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Contents of Volumes III and IV

Volume III, Number 1

Essig, E. O.
The Use of Sodium Cyanide, 385-389

Essig, E. O.
The Natural Enemies of the Citrus Mealy Bug III, 390-397

Davidson, W. M.
Notes on Some Aphididæ Taken in Placer County, 398-399

Essig, E. O.
Aphididæ of Southern California V, 400-403

Essig, E. O.
Notes on Coccidæ VI, 404-411.

Banks, Nathan
The Phalangida of California, 412-421.

Crawford, D. L.
American Psyllidæ III (Triozinæ), 422-453.

Grinnell, Fordyce
West Coast News Notes 454-455.

Volume III, Number 2

Essig, E. O.
Host Index to California Plant Lice, 457-468.

Essig, E. O.
Notes on Coccidæ VI, 469

Chamberlain, R. V.
The Chilopoda of California II, 470-479.

Crawford, D. L.
American Psyllidæ IV, 480-503

Hall, H. V. M.
Studies in Acarina I, 504-510

Coolidge, K. R.
Notes on Rhopalocera, 511-514

Volume III, Number 3

Messenger, C. B.
A Commissioner Makes Good, 515-517

Essig, E. O.
The Natural Enemies of the Citrus Mealy Bug IV, 518-522.

Essig, E. O.
Aphididæ of Southern California VII, 523-557.

Smith, J. B.
Noctuidæ of California III, 558-567

Distant, W. L.
A New Species of Cicadidæ, 568

Stout, V. R.
A New Subterranean Freshwater Amphipod, 569-571

Stafford, B. E.
A New Subterranean Freshwater Isopod, 572-575

Cook, A. J.
Three Alarming Insect Pests, 576-577

Grinnell, Fordyce
West Coast News Notes, 578-579

Volume III, Number 4.

Essig, E. O.
Aphididæ of Southern California VIII, 586-603

Essig, E. O.
Natural Enemies of the Citrus Plant Lice, 604-616

Essig, E. O.
Remedies for Plant Lice on Citrus Trees, 617-619

Kuwana, S. I.
The White Flies of Japan, 620-627.

Crawford, D. L.
American Psyllidæ V, 628-632.

Banks, Nathan
The Pseudoscorpions of California, 633-640.

Hall, H. V. M.
Studies in Acarina II, 641-648

Volume IV, Number 1

Chamberlain, R. V.
The Chilopoda of California III, 651-672.

Schrader, Wilhelm
Inbreeding of Junonia coenia under High Temperature through Twenty-two Successive Generations, 673-677

Bernhauer, Max
Zur Staphylinidenfauna von Nordamerika 5. Beitrag, 678-683

Crawford, D. L.
A Note on Certain Psyllidæ, 684

Grinnell, Fordyce
West Coast News Notes, 685-686.

Volume IV, Number 2

Crawford, D. L.
The Petroleum Fly in California, 687-697.

Essig, E. O.
Aphididae of Southern California VIII, (IX) 698-745.

Dyar, H. G.
Some Lepidoptera from Mexico, 746-748.

Hall, H. V. M.
Studies in Acarina III, 749-751.

Felt, E. P.
Diarthronomyia californica, 752.

Volume IV, Number 3

Felt, E. P.
The Gall Midge Fauna of Western North America, 753-757.

Essig, E. O.
Aphididae of Southern California X, 758-797.

Kell, D.
The "Longulus" Scale, 798-800.

Schrader, Wilhelm
Cool Air Experiments with Junonia coenia, 801-806.

Bryant, H. C.
Some Insects and Other Arthropods in the Diet of the Western Meadowlark, 807-809.

Hilton, W. A.
Sensory Setæ of Tarantula and Some of its Relatives, 810-817.

Longstaff, C. B.
Butterfly Hunting in Many Lands (Book Review), 818.

Grinnell, Fordyce
West Coast News Notes, 819-820.

Volume IV, Number 4

Weinland, H. A.
The Cosmopolitan Habits of the Fruit Fly, 821-825.

Essig, E. O.
Host Index to California Plant Lice, II, 826-828.

Alexander, C. P.
The American Species of Adelphomyia Bergroth, 829-831.

Hilton, W. A.
A Preliminary Study of the Central Nervous System of Spiders, 832-836.

Cole, F. R.
Notes on the Diptera of Laguna Beach, 837-840.

Bacon, Gertrude
Some Collembola of Laguna Beach, 841-845.

Shorter Articles and Important Literature of the Past Year, 846-865.

Grinnell, Fordyce
West Coast News Notes, 866.

Index to Volumes III and IV

Acarina, 504, 641, 749.
Acronycta cyanescens, 563.
  felina, 562.
  frigida, 563.
  hastulifera, 562.
  hesperida, 562.
  lituratа, 564.
  marmorata, 564.
  mansueta, 563.
  noctivaga, 565.
  othello, 565.
  pacifica, 563.
  perdita, 565.
  quadrata, 564.
  tritona, 564.
Adelphomyia, 829.
  americana, 829.
  cauga, 831.
Aesthma, 859.
Alfalfa weevil, 848.
Alexander, C. P., 829.
Aleyrodes aucubae, 625.
  akebiae, 622.
  camelliae, 625.
  citri, 621.
  curyae, 625.
  giffardi, 621.
  marlatti, 623.
  spinosus, 625.
  shizuokensis, 621.
  taonabae, 623.
  tokyonis, 622.
Allograpta obliqua, 613.
Allotrioza arbolensis, 444.
  magnoliae, 445.
Amphopod, fresh water, 570.
Anethops occidentalis, 475.
Anthobium fenyesi, 679.
  orientale, 678.
Aphalara artemisiae, 496.
  artemisiae augustiphennis, 499.
  calthae, 495.
  communis, 499.
  communis netzarta, 499.
  maculipennis, 495.
  minutissima, 500.
  nebulosa, 502.
  nebulosa americana, 503.
Aphididae, 398, 400, 457, 523, 586, 698, 758, 820.
Aphidius testaceipes, 614.
Apis brassicae, 399, 523, 698.
  caryella, 764.
  caenothi, 523.
  citrifolii, 592.
  cookii, 587.
  glossypii, 590.
  hirsuti, 525.
  lutescens, 399, 401.
  maidis, 790.
  medelicagnis, 527.
  nerii, 530.
  platanoides, 759.
  rudbeckiae, 400.
Arenophilus bipuncticeps, 658.
Arrup pylorus, 654.
Arrochia californica, 679.
Asphondyliarae, 755.
Atissa pygmaea, 838.
Atwood, G. W., 847.
Bacon, Gertrude, 841.
Banks, N., 413, 633.
Bernhauer, M., 678.
Blothrus californicus, 640.
  magnus, 640.
Bolitobius arizonensis, 681.
  californicus, 680.
  elefas, 681.
  nepigonensis, 681.
Brazilian membracid, 864.
Brewster, W., 848.
Bryant, H. C., 807.
Callipterus quercus, 399.
Carbolic acid emulsion, 405.
Carsidara concolor, 484.
  gigantea, 486.
  mexicana, 487.
  rostrata, 486.
Carsidarinae, 481.
Campodeidae, 860.
Chartophorus nigrae, 398.
  populifoliae, 399.
  salicicola, 532.
Chamberlin, R. V., 470, 651.
Chelanops acuminatus, 638.
  dorsalis, 638.
  oblongus, 638.
  pallipes, 638.
Chelifer cancroides, 637.
  fuscipes, 637.
  scubrisulis, 637.
Chilopoda, 470, 651.

Chordotonal organs, 853, 856.
Chrysopa californica, 604
Chrysoplatycerus splendens, 521.
Cicadidae, 568.
Citrus mealy bug, 390, 518.
Coccidae, 404, 468
Coccinella abdominalis, 608.
californica, 607.
Cole, T. R., 837.
Coolidge, K. R., 511.
Cook, A. J., 576, 581.
Crawford, D. L., 422, 480, 628, 687.
Cryptops hyalinus, 476.
Cynorta bimaculata, 415.
Currant fly, 850.
Damaeus cephalotus, 504.
Daniels, N. W., 849.
Dasyneuriariae, 754.
Davidson, 398.
Dendrolasma mirabilis, 418.
Diarthronomyia californica, 752.
Disease and insects, 849.
Distant, W. L., 568.
Dolichopus bakeri, 839.
Doxocopa coeles, 510.
Dyar, H., 746.
Dytiscus, 850.
Ecology of Dragon-fly nymphs, 859.
Elchochaitophorus populifolii, 722.
Ephelmus arizonensis, 680.
Epicarsa corniculata, 488.
Epidosariae, 754.
Epitrioza medicaginis, 452.
oaxacensis, 453.
Eriococcus adenostomae, 408.
Euchloe sara, 513.
Fulcanium prunosum, 404.
Eumaeus atala, 512.
Eurybunus brunneus, 419.
spinosus, 419.
Essig, E. O., 386, 390, 400, 404, 457, 468, 518, 523, 586, 604, 617, 698, 826.
Essigella californicus, 780.
Eyes of Dytiscus, 852.
Felt, E. P., 752, 753.
Fossil Coleoptera, 861.
Fullawaya saheiradicus, 735, 737.
Fungus gnats, 860.
Galls, 852.
Gall midge fauna, 753.
Garypus californicus, 635.
Geophilus nasutus, 658.
regnans, 657.
rubens, 656.
Gingla phomicoruma, 748.
Gipsy moth, 847.
Globipes spinulatus, 420.
Gnathomeremum melanonotum, 661.
Gosiphilus bakeri, 672.
laticeps, 672.
minor, 672.
Grinnell, F., 454, 578, 685, 820, 866.
Guernsey, M., 859.
Hall, H. V. M., 504, 749.
Halteres, 853.
Head glands, Orthoptera, 858.
Hercostomus occidentalis, ——.
Hermannia hieroglyphica, 647.
Hilton, W. A., 810, 818, 832, 853.
Hippodamia convergens, 607.
Hoplocerma capitata, 508.
Hyadaphis pastinacae, 534.
Hylecoetus dermestoides, 862.
Hyperaspis lateralis, 519.
Ideobisium magnum, 639.
threveneti, 639.
Ideoroneus obscurus, 639.
Ideopterus nephrelepidis, 538.
Infantile paralysis, 849.
Isopod, 573.
Isotoma bidenticulata, 842.
besselsii, 843.
Honidinariae, 756.
Junonia coenia, 673, 801.
Kell, D., 798.
Kuwana, 621.
Lachnus dentatus, 398.
juniperi, 541.
pini-radiatae, 398.
Laemia, 858.
Lascophthicus pyrastri, 611.
Leg muscles, 857.
Lepidoptera from Mexico, 746.
Lepidosaphis gloverii, 406.
Leptobunus californicus, 420.
Leuronychus pacificus, 420.
parvulus, 420.
Lestremiinae, 753.
Limotenia laevipes, 659.
Liobunum bimaculatum, 421.
exilipes, 421.
Live Oak insects, 850.
Lohmannia spinosa, 645.
Longipeltina bakeri, 682.
"Longulus" scale, 798.
Loxostege aulocratoralis, 747.
Lycaena hilda, 512.
Macrosiphum albifrons, 543.
californicum, 399.
frigidae, 546.
laevigatae, 548.
rosae, 399, 550.

Meadowlark, diet, 807
Mecistocephalus anomalus, 653
limatus, 653.
Melitaea colon, 510.
Melanoxantherium rufus, 786
Membracidae, 864
Micrella monelli, 717
Mimanomma spectrum, 864
Monella californicus, 767
Myriapoda, 860.
Myzocallis alni, 764
Myzus persicae 598.
Nemastoma modesta, 417.
Neotrioza immaculata, 450.
laticeps, 451
Nitopus californicus, 420
Notaspis bilamellatus, 505
nuda, 640.
pectnate, 749
Notobus inermis, 671
teniopsis, 670.
Obisium macilentum, 639
Oligotrophiariae, 755.
Oribata alata californica, 643
humida, 643.
latincisa gigantea, 508.
Orthezia artemisiae, 469.
Ortholasma pictipes, 417.
rugosa, 417.
Otocryptops gracilis, 473.
mundus, 473.
sexspinosus, 473
Papilio mylotes, 513.
Paraliodes encurvata, 646.
Paratrioza cockerelli, 448
maculipennis, 450.
ocellata, 447, 628
Pectiniunguis americanus, 668
heathi, 668
heathi catalinae, 669
montereus, 668
Pelopsis nudiuscula, 508.
Pemphigus californicus, 700.
fraxini-dipetalae, 553.
populicaulis, 708
populimonilis, 398, 704.
populitransversus, 398.
Pepper tree caterpillar, 846.
Perla, 858
Perrin, C. A., 848.
Petroleum fly, 687.
Phalangida, 412.
Phlegmacera occidentalis, 417.
Phthiracarus contractilis, 751.
retraltiens, 750.
Plant lice, host index, 457, 820
Pleonectyptera cuernavacalis, 746
Proterinus densipens, 678
Protolophus
singularis, 419
tuberculatus, 419
Porotopace carolina, 858
Pseudoscorpions, 633
Pseudogarypus bicornis, 637
Psilopa petrolei, 687
Physlla alni trimaculata, 631.
americana, 628
Psyllidae, 422, 480, 628
Psyllopa floridensis, 629
iheis, 632
magna, 629
rubesiae, 630
Ptychoglene haematodes, 746.
Receptulum semins, 857
Rhopalocera, 511
Rhinopsylla antennata, 441
antennata proxima, 442
jalapensis, 490
Rhizobius lopanthae, 518
Rhizoglyphus longitarsus californicus, 751.
Rhopalosiphum nymphaeae, 793
Rhopalosiphum dianthi, 399.
Sensory system of insects, 855.
Sensory setae, 855.
Schrader, W., 673, 801.
Schizoneura queri, 398.
Sclerobunus brunneus, 416
robustus, 416.
Scolopendra dihaam, 478.
heros, 478
morsitans, 479
polymorpha, 478
Scolopocryptops miersii, 475.
Scotolemon californica, 416
Scymnus sordidus, 520, 610.
guttulatus, 395.
Siphocoryne conii, 399.
Smith, J. B., 558
Somphilus secundus, 665
Spider book, 863.
Spider's nervous system, 832
Spider webs, 862.
Stafford, B. E., 573
Staphylini denfauna, 679
Static organs, 855.
St. Clair, R. E., 851
Sitalces californicus, 415.
Stigma of bugs, 858
Sting of ants, 857.

Stout, V. R., 570
Symdobius salicicorticis, 731
macrostachyae, 727.
Syrphus americanus, 612
Tabiphilus rex, 665.
Taiajuna claremontus, 662.
occidentalis, 661
Tampiya pylorus, 655.
Tampyidae, 654
Taracus pallipes, 416
spinosus, 416
Terias linda, 511.
Tarantula, 810
Termites, 850.
Theatops erythrocephalus californiensis, 472.
Thecla sunaethis, 513.
Thomasia crucis, 741.
Thorax of insects, 857.
Toxoptera aurantiae, 601
Trioza albifrons, 438.
assimilis, 438.
aurantiaca, 628
frontalis sulcata, 436.
longi stylus, 434.
mexicana, 439.
mexicana minuta, 440.
minuta, 432.
minuta similis, 433.
montana, 631.
nicaraguensis, 436.
proximata, 435.
quadripunctata, 433.
salicis, 432.
similis fovealis, 438.
tripunctata, 430.
varians, 628
Triozinae, 422
Trizoida californica, 492.
johnsonii, 492.
Tuberolachnus viminalis, 774.
Vertebrates and their kin, 862.
Watophilus errans, 663.
laetus, 663.
Weinland, H. A., 821.
White ants, 850.
White flies of Japan, 620.
White scale of mulberry, 848.
Yrias prophronis, 747.

VOLUME THREE NUMBER ONE

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Contents

1. ESSIG, E. O. — The Use of Sodium Cyanide
2. ESSIG, E. O. — Natural Enemies of Citrus Mealy Bug III
3. DAVIDSON, W. M. — Aphididae of Placer County
4. ESSIG, E. O. — Aphididae of Southern California V.
5. ESSIG, E. O. — Notes on Coccidae VI.
6. BANKS, NATHAN — The Phalangida of California
7. CRAWFORD, D. L. — American Psyllidae III (Triozinae)
8. GRINNELL, FORDYCE — West Coast News Notes

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Pomona College Journal of Entomology

Volume III FEBRUARY 1911 Number 1

THE USE OF SODIUM CYANIDE

BY E. O. ESSIG
HORTICULTURAL COMMISSIONER OF VENTURA COUNTY

At the middle of the past fumigation season, the fumigators of the southern part of the state, without any advanced warning, were forced to finish up the season with sodium cyanide. To a great many this meant that they were to begin using a substance with which they were totally ignorant. It came as a last resort to those who had not already fumigated, and its use was forced upon them. Personally, I had had no experience with the sodium cyanide, and did not know what serious mistakes might result from its use. It also meant that a new equipment was necessary for measuring the acid and water and that new charts must be printed for fumigators of the county. At once there was a clamor among the smaller fumigators for information concerning the use of the new material. They had no charts and no way of making new ones. The graduates for measuring the acid and water could not be had. In the face of these conditions the fumigators of Ventura County got together and began to find out for themselves the value of sodium cyanide and the best means of using it. Those who led in the work were: Mr. C. E. McFadden, from Fullerton, who had two large fumigation outfits working in this county, The Limoneira Company, and The County Fumigation outfit. Charts were printed, after the recommended dosage had been thoroughly tested. Graduates were made by etching ordinary glass pitchers and the work was delayed only temporarily. In all, more than 20 tons of the sodium cyanide was used with excellent results. Our experience was such as to give us perfect confidence in the use of this material for another year and by some it is preferred to the potassium cyanide.

Believing that others may be interested in what we found out, our combined resultant observations and experiences are briefly stated in this article.

KIND OF CYANIDE USED

The only available cyanide, at the time, was what is known as the 133 per cent sodium cyanide, manufactured by the Roessler & Hasslacher Chemical Co., for sale by the Braun Corporation. I first obtained 400 pounds for trial purposes, and observing no marked differences in it from what we were accustomed to, later ordered large amounts.

PROPORTIONS

We followed closely the directions laid down by R. S. Woglum and so used the chemicals in the following proportions:

Sodium cyanide	1 dry weight.
Sulphuric acid	1½ liquid "
Water	2 " "

Some have recommended using 1 of acid instead of 1½, which will make a little saving, but which we considered too small to again change our apparatus.

SCHEDULES

Sodium cyanide, containing much more available hydrocyanic acid gas, is more powerful as an insecticide than potassium cyanide. The amount is therefore cut down 25% less than the potassium. For a purple scale dosage we cut Woglum's Schedule No. 1 just 25%, and for black scale cut the potassium cyanide purple scale dosage 25%. It simply means that with three-fourths of a pound of sodium cyanide, as much efficiency may be obtained as from a full pound of the potassium cyanide. Accordingly a large number of schedules as per accompanying cut were printed for use in fumigating black scale. (Figure 133.)

VENTURA COUNTY HORTICULTURAL COMMISSIONER
E. O. ESSIG

FUMIGATING SCHEDULE FOR BLACK SCALE
SODIUM CYANIDE
DISTANCE AROUND IN FEET

DISTANCE OVER IN FEET

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48										
10	1	1	1	1	1																						10
12	1	1	2	2	2	2																					12
14	2	2	2	2	2	2	3	3	3	3	3	4															14
16	2	2	2	2	3	3	3	3	3	4	4	4	4	4													16
18	2	2	2	3	3	3	4	4	4	4	4	4	4	5													18
			20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60				
20			2	3	3	4	4	4	4	4	4	5	5	5	5	5	6	6									20
22					4	4	4	4	4	4	5	5	5	5	6	6	6	6									22
24						4	4	4	5	5	5	5	6	6	6	6	7	7									24
26							4	5	5	5	5	6	6	6	6	7	8	8	8	8	8	8					26
28								5	5	6	6	6	6	7	7	8	8	8	8	8	9	9					28
								30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68
30								5	6	6	6	7	7	8	8	8	8	8	8	9	10	11	11	11	11	12	12	30
32											7	8	8	8	8	9	9	9	10	10	11	11	11	11	12	12	13	32
34											8	8	8	8	9	10	10	11	11	11	11	11	12	12	13	13	13	34
36											8	8	8	9	10	10	11	11	11	11	12	13	13	13	14	14	14	36
38													9	9	10	11	11	11	12	12	13	13	13	14	14	14	15	38
													40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
40													9	10	11	11	11	11	12	13	13	14	14	14	15	15	15	40
41														11	11	11	11	12	13	13	14	14	14	15	15	16	16	42
42															11	11	12	13	13	14	14	14	15	15	16	16	16	44
43																12	13	13	14	14	14	15	15	15	16	17	17	46
44																		13	14	14	14	15	15	15	16	17	17	48
																		50	52	54	56	58	60	62	64	66	68	
45																		13	14	14	15	15	15	16	17	17	17	50
46																		14	14	15	15	15	16	17	17	17	17	52
47																		14	14	15	15	16	17	17	17	17	18	54
48																		14	15	15	16	17	17	17	17	18	18	56
49																		14	15	16	16	17	17	17	17	18	19	58

NOTE—Quarter and half ounces are omitted to make the schedule more practical for field conditions
Proportions for mixing chemicals—Sodium Cyanide 1 Sulphuric Acid 1½, Water 2

Figure 133. Sodium Cyanide Schedule for Black Scale.

These schedules are printed on fairly stiff paper so that they may be tacked upon a board for the use of the generator of the outfit. The figures are black and large enough to be plainly seen by the light of a torch or lantern on the darkest night. Half and quarter ounces are omitted, because of the difficulty in reading the small fractions at night and because few scales are fine enough to register so small amounts accurately. All less than half ounces are placed in the lower figure, while half ounces or over are placed in the next higher figure. A more convenient way of fixing up this schedule is to have a cylinder made of zinc, with a narrow slot, the width of a row of figures, covered by a glass, and a wooden roller in the inside, similar to a rolling pin. Each end of the cylinder is closed with a cap with a hole in the center, in which turns the handles of the wooden roller. The chart or schedule is attached to the roller so as to revolve in the cylinder. The figures of the distances around are pasted along the top of the slot to conform with the like numbers on the schedule. In finding the dosage one has only to turn the roller until the distance over shows at the left hand end of the slot, the figure at the top of the slot shows the distance around. In this way, the chart is kept perfectly dry and bright and the possibilities for making a mistake are reduced to a minimum. It is right to state here that this arrangement was first invented by Mr. McFadden, who uses it on all of his chemical charts.

FIELD PRACTICE

The Morrill System of marked tents was, of course, used with the above charts. The distance around the tree was taken with a tape line. It was early learned in our experiences that pacing was unreliable, because every man paced differently and some were very careless about the work at best. It takes very little longer to measure, than pace, and as one man had to be kept at this work it made the expense no greater at all and made no delays.

Five men are used on an outfit of 20 to 30 tents, the duties of which are as follows: 2 tent pullers; 1 taper, who measured the trees around and passed along the empty generators; 1 generator who measured the acid and placed the generators under the tents; 1 cyanide man, who kept the records, weighed the cyanide and held up the sides of the tents for the generator to place the pots in position. *Care must be taken that no man who handles acid touches a tent.* The taper wears a cloth glove, which will absorb anything that might adhere to the handle of the pot.

A complete record of the dosage of every tree is kept, giving not only the dosage, but the temperature and time at the beginning of each throw. This field chart is tacked to a wooden roller, which fits into a zinc cylinder similar to the one used for the chart, except that the slot is open so that the dosage may be written down. This is, I consider, a very important practice, for in cases of burnings or poor work the original dosage, with time, exposure, and temperature are at hand for ready reference. Many otherwise unaccountable damages, have thus been traced to an over dose or a cold period, while an underdose may explain a poor job.

Tents are mended every day with a sewing machine. The patches are sewed on the underside so as not to cover up the numbers. And the seam is not so liable to catch on a limb as the torn canvas under the patch, which is not always sewed down. A full 1 hour or 45 minute exposure should be used, as is the common practice with potassium cyanide.

OBSERVATIONS

Temperature.—In using potassium cyanide we were always very careful not to fumigate when it was between 36° or 40° F. above zero (or lower) because we were always sure to receive severe burnings. Even as high as 42° F. with moisture might prove disastrous. The fruit of the Valencia orange trees has been a source of considerable trouble with us on account of burnings. When it was decreed that we must use sodium cyanide, I was afraid of fumigating a Valencia orchard, so managed to get enough of the potassium to do the work. Every precaution was taken to observe all the rules regarding temperature and moisture, but in spite of everything we burned considerable of the fruit. The same was true in regard to cold and damp nights in our work on lemons. It was a practice with us to quit at 40° F. above zero or when the leaves of the trees became damp enough to strike them and feel the spray hit the hand. In this county there are many foggy and damp nights, which are excellent for the crops, but bad for fumigation. If the bulk of the work was not done during the months of September and October it was found difficult to do it afterwards.

In using the sodium cyanide we found out that the matter of moisture and moderate cold 40° F. did not make any difference at all. In fact many tests were made when the trees were very damp and the thermometer was as low as 37° without a sign of burning. In these tests the regular black scale dosage, as shown, was used. *This information we consider to be very valuable, because it will mean that more work can be done while the crew is in the field and in operation.* Many nights we have been able to work but 2 or 3 hours, and under such conditions it was very difficult to keep a crew in the field at all. This may not have been the experience with all other parties, but was certainly so with all who used it in this vicinity.

Killing Power.—In the matter of efficiency against black scale, I am satisfied that the work done will equal that done by the use of the potassium cyanide. Some five or six hundred acres were fumigated and all results are splendid. There was no guess-work, nothing but intelligent and up-to-date fumigation with marked tents and chemical charts.

Costs. Last fall potassium cyanide, 98 to 99 per cent pure, cost our growers 25½ cents a pound delivered. Sodium cyanide cost 29 cents a pound delivered. The cost per ounce of potassium was approximately 1.593c; that of sodium, 1.801c; or about $.016 for potassium and $.018 for the sodium. The following table will give some idea of the difference in costs:

Cyanide	Tree measurements Over	Around	Ounces of cyanide per tree	Price per oz	Total cost per tree
Potassium	30	50	11	.016	.176
Sodium	30	50	8	.018	144
Potassium	34	50	13½	.016	221
Sodium	34	50	11	.018	198
Potassium	49	62	23	.016	368
Sodium	49	62	17	.018	306

It will be seen that the cost is of enough importance to warrant the buying of the sodium cyanide, providing that it does as good work and will not burn the fruit or injure the foliage. With us it is just as good as the potassium without the injurious qualities and with the additional advantage that it does not burn damp and cold foliage and fruit as readily as does the potassium cyanide.

I understand that the "American" sodium cyanide is much cheaper than the imported brand under discussion. It corresponds more to the potassium cyanide in the amount of available hydrocyanic acid gas available, being what is known as 98-100 per cent. Mr. Woglum made some tests regarding this chemical with the result that he pronounced it unfit for fumigation purposes. Since then Mr. C. E. McFadden, who has had a great deal of fumigation experience in the most practical way, gave this cyanide a trial. He told the writer that he got excellent results with it and I remember quite distinctly that he expressed his desire to get this form of sodium cyanide last fall in place of the European brand. From our experience with the sodium, I can see no reason why the cheaper quality will not do the work. It is at least worth trying, and I think that every progressive fruit grower should look into the matter. The cyanide outlook is not at all encouraging. If a cheaper form can be obtained, so much cheaper as the form under discussion, it should be given a thorough test. Certainly I shall make experiments with it as soon as any quantity of it may be had.

The one objection to sodium cyanide, not mentioned above, is the formation of the sodium or alkali salt from the residue. The residue of the potassium cyanide amounts to several dollars worth of good fertilizer to a ton, which is no little item in a large orchard, while the salt from the sodium cyanide has a negative value and is a distinctly harmful product. It might be advisable to empty the residue in a waste tank and dump it outside of the orchards because of this, but our experience with the cyanide, like that with the nitrate of lime, is so limited as to make any remedial remarks seem unnecessary.

THE NATURAL ENEMIES OF THE CITRUS MEALY BUG III

BY E. O. ESSIG

Cryptogomus orbiculus

This is the latest imported enemy of the citrus mealy bug (*Pseudococcus citri* Risso) which was secured by the California State Horticultural Commission through Mr. Geo. Compere from the Philippine Islands. To date, colonies of this insect have been sent to many localities in this state where the mealy bugs, including both the citrus mealy bug and the long-tailed mealy bug (*Pseudococcus adonidum* Linn.) exist. From articles to be included in the end of this work, it will be seen that great hopes are being placed upon this insect as a means of exterminating the mealy bugs, which are threatening our citrus groves and even the vineyards in Fresno County.

Accordingly, with the rest, I received some of the first colonies to be sent out from the State Insectary. Mr. Geo. Compere brought the adults, pupæ and larvæ, himself into this county and saw them given a proper start in breeding cages equipped for this special work. For six months now I have given this insect my very best attention and believing that others were also interested in it, I am taking this first opportunity to publish the following description, partial life-history, and field notes, together with photographs and drawings which may aid in the identification and recognition of this ladybird beetle and all of its forms, wherever found.

Eggs. The eggs are lemon yellow in color, oblong in shape and are approximately 0.33 mm. in length and 0.11 mm. in width. They are laid singly among the egg-masses of the mealy bugs, in the case of the citrus mealy bug, and among the young in the case of the viviparous form (the long-tailed species). The eggs may then be found upon the leaves, fruit, stems, or even the larger limbs and the trunks of the trees. The individuals I found were just being deposited upon a leaf by a female. Because of their minuteness, it would be difficult to find them except by watching the female as stated. From inside observations it takes these eggs about three weeks or a month to hatch. In the field it would take as long or perhaps longer. It must be remembered, however, that these observations have been made during the winter months, and that during the warm summer weather the eggs would hatch much quicker—between 2 and 3 weeks at the most.

Larvæ (Fig. 134 A). The photograph shows the larva, full grown, with its white cottony protective coating, while the drawing shows the larval body with this coat removed. When first born the young larvæ are yellow and have very little of the cottony covering. As they grow the covering is secreted very rapidly until the entire body is hidden under a snow-white mass of long filaments, which extend from the body in all directions. When disturbed these filaments are thrown in an upright position, but they usually remain spread

out as shown in the photo. With the filaments extended the body averages from 5 to 8 mm. in length and from 3 to 4 mm. in width.

The body proper averages 3.5 mm. in length and 1.1 mm. in width. The color is a rich yellow with a slightly dark blotch on each dorsal side of the prothorax (Fig. 134 A).

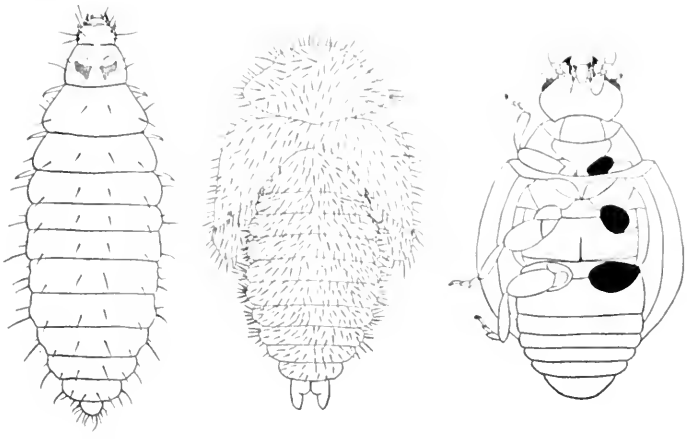

Figure 131. Cryptogonus orbiculus:
A, larva with wooly covering removed; B, pupa; C, adult.

Head.—Narrower than prothorax, but nearly as long. Palpi quite large, antennæ small. Spines long. The mandibles are strong and bifurcate. Prothorax with few spines and a dark blotch on each side of the dorsum. Meta- and meso-thorax normal and slightly longer and broader than the prothorax. Single spines on margins and two on each side of the dorsum, as shown in cut.

Abdomen made up of nine segments with the posterior segment small. There are few hairs as shown in the drawing.

Legs short and slender, but strong. Light in color. Extend beyond the margins of the body when bare, but are not visible in the normal covered form.

The larvæ being so small usually feed upon the eggs and the smallest mealy bugs. Occasionally, however, they may be observed devouring mealy bugs almost as large as themselves. They are quite active and feed rapidly. The appetite is what counts in judging any predaceous insect and this is a very important thing about the insect in question.

When the larva is ready to moult for the last time it selects some hidden place in the crotch of a tree, under a mass of mealy bug eggs, in a dried leaf, or under the surface clods on the ground. Here it attaches itself at the posterior

end and transforms within the cottony case of the larval stage. The form gradually assumes a round shape and in this way the pupæ may be told from the larvæ.

Nymphs or Pupae. (Fig. 134 B). The drawing shows the pupal or nymphal body after it has been removed from the larval case in which it transforms. As is seen it shows the characteristic spines on the body as is shown in the three other members of the Scymnini, all of which are covered with the white cottony wax. The normal covered form of the nymph is about that of pupa, except that it gradually shortens up into somewhat of a spherical form. The body proper averages 2 mm. in length and 1 mm. in width. It requires from three weeks to a month for the insects to pass through this stage, but during the winter they may remain in the pupa cases for several months, if the weather is cold and damp.

It is noticeable that the spines on the lateral margins of the abdomen do not appear on the three last segments, while in *Scymnus guttulatus* they extend to the last segment and in *Cryptolaemus montrouzieri* the same is also true, except that the spines are few on the next-to-the-last segment also.

Adult (Fig. 134 C). The adult insect appears, at first sight, to be black, but upon closer examination it will be found that the background is black with one quite large reddish-brown spot on each elytra as shown in the drawing. The form is elongate oval. Length, 2.5 mm., width, 1.1 mm. The entire body is finely hirsute. *Eyes* hairy. Punctures on elytra finely set. Prothorax narrower than rest of body proper. *Antennae* small, hairy. Maxillary palpi, large. *Labial palpi*, normal. *Mesothorax* and *metathorax* nearly equal in length, the latter slightly broader. *Coxae* not approximate. Trochanters small. Femora large but short, tibia nearly as long as femurs, but much narrower. Tarsi two-thirds as long as tibia. Claw normal. First abdominal segment as long as the second and third.

The adults are most active and difficult to capture in the field. They take to wing as soon as disturbed or crawl in some small crevice with such

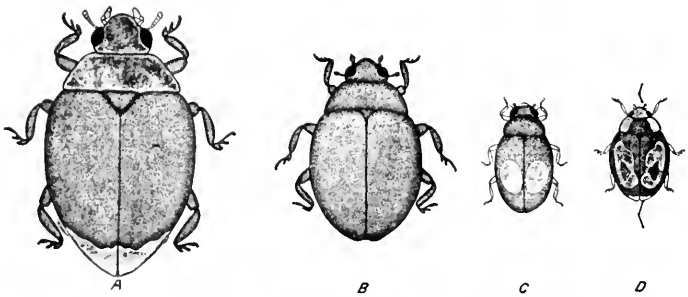

Figure 135. The Ladybird Beetles predaceous on the Citrus Mealy Bug: A, Cryptolaemus montrouzieri; B, Rhizobius ventralis; C, Cryptogonus orbiculus; D, Scymnus guttulatus.

rapidity as to make their capture almost impossible. In the breeding cages they are easily taken by means of a small bottle.

The first colony, numbering 20 adults and 40 larvæ was brought to my office on the 27th day of July, 1910, by Geo. Compere. They were immediately placed in a breeding cage and quantities of food placed at their disposal. The first brood from the larvæ appeared the last of September and in October enough were out to make a liberation in the field. Another increase, in the form of a second brood, appeared in December and a third during the month of January. These broods were not clear cut, but distinct in the emerging of a large number of adults at one time.

To date, January 20th, the following numbers have been removed from the breeding cage:

1910.			
October	17	7	individuals.
"	19	33	"
"	24	43	"
November	23	25	"
"	24	50	"
December	5	12	"
"	15	10	"
1911.			
January	6	30	"
"	20	200	left in cage (Larvæ, pupæ, and adults)

This will give a fairly accurate account of the rate of increase that might be expected of this insect.

The first colonies were placed in the field in October on an isolated infestation of mealy bug. Since then three of the above colonies were also liberated on this tree. A close watch has been kept of the tree. Because of the lateness of the season or unfavorable weather, the insects did not do well in the open. To date none of the larvæ or adults can be found. Perhaps with the coming of summer the infestation of mealy bugs will be entirely cleaned up. I shall not be in a position to give authentic data concerning the field work of this ladybird beetle until next fall, when I shall again record its progress. Suffice it at the present time to give the testimony of others who have written concerning this insect.

Mr. Jeffrey, State Commissioner of Horticulture, has written of it:

"George Compere has just returned to Sacramento from China, Japan and the Philippines, bringing over a large collection of predacious insects and Hymenopterous parasites of the mealy bug. There were fifteen packages in all, many of them inclosing large plants bearing hosts of mealy bugs and their enemies. We have been disappointed so often with these importations that no estimate of the effectiveness of these new beneficial insects will be made. Disappointments, however frequent, do not justify the abandonment of researches of this kind, but the work must be kept on and on as long as there is the slightest hope of results, for in the case of the mealy bug there seems no hope of control by mechanical appliances. This renders

the mealy bug one of the most alarming of all orchard pests, and it is now recognized as a most desperate infection with which to deal. Without predicting success for the Manila importations I may with propriety inform the readers of "The Times" how the new insects behave.

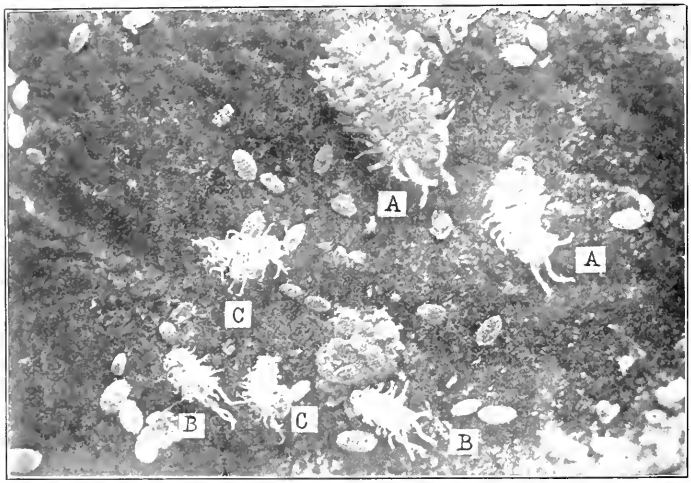

Figure 136. Larvae of the Ladybird Beetles predaceous on the Citrus Mealy Bug: A, Cryptolaemus montrouzieri; B, Cryptogomus orbiculus; C, Scymnus guttulatus.

