With the author's Compliments

The Coccidæ of Kansas, II.

Contribution from the Entomological Laboratory, No. 66.

BY S. J. HUNTER.

With Plates XIII to XVII.

In the study of the material here presented, it was found that the most satisfactory mounts were made from specimens boiled in a solution of KOH composed of equal parts of water and saturated solution of the potassium hydrate. The material was allowed to boil several minutes, then was transferred to warm water and washed with camel's hair brush until all the coloring matter had left the body. From here the specimens were readily transferred to glycerine jelly for temporary study or through the clearing mixture mentioned in the previous paper into balsam for permanent reference.

I am again placed under obligations to Professor T. D. A. Cockerell who has very kindly read the manuscript and given some notes upon the species here studied. The drawings accompanying this paper were made by Miss Ella Weeks under the author's immediate supervision. Thanks are due her for the care and skill exercised in their production.

All measurements given, both in text and plates, are in micro-millimeters.

Lecanium maclurae nov. sp. Plate XIII, Figs. 1, 2.

Female. Scale; long. 3 to 5, lat. 2½ to 4, alt. 1½ to 2, μ. Color light brown, older scales comparatively flat, younger scales when dry wrinkle up forming ridges on longitudinal median line. In older specimens the longitudinal median surface is smooth, this area being fusiform, but not greatly enlarged in the center. Fusiform space pitted on each side, the lateral surface in folds; the depressions each contain several small pits. The caudal margin somewhat plicate. The edges of body wall not upturned on median margins of caudal opening. Gland pits in derm comparatively few. Mouth parts prominent, and bearing a well developed triangular labium having three prominent spines on lateral margins.

Antennæ seven jointed, the fourth being the largest, the sixth the shortest. Beginning with the proximal segment they measure 56-68; 32-36; 56-68; 52-56 28-40; 20-24; 28-32; micromillimeters respectively. Chætotaxy and structure shown in figure. In some specimens sutures between 1 and 2, in others sutures between 3 and 4, 5 and 6 are indistinct. The third and fourth are without spines, the remaining segments show spines as indicated in figure.

The legs are well developed, and highly chitinized. The body when boiled in KOH gives reddish brown coloring matter and becomes clear, the legs however retain part of their chitine. Trochanter prominent, prothoracic leg in some specimens shows unusually long hairs, two on trochanter, one on coxa; hairs elsewhere as indicated in figure. Claw curved, with two stout knobbed digitules. The second digitule of claw seen only in the mesothoracic leg. Tarsus bearing two long slender knobbed digitules. Chætotaxy and relative sizes of segments shown in figure.

Habitat. On the twigs of osage orange, May 18, 1898. These specimens were received from Claflin, Barber county, through the Honorable F. D. Coburn Secretary of the State Board of Agriculture. The twigs were thickly covered with scales but so thoroughly were they parasitized by chalcids and attacked by the larvæ of a coccinellid that it was with difficulty that suitable material for study was obtained from material sent. These insects are widely separated from *L. maclurarum* Ckll. Description of *L. robiniarum* Douglas is not at hand. I note however that a probable variety has been found in New Mexico* on osage orange. The parasites left no eggs for comparison, so even this remote clue is wanting. Professor Cockerell says: "It isn't *robiniarum*. It is related, I think, to *L. fitchii*."

Lecanium canadense Ckll. Plate XIV, Figs. 1, 2, 3.

Lecanium caryae v. canadense Ckll. Can. Ent., Vol. 27, 1895, p. 253.

Lecanium canadense Ckll. Can. Ent., Vol. 30, p. 294.

This scale at first glance resembles scale of *L. kansasense* but upon close examination the smooth central boss is not so apparent, nor raised smooth ridge on each side of the boss. The legs and antennæ present still greater distinctions. Scale of female, long, 4 to 5½; lat. 4; alt. 3½ to 4 μ. Hemispheroidal, and caudal margin slightly extended. Some specimens show slight elevation on center of dorsum, others not raised but shiny on dorsum and with but

*Ckll. Can. Ent. '95. p. 257. Insect Life, Vol. VII. p. 209.

few pits. Caudal half of lateral portion of body plicate. Color very dark brown, pits nowhere deep, unpitted surface shiny. Derm, when bleached shows numerous gland pores.

