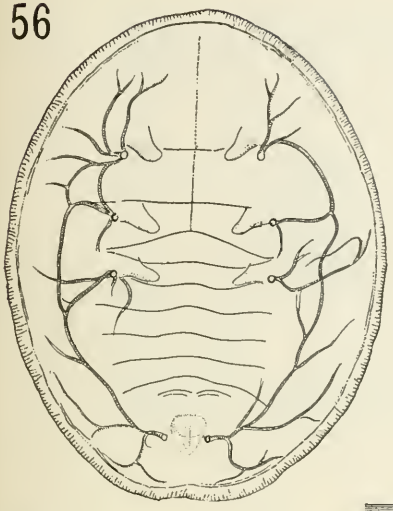

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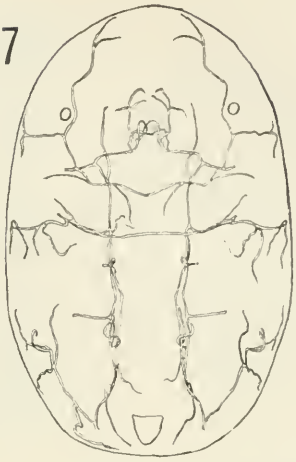

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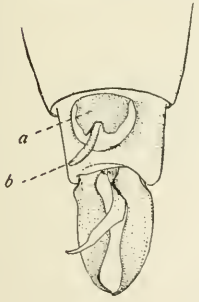

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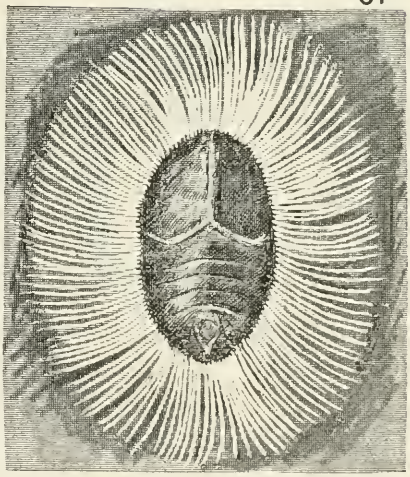

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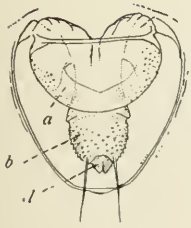

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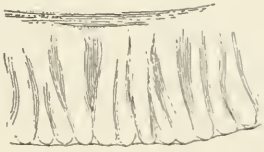

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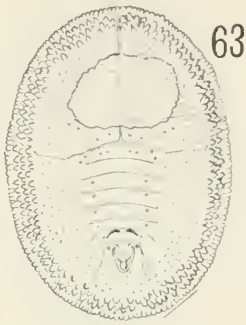

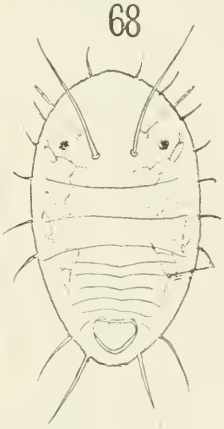

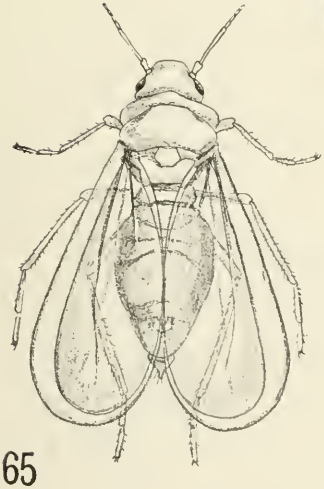

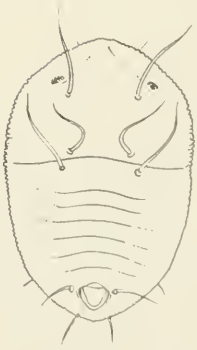

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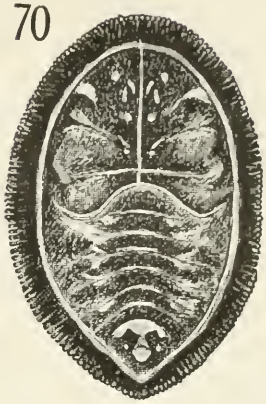
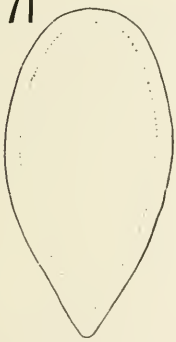
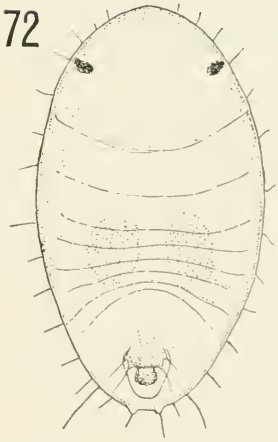
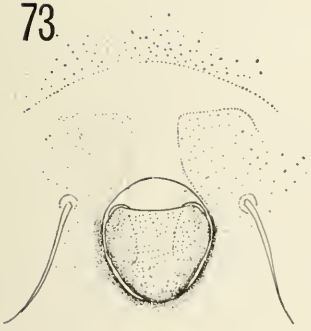
FOR EXPLANATION OF PLATE SEE PAGE 537.









ALEYRODIDÆ OF CALIFORNIA.

FOR EXPLANATION OF PLATE SEE PAGE 537.