Last February Compere left for the Orient with millions of mealy bugs upon plants encased for returning to California after the mealy bugs became infected. On his return he was met at Honolulu with a new supply upon which to feed his insects the latter portion of their journey. With all this supply the ladybirds devoured the material and hundreds of them had to be turned out in mid-ocean to conserve the food for the remainder. Compere arrived with about 1000 adults of the species known as *Crytogomus orbiculus*, the kind upon which some hope of success is based. This ladybug is somewhat smaller than the *Vedalia*, equally prolific and voracious. In the insectary at this writing may be seen the adults devouring full-grown mealy bugs and the young burying themselves in the egg masses as did the *Vedalia* twenty years ago with the white scale. I noted the time required by one of the ladybugs to devour a half-grown mealy bug. Five minutes finished the meal. On the bottom of a case of plants was a full pint of the white coverings so noticeable with the citrus mealy bug. All will depend upon the ability of the new insects to adapt themselves to our climatic and orchard conditions; and there we may look for failure, with a possibility that the mealy bug may meet the same fate as did the white scale. At any rate, thousands

of the new importations will be sent out and fair trial given the Philippine insects. They were found twenty miles east of Manila."

Scymnus guttulatus Lec.

In December of the year 1909, I wrote the State Insectary at Sacramento for some predaceous or parasitic insect enemies of the mealy bug. In reply to this request the Acting Superintendent, Mr. E. Maskew, forwarded to me at once colonies of *Scymnus guttulatus* Lec which had done good work on the mealy bug in the central and northern part of the State. The shipments received from the State Insectary are as follows:

Date of shipment.	*No. of Individuals.*	*Liberated*
December 30, 1909	500	In orchard tents
December 31, 1909	300	Breeding cages and in open orchards
January 3, 1910	100	In orchards
January 5, 1910	75	In tent houses built over trees, same as first shipment.

These sendings amounted to 975 individuals, enough to give some idea as to their efficiency in a comparatively short time.

As stated above 575 were liberated in special tent houses built over large trees infested with mealy bugs right in the orchard. Into these tents was kept a bountiful supply of mealy bugs throughout the entire year from Dec. 1909 until January 1911. The remainder were liberated in office breeding cages and in the open. Those liberated outside were lost completely. I have never been able to secure a single specimen of this species in the open.

Those liberated in the tent houses had every opportunity that could be given them. They were protected from the winter and supplied with so many mealy bugs that the trees were greatly injured by their numbers. In spite of the conditions, little or no progress was made. At the end of a year we had taken out less than the number first liberated in the tent houses. They made no progress against the numbers of the mealy bugs at all. In the office they multiplied a little better and quite a number were liberated in the orchards. It might be that they must become acclimated before they are able to do good work, so we are still watching their progress. Several colonies have been sent to other localities, viz. Placentia, Hueneme, and Ventura and it may do better there. It is not out of the limits of this work to include a description of this species.

Eggs.—Very small and deposited singly among the egg masses of the mealy bugs or on the surfaces of the leaves among the young scale insects.

Larvae. (Fig. 137 A and Fig. 136 C). The full grown larvae cannot easily be told from that form of *Cryptolaemus orbiculus*. They are covered with the same appearing, long white cotton filaments. The ventral side is bare and shows the yellow color of the body proper. The length of this species averages 6 mm., the width, 2.5 mm., with the covering and about half these measurements without the covering.

The body proper is a rich yellow, without any black markings whatever. The shape is long and slender; tapering from the middle towards both ends. The head is as wide as the 9th abdominal segment. The 3rd and 4th abdominal segments are the widest. The body becoming narrower more abruptly posteriorly than anteriorly. The legs are rather long and slender. The spines are simple, long, and arranged normally, i. e., on each segment are two laterals, two near the lateral margins, two on the dorsum mid-way from the central axis to the sides. Then there are two pairs of short spines on either side of this central axis, as shown in the drawing.

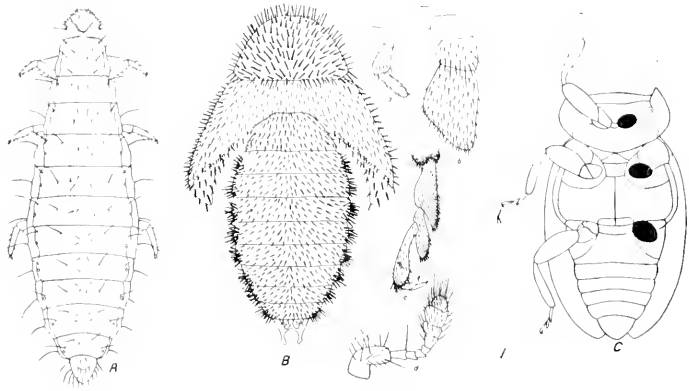

Figure 137. Scymnus guttulatus Lec.
A, larva; B, pupa; C, adult: a, labial palpus; b, maxillary palpus; *c*, tarsus and claw; d, antenna.

The palpi are small and inconspicuous as are also the antennæ.

Nymphs or Pupæ. (Fig. 137 B). The nymphs transform within their larval skins and are hid away in some secluded nook or in a dry curled-up leaf. The form is about the same as that stage of *Cryptogomus orbiculus* already described. Many of this species pupate on the undersides of the clods on the ground and especially among the fallen leaves. In collecting the adult forms with a sheet we found that more were to be had by disturbing the leaves and catching the emerging adults on the underside of the sheet, rather than jarring them from the trees.

The pupæ are 2 mm. in length and 1 mm. in width. The posterior abdominal segment has a very characteristic pair of appendages which are shown in the drawing. There seems to be a marked difference in these supporters among the various forms already noticed. As has been stated they are known as the anal forks. The forks serve to hold the nymph in the skins of the larvæ.

The entire body is thickly covered with stout spines, which are largest on the lateral margins of the abdominal segments.

The color is the same as that of the leaves at first and gradually assumes the shade of the adult as it becomes transformed into that stage.

Adult. (Fig. 135 D and Fig. 137 C). The following brief principal characters of this species are given by Casey as follows:

"Black throughout, broadly oval, the legs piceous, each elytron with two transverse discal spots which are almost, or completely divided, each into two small pale spots, the outer of which are the more linear and oblique; punctures fine and close set, the pubescence rather coarse, cinereous and conspicuous but easily denuded. Length 1.8 mm., width 1.2 mm. Abdominal lines extending outward externally parallel to the edge of the segment and at a slight distance therefrom; prosternum relatively slightly wider between the coxæ, flat and wholly devoid of carinæ; genital or sixth ventral segment usually developed." Jr. N. Y. Ent. Soc., Vol. VII, pp. 139, 155, 1899.

The palpi and antennæ (Fig. 137 a, b, d) are large and very hairy. The tarsi are well developed and covered with numberless hairs.

The adults are very active, and difficult to find in the field. This form is liable to be confused with a native species *Scymnus sordidus* Horn, which is plentiful in Southern California and which also feeds upon the mealy bugs. The former is nearly black, with the brownish red markings, while the latter appear reddish-brown throughout or even paler.

I have not been able to find any economic treatment of this insect in entomological literature, and am inclined to believe that it is of little importance as an enemy of the citrus mealy bug, though it may be an excellent predator on other insects.

NOTES ON SOME APHIDIDÆ TAKEN IN PLACER COUNTY

BY W. M. DAVIDSON

During the month of August, 1910, I was at Penryn, in western Placer County, and was able to spend some time in observing and collecting plant lice in that region. Penryn is in the heart of the Placer County deciduous fruit district, but curiously enough I was unable to find any aphids on fruit trees, although there was abundant evidence—especially on plums and apples—of their presence earlier in the year. I suspect *Aphis pomi* De Geer, and *Hyalopterus arundinis* Fabr. were abundant in the spring. Several fruit growers affirmed that they had been numerous about leafing time. Doubtless Syrphus larvæ—I observed a strong Syrphid fauna—and ladybird beetles had done their work. The flora of this region is that of the Sierra foothills. Among the trees most commonly met with are *Pinus Sabiniana* Dougl., *Quercus lobata* Née, *Quercus wislizenii* A. DC., *Populus fremontii* Wats., several species of *Salix*, and *Alnus rhombifolia* Nutt.

Schizoneura querci Fitch

A wooly Schizoneura on both leaves and twigs of *Quercus wislizenii* A. DC., the valley live oak. The species is abundant and is evidently the same as that found on *Quercus agrifolia* in the Santa Clara Valley. The specimens agree fairly well with Fitch's species, but this may be a different species.

Lachnus dentatus Le Baron

I found this insect on the narrow-leaved willow (*Salix fluviatilis* Nutt.). It is not common.

Lachnus pini-radiatae Davidson

This is a scarce species and occurs on the needles of *Pinus Sabiniana* Dougl.

Pemphigus populimonilis Riley

This and the next species were observed in abundance on *Populus fremontii* Wats.

Pemphigus populitransversus Riley

A late and apterous form in the galls.

Chaitophorus viminalis Monell

Abundant on *Salix spp.* I saw some trees which were blackened all over by fungi feeding on the honey-dew exuded by this insect.

Chaitophorus nigrae Oestl(?)

This is the same species that occurs in Santa Clara County, and which I listed as doubtful under Oestlund's species in the Journal of Economic Entomology, Aug. 1910. I found no winged specimens. The apterous female

(vivipara) is dark brown with a median dorsal yellow line. It has the hairs and other characteristics of the genus Chaitophorus. On *Salix* spp.

Chaitophorus populifoliae Fitch

The specimens agree with Oestlund's description of this species. Mr. J. J. Davis writes me that he is certain Oestlund's specimens are not the same as those described by Fitch. Both alate and apterous viviparae occured commonly on *Populus fremontii* Wats.

Callipterus quercus Kalt

This is the same insect that I listed under this name in the Journal of Economic Entomology Aug. 1910, p. 367. I cannot compare it satisfactorily with any native Callipterus, while it compares favorably with Buckton's description of *C. quercus*. I have taken specimens of this insect in the Santa Clara valley on the under side of the leaves of *Quercus lobata* Nee, *Q. californica* Cooper, *Q. douglasii* H. and A., and on an imported English oak, *Quercus robur* (?). It seems to attack the last named more severely than the others. On *Q. lobata* Nee, in Placer County.

Aphis brassicae Linn

On cabbages, uncommon.

Aphis lutescens Monell

This bright yellow insect was observed in abundance on the stalks and hoods of *Asclepias mexicana* Cav.

Siphocoryne conii Davidson

The Placer County specimens are identical with those taken at Palo Alto on *Conium maculatum* L. and described by me in the Journal of Economic Entomology, Aug. 1909. The insect is rare in Placer County. Its food plant is an umbelliferous plant which I have been unable to identify.

Rhopalosiphum dianthi Schrank

Common on *Sonchus oleraceus* L. In the Santa Clara valley both this species and *Macrosiphum sonchella* Monell are found commonly on sow-thistle, sometimes together on the same specimen of food plant, but in Placer County I failed to find the latter species although I examined considerable numbers of the food-plant.

Macrosiphum californicum Clarke

Common on the tips of willow shoots where they cause the shoot to curl. They prefer the young stem growth to the leaves.

Macrosiphum rosae Ream

Fairly common on cultivated roses.

APHIDIDÆ OF SOUTHERN CALIFORNIA V

BY E. O. ESSIG

Aphis rudbeckiae Fitch

Winged Viviparous Female. (Fig. 138). Length, 2.25 mm., width, 1 mm., wing expansion, 9.5 mm. *Prevailing color*—Wine red with margins of abdomen, thorax and head darker. *Head*—Narrower than thorax, dark reddish-brown, shining. *Eyes*—Dark with typical terete tubercles. *Antennae* (Fig. 140 V) arise from slight frontal tubercles, longer than the body, tapering, dark in color, slightly hairy—6-articled (7 according to older classification); I 0.188 mm., II 0.094 mm., III 1.05 mm., IV 0.76 mm., V 0.68 mm., VI 1.218

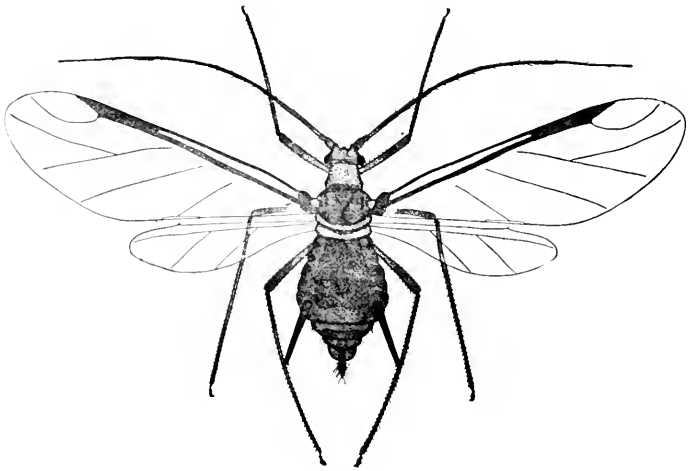

Figure 138. Aphis rudbeckiae, winged viviparous female.

mm. (VI 0.188 mm. and VII 1.03 mm.). The sensoria are of various shapes, round and scattered, abundantly on article III, one on article V, and several in the nail-like process on article VI. *Prothorax*—Same color as head, without lateral tubercle, narrower than mesothorax. *Rostrum*—Reaches to first abdominal segment, dark at tip, stout. *Abdomen*—Dark red at margins, shiny, round and wider than thorax. *Cornicles*—Black, cylindrical, 0.85 mm. in length. Wide at mouth end. *Legs*—Long and slender, slightly hairy, dark at joints. (At the union of the femur and tibia, at the distal and of tibia, all of the tarsi and claws.) *Wings*—Hyaline, typical aphis form. (See cut.) *Primary*—Length 4 mm., width, 1.5 mm. Costal and sub-costal veins wide

and dark. Stigma long and as dark as costal veins. Other veins fuscous and brown. *Secondary*—Length, 2.5 mm., width, 0.7 mm. *Style* Dark, longer than half the length of the cornicles.

Apterous Viviparous Female. (Fig. 139.) Length, 2.5 mm., width, 1.5 mm. *Prevailing color*—Wine-red, maroon, to a dark reddish brown, throughout the body proper. Shiny. *Antennae* Slightly shorter than those of the

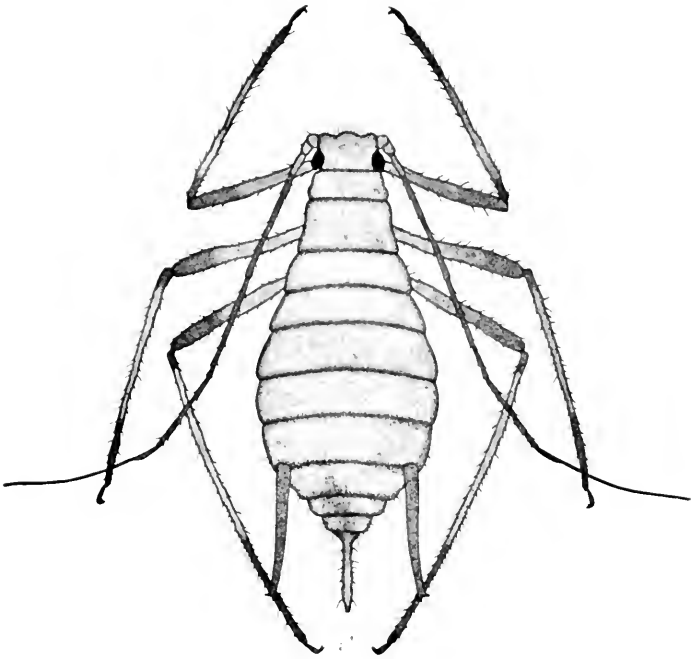

Figure 139. Aphis rudbeckiae, apterous viviparous female.

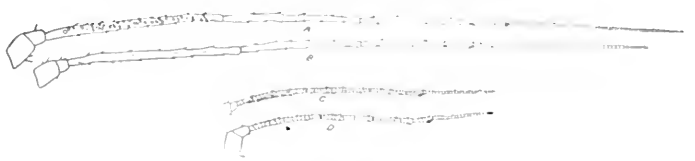

Figure 140.

A, antenna of winged viviparous female; B, antenna of apterous viviparous female of Aphis rudbeckiae; C, antenna of winged viviparous female; D, antenna of apterous viviparous female, of Aphis lutescens.

winged form (Fig. 140 B); I 0.150 mm., II 0.65 mm., III 1.01 mm., IV 0.65 mm., V 0.506 mm., VI 1.175 mm., (VI 0.165 and VII 1.01 mm.). Slightly hairy. *Cornicles*—Dark, length, 1.5 mm. Rostrum reaches mesothoracic coxæ.

Collected by the author from *Ambrosia psilostachya* and *Baccharis viminea*.

Aphis lutescens Monell

Winged Viviparous Female. (Fig. 141 A.) Length, 1.75 mm., width, 1 mm., wing expansion, 7.7 mm. *Prevailing color.*—Lemon yellow, with dark thorax and other dark markings as below described. *Head*—Narrower than thorax.

Figure 141. Aphis lutescens:
A, Winged viviparous female; B, apterous viviparous female.

light yellow in color. *Eyes*—Dark, small. *Antennæ* (Fig. 140 C)—Shorter than the body, pilose. Lengths of articles are as follows: I 0.063 mm., II 0.045 mm., III 0.376 mm., IV 0.25 mm., V 0.188 mm., VI 0.47 mm. (VI 0.094 and VII 0.376 mm.). There is a row of large circular sensoria on article III, one on article V near the distal end, and several in the nail-like process of article VI. There are few hairs on the articles. *Prothorax* with a small lateral tubercle. Posterior half dusky in color. *Rostrum*—Reaches beyond the metathoracic coxæ. Dark at the tip. *Abdomen*—Smooth, bright yellow, with margins spotted black as shown in drawing. Large black blotches around the bases of the cornicles, one blotch between these blotches, one behind this and a dark style. Three dark spots on dorsal surface of abdomen in front of the cornicles. Hairs on margins. *Thorax*—Dark. *Cornicles*—Cylindrical, dark, more than twice as long as the tarsus. *Legs*—Normal. Dusky at the union of the femur and tibia, at the union of the tibia and tarsus, the tarsus and also the claws. Slightly hairy. *Wings*—Normal as shown in the cut. Veins yellowish brown as is also the long and narrow stigma. *Primary wings*—Length, 3.75 mm., width, 1 mm. *Secondary wings*—Length 1.8 mm., width, 0.4 mm. *Style*—About half as long as the cornicles, dark, hairy.

Apterous Viviparous Female. (Fig. 141 B). Length, 2 mm., width, 1.2 mm. *Prevailing color*—Bright lemon-yellow throughout. *Antennæ*—Resembles

those of the winged form without the sensoria. The articles are somewhat variable in length; I 0.095 mm., II 0.071 mm., III 0.438 mm., IV 0.188 mm., V 0.2 mm., VI 0.469 mm. (VI 0.094 mm., VII 0.375 mm.). The *head* and *thorax* are yellow. The *abdomen* is very smooth and beautifully rounded and tapered as shown in the cut. *Cornicles*—Dark, usually extend outwardly at right angles to the body axis. *Style*—Dark. Other characters same as in winged form.

This insect was very abundant this year feeding upon the small Milkweed, *Asclepias mexicana*, in all parts of Southern California. It is preyed upon by the larvæ *of Syrphus* sp., *Chrysopa* sp., *Coccinella californicus*, *Hippodamia convergens*, and by internal parasites.

NOTES ON COCCIDÆ VI

BY E. O. ESSIG

Eulecanium pruinosum Coquillett

(Frosted Scale)

Adult Female (See Fig. 142). The scale body varies in color from a pale to a dark reddish-brown. It is often covered with a fine coating of white, powdery wax, which gives it a grayish appearance. This wax does not always appear on the scale, and wherever it does appear it is worn off with age.

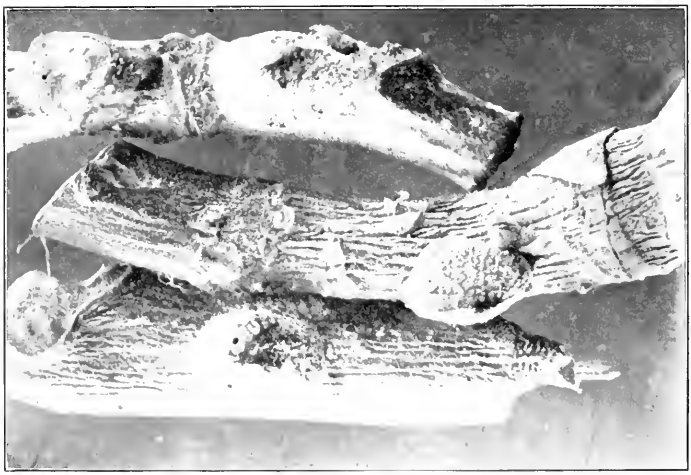

Figure 142. Eulecanium pruinosum.

The scale proper is slightly longer than broad, very convex, with irregular surface. Length, 7 mm., width, 5 mm.

The antenna is large at the base, 7-articled, with formula as follows: (3, 4, 7) (1, 2), 5, 6. The apical article is provided with a style at one side of the marginal-tip.

Concerning the resemblance of this species to the European fruit scale, *Lecanium corni* (Bouche), J. G. Sanders, of the Bureau of Entomology, Washington, D. C., writes:

"Its (frosted scale) general appearance is like a very large *L. corni*, very convex, dark reddish brown, variously pitted and grooved; the 7-jointed

antennæ and the legs and other characters are quite similar to *cornu*, but the derm pores furnish the most evident character for the species. . . . The pores are small, clearly defined, and regularly arranged, but they do not show a tendency to arrange themselves in broken rows perpendicular to the margin as in *L. cornu*." Ec. Jr. Ent. Vol. II, p. 142.

Eggs.—Are ovoid in shape, yellowish-white in color, and are deposited beneath the female scale in great numbers.

Larvae.—Pale green or yellow in color, with many ridges running across the main axis of the body and one ridge running on the dorsal median line. There are two characteristic hairs or spines on the anal lobes one on each which are half as long as the body.

Host Plants.—This scale has become quite a pest in some localities. On the peach and apricot it may do as much damage as the fruit scale, while on some of the ornamental trees it is most serious. In California it has been found on Apricot, Peach, Plums, Prunes, Pears, Apples, Ash, Locust, English Walnut, Grape, Rose, Osage Orange, Birch, and various deciduous ornamental trees.

Habitat.—It is the present belief that this insect is a native of Mexico and was introduced to its present localities on imported plants. It is not known outside of North America. Its present distribution is as follows: California (all parts of the State), New Mexico, Arizona, Mexico, New York, Massachusetts, Canada.

Remedies.—The first work was done on this pest, in Los Angeles, during the year 1888, by D. W. Coquillett, who used the Resin Spray with good results.

FORMULA FOR RESIN SPRAY USED BY COQUILLETT

Resin	30 lbs.
Caustic soda (70%)	9 lbs.
Fish oil	4½ pints
Water to make	100 gallons of spray

As is well known this spray is very effectual against many of the coccids and was early used as a remedy for all scale insects by the State Board of Horticulture of this state. It is, however, somewhat difficult to mix and quite expensive. In my work on Lecaniums I have found the carbolic acid emulsion to be very effective. It is easy to make and inexpensive. The formula for mixing is as follows:

Whale oil soap	40 lbs.
Crude carbolic acid	5 gals.
Water to mix	40 gals.

For use dilute 1 to 20 or if there is a very bad infestation dilute 1 to 15 of water.

First heat the 40 gallons of water in a large iron kettle over a steady fire. Dissolve the 40 pounds of soap in the hot water. After it is thoroughly dissolved, add the 5 gallons of carbolic acid. Let cook for five or ten minutes and stir thoroughly. The resulting stock solution will be ready for use

and will keep for a long time. The spray resulting from diluting the stock solution is a perfect emulsion and needs no agitating while being applied. For this reason it is a splendid wash for greenhouses and gardens, where the applications of any insecticide must be made with a hand pump.

Lepidosaphes gloverii Packard

(Long or Glover's Scale)

There is liable to be some confusion in the minds of some of the fruit growers concerning the purple and long scales. They resemble each other to a remarkable degree to the untrained eye, but if the differences are pointed out there can be no mistake regarding either. The following note is aimed to give a description of the long scale such as shall familiarize all with it, as well as a short history of its distribution.

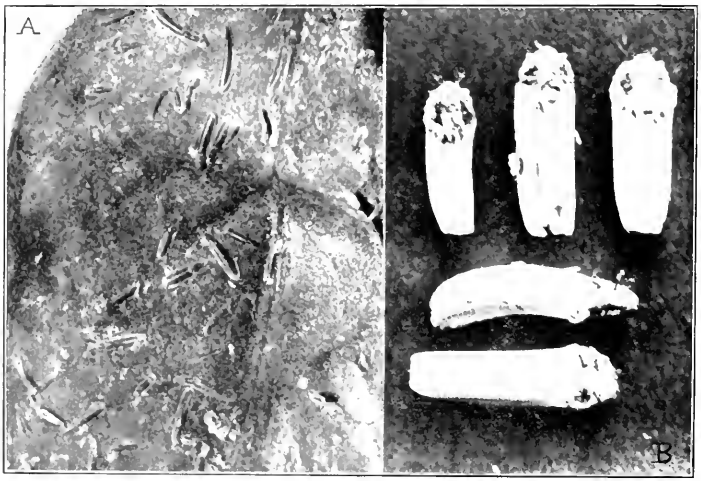

Figure 143.
A, Lepidosaphes gloverii; B, Orthezia artemisiae.

DESCRIPTION

"The long scale is of a more linear shape (Fig. 143 A) than the purple scale, with which it is often associated. The outline of the body is not so often curved as is that of the purple scale.

Female.—The female scale is brownish, about .11 of an inch (3 mm.) in length, and less than one-fourth as wide. When crowded the scales adjust themselves to their surroundings by taking all sorts of shapes, and many will be dwarfed and malformed almost beyond recognition, except by microscopic examination. The young insects themselves are of a translucent waxy-

white, with the outer edge of the last joint yellowish. As they grow older, they incline to purple, which becomes deeper as the insect increases in age. The adult female is about .05 of an inch (1.3 mm.) in length. The sucking proboscis is longer than the body. (See Fig. 144 D.)

Male.—The scale of the male is smaller than that of the female, about .04 of an inch (1 mm.) in length, and usually straight. The color varies from shades of brown to yellow when young, becoming darker with age, and reaching a dark brown in the older females. Generally speaking, densely clustered colonies, including both sexes, have a reddish hue. The male insect is a minute, two-winged fly, .01 of an inch in length. Its body is pale pink in color, and about one-fourth as wide as long. The eggs are elongate oval in shape, passing from a light to a purple color before hatching." H. A. Gossard, Fla. Agrcl. Exp. Sta. Bull. No. 51, 1900, pp. 112-113.

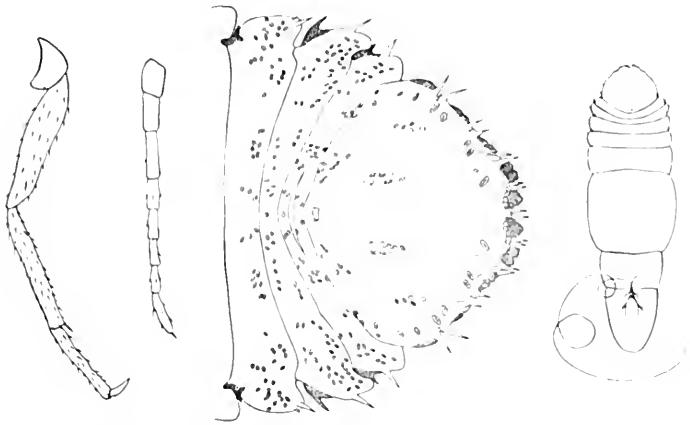

Figure 144. Details of Coccidae:
A, leg; B, antenna of female of Orthezia artemisiae; C, pygidium; D, body outline of female of Lepidosaphes gloverii.

LIFE HISTORY

"Development of the Insect and Formation of the Scale.—Our observations show that the development of Glover's Scale, is, up to certain point, almost parallel with that of *M. citricola* (purple scale), and that its failure at that point may be abnormal will be seen from the following:

March 27, eggs under observation began to hatch. The young larvæ are purplish, with the front of the head and the margin of the body yellowish. Most of them settle almost immediately, and at two days the cottony secretion has covered one-half of the insect. At four days it reaches beyond the eyes, and the larva itself seemed to be more elongated, with the joints more distinct. At six days most of them were entirely covered, with the excretion ex-

tending like two horns at each side of the head. With some there were only two or three transverse constrictions of the covering, giving them a very peculiar appearance. At seven days the future dentate appearance of the abdomen could already be detected through the skin and at eleven, several presented every appearance of a speedy moult, having pushed themselves forward from the covering. They remained in this state, however, without marked change, except that some secreted a tuft of waxy threads, which rose erect for two or three times the length of the scale. For twelve days more before shedding their first skin, which was done at the age of 23 days. The moult was performed in precisely the same manner as with citricola. Immediately after the moult the whitish permanent scale began to form. At thirty-two days one could begin to distinguish the legs and antennæ of the future pupæ in the males. At forty-four days the first female was observed to have cast its second skin; the color after the moult is white, with the anal segments and the middle of the body yellowish. About the same time the males become pupæ, and at 45 days the first adult male was found. From this time up to the age of 102 days the female scales were watched daily, but no eggs were observed. At this age all either died or were mounted, so the age at which the eggs are deposited has not been determined. It may be that the non-development in this case was due to the fact that the females had not been fertilized." Rept. Calif. Bd. Hort. 1895, pp. 183-184.

"It apparently requires a great deal of moisture to thrive well, and hence is especially apt to be abundant on oranges or other plants grown in conservatories, and this also accounts, doubtless, for its greater multiplication and injury in Florida than on the Pacific Coast. It has from three to four distinctly defined generations in a year. Breeding continues practically throughout the season, the periods of growth being somewhat slower in the cooler rainy season of winter than in the summer. According to Hubbard, there are three periods in Florida when the young are especially abundant, marking in a rough way the appearance of the main broods, namely, March and April, in June and July, and in September and October; the fourth irregular brood, occurring in January or February." C. L. Marlatt, Yearbook Dept. Agric. 1900, pp. 265-266.

REMEDIES

This insect is handled the same as purple, red, or yellow scale, viz., fumigated with the regular Purple Scale Dosage No. 1 originated by R. S. Woglum. Like these scales it may be handled at any period of the year, but the common practice is to fumigate at the season when the black scale may also be killed at the same time—from September 1st to January 1st.

Host Plants.—Orange, *Pritchardia filamentosa;* Lemon, *Magnolia fuscata;* Pomelo, Lime.

Eriococcus adenostomae Ehrh

Adult Female. (Fig. 145).—Length 3 to 4 mm., width 1.5 to 2 mm. Body—Dull purple and enclosed in a white or cream-colored sac of finely

woven texture. This covering is somewhat longer than the body and is marked with depressions as shown in the photograph. With age this sac may become quite dark, almost brown, the adult female body withered up and only the eggs remaining. The body proper is dark purple, as stated above, is rather broadly oval in shape, and becomes perfectly transparent after having been boiled in KOH. The antennæ remain light brown and are usually 7-articled (Fig. 146 D). Article III is the longest. Often the articles of the antennæ of the same individuals will be irregularly segmented, as is shown in the accompanying drawing (Fig. 146 C). The antenna C is 8-articled, while antenna D is normally 7 articled, with a faint sign of division on the 7th article. Out of a great number of specimens examined, I found that there were more individuals with 8 articles than with 7, although this may be out of the ordinary. There are very few hairs on any of the articles

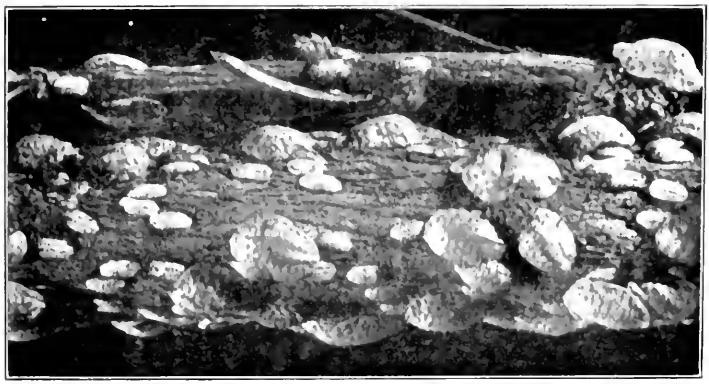

Figure 145. Eriococcus adenostomæ.

excepting apical one. None of the adult forms, which were through egg laying had any legs at all, so I am not able to give the data concerning them.

The ventral derm has two alternating rows or rather large round openings or glands from the spiracles to the pygidium.

Pygidium (Fig. 146 B), with one large spine and two short stout spines on anal lobes, with several short spines on the inner margins. Anal ring scalloped, bearing 8 long spines. Pores or gland openings scattered over derm.

Eggs.—Wine-colored or light purple. Deposited in the sac at the posterior end in large numbers where they remain until hatched in the spring.

Adult Male (Fig. 146 A).—*Sac* about half as long as that of the adult female and narrow. The smallest scales in the photograph are the male cases. The coloring is the same as those of the female.

Adult.—Very minute (0.7 mm. long) with large wings. *Color*—Wine or dark reddish purple, covered with fine, white, waxy powder to give it a grayish appearance. *Antennae*—Normally long and hairy. Eyes, dark purple. Legs, slender and hairy. Wings, hyaline with typical venation. Thorax large with hairy prothorax and dark dorsal band between wing-bases. Abdomen narrow and segmented distinctly at margins. Anal filaments nearly as long as body, and snowy-white. There is usually a spine-like style at tip of abdomen. This is in two divisions, resembling an ovipositor.

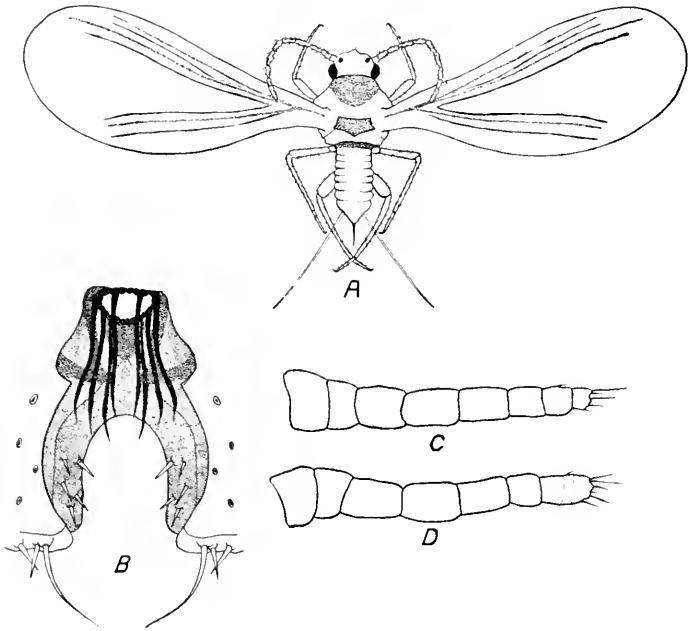

Figure 146. Eriococcus adenostomae:
A, adult male; B, pygidium of female; C, 8-articled antenna of female; D, normal 7-articled antenna of female.

I chanced upon a very thick infestation of this scale in the mountains above Santa Paula at an altitude of some 2000 feet. Only Chamiso (*Adenostoma fasciculatum*) served as a host plant, although growing in the same localities were numerous other trees and shrubs. Undoubtedly the insect had been in this locality for some years, for old dead shrubs bore traces of the female sacs. The infestation, though thick, had not spread over an area of more than 100 feet in circumference, while the host plant covered

acres and even miles uninterruptedly. This is accounted for by the fact that the scale has two internal parasites which I have been able to hatch from them in considerable numbers.

This beautiful species was first described by Mr. Edw. M. Ehrhorn in the Canadian Entomologist, Vol. XXX, p. 244 (1898).

Mr. T. D. A. Cockerell also had an article on the same insect in the Can. Ent. Vol. XXX, p. 246 (1898).

This insect (Fig. 145) was first sent to the writer by Roy K. Bishop, Horticultural Commissioner of Orange County. Since that time I have obtained it in the vicinity of Santa Paula.

The long white egg sac makes it at once conspicuous and easy to detect. It occurs in great numbers on the California Sage (*Artemisia californica*) during the later summer months. That it never increases to any damaging numbers may be explained by the fact that it is parasitized by a dipterous insect which is an egg feeder. In some dozen mounted females I was able to obtain several of the puparia of the parasite, but was not fortunate enough to obtain the adult fly.

THE PHALANGIDA OF CALIFORNIA

BY NATHAN BANKS

UNITED STATES DEPARTMENT OF AGRICULTURE

The Phalangida, or Opiliones as they are called by some writers, constitute a very distinct order of the Arachnida. The body is seen to be of two large parts broadly connected to each other; the anterior part is the cephalothorax, the posterior part is the abdomen. The cephalothorax is of one piece above, but usually shows one or two incomplete transverse furrows or grooves. There is also a furrow along each side and it is considered that the part beyond

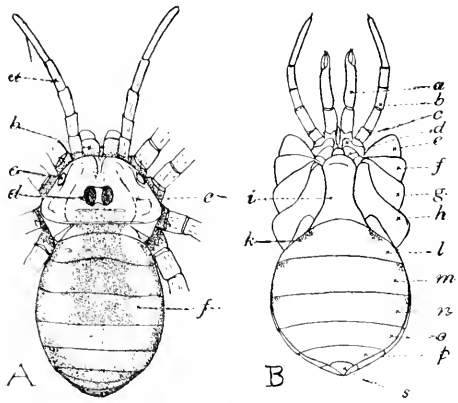

Figure 147. Dorsal and ventral views of a Phalangid.