Antennæ six jointed. Professor Cockerell adds: "This species occasionally shows 7 jointed antennæ." The third joint about 1/3 length of whole member, the sixth shows distinct compression which suggests a suture but none could be found in specimens examined. Individual lengths and comparative sizes of segments shown in figure.

Leg, size of segments variable. Trochanter prominent. Limits of forms of this species studied:

C. 120–140; tr. 68; fem. 180–204 (including tr); tib. 120–152; tars. 80–88; cl. 12–12.

Only one long slender tarsal digitule seen, knobbed; two short stout digitules belong to the claw.

Habitat on *Ulmus americana* University Campus, April, 1898 Collected by Mr. P. A. Glenn.

Lecanium kansasense, nov. sp. Plate XIV, Figs. 4, 5.

Female, long. 3 to 5½, lat. 2½ to 3½, alt. remains constant at 2, μ. Color dark brown, very shiny, derm apparently thick, when boiled in KOH becomes translucent retaining some coloring. Derm checkered with numerous gland pits. Some scales, when taken, March, '98, were sparsely covered with white powder. When scale is removed distinct oval ring with anal indentation distinctly apparent upon bark of host.

On median surface of dorsum is a smooth space, oval-shaped and slightly raised, bordered on each side by row of punctures. Some specimens show slight smooth elevation and another row of punctures laterad of first rows, so that boss from long focus appears to be encircled by two rows of pits. Lateral and caudal aspects plicate, cephalic aspect minutely wrinkled.

Antennæ six jointed, structure, average length, and arrangement of hairs shown in figure. Third joint a little longer than 4+5+6. Segments always well marked. Terminal hair equal in length to proximal joint.

Leg strongly chitinized, does not bleach as readily as derm. Number and position of digitules, average length of segments and chætotaxy shown in figure.

Habitat. On *Cersis canadensis L.*, University Campus, January, 1898.

I am inclined to associate with this species scales of *Lecanium*, insufficient in number for thorough study, taken from *Juglans nigra*, a potted rose, and from *Ulmus fulva*. In none of these were either legs or antennæ found. The paucity of material, therefore, prevents a more positive opinion. From the scales, however, it is evident that they are closely related, if not identical. Of the scale on *Ulmus fulva* Professor Cockerell says: "I feel confident that the one on *Ulmus fulva* belongs here." If these can subsequently be proven identical, it will be of interest in showing the range of adaptability of this species.

Lecanium cockerelli nov. sp. Plate XV, Figs. 1, 2, 3.

Scale of female. Average long. 8.5, lat. 5 to 6 (apparently governed by width of branch), alt. 3, μ. Scales of extreme length are long. 10.4, lat. 6.6, alt. 4.2 This striking scale will be easily recognized by its two prominent tubercles on the cephalic half of the body, situated laterad of the longitudinal median line. From these tubercles the body descends rapidly cephalo-ventrad to the bark of host, giving the cephalic aspect somewhat of the appearance of the upper part of the face of a bull dog. From the tubercles the body slopes gradually caudo-ventrad to the bark of the host. Derm closely pitted with shallow punctures, color very dark brown.

When removed from bark the margin of the insect leaves an elliptical ring, central portion of which is covered by a white powder. By transmitted light derm is shown to be closely perforated by minute gland pores.

Antennæ, stout, eight segments, arrangement of hairs and length of segment shown in figure. Leg stout, tarsus bears two long slender knobbed digitules, claw with two stouter digitules, length of claw and tarsus 128 micromillimeters.

Habitat. Taken February, 1898, on *Ulmus americana* in Lawrence, Kansas. Many of the outer branches of trees were closely studded upon the upper surface by these scales. The same trees were examined February of this year and but a single specimen was found. I cannot charge this disappearance to parasites exclusively. I would rather believe that the severe weather and the two very heavy sleets that covered the trees and remained upon them for several days were largely responsible for the clearance of old scales.