A, Dorsal view: a, palpus; b, mandible; c, lateral pore; d, eye tubercle; e, cephalothorax; f, abdomen. B, Ventral view: a, mandible; b, palpus; c, maxilla; d, pedal lobe; e, coxa I; f, coxa II; g, coxa III; h, coxa IV; i, advancement of abdomen; k, spiracle; l, 2nd ventral segment; m, 3rd ventral segment; n, 4th ventral segment; o, 5th ventral segment; p, 6th ventral segment; s, anal plate.

the furrow is the pleura. On this pleural portion near the anterior end is a small somewhat circular depression with a membranous bottom, this is the lateral pore. On the middle line of the cephalothorax and toward the anterior margin is a small rounded elevation with a simple eye on each lateral face, this is the eye tubercle or eye-eminence. The abdomen is quite broad, never slender, and never depressed; usually quite convex above.

Abdomen is considered to consist of eight segments, but in many forms the basal and median ones are poorly defined on the dorsum; on the venter there are usually six distinct segments. The underside of the cephalothorax is occupied by the coxæ, and by a median piece similar to and often called the

sternum. It is, however, something quite different; it is the basal ventral segments of the abdomen pushed forward over the bases of the coxæ. It carries with it the opening of the genital organs, which thus in certain forms appear to issue close to the mouth. This advancement of the abdomen is so pronounced in many of our common forms that the coxæ are crowded at the base, and so appear to radiate from a central point.

Legs are usually long and slender, they consist of a basal joint, the coxa, almost wholly attached to the venter, a small trochanter, a long femur, a short patella, a long tibia, a long metatarsus, and a fairly long tarsus, more or less broken up into several articles. The metatarsi and the tibiæ are oft times divided by what are termed false articulations. The tarsus ends in one or two claws. In front of the first pair of legs are the palpi, which are of five joints, coxa, femur, patella, tibia, and tarsus, the latter often ends in a claw, and the femora sometimes bear spines. Between the palpi are the mandibles, falces, or cheliceræ; they consist of a large basal joint, or paturon, and an apical chelate claw.

Male usually has the body either shorter or else more slender than the female, in some cases the male has the tarsus of the palpus more curved than in the female, and in others the male palpi are greatly enlarged. As a rule, the male has longer and more slenger legs than the female. In a few cases the male has the hind coxæ enlarged; in many species the males are more spinose than the females. The Phalangida are commonly called "harvest-men," "grandfather greybeards," or "daddy-long-legs." They spin no web, and make no retreat or place of concealment. Usually they move slowly, but some can run rather rapidly; a few, when disturbed, feign death. They commonly feed on living insects which they capture with their jaws, or with the palpi. They appear to have few enemies, and their long legs and often hard and spiny body make them rather undesirable food for birds. Sometimes one finds a species of mite attached to their legs. When handled, they often exude from near the coxæ, a whitish fluid, which in some cases has a disagreeable odor. The eggs are deposited in the fall or early spring, in crevices of the soil, or in wet or decayed wood. The young, on hatching, are in general similar to the adults, but often present differences in the palpi. Probably all of them have but one generation a year.

Phalangids are widely distributed; in the tropics are great numbers of curious species, while others live on the storm-swept peaks of high mountains. Several have been taken in caves; some of these cave forms also occur outside of caves, but in dark situations.

The species do not vary much in appearance; in some of the mountain loving forms the colors vary from dark to light; in some species that have a long north and south range, the northern specimens have much shorter legs, and a less spinose body than specimens from the southern localities.

There are probably about 100 species in the United States; 20 species are known from California. These belong to 10 genera that may be distinguished by the following synoptic table:

1. First ventral segment of abdomen not extending in front of the hind coxæ; hind tarsus with two claws or a compound claw at tip; palpus with the tibia and tarsus depressed; hind legs usually the longest 2
   First ventral segment of abdomen extends much in front of the hind coxæ; each tarsus with but one simple claw; palpus with tibia and tarsus cylindrical; second pair of legs the longest 5
2. Hind coxæ wholly united to the venter, spiracles distinct *Cynorta*
   Hind coxæ free at apex, spiracles obscure. 3
3. Two simple claws to each hind tarsus. 4
   A forked claw on each hind tarsus; palpus not as long as body *Sclerobunus*

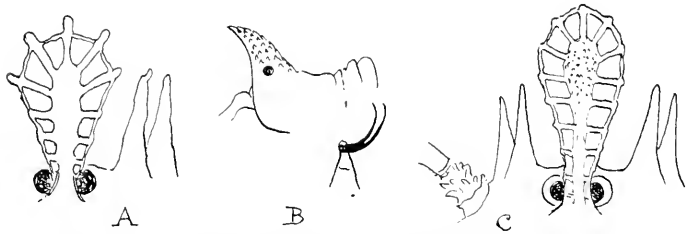

Figure 148. Head details of Phalangida:
A, Eye tubercle of Ortholasma pictipes; B, head and claw of Sitalcina californica; C, head of Ortholasma rugosa.

4. Eye-tubercle arising from the anterior margin of the cephalothorax; palpi shorter than the body *Sitalcina.*
   Eye-tubercle arising some distance back from the anterior margin of the cephalothorax; palpi longer than the body *Scotolemon.*
5. Last joint of palpus with a claw at the end, this joint usually longer than the preceding joint 10
   Last joint of palpus without a claw at tip, this joint much shorter than the preceding joint 6
6. Palpi very short, concealed under a projection of the eye-tubercle . . 9
   Palpi long and prominent 7
7. Mandibles longer than body, projecting forward *Taracus.*
   Mandibles shorter than body . . . 8
8. Fourth joint of palpus much thickened *Phlegmacera.*
   Fourth joint of palpus not thickened *Nemastoma.*
9. Eye-tubercle with a broadly spatulate projection; two spines each side on the anterior margin of cephalothorax *Ortholasma.*
   Eye tubercle with branched projection, a single and club-like spine each side on the anterior margin of cephalothorax . *Dendrolasma.*

10. Male with the palpus much enlarged and the last joint a little shorter than the preceding joint; female with patella of palpus branched palpal claw smooth; a row of teeth on each side of coxæ *Protolophus*
Last joint of palpus longer than the preceding joint; patella without a branch 11

11. Coxæ II much shorter at base than I or III; femora and tibiæ I and III enlarged 12
Coxæ II reaching as far down as base as I or III; femora and tibiæ I and III not enlarged 13

12. Eye-tubercle spinose; legs unmarked *Globipes*
Eye-tubercle smooth; legs banded *Eurybunus*

13. A group of spinules on the anterior margin of the cephalothorax; legs rather short *Nitopus*
No such spinules 14

14. Palpal claw denticulate; a small tooth at base of palpus beneath; legs very long and slender, in adult with teeth along edge of some of the coxæ *Liobunum*
Palpal claw smooth; legs usually shorter 15

15. Legs slender; femur I longer than width of the body *Leuronychus*
Legs shorter, femur I not as long as the width of the body *Leptobunus*

Cynorta

Of this genus there is but one species known from California.

Cynorta bimaculata Bks.

This is a very hard-bodied form, yellow-brown in color, with two large pale yellow spots on the dorsum of abdomen; there are no spines or tubercles on the dorsum (Eastern species have two spines or tubercles). It is only known from San Diego.

Sitalcina n. gen.

But one species described from California.

Sitalces californica Bks.

Color pale yellowish, legs whitish toward the tips. Eye-tubercle large, on the anterior margin of the cephalothorax, roughened and granulate. Dorsum of abdomen finely granulate, and with six transverse rows of larger granules. Third joint of palpus with two projections above and one below; fourth joint with two projections below, several small ones above; fifth joint with two projections below. Length 2 to 3 mm. From Marin County, and Mt. Shasta.

Sclerobunus

Two species occur on the West Coast, one not yet recorded from California, but will doubtless occur in the northern part of that state.

1. Color red, tips of legs black *robustus.*
Color brown, tips of legs yellowish *bronneus.*

Sclerobunus robustus Packard

The anterior femora have three or four little tubercles, each tipped with a stiff hair; each of the four posterior claws have one large projection each side; the male has the second joint of palpus more gibbous than in the female. Length 3 to 4 mm. Known from Mt. Shasta region, also Washington and Colorado.

Sclerobunus brunneus Bks.

Dorsum and legs have many little tubercles, each tipped with a stiff hair; each of the four posterior claws have two curved projections each side; second joint of palpus not as large as in *S. robustus*. Length 2 mm. From Washington.

Scotolemon

The species of this genus often live in caves, and such is the habitat of the one known Californian species.

Scotolemon californica Bks.

No eyes, eye-tubercle not prolonged into a spine. Pale yellowish, dorsum of abdomen rather darker. Dorsum with small pointed granules, those on the abdomen arranged in transverse rows; venter and coxæ with similar granules, often tipped with a hair. Palpi large and stout, the joints with pointed processes; legs slender, finely granulate. Length 1.8 mm. From Alabaster Cave, Calif.

Taracus

Two species are known from California.

1. Body with many small projections, each tipped with a hair ..... *spinosus.*
   Body without hair-bearing projections..... *pallipes.*

Taracus spinosus Bks.

Pale yellowish, claws of mandibles reddish-brown; cephalothorax smooth; just behind the eye-tubercle is a median spine flanked each side by an oblique row of tubercles. Dorsum and venter of abdomen closely covered with projections, each with a stiff black hair at tip, those on dorsum are curved. From Southern California.

Taracus pallipes Bks.

Rather brownish above, mandibles dark; cephalothorax and abdomen smooth, without projections, the spine behind the eye-tubercle is not flanked each side by a row of tubercles. From Mt. Shasta, Calif., and also in Washington (Olympia). (Fig. 149.)

Phlegmacera

This genus is readily known by the swollen joints of the palpi, the last joint being very small; one species has been taken in California.

Phlegmacera occidentalis Bks

This is pale in color, with a large brown spot on the cephalothorax and over the base of the abdomen; legs are brownish, with white marks on base and tip of femora, tips of patellæ and tibiæ, and fainter ones on metatarsi and tarsi. There is a pair of erect spines on base of abdomen, and in the male the basal joint of the mandibles is prolonged upward. From Santa Clara County, Calif., and also Washington.

Nemastoma

One species of these tiny Phalangids occurs in California; the palpi are slender throughout.

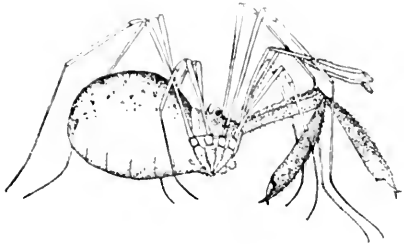

Figure 149. Taracus pallipes.

Nemastoma modesta Bks.

Dorsum brown to red-brown; legs pale. From the broad, low eye-tubercle there extends obliquely backward a row of tubercles with flat tops broader than the base, on the base of abdomen is a transverse row connecting the rows from the eye-tubercle; on dorsum of abdomen are four small submedian white spines or processes; legs and palpi finely hairy. Mt. Shasta, Claremont, and Santa Clara County.

Ortholasma

Two species are found in California:

1. Process of eye-tubercle with six or more openings each side; femora and tibiæ not banded *rugosa*
   Process of eye-tubercle with about 4 or 5 openings each side; femora and tibiæ banded *pictipes*

Ortholasma pictipes n. sp.

Body brownish, a faint median pale stripe on abdomen; the process of eye-tubercle whitish; legs dark, two bands on femora and tibiæ (except leg II), one near middle, one near tip; leg II with band on femora toward tip, tibia mostly pale; eye-tubercle with only four or five openings each side, and the spikes projecting beyond the connecting rim; two spine like processes each side on front of cephalothorax; cephalothorax roughened mostly in two curved

rows behind, and on lateral edge; abdomen with connecting ridges, which form five longitudinal rows of areas, from the connections of the median row there are slight tubercles; around hind border is a row of rather clavate tubercles, and the posterior slope of abdomen is transversely roughened, legs roughened, the trochanters not so much as in *O. rugosa;* large processes at tip of coxæ III and IV as in *O. rugosa;* venter also roughened as in *O. rugosa.* From Humboldt County, Calif., June 24, and Mt. Wilson, Sept. (Bradley) kindly given me by Prof. J. H. Comstock.

Ortholasma rugosa Bks.

Cephalothorax with a pair of spines on each side of anterior margin; projection of eye-tubercle spatulate; dorsal surface with intersecting ridges which give rise to tubercles and processes; on the posterior margin is a row of simple spines, the larger ones near the middle; the coxæ and trochanters roughened. Common in Southern Calif., Claremont; San Diego, Los Angeles, and Alameda Counties.

Dendrolasma

But one species is described.

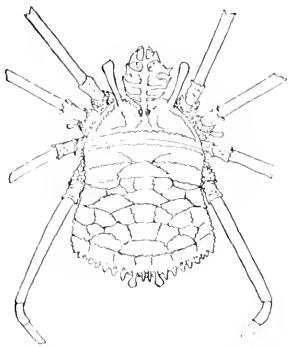

Figure 150. Dendrolasma mirabilis.

Dendrolasma mirabilis Bks.

Cephalothorax has a single clavate process each side on anterior margin; projection of eye-tubercle is branched; the dorsum has intersecting lines forming a definite pattern; on posterior margin is a row of clavate processes, each with a slight basal projection on each side; coxæ and trochanters roughened, on coxæ I and II at tip is a connected row of tubercles, and on coxæ II one of these tubercles is greatly enlarged. From Coulterville, Mariposa County; also Washington. (Fig. 150).

Protolophus.

Two species are known from California; the *P. tuberculatus* very much more common than the other.

1. Abdominal tubercles unarmed *tuberculatus.*
   Abdominal tubercles with a few apical spines *singularis.*

Protolophus tuberculatus Bks.

Gray to brownish, more or less mottled with brown; abdomen often red brown, with a broad median dark stripe or vase-mark; coxæ brownish, trochanters yellowish, rest of legs reddish or yellowish brown. Specimens come from Marin County, Santa Clara County, Los Angeles, Claremont, Haywards, Santa Catalina Island, and Santa Rosa Island. (Fig. 151.)

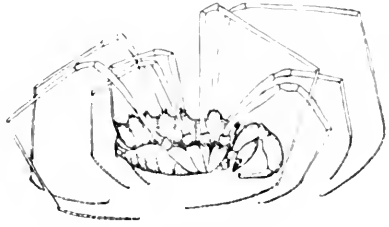

Figure 151. Protolophus tuberculatus.

Protolophus singularis Bks.

Abdominal tubercles have from two to four spines; the anterior margin of cephalothorax is more spinose, and the palpi are more enlarged in the male, the second pair of legs more slender. From near San Diego.

Eurybunus

The legs are short, the femora and tibia of legs I and III thickened. Two species are described from California.

1. Body smooth; leg IV nearly as long as II *brunneus.*
   Body with transverse rows of spinules; leg IV much shorter than II *spinosus.*

Eurybunus brunneus Bks.

Dorsum brown, margin of abdomen narrowly white, coxæ, trochanters, and part of femora yellowish, a band near tip, femora brown, the extreme tip whitish; base of patella brown, tip white; middle of tibia brown, base and tip white; same with the metatarsus; tarsi brownish; palpi and mandibles yellowish. Southern California.

Eurybunus spinosus Bks.

Grayish brown above, a black mark on each side of base of abdomen; femora I and III brown, with a pale ring on middle; tibiæ I and III brown, mottled with pale; femora and tibiæ II and IV whitish, with irregular brown

spots; all metatarsi pale; tarsi ringed with brown at the false articulations; palpi pale, spotted with brown, black at tip. Los Angeles, Calif.

Globipes

But one species is known.

Globipes spinulatus Bks.

Reddish brown, dorsum somewhat mottled with brown, base of legs yellowish, rest reddish; cephalothorax and abdomen smooth; eye-tubercle low and with few spinules above; femur II longer than the body, and more than twice as long as femur I. From Southern California.

Leuronychus

Two species are known.

1. A brown dorsal stripe — *pacificus.*
   No dorsal stripe — *parvulus.*

Leuronychus pacificus Bks.

Whitish to grayish, with a broad median brown stripe; the patellæ of legs brown, lineate with white; trochanters brown; spinules on venter and coxæ. From Olympic, Wash., and Mt. Shasta, Calif.

Leuronychus parvulus Bks.

No stripe on dorsum, but a spot on abdomen in form of a Greek cross; patellæ not lineate with white; trochanters pale; only stiff black hairs on venter and coxæ. From Olympia, Wash., probably occurs in northern California.

Leptobunus

But one species known from California.

Leptobunus californicus Bks.

Whitish above, mottled with brown and black, the vase mark indefinite; femur I shorter than the body, tips of coxæ pale, tibia I with two dark bands; apical brown rings on other joints, palpi not lineate with brown. Southern California., Los Angeles. Another species, *L. borealis*, is known from Alaska; it has the tips of coxæ dark, one band on tibia I, and the palpi lineate with brown.

Nitopus

One species is recorded from California.

Nitopus californicus Bks.

Grayish above, indistinctly mottled with white and brown; femora and tibiæ with brown bands near base and tip; tibia II is much longer than metatarsus II, one false articulation in metatarsus I. From Los Angeles.

Another species *N. dorsalis*, with a white median stripe, is known from Alaska; the tibia II is not longer than metatarsus II, and there is no false articulation in metatarsus I.

Liobunum

To this genus belongs the excessively long legged forms. Many species are known from the eastern United States, and from Europe, but only two are so far recorded from the West Coast, one of these, however, is very common.

1. Two large yellow spots over the junction of the cephalothorax and abdomen ..... *bimaculatum*

   No large yellow spots on junction of the cephalothorax and abdomen ..... *exilipes*

Liobunum exilipes Wood

Adult males are dark brown, with some scattered small pale spots, a larger pale spot in front of the eye-tubercle, and the palpus, except the tarsus, is black. The female is paler, and, when mature, shows a dark vase mark on the dorsum. Young are pale, mottled with brown and black. In both sexes the trochanters are darker than the coxæ, and the tips of the femora and tibiæ are more or less distinctly paler than the rest of the joint. Specimens have been examined from Mt. Shasta, Santa Clara County, Los Angeles, Claremont, Santa Rosa Island, and it also occurs in Washington State.

Liobunum bimaculatum Bks.

This species has still longer legs than *L. exilipes*; it is dark brown in color, with two prominent yellow spots, and the trochanters are no darker than the coxæ. I have seen it only from near San Diego.

AMERICAN PSYLLIDÆ III (Triozinæ)

BY D. L. CRAWFORD

The following descriptions complete the study of the *Triozinae* as based on the material now at hand. The synopses which accompany the descriptions will supersede and replace the provisional synopsis as published in an earlier number of the JOURNAL. Although there are several new genera and many new species here presented, yet there must be many more new forms in America still, and until these are studied thoroughly nothing in the nature of a monograph can be attempted. In the interest of science, therefore, it is hoped that all the material possible will be made available for study, for the furtherance of the knowledge of this important group of insects.

The facial cones furnish striking and constant generic characters, as do also the pronotum and mesothorax. Undue emphasis, however, was at first put on the position and trend of the facial cones; this is of secondary importance, to be sure, but not a primary diagnostic character, since it separates synoptically the sexes of a species, as occurred in *T. tripunctata* (Fitch) Riley. A striking variation occurs in the form of the pronotum. In the genus *Allotrioza* the pronotum is relatively very long and extending on its dorsal surface from the anterior margin of the dorsulum to the posterior margin of the vertex. In all or most of the other *Triozinae* the pronotum is relatively shorter and is partially concealed by descending behind the posterior margin of the vertex, and does not attain posteriorly to the surface of the dorsulum; this has been spoken of as the pronotum depressed below the dorsulum and head. The dorsulum in the latter case is usually roundly pointed cephalad, and of rather a spherical-triangular shape.

Very good diagnostic characters lie in the genitalia of the male, but since often only the female is represented in the collections, these characters can not well be used. In the preliminary study the term *anal projection* was suggested for the dorsal portion of the male genitalia. The term *anal valve* is more suitable and will be used hereafter. The lateral view of the anal valve is very important and should always be represented by a good clear figure. Of the female genitalia three general types are easily recognizable: the short, the long, and the extremely long and slender. The first is, typical in the species *Trioza salicis*, the second in *T. quadripunctata*, and the third in *T. longistylus*.

The veins of the forewings are nearly always set with fine microscopic hairs at regular intervals, but with very few exceptions these setæ are visible only under very high power; occasionally, however, as in *T. mexicana*, they are more conspicuous and easily visible under a low power of magnification. In many forms the wing membrane is covered with punctural dots but these are not visible except under the high power; in a few species these are very conspicuous, giving a fulvous, smoky appearance to the wing.

Synopsis of the Genera of Triozinae

A. Radius longer than basal portion of subcosta.

B. Facial cones (as cones) entirely wanting or sub-obsolete.

C. Vertex very deeply emarginate anteriorly at median suture, with the antennæ attached to the projecting rostra. Facial cones entirely wanting.

D. Bi-rostrate appearance of head very marked; emargination very deep. Third antennal segment not very thick midway, sometimes somewhat enlarged. *Rhinopsylla* Riley

DD. Bi-rostrate appearance of head not so conspicuous, emargination deep but less than above. Third antennal segment very much enlarged and thickened midway, thicker than succeeding segments and almost as thick as preceding. *Bactericera* Puton.

CC. Vertex not deeply emarginate anteriorly, without the peculiar bi-rostrate appearance. Facial cones sub-obsolete, with merely globose projections at insertion of antennæ. *Epitrioza* Crawford.

BB. Facial cones (as cones) not entirely wanting.

C. Pronotum long, quite flat, not depressed below dorsulum and head; dorsulum not strongly arched. *Allotrioza* Crawford.

CC. Pronotum short, arched and distinctly descending cephalad; distinctly depressed below dorsulum and head; dorsulum quite strongly arched.

D. Facial cones exceedingly short and small, scarcely projecting beyond vertex; labrum easily visible from in front; antennæ inserted on frons and base of facial cones; vertex distinctly raised plate like, and usually conspicuously colored; margin of vertex colored differently from discal portion. Anal valve of male genitalia bilobate; claspers not acute at apex. *Paratrioza* Crawford.

DD. Facial cones at least moderately long, or not exceedingly short; labrum not visible from in front.

E. Thorax broader than entire width of head including eyes. Facial cones normal, usually moderately long, rather acutely rounded apically, more or less divergent. *Trioza* Forster. (*Petalolyma* Scott)

EE. Thorax distinctly narrower than entire width of head including eyes. Facial cones long, very slender and acute, closely appressed and not divergent in the least. *Neotrioza* Crawford.

AA. Radius shorter than basal portion of subcosta; discoidal portion of subcosta almost wanting. *Ceropsylla* Riley.

General Revised Synopsis of the Genus Trioza

A. Forewings not entirely hyaline; with more or less dark banding.

B. Subcosta bordered with dark band; radius straight, shorter than second cubital; first furcal two-thirds as long as third; genital segment of female very short; anal valve of male obtriangular, with large posterior lobe. *T. californica* Crawf.

BB. Both cubital veins and radius bordered with dark bands; marginal cells darkened; radius long, flexed midway; first and third furcals subequal; female genital segment quite long; anal valve of male obtriangular, with large posterior lobe.
T. tripunctata (Fitch) Riley.

BBB. Hind margin darkened from tip of clavus to apex of wing and through both marginal cells; radius straight, rather short; female genital segment short; anal valve small, with a rectangular posterior lobe.
T. marginata Crawf.

AA. Forewings without stripes or bands, hyaline or slightly fulvous.

B. Setæ on veins of forewing conspicuous; membrane of wing with punctural dots. Facial cones large. Female genital segment long. Anal valve large, arcuately lobate posteriorly.

C. Body large; wings quite fulvous; setæ on veins prominent.
T. mexicana Crawf.

CC. Body rather small; wings but slightly fulvous; setæ not prominent.
T. mexicana minuta Crawf.

BB. Setæ on veins of forewings very inconspicuous or wanting; wing membrane with few or no punctural dots.

C. Dorsum and vertex conspicuously pubescent.

D. Pubescence long, quite dense. Vertex bulging; facial cones very short; pronotum short. Wings large; second marginal cell unusually large. Female genital segment moderately long; anal valve of male almost as large as ventral plate and similar in shape, with a dorsal epiphysis.
T. diospyri Ashmead.

DD. Pubescence not long, somewhat pulverulent. Vertex flat; facial cones moderately long; pronotum quite long. Wings not large; marginal cells subequal. Female genital segment rather long; anal valve of male small.
T. bakeri Crawf.

CC. Dorsum and vertex not pubescent, or if so, very inconspicuously.

D. Facial cones very short and broadly rounded apically, quite vertical. Female genital segment exceedingly long and acute. Pronotum quite long.

E. Epimeron long, visibly as long as episternum. Cone into eye more than twice; labrum very large. Genital segment nearly one-fourth as long as rest of body.
T. longistylus Crawf.

EE. Epimeron concealed partially, visibly not as long as episternum. Cone into eye scarcely more than twice; labrum not large.

F. Epimeron visibly half as long as episternum. Style-like process of female genital segment about as long as basal portion.
T. collaris Crawf.

FF. Epimeron visibly only about one-fourth as long as episternum. Facial cones extremely short. Style of female fully twice as long as basal portion of genital segment.
T. proximata Crawf.

DD. Facial cones not very short, at least moderately acute apically. Female genital segment not extremely long and acute. Pronotum usually rather short.

E. Wings very broadly rounded apically, without any angulation whatever (*T. longicornis* is typical of a rounded wing, *T. similis* and *T. albifrons* I consider slightly angulated); furcation of second cubital on or behind long axis of wing from base of subcosta to apex of wing. Facial cones long, divergent.

F. Thorax and vertex quite conspicuously striped and banded with yellowish white on dark ground color. *T. varians* Crawf.

FF. Thorax and vertex not striped or banded.

G. Facial cones quite horizontal, easily visible from above. Radius short, straight; fourth furcal one-half as long as second cubital. *T. rotundiconnis* Crawf.

GG. Facial cones subvertical, only slightly visible from above. Radius long, curved; fourth furcal less than one third as long as second cubital. *T. longicornis* Crawf.

EE. Wings not very broadly rounded, as above; more or less angulated or acute apically; furcation of second cubital usually in front of the long axis of wing. Facial cones not very long.

F. Length of forewing distinctly less than 3 mm. Body very small. Facial cones short, subacute.

G. Genital segment of female long, with a short, slender ovipositor sheath. Labrum small. Prepimeron mostly concealed, visibly only half as long as episternum; forecoxæ mostly visible. *T. nicaraguensis* Crawf.

GG. Genital segment of female very short; dorsal plate very obtuse. Labrum relatively large. Prepimeron visibly as long as or longer than episternum; forecoxæ mostly concealed.

H. Facial cones straight and quite parallel on inner margin, scarcely divergent. *T. minuta* Crawf.

HH. Facial cones not entirely straight, somewhat divergent. Body slightly larger. *T. minuta similis* Crawf.

FF. Length of forewing fully 3 mm. or more. Body not unusually small.

G. Radius short, straight, without a curve; subcosta nearly or fully as long as margin of radial cell.

H. Hind margin of wing with four spots visible to unaided eye, one on margin of each marginal cell, one on cubital cell, and one on anal angle. Vertex glabrous. Prepimeron mostly visible. *T. quadripunctata* Crawf.

HH. Hind margin without four easily visible spots; three usual marginal spots present. Vertex slightly pubescent. Prepimeron mostly concealed.

I. Body brownish red to orange. Thorax quite strongly arched; notal pubescence very inconspicuous. *T. frontalis* Crawf.

II. Body dark reddish brown. Thorax less strongly arched; notal pubescence slightly more conspicuous. *T. frontalis sulcata* Crawf.

GG. Radius quite long, not straight, curved more or less in distal half. Cubcosta distinctly shorter than margin of radial cell.

II. Head, facial cones, and notum whitish; vertex bulging, with a short sulcate impression midway on each side of median suture. Female genital segment short; anal valve of male spatulate. *T. albifrons* Crawf.

HH. Head, facial cones and notum not whitish, vertex usually more extensively impressed.

I. Facial cones scarcely divergent; head usually black.

J. Facial cones almost straight on inner margin, scarcely divergent throughout; cone into eye 1. *T. salicis* Mally.

JJ. Facial cones conical, but slightly divergent, not straight on inner margin as above. Cone into eye $1^1/_4$. *T. nigrifrons* Crawf.

II. Facial cones distinctly divergent, conical. Cone into eye 1 or less. Head usually orange colored.

J. Vertex conspicuously bulging over insertion of antennæ. Facial cones moderately long, and quite stout and divergent. Female genital segment moderately long; anal valve of male ovoid. *T. assimilis* Crawf.

JJ. Vertex not conspicuously bulging over insertion of antennæ.

K. Wings slightly fulvous, not entirely clear. Vertex not deeply impressed.

L. Wings quite conspicuously fulvous; somewhat rounded at apex. Prœpisternum short and relatively broad. Vertex between eyes four times the width of eye. Anal valve of male small, simple. *T. fulvida* Crawf.

LL. Wings inconspicuously fulvous; rather subacute at apex. Prœpisternum long and relatively slender. Vertex three times width of eye. Anal valve large, with a posterior lobe. *T. aurantiaca* Crawf.

KK. Wings not fulvous, perfectly clear.

L. Vertex with a marked sulcate impression on each side of median suture. Facial cones slender, very divergent. Female genital segment moderately long.

M. Abdomen white ventrad. Facial cones very slender. *T. similis* Crawf.

MM. Abdomen unicolored, ventrad and dorsad. Facial cones not so slender. *T. similis fovealis* Crawf.

LL. Vertex without marked sulcate impression; usually with a shallow impression. Facial cones not very slender, quite divergent.

M. Wings somewhat rounded at apex. Cone into eye less than 1. Anal valve of male small and simple.
T. fulvida similis Crawf.

MM. Wings subacute at apex. Cone into eye fully 1. Anal valve of male quite long with a posterior epiphysis.
T. nigra Crawf.

Synopsis of the Genus Trioza Based Principally on the Genitalia

A. Female genital segment very short, scarcely longer than preceding ventral selerite.

B. Dorsal plate of female genitalia rhomboidal, not arched between apex and genital pore, nor on ventral surface. Wings very broadly rounded.

C. Ventral plate of female triangular; without epiphysis at apex. Fourth furcal less than one-fourth as long as second cubital; radius long. Facial cones subvertical, long. *T. longicornis* Crawf.

CC. Ventral plate of female rounded, with an acute epiphysis at apex. Fourth furcal about one-half as long as second cubital; radius rather short.

D. Anal valve of male simple, converging toward apex, somewhat knobbed at tip. Facial cones almost horizontal, long.
T. rotundipennis Crawf.

DD. Anal valve of male not simple, with a moderately large posterior lobe. Facial cones subvertical, rather long. Head and thorax more or less striped and banded. *T. varians* Crawf.

BB. Dorsal plate of female not rhomboidal, rounded on both upper and lower surfaces. Wings not very broadly rounded.

C. Forewing with black or brown band. Radius straight, rather short. Anal valve of male with a posterior lobe.

D. Subcosta bordered with conspicuous black band for entire length.
T. californica Crawf.

DD. Subcosta normal; hind margin with brown band from tip of clavus to apex of wing and through both marginal cells.
T. marginata Crawf.

CC. Forewings without bands or stripes. Radius usually curved.

D. Facial cones scarcely divergent, rather short.

E. Facial cones almost straight on inner margin, not conical.

F. Body small; wings very small. Dorsal plate of female very obtuse at apex.

G. Facial cones scarcely divergent, quite straight on inner margin.
T. minuta Crawf.

GG. Facial cones slightly divergent in apical half. Body slightly larger. *T. minuta similis* Crawf.

FF. Body normally large; wings normal. Dorsal plate of female quite acute apically. *T. salicis* Mally.

EE. Facial cones quite distinctly conical in shape, but only slightly divergent *T. nigrifrons* Crawf.

DD. Facial cones distinctly divergent, conical in shape, and quite long.

E. Anal valve of male simple, small, convergent to apex; claspers very small.

F. Wings fulvous. *T. fulvida* Crawf.

FF. Wings clear. *T. fulvida similis* Crawf.

EE. Anal valve not simple, rather large, with a posterior lobe.

F. Posterior lobe of anal valve quite large, reaching beyond base of claspers. Dorsal plate of female subacute and curved down in apical half. *T. aurantiaca* Crawf.

FF. Posterior lobe of anal valve small, short, scarcely more than an epiphysis. Dorsal plate of female not curved down as above. *T. nigra* Crawf.

AA. Genital segment of female not short, distinctly longer than preceding ventral sclerite; usually more than twice as long.

B. Female without long, slender, acute, style like ovipositor sheath; genital segment only moderately long.

C. Vertex and notum conspicuously pubescent.

D. Pubescence long, quite dense; vertex bulging; facial cones very short. Pronotum short. Wings large; second marginal cell unusually large. Anal valve of male about as large as ventral plate and similarly shaped. *T. diospyri* Ashm.

DD. Pubescence not long, pulverulent; vertex flat. Facial cones moderately long. Pronotum quite long. Wings not large; marginal cells subequal. Anal valve of male small. *T. bakeri* Crawf.

CC. Vertex and notum not conspicuously pubescent.

D. Genital segment of female about as long as wide dorso-ventrally. Anal valve not spatulate.

E. Dorsal and ventral plates equally long, quite stout, and not acute at apex. Vertex conspicuously impressed discally.

F. Abdomen white ventrad. Facial cones very slender and acute. *T. similis* Crawf.

FF. Abdomen unicolored. Facial cones not very slender. *T. similis fovealis* Crawf.

EE. Dorsal plate distinctly longer and less acute than ventral. Vertex scarcely impressed discally.

F. Veins of wing set with double row of setae. Anal valve straight on anterior margin, roundly lobate posteriorly; claspers large, not acute at apex.

G. Setae on veins quite prominent; wing somewhat fulvous; punctural dots on wing membrane conspicuous. Body large, robust. *T. mexicana* Crawf.

GG. Setæ less prominent; wings less fulvous; punctural dots not conspicuous. Body smaller. *T. mexicana minuta* Crawf.

FF. Veins of wing without setæ, or if present scarcely visible. Anal valve of male ovoid, extending caudad. Claspers slender, curved, acute apically. *T. assimilis* Crawf.

DD. Genital segment of female distinctly longer than dorso-ventral width. Anal valve more or less spatulate.

E. Both cubital veins and radius bordered with brown or black band. Anal valve large, with a large posterior lobe. *T. tripunctata* (Fitch) Riley.

EE. Cubitals and radius without dark bands. Anal valve without large posterior lobe.

F. Anal valve very large, spatulate, both margins subequal in length; with a bifurcate ridge extending from base toward each dorsal corner.

G. Body brownish red to orange. Thorax quite strongly arched. Notum finely and inconspicuously pubescent. *T. frontalis* Crawf.

GG. Body dark reddish brown. Thorax less strongly arched. Notal pubescence slightly more conspicuous. *T. frontalis sulcata* Crawf.

FF. Anal valve not unusually large, subspatulate; posterior margin much shorter than anterior; bifurcate ridge wanting.

G. Forewing with four spots on hind margin visible to unaided eye, one on margin of each marginal cell, one on cubital margin, and one on anal angle. Vertex orange to brown. Margins of anal valve arcuate. *T. quadripunctata* Crawf.

GG. Forewing without four visible spots; three usual spots present. Vertex and facial cones whitish. Margins of anal valve quite straight. *T. albifrons* Crawf.

BB. Female with a long, slender, acute ovipositor sheath; with basal portion of genital segment large, subspherical; genital segment very long. Facial cones quite short.

C. Produced ovipositor sheath not longer than enlarged basal portion of genital segment.

D. Produced sheath very short; body very small. Wing less than 2.5 mm. in length. Facial cones subacute. *T. nicaraguensis* Crawf.

DD. Produced sheath about as large as enlarged portion. Body normally large. Wing more than 3.3 mm. in length. Facial cones rounded. *T. collaris* Crawf.

CC. Produced ovipositor sheath much longer than basal portion of genital segment. Facial cones very short and rounded.

D. Genital segment less than one-fourth the length of rest of body. Præpimeron visibly as long as episternum. *T. longistylus* Crawf.

DD. Genital segment fully one-fourth as long as remainder of body. Epimeron mostly concealed, visibly shorter than episternum. *T. proximata* Crawf.

Trioza tripunctata (Fitch) Riley

(Fig. 152, A; 153, G; 154, A; 155, A)

(*Psylla tripunctata* Fitch) (Non *Trioza tripunctata* Low)

Length of body (female) 2.8 mm.; (male) 2.3 mm.; length of forewing 3.5 mm.; greatest width 1.5 mm.; width of vertex between eyes .49 mm.; with eyes .80 mm.; general color brown to dark brown, dorsum black; head lighter; antennæ yellowish, black at tip.

Head deflexed, rather coarsely punctate, with eyes not as broad as thorax. Posterior margin of vertex narrowly elevated over middle half, slightly arcuate; vertex raised plate-like on each side of median suture; with a shallow, oblique depression on each side extending from posterior marginal ridge toward front and eyes; anterior margin of plates down-curved and emarginate at median suture. Eyes very prominent; anterior ocellus imbedded between conical insertion of antennæ and base of facial cones. Facial cones medium in length, rounded apically, quite divergent, subvertical, moderately pubescent. Antennæ of usual *triozal* form, yellowish, except two apical segments and tips of intermediate segments black.

Thorax coarsely punctate, quite strongly arched. Pronotum moderately short, distinctly depressed below head and dorsulum; dorsulum quite heavy, ascending strongly, roundly acute cephalad, about as long as scutum. Metasternal spurs short. *Wings* quite large, roundly acute apically, almost two and one-half times as long as broad, broadest across middle of first marginal cell, distinctly narrowed in basal half; hyaline, except three brown bands along first and second cubital and radial veins and covering both marginal cells; radius not quite as long as second cubital, flexed midway; marginal cells subequal and similar in shape; third furcal vein very short; ventation brown, conspicuous.

Male.—Genital segment prominent, not as long as two preceding segments; claspers stout, simple, long; anal valve large, extending beyond base of claspers. Pubescence short and sparse. *Female.*—Genital segment very long, almost as long as rest of abdomen, very slender and acute; dorsal plate slightly overreaching ventral and less acute; genital pore scarcely one-fourth as long as dorsal plate; ventral plate very acute; ovipositor very long and acute (exserted in type female); pubescence sparse and short.

Redescribed from one male and one female taken by Mr. F. A. Sirrine at Jamaica, Long Island, October 11th.

This species was described briefly by Fitch in 1851 as follows: "Wax yellow, dorsum black; legs and antennæ pale yellow, the latter black at the tips; elytra hyaline, nerves brown, beyond the furcation widely margined with smoky fulvous; a blackish dot on the middle of the terminal margin of each of the inner apical cells. Length 0.16 inch." The specific name was derived from the three marginal dots common to nearly all the *Triozas*. In 1877 [illegible] Franz Low described a new European Psyllid as *Trioza tripunctata*, not knowing of course that there was another *Trioza* of the same name then classed as a *Psylla*. In 1893 Riley placed Fitch's *Ps. tripunctata* in the genus *Trioza*,

Figure 152. Heads of Triozinae:

A, Trioza tripunctata; B, T. salicis; C, D, T. minuta; E, T. quadripunctata; F, T. longistylus; G, T. assimilis; H, T. similis foveatis; I, T. mexicana; J, Allotrioza arbolensis; L, A. magnoliae; N, A. arbolensis; N, Paratrioza ocellata; O, Eputrioza medicaginis; P, E. oaxacensis; R, E. medicaginis; S, Paratrioza ocellata; T, Trioza nicaragnensis.

thus making two members of the genus bear the same name. According to Section 69 of the code of nomenclature now in preparation by the Entomological Society of Washington the *tripunctata* of Low must be changed. In 1908 the Japanese entomologist, Kuwayama, described a new *Psylla*, naming it *Ps. tripunctata*. Since this name is already synonymical in that genus from Fitch's original description, this name can not be attached to the new Japanese species. This may become instead *Psylla kuwayamai* n. n.

Trioza salicis Mally

(Fig. 152, B; 154, D; 155, B)

Length of body 1.9 mm.; length of forewing 3.0 mm.; greatest width 1.3 mm.; width of vertex between eyes .40 mm.; with eyes .68 mm. General color orange yellow to brown, notum and head darker; antennæ black in apical half.

Head deflexed, very finely punctate, with eyes not as broad as thorax. Posterior margin narrowly elevated over middle three-fifths, only slightly arcuate; discal area with broad shallow depression on each side of median suture, and bi-lobately projecting, with anterior ocellus imbedded under it at base of facial cones; vertex not raised plate-like. Facial cones rather short, acute, almost parallel on inner margin and scarcely divergent, almost vertical, sparcely pubescent apically. Antennæ inserted on front below eyes, within; insertion yellow, the rest of vertex, front and facial cones black or dark brown.

Thorax arched, rugosely punctate. Pronotum short, much depressed below dorsulum and head; propimeron very distinctly visible. Dorsulum quite large, strongly ascending, rather acute anteriorly; lighter in color on anterior portion than posteriorly; meta-sternal spurs short. *Wings* hyaline, about two and a half times as long as broad, broadest across first furcal, subacute apically; anal vein very heavy and dark; venation very light brown.

Female.—Genital segment very short, scarcely longer than two preceding tergites or anal ventral sclerite; dorsal plate overreaching ventral, almost glabrous, pubescence very sparse and brief; genital pore almost half as long as dorsal plate; ventral plate acutely beaked apically.

at Ames, Iowa, and from several females collected at Algonquin, Illinois; all specimens were taken either in September or October.

This species was first described by Mally in 1895 from specimens taken on willow (Salix) at Ames, Iowa. His description is taken up mostly with coloration and wing venation, two characters which are of little specific value in this genus. The male genitalia are scarcely described and not figured, and unfortunately there is no male specimen in this collection. Consequently this character must be described at some future time.

Trioza minuta Crawf.

(Fig. 152, C, D; 154, B; 155, C)

Length of body 1.7 mm.; length of forewing 2.6 mm.; greatest width .9 mm.; width of vertex between eyes .40 mm.; with eyes .62 mm. General color very light orange yellow throughout; antennæ black apically.

Head quite strongly deflexed, very slightly impunctate, with eyes not broad as thorax. Posterior margin of vertex arcuate, slightly elevated over middle one-third, scarcely emarginate at median suture, vertex scarcely raised plate-like; discal area with a small fovea on each side posteriorly and a shallow divergent depression extending downward toward front. Facial cones short, vertical, scarcely divergent, almost straight and parallel on inner margin, quite acute, pubescence short and sparse. Antennæ inserted on frons and shorter than facial cones; form of antennæ as usual in genus.

Thorax not strongly arched, more coarsely punctate than vertex, rather slender. Pronotum short, depressed below head and dorsulum, nearer to level of dorsulum than of head. Dorsulum ascending, about as long as scutum. Metasternal spurs short. *Wings* hyaline, very slender, fully three times as long as broad, broadest across first marginal cell, subacute apically, first furcal quite short, second and fourth subequal; venation brownish yellow, not conspicuous.

Female.—Genital segment very short, about as long as two preceding tergites; dorsal plate very slightly longer than ventral, very broadly rounded apically; ventral plate acute and somewhat beaked at tip; pubescence short and sparse.

Described from three females from Arizona in the C. F. Baker collection.

Trioza minuta similis Crawf.

Body small, slightly larger than species. Vertex very similar in form, facial cones less parallel and straight on inner margin, more divergent. Thoracic characters very similar to species. Wings slightly larger, but similarly veined. Female genitalia quite similar to species. *Male.*—Genital segment rather short; claspers slender, simple, incurved apically. Anal valve proportionately rather large, bilobate, with posterior lobe.

Described from several males and females from Oregon in the C. F. Baker collection.

Trioza quadripunctata Crawf.

(Fig. 152, E; 153, H; 154, C; 155, D)

Length of body 2.3 mm.; length of forewing 3.3 mm.; greatest width 1.5 mm.; width of vertex between eyes .42 mm.; width eyes .71 mm. General color greenish yellow; antennæ black in distal half.

Head deflexed, somewhat punctate, with eyes almost as broad as thorax. Posterior margin of vertex narrowly elevated over middle two-thirds, slightly arcuate; vertex not elevated plate-like; discal area with a small fovea on each side between median suture and posterior ocellar area, and a sulcate depression extending obliquely toward front and lower margin of eye; broadly and deeply emarginate anteriorly at median suture, and protruding bilobately over frons; median suture distinctly emarginate; facial cones medium in length, rather acute, quite strongly divergent, usually subvertical, sometimes almost horizontal, pubescence rather sparse and brief. Antennæ inserted under pro-

truding vertical lobes above base of facial cones; antennal impressions scarcely larger than scape.

Thorax strongly arched, more coarsely punctate than vertex. Pronotum rather long, depressed below head and dorsulum but not as much as usual; propisternum long, reaching arcuately almost to suture of dorsulum and mesopleurites. Dorsulum large, about as long as scutum, roundly acute cephalad. Metasternal spurs short. *Wings* hyaline, relatively quite broad, only a trifle more than twice as long as broad, broadest across middle of first marginal cell, rounded apically but not broadly so; radius almost straight; marginal cells subequal; with four distinctly visible maculæ on posterior margin, the largest in first marginal cell, one on margin of cubital and second marginal cells and the fourth at tip of clavus; venation light brown.

Male.—Genital segment large, larger than two preceding sclerites; dorsal surface of plate ascending caudad; claspers long, simple, arcuate and incurved; anal valve about as long as claspers, with a small posterior lobe on each lateral flap; pubescence sparse. Abdominal tergites short, extending about to third ventral sclerite. *Female.*—Abdomen much heavier and broader than in male. Genital segment long, almost as long as rest of abdomen, quite acute apically; dorsal plate slightly longer and less acute than ventral; genital pore fully one-third as long as dorsal plate.

Described from one male and four females from Colorado; collector C. F. Baker.

Trioza longistylus Crawf.

(Fig. 152, F; 154, E; 155, E)

Length of body with ovipositor 3.1 mm.; without ovipositor 2.5 mm.; length of forewing 3.9 mm.; greatest width 1.6 mm.; width of vertex between eyes .48 mm.; with eyes .90 mm. General color greenish yellow; body quite large and robust.

Head strongly deflexed, quite coarsely punctate on vertex and frons, with eyes not as broad as thorax. Posterior margin of vertex narrowly elevated, arcuate; vertex not raised plate-like; discal area on each side with an angulate-sulcate depression diverging from posterior marginal ridge toward frons and lower margin of eye; elevation along median suture quite broad; anterior margin not deeply emarginate at median suture. Facial cones short, rounded apically, divergent only in distal half, quite vertical, scarcely pubescent. Antennæ inserted on frons below termination of frontal sulca.

Thorax strongly arched, more coarsely punctate than vertex. Pronotum quite long, somewhat depressed below head and dorsulum; with a fovea on each side above episternum. Dorsulum large, rather broadly rounded cephalad, strongly ascending; dorsulum caudad and scutum rugulose. *Wings* large, hyaline, about two and a half times as long as broad, broadest across first marginal cell, rounded apically but not broadly so; first marginal cell slightly larger than second; second furcal distinctly arched; second cubital about twice the length of fourth furcal; radius about as long as second cubital; clavel margin very heavy and prominent; venation light brown.

Female.—Abdomen robust. Genital segment large, subglobose, greatly produced caudad; dorsal plate slightly shorter than ventral; genital pore very small; both plates produced into an ovipositor sheath longer than genital segment basally; sheath and style together almost one-fourth as long as rest of body. Pubescence very sparse and brief.

Described from three females in the C. F. Baker collection, two taken in Colorado and one in Santa Clara County, California.

This species is very closely related to *Trioza collaris* Crawford, but differs in the following characters: *T. collaris*—Facial cones not broadly rounded, prepimeron short, not visibly as long as episternum; dorsulum with an acute epiphysis cephalad; both pronotum and dorsulum very sparsely pubescent, ovipositor sheath and style about as long as rest of genital segment. *T. longistylus*—Facial cones broadly rounded apically; prepimeron visibly fully as long as episternum; dorsulum without epiphysis cephalad, pronotum and dorsulum not pubescent; ovipositor sheath and style twice as long as rest of genital segment.

The two species are, however, of the same type and should not have been so far separated in the preliminary synopsis.

Trioza proximata n. sp.

(Fig. 153, J; 155, F)

Length of body (female with ovipositor) 3.4 mm.; (without ovipositor) 2.7 mm.; male 2.4 mm.; length of forewing 3.7 mm.; greatest width 1.5 mm.; width of vertex between eyes .44 mm.; with eyes .78 mm. General color light greenish yellow.

Head moderately deflexed, with eyes not as broad as thorax, punctate. Posterior margin of vertex narrowly elevated; vertex not raised plate-like; discal area excised and impressed very similarly to *T. longistylus*, elevation along median suture quite prominent; anterior margin slightly emarginate at median suture. Facial cones short, rounded apically, more or less straight and parallel on basal half of inner margin, somewhat divergent distally, vertical to subvertical, moderately pubescent. Antennæ inserted on frons and base of facial cones laterad. Eyes prominent.

Thorax arched, more coarsely punctate than vertex. Pronotum moderately long, depressed below head and more or less below dorsulum; with a fovea on each side above pleurites. Dorsulum large, quite acutely rounded cephalad, sometimes almost pointed. Meta-sternal spurs very short. *Wings* hyaline, about two and a half times as long as broad, broadest across first furcal, broadly rounded apically; radius longer than second cubital; fourth furcal more than half as long as second cubital.

Male.—Abdomen slender. Genital segment large, prominent; anal ventral sclerite small. Genital plate large, rounded; claspers long, slender, simple, curved forward and inward; penis long, slender; anal valve large, longer than claspers, almost straight on anterior margin, posterior margin broadly rounded, except distally; with a small epiphysis distally. Pubescence sparse and brief,

longer on anal valve. *Female.*—Genital segment and ovipositor very similar to that of *T. longistylus;* dorsal plate somewhat longer than ventral; sheath and style together fully one-fourth as long as rest of body. Pubescence brief and sparse.

Described from three females and four males collected at Oaxaca, Mex., and two females at Orizaba, Mex., coll. D. L. Crawford.

This species is very closely related to *T. longistylus* and *T. collaris* Crawford. The principal and most constant variation between these three species lies in the dorsulum, facial cones, and female genitalia. In all probability the male of the two United States species, still unknown, will prove to be very similar in respect to genitalia to the Mexican form.

Trioza nicaraguensis Crawf.

(Fig. 152, T; 154, F; 155, K)

Length of body 1.7 mm.; length of forewing 2.3 mm.; greatest width .8 mm.; width of vertex between eyes .30 mm.; with eyes .56 mm. General color lemon yellow; antennæ black apically. Insect small.

Head moderately deflexed, quite coarsely punctate, with eyes not quite as broad as thorax. Posterior margin of vertex arcuate, scarcely elevated narrowly; vertex not raised plate-like; discal area with a fovea on each side midway between median suture and posterior ocellar region; without a depression or sulcus, or if present very slight; lobately produced cephalad over anterior ocellus, scarcely emarginate at median suture. Facial cones rather short, acute, moderately divergent, more so in distal half than in basal, subvertical, very slightly and inconspicuously pubescent. Antennæ slender, inserted at base of facial cones below produced vertex laterad. Eyes comparatively appressed, not as prominently bulging as usual. Labrum small.

Thorax not large, arched but not strongly so. Pronotum short, depressed below head and dorsulum; prepisternum large, subtrapezoidal; epimeron almost invisible; fore coxæ large, mostly visible. Dorsulum quite acutely rounded cephalad, slightly overhanging pronotum. *Wings* small, slender, delicate, hyaline, about three times as long as broad, broadest across first marginal cell, subacute apically; radius not as long as second cubital; marginal cells subequal; venation yellowish, not conspicuous.

Female.—Genital segment quite large, almost as long as rest of abdomen; dorsal plate smaller; both plates about equal in length; genital pore large about one third as long as dorsal plate; both plates produced caudad into a short ovipositor sheath; sheath and style not quite as long as rest of genital segment. Pubescence sparse and brief.

Described from one female collected in San Marcos, Nicaragua, by C. F. Baker.

Trioza frontalis sulcata (Crawf.)

(Syn. *Trioza sulcata* Crawford.)

In general this varietal form is very similar to the species. Although coloration is but superficial and seldom a true varietal character, yet this

Figure 153. Heads and male genitalia of Triozinae:

A, Neotrioza immaculata; B, N. laticeps; C, D, Rhinopsylla antennata; E, Neotrioza immaculata; F, N. laticeps; G, Trioza tripunctata; H, T. quadripunctata; I, T. assimilis; J, T. proximata; L, T. mexicana; N, Allotrioza magnoliae; N, A. arbolensis; O, Paratrioza maculipennis; P, Epitrioza medicaginis; R, Paratrioza ocellata; S, P. cockerelli; T, Neotrioza immaculata; U, Rhinopsylla antennata.

is the most apparent difference between the species and its variety. The species is brownish red to orange, usually quite light colored, whereas the varietal form is very dark reddish brown. The principal structural differences are thoracic; the dorsulum in the variety is distinctly less arched than in the species, and the notum is finely pubescent; the notum of the species is also pubescent but much less conspicuously.

These two forms were separated as species in the provisional synopsis chiefly on the difference in the trend of the facial cones, but this is not a sufficiently constant character to warrant this separation.

The form mentioned in the provisional synopsis as *Trioza sulcata similis* is found on further study to be identical with *T. frontalis*. Therefore the varietal name becomes synonymical.

Trioza similis fovealis (Crawf.)

(Syn. *Trioza fovealis* Crawford)

(Fig. 152, H; 154, I)

This varietal form is very similar to the species in almost all characters. The following differences make it evident that it is truly a variety. The facial cones are distinctly shorter and less slender in the varietal form; the epimeron is not so prominent as in the species; the tergites of the abdomen are concolorous with the sternites; this character is of more importance than it might at first thought seem, since the relative coloration of the abdomen dorsad and ventrad is quite constant. The female genitalia are quite similar, though not exactly so. Described from one female taken in Colorado by C. F. Baker.

It will be noted in Fig. M, on page 348, Vol. II, No. 4 of the POMONA JOURNAL, that the frons and the insertion of the antennæ is erroneously represented. The illustration presented for the varietal form is more correct for the species, also.

Trioza albifrons Crawf.

(Fig. 154, L)

POMONA JOURNAL Ent. Vol. II, No. 4, page 355. The type locality of the species is Claremont, California. Subsequent to the description of the species numerous specimens of both sexes were collected at Nordhoff, California, by D. L. Crawford, on leaves of nettle (*Urtica holosericea*). Since only the male was known from the Claremont forms, the characters of the female are here added.

Female.— Abdomen large, stout. Genital segment long, almost three times as long as preceding ventral sclerite; dorsal plate very slightly longer and less acute than ventral plate; genital pore less than one-third the length of dorsal plate. Pubescence sparse.

Trioza assimilis Crawf.

(Fig. 152, G; 153, I; 154, H; 155, G)

Length of body 2.3 mm.; length of forewing 3.3 mm.; greatest width 1.4 mm.; width of vertex between eyes .47 mm.; with eyes .70 mm. General

color dark orange red to dark brown with a reddish tinge; abdomen greenish white; thorax often lighter colored laterad.

Head moderately deflexed, with eyes not as broad as thorax, very finely punctate. Posterior margin of vertex slightly elevated narrowly, arcuate; vertex not raised plate-like; discal area almost plane; with a very shallow and slight depression in center; anterior margin quite strongly protruding over insertion of antennæ, emarginate roundly at median suture; anterior ocellus under protrusion of vertex at base of facial cones. Facial cones medium in length, subacute, quite strongly divergent, subvertical to subhorizontal, usually not visible from above, moderately pubescent. Antennæ normal, inserted on frons at base of facial cones laterad.

Thorax quite strongly arched, more coarsely punctate than vertex. Pronotum short, depressed below head and dorsulum; propimeron usually only moderately visible, occasionally very prominent. Dorsulum strongly ascending, roundly acute cephalad. Scutum quite broad. Metasternal spurs small. *Wings* hyaline, almost two and one-half times as long as broad, broadest across first marginal cell, subacute to roundly acute apically, usually the latter; radius as long as second cubital; radial cell very slender throughout; marginal cells subequal, the second a trifle larger; anal angle usually concolorous with the rest of marginal veins, some times dark brown.

Male.—Abdomen more slender than that of female; flexible at fourth and fifth ventral sclerites. Genital plate not large; ventral plate normally rounded caudad and horizontal dorsad; claspers quite long, slender, acute, simple; anal valve rather small, extending scarcely to base of claspers; composed of two simple elliptical flaps, with a row of hairs dorsally. Pubescence sparse and brief. *Female.*—Genital segment moderately large, longer than preceding ventral sclerite; dorsal plate longer and less acute than ventral; genital pore inclined toward anal tergite; pubescence sparse.

Described from numerous males and females collected by C. F. Baker in Santa Clara County, California, and three specimens in Ormsby County, Nevada.

This species is quite closely related to *T. aurantiaca* and *T. fulvida* Crawford. As was noted in *T. aurantiaca* there is in this species more or less gradual variation in the characters mentioned as variable in the foregoing description. Among all the specimens studied, three males were found to have a slightly more acute wing and a black anal angle, the two characters seeming to be associated.

Trioza mexicana n. sp.

(Fig. 152, I; 153, L; 154, G; 155, H)

Length of body (female) 2.6 mm.; length of forewing 3.6 mm.; greatest width 1.5 mm.; width of vertex between eyes .52 mm.; with eyes .87 mm. General color reddish brown, usually quite dark, occasionally lighter.

Head somewhat deflexed, with eyes not as broad as thorax, punctate. Posterior margin of vertex arcuate, scarcely elevated; vertex not raised plate-like, finely pubescent; discal area almost flat, with a slight foveal depression near

posterior margin on each side of the median suture. Facial cones large, long, subacute, quite strongly divergent, intermediate between vertical and horizontal, easily visible from above, sparsely pubescent. Antennæ inserted on frons at base of facial cones laterad. Eyes large, prominent. Labrum medium in size.

Thorax arched strongly, coarsely punctate. Pronotum moderately long, arched and strongly descending cephalad, depressed below head and more or less below dorsulum; propleurites narrow. Dorsulum moderately long, ascending to scutum. Metasternal spurs medium. *Wings* subhyaline, slightly dusky, covered over entire membrane with fine punctural dots; all veins set with a double row of minute setæ; less than two and one-half times as long as broad, broadest across base of first marginal cell, broadly rounded apically; marginal cells subequal; second furcal quite strongly arched; venation prominent.

Male.—Abdomen more slender and smaller than in female. Genital segment large, rounded; claspers long, only slightly tapering, abruptly broadened at tip; anal valve very large, long; straight on anterior margin, lobately arched on posterior margin; with a small capitate lobe projecting caudad and dorsad; posterior margin with a conspicuous fringe. Pubescence sparse and brief. *Female*.—Abdomen stout. Genital segment large, not quite as long as rest of abdomen; dorsal plate longer than ventral; both plates acute, slightly serrate apically; genital pore fully one-fourth as long as dorsal plate; ovipositor quite long, not acutely pointed. Pubescence sparse and brief.

Described from four males and numerous females, collected in the mountains near Cuernavaca, Mexico (altitude 10,000 feet), by D. L. Crawford. Food plant: *Rhus sp.*

Trioza mexicana minuta n. var.

Body distinctly smaller than in the species. Head quite similar to species; pronotum comparatively shorter and more depressed; wings smaller, less dusky; setæ on veins less prominent, although present; venational characters similar. Genitalia very similar to species; male genitalia comparatively smaller.

Described from three females and one male collected at Oaxaca, Mex., by D. L. Crawford.

Rhinopsylla Riley

This genus was erected for the single species *Schwarzii*, in 1883. While this species possesses characteristics which evidently separate it generically, still the description of the genus was made so restrictive by Riley that closely related species could not be included in a generic group with this species. The following description of the genus is more general and only characters are mentioned which belong to the entire *Rhinopsylla* group of species, rather than to the single species described by Riley.

Body moderately slender, slightly arched dorsally, punctate. Head, including eyes, as broad or broader than thorax. Vertex very deeply and triangularly emarginate anteriorly at median suture, giving a very marked birostrate appearance. Antennæ attached to apex of rostra, greatly increasing the

peculiar birostrate appearance; basal segment of antennæ large and broad, second segment large, but smaller than first, third segment very long; facial cones entirely wanting; face slightly swollen under insertion of antennæ.

This genus is very closely related, apparently, to the European genus *Bacteriecera* Puton, and in fact may be identical. The absence of the facial cones and the unusual length of the third antennal segment ally the two genera very closely. Low's description of *Bacteriecera* gives as characters of the vertex: "Vertex half as long as width between eyes; with two flat, broad impressions, rounded anteriorly and extending well forward, emarginate at median suture; posteriorly almost plane." It is quite probable that in the formation of the head the two genera are closely related. Until the European form becomes available for study, we should allow *Rhinopsylla* to stand as a very closely allied genus. The genus *Bacteriecera* can scarcely be erected into a subfamily, as distinct from *Trioziuae*, as has been attempted by some, since there is too close a relationship existing between them.

Synopsis of the Genus Rhinopsylla

A. Fore femora distinctly enlarged, compressed, and curved. Third antennal segment thicker midway than succeeding segments. Wings slender, more than three times as long as broad. *Rh. schwarzii* Riley

AA. Fore femora not distinctly enlarged, compressed nor curved. Third antennal segment slender, not thicker than succeeding segments. Wings only two and a half times as long as broad.

B. Birostrate appearance of head very pronounced; basal segments of antennæ almost as broad as ends of projecting rostra. Body black. *Rh. antennata* Crawf.

BB. Birostrate appearance less pronounced; basal antennal segments smaller; sulcate impressions of vertex more pronounced. Body orange. *Rh. antennata proxima* Crawf.

Rhinopsylla schwarzii Riley

Proceedings of the Biological Society of Washington, Vol. II, 1882-84, page 77.

Rhinopsylla antennata (Crawf.)

(Syn. *Paratrioza antennata* Crawf.)

(Fig. 153, C, D, U; 155, S)

Length of body 1.8 mm.; length of forewing 2.7 mm.; greatest width 1.1 mm.; width of vertex between .44 mm.; with eyes .73 mm. General color black; abdomen white ventrad; antennæ and tarsi lighter.

Head not deflexed, with eyes about as broad as thorax, impunctate; broad posteriorly, when viewed laterally, and tapering toward insertion of antennæ. Posterior margin of vertex arcuate, scarcely elevated narrowly; vertex not raised plate-like; discal area with a distinct sulcate impression extending forward and toward lower margin of eye on each side, anterior margin deeply emarginate at median suture, making head appear strongly birostrate. An-

terior ocellus at apex or emargination, visible from above. Facial cones entirely wanting; face slightly swollen beneath each antennal insertion and sparsely pubescent. Antennæ inserted on truncate termination of rostrate lobes; basal segment very large and broad, almost as broad as anterior margin of projecting lobes; second segment smaller; third segment longer than fourth and fifth combined, slender, not broader than succeeding segments. Labrum moderately large, posterior.

Thorax scarcely arched, quite coarsely punctate. Pronotum moderately long, somewhat arched, not depressed below head and dorsulum; lateral impressions rather elongate, posterior; pleurites large. Dorsulum small. Anterior femora of normal length and thickness, scarcely arcuate. *Wings* hyaline, small, about two and a half times as long as broad, broadest across base of first marginal cell, subacute apically; radius shorter than second cubital; marginal cells subequal; fourth furcal terminating above apex of wing; venation light, inconspicuous.

Male.—Abdomen moderately stout; white ventrad, black dorsad. Genital segment small, not much larger than preceding ventral sclerite; claspers small, subglobose basally, slender and acute apically; pubescence short and sparse. Anal valve about equal in size to ventral plate, almost straight on inner margin, strongly arched posteriorly; pubescence longer than on genital plate and claspers.

Described from two males collected in Colorado, by C. F. Baker. Type in Nat. Museum.

Rhinopsylla antennata proxima n. var.

The chief variation from the species lies in the cephalic characters. The anterior emargination is less pronounced and the basal segments of the antennæ are distinctly smaller, but of the same type. The sulcate depression on the vertex is more marked. The facial cones are entirely wanting but the enlargements under the antennal insertions are more distinct. The color is lighter in the variety, but this is not necessarily a varietal character.

Described from one female collected in Colorado, by C. F. Baker.

Allotrioza n. gen.

Pronotum long, usually quite flat, not depressed below dorsulum and head; notum not strongly arched. Head not deflexed; vertex usually with a deep fovea posteriorly on each side of the median suture and more or less of a depression extending forward. Facial cones short, very broadly rounded apically, quite horizontal; labrum often visible from in front.

Wings quite acutely rounded apically; first marginal cell larger than second; first cubital vein comparatively short, scarcely ever more than twice as long as first furcal, sometimes equal in length to first furcal.

Type of genus: *Allotrioza arbolensis* Crawf.

Synopsis of the Genus Allotrioza

A. Wings not entirely clear, more or less maculated. Facial cones subacute viewed from side. Præpisternum almost horizontal; epimeron inferior.

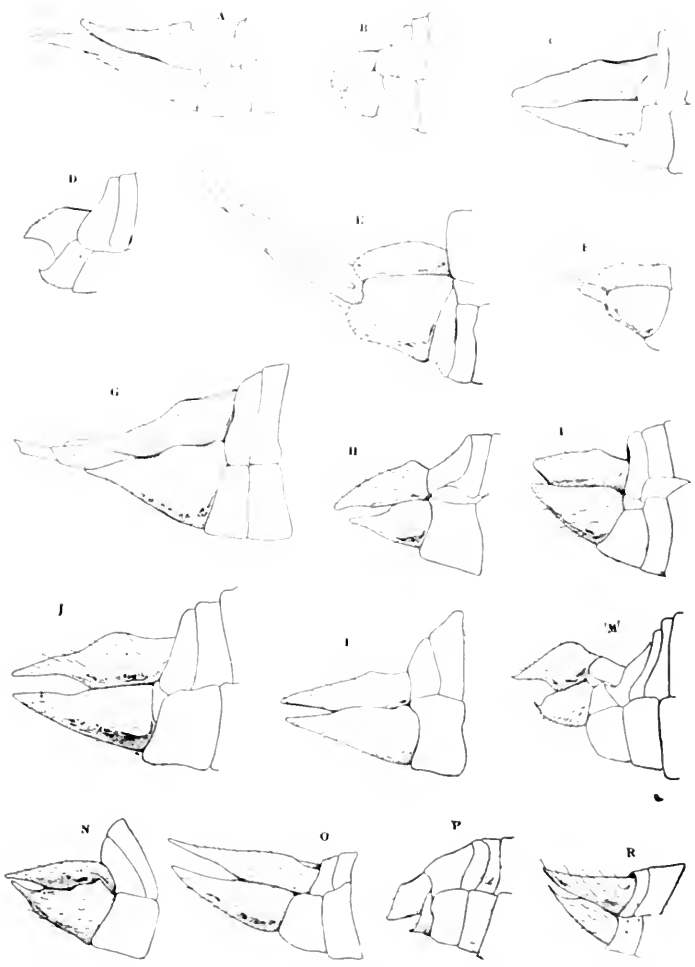

Figure 154. Female genitalia of Triozinae:

A, Trioza tripunctata; B, T. minuta; C, T. quadripunctata; D, T. salicis; E, T. longistylus; F, T. nicaraguensis; G, T. mexicana; H, T. assimilis; I, T. similis fovealis; J, Allotrioza magnoliae; L, Trioza albifrons; M, Allatrioza arbolensis; N, Eutrioza medicaginis; O, E. oaxacensis; P, Paratrioza ocellata; R, Neotrioza laticeps.

B. Both marginal cells and distal portion of cubital cell maculated. Wing subacute at apex. Vertex elevated distinctly along median suture. Body mottled. *A. maculata* Crawf.

BB. With a more or less faint maculation across wing midway, from first marginal cell through most of radial cell; wing very acute at apex. Vertex more nearly flat, whitish. Body not mottled. *A. acutipennis* Crawf.

AA. Wings entirely clear, not maculated. Facial cones broadly rounded. Propisternum vertical; epimeron posterior and lateral.

B. Body very small. Wings small, and less than two and a half times as long as broad; radius very short and straight. Female genital segment about as long as dorso-ventral width. Anal valve of male small. Eyes small. *A. viridis* Crawf.

BB. Body large. Wings large, more than two and a half times as long as broad; radius not very short. Eyes large.

C. Second marginal cell smaller than first; fourth furcal one-fourth as long as second cubital. Propleurites small. Female genital segment longer than dorso-ventral width. Anal valve large, longer than claspers. *A. magnoliae* Ashm.

CC. Second marginal cell as large as first; fourth furcal one-half as long as second cubital. Propleurites very large. Female genital segment not longer than dorso-ventral width. Anal valve small. *A. arbolensis* Crawf.

Allotrioza arbolensis (Crawf.)

(Syn. *Paratrioza arbolensis* Crawf.)

(Fig. 152, J, M; 153, N; 154, M; 155, I)

Length of body 2.0 mm.; length of forewing 3.9 mm.; greatest width 1.5 mm.; width of vertex between eyes .60 mm.; with eyes .96 mm. General color light green throughout. Body very large.

Head not deflexed, very large, coarsely punctate. Posterior margin of vertex somewhat arcuate; vertex quite distinctly raised plate-like; discal area with a deep fovea on each side posteriorly, and a marked excision diverging toward insertion of antennæ, deeper at the margins of the excision than in the middle; a prominent elevation left on each side of median suture not quite attaining anterior margin of vertex; median suture very prominent. Eyes very large. Facial cones short, horizontal, broadly rounded at apex, slightly flexed midway, quite divergent, moderately pubescent. Antennæ large basally, inserted beneath margin of vertex more or less laterad. Labrum very large, easily visible from in front.

Thorax large, and broad, slightly broader than head including eyes, more coarsely punctate than vertex. Pronotum very long, about one-third as long as dorsulum, not depressed below dorsulum and head; with a fovea on each side above pleurites; propleurites large; episternum unusually large. Dorsulum broad, but not proportionately long, rather triangular, quite acute cephalad.

Metasternal spurs of medium size; anterior pair present but very small. *Wings* hyaline, large, straight on hind margin, front margin arched, not quite three times as long as broad, broadest across first furcal; fourth furcal almost one-half as long as second cubital, terminating at apex of wing.

Male.—Abdomen quite stout. Genital segment of medium size, claspers moderately large at base, subacute apically, anal valve rather small, simple. (In the only two male specimens available the claspers are drawn down into the genital plate and not entirely visible.) Pubescence moderate. *Female.* Abdomen larger than in male. Genital segment rather small, scarcely longer than two preceding ventral sclerites; dorsal plate longer than ventral, acutely pointed; genital pore about one fourth as long as dorsal plate, on descending area; ventral plate acutely pointed; pubescence rather sparse.

Described from two males and four females collected by C. F. Baker in Arboles, Colorado. *Food-plant. Shepherdia.*

In the preliminary synopsis of *Triozinae* this species was included in the new genus *Paratrioza*. The limits of this genus have been subsequently altered and another genus erected to include this and several other closely allied species.

Allotrioza magnoliae (Ashm.)

(Syn. *Trioza magnoliae* Ashm. *Psylla magnoliae* Ashm.)

(Fig. 152, L; 153, M; 154, J; 155, J)

Length of body 2.7 mm.; length of forewing 3.8 mm.; greatest width 1.3 mm.; width of vertex between eyes .56 mm.; with eyes .94 mm. General color light yellowish green throughout. Body large.

Head not deflexed, large, quite coarsely punctate. Posterior margin of vertex arcuate, rather narrowly elevated between ocellar regions; vertex not raised plate-like; vertex very similar in excision to that of *A. arbolensis* and *A. maculata*, but less marked than either. Antennae inserted on frons sublaterad. Facial cones short, longer than in *A. arbolensis*, very broadly rounded apically subhorizontal, quite divergent, moderately pubescent. Labrum moderately large, scarcely visible from in front.

Thorax large, long and quite broad, broader than head including eyes, slightly arched. Pronotum long, flat, not depressed below head and dorsulum, with a plicate marking extending from pleurites on each side about half the distance upward, pleurites not unusually large; forecoxae large. Dorsulum long, longer than scutum, rather acutely rounded cephalad. Metasternal spurs of medium size. *Wings* hyaline, large, rather slender, fully three times as long as broad, broadest across first marginal cell, both margins quite nearly equally arched, subacute apically; first marginal cell much longer than second; first cubital not much longer than first furcal; fourth furcal about one fourth as long as second cubital, terminating distinctly above apex of wing.

Male.—Abdomen tapering roundly to genital segment, anal segment quite constricted. Genital segment moderately large, of usual form; claspers large basally, tapering abruptly, recurved at tip, almost as long as anal valve; anal valve truncately conical when viewed laterally, quite large. Pubescence

moderate. *Female.*—Abdomen larger than in male. Genital segment long, almost as long as rest of abdomen; both plates about equal in length and quite acute; genital pore long, about one-fifth as long as dorsal plate. Pubescence moderate.

Redescribed from one male and three females collected at Crescent City, Florida, and loaned from the National Museum by the kindness of Dr. L. O. Howard.

The original description was based on specimens taken at Jacksonville, Florida. For the brief and inadequate description as given at that time, see Canad. Entom. Vol. XIII, No. 10, page 224. The close resemblance in many respects to *A. arbolensis* is very marked; this resemblance was noted as a possibility in the preliminary synopsis, although no specimens were then available for comparison.

Allotrioza maculata (Crawf.)

(Syn. *Trioza maculata* Crawf.)

For the description of this species see Pom. Journ. Entom., Vol. II, No. 4, page 349, and figures accompanying.

Allotrioza acutipennis (Crawf.)

(Syn. *Trioza acutipennis* Crawf.)

Pom. Journ. Entom. Vol. II, No. 4, page 350, with illustrations.

Allotrioza viridis (Crawf.)

(Syn. *Trioza viridis* Crawf.)

Pom. Journ. Entom. Vol. II, No. 4, page 359, with figures.

Paratrioza n. gen.

Head more or less deflexed; vertex distinctly raised plate-like, pubescent, and margined with a band lighter in color than discal portion; center of discal area lighter than surrounding surface. Facial cones very short, small, acute, most easily visible from in front or above; antennæ inserted on frons and outer basal portion of facial cones. Labrum visible from in front. Thorax not strongly arched. Wings rather small, usually about three times as long as broad. Abdomen short.

Type of genus: *Paratrioza ocellata* Crawf.

Synopsis of the Genus Paratrioza

A. Wings maculated, quite acute at apex; radius short and straight; second marginal cell much smaller than first. Vertex and notum not conspicuously striped and banded. *P. maculipennis* Crawf.

AA. Wings not maculated, subacute; radius rather long, curved; marginal cells subequal. Vertex and notum conspicuously striped and banded.

B. Anal valve of male with a large, triangular, subacute posterior lobe; vertical axis shorter than horizontal. Facial cones horizontal, not porrect, projecting outwardly. Antennæ inserted in front. Vertex with a brown macula in center. *P. cockerelli* Sulc.

BB. Anal valve of male larger, with a small rounded posterior lobe; vertical axis longer than horizontal. Facial cones porrect. Antennæ inserted somewhat laterad.

C. Vertex with markings white to dirty white.

D. Vertex discally with a white macula, more or less extensive. *P. ocellata* Crawf.

DD. Vertex discally without macula. *P. ocellata nigra* Crawf.

CC. Vertex with markings fulvous to deep orange. *P. ocellata flava* Crawf.

Paratrioza ocellata (Crawf.)

(*Paratrioza pulchella* Crawf.)