This attractive species is dedicated to Professor T. D. A. Cockerell whose studies have greatly enriched Coccidological literature.

On walnut, the same species was found, but the scale is uniformly smaller and the size of segments of leg and antennæ correspondingly less. Long. 6–7, lat. 4–5, alt. 3–4, μ. A comparison of figure 2 with figure 3 will show differences in size of the antennæ and legs of the walnut and elm scales.

Habitat on *Juglans nigra*, University Campus, April, '98.

From the relative sizes can it be said that elm is the better adapted host?

Professor Cockerell writes that he has received specimens of this scale from Mr. G. B. King and several other correspondents but the material was in unfit condition for description,

Lecanium armeniacum Craw. Plate XV, Fig. 4.

Comparison of the infested twigs with photograph upon title page of bulletin No. 83 Cornell University by M. V. Slingerland, suggests a possibility of this being the same species. Later, however, in the description, Professor Cockerell is quoted as associating that insect with *juglandis*, a 7-jointed species. There being no descriptions, specimens *in situ*, or slide specimens at hand the following notes are offered.

Scale of female, crowded closely upon twigs of plum sometimes 2 and 3, one upon another. Color of scale pale brown; some of scales full and show no foldings, others show a row of pits on each side of longitudinal median line and sides plicate. Some scales have retained their form while others are much shriveled up. The shape of scales, hemispheroidal with sides somewhat depressed. Long. 4, lat. 3, alt. 2.5, μ.

Antennæ 6 and 7 jointed, the basal joint quite stout and globular, the first and second segments bear unusually long hairs, the third segment (when 7 jointed) bears one, the fourth again bears two unusually long hairs. Further chætotaxy and relative dimensions shown in figures.

Legs are slender and might be characterized by the marked constriction at the joints. There is an exception to this, however, in the case of the trochanter and femur. Here the segments are simply marked off by a straight line, no noticeable indentation being apparent on the margins. Tarsus bears two long slender knobbed digitules, claw bears two much shorter and stouter digtules.

Habitat, on plum twigs. This insect was found by the writer among the collections and bore the label "Scale bugs on plum, Kansas." Reference to the lot number showed that these scales were taken by Prof. V. L. Kellogg in 1891. The date of collection was not given but upon twigs there remained some leaves and blossoms so that the time of the year can be satisfactorily determined.

A comparison with descriptions of *L. rugosum* Sig.* shows not "rugose" but plicate, not "hills" but ridges and furrows upon the sides. The plum scales are light brown. Antennæ 6 and 7 jointed, never "eight"; in view of obscurity of segmentation, it is interesting to note that the plum scale agrees with *rugosum* in that 3 exceeds part distad of 3, if 3+4 are one segment as in plate, figure 4 *a*, but if they are as drawn in same plate, figure 4 *b*, joint 3 is less than all distad. Size uniformly smaller than *rugosum*, plum scale elongate, *rugosum* circular. Groove in anterior tarsus not shown; posterior tarsus not wider than tibia; chætotaxy not similar.

With the Queenston scale:†—"legs well developed," trochanter has "one" hair, coxa bears not "one" but two long and two short hairs. Length of femur, tibia and tarsus within possible bounds, but digitules of claw not "long" but short and stout extending but little beyond claw.

No further literature being at hand for comparative study I sent this scale with my notes to Professor Cockerell. He says. "This scale has much in common with *L. armeniacum*, yet seems not quite the same. I wish we knew the sub- adult (living) female and the newly hatched larva." Professor Cockerell kindly sent me specimens of *armeniacum*. A comparison shows, legs similar; antennæ agree with seven segmented specimens except that 5th joint in *armeniacum* is shorter than in plum insect.

The greatest difference appears to be in the scale itself. When bleaching, it colors the fluid a yellowish ochre; the plum scale gives off brownish coloring. Scale of *armeniacum* is not plicate and shows no longitudinal median raised smooth ridge; this insect, *armeniacum*, is more hemispheroidal with side quite full; plum scale more elongate and flattened.