(Fig. 152, N, S; 153, R; 154, P; 155, M)

Length of body 1.5 mm.; length of forewing 2.7 mm.; greatest width 1.0 mm.; width of vertex between eyes .44 mm.; with eyes .75 mm. General color light to dark brown, to the naked eye; striped and banded on head and thorax; vertex black, with a whitish band bordering it and a white macula in center of discal area; dorsulum with a white stripe along median dorsal line, and a recurved stripe on each side extending from posterior margin semicircularly to near tegular epiphyses; scutum with a stripe on each side of the median dorsal line and an arcuate stripe sublaterad. Body very small and short.

Head deflexed, with eyes about as broad as thorax, very finely punctate. Posterior margin of vertex arcuate, slightly raised narrowly; vertex elevated plate-like; pubescent; discal area with a slight foveal impression posteriorly, quite plane except the elevated ocellar regions; scarcely emarginate at median suture anteriorly. Anterior ocellus visible from in front. Facial cones small, acute, divergent, almost horizontal, moderately pubescent; not easily visible from side. Antennæ inserted on frons and outer base of facial cone. Labrum rather large, easily visible from in front.

Thorax arched, punctate. Pronotum short, slightly arched, depressed below dorsulum, anterior margin lower than post-ocellar regions of vertex, propleuron mostly concealed; forecoxæ small. Dorsulum small, subacute cephalad. Metasternal spurs small. *Wings* small, hyaline, about two and three-fourths times as long as broad, broadest across first furcal, subacute apically; radius about as long as second cubital; first cubital long; first marginal cell somewhat smaller than second; venation light yellowish brown.

Male.—Abdomen very short, more slender than in female. Genital segment rather short, larger than preceding ventral sclerite; claspers long arcuate, margins parallel, obtuse at apex; pubescence sparse and brief. Anal valve long, rather narrow, with a small rounded epiphysis on each flap posteriorly; pubescence longer than on genital plate. *Female.*—Genital segment very small; ventral plate very short, acute caudad; dorsal plate about as large as preceding tergite, subacute at apex; genital pore almost half as long as dorsal plate; pubescence sparse.

Described from numerous males and females collected by C. F. Baker in Colorado and Arizona. Type in Nat. Museum.

The cephalic and thoracic color markings are quite characteristic and constant. There is a variation, however, in the discal macula of the vertex. In some specimens this macula extends arcuately to the post-ocelli, and is quite broad, while in others it is narrow and does not attain to the post-ocelli. In some individuals it even tends to disappear entirely. Although the variation is gradual and quite complete, it seems advisable to separate as a variety those forms in which the macula is scarcely present or entirely wanting.

The cephalic markings are quite uniformly of a white or flavous white color. In a few individuals this varies toward flavous rather than white. A second variety seems to exist in which the cephalic markings are distinctly flavous. The thoracic markings vary widely from white to dull dirty yellow.

Paratrioza ocellata nigra n. var.

General characters same as for species. Discal area of vertex without macula or stripe.

Paratrioza ocellata flava n. var.

General characters as for species. Cephalic markings dark flavous. Thoracic markings lighter flavous.

Paratrioza cockerelli (Sulc.)

(*Trioza cockerelli* Sulc.)

(Fig. 153, S; 155, L)

Length of body 1.3 mm.; length of forewing 2.6 mm.; greatest width 1.0 mm.; width of vertex between eyes .30 mm.; with eyes .60 mm. General color light brown to brown, as seen with the naked eye; vertex colored very similarly to *P. ocellata* but less markedly so; thorax not so distinctly striped as *P. ocellata*.

Head deflexed, with eyes not as broad as thorax, very finely punctate. Vertex raised plate-like, pubescent; discal area with a small foveal impression posteriorly on each side of the median suture; emarginate on anterior margin above insertion of antennæ; scarcely emarginate at median suture; anterior ocellus under projecting vertex. Facial cones very small, subacute when viewed from in front, scarcely visible from side; projecting outward from face over insertion of antennæ; labrum prominent; antennæ inserted on frons more nearly in front than in *P. ocellata*.

Thorax arched, punctate. Pronotum arched, depressed below dorsulum and head slightly; prepimeron mostly concealed. Dorsulum small, subacute cephalad. *Wings* hyaline, small, a little more than two and a half times as long as broad, broadest across first marginal cell; radius about as long as second cubital; marginal cells subequal.

Male.—Genital segment rather small; claspers long, arcuate, obtuse at apex; anal valve long, straight on anterior margin, with a posterior, triangular lobe projecting from almost entire vertical length; vertical axis shorter than horizontal axis from tip of posterior lobe to center of anterior vertical margin. Pubescence sparse. *Female.*—Genital segment very similar to that of *P. ocellata*, ventral plate relatively a little larger.

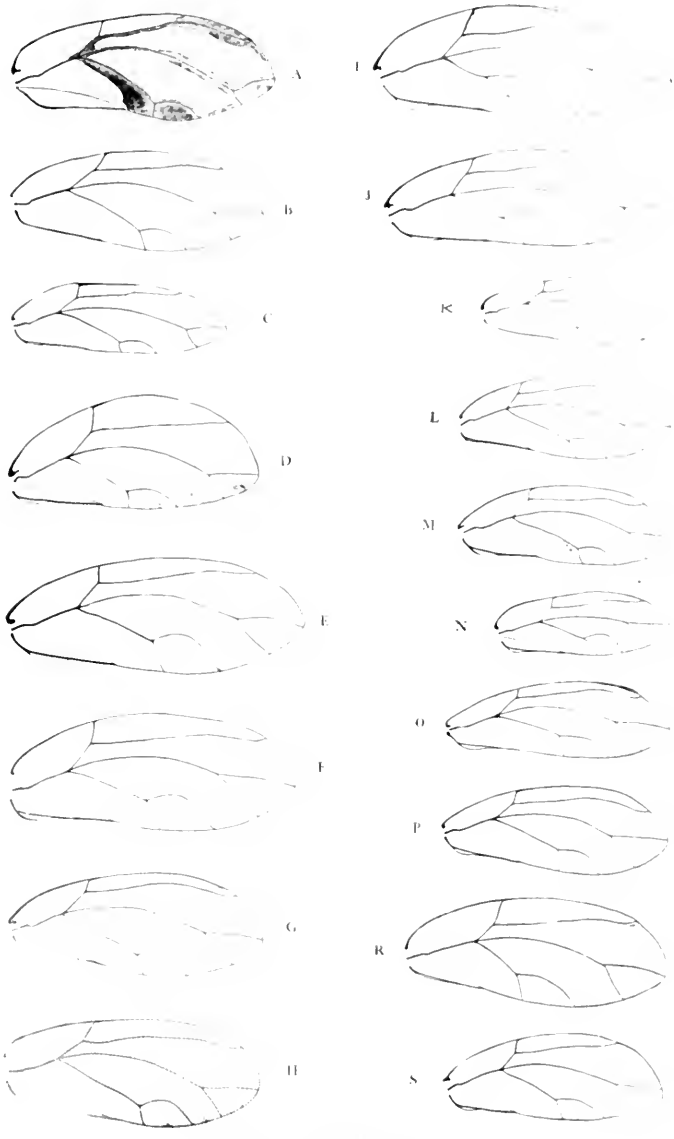

Figure 155. Wings of Triozinae:

A, Trioza tripunctata; B, T. salicis; C, T. minuta; D, T. quadripunctata; E, T. longistylus; F, T. proximata; G, T. assimilis; T. T. mexicana; I, Allotrioza arbolensis; J, A. magnoliae; K, Trioza nicaraguensis; L, Paratrioza cockerelli; M, P. ocellata; N, Epitrioza medicaginis; O, Neotrioza laticeps; P, N. immaculata; R, Epitrioza oaxacensis; G, Rhinopsylla antennata.

Redescribed from one male collected at Boulder, Colorado, by Prof. T. D. A. Cockerell. *Food-plant*: *Capsicum annuum* (pepper).

The single male specimen sent me by Prof. Cockerell was imperfectly colored as compared with the description by Sulc. His characterization of color and of the genitalia of both sexes was used in the above description since these characters were not readily available in my specimen. The striking similarity to *P. ocellata* is apparent. The two species may be distinguished by the following characters:

Paratrioza ocellata: Facial cones nearly porrect and horizontal; antennæ inserted on frons sublateral; vertex with a white macula in center; thorax usually distinctly striped. Anal valve of male long and rather narrow, with a small rounded epiphysis posteriorly; vertical axis longer than horizontal axis.

Paratrioza cockerelli: Facial cones not porrect, projecting outwardly, horizontal; antennæ inserted more nearly in front; macula in center of vertex brown; thorax not distinctly striped. Anal valve of male relatively shorter; posterior lobe or epiphysis large, triangular, long at base, subacute at apex; vertical axis shorter than horizontal axis.

Paratrioza maculipennis (Crawf.)

(Syn. *Trioza maculipennis* Crawf.)

(Fig. 153, O)

Pomona Journ. Entom. Vol. II, No. 2, page 237.

The facial cones are somewhat larger and more prominent in this species, but are manifestly of the same type. The male genitalia are more accurately represented in the figure herewith shown than in the location cited above.

Neotrioza n. gen.

Head with eyes distinctly broader than thorax. Facial cones quite long, very slender and acute, closely appressed and not in the least divergent. Vertex raised plate like. Antennæ inserted in front below vertex. Thorax very slender and narrow. Pronotum short, depressed below head and dorsulum.

Type of genus: *Neotrioza immaculata* Crawf.

Synopsis of the Genus Neotrioza

A. Facial cones long, vertical; cone into eye more than 1. Wing about two and a half times as long as broad. *N. immaculata* Crawf.

AA. Facial cones retrose, not very long; cone into eye less than 1. Wing fully three times as long as broad. *N. laticeps* Crawf.

Neotrioza immaculata (Crawf.)

(*Trioza immaculata* Crawf.)

(Fig. 153, A, E, T; 155, P)

Length of body 1.7 mm.; length of forewing 2.7 mm.; greatest width .9 mm.; width of vertex between eyes .30 mm.; with eyes .59 mm. General color dark brown, thorax lighter; vertex black with yellowish border; facial cones whitish; antennæ black throughout.

Head quite strongly deflexed, scarcely punctate, with eyes distinctly broader than thorax. Posterior margin of thorax only slightly elevated narrowly, arcuate, not emarginate at median suture; vertex slightly pubescent, raised plate-like, with the border yellowish orange in color and the discal area black, discal area quite plane, except the elevated postocellar regions, anterior margin somewhat emarginate at median suture and slightly deflexed; anterior ocellus at base of facial cones and median suture of vertex. Facial cones long, slender, closely appressed and not divergent, very acute, vertical, very sparsely pubescent. Antennæ inserted on frons, not laterad, very slender, two basal segments quite slender.

Thorax arched, very slender and narrow, slightly punctate, sparsely and briefly pubescent. Pronotum short, depressed below dorsulum and head; pleurites small. Dorsulum ascending, narrow, rather broadly rounded cephalad. Metasternal spurs small and short. *Wings* small, hyaline, a little more than two and a half times as long as broad, broadest across second furcal, subacute apically; radius longer than second cubital; second furcal shorter than fourth furcal.

Male.— Abdomen slender, not arched. Genital segment small; ventral plate not as large as anal tergite; claspers spatulate, of medium length; anal valve long, extending to apical margin of ventral plate, broader at base than at tip; pubescence rather dense.

Described from one male collected at Algonquin, Illinois, by Dr. Nason.

Neotrioza laticeps (Crawf.)

(*Trioza laticeps* Crawf.)

(Fig. 153, B, F; 154, R; 155, O)

Length of body 1.6 mm.; length of forewing 2.7 mm.; greatest width 1.0 mm.; width of vertex between eyes .38 mm.; with eyes .62 mm. General color dark brown, thorax lighter; head and facial cones black.

Head strongly deflexed, with eyes distinctly broader than thorax, very slightly punctate. Posterior margin of vertex only slightly elevated narrowly, arcuate, not emarginate at median suture; vertex raised plate-like, slightly pubescent; quite black; discal area plane, except elevated postocellar regions, anterior margin emarginate at median suture; anterior ocellus at base of facial cones and emargination of vertex. Facial cones long, shorter than in *N. immaculata*, slender, acute, closely appressed and not divergent, vertical or retrose, slightly pubescent. Antennæ inserted on frons below frontal plates of vertex, in front; very slender; basal segments quite slender.

Thorax arched, slender and narrow, punctate, briefly and sparsely pubescent. Pronotum short, depressed below head and dorsulum; pleurites normal. Dorsulum ascending, narrow, quite broadly rounded cephalad. *Wings* hyaline, small, slender, fully three times as long as broad, broadest across first marginal cell, subacute apically; radius as long as second cubital; second furcal fully as long as fourth furcal.

Female.—Abdomen slender. Genital segment almost as long as rest of abdomen, very acute caudad; dorsal plate longer and heavier than ventral;

genital pore about one-fifth as long as dorsal plate; ventral plate quite linear and very acute distally; pubescence sparse.

Described from one female collected by G. R. Pilate in Louisiana.

Epitrioza n. gen.

Head small, scarcely deflexed; vertex more or less excised; facial cones almost obsolete, reduced to globose lobes scarcely visible from the side. Antennæ inserted on frons and base of facial cones laterad; labrum easily visible from in front below facial cones.

Thorax not strongly arched, broader than head including eyes; pronotum rather short, distinctly arched and scarcely depressed below head and dorsulum; prepimeron only slightly visible; propleurites set rather obliquely; forecoxæ almost entirely visible in front of the mesepisternum. Wing venation quite similar to typical *Triozinae;* first cubital scarcely more than twice the length of first furcal.

Type of genus: *Epitrioza medicaginis* Crawf.

Synopsis of the Genus Epitrioza

A. Body very small; wings small, less than 2.5 mm. in length, slightly coriaceous. Vertex raised somewhat plate-like, bulging over insertion of antennæ. Pronotum quite long. Forecoxæ short. Genital segment of female scarcely longer than dorso-ventral width.
E. medicaginis Crawf.

AA. Body normally large. Wings normal, more than 3 mm. in length, hyaline. Vertex not raised plate-like, not bulging over insertion of antennæ. Pronotum quite short. Forecoxæ long. Female genital segment about twice as long as basal dorso-ventral width. *E. oaxacensis* Crawf.

Epitrioza medicaginis (Crawf.)

(*Paratrioza medicaginis* Crawf.)

(Fig. 152, O, R; 153, P; 154, N; 155, N)

Length of body 1.7 mm.; length of forewing 2.6 mm.; greatest width 1.0 mm.; width of vertex between eyes .43 mm.; with eyes .68 mm. General color yellowish green throughout. Body small, slender.

Head scarcely deflexed, small, with eyes not quite as broad as thorax, somewhat punctate. Posterior margin of vertex arcuate, slightly elevated narrowly; vertex raised somewhat plate-like; discal area with a distinct fovea on each side of median suture, near posterior margin and an oblique depression extending forward and toward eyes; anterior margin moderately emarginate at median suture above anterior ocellus. Facial cones reduced to two rather large globose lobes extending vertically downward, scarcely visible from side, slightly pubescent; antennal insertions prominent, occupying large area laterad. Labrum large, prominent below facial cones from in front.

Thorax small, not strongly arched, quite coarsely punctate; pronotum short, arched, not depressed below head and dorsulum; sides quite parallel; propleurites obliquely set; prepimeron small; forecoxæ small, almost entirely

visible. Dorsulum ascending, quite small. Metasternal spurs quite small. *Wings* small, hyaline, but very faintly coriaceous; less than three times as long as broad, broadest across first furcal, rounded apically but not broadly so, radius as long as second cubital; first cubital about twice the length of first furcal; fourth furcal fully half as long as second cubital, marginal cells subequal; venation rather inconspicuous.

Male.—Abdomen long and slender. Genital segment medium in size; genital plate rounded; claspers bicuspidate, the posterior cusp longer, slightly more acute, glabrous; the remainder of surface of claspers sparsely pubescent; anal valve quite large, broad at base, distally more slender and terminating in an uniformly tapering epiphysis; sparsely pubescent. *Female.*—Abdomen very long, less slender than in male. Genital segment moderately large; both plates of almost equal length, quite acute; genital pore small; sparsely pubescent.

Described from one male and one female collected by T. D. A. Cockerell in Colorado. *Food plant*: *Medicago sativa* (alfalfa).

Epitrioza oaxacensis n. sp.

(Fig. 152, P; 154, O; 155, R)

Length of body 1.9 mm.; length of forewing 3.3 mm.; greatest width 1.2 mm.; width of vertex between eyes .45 mm.; with eyes .70 mm. General color light green with a tinge of yellow. Body medium in size.

Head scarcely deflexed, small, punctate; posterior margin of vertex arcuate, very slightly elevated narrowly; vertex not raised plate-like; discal area with a distinct fovea on each side near posterior margin and a short sulcate depression extending toward eye. Anterior margin somewhat emarginate at median suture. Facial cones reduced to globose lobes, very slightly angulated on inner margin; slightly visible from side, sparsely pubescent; labrum visible from in front below facial cones. Antennæ inserted on frons and base of facial cones sublaterad.

Thorax moderately arched, broader than head including eyes, quite coarsely punctuate; pronotum short, arched, scarcely depressed below head and dorsulum, broader at pleurite than dorsally; propleurites obliquely set; prepimeron small; forecoxæ moderately large, almost entirely visible from in front of mesepistermum. Dorsulum moderately long, usually very narrow, occasionally normally broad, rounded cephalad. *Wings* rather large, hyaline, about two and a half times as long as broad, broadest across first marginal cell, quite broadly rounded apically; radius as long as second cubital; first cubital just twice the length of first furcal; fourth furcal slightly less than half the length of second cubital; marginal cells subequal; one specimen presents the anomaly of the furcation distally of the radius of *both* primary wings.

Female.—Abdomen moderately stout. Genital segment long, slender; dorsal plate slightly longer than ventral, equally acute but less slender; genital pore small, elliptical; pubescence sparse and brief.

Described form four females collected by D. L. Crawford at Oaxaca, Mex.

WEST COAST NEWS NOTES

[In this department we hope to give in most numbers of the JOURNAL some idea of the doings and movements of western entomologists, notices of publications of interest to western students, notices of entomological meetings, etc. To this end, we hope that students or collectors will send in all items of entomological interest about themselves or others. Address: Mr. Fordyce Grinnell, Jr., 572 N. Marengo Ave., Pasadena, Cal.]

Mr. W. M. Mann, of Stanford University, spent the Christmas vacation in collecting at Pacific Grove.

Mr. F. X. Williams, formerly of San Francisco, now of the University of Kansas, spent the fall months of 1910 visiting various museums in the east.

The annual address before the American Association for the Advancement of Science was by Dr. D. S. Jordan on "The Making of a Darwin."

At the meeting of the Southern California Academy of Science held on Dec. 5, Dr. William Morton Wheeler gave a short talk on Museums and Museum Management; and Dr. Thomas Powell upon "The Appropriation of Food and the Energy Derived Therefrom by Animal Life," illustrated with slides.

Dr. William Morton Wheeler spent the first three weeks of December in Southern California, principally in Pasadena, collecting ants. He spent two days at Pomona College in company with Prof. Baker and Mr. Metz.

Mr. Percy Leonard of Point Loma, near San Diego, is doing some interesting work on the habits of the Honey Ant, *Myrmecocystis mexicanus mojave* Wheeler.

The Washington, D. C., entomologists are working on a code of nomenclature for entomologists. A manuscript draft has been circulated in Southern California, for comments and criticisms. The code will be a very useful document.

Mr. E. P. Van Duzee, the hemipterist of Buffalo, N. Y., is planning to attend the meeting of the American Library Association in May, in Pasadena, and will spend several weeks of collecting in the vicinity.

The Annual Meeting of the San Diego Society of Natural History was held at the McNeece Building, San Diego, on the afternoon of January 12, 1911. Ford A. Carpenter is the Secretary.

Mr. J. R. Haskin, of Los Angeles, is describing a new *Melitaea* (*Lemonias*) related to *gabbii*, from the Mojave Desert, Calif., and Northern Arizona.

Miss Julia D. E. Wright, former Secretary of the Santa Clara Valley Entomological Club, is now living in San Francisco.

A new bill for the State Legislature, reorganizing county work in economic entomology is being drafted by representatives of our horticultural interests. One of the prime objects of this bill is the obtaining of competent men for this most important work. May wisdom prevail!

Students of Pomona College have recently furnished large quantities of material to Mr. Banks, Dr. Folsom, Prof. Chamberlin and others to assist in the preparation of working synopses of California arthropods. These synopses promise to be a godsend to Californian students throughout the state.

On December 17, 1910, the corner stone of the County Museum Building was laid in Los Angeles. The style of architecture is Spanish Renaissance, and the building will be beautiful and commodious. It is fireproof, being constructed of steel frame and brick laid in varying designs, with terra cotta cornices and trimmings. Steel trusses will support roofs of waterproof concrete slabs covered with Spanish tiles. The south wing is to be occupied by the Southern California Academy of Sciences, for a museum of natural history; the north wing will be occupied by the Historical Society; and the west wing devoted to art under the direction of the Fine Arts League of Los Angeles. In time the museum will rank with any in the country.

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Pomona College Journal of Entomology

MAY 1911

Contents

1. ESSIG, E. O. — Host Index to Californian Plant Lice
2. ESSIG, E. O. — Notes on Coccidae VII
3. CHAMBERLIN, R. V. — The Chilopoda of California II
4. CRAWFORD, D. L. — American Psyllidae IV
5. HALL, H. V. M. — Studies in Acarina I
6. COOLIDGE, K. R. — Notes on Rhopalocera

TITLE PAGE AND INDEX TO VOLUMES I AND II

PUBLISHED QUARTERLY BY THE

Department of Biology of Pomona College

A. J. COOK, D. Sc., Head Professor

CLAREMONT, CALIFORNIA, U. S. A.

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During 1909 the existence of the Journal was credited to the support of the Ontario-Cucamonga Citrus Association. It is to be noted, however, with due appreciation, that one member of that Exchange, Mr. A. P. Harwood, was the donor of one-half of the amount from that source. During 1911, the Journal is pleased to acknowledge a wider support, including the Ontario-Cucamonga Exchange, with Mr. A. P. Harwood, The Call Fruit Company, The A. C. G. Fruit Exchange, The Covina Fruit Exchange, The Semi-tropic Fruit Exchange, The Arlington Heights Fruit Exchange, The Santa Paula Fruit Exchange, The Tulare Fruit Exchange and the San Antonio Fruit Exchange.

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Pomona College Journal of Entomology

Volume III MAY 1911 Number 2

HOST INDEX TO CALIFORNIA PLANT LICE (Aphididæ)

F. O. ESSIG
HORTICULTURAL COMMISSIONER OF VENTURA COUNTY, CALIFORNIA

The following index has been largely compiled from the works of W. T. Clarke, W. M. Davidson, H. F. Wilson, A. P. Hayne, Carroll Fowler and G. Del Guercio. For three years the writer has been collecting and studying this group of insects and has yet a large number of undetermined species to add. A rough preliminary list was sent to Prof. O. W. Oestlund (of the University of Minnesota), Edith M. Patch (University of Maine, Agrcl. Exp. Station), Prof. Theo. Pergande (Div. of Entomology, U. S. Dept. of Agriculture), Prof. C. F. Baker (Pomona College), and Prof. H. F. Wilson (Univ. of Oregon, Agrcl. Exp. Station), Mr. W. M. Davidson, Mr. Morrison (Stanford University), and Mr. J. T. Monell.

The index has been completely remodeled according to their notes.

I heartily invite all entomologists to assist me in the development of this index and in perfecting the list of synonyms of this very important group.

Abies concolor Parry (White Fir).
Lachnus abietis Fitch-Davidson, Jr. Ec. Ent. II, 299, 1909.

Abies grandis Lindl.
Lachnus occidentalis Davidson, Jr. Ec. Ent. II, 300, 1909.

Acer sp. (Maple).
Drepanosiphum platanoides Schrk.-Wilson, Jr. Ec. Ent. II, 350, 1909.

Acer dasycarpum Ehrh. (White or Silver Maple).
Drepanaphis acerifolii (Thos.) Del. Guer.-Davidson, Jr. Ec. Ent. III, 380, 1910.

ACER NEGUNDO see *Negundo acerioides Moench.*

Acer saccharinum Wag. (Soft, Rock or Sugar Maple).
Drepanaphis acerifolii (Thos.) Del. Guer.-Davidson, Jr. Ec. Ent. II, 303, 1909.

ALDER see *Alnus.*

Alnus rhombifolia Nutt. (Alder).
Callipterus alnifoliæ (Fitch MSS.)-Davidson, Jr. Ec. Ent. III, 375, 1910.

Amaranthus retroflexus L. (Pigweed).
Trifidaphis radicicola (Essig) Del. Guer.-Essig, P. C. Jr. Ent. I, 10, 1909.

Ambrosia psilostachya DC. (Ragweed).
Macrosiphum rudbeckiæ (Fitch) Sanb.-Essig, P. C. Jr. Ent. III, 402, 1911.

Amsinckia spectabilis F. & M.
Myzus persicæ Sulz.-Davidson, Jr. Ec. Ent. III, 378, 1910.

Angelica sp.
Aphis angelicæ Koch.-Wilson, Jr. Ec. Ent. II, 348, 1909.
APPLE see *Pyrus mali Linn.*
APRICOT see *Prunus armeniaca L.*
Arbutus menziesii Pursh. (Madrono).
Rhopalosiphum arbuti Davidson, Jr. Ec. Ent. III, 378, 1910.
Artemisia californica Less. (California Sage).
Aphis medicaginis Koch, Morrison in litt.
Arundo sp. (Bamboo).
Callipterus arundicolens Clarke, Can. Ent. XXXV, 249, 1903.
Asclepias mexicana Cav. (Milkweed).
Aphis lutescens Monell-Davidson, Jr. Ec. Ent. III, 377, 1910.
ASH-LEAVED MAPLE see *Negundo aceroides Moench.*
Avena sativa Linn. (Oats).
Aphis padi L.-Davidson, Jr. Ec. Ent. III, 377, 1910.
Baccharis sp.
Macrosiphum baccharidis Clarke, Can. Ent. XXXV, 254, 1903.
Baccharis viminea DC.
Macrosiphum rudbeckiæ Fitch-Essig, P. C. Jr. Ent. III, 402, 1911.
BAMBOO see *Arundo.*
BARBERRY see *Berberis.*
BASSWOOD see *Tilia.*
BEAN see *Phaesolus.*
BEECH see *Fagus.*
BEET see *Beta.*
Berberis vulgaris Linn. (Common Barberry).
Liosomaphis berberidis (Kalt) Walk.-Davidson, Jr. Econ. Ent. III, 378, 1910.
Beta vulgaris L. (Common Beet).
Trifidaphis radicicola (Essig) Del. Guer.-Essig, Po. Jr. Ent. I, 8, 1909.
Beta vulgaris L. var. (Sugar Beet).
Pemphigus betæ Doane-Clarke, Can. Ent. XXXV, 248, 1903.
Betula sp. (Birch).
Callipterus betulæcolens (Fitch) Monell-Davidson, Jr. Ec. Ent. III, 376, 1910.
Bidens laevis L. (Marigold).
Aphis calendulicola Monell-Clarke, Can. Ent. XXXV, 250, 1903.
BIRCH see *Betula.*
BLACK MUSTARD see *Brassica nigra* Koch.
BLACK WALNUT see *Juglans sp.*
BLUE OAK see *Quercus douglasii H. & A.*
Brassica campestris Linn. (Wild Mustard).
Aphis brassicæ L.-Davidson, Jr. Ec. Ent. II, 302, 1909.
Brassica nigra Koch. (Black Mustard).
Aphis brassicæ L.-Essig in Collection.
Brassica oleracea L. (Cabbage).
Aphis brassicæ L.-Davidson, Po. Jr. Ent. III, 399, 1911.
Myzus persicæ Sulz. Morrison in litt.
Bromus secalinus L. (Chess, Cheat).
Aphis avenæ Fabr.-Clarke, Can. Ent. XXXV, 254, 1903.
BUCKTHORN see *Rhamnus.*
BURR CLOVER see *Medicago denticulata* Willd.
Bursa bursa-pastoris (L.) Britt. (Shepherd's Purse).
Aphis gossypii Glover-Clarke, Can. Ent. XXXV, 250, 1903.
BUTTERCUP see *Ranunculus californicus* Benth.
CABBAGE see *Brassica oleracea L.*
CALIFORNIA SAGE see *Artemisia californica* Less.
CANAIGRE see *Rumex hymenosepalus* Torr.
Capsicum annum var. abbreviatum Fing. (Celestial Pepper).
Myzus persicæ Sulz.-Davidson, Jr. Ec. Ent. II, 303, 1909.
CARNATION see *Dianthus caryophyllum L.*
Castanea sp. (Chestnut).
Callipterus castanea (Fitch) Gillette-Clarke, Can. Ent. XXXV, 249, 1903.
CAT'S VALERIAN see *Valeriana officinalis L.*
Ceanothus cuneatus Nutt.
Aphis ceanothi Clarke-Davidson, Jr. Ec. Ent. III, 377, 1910.
Ceanothus integerrimus H. & A.
Aphis ceanothi Clarke, Can. Ent. XXXV, 250, 1903.
CELESTIAL PEPPER see *Capsicum annuum var. abberviatum* Fing.
CHEAT see *Bromus secalinus L.*
CHESS see *Bromus secalinus L.*

Chestnut see *Castanea*.

Chrysanthemum indicum L.

Myzus persicæ Sulz-Davidson in litt.

Citrullus vulgaris, Schrad. (Watermelon).

Aphis gossypii Glover-Clarke, Can. Ent. XXXV, 250, 1903.

Citrus aurantium Linn. (Orange).

Aphis citri Ashm. (?)-Essig, P. C. Jr. Ent. I, 47, 1909.

Aphis gossypii Glover(?)-Essig, P. C. Jr. Ent. II, 223, 1910.

*Macrosiphum citrifolii (Ashm.) Sanb.-Ashmead, Can. Ent. XIV, 91, 1882.

Cluster Pine see *Pinus pinaster* Ait.

Common Valerian see *Valeriana officinalis L.*

Conium maculatum L. Poison Hemlock).

Siphocoryne conii Davidson, Jr. Ec. Ent. II, 304, 1909.

Copper Beach see *Fagus*.

Corn see *Zea mays L.*

Cornus occidentalis (T. & G) Coville.

Aphis helianthi Monell-Davidson in litt.

Corylus sp. (Hazelnut).

Myzocallis coryli (Goetz.) Pass.-Clarke, Can Ent. XXXV, 249, 1903.

Crataegus sp. (Hawthorn).

Aphis crataegi Monell-Clarke, Can. Ent. XXXV, 250, 1903.

Crataegus oxyacantha L. (English Hawthorn).

Aphis crataegifoliæ Fitch-Davidson, Jr. Ec. Ent. III, 377, 1910.

Cruciferae (Mustard Family).

Aphis brassicæ L.-Clarke, Can. Ent. XXXV, 250, 1903.

Cucurbita pepo L. var. *orifera* L. (Gourd).

Aphis gossypii Glover-Davidson in litt.

Cyanoglossum sp. (Forget-me-not, Hound's Tongue).

Myzus persicæ Sulz.-Davidson, Jr. Ec. Ent. III, 378, 1910.

Dianthus caryophyllum L. (Carnation).

Myzus persicæ Sulz-Davidson in litt.

*Hunter Aphilidæ of North America, Bull. 60, Ia. Agrcl. Exp. Sta., p. 113, 1901.

Digger Pine see *Pinus sabiniana* Dougl.

Dock see *Rumex*.

Elm see *Ulmus*.

Encina see *Quercus agrifolia* Nee.

English Ivy see *Hedera helix L.*

English Walnut see *Juglans regia L.*

Epilobium sp. (Willow-Herb).

Aphis œnotheræ Oestl.-Clarke, Can. Ent. XXXV, 252, 1903.

Eriobotrya japonica Lindl. (Loquat, Japan Plum).

Aphis pomi De Geer-Neuls in Collection.

European Grape see *Vitis vinifera L.*

Evening Primrose see *Sphaerostigma*.

Fagus sp. (Copper Beech).

Phyllaphis fagi (L.) Davidson, Jr. Ec. Ent. III, 376, 1910.

False Spruce see *Pseudotsuga douglasii* Carr.

Fennel see *Foeniculum*.

Fern see *Filicales*.

Filicales spp. (Ferns).

Idiopterus nephrolepidis Davis-Davidson, Jr. Ec. Ent. III, 376, 1910.

Fir see *Abies*.

Foeniculum foeniculum (L.) Kant. (Sweet Fennel).

Siphocoryne fœniculi Pass.-Clarke, Can. Ent. XXXV, 252, 1903.

Forget-me-not see *Cyanoglossum*.

Garden Heliotrope see *Valeriana officinalis L.*

Gourd see *Cucurbita pepo* L. var. *orifera L.*

Grape see *Vitis*.

Green Gage Plum see *Prunus domestica var. cereola L.*

Hawthorn see *Crataegus*.

Hazelnut see *Corylus*.

Hedera Helix L. (English Ivy).

Aphis hederæ Kalt.-Essig, Po. Jr. Ent. II, 336, 1910.

Aphis rumicis L.-Davidson, Jr. Ec. Ent. III, 376, 1910.

Myzus persicæ Sulz.-Clarke, Can. Ent. XXXV, 252, 1903.

Aphis anglicæ Koch.-Wilson, Jr. Ec. Ent. II, 348, 1909.

Heliotrope, Garden see *Valeriana officinalis L.*

Hemlock, Poison see *Conium*.

Honeysuckle see *Lonicera*.

Hop see *Humulus lupulus L.*

HOUND'S TONGUE see *Cyanoglossum.*

Humulus lupulus L. (Common Hop).
Phorodon humuli Schrank.-Clarke, Bull. No. 160, Cal. Ex. Sta., 1904.

JAPAN PLUM see *Eriobotrya japonica Lindl.*

Jasmin sp. (Jasmine).
Macrosiphum jasmini Clarke, Can. Ent. XXXV, 252, 1903.

Juglans sp. (Black Walnut).
Monellia caryæ (Monell) Gill.-Clarke, Can. Ent. XXXV, 249, 1903.

Juglans regia L. (English or Persian Walnut).
Callipterus juglandicola (Kalt) Walker-Essig, P. C. Jr. Ent. II, 302, 1909.
Monellia caryæ (Monell) Gill.-Davidson, Jr. Ec. Ent. II, 301, 1909.

Lathyrus odoratus L. (Sweet Pea).
Macrosiphum ulmariæ (Schrk.) Schout-Davidson in litt.

Lathyrus sp. (Wild Pea).
Macrosiphum ulmariæ (Schr.) Schout.-Davidson, Jr. Ec. Ent. II, 304, 1909.

LAURESTINUS see *Viburnum tinus L.*

LIVE OAK see *Quercus agrifolia* Nee.

LIVE OAK, VALLEY see *Quercus wislizeni A. DC.*

Lonicera hispidula Dougl. (Honeysuckle.)
Hyadaphis xylostei (Schrank) Schout.-Davidson, Jr. Ec. Ent. II, 303, 1909.

LOQUAT see *Eriobotrya japonica* Lindl.

Lotus americanus (Nutt.) Bisch.
Aphis medicaginis Koch-Morrison in litt.

Lupinus sp. (Lupin).
Macrosiphum ulmariæ (Schrk.) Schout.-Davidson in litt.

Lycopersicum esculentum Mill. (Tomato).
Macrosiphum lycopersici Clarke, Can. Ent. XXXV, 253, 1903.

MADRONO see *Arbutus menziesii* Pursh.

MALLOW see *Malva.*

Malva parviflora L. (Mallow).
Myzus persicæ Sulzer-Davidson, Jr. Ec. Ent. II, 303, 1909.

MAPLE see *Acer.*

MARIGOLD see *Bidens laevis L.*

Medicago denticulata Willd. (Burr Clover).
Aphis medicaginis Koch.-Davidson, Jr. Ec. Ent. II, 302, 1909.

MILKWEED see *Asclepias mexicana* Cav.

MONTEREY PINE see *Pinus radiata* Gord.

Morus sp. (Mulberry).
Aphis mori Clarke, Can. Ent. XXXV, 251, 1903.

MULBERRY see *Morus.*

MUSTARD, BLACK see *Brassica nigra* Koch.

MUSTARD, COMMON see *Brassica campestris L.*

MUSTARD FAMILY see *Cuciferae.*

NARROW-LEAVED WILLOW see *Salix fluviatilis* Nutt.

Negundo aceroides Moench. (Ash-leaved Maple).
Chaitophorus negundinis Thos.-Davidson, Jr. Ec. Ent. III, 376, 1910.

Nerium oleander L. (Oleander).
Aphis nerii Kalt-Davidson, Jr. Econ. Ent. III, 377, 1910.

NETTLE see *Urtica holosericea* Nutt.

NIGHTSHADE see *Solanum.*

OAK see *Quercus.*

OAT see *Avena sativa L.*

OENOTHERA see *Sphaerostigma.*

OLEANDER see *Nerium oleander L.*

ORANGE see *Citrus aurantium L.*

ORIENTAL PLANE TREE see *Platanus orientalis L.*

Orthocarpus purpurascens Benth. (Owl Clover).
Macrosiphum orthocarpæ Davidson, Jr. Ec. Ent. III, 380, 1910.

OWL CLOVER see *Orthocarpus purpurascens* Benth.

PEA see *Pisum.*

PEA, WILD see *Lathyrus.*

PEACH see *Prunus persica B. & H.*

PEAR see *Pyrus communis L.*

PERSIAN WALNUT see *Juglans regia L.*

Phaesolus sp. (Bean).
Macrosiphum ulmariæ (Schrk.) Schout.-Davidson, Jr. Ec. Ent. III, 380, 1910.

PIGWEED see *Amaranthus retroflexus L.*

PINE see *Pinus.*

PINUS MARITIMA POIR see *Pinus pinaster* Ait (Cluster Pine).

Pinus pinaster Ait. (Cluster Pine).
Pineus pinicorticis (Fitch) Shim.-Davidson, Jr. Ec. Ent. II, 299, 1909.
Pinus radiata Gord. (Monterey Pine).
Essigella californica (Essig) Del. Guer.-Essig, Po. Jr. Ent. I. 4, 1909.
Lachnus pini-radiatae Davidson, Jr. Ec. Ent. II, 299, 1909.
Mindarus abietinus Koch.-Clarke, Can. Ent. XXXV, 248, 1903.
Pinus sabiniana Dougl. (Digger or Silver Pine).
Lachnus pini-radiatae Davidson, Po. Jr. Ent. III, 398, 1911.
Pisum sativum L. (Pea).
Macrosiphum ulmariae (Schrk.) Schout.-Essig, Po. Jr. Ent. II, 338, 1910.
Plane Tree see *Platanus.*
Platanus orientalis L. (Oriental Plane Tree).
Drepanosiphum platanoides Schrk.-Davidson, Jr. Ec. Ent. III, 377, 1910.
Plum see *Prunus domestica L.*
Plum, Green Gage see *Prunus domestica var. cercola L.*
Poison Hemlock see *Conium.*
Poplar see *Populus.*
Populus sp. (Poplar or Cottonwood).
Melanoxantherum rufulus (Davidson) Schr.-Davidson, Jr. Ec. Ent. III, 376, 1910.
Melanoxantherum salicetí (Harris) Schr.-Davidson, Jr. Ec. Ent. III, 375, 1910.
Pemphigus populicaulis Fitch-Davidson, Jr. Ec. Ent. II, 299, 1909.
Pemphigus populitransversus Riley-Davidson, Jr. Ec. Ent. III, 372, 1910.
Populus fremontii Wats.
Chaitophorus populifoliae Fitch-Davidson, Jr. Ec. Ent. III, 375, 1910.
Pemphigus populimonilis Riley-Davidson, Jr. Ec. Ent. III, 374, 1910.
Populus trichocarpa T. & G. (Cottonwood).
Thomasia populicola (Thos.) Wilson-Essig, P. C. Jr. Ent. I, 99, 1909.
Pemphigus populicaulis Fitch-Davidson, Jr. Ec. Ent. II, 299, 1909.
Pemphigus populiconduplifolius Cowen Davidson, Jr. Ec. Ent. III, 374, 1910.
Polygonum sp.
Rhopalosiphum nymphaeae (L.) Koch-Davidson, Jr. Ec. Ent. III, 377, 1910.
Prunus armeniaca L. (Apricot).
Hyalopterus arundinis Fabr.-Clarke, Can. Ent. XXXV, 249, 1903.
Prunus domestica L. (Plum).
Aphis persicae-niger Smith-Clarke, Can. Ent. XXXV, 252, 1903.
Hyalopterus arundinis Fabr.-Fowler, Rep. Cal. Exp. Sta. Pt. I, p. 78, 1899-1900.
Myzus persicae Sulz.-Davidson, Jr. Ec. Ent. II, 303, 1909.
Phorodon humuli Schrank-Davidson, Jr. Ec. Ent. III, 380, 1910.
Prunus domestica var. cercola L. (Green Gage Plum).
*Aphis alamedensis Clarke, Can. Ent. XXXV, 251, 1903.
Myzus cerasi (Fabr.) Buck.-Clarke, Can. Ent. XXXV, 252, 1903.
Prunus persica B. & H. (Peach).
Aphis persicae-niger Smith-Clarke, Can. Ent. XXXV, 252, 1903.
Myzus persicae Sulz.-Davidson, Jr. Ec. Ent. III, 379, 1910.
Pseudotsuga douglasii Carr. (False Spruce).
†Gillettea coweni (Gill.) Borner-Davidson, Jr. Ec. Ent. III, 372, 1910.
Pyrus communis L. (Pear).
Aphis pomi (?) De Geer-Davidson, Jr. Ec. Ent. II, 302, 1909.
Pyrus mali L. (Apple).
Aphis pomi De Geer-Fowler, Rep. Cal. Exp. Sta. Prt. I, p. 78, 1899-1900.
Aphis sorbi Kalt.-Clarke, Can. Ent. XXXV, 252, 1903.
Schizoneura lanigera Haus.-Fowler, Rep. Cal. Exp. Sta., Pt. I, 82, 1899-1900.
Quercus sp. (Oak).
Schizoneura querci Fitch-Clarke, Can. Ent. XXXV, 248, 1903.

*In description spelled Aphis alemedensis Clarke
†Chermes cooleyi var. coweni Gillette

Quercus agrifolia Nee. (Live Oak, Encina).
Drepanaphis acerifolii (Thos.) Del. Guer.-Clarke, Can. Ent. XXXV, 249, 1903.
Schizoneura quercı Fitch-Davidson, Jr. Ec. Ent. III, 374, 1910.

Quercus californica Cooper.
Callipterus quercus Kalt.-Davidson, Jr. Ec. Ent. III, 376, 1910.

‡*Quercus kelloggii* (?).
Callipterus quercus Kalt.-Davidson, Jr. Ec. Ent. II, 302, 1909.

Quercus imbricata.
Callipterus hyalinus Monell-Clarke, Can. Ent. XXXV, 249, 1903.

Quercus lobata Nee. (Valley or White Oak).
Callipterus quercus Kalt.-Davidson, Jr. Ec. Ent. III, 376, 1910.

§*Quercus robur* (?).
Callipterus quercus Kalt.-Davidson, P. C. Jr. Ent. III, 399, 1911.

Quercus wislizeni A. DC. (Valley Live Oak).
Schizoneura quercı Fitch-Davidson, P. C. Jr. Ent. III, 398, 1911.

RADISH, WILD see *Raphanus sativus L.*

RAGWEED see *Ambrosia psilostachya* DC.

RAIZ COLORADO see *Rumex hymenosepalus* Torr.

Ranunculus californicus Benth. (Buttercup).
Pemphigus ranunculi Davidson, Jr. Ec. Ent. III, 373, 1910.

Raphanus sativus L. (Wild Radish).
Aphis brassicæ L. Essig. In Coll.

RED DOCK see *Rumex.*

Rhamnus californica Esch. (Buckthorn).
Macrosiphum rhamni Clarke, Can. Ent. XXXV, 254, 1903.

ROCK MAPLE see *Acer saccharinum* Wang.

Rosa sp. (Rose).
Macrosiphum rosæ L. Davidson, Jr. Ec. Ent. II, 304, 1909.
Myzus rosarum Walk.-Morrison in litt.

Rosa californica C. & S. (Wild Rose).
Myzus rosarum Walk.-Davidson, Jr. Ec. Ent. III, 379, 1910.

Rumex sp. (Red Dock).
Pemphigus betæ Doane-Clarke, Can. Ent. XXXV, 248, 1903.

Rumex hymenosepalus Torr. (Raiz Colorado, Canaigre).
Pemphigus betæ Doane-Clarke, Can. Ent. XXXV, 248, 1903.

Rumex occidentalis Wats.
Pemphigus betæ Doane-Davidson, Jr. Ec. Ent. II, 299, 1909.

SAGE see *Artemisia californica* Less.

ST. GEORGE'S HERB see *Valeriana officinalis L.*

Salix sp. (Willow).
Chaitophorus nigræ Oestl.(?) Davidson, Po. Jr. Ent. III, 398, 1911.
Chaitophorus viminalis Monell-Clarke, Can. Ent. XXXV, 248, 1903.
Macrosiphum californica Clarke, Can. Ent. XXXV, 254, 1903.
Melanoxantherium rufulus (Davidson) Davidson, Jr. Ec. Ent. II, 301, 1909.
Melanoxantherium saliceti (Harris) Davidson, Jr. Ec. Ent. II, 300, 1909.
Siphocoryne salicis Monell-Davidson, Jr. Ec. Ent. II, 303, 1909.

Salix fluviatilis Nutt. (Narrow-leaved Willow).
§Lachnus viminalis Boisduval-Essig. In Coll. Det. by J. T. Monell.

Scrophularia sp.
Phorodon scrophulariæ Thos.-Clarke, Can. Ent. XXXV, 252, 1909.

Senecio vulgaris L. (Groundsel).
Aphis bakeri Cowen (?)-Davidson, Jr. Ec. Ent. III, 377, 1910.
Myzus persicæ Sulz.-Davidson, Jr. Ec. Ent. III, 378, 1910.

SHEPHERD'S PURSE see *Bursa bursa-pastoris* Britton.

SILVER MAPLE see *Acer dasycarpum* Ehrh.

SILVER PINE see *Pinus sabiniana* Dougl.

SNOWBERRY see *Symphoricarpus racemosus.*

SOFT MAPLE see *Acer saccharinum* Wang.

‡Quercus douglasii H. & A. (?).
§Quercus rubra L. (?).

§See Tuberolachnus viminalis (Boyer) Mord. in Synonyms at end.

Solanum douglasii Dunl. (Nightshade).
Trifidaphis radicicola (Essig) Del Guer.-Essig, Po. Jr. Ent. I, 8, 1909.
Sonchus sp.
Macrosiphum sonchella Monell-Clarke, Can. Ent. XXXV, 253, 1903.
Sonchus asper Vill. (Spiny-leaved Sonchus).
Rhopalosiphum persicæ Sulz.-Davidson, Jr. Ec. Ent. III, 378, 1910.
Sonchus oleraceus L. (Sow Thistle).
Macrosiphum sonchella Monell-Davidson, Jr. Ec. Ent. II, 304, 1909.
Myzus persicæ Sulz.-Davidson, Jr. Ec. Ent. II, 303, 1909.
Rhopalosiphum lactucæ Kalt.-Davidson, Jr. Ec. Ent. III, 378, 1910.
Sorghum sp.
Aphis maidis Fitch-Clarke, Can. Ent. XXXV, 251, 1903.
Sow Thistle see *Sonchus oleraceus L.*
Sphaerostigma veitchianum (Hook) Small. (Evening Primrose).
Aphis oenotheræ Oestl.-Davidson, Jr. Ec. Ent. III, 380, 1910.
Spiny-leaved Sonchus see *Sonchus asper* Vill.
Spiraea salicifolia L.
Aphis spiræella Schout.-Davidson in litt.
Spruce, False see *Pseudotsuga douglasii* Carr.
Sugar Beet see *Beta vulgaris var. L.*
Sugar Maple see *Acer saccharinum* Wang.
Sweet Fennel see *Foeniculum foeniculum* Karst.
Sweet Pea see *Lathyrus odoratus* L.
Sycamore see *Platanus.*
Symphoricarpus racemosus (Snowberry).
Aphis albipes Oestl.-Davidson, Jr. Ec. Ent. III, 376, 1910.
Tilia sp. (Basswood).
Eucallipterus tiliæ (Linn.) Gill.-Davidson, Jr. Ec. Ent. III, 377, 1910.
Tomato see *Lycopersicum esculentum* Mill.
Triticum sp. (Wheat).
Aphis avenæ Fabr.-Davidson, Jr. Ec. Ent. III, 377, 1910.
Tulip see *Tulipa.*
Tulipa sp. (Tulip).
Macrosiphum tulipæ Monell.-David son, Jr. Ec. Ent. III, 380, 1910.
Rhopalosiphum tulipæ Thos.-David son, Jr. Ec. Ent. III, 377, 1910.
Ulmus sp. (Elm).
Colopha ulmicola (Fitch) Monell-Davidson, Jr. Ec. Ent. II, 299, 1909.
Myzocallis ulmifolii (Monell)-Davidson, Jr. Ec. Ent. II, 304, 1909.
Schizoneura americana Riley Clarke, Can. Ent. XXXV, 248, 1903.
Urtica holosericea Nutt. (Nettle).
Macrosiphum ulmariæ (Schrk.) Schout.-Davidson, Jr. Ec. Ent. II, 304, 1909.
Urtica urens L. (Nettle).
Myzus persicæ Sulz. Davidson in litt.
Valerian see *Valeriana.*
Valeriana officianalis Linn. (Conium, St. George's Herb, Garden Heliotrope, Cat's Valerian).
Macrosiphum valerianiæ Clarke, Can. Ent. XXXV, 251, 1903.
Valley Live Oak see *Quercus wislizeni A. DC.*
Valley Oak see *Quercus lobata* Nee.
Vetch see *Vicia.*
Viburnum tinus L. (Laurustinus).
Aphis pomi De Geer-Davidson, Jr. Ec. Ent. III, 377, 1910.
Vicia sativa L. (Vetch).
Macrosiphum ulmariæ (Schrk.) Schout.-Essig, PC. Jr. Ent. II, 338, 1910.
Viola sp. (Violet).
Rhopalosiphum violæ Perg.-Essig, PC. Jr. Ent. I, p. 4, 1909.
Vitis sp. (Grape).
§Phylloxera vastatrix Planchon-Davidson, Jr. Ec. Ent. II, 1909.
Vitis vinifera L. (Wild or English Grape).
*Phylloxera vastatrix Planchon-Hayne, Rept. Cal. Exp. Sta. p. 376, 1887-1895.
Watermelon see *Citrullus vulgaris* Schrad.
Wheat see *Triticum.*

§See Rhizaphis vastatrix Planch in Synonyms.
*Recorded by Hayne as simply Phylloxera See Rhizaphis vastatrix Pl. in Synonyms.

WHITE MAPLE see *Acer dasycarpum* Ehrh.
WHITE OAK see *Quercus lobata* Nee.
WILD PEA see *Lathyrus*.
WILD ROSE see *Rosa californica C. & S.*
WILLOW see *Salix*.
WILLOW-HERB see *Epilobium*.
Zea mays L. (CORN).
Aphis maidis Fitch-Clarke, Can. Ent. XXXV, p. 251, 1903.

SYNONYMS

In order to make the above list as accurate and up-to-date as possible, duplicate copies of the first rough draft were sent to all of the American writers on this subject for corrections, additions, subtractions, comments, etc. At this time I have received returned copies from several, but have found it necessary to go ahead with the editing before all of the first copies are returned. All corrections in the future, however, shall be added as supplemental work, so that the present work shall continue to grow and be of more value as the various points are cleared up. I am especially indebted to Prof. O. W. Oestlund for the large list of synonymous names which he so thoroughly worked up. Also to Prof. H. F. Wilson, Miss Edith Patch, Prof. C. F. Baker, J. T. Monell, and W. M. Davidson.

In preparing this list the following authors were constantly referred to:

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XXXVII, pp. 414-420, Dec. 1905.
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C. P. GILLETTE, Journal of Economic Ent.,
I, pp. 302-311, Oct. 1908.
I, pp. 359-369, Dec. 1908.
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II, pp. 385-388, Dec. 1909.
III, pp. 367-371, Aug. 1910.
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Proc. Academy of Nat. Sci. of Philadelphia, Jan. 1907.
C. F. JACKSON, A Synopsis of the Genus Pemphigus with Notes on Their Economic Importance, Life History and Geographical Distribution.
O. W. OESTLUND, List of the Aphididæ of Minnesota, 1886.
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CYRUS THOMAS, Eighth Rept. of Entomologist of Illinois, 1879.
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Jr. Econ. Ent. II, 364-350, 1909.
E. M. PATCH, Bull. 181, Maine Agrcl. Exp. Sta., May, 1910.
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J. J. DAVIS, Ann. of Ent. Society of America III, No. 3, Sept. 1909.
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Jr. Economic Ent. III, pp. 482-499, Dec. 1910.
W. D. HUNTER, Aphid. of N. A. Bull. No. 60, Ia. Agrcl. Exp. Sta., 1901.
T. D. A. COCKERELL, Can. Ent. XXXVI, pp. 262-263, Sept. 1904.

1904 Aphis avenae (Fabr.) Perg. Bull. 44, Div. Ent. U. S. Dept. Agrcl.
1775 Nectarophora avenæ Fabr. Ent. Syst. 736.
1886 Aphis annuæ Oestl. Aphid of Minn. p. 43.

1901 Aphis fitchii Sander. 13th Rept. Del. Agr. Exp. Sta. 128.
After Schouteden Cat. Aphid Belgique 217, 1905.
See *Aphis padi L.* and Macrosiphum avenæ (Fabr.) Sanb.

1895 Aphis bakeri Cowen, Homop. Colorado, p. 118.
1895 Aphis cephalicola Cowen, Hom. Colo., p. 118.

1758 Aphis padi Linn.
Aphis holci Ferrari.
1835 Aphis zeæ Bon. Ann. Soc. Ent. Fr. IV, p. 658.
After Schouteden, Cat. Aphid Belg. p. 225, 1905.
According to Mordwilko 1909 the following:
1758 Aphis padi L.
1794 Aphis avenæ Fabr.
Hence:
1758 Aphis padi L.
1775 Nectarophora avenæ Fabr.
1794 Aphis avenæ Fabr.
1904 Siphocoryne avenæ (Fabr.) Perg. (After suggestion of Oestl.)
See Macrosiphum avenæ (Fabr.) Sanb.

1773 Aphis pomi De Geer. Memoires III.
1775 Aphis pyri mali Fabr. Syst. Ent.
1843 Aphis mali Kalt. Mon. Fam. Pflz. p. 72.
1901 Aphis padi Sand., 12th Rept. Del. Exp. Sta. p. 191.
After Gillette, Jr. Ec. Ent. I, 303, 1908.

1879 Calaphis betulaecolens (Fitch) Monell, Bull. U. S. Geo. Survey. V, 30.
1851 Aphis betulaecolens Fitch, Cat. Hom. N. Y. 66.
1879 Callipterus betulaecolens Thos. 8th Rept. Ent. III, p. 198.

—*Callipterus alnifoliae* (Fitch) MSS.
1851 Lachnus alnifoliæ Fitch, Cat. Hom. N. Y. 67.

1910 Calaphis castanea (Fitch) Gill. Jr. Ec. Ent. III, 368.
1856 Aphis castanea Fitch. Rept. Ins. N. Y. III, 471.

1870 Chromaphis juglandicola (Kalt.) Walk. Zoolog. V, 2006.
1843 Callipterus juglandicola Kalt. Monog Pflz. p. 151.

1897 Colopha ulmicola (Fitch) Monell, Can. Ent. IX, 102.
1858 Brysocrypta ulmicola Fitch, 5th Rept. Ins. N. Y. 843.
1862 Thelaxes ulmicola Walsh Proc. Ent. Soc. Phil. I, 304, 305.
1890 Pemphigus ulmicola Pack. Gmde 524.
1879 Glyphina ulmicola Thos. 8th Rept. Ent. III, pp. 112, 204.
1883 Colopha compressa (Koch) Monell, Can. Ent. XIV, 15.

1909 Drepanaphis acerifolii (Thos.) Del Guer. Rev. Path. Veg. An. IV, No. 1.
1878 Siphonophora acerifolii (Thos.) Bull. III Lab. Nat. Hist. II, 4.
1879 Drepanosiphum acerifolii (Thos.) Monell, U. S. Geol. Surv. Vol. I, 27.
1909 Phymatosiphum acerifolii (Thos.) Davis, Ann. Ent. Soc. Am. Sept. p. 196.

1909 Essigella californicus (Essig) Del Guer. Rev. Path. Veg. Ann. III, p. 2.
1909 Lachnus californicus Essig, P. C. Jr. Ent. I, 4.

1910 Eucallipterus tiliae (Linn) Gill., Jr. Ec. Ent. III, 367.
Callipterus tiliæ L.

1909 Gillettea cowcni (Gill) Borner, Zol. Anz. XXXIV, 198.
1907 Chermes cooleyi var. cowcni, Gill. Proc. Ac. Nat. Sci. p. 10.

1854 Hyalopterus arundinis (Fabr.) Koch Pflz. 16.
1749 Aphis pruni Fabr. Syst. Ent. IV, 213.
1886 Aphis phragmitidicola Oestl. List. Aphid Minn. 44.
Schouteden considered A. pruni and H. arundinis as separate species, Cat. Aphid. Belg. 230, 1905.

1868 Liosomaphis berberidis (Kalt.) Walk. Zoolog. p. 1419.
1851 Aphis berberidis Fitch, Cat. Hom. Ny. 65.
1857 Rhopalosiphum berberidis Kalt., Mon. Pflz. 95.

1906 Macrosiphum avenae (Fabr.) Sanb. Del. Agrcl. Exp. Sta. —.
1775 Nectarophora avenæ Fabr. Ent. Syst. 736.
1798 Aphis granaria Kirby. Trans. Linn. Soc. IV, 238.
1843 Aphis cerealis Kalt. Monog. Pflz. 1, 16.
1855 Siphocoryne cerealis (Kalt.) Koch.
1876 Siphonophora granaria Buck.
1879 Siphonophora avenæ (Fabr.) Thos. Rep. Ent. III, 8th p. 51.
1887 Nectarophora granaria (Kirby) Oestl. Aph. Minn. 82.
1904 Macrosiphum cerealis (Kalt.) Perg. Bull. 45, Div. Ent. U. S. Dept. Agr. p. 18.
1904 Macrosiphum granarium (Buck) Perg. Bull. 45 Div. Ent. U. S. Dept. Agr. p. 14.

It will be seen that there is a great deal of confusion regarding the synonymy of Aphis avenae (Fabr.) Perg., Aphis padi Linn., Macrosiphum avenae (Fabr.) Perg., Macrosiphum granarium (Kirby) Perg. Prof. Oestlund suggests the following for the present:

1758 Aphis padi Linn.
1906 Macrosiphum avenæ (Fabr.) Sanb.
1904 Macrosiphum cerealis (Kalt.) Perg.
1904 Macrosiphum granarium (Buck.) Perg.

But he goes on to say that the above has not been thoroughly established and that the present arrangement of Pergande's should be accepted, which is as follows.

1904 Macrosiphum cerealis (Kalt.) Perg.
1843 Aphis cerealis Kalt.
1855 Siphonophora cerealis (Kalt.) Koch.

1904 Macrosiphum granarium (Buck) Perg.
1876 Siphonophora granaria (Buck).
1887 Nectarophora granaria (Buck) Oestl.
1906 Macrosiphum avenæ (Fabr.) Sanb.
1886 Aphis aunuæ Oestlund, Aphid Minn. p. 43 (?).

1911 Macrosiphum baccharidis (Clarke).
1903 Nectarophora baccharidis Clarke, Can. Ent. XXXV, 254.

1911 Macrosiphum californica (Clarke).
1903 Nectarophora californica Clarke, Can. Ent. XXXV, 254.

1911 Macrosiphum jasmini (Clarke).
1903 Nectarophora jasmini Clarke, Can. Ent. XXXV, 252.

1911 Macrosiphum lycopersici (Clarke).
1903 Nectarophora lycopersici Clarke, Can. Ent. XXXV, 253.

1911 Macrosiphum rhamni (Clarke).
1903 Nectarophora rhamni Clarke, Can. Ent. XXXV, 254.

1906 Macrosiphum rudbeckiae (Fitch) Sanb.
1851 Aphis rudbeckiæ Fitch, St. Lab. Nat. Hist. p. 66.
1878 Siphonophora rudbeckiæ (Fitch) Thos. III. St. Lab. Nat. Hist. No. 2, p. 4.
1879 Siphonophora rudbeckiæ (Fitch) Monell, Bull. U. S. Geol. Surv. V, 21.
1887 Nectarophora rudbeckiæ (Fitch) Oestl. Aphid Minn. p. 83.

1905 Macrosiphum ulmariae (Schrk.) Schout. Cat. Aph. Belgiq. p. 240.
1801 Aphis ulmariæ Schrank.
1843 A. pisi Kalt. Monog. p. 23.
1855 Siphonophora pisi (Kalt) Koch. Pflz.
1855 S. gei Koch. Pflz.
1857 S. ulmariæ (Schrk.) Kalt.
1887 Nectarophora pisi (Kalt.) Oestl., Aphid. Minn. 82.
1900 N. destructor Johnson, Can. Ent. XXXII, 56-60.
Also
Aphis onobrychis Boyer.
Aphis lathyri Walker.

1911 Macrosiphum valerianiae (Clarke).
1903 Nectarophora valerianiæ Clarke, Can. Ent. XXXV, 253.

1911 Melanoxantherium rufulus (Davidson).
1909 Cladobius rufulus Davidson, Jr. Ec. Ent. II, 301.

1911 Melanoxantherium saliceti (Harris).
Cladobius saliceti Harris.

1857 Mindarus abientinus Koch., Pflz. 277.

1879 Schizoneura pinicola Thos. 8th Rept. Ent. Ill, p. 137.

1910 Monellia caryae (Monell) Gillette, Jr. Ec. Ent. III, 367.

1879 Callipterus caryae Monell, U. S. Geo. Surv. V, No. 1, p. 31.

1860 Myzocallis coryli (Goetze) Pass., Gali Afidi. p. 28.

Callipterus coryli Goetze.

(After Kirkaldy in Can. Ent. XXXVII, 417, 1905.)

1843 Myzus cerasi (Fabr.) Buck., Brit. Aphid. I, 174.

1822 Aphis cerasi Fabr., Syst. Ent. p. 734.

1876 Myzus persicae (Sulz) Buck Brit. Aphid. 178.

1761 Aphis persicae Sulz. Kenz. Ins. p. 105.

1801 A. dianthi Schr., Fauna Boica II.

1857 Rhopalosiphum dianthi Schr., Koch., Die Pflz., 42.

1879 Megoura solani Thos., 8th Rept. Ent. Ill., p. 73.

1879 Siphonophora achyrantes Monell, Bull. U. S. Geol. Surv. V, No. 1, 18.

1886 Myzus malvae Oestl., Geol. Surv. Minn. 14th Rept. Aphid of Minn., p. 31.

(After Gillette, Jr. Ec. Ent. I, p. 359, 1908.)

1859 Pemphigus populicaulis Fitch, Rept. Ent. N. Y. V, 845.

1862 Byrosrypta populicaulis Walsh, Proc. Ent. Soc. Phil., II, 305.

1857 Phyllaphis fagi (Linn.) Koch. Die. Pflz. Aphid., 248.

1735 Aphis fagi L. Syst. Nat. II, 735.

1869 Pineus pinicorticis (Fitch) Shimer, Trans. Am. Ent. Soc. II, 383.

1855 Coccus pinicorticis Fitch, Trans. N. Y. Agrcl. Soc. XIV, 871.

1858 Chermes pinifoliae Fitch Trans. N. Y. Agrcl. Soc. XVII, 741.

1841 Schizoneura lanigera (Hauss.) Hartig, Gei. Zoit. Ent. III, 367.

1802 Aphis lanigera Hauss., Ill. Mag. I, 229.

1849 Eriosoma mali Smon.

1824 Myzoxylus mali Blot. Mem. Soc. Linn. Calvados, I, p. 114.

1834 M. lanigera Arvilly, Die Moyzoxile, p. 1.

1856 Pemphigus (?) pyri Fitch, I Rept. Ent. N. Y., p. 118.

A. mali (Thos.) Bingly, .

1897 Ceratovacuno lanigera Zehnt. Med. Procfs. Java, No. 37, p. 29.

1867 Rhizaphis vastatrix Planchon, Comp. Rend. Acad. Sci., Paris, p. 62.

1868 Phylloxera vastatrix Planch. Comp. Rend. Acad. Sci., Paris, Sept. 14.

1855 P. vitifoliae Fitch, Rpt. Ins. N. Y. I, 158.

1862 Brysocrypta vastatrix, Walsh, Proc. Ent. Soc. Phil. I, 305.

1897 Rhizoecra vastatrix (Plane.) Kirk, N. Z. Dept. Ag. Lflts. No. 20, p. 3.

1874 Rhopalosiphum nymphae (L.) Koch. Pflz., p. 23.

1761 Aphis nymphae L. Syst. Nat.

1860 Siphocoryns nymphae (Fr.) Pass., Gali Afidi, 28.

1910 Aphis aquaticus Jackson, Ent. News, XXI, 245.

1910 Thomasia populicola (Thos.) Wilson, Can. Ent. XLII, 386.

1878 Chaitophorous populicola Thos. Bull. Ill. Lab. Nat. Hist. II, 10.

1909 Trifidaphis radicicola (Essig) Del Guercio, Riv. Path. Veg., Anno III, 5.

1909 Pemphigus radicicola Essig, P. C. Jr. Ent. I, 10.

1908 Tuberolachnus viminalis (Boyer) Mord., Ann. Mus. Zool. Acad. Imp. Sci., XIII, 374.

*Lachnus viminalis Boyer.

*1872 L. dentatus Le Baron, 3d Rept. Ins. Ill., 138. (♂).

*L. viminalis Fonsc.

*L. salicis Curtis.

*L. saligna Walker.

* After Schouteden, Cat. Aphid. Belg., p 207, 1905

ADDITIONS AND CORRECTIONS

Number of the heading of my last study on the Aphididæ of Southern California should have been VI and not V.

On page 100, Vol. III, No. 1, the synonymy of Aphis rudbeckiæ should be:

1906 Macrosiphum rudbeckiae (Fitch) Sanb.
1851 Aphis rudbeckiæ Fitch. Cat. Homoptera, N. Y., 66.
1878 Siphonophora rudbeckiæ (Fitch) Thos. Ill. St. Lab. Nat. Hist. No. 2, 4.
1879 S. rudbeckiæ (Fitch) Monell, Bull. U. S. Geo. Surv. V, 21.
1887 Nectarophora rudbeckiæ (Fitch) Oestl. Aphid. Minn., p. 83.

ADDENDUM TO THE SYNONYMY

Siphocoryne
Hyadaphis Kirkaldy.

Mr. Davidson also made other corrections here, which had been done before the article went to press, so are not necessary here. Regarding other important points he wrote as follows:

Drepanaphis platanoides Schrank. "I have commonly taken the apterous oviparous female, but never the winged form."

Aphis atriplicis L. "I believe there is a record of Aphis atriplicis L. being found in Southern California on Atriplex sp. This is in an old number of the Southern California Academy of Sciences' publications. According to some authors, atriplicis equals rumicis L."

"I have also a few additional things to suggest. In my first paper I mentioned Pemphigus populicaulis. This was later (as in my second paper) found to be P. populitransversus. As far as I am concerned, the former has not been found in this State." "Similarly Aphis cratægifoliæ Fitch was the species I took on Cratægus, not cratægi, although the latter has very possibly been reported. According to the International Zool. Congress Nomenclature Rules, my Pemphigus ranunculi must be changed and possibly ought to be listed *P. sp.* (ranunculi preoccupied) or just *P. sp.* Davidson."

Accordingly Pemphigus populicaulis Fitch must be struck off from the Host Index for the present. Prof. W. T. Clark reported Aphis cratægi Monell on Cratægus sp. in Canadian Entomologist XXXV, p. 249, 1903.

From Mr. J. T. Monell I have learned that the following synonyms should also be added:

Chaitophorus viminalis Monell.
Chaitophorus nigræ Oestl.
Siphocoryne capreae Fab.
S. salicis Monell. Or according to later revision as follows:
Hyadaphis pastinacae (Linn.) Schout.
Siphocoryne capreæ Fab.
S. salicis Monell.

NOTES ON COCCIDÆ VI

E. O. Essig

In Vol. III, No. 1, page 108, the insect described as *Eriococcus adenostomae* Ehrhorn is *Lecaniodiaspis rufescens* Cockerell.

On page 111 the title and part of the description of *Orthezia artemisiae* Ckll. were omitted by the printers and was as follows:

Orthezia artemisiae Ckll.

This insect (Fig. 143 B. P. C. Jr. Ent. Vol. III, No. 1., p. 106) was first sent to the writer by Roy K. Bishop, Horticultural Commissioner of Orange county. Since that time I have obtained it in the vicinity of Santa Paula.

The long white egg sac makes it at once conspicuous and easy to detect. It occurs in great numbers on the California sage (*Artemisia californica*) during the later summer months. That it never increases to any damaging numbers may be explained by the fact that it is parasitized by a dipterous insect which is an egg feeder. In some dozen females I was able to obtain several of the puparia, but was not fortunate enough to hatch out an adult fly.

In describing this coccid, I can do no better than to duplicate here, Cockerell's original description, which is as follows:

"*Orthezia artemisiae* n. sp. *Female:* Immature form. Antennæ and legs piceous. Body covered with white secretion. Dorsum with two rows of dentiform tufts; the first four directed forwards; the remaining seven, decreasing in size caudad, directed backwards. Nine lateral tufts; the first on a level with the second dorsal tufts, at right angles to the body; the others directed backwards, and about of equal length, except the last two, which are longer and narrower, the last being longest. Caudal tufts extending caudad of last lateral tufts.

"*Mature Female:* Differs by having the lamellæ or tufts much elongated, the first dorsal erect, longer than broad; the remaining dorsal produced and no longer dentiform. The arrangement is now practically as in adult *O. urticae* (L.), except that the first dorsal lamellæ are smaller (instead of larger) than the third. The hindmost lateral lamellæ are also somewhat less produced than in *urticae*. Antennæ and legs red-brown; antennæ eight-segmented, three longest; five a little longer than four; six and seven about equal, and shorter than four; eight about as long as five. Length of insect, without ovisac, $2\frac{1}{2}$ mm. Ovisac moderate, white, distinctly ribbed."

"*O. artemisae* is nearest to *O. annae*, but the latter has the lamellæ less definitely formed, and differs also in the antennæ." Can. Ent. XXX. p. 19-20, 1898.

THE CHILOPODA OF CALIFORNIA II

RALPH V. CHAMBERLIN, PROVO, UTAH.

FAMILY LITHOBIIDAE (continued)

Genus Pseudolithobius Stuxberg

Only the type species of this genus is known.

Pseudolithobius megaloporus Stuxberg

Antennæ very short, consisting of nineteen to twenty articles, of which the ultimate is very long. Ocelli seven in two series (1-3, 3). Prosternal teeth 2-2 or 3-3. Angles of the ninth, eleventh and thirteenth dorsal plates produced. Coxal pores 2, 2, 1, 1, 1, very large, circular. Anal legs very short, crassate, spines 0, 1, 1, 0, the claw unarmed.

Length of body 12 mm.; of antennæ 4 mm.; of anal legs 2.5 mm.

Known only from the type collected near San Francisco by Eisen.

Thus far I have not identified this species in an abundance of material from California. Judging from the description of antennæ, spining of legs, coxal pores, etc., it would seem practically certain that this species was based upon an immature specimen.

Order Epimorpha

The members of this order fall in two main groups or suborders which may be separated as follows:

Key to suborders of the Epimorpha

A. With twenty-one or twenty-three pairs of legs; pairs of spiracles nine, ten, eleven, or nineteen. *Scolopendroidea.*

AA. Pairs of legs thirty-one or more; pairs of spiracles two less than the number of pairs of legs, being absent from the first and the last body segment. *Geophiloidea.*

Suborder Scolopendroidea

The members of the Scolopendroidea live for the most part in the warmer regions of the earth, the large tropical and sub-tropical centipedes belonging here.

The members of the group are essentially nocturnal, during the daytime lying concealed in holes in the ground, under stones, bark, logs, fallen leaves, etc., and at night wandering about and often entering dwelling houses. They live chiefly upon insects, spiders, worms, and smaller chilopods.

The body is elongated and varies from slender to robust. The antennæ are short and are composed of from seventeen to thirty-three articles, the number varying mostly toward the lesser limit. Eyes either absent or composed of four simple ocelli on each side. Prehensorial feet with coxæ completely fused in a prosternum which mesally extends cephalad in two processes which may or may not bear teeth. The basal plate, or dorsal scutum of segment to which prehensorial feet belong, either absent or rudimentary. Pairs of legs constant (either

twenty-one or twenty-three) both for genera and for species. Coxa of anal legs absent or fused with the pleurae, forming thus the so-called pseudopleura or coxapleura, and the trochanter absent or rudimentary. The pseudopleurae are strongly developed and are more or less produced caudad at mesal side into the so-called pseudopleural processes, the processes often bearing a number of spines which may also exist on the caudal margin cetad of the process; always densely porose over surface. Tarsi of anal legs from two to many segmented, those of the other legs undivided or biarticulate.

The three families of this sub-order may be separated by means of the following key. Of these three families two are known to be represented in California:

Key to Families of the Scolopendroidea

A. Without eyes; tarsi of all legs excepting the anal and penult pairs unsegmented; tibia at distal end with one or two spines or with bristles arranged in longitudinal rows beneath. Family *Cryptopidae*.

AA. Eyes present, composed of four ocelli on each side; tarsi of anterior legs all biarticulate; tibia without spines at distal end or rows of bristles beneath.

B. Spiracles oval or circular, oblique to long axis of body; tarsal spines generally present and two in number on the anterior legs; cephalic plate never overlapping the first dorsal plate; basal plate and longitudinal furrows never present. Family *Otostigmidae*.

BB. Spiracles angular, triangular or narrowly slit-like, parallel to long axis of body; tarsal spines absent or only one in number; cephalic plate often overlapping the first dorsal plate or in other cases basal plate and longitudinal furrows present. Family *Scolopendridae*.

Family Cryptopidae

The genera of this family occurring within the United States may be separated by means of the following key:

Key to genera of the Cryptopidae

A. Twenty-one leg-bearing segments; pairs of spiracles nine or nineteen.

B. Last dorsal plate not longer than the penult, mostly shorter than wide, its caudal margin convexly excurved or bluntly angular.

C. Pseudopleura not produced caudad into a slender process. Genus *Crytops* Leach.

CC. Pseudopleura produced caudad into a slender process. Genus *Anethops* Chamberlin.

BB. Last dorsal plate nearly twice as long as the penult, longer than wide, the caudal margin nearly straight.

C. Nine pairs of spiracles. Genus *Theatops* Newport.

AA. Twenty-three leg-bearing segments; pairs of spiracles ten or eleven.

B. Anal legs with a claw and a two-jointed tarsus; prefemur of anal legs with but two spines; femur of prehensorial feet with a basal tooth.

C. Seventh segment without spiracles (ten pairs of spiracles present). Genus *Otocryptops* Haas.

CC. Seventh segment with spiracles (eleven pairs of spiracles present). Genus *Scolopocryptops* Newport.

BB. Anal legs without a claw and the tarsi transformed into a many jointed, antenna-like lash; prefemur of anal legs with rows of from three to six spines on ventral surface; femur of prehensorial feet without basal tooth. Genus *Newportia* Gervais.

Genus Theatops Newport

Of this genus, one species (*T. erythrocephalus*) occurs in southern Europe and three in North America, of which the one found in California is very close to the European form and is accordingly listed below as a subspecies to it.

The members of this genus are of medium size (35-46 mm.), have twenty-one pairs of legs, and but nine pairs of circular or subcircular spiracles, not being present on the seventh segment. The antennæ consist uniformly of seventeen articles. The anal legs are short and thick, with the claw strongly enlarged.