Professor Cockerell suggested that Mr. Theo. Pergande be consulted since he has been working upon these fruit tree Lecaniums.

Accordingly I have received the following from Mr. Pergande through Dr. Howard:

"I have examined and compared the specimens sent with mounted and dry material of *Lecanium armeniacum* in our collection, and have come to the conclusion that the plum scale from Kansas

*Translated by Mrs. T. D. A. Cockerell. Can. Ent. Vol. 27. p. 59.
†T. D. A. Cockerell. ibid, p. 60.

is identical with the above species. With regard to the difference in length of one or the other of the antennal joints, as noticed, I will say that it is simply individual variation; even in the same specimen the comparative length of either of the joints of both antennæ varies frequently more or less. There is generally also a more or less perceptible variation in size, color and shape in the same species, dependent, in a measure, on the food plant on which it may have established itself, and also on the locality. Old specimens, which have attained their full growth and have died a natural death, are generally darker, if prepared for the microscope, than younger individuals of the same stage and with all the pores of the germ much more distinct. As to the shape of the individual scales and their sculpturing, I find in our material of typical specimens of *Lecanium armeniacum* the same variations as those mentioned."

The limitation of variations within a species never fails to be of interest. With a view to setting these forth in this species the following data are given concerning the antennæ:

After examining the antennæ of 19 bleached insects from plum by means of a $\frac{1}{12}$ oil immersion objective, it was found that four of this number bore 7 jointed antennæ, two showed faint trace of suture between 3 and 4 (of the 7 jointed variety) and thirteen bore distinctly 6 segmented antennæ, 3 and 4 appearing as one and about equal in length to 3 + 4 of the 7 segmented antennæ. Measurements of antennæ of representative insects will show these variations in detail.

A brace is used to show that the two antennæ belong to the same insect. In this connection it is well to note the variations in number of segments within the individual as shown in the cases of *f* and *i*.

<table>
<tr><th>Lot No. of Specimen.</th><th>1st</th><th>2d</th><th>3d</th><th>4th</th><th>5th</th><th>6th</th><th>7th</th></tr>
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Antennæ of *L. armeniacum** on prune, from Healdsburg, California (Ehrhorn).

m	48	40	56	48	20	16	40
	36	40	48	46	16	20	40
n	48	40	56	52	20	24	40
	36	40	52	56	20	24	40

Lecanium hesperidum L. Plate XVI, Figs. 1, 2, 3.

Habitat. In conservatories on *Abutilon* sp. and *Citrus* sp. In green house on *Citrus* sp., *Hedera helix* and *Nerium oleander*.

This species was found on trunk, branches, leaves and fruit of the citrus trees. The scales upon the trunk are darker and more convex than those on branches. Those on branches and leaves incline to be yellowish, while those on the trunk are grayish. The outlines of both remain the same (Plate XVI, Fig 1) except when modified by mid rib or by bordering on branch.

The scales on ivy and oleander are uniformly darker than orange scales; some of them are amber colored. The marginal outline is ovate, cephalic half being the wider. These scales are also more convex than the orange scales, and show on dorsum in some cases the figure H, the transverse bars joining the marginal spikes.

Antennæ, legs and nymphs of all these scales agree in structure.

The subject of tesselation naturally arises in this connection. Considerable attention has been paid to the bleached derm. The results obtained, however, have not been constant. With the aid of favorable reagents and suitable stains it is hoped that some definite data may be secured which will admit of something being said upon this point at a later date.

Lecanium coffeæ Walker. Plate XVI, Fig. 4.

Habitat. On sword fern, *Pteris* sp., green house, Lawrence.

Lecanium oleæ Bernard. Plate XVI, Fig. 5.

These scales differ in number and relative sizes of segments of antennæ as compared with Comstock's description in U. S. Ag. Rep., 1880, p. 336.