Theatops erythrocephalus subspecies californiensis Chamberlin

This is the only form of *Theatops* thus far known to occur on the Pacific coast.

From 40 to 46 mm. in length. Brown in color, with antennae and legs yellowish. Teeth of prosternum 3-3, large. Tooth on femur of prehensorial feet rather large and stout. Tibiæ, except of last two pairs, armed with a spine both above and beneath. Anal legs stout, short, the claw about as long as the two tarsal joints together. Prefemur and femur both armed beneath toward mesal side with a single moderate tooth. Pseudopleura with process ending in a stout spine or tooth.

The only record from the state is Quincy, Cal., the type locality. Probably the same form as that reported by Kraepelin from Oregon.

Genus Otocryptops Haase

This genus, of which some five species are now known, is represented in the faunæ of both hemispheres. Two species occur in California.

The members of this genus when fully grown reach a length of mostly from 50 to 60 mm. They have twenty-three pairs of legs and ten pairs of oval spiracles. As in the preceding genus, the antennæ are composed constantly of seventeen articles. Anal legs not shortened, and the claw of moderate size.

The California species may be identified by means of the following key, in which a new species from Idaho is also taken up:

Key to Species of Otocryptops

A. Ventral plates nearly all with a distinct median furrow; dorsal scuta mostly with a median furrow.

B. Inner spine of prefemur rudimentary to entirely aborted; lateral angles of the last dorsal plate ending in a small spinous point; last ventral plate with caudal margin truncate or but weakly incurved. *O. gracilis* Wood.

BB. Inner spine of prefemur well developed; lateral angles of the last dorsal plate not at all spinous pointed; last ventral plate with caudal margin conspicuously concave. *O. mundus* sp. nov.

AA. Ventral plates smooth, without a median furrow; dorsal scuta without a median furrow; cephalic plate margined laterally as well as at caudal angles. *O. sexspinosus* Say.

Otocryptops gracilis Wood

Yellowish brown to ferruginous or yellowish red in color. All articles of the antennæ hirsute or the dorsal surface of the first alone smooth. Prosternum mostly with two small teeth. The median furrow of ventral plates deep and widened at middle of length. Processes of pseudopleuræ short. Prefemur with ventral spine well developed, the inner one obsolte or absent.

Fort Tejon (type locality, Wood); Los Angeles (author); Claremont (common, Pomona College Coll.); Stanford (Mann).

Known only from California, where it is commonest in the southern portion of the state. It has not been recorded from north of Stanford. The species is closest to the following one:

Otocryptops mundus sp. nov.

(Figure 156, A, B, E, F)

Head mostly smooth, finely punctate, especially over caudal and caudo-lateral portions. Margined caudo-lateral and also to some extent laterally. All articles of antennæ pubescent or the first article smooth dorsally as in *gracilis*. Dorsal plates 5-22 strongly margined laterally, the fourth more weakly so, the twenty-third weakly so. Median furrows on dorsal plates much as in *gracilis*. Last dorsal plate but slightly narrowed caudad, caudal border less extended than in *gracilis*, the lateral angles rounded and wholly without indications of spinous point. Prosternum without teeth. Ventral plates from one to twenty-one with a longitudinal median furrow. Last ventral plate rather deeply excavated caudally. Pseudopleuræ with conspicuous, pointed caudal processes, decidedly longer than in preceding species. Anal legs very long and stout; both ventral and inner spine of prefemur stout and conspicuous. Brown; head and last segments reddish; legs and antennæ yellowish or yellowish brown, anal legs darker. Length ad 60 mm.

Kendrick, Idaho (Mann), is the only known locality thus far.

The species is very close to the preceding and might even be with reason regarded as a subspecies to it.

Otocryptops sexspinosus Say

Brownish to deep rust red. Antennæ usually with the first two articles glabrous and shining, the others densely hirsute. The prosternal margin nearly straight and smooth, without any indications of teeth. Prefemur of anal legs with both ventral and inner spine conspicuous. Pseudopleural processes large. Ventral plates smooth, without median furrow. No median dorsal furrow or line.

One of the commonest of all chilopods throughout most of the state but becom-

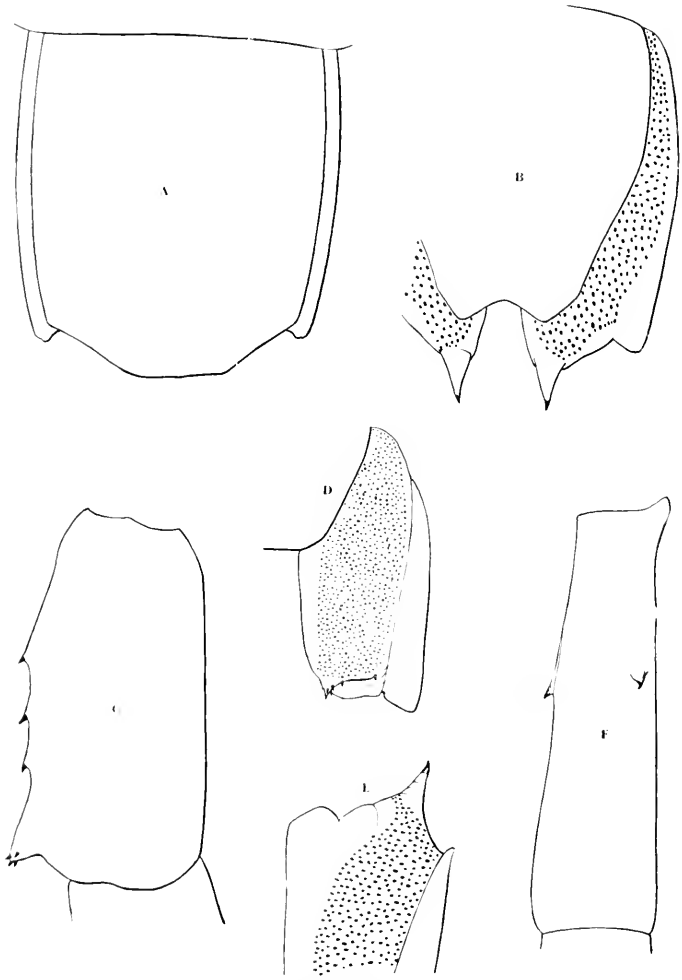

Figure 156

A, last dorsal plate of Otocryptops mundus; B, ultimate ventral segment of O. mundus, ventral aspect, showing last ventral plate and left pseudopleura, with pores, caudal process, etc.; C, prefemur of right anal leg of Scolopendra polymorpha, dorsal aspect, showing apical process with its spines and some of the inner spines, etc.; D, left pseudopleura of S. polymorpha, ventral aspect, showing pores, caudal process with its spines, etc.; E, pseudopleura of O. mundus, lateral aspect, showing caudal process, etc; F, prefemur of left anal leg, ventral aspect, of O. mundus, showing ventral and inner spine.

ing rare southward, where it seems to be replaced by *gracilis*. Shasta Springs, San Francisco, Pacific Grove, Stanford, etc. (author).

Genus Scolopocryptops Newport

This genus, represented by only three or four known species, is represented in the fauna of China and of North and South America.

The genus is very close to *Otocryptops* in nearly all important structural characters, but differs in having eleven pairs of spiracles instead of the ten of the latter genus, the thirteenth body segment bearing the extra pair.

One species is at present known from North America.

Scolopocryptops miersii Newport

Extremely variable in color. Most adults dark brownish black; legs yellow, the last pairs and the antennæ proximally mingled bluish green and yellow. The three proximal articles of the antennæ smooth and shining. Prosternum with angle at each side more or less produced into a tooth-like process. Femur of prehensorial feet bearing on mesal surface a rather large and stout basal tooth which at its base is one-sixth as wide as the femur. Ventral plates without median furrow. Legs nearly glabrous. Legs back as far as the nineteenth pair with two tibial and one tarsal spine, most claws unarmed at base. Prefemur of anal legs with a stout spine beneath and a smaller one within. Length up to 100 mm. or more.

Doubtfully recorded from California. However, it is widespread in the southeastern states and through Mexico, southward to Brazil, and it is naturally to be expected within this state.

Genus Anethops Chamberlin

The species listed below is the only representative of this genus known:

Pairs of legs twenty-one. Spiracles ten pairs. Sterna with a median furrow in some, crossed by a transverse impression. Antennæ composed of seventeen articles, thickened proximally. Processes of pseudopleuræ ending in a single spine. Tarsi of all legs excepting the last ones unsegmented. Claw of anal legs not of unusual size, armed at base with spines.

Anethops occidentalis Chamberlin

Ferruginous, feet pale. Most ventral plates with a cruciform impression, the longitudinal furrow deepest. Prosternum without dental plate. Tooth on femur of prehensorial feet small, acute. Length ad 35 mm.

Known only from type specimen taken in San Gabriel canyon, Los Angeles county.

Genus Cryptops Leach

A cosmopolitan genus represented by more than two dozen known species, some of which range farther north than any others of the *Scolopendroidea*.

Pairs of legs twenty-one. Pairs of spiracles nine. Antennæ normally with seventeen articles, the number sometimes less. Dorsal scuta with two longitudinal furrows and often also a median keel. Sterna with distinct cruciform impressions. Prosternum without anterior extensions and with no dental plates.

Prehensorial feet without a tooth on mesal face of femur, claws large. Pseudopleuræ without caudal processes, merely rounded caudally. Legs without tibial spines. Tibia and first tarsal joint of anal legs with a comb-like row of spines or teeth on ventral surface.

Cryptops hyalinus Say

Fulvous, the legs and antennæ paler. Very slender. Prosternal margin with six to eight fine, short hairs. Eighteenth sterna with cross furrow only, the nineteenth to twenty-first mostly unfurrowed. Inner margin of pseudopleura rounded, porigerous area with about seventeen large pores, the smooth caudal border clothed only with scattered hairs. Spiracles small, circular. Prefemur of anal legs ventrally with numerous spiniform bristles, without apical spiniform process; femur similarly clothed, without apical tooth or process. Tibia ventrally with seven to eight comb-teeth; the first joint of tarsus with four, neither with lateral spines. Length 15-20 mm.

Doubtfully recorded from California (Kraepelin). A vial, possibly, but not certainly, from southern California (Catalina Island), and in the author's collection, contains several specimens of this species. The species is widespread in the eastern and southeastern United States.

Genus Newportia Gervais

Between fifteen and twenty species of this genus are known, all from America and all but one (*N. utahensis* Chamb.) from tropical or sub-tropical localities.

In the members of this genus there are twenty-three pairs of legs and eleven pairs of spiracles. First dorsal plate with a transverse cervical furrow. Ventral plates with longitudinal furrows but with no cross impressions. Prosternum with or without dental laminæ. Femur of prehensorial feet without basal tooth. Pseudopleuræ with long, pointed caudal processes. Tarsi of anal legs composed of numerous segments, lash-like.

While no species of this genus has as yet been found within California, it seems quite likely that the genus will be found to be represented in the southern portion of the state. The species of the genus are obscure in habit and most of them are known from one or from but few specimens. Hence, a species occurring in a locality may long escape discovery.

Family Scolopendridae

The genera of this family known to occur within the United States may be separated by means of the following key:

Key to genera of the Scolopendridae

A. All legs lacking tarsal spines.
  B. Process of pseudopleura three to many toothed or spined, slender, subcylindric; no trace of basal plate. Genus *Hemiscolopendra* Kraepelin.
AA. All legs, excepting the anal, with tarsal spines (cephalic plate with caudal margin free).
  B. Claw of anal legs and without basal spines; cephalic plate but slightly overlapping the first dorsal. Genus *Arthrorhabdinus* Verhoeff.

BB. Claw of anal legs with distinct basal spines; cephalic plate distinctly and considerably overlapping the first dorsal plate.
Genus *Scolopendra* Linnaeus.

Genus Hemiscolopendra Kraepelin

This genus is peculiar to the western hemisphere. Its species have for the most part been considered under *Scolopendra*, which they conform to in general habit and structure. One species (*H. punctiventris* Newport) is widespread in the eastern United States, but none is known from California.

Genus Arthrorhabdinus Verhoeff

Established as a subgenus to *Arthrorhabdus*, a South African genus, for the Texan species *A. pygmaeus* Pocock, a species which may possibly range across Arizona into southern California and which is accordingly included here.

Genus Scolopendra Linnaeus

This, the typical centipede genus, embraces about two dozen valid species and presents an excessive range under these of minor geographical forms, of which a very large number have by different authors been dignified as species. The variability in size, color, and many other characters is extreme. It is cosmopolitan in the warmer zones of the earth.

No basal plate present. Antennae composed of seventeen to thirty-one articles, of which the proximal four or more are glabrous. Prosternum with dental plate; femur of prehensorial feet with basal tooth. Pseudopleura with toothed or spined caudal process. A tarsal spine on each leg excepting last pair. Prefemur of anal legs spined, always with spines at apical process or angle.

The species occurring within California may be distinguished as follows:

Key to Species of Scolopendra

A. First dorsal plate with a deep transverse impression back of anterior margin.

B. Cephalic plate impressed with two fine longitudinal furrows which diverge cephalad; length 100 to 200 mm. *S. heros* Girard.

BB. Cephalic plate wholly without furrows or at most with a weak median furrow; first legs with two tarsal spines; length mostly from 50 to 100 mm.

C. Apical process of prefemur of anal legs mostly with four spines; cephalic plate always without any furrows. *S. polymorpha* Wood.

AA. First dorsal plate without a deep transverse impression back of cephalic margin (legs of first pair with but one tarsal spine).

B. Prefemur of anal legs with none to five spines only.

C. Prefemur of anal legs without spines beneath and at most with two on the inner or mesal surface. *S. dehaani* Brandt.

CC. Prefemur of anal legs with four or five spines, of which two are always ventral in position. *S. subspinipes* Leach.

BB. Prefemur of anal legs with ten to fifteen spines, of which six to nine are ventral in position and arranged in three series.

C. Apical process of prefemur bearing three or four spines.
S. morsitans Linnaeus.

Scolopendra heros Girard

Very large, attaining a maximum length of above 200 mm. Dark green to olive or chestnut brown; the head often showing both colors in parts or entirely chestnut. Prosternal teeth 4-4 to 5-5, the three inner ones more or less united or fused at base; caudal limiting furrows of dental plates forming nearly a straight line. Legs one to twenty with a tarsal spine, prefemora and femora unarmed at distal end above. Pseudopleural process bearing six to eleven spines, and one or two on caudal margin ectad of process. Prefemur of anal legs mostly with eleven spines on ventral surface, these irregularly scattered or else arranged in four series; five spines on inner surface and above; apical process bearing seven to eleven spines.

Found from the southeastern states through Kansas, Indian Territory and Texas to Arizona and Mexico. Probably will be found in southern California.

Scolopendra polymorpha Wood

(Figure 156, C, D)

Attaining a maximum length of about 140 mm. In color from clear or dark olive yellow to olive brown, the caudal borders of dorsal plate mostly dark green; legs yellow. Prosternal teeth four to four. First legs with two tarsal spines, legs two to twenty with but one. Prefemora and femora of these legs unarmed at distal end above. Pseudopleural process tipped with four to seven spines or points; one spine on caudal margin. Prefemur of anal legs with eight to ten ventral spines in two rows, and mesally with nine to thirteen; apical process ending mostly in four (rarely in three or five) spines.

Known from Kansas, Indian Territory, Texas, Arizona and California, in the latter state being clearly the most common species. Specimens have been examined from Stanford, Los Angeles (author and W. M. Mann), and Claremont (Baker, A. Pruett, F. M. Eakin, Helen Humphrey, A. Sugg, P. Daggs, Helen Davis, K. Garner, A. M. Wire).

Scolopendra dehaani Brandt

Occasionally reaching a length of as much as 200 mm. Very variable in color; from olive to green and brown, the caudal margin of dorsal plates commonly dark green; head and first dorsal plate often differently colored from rest of body. Prosternal teeth five to five (rarely four to four) to nine to nine. Prefemur of anal legs without spines beneath, with one to three within; apical process one or two pointed. Pseudopleural process with two spines or points.

In the United States known only from California, where it has likely escaped from vessels. It is common in India, China, and the East Indies.

Scolopendra subspinipes Leach

Very similar to the preceding species in size and coloration, the former possibly to be regarded as but a subspecies or variety.

It differs from *S. dehaani* chiefly in having the prefemur of the anal legs armed beneath with from one to three spines.

Cosmopolitan in tropical and warmer regions of the earth. In the United States known only from Florida and California.

Scolopendra morsitans Linnaeus

Mostly attaining a length not above 90 mm.; rarely 100 or 120 mm. Lemon yellow to reddish yellow, with or without green caudal borders to the dorsal plates; more rarely olive green to dark green with the head and last segment then mostly yellowish brown. Prosternal teeth four to four, four to five. Legs one to twenty with tarsal spine, leg twenty-one mostly without such. Pseudopleural process ending mostly in four points or spines, commonly a single spine on caudal margin ectad of process. Prefemur of anal legs ventrally with three rows of three spines each, mesally without spines, but dorsally with four to six spines in two rows; apical process bearing four spines (rarely five to eight).

Cosmopolitan in warm and temperate regions. In the United States known from Georgia, Florida, Kansas, Utah, and California.

AMERICAN PSYLLIDÆ IV

(A Partial Revision of Subfamiles)

D. L. CRAWFORD

For some years students of the family *Psyllidae* have recognized that the classification based upon wing venational characters was more or less superficial. One of the first difficulties encountered in the study of the immense series of species and specimens in the collections at hand was the constant separation into widely distinct artificial groups of two forms really very closely related. The relative length of the cubital petiole and discoidal portion of subcosta in the subfamilies *Aphalarinae* and *Psyllinae* is purely artificial and impossible, even Dr. Franz Low himself including under one or the other subfamily forms which by the diagnostic lines proposed by himself could not possibly be included therein. For instance, in the genus *Aphalara,* typical of the subfamily *Aphalarinae,* are included forms in which the cubital petiole is distinctly shorter than the discoidal portion of subcosta: *Aphalara signata* Low (*Turkestanische Psylloden,* F. Low, p. 254, with figures), and others by Low; *Aph. multipunctata* Kuwayama, and *Aph. fasciata* Kuway., and *Aph. flava* Kuway. (Trans. Sapporo Nat. Hist. Soc. Vol. 11, 1907, Figs. 2, 3, 4).

The unmistakable relationship of certain groups of species and genera in spite of previously existing groupings points to the fact that a complete revision and recast of the entire family is most necessary. This is shown very forcibly by the related genera in *Carsidarinae,* formerly known in part as *Prionocnemidae,* and, again, by the new genus *Triozoida,* one species of which is without a cubital petiole and the other with a very short petiole, but both very clearly congeneric. The same fact is brought out further by the genera of the two subfamilies, *Aphalarinae* and *Psyllinae.* In each of these two groups are genera, which, if the length of the cubital petiole were overlooked, would be unavoidably thrown together into the same genus, or, at least, very closely allied genera.

In this paper the subfamily *Carsidarinae* is presented in as complete form as is possible at this time. The genus *Triozoida* treated next is presented separately for the time being, since the relationships of the whole family must be considered on the new basis, and this cannot be done until the entire group has been thoroughly studied. The treatment of this genus, however, is given here because of the extremely important evidence which it presents. The genus *Aphalara* is, also, treated as completely as possible now. Access has been had to authentically named specimens of several European species of the genus and the true relationships between these and common American species are here established. The genus is redescribed on a new basis, as are, in fact, all the genera herein presented.

Some confusion has arisen because of several manuscript names which Riley attached to certain species, especially in the *Aphalarinae;* authentic specimens of these are in the C. F. Baker collection from the National Museum, and their present references given here:

Aphalara angustipennis.....*Aph. artemisiae angustipennis* Crawf.
Aphalara utahensis.....*Aph. artemisiae* Forst.

Aphalara harrisii	*Aph. picta* Zett.
Aphalara occidentalis	*Aph. minutissima* Crawf
Aphalara epilobii	*Aph. nebulosa americana* Crawf.

In this paper are mentioned portions of a large number of Psyllidae received from Mr. W. D. Hunter of the Exp. Station at Dallas, Texas, and some, also, from Mr. E. S. Tucker at the same station.

Carsidarinae

(Syn. *Prionocnemidae* Scott pt., *Ciriacreminae* Enderlein pt.)

The name *Prionocnemidae* was proposed in 1882 by John Scott as a subfamily name for the two genera *Carsidara* and *Tyora*, both of which genera were based principally on the presence of a basal spur on the hind tibiæ. This name, of course, cannot stand, for several reasons; the subfamily name must terminate in *inae* and must be derived from the oldest genus in the group, which in this case is *Carsidara;* moreover, the use of the name *Prionocnemidae* is precluded in *Psyllidae* by the existence of a genus in Coleoptera, *Prionocnemus* Kirsch (1874). In 1910 Dr. Enderlein proposed the name *Ciriacreminae* for several genera possessing the post-tibial spur, whether or not they were otherwise related. In the group he includes the genera *Carsidara* and *Tyora* and several other genera not closely allied to these. Regardless of the fact that the group is not closely interrelated, this subfamily name is untenable for the reason that it has been derived from one of the last named genera.

The presence of the basal post-tibial spur is not a character which necessarily relates all species possessing it. In this family there are several species with the armed tibiæ which are manifestly not related to each other in any way, except in that one character, and to place all these forms in one subfamily, as done by Enderlein, will result in as much confusion as from grouping genera on wing venation. A species undoubtedly belonging to Enderlein's new and typical genus *Ciriacremum* in the collection at hand is not in the slightest degree related to the several species of *Carsidara* and its allied genera.

The subfamily *Carsidarinae* must, therefore, be recognized as a very homogeneous and closely related group, one characterization of which is the post-tibial spur *usually* present, and when present, in varying degrees of prominence. The principal diagnostic character of the group is in the thorax and head, with accompanying minor characters of the appendages.

To this subfamily are now referred several genera from the *Aphalarinae, Psyllinae* and *Triozinae* which are unmistakably and without the slightest doubt very closely allied to the genus *Carsidara*. This removal of genera from all subfamilies shows that the characters heretofore used for separation of subfamilies in the *Psyllidae* have been only artificial and crude, at best. The primary characters would best be looked for in the thorax first, then the head and then the appendages, the legs and the wings. To use venational characters of the forewing for the subfamily diagnosis is impossible, even when the difference is in the presence or absence of the cubital petiole, and much more so when the difference is a relative one between the lengths of two short veins. It is a remarkable fact that Kuwayama did not discover the relationship of his genera *Tenaphalara, Macro-*

homotoma and *Mesohomotoma*, both to the genus *Carsidara* and to each other, and that, instead, he placed one in one subfamily and the others in another. The actual relationship of Kuwayama's genera here mentioned cannot be truly ascertained until more is known about the cephalic, thoracic and genital characters. From his meagre descriptions and figures, however, it seems highly probable that his *Mesohomotoma* is congeneric with *Carsidara* Walker, and that all these genera are certainly *Carsidarinae*. Although the genus *Freysuila* Aleman, described by E. A. Schwarz in 1897 (Proc. Ent. Soc. Washington, Vol. IV, p. 196) is said to have no post-tibial spurs, nevertheless the deeply excised and strongly birostrate vertex, the unusually long antennæ and the form of the wing place this genus without doubt with the *Carsidarinae*. Mr. Schwarz mentions its similarity to *Homotoma* and *Rhinopsylla*, which probably would indicate that the genus *Homotoma*, also, belongs in this subfamily. Although the genus is unknown to me in nature, I have little doubt but that it should be included with the above mentioned genera, from the descriptions given of it.

It is exceedingly interesting and an unquestionable fact that *Rhinopsylla* and probably *Bactericera* must be removed from *Triozinae* to this subfamily. The striking resemblance to these other genera in the peculiar birostrate appearance of the head and the presence of the post-tibial spur, and other characters of greater importance place all these genera in a remarkably homogeneous supergroup, in spite of venational differences heretofore thought to be primary. It is interesting to note that Riley overlooked the similarity in head structure between his *Rhinopsylla* and *Carsidara* and stated in connection with his description that "the remarkable formation of the head removes *Rhinopsylla* not only from the other genera of this subfamily but from all Psyllidæ hitherto described."

The following table of genera of this subfamily is based chiefly on purely artificial characters since none others are available for the genera not represented in these collections. As soon as further knowledge of these other genera is available the true generic lines can be drawn and synopses made for them. In the interest of the study of this family it is strongly urged that such knowledge may be made available, especially in the form of clear and complete detailed drawings.

Description of Subfamily

Vertex very deeply excised in front at median suture, strongly birostrate. Antennæ attached to apex of rostrate lobes; two basal segments very large and long; flagellum usually very long and slender. Facial cones entirely wanting; antennal bases sometimes swollen slightly. Anterior ocellus more or less visible from above, usually on dorsal surface. Labrum small, posterior; rostrum usually very long and slender. Thorax often quite narrow. Propleurites very long; epimeron largely visible. Posterior tibiæ usually distinctly spurred at base; spur sometimes more or less reduced. Wings very transparent and shining, usually very distinctly angulate at apex; vein furcation scarcely dichotomous, the branches lateral instead of terminal.

Table of Genera

A. Cubital petiole wanting; fourth furcal terminating at or near apex of wing. Post-tibial spur small.

B. Excision of vertex very deep. Third antennal segment slender, or at least distinctly less slender than second

Rhinopsylla Riley.

BB. Excision of vertex not so deep. Third antennal segment very long and almost as thick at center as preceding segment.

Bactericera Puton.

AA. Cubital petiole distinctly present, variable in length.

B. Fourth furcal terminating above apex of wing; apex within second marginal cell.

C. Antennæ short; flagellum broadly compressed and densely pubescent. Fourth furcal terminating far above apex of wing.

Homotoma Guer.

CC. Antennæ very long; flagellum very slender; third segment quite thick and densely pubescent. Fourth furcal not far above apex of wing. Posterior tibiæ not spurred at base. Anterior ocellus in front.

Freysuila Aleman.

BB. Fourth furcal terminating below apex of wing; apex between fourth furcal and radius.

C. Wing broadly rounded at apex; antennæ short, very stout, glabrous; rostrum rather short; radius sharply angulated midway. Anterior ocellus in front.

Epicarsa Crawf.

CC. Wing acutely angulated at apex; rostrum long.

D. First marginal cell as large as second.

E. Pterostigma large, broad, short; radius short. Antennæ short.

Macrohomotoma Kuway.

EE. Pterostigma long, narrow; radius long.

Tyora Walker.

DD. First marginal cell much smaller than second. Pterostigma long, or wanting. Anterior ocellus usually above. Antennæ usually long, slender.

E. Dorsal plate of female genital segment with a prominent convexity near apex and a tuft of long slender hairs thereon. Wings not more than three times as long as broad; fourth furcal strongly curved downward.

F. Pterostigmal space wanting; radius very short; cubital petiole less than one-third the length of discoidal subcosta.

Mesohomotoma Kuway.

FF. Pterostigmal space present, open or closed; radius not very short; cubital petiole at least half as long as discoidal subcosta.

Carsidara Walker.

EE. Dorsal plate of female genital segment without densely pubescent convexity caudad. Wings very slender, more than three times as long as broad; fourth furcal almost straight. Pterostigmal space quite large, open; cubital petiole longer than discoidal subcosta.

Tenaphalara Kuway.

Carsidara Walker

Head moderately small; vertex usually sulcately impressed, scarcely plane, strongly birostrate anteriorly; anterior ocellus usually above, upon vertex; posterior ocelli anterior. Antennæ large basally; flagellum very long and slender. Labrum small, posterior; rostrum very long, slender and acute.

Thorax usually quite narrow. Post-tibial spur large, prominent. Wing shining, hyaline, quite acutely angulate at apex; vein furcation scarcely dichotomous, lateral.

Type of genus: *Carsidara marginalis* Walker.

Carsidara concolor n. sp.

(Figure 157, A; 158, C; 159, A; 160, D)

Length of body 2.4 mm.; length of forewing 2.9 mm.; greatest width 1.0 mm.; width of vertex between eyes .40 mm.; with eyes .78 mm. General color light green, somewhat flocculent.

Head not deflexed, with eyes about as broad as thorax, finely punctate; dorsoventral width of profile greater than length through central axis of eye. Occipital margin arcuate; discal areas on each side of median suture with a long, oblique, sulcate impression between posterior and anterior ocelli, and a smaller impression near anterior ocellus; posterior ocellar regions not greatly elevated; vertex very deeply emarginate and excised at median suture anteriorly, strongly birostrate. Anterior ocellus near apex of excision, but not on it, quite large, distinct. Antennæ attached to rostrate lobes of vertex; basal segments very large; flagellum extremely long and slender, filiform; third segment much longer than fourth. Facial cones wanting; antennal bases scarcely swollen. Genæ prominent. Labrum small, posterior; rostrum very long and slender. Eyes large, quite strongly bulging.

Thorax rather narrow, finely punctate. Pronotum rather long relatively; propleurites very long and prominent; pleural suture curved, attaining almost to lower margin of dorsulum; furcocoxæ large, mostly visible. Dorsulum quite short, narrow. Metasternal spurs moderately long. Post-tibial spur prominent, quite large. Wings relatively quite large, hyaline, transparent, about two and three-fourths times as long as broad, broadest across first marginal cell, quite acute at apex; first marginal cell much smaller than second; fourth furcal rounded, terminating below apex of wing; radius long; pterostigmal space open, quite long and broad; cubital petiole shorter than discoidal subcosta; basal subcosta shorter than discoidal subcosta; with a distinct plica connecting base of fourth furcal to radius.

Male—Abdomen moderately long. Genital segment relatively large; claspers long, curved, obtuse at apex; auxiliary claspers shorter, erect, very acute at tip; anal valve very large, as long vertically as genital plate, with a short, broad posterior lobe; pubescence rather short and flocculent.

Female—Genital segment almost as long as rest of abdomen, slender, acute at apex; dorsal plate with a strong convexity dorsad on basal two-thirds, and a tuft of long slender hairs at caudal end of convexity; both plates of almost equal length.

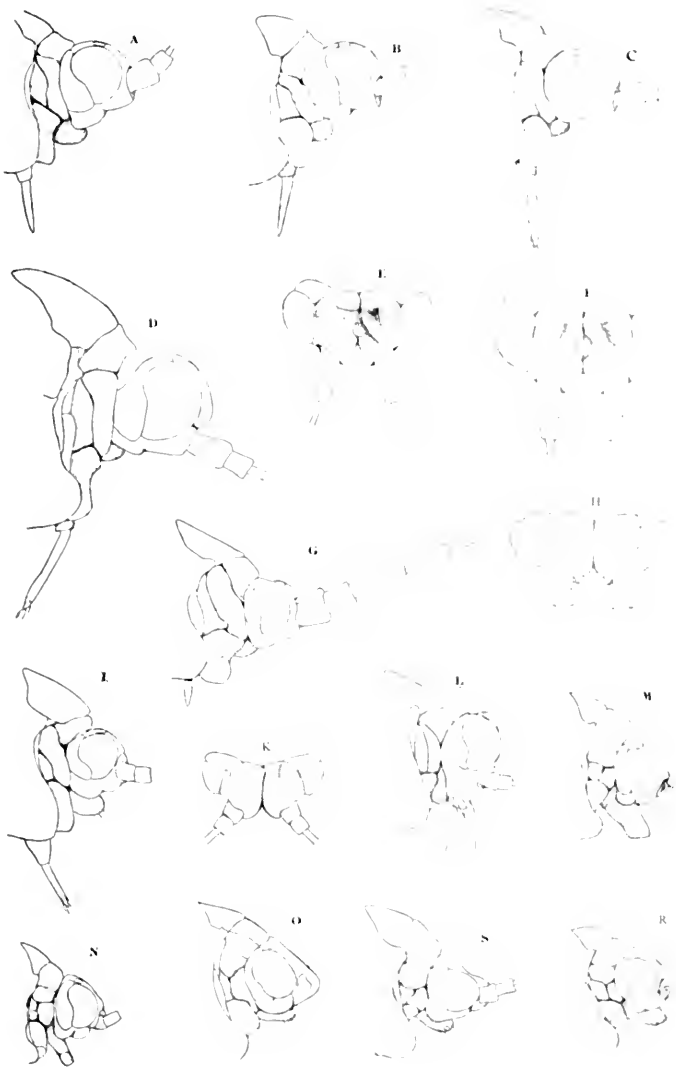

Figure 157. Details of Psyllidæ

A, Carsidara concolor; B, C. mexicana; C, C. rostrata; D, C. gigantea; E, C. rostrata; F, C. gigantea; G, H, Epicarsa corniculata; I, K, Rhinopsylla jalapensis; L, Triozoida johnsoni; M, N, Aphalara calthæ; O, Aph. artemisiæ angustipennis; S, Aph. communis; R, Aph. calthæ maculipennis.

This species is quite closely related to *Carsidara dugesii* Low, described from Mexico. There is a striking and constant difference, however, in the absence in the Cuban species of the conspicuous stripes and bands of the Mexican form. With the exception of minor differences in the cephalic characters the two species are quite similar.

Described from numerous males and females collected at Havana, Cuba, by C. F. Baker.

Carsidara gigantea n. sp.

(Figure 157, D, F; 158, A; 160, A)

Length of body 2.8 mm.; length of forewing 3.8 mm.; greatest width 1.4 mm.; width of vertex between eyes .47 mm.; with eyes .96 mm. General color light yellowish green throughout; distal portions of antennal segments black. Body very large.

Head not deflexed, subglobose, finely punctate, with eyes not quite as broad as thorax. Occipital margin arcuate, scarcely elevated narrowly; discal area with a deep sulcate impression between posterior and anterior ocelli, and a lesser one extending outward on each side from anterior ocellus; anterior ocellus almost in center of vertex on median suture; posterior ocelli well forward, almost opposite anterior ocellus; anterior margin very deeply emarginate at median suture, strongly birostrate; antennæ inserted at apex of rostrate lobes; basal segments very large and long; flagellum very long, slender, filiform; third segment almost twice as long as fourth. Facial cones wanting; antennal bases scarcely swollen. Genæ not prominent. Labrum very small, posterior, inconspicuous; rostrum very long, slender, acute. Eyes large, prominent.

Thorax large, long, broad, punctate, indistinctly striped. Pronotum long, flat on dorsal surface; propleurites very long and large; pleural suture curved, visibly as long as episternum; forecoxæ large, mostly visible. Dorsulum very long and broad. Scutum long. Post-tibial spur quite long and large. Wings large, hyaline, shining, about two and three-fourths times as long as broad, broadest across middle, quite acute at apex; first marginal cell much smaller than second; fourth furcal almost as long as second cubital, curved strongly, terminating below apex of wing; radius long; pterostigmal space open, large, long; cubital petiole not quite as long as discoidal subcosta; basal subcosta shorter than cubital petiole.

Female—Abdomen large, stout. Genital segment very stout, relatively short, quite acute apically; dorsal plate large, abruptly acute at apex; ventral plate more slender, equal in length to dorsal plate at apex but basally much shorter; pubescence rather dense and long.

Described from three females collected in Granada, Nicaragua, by C. F. Baker.

Carsidara rostrata n. sp.

(Figure 157, C, E; 158, B; 160, C)

Length of body 2.1 mm.; length of forewing 3.3 mm.; greatest width 1.1 mm.; width of vertex between eyes .10 mm.; with eyes .76 mm. General color light green. Body moderately large.

Head not deflexed; profile subglobose; with eyes not quite as broad as thorax, punctate. Occipital margin arcuate, scarcely elevated narrowly; discal areas of

vertex deeply impressed with two oblique sulca on each side of median suture, one subtransverse and oblique and the other extending outward from anterior ocellus; anterior ocellus large, on median suture above the apex of excision; posterior ocelli well forward; anterior margin of vertex deeply excised at median suture, making vertex strongly birostrate, antennæ inserted at apex of rostrate lobes; basal segments large; flagellum very long, slender, filiform. Facial cones wanting. Genæ not prominent. Labrum very small, posterior, inconspicuous; rostrum very long, slender, acute. Eyes large.

Thorax broad, quite long, rather coarsely punctate, not strongly arched. Pronotum relatively long, flat on dorsal surface; propleurites long, prominent; pleural suture visibly as long as episternum; forecoxæ quite large, mostly visible. Dorsulum relatively short, broad, broadly rounded on both margins; scutum much longer than dorsulum. Post-tibial spur prominent, quite large. *Wings* relatively large, hyaline, almost three times as long as broad, quite acute at apex; first marginal cell very much smaller than second; fourth furcal almost as long as second cubital, strongly curved, and terminating below apex of wing; radius long; pterostigmal space closed, quite long and broad; cubital petiole about two-thirds as long as discoidal subcosta, as long as basal subcosta.

Female.—Abdomen stout. Genital segment almost as long as rest of abdomen, large, upcurved, quite acute; dorsal plate longer basally than ventral; ventral plate strongly upcurved on inferior margin near base; pubescence moderate.

Described from three females collected by C. F. Baker in Chinandega, Nicaragua.

Carsidara mexicana n. sp.

(Figure 157, B; 158, O; 159, B; 160, E)

Length of body 1.9 mm.; length of forewing 2.9 mm.; greatest width 0.9 mm.; width of vertex between eyes .39 mm.; with eyes .72 mm. General color greenish throughout.

Head not deflexed; profile longer than broad, rounded above; with eyes about as broad as thorax, finely punctate. Occipital margin arcuate, somewhat elevated narrowly, discal area of vertex deeply impressed with an oblique sulcus on each side of median suture extending well forward, and a very inconspicuous impression on each side of anterior ocellus; anterior ocellus on median suture slightly above apex of excision; vertex on anterior margin deeply excised at median suture, strongly birostrate; antennæ inserted on apex of rostrate lobes; basal segments large; flagellum very long and slender. Facial cones wanting; antennal bases scarcely swollen. Labrum small, posterior; rostrum very long, slender, acute. Genæ slightly swollen. Eyes large.

Thorax scarcely arched, not very broad, quite coarsely punctate. Pronotum relatively long, flat on dorsal surface, extending well down laterally; propleurites long; pleural suture oblique, not as long visibly as episternum; epimeron more or less concealed; forecoxæ large, almost entirely visible. Dorsulum relatively quite short, broad, not as long as scutum. Post-tibial spur conspicuous but smaller than in *C. gigantea*. *Wings* rather small, hyaline, almost three times as long as broad, broadest across second furcal; quite acute at apex; first marginal

cell much smaller than second; fourth furcal almost as long as second cubital, strongly curved and terminating below apex of wing; radius rather short; pterostigmal space closed, rather short and broad; cubital petiole shorter than discoidal subcosta, as long as basal subcosta.

Male—Abdomen moderately stout. Genital segment large; claspers long, strongly curved, obtuse at apex; auxiliary claspers shorter, very acute; anal valve quite large, vertically almost as long as genital plate, with a short, large, posterior lobe; pubescence moderate.

This species resembles quite closely *C. rostrata* Crawf. and may possibly be the male of that species, although this is quite improbable.

Described from one male collected by C. F. Baker at Acapulco, Mexico.

Epicarsa n. gen.

Head small; vertex flat, quite strongly birostrate; anterior ocellus at base of excision, easily visible from above; posterior ocelli anterior. Labrum small, posterior; rostrum comparatively short. Antennæ very stout and thick, relatively short; basal segments largest. Pronotum quite long, flat. Dorsulum long. *Wings* rather rounded at apex, otherwise similar to subfamily type.

Type of genus: *Epicarsa corniculata* Crawf.

Epicarsa corniculata n. sp.

(Figure 157, G, H; 159, D; 160, F)

Length of body 2.0 mm.; length of forewing 2.9 mm.; greatest width 1.3 mm.; width of vertex between eyes .43 mm.; with eyes .75 mm. General color dark brown or black; head and prothorax jet black; abdomen lighter; genitalia yellowish brown.

Head not deflexed, with eyes almost as broad as thorax, finely punctate; occipital margin straight, emarginate at median suture, not elevated narrowly; vertex discally quite plane, slightly elevated near eyes on postocellar regions, scarcely impressed; very deeply excised on anterior margin at median suture, strongly birostrate; with a conspicuous tuberculous epiphysis near eye over insertion of antennæ; postocular portion of occiput not large. Facial cones entirely wanting; antennal bases scarcely swollen; genæ not prominent. Labrum very small, posterior, inconspicuous; rostrum relatively rather short and quite stout. Eyes quite large; posterior ocelli reniform, anterior; anterior ocellus in front at apex of excision, visible from above. Antennæ not long, very stout and thick; two basal segments very large; third about as long as first two together; scarcely pubescent.

Prothorax quite strongly arched, broad, coarsely punctate. Pronotum long, flat on dorsal surface; pleurites very large and long; pleural suture oblique, almost as long as episternum; forecoxæ large, mostly visible. Dorsulum long. Post-tibial spur not very long, conspicuous. *Wings* large, hyaline, shining, less than two and one-half times as long as broad, quite broadly rounded at apex; first marginal cell very much smaller than second; second very large; radial cell short, broad, peculiarly rhomboidal; radius angulate midway, almost contiguous with furcation of second cubital; without pterostigma; cubital petiole shorter than discoidal subcosta; with a prominent black band along third furcal and distal half of radius; a black band along second furcal, and a third on radial subcosta.

Figure 158. Details of Psyllidæ

A, Carsidara gigantea; B, C rostrata; C, C concolor; D, Rhinopsylla jalapensis; E, Aph. calthæ; F, Aph. artemisiæ angustipennis; G, Aph pulchella; H, Aph calthæ; I, Aph. minutissima; L, Aph calthæ; M, Aph picta; N, Aph calthæ maculipennis; O, Carsidara mexicana (post tibial spur); P, Aph communis; R, Aph picta; S, Aph nebulosa americana; T, Aph. pulchella; U, Aph. minutissima.

Male—Abdomen quite stout. Genital segment relatively rather small; claspers short, slender, procurved; anal valve small, simple; auxiliary claspers small or wanting.

Described from one male collected by C. F. Baker at Para, Brazil.

Rhinopsylla jalapensis n. sp.

(Figure 157, I, K; 158, D; 159, C; 160, B)

Length of body 2.6 mm.; length of forewing 3.7 mm.; greatest width 1.4 mm.; width of vertex between eyes .40 mm.; with eyes .67 mm. General color greenish brown.

Head not deflexed, finely punctate, with eyes broader than thorax; profile subglobose. Occipital margin arcuate, scarcely elevated narrowly; discal area with a deep sulcate impression extending obliquely toward outer margin of antennæ; postocellar regions well forward, not elevated strongly; anterior margin deeply excised and emarginate at median suture; anterior ocellus at apex of excision, visible from above; antennæ inserted on apex of rostrate lobes; basal segments large; flagellum very long and slender. Facial cones wanting; antennal bases swollen. Genæ prominent. Labrum rather large, posterior; rostrum very long, slender, acute. Eyes large.

Thorax arched, rather narrow, coarsely punctate. Pronotum short, depressed somewhat below dorsulum; propleurites long; pleural suture oblique, not as long visibly as episternum; forecoxæ quite large, mostly visible. Dorsulum long, quite acutely angulated cephalad, almost as long as scutum. Post-tibial spur somewhat reduced, but distinctly present. *Wings* large, hyaline, acute at apex, about two and three-fourths times as long as broad, broadest across first marginal cell; first marginal cell smaller than second; fourth furcal terminating at apex of wing; radius moderately long; pterostigma wanting; cubital petiole wanting.

Male—Abdomen rather slender. Genital segment large; claspers large, stout, obtuse at apex; anal valve long, spatulate; pubescence moderate.

Female—Genital segment almost as long as rest of abdomen, quite acute and slender; dorsal plate very slightly longer than ventral; pubescence rather sparse.

Described from several males and females collected at Jalapa, Mexico, (D. L. Crawford).

Formerly Known Species of the Carsidarinae

Carsidara dugesii Low

1886—Neue Beitrage zur Kenntniss der Psylloden. F. Low, p. 160.

Carsidara marginalis Walker

1876—Journ. Proc. Linn. Soc. of London, Vol. X, page 329.
1882—Trans. Ent. Soc. London, XVIII, part III, page 467.

Tyora congrua Walker

Ins. Saund Homopt. (Walker) page 111.
1882—Trans. Ent. Soc. of London, Vol. XVIII, part III, page 471.

Macrohomotoma gladiatum Kuwayama

1907—Trans. Sapporo Nat. Hist. Soc. Vol. II, page 180.

Mesohomotoma camphorae Kuwayama

1907—Loc. cit. page 181.

Tenaphalara acutipennis Kuwayama

1907—Loc. cit. page 156.

Homotoma ficus Linne

1767—Syst. Nat. T. I, part 2, p. 739 (Chermes ficus).
1844—Iconogr. (Insectes) Guerin, p. 376. (Genus Homotoma).
1868—Verhandl. d. k. k. bot.-zool. Ges. Wein. p. 896. (G. v. Frauenfeld).
1878—Ibid. (Low) p. 587.
1882—Ibid. (Low) p. 238.

Homotoma radiatum Kuwayama

1907—Trans. Sapporo Nat. Hist. Soc. Vol. II, p. 181.

Freysuila dugesii Aleman

1887—La Naturaleza (2) I, no. 4, pp. 24-26, Tab. III.
1897—Proc. Ent. Soc. of Washington, Vol. IV, p. 196.

Freysuila dugesii ernstii Schwarz

1897—Loc. cit.

Freysuila dugesii cedrelae Schwarz

1897—Loc. cit.

Rhinopsylla schwarzii Riley

1883—Proc. Biol. Soc. of Washington, Vol. II, p. 78.

Rhinopsylla antennata Crawford
(and variety *proxima* Crawf.)

1910—Pomona Journ. Ent. Vol. III, No. 1, p. —.

Bactericera perrissii Puton

1880—Turkestanische Psylloden (F. Low) p. 261.

Triozoida n. gen.

Head strongly deflexed, with eyes almost or fully as broad as thorax. Vertex not punctate; post-ocellar regions elevated; occipital margin narrowly elevated; vertex rounded in front, with anterior ocellus visible only from front. Facial cones posterior, behind antennal insertions, with long pubescence. Labrum short, subglobose. Eyes large, prominent. Antennæ inserted in front.

Thorax arched. Pronotum not long, depressed below occiput and more or less below dorsulum, descending cephalad; propleurites together somewhat pyriform; dorsulum ascending, quite acutely rounded cephalad. *Wings* hyaline, *triozine* in form; cubital petiole present or wanting, greatly reduced; subcosta very heavy throughout.

Anal valve of male rather small, rounded, simple.

Type of genus: *Triozoida johnsonii* Crawf.

Triozoida johnsonii n. sp.

(Figure 157, L; 159, E; 160, G)

Length of body 2.2 mm.; length of forewing 3.0 mm.; greatest width 1.0 mm.; width of vertex between eyes .18 mm.; with eyes .78 mm. General color dark brown or black; vertex shining black; dorsulum light brown.

Head strongly deflexed, with eyes not quite as broad as thorax, not punctate. Occipital margin arcuate, narrowly elevated over middle; vertex between post-ocellar regions without foveal impressions, rounded toward the front as in *Calophya;* post-ocellar regions distinctly and sharply elevated; anterior ocellus under rounded vertex, somewhat visible from front, more easily from below. Facial cones short, obtuse at apex, vertical, posterior, behind antennal insertions, with very long pubescence distally. Labrum between and behind facial cones, appearing almost a third cone; rostrum moderately long. Eyes very large, prominent, hemispherical as in *Trioza,* projecting forward beyond margin of vertex. Antennæ inserted in front of facial cones, of medium length; flagellum slender.

Thorax arched, more coarsely punctate than head. Pronotum moderately short, descending cephalad below occiput, depressed below dorsulum; longer laterally; propleurites quite large, pyriform; pleural suture curved, extending to tip of episternum; epimeron largely visible; forecoxæ relatively small, mostly concealed. Dorsulum long, converging cephalad to a rounded point, spherically triangular. *Wings* hyaline, shining, long, slender, almost three times as long as broad, broadest across first marginal cell, sharply angulated at apex; first marginal cell smaller than second; fourth furcal terminating at apex of wing; radius short, quite straight; cubitial petiole distinctly present but extremely short; subcosta very thick and dark from base to radial margin; with three punctural spots on margin of marginal and cubital cells.

Male—Abdomen slender, rather long. Genital segment relatively not very large; rounded; claspers quite long, simple, subacute at apex, pubescent; anal valve short, broadly rounded, semi-ovate, simple, pubescent.

Described from one male collected at Belize, British Honduras, by J. D. Johnson. This species is very closely related to *Trioza californica* Crawf. in the structure of the forewing, vertex, head and notum. The subcosta in *T. californica* is large and heavy and the two cubitals, much lighter, are often slightly petiolate. The similarity is so marked as to make these two species congeneric without a doubt.

Triozoida californica Crawf.

(Syn. *Trioza californica* Crawf.)

1910– Pomona Journ. Ent. Vol. II, No. 2, p. 234.

Aphalara Forst.

Head scarcely deflexed. Vertex quite flat, not rounded, broader than long, with or without distinct foveal impressions or sulci; produced anteriorly into two roundly projecting lobes or epiphyses on each side of median suture. Anterior ocellus under vertex, usually some what stalked, and often slightly visible from above. Facial cones entirely wanting. Labrum prominent, elongate or subglobose. Antennæ rather short.

Thorax arched. Pronotum terminating laterally in a distinct knob like enlargement (lateral tubercle of pronotum); propleurites exceedingly short, nearly square, rather depressed. Dorsulum variable in length, usually shorter than scutum. *Wings* broadly rounded at apex, hyaline, maculate, fumate, or spotted; vein furcation distinctly dichotomous; pterostigma wanting.

Anal valve of male with a long acute posterior lobe usually reaching to tip of genital plate, and often with an inferior epiphysis; claspers broadly spatulate to subspatulate at tip.

Type of genus: *Aphalara calthae* Linne (1760).

It has been necessary to reassign the diagnostic lines of this genus because of the artificiality of the previously accepted lines. After long and careful study of large series of species and specimens, it seems beyond question that the character

Figure 159. Details of Psyllidæ

A, Carsidara concolor; B, C mexicana; C, Rhinopsylla jalapensis; D, Epicarsa corniculata; E, Triozoida johnsoni; F, G, Aphalara calthæ; H, Aph. communis; I, Aph. minutissima; L, Aph. calthæ maculipennis; M, Aph artemisiæ angustipennis; N, Aph. pulchella; O, Aph. picta; P, Aph. nebulosa; R, Aph nebulosa americana; S, Aph. calthæ.

of the propleurites is of prime importance in this genus, as in many others also. This has been entirely ignored or overlooked by other students of this family. As accompanying diagnostic characters the absence of facial cones, and the long posterior lobe of the anal valve of the male are very constant. A recast of European species in accordance with this diagnosis will be necessary but, because only a few of these species are represented in the collections at hand, this cannot be attempted here.

Synopsis of Species of Genus Aphalara

A. Labrum very elongate, truncate at apex, descending from face anteriorly. Notum with four more or less distinct light colored stripes. Female genital segment very short. Anal valve of male slightly longer than genital plate. Wings fumate apically.

Aphalara calthae L.

AA. Labrum not elongate nor truncate, subglobose and more or less appressed to face.

B. Wings more or less maculate or spotted.

C. Wings with small brown spots and dots.

D. Spots distinct and numerous, covering entire surface; wings whitish.

E. Body small, wings quite white; spots well separated.

Aphalara artemisiae Forst.

EE. Body larger; wings less white; spots very thickly crowded and often merged.

Aphalara artemisiae angustipennis Crawf.

DD. Spots indistinct, few, and only in apical half. Wings fulvous.

Aphalara communis metzaria Crawf.

CC. Wings with maculæ, not spotted or dotted.

D. Labrum quite long, extending forward as far as insertion of antennæ.

DD. Labrum short, not extending forward to insertion of antennæ.

Aphalara calthae maculipennis Low.

E. Profile of head distinctly shorter than broad dorso-ventrally. Wings conspicuously attenuate basally. Anal valve of male with long, tapering lobe posterior; claspers spatulate-clavate.

Aphalara pulchella Crawf.

EE. Profile of head fully as long as broad or longer. Wings not conspicuously attenuate at base. Anal valve of male conspicuously lanceolate; petiolate at base; claspers abruptly and greatly broadened at tip into transverse plate.

Aphalara nebulosa americana Crawf.

BB. Wings clear, not maculate or spotted.

C. Body very small; wings small, white, transversely wrinkled. Profile of head almost round.

Aphalara minutissima Crawf.

CC. Body large; wings large, not white nor transversely wrinkled.

D. Body of medium size, yellowish. Dorsum rather flat, not strongly arched. Wings rather slender, first marginal cell long.

Aphalara communis Crawf.

DD. Body very large, brown. Dorsum quite strongly arched. Wings very large, attenuate at base; first marginal cell relatively short. *Aphalara picta* Zett.

Aphalara calthae Linne (1760)

(Figure 157, M, N; 158, E, H, I.; 159, F, G, S; 160, I, M)

(Syn. *Aph. polygoni* Forst.)

(*Psylla quadrilineata* Fitch, and (?) *Aph. exilis* W. & M.)

Length of body 1.8 mm.; length of forewing 2.6 mm.; greatest width 1.0 mm.; width of vertex between eyes .47 mm.; with eyes .76 mm.; length .31 mm. General color brown, light to dark; vertex usually light; mesonotum with four stripes of light brown, lighter than ground color, two on each side of median line; stripes usually prominent, sometimes inconspicuous or indistinct; abdomen darker, somewhat variegated.

Head slightly deflexed, very coarsely punctate; profile relatively short, about nine-tenths as long as broad; with eyes not quite as broad as thorax. Occipital margin arcuate, centrally elevated slightly; discal area with a marked foveal impression on each side of median suture; emarginate anteriorly at median suture and over each antennal insertion. Facial cones entirely wanting. Genæ distinctly swollen. Anterior ocellus under projecting vertex, not visible from above, scarcely stalked. Labrum very prominent, elongate, truncate at apex, yellow.

Thorax broad, somewhat arched, coarsely punctate. Pronotum long, almost as long as dorsulum; with two foveal impressions on each side; propleurites very short, quadrate, depressed; forecoxæ mostly concealed. Dorsulum short; with four light colored stripes on dorsal surface. *Wings* rather small, fumose, darker in apical half than in basal; sides subparallel, about two and a half times as long as broad, broadest across first marginal cell, broadly rounded apically; pterostigma wanting; cubital petiole shorter than discoidal subcosta and shorter than first cubital; marginal cells subequal; clavel suture terminating very near to tip of first furcal; apex of wing between radius and fourth furcal.

Male—Abdomen strongly convergent caudad. Genital segment moderately large; genital plate about as large as two preceding ventral sclerites; claspers rather short, laterally arched, narrowly spatulate at apex; anal valve large basally, with a long, slender posterior lobe, extending beyond tip of genital plate; axial epiphysis not large.

Female—Genital segment short, scarcely longer than anal ventral sclerite; dorsal plate longer than ventral and more acute; ventral plate very obtuse at apex.

Redescribed from one female in the C. F. Baker collection determined by Dr. Franz Low, collected at Stockholm, Sweden, by Frauenfeldt, and from numerous males and females collected in various parts of the United States.

This species was first described by Linne in 1760 from specimens on *Caltha palustris*. Forster later described a species on *Polygonum* as *Aphalara polygoni*, which Low declared after careful comparison to be identical to *Aph. calthae*. The name *Aph. polygoni*, therefore, is synonymical. In 1851 Fitch described a new species in America, naming it *Psylla quadrilineata*. As far as his very brief description goes it compares very closely to the European *Aph. calthae*. According

to C. W. Mally, *Psylla quadrilineata* is identical with *Aph. polygoni*, and therefore is undoubtedly another synonym of *Aph. calthae*.

The species has apparently a world-wide distribution and consequently is subject to more or less minor variation. The color varies from light to dark brown, sometimes almost unicolored, and often somewhat variegated. The notal stripes, for which Fitch named his *quadrilineata*, are usually very prominent, sometimes scarcely differentiated from the ground color when this is quite light, and sometimes the stripes are almost wanting on the darkest notum; the wings are usually subhyaline, fumose, especially in the apical half, less so in basal half; often they are fulvous-fumate throughout, by transmitted light darker apically; the venation is always conspicuous, though some of the venational characters are variable.

The distribution in the United States as represented in the collections at hand is as follows: In the C. F. Baker collections from Colorado, Arizona, California, Oregon, Washington, Idaho, Louisiana, Illinois, Massachusetts; Colorado (E. S. Tucker), Texas (E. S. Tucker); Canada (C. F. Baker); Mexico (C. F. Baker); Havana, Cuba (C. F. Baker).

From a single female from Aaken, Germany, determined by Dr. F. Low as *Aphalara exilis* W. & M., it seems that it is very probable that this species is synonymical with *Aph. calthae* L.

Aphalara calthae maculipennis Low

(Syn. *Aphalara exilis rumicis* Mally)

(Figure 157, R; 158, N; 159, L; 160, T)

This variety was described by F. Low in 1886. As the name indicates, the chief difference lies in the maculation of the wing in the apical portion. This is probably only an intensification of the apical fumose condition in the species. About the only prominent structural difference is in the labrum, which in the variety is relatively short and lying close to the face, not elongate and truncate and extending downward as in the species. The abdomen is often relatively stouter in the female than it is in the species. The notal stripes are less conspicuous. The characters of the labrum and the abdomen were not given by Low, but are quite probably true of his types. Whether or not these characters are of specific value will have to be determined by further study; for the present this will remain as a variety of the species. The size of the insect varies quite widely, as it does also in the species.

Redescribed from specimens in the C. F. Baker collections from Colorado, Arizona, Oregon, Washington, Illinois, Texas (E. S. Tucker). From Mally's description of his variety of *Aph. exilis* W. & M., it seems beyond a reasonable doubt that it is synonymical with Low's variety of *calthae*.

Aphalara artemisiae Forster

(Figure 157, O)

(Syn. *Psylla malachitica* Dahlbaum)

Length of body 2.0 mm.; length of forewing 2.6 mm.; greatest width 1.0 mm.; width of vertex between eyes .18 mm.; with eyes .82 mm.; length down center .36 mm. General color greenish white to greenish yellow throughout. Body quite variable in size.

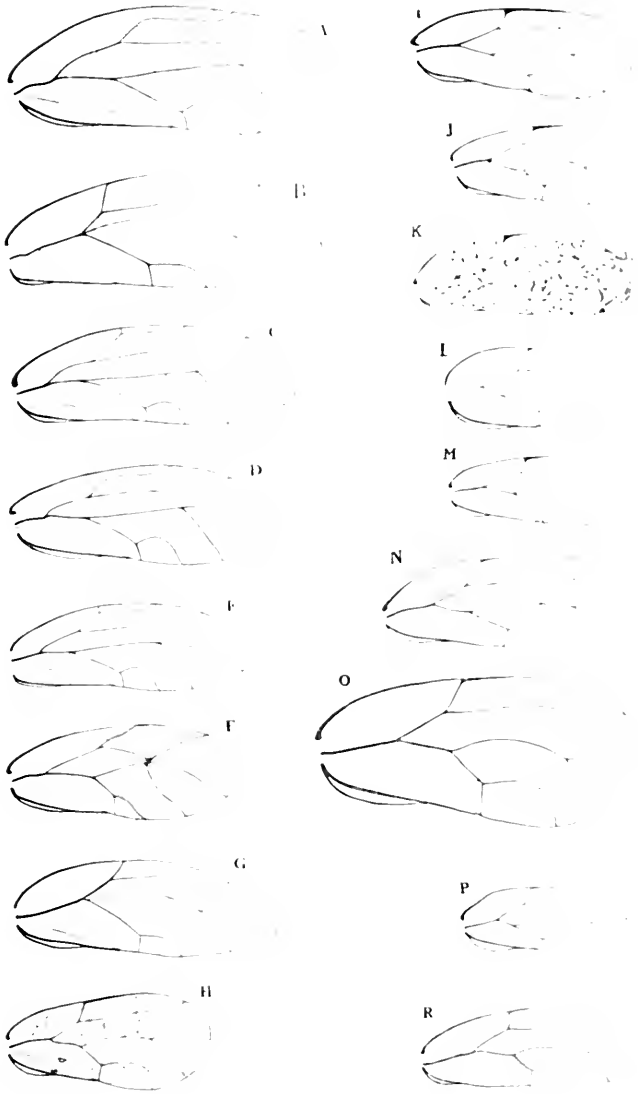

Figure 160. Details of Psyllidæ

A, Carsidara gigantea; B, Rhinopsylla jalapensis; C, Carsidara rostrata; D, C. rostrata; E, C. mexicana; F, Epicarsa cornuculata; G, Triozoida johnsoni; H, Aph. pulchella; I, Aph. calthæ; J, Aph. calthæ maculipennis; K, L, Aph. artemisiæ angustipennis; M, Aph. caltha; N, Aph. communis; O, Aph. picta; P, Aph. minutissima; R, Aph. nebulosa americana.

Head not deflexed, with eyes almost as broad as thorax; profile triangular. Occipital margin arcuate; vertex almost plane, punctate, with a slight impression posteriorly on each side of median suture; anterior margin emarginate broadly at median suture and less so over each antennal insertion. Facial cones entirely wanting. Anterior ocellus somewhat stalked, under projecting vertex, not visible from above. Genæ somewhat swollen. Labrum moderately large, posterior, subglobose from in front, ovoid from side, slightly pubescent. Antennæ short, scarcely longer than width of vertex with eyes; two basal segments large.

Thorax large, broad, coarsely punctate, not strongly arched. Pronotum long, from one to two-thirds times the length of dorsulum; flat on dorsal surface; extending down on both sides to central axis of eye; propleurites short, depressed; forecoxæ rather small. Dorsulum short, broad, almost as long as scutum. *Wings* rather small, covered with large, roundish brown dots over entire surface; sides subparallel; more than two and two-thirds times as long as broad, broadest across first marginal cell, broadly rounded apically; pterostigma wanting; marginal cells variable in size; second furcal varying from one-half to three-sevenths the length of radius; fourth furcal one-half to three-sevenths the length of second cubital, terminating at or near tip of wing.

Male—Genital segment moderately large, claspers long, laterally arched, not tapering to apex, slightly spatulate; anal valve almost as long vertically as claspers, with a very long, slender, posteriorly projecting lobe on each side, extending to tip of genital segment; pubescence sparse.

Female—Genital segment very long, fully as long as rest of abdomen; dorsal plate longer and less acute than ventral; genital pore less than one-fourth the length of dorsal plate.

Redescribed from one male from Pernitz, Austria, determined by Franz Low, and from several males and females from Colorado in the C. F. Baker collection. This species in the United States was named in manuscript *Aphalara utahensis* by Riley. Four English specimens in the collection determined by James Edwards as *Aph. artemisiae* Forst., belong to another species entirely.

The male specimen on which this description is largely based is at one extreme of a large series of variations within the species. The numerous specimens in the collection form a continuous series, from the small and whitish body and whitish wings to forms with much larger and greenish yellow body and yellowish white wings; the dotting and spotting of the forewing, also, is widely but gradually variable from sparsity to great density and running together of dots, often to form maculæ. This fact makes the smaller and more sparsely dotted wings appear to the naked eye as almost white, whereas those that are most densely dotted appear yellowish and occasionally light brown. By transmitted light, however, the undotted membrane is always white and corrugated. The structural characters are quite constant throughout the species, with the possible exception of the minor details of wing venation. Although there exists a continuous series as described above, still it seems advisable to separate those most darkly spotted into a more or less distinct variety. Riley, from the material at his disposal, recognized two distinct species, apparently not having a complete series. His manuscript name for the larger and darkly spotted forms was *Aph. angustipennis*.

Aphalara artemisiae angustipennis n. var.

(Figure 157, O; 158, P; 159, M; 160, K, L.)

Body larger than in the species, whitish yellow to yellowish; wings yellowish white, often brownish by dense spotting; wing membrane less corrugated. Structurally there is very slight differentiation.

Described from many males and females collected in Colorado by C. F. Baker; determined by E. A. Schwarz as identical to Riley's manuscript forms of *Aph. angustipennis*.

Aphalara communis n. sp.

(Figure 157, S; 158, P; 159, H; 160, N.)

Length of body 2.7 mm.; length of forewing 3.0 mm.; greatest width 1.1 mm.; length of vertex .36 mm.; width between eyes .52 mm.; with eyes .84 mm. General color greenish yellow; body moderately large.

Head not deflexed, with eyes not quite as broad as thorax, not coarsely punctate. Occipital margin arcuate; vertex discally rather plane, with a shallow, lunate impression posteriorly; discal areas large; anterior margin roundly emarginate at median suture and less so over antennal insertions. Facial cones wanting. Gene quite swollen. Eyes prominent, large; anterior ocellus not visible from above, under vertex, scarcely stalked. Labrum not large, subglobose, slightly pubescent. Antennæ inserted on frons under slightly projecting vertex.

Thorax level, scarcely arched, large, broad, not coarsely pubescent, slightly rugulose. Pronotum large, long, prominent, almost as long as dorsulum; pleurites small, short; pleural suture oblique; forecoxæ mostly concealed. Dorsulum broad. *Wings* large, rather long, hyaline and slightly flavous, about two and three-fourths times as long as broad, broadest across first marginal cell, broadly rounded apically; first marginal cell long, more than half as long as radial cell; cubital petiole usually about equal in length to discoidal subcosta, sometimes shorter.

Male—Genital segment very large, prominent; claspers long, conspicuously spatulate apically; anal valve large, with long posterior lobe; inferior cusp not large; penis long.

Female—Abdomen large, heavy. Genital segment very long; usually longer than rest of abdomen; dorsal plate longer and less acute than ventral; genital pore relatively rather short; pubescence short and sparse.

Described from numerous males and females collected by C. F. Baker at Pagosa Springs, Colorado. Distribution: In the C. F. Baker collections as follows: Colorado, Arizona, California, Nevada, Wisconsin, Louisiana, Alabama; Louisiana (F. C. Bishopp); Wyoming (C. W. Metz).

This species is very closely related to *Aph. nervosa* Forst., a European species. The principal difference is in the wing membrane; in the European species it is conspicuously transversely wrinkled, subhyaline and not flavous; in the American species it is distinctly flavous and scarcely transversely wrinkled.

Aphalara communis metzaria n. var.

This variety is separated chiefly upon the presence of brown dots or spots in the distal portion of the forewing, somewhat as in *Aph. angustipennis* Crawf., but

less conspicuous. In the variety as well as in the species there is a variation in the length of the female genital segment, sometimes being very long and occasionally rather short relatively, but always it is nearly or fully as long as rest of abdomen.

Described from one female collected at Banner, Wyoming, by C. W. Metz, and several from Pagosa Springs, Colorado (C. F. Baker).

Aphalara pulchella n. sp.

(Figure 158, G, T; 159, N; 160, H)

Length of body 2.0 mm.; length of forewing 2.6 mm.; greatest width 1.2 mm.; length of vertex .29 mm.; width between eyes .46 mm.; with eyes .72 mm. General color black to glossy jet, occasionally brown.

Head not deflexed, with eyes not as broad as thorax, very deeply and conspicuously sculptured rugosely; profile short. Occipital margin arcuate, slightly elevated in center; postocellar regions quite elevated; discal areas with a foveal impression posteriorly; anterior margin quite deeply emarginate or excised at median suture and less so over antennal insertions. Facial cones wanting. Genæ swollen. Labrum rather small, subglobose, slightly pubescent. Antennal bases not swollen. Eyes prominent. Anterior ocellus scarcely stalked, very slightly visible from above. Antennæ short.

Thorax broad, arched, very conspicuously and coarsely sculptured rugosely, more so than on head. Pronotum moderately long, attaining laterad to central axis of eye; pleurites short, depressed; pleural suture erect, arcuate; forecoxæ mostly concealed. Dorsulum about twice as long as pronotum, arcuately rounded on both margins, without posterior epiphyses. *Wings* relatively rather large, attenuate basally, maculate more or less over entire surface, especially in distal half; scarcely more than twice as long as broad, broadest across tip of second furcal, very broadly rounded at apex; apex at or near tip of fourth furcal; first marginal cell more than half as long as radial cell; second marginal cell large; cubital petiole scarcely as long as discoidal subcosta; pterostigma almost wanting.

Male—Abdomen slender. Genital plate long; profile slender; dorsal margin straight, claspers large, clavate-spatulate, attenuate at base; anal valve large; posterior lobe very long, tapering as long as genital plate; axial epiphysis quite large, obtusely rounded; pubescence sparse.

Female—Abdomen stout, short. Genital segment very long, much longer than rest of abdomen, slender, acute; dorsal plate longer and less acute than ventral genital pore relatively short, with a short fringe of hairs on inferior edge of dorsal plate over ovipositor; pubescence sparse.

Described from one male and several females collected in Claremont, California, and San Mateo county, California, by C. F. Baker.

Aphalara minutissima n. sp.

(Figure 158, I, U; 159, I; 150, P)

Length of body 1.1 mm.; length of forewing 2.1 mm.; greatest width .8 mm.; width of vertex between eyes .39 mm.; with eyes .70 mm. General color whitish, white to greenish-white.

Head not deflexed, with eyes fully as broad as thorax, rather small, punctate. Occipital margin arcuate somewhat, not elevated narrowly; vertex discally quite plane, with a slight impression in center, and raised somewhat on postocellar regions; anterior margin not very deeply emarginate at median suture, slightly emarginate over antennal insertions. Facial cones entirely wanting; antennal bases not swollen. Genæ not prominent; eyes small; ocelli small; anterior ocellus scarcely stalked, not visible from above. Antennæ short, slender. Labrum relatively rather large, subglobose, pubescent; rostrum short.

Thorax arched, quite broad, coarsely punctate. Pronotum long, about half as long as dorsulum, flat on dorsal surface; pleurites short, depressed; pleural suture erect, shorter than episternum, forecoxæ rather large. Dorsulum short, broad; scutum much longer than dorsulum. *Wings* small, not hyaline, subcoriaceous, corrugated, whitish; about two and a half times as long as broad, broadest across first marginal cell, quite broadly rounded at apex; first marginal cell long, more than half the length of radial margin; second marginal cell short, triangular; radius long, curved apically; pterostigma wanting, cubital petiole slightly shorter than discoidal subcosta.

Male—Abdomen short. Genital segment relatively large; claspers short, very broad and heavy, subspatulate at apex; anal valve very large; posterior lobe long and slender, longer than genital plate; inferior process small; axial epiphysis quite prominent.

Female—Abdomen stout. Genital segment long, stout, subacute at apex; dorsal plate slightly longer than ventral, serrated on inferior margin caudad.

Described from many males and females collected in Ormsby county, Nevada, by C. F. Baker. This species may be known in some collections by the manuscript name of *Aph. occidentalis*.

Aphalara picta Zetterstedt

(Figure 158, M, R; 159, O; 160, O)

(Syn. *Aph. flavipennis* Forst., *Aph. nervosa* Thoms. [nec Forst.])

(*Psylla alpigena* M. D., *Psylla sanchi* Forst.)

Length of body 3.3 mm.; length of forewing 4.2 mm. or less; greatest width 2.0 mm. or less; width of vertex between eyes .61 mm.; with eyes 1.16 mm. General color light yellowish brown to brown. Notum often more or less conspicuously striped longitudinally; abdomen darker; wings flavous. Body very large and stout.

Head scarcely deflexed, large, vertex continuing plane of dorsum; profile triangular; with eyes not as broad as thorax, punctate. Vertex flat, almost plane, with a small fovea in rear center on each side of median suture; occipital margin arcuate, not elevated; postocellar areas scarcely elevated; anterior margin emarginate at median suture, and very slightly so over insertion of antennæ. Facial cones entirely wanting; genæ not swollen. Labrum very small, posterior, subglobose; rostrum short. Eyes relatively very large, covering most of side of head; anterior ocellus under vertex, slightly stalked, not visible from above. Antennæ short, filiform, inserted beneath vertex, lateral.

Thorax large, broad, not strongly arched, coarsely punctate, often striped longitudinally. Pronotum long; lateral tubercle of pronotum large; pleurites small relatively, quadrate, compressed; forecoxæ moderately large, largely visible. Dorsulum longer than pronotum, transversely shorter. *Wings* very large, flavous, subhyaline, a little more than twice as long as broad, broadest across first marginal cell subapically, very broadly rounded at apex; apex at or above termination of fourth furcal; first marginal cell large; second cubital arcuate; radius rather short, curved slightly; cubital petiole usually nearly as long as discoidal subcosta; pterostigma wanting, or nearly so; venation conspicuous.

Male—Abdomen moderately large. Genital segment large, prominent, broadest at base; claspers long, spatulate, attenuate at base; anal valve large; posterior lobe long, slender, stiffly pubescent; inferior epiphysis acute, quite long; axial epiphysis long; penis large.

Female—Abdomen stout. Genital segment long, almost as long as rest of abdomen; dorsal plate longer and slightly less acute than ventral; pubescence stiff, prominent.

Redescribed from four females from Aaken, Germany, determined by Dr. Franz Low, and from several males and females in the C. F. Baker collection from Colorado. Some of the European specimens are apparently co-types of *Aph. flavipennis* Forster.

Aphalara nebulosa Zett

(Figure 159, P)

(Syn. *Aph. radiata* Scott, *Aph. gramina* Thoms. [nec Linne.])

Length of body 1.9 mm.; length of forewing 2.6 mm.; greatest width 1.1 mm.; width of vertex between eyes .38 mm.; with eyes .78 mm. General color brown, with light brown to yellowish markings and spots; abdomen darker; vertex lighter on border, dark discally; antennæ and legs light.

Head scarcely deflexed, not large, finely punctate; profile subtriangular, rounded in front. Vertex flat, not rounded, somewhat descending, with a shallow fovea on each side in rear center, and a shallow divergent impression extending forward therefrom; occipital margin arcuate, not elevated narrowly; vertex almost black on impressed area, with a yellowish margin all around, narrower in front; black area confluent at median suture; postocellar areas but slightly elevated; anterior margin emarginate at median suture, receding to anterior margin of eye. Facial cones entirely wanting; antennal bases slightly swollen. Labrum small, posterior, subglobose; rostrum short; genæ scarcely swollen. Eyes relatively rather large; anterior ocellus beneath vertex somewhat stalked, not visible from above. Antennæ quite long, slender, filiform; two basal segments darker colored.

Thorax not strongly arched, broader than head with eyes, punctate. Pronotum not very long, lighter in color than rest of notum; lateral tubercle about as large as episternum, pleurites small, quadrate, compressed; forecoxæ small, not extending to lower margin of mesopleurites. Dorsulum relatively rather long, darker than pronotum but lighter than scutum; transversely shorter than pronotum. *Wings* rather large, subhyaline, maculate apically and less so basally; with a distinct complete band extending from termination of radius across wing diagonally

to second furcal; other maculae at apex and near center of wing; a little more broadly rounded at apex; apex at or near termination of fourth furcal; first marginal cell very long; first cubital very short; second furcal not sharply angulate distally; second cubital not strongly arcuate; second marginal cell broad; radius long, straight, except distally; cubital petiole about as long as discoidal subcosta.

Male—Abdomen long, brown with light spots. Genital segment prominent, not very large; genital plate with a lateral, basal elevation on each side, much smaller caudad; claspers rather small, slender, with an abrutly and briefly spatulate transverse plate at apex, longer anteriorly than posteriorly; anal valve large; posterior lobe conspicuously lanceolate and petiolate; axial epiphysis short, obtuse; pubescence short, rather dense.

Redescribed from two males from England, determined by James Edwards. This species, although it is European, is included in this paper because of the fact that there is an American form extremely close to it. This has been described as a variety of the European species.

Aphalara nebulosa americana n. var.

(Figure 158, S; 159, R; 160, R)

The principal structural differentiation between species and variety lies in the labrum, male genitalia and forewing. The labrum in the variety is distinctly smaller and less conspicuous; the claspers of the male are distinctly larger; transverse plate almost as long as rest of clasper, while in the species it is but slightly more than half the length of clasper. Wing less darkly maculated; apical band not complete across wing. Coloration is quite constant in species and variety.

Described from one male in the C. F. Baker collection from Colorado. This variety may be known in cabinets