*Since the above went to press I have received the following concerning *L. armeniacum* on prune from Mountain View. California (Ehrhorn): "Antennæ (1) 47, (2) 28, (3) 45, (4) 59-62, (5) 18-19, (6) 20, (7) 45. One antenna appeared to have only six segments, 6 measuring 42 micro-millimeters. The legs were not obtained in good condition but the coxa is 90, the femur with trochanter 145 micro-milimeters." Cockerell and Parrott, Industrialist. April. 1899, p. 233.

An examination of five of the Healdsburg prune *armeniacum* gave cephalic leg—coxa 88, tr. 52, fem. 104, tib. 100, tar. and cl 76; meta-thoracic leg—coxa 96-104, tr. 56, fem. 128, tib. 120, tar. and cl 84.

Habitat. on *Nerium oleander*, green house, Lawrence.

Professor Cockerell notes upon this species: "The typical antenna has 8 segments. These examples vary in the direction of *L. mirandum*, Ckll. and Parrott, ined., from Tlacotalpan, Mexico, and a study of them, together with other material, has led me to be of the opinion that *mirandum* is, after all, only one of the forms of *oleæ*."

Lecaniodiaspis (?) **parrotti nov. sp.** Plate XVII, Figs. 4, 5.

Turtle shaped back resembles somewhat the carapace of *Chelydra serpentina*. 7 tubercles compose median carina, the second the longest, then graduated dorsad, radiators extend down and out from tubercles. Ribs on dorsum apparent, corresponding in number, position and size to the median tubercles. Ribs bear distinct elevations midway between carina and margin of body, and where ribs meet margin are to be seen protuberances corresponding in size to the median tubercles.

Marginal outline forms an oval; cephalic margin bears three small tubercles, the median pointed, the ones on each side obtuse, the three being nearly equal in size. At the caudal extremity of longitudinal median carina is a prominent quadrangular structure, extending caudad from margin of the body.

Thickness of body 1.1 μ., margin of dorsum elevated from bark .4 μ. Dorsum and side wine colored, covered in places by grayish white, derm of body wrinkled, waxy secretion apparent under ventrum.

Described from one specimen *in situ* on *Aesculus glabra*, and named in honor of Mr. P. J. Parrott of the State Agricultural College. Taken 4 miles west of Lawrence, February 9, 1899.

This specimen was opened and within there was found the pupa of a parasitic hymenoptera, which in its development had destroyed the larger part of the body of the insect, so that it could not be ascertained whether the antennæ were present, rudimentary or absent. It is therefore placed provisionally in *Lecaniodiaspis*. The segmentation and chitinization of ventrum of that part of the body examined resembled the same portion of the body of *pruinosus*. The scale itself is quite characteristic and will, I believe, be readily recognized from the two figures accompanying this description. In this connection it is fitting to record that Professor Cockerell wishes to say that in his opinion *Lecaniodiaspis artemesiæ* Ckll should be transferred to *Solenococcus* as *Solenococcus artemesiæ* Ckll.

Lecaniodiaspis celtidis Ckll., sub. sp. **pruinosus** sub. sp nov. Plate XVII, Figs. 1, 2.

Female: long. 4, lat. 3, alt. 1, μ. Median carina and interrupted transverse ridges distinctly seen in younger specimens, less apparent on dorsum of old scales. Scales slightly convex, sides of dorsum arise from bark of host. Color pale ochrous with frosty white covering. The color and shape resemble *celtidis* but in *celtidis* the frosting is coarser and *celtidis* does not show median carina or segmentation on dorsum.

Anal margins bearing hairs, two bristles prominent on tips of each anal plate. Antennæ eight jointed, joints distinct, measurements and chætotaxy shown in figure.

Ventrum distinctly segmented showing chitinized plates transverse and longitudinal. Mouth parts prominent, setæ 1.48 mm. long.

Antennæ 8 jointed, basal joint, 36; 2d, 24; 3d, 36; 4th, 40; 5th, 40; 6th, 28; 7th, 24; 8th, 20.

Habitat on bark of *Ulmus americana*, Lawrence, April, 1898.

I have not seen the original description of *L. celtidis* Ckll. but I received some time ago specimens of *celtidis* from Prof. Cockerell, and have made therefrom a sketch of the antenna for comparison. Antenna of *pruinosus* is eight segmented; the basal segment bearing one minute hair, the second has two prominent hairs, third and fourth joints naked; fifth, six and seventh bearing each one hair; the terminal segment carries seven bristles. The whole member is short and stout. The eight jointed antenna of *celtidis* is longer, more slender, and bristles were observed on the second, fifth and terminal joints, the terminal joint bearing eight. The differences in length of respective segments are shown by the measurements attending. The characteristic structures of the scales, as before stated, are distinctions of moment.

The genera, *Chionaspis* and *Pulvinaria* will be discussed in the next paper upon this subject.

Author's edition, published April 12, 1899.

PLATE XIII.

Fig. 1. *Lecanium macluræ* nov. sp. on osage orange. Adult female on center of twig, immature female on side of twig. Enlarged six times.

Fig. 2. *Lecanium macluræ* nov. sp. Antenna, prothoracic leg, mesothoracic leg, and metathoracic leg of adult female. Claws of pro- and mesothoracic legs enlarged beneath respective members. Two digitules of claw seen only in mesothoracic leg. Enlarged about 125 times.

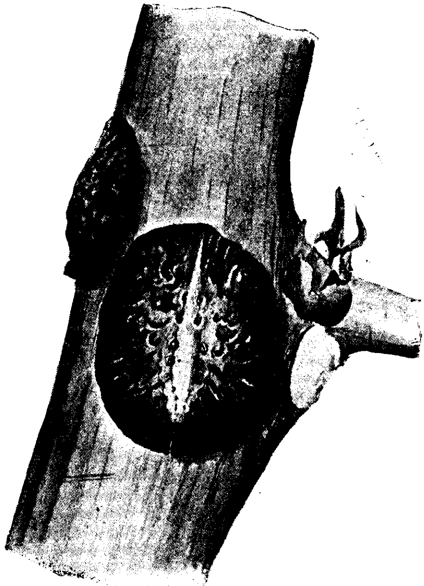

Fig. 1.

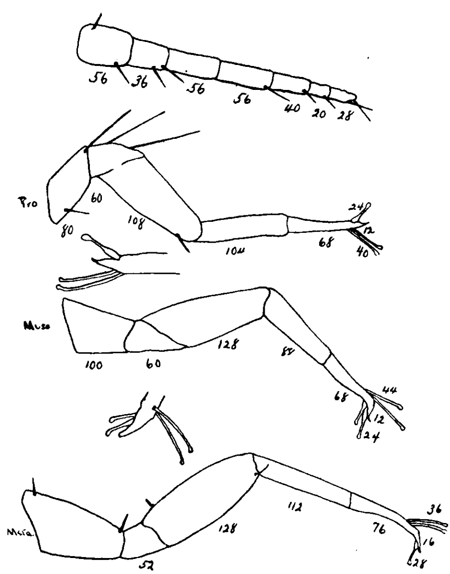

Fig. 2.

Ella Weeks, del. ad nat.

PLATE XIV.

Fig. 1. *Lecanium canadense*, Ckll. on *Ulmus americana*. Dorsal view of female. Enlarged ten times.

Fig. 2. *Lecanium canadense*, Ckll. on *Ulmus americana*. Lateral view of female. Enlarged ten times.

Fig. 3. *Lecanium canadense*, Ckll. Antenna, and metathoracic leg of female. Enlarged about 125 times.

Fig. 4. *Lecanium kansasense*, nov. sp. Dorsal view of female, on *Cercis canadensis*. Enlarged six times.

Fig 5. *Lecanium kansasense*. Antenna and leg of female. Enlarged about 125 times.

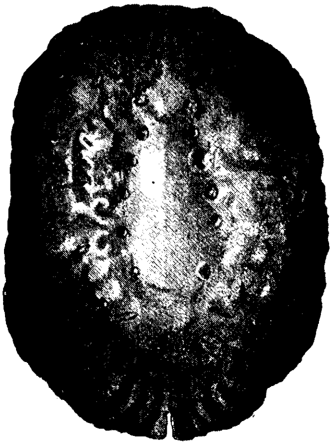
Fig. 1.

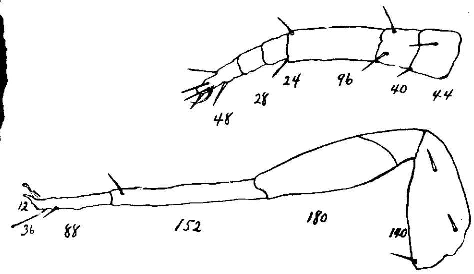

Fig. 3.


Fig. 2.


Fig. 4.

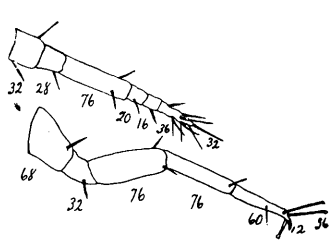

Fig. 5.

Ella Weeks, del. ad nat.

PLATE XV.

Fig. 1. *Lecanium cockerelli*, nov. sp. Dorsal view of female on *Ulmus americana*. Enlarged 12 times.

Fig. 2. *Lecanium cockerelli*, nov. sp. Antenna and leg of female on *Ulmus americana*. Enlarged about 125 times.

Fig. 3. *Lecanium cockerelli*, nov. sp. Antenna and leg of female on *Juglans nigra*. Enlarged about 125 times.

Fig. 4. *Lecanium armeniacum* Craw. *a*. Antenna of female bearing six joints; *b*, antenna of female bearing seven joints; *c*, leg of female.

Attention is called to the fact that bristle extending from the distal end of joint 3, in the seven-jointed variety, was not found in any of the 13 specimens examined of the six-jointed variety, extending as would be expected from the middle of the long 3d segment. The long 3d segment always bore hairs at distal end and nowhere else.

Fig 1.

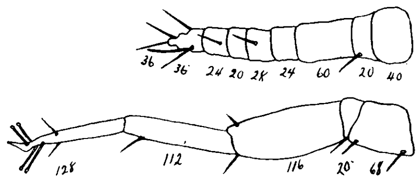

Fig 2.

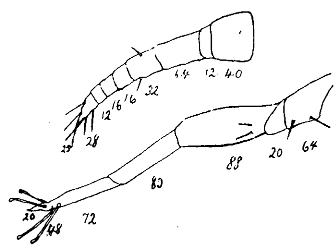

Fig. 3.

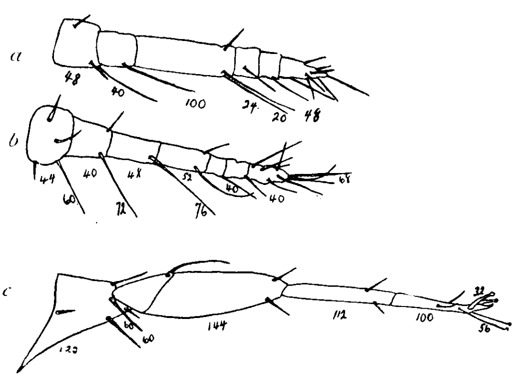

Fig. 4.

Ella Weeks del. ad nat.

PLATE XVI.

Fig. 1. *Lecanium hesperidum* L. Dorsal view of female on *Citrus* sp. Enlarged 15 times.

Fig. 2. *Lecanium hesperidum* L. *a.* Antenna of female on *Citrus* sp. Enlarged about 125 times. *b.* Antenna of female as delineated by Berlese (Tracing sent by Professor Cockerell).

Fig. 3. *Lecanium hesperidum* L. *a.* Antenna of female. *b.* Antenna of female drawn to show difference in sizes. *c.* Leg of female. On *Hedera helix.* Enlarged about 125 times.

Fig 4. *Lecanium coffeæ* Walker. Antenna and leg of female.

Fig. 5. *Lecanium oleæ* Bernard. Antenna and leg of female, 5th joint not always distinct. On *Nerium oleander.* Enlarged about 125 times.

Fig. 1.

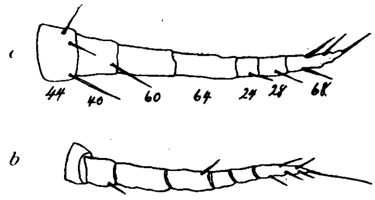

Fig 2.

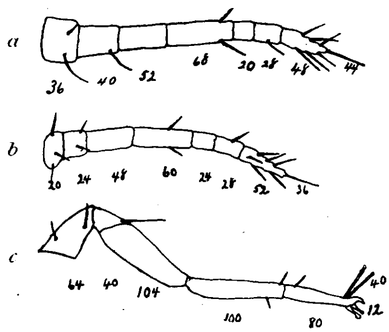

Fig. 3.

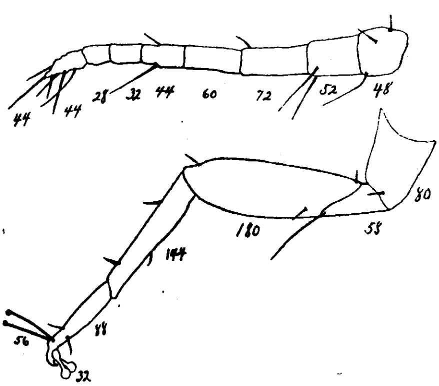

Fig. 4.

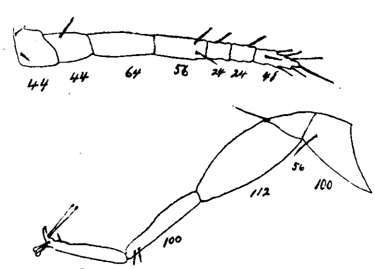

Fig. 5.

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PLATE XVII.

Fig. 1. *Lecaniodiaspis celtidis* Ckll , sub. sp. *pruinosus* sub. sp. nov. Dorsal view of female on *Ulmus americana*.

Fig. 2. *Lecaniodiaspis celtidis* Ckll. sub. sp. *pruinosus* sub. sp. nov. Antenna of female. Enlarged about 125 times.

Fig. 3. *Lecaniodiaspis celtidis* Ckll. Antenna of female. Enlarged about 125 times.

Fig. 4. *Lecaniodiaspis* (?) *parrotti*, nov. sp. Dorsal view of female on *Aesculus glabra*. Enlarged 12 times.

Fig. 5. *Lecaniodiaspis* (?) *parrotti*, nov. sp. lateral view of female. On *Aesculus glabra*. Enlarged 12 times.

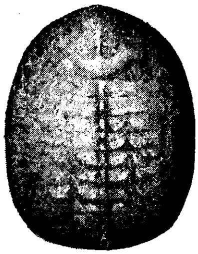

Fig 1.

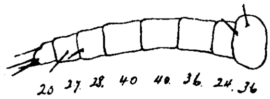

Fig. 2.

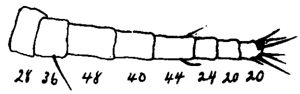

Fig. 3.

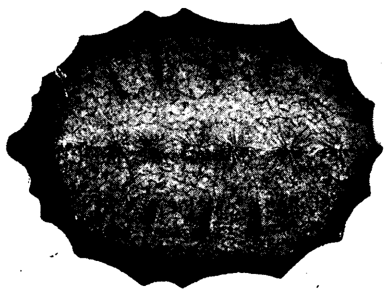

Fig. 4.

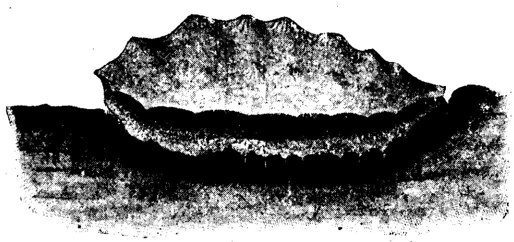

Fig. 5.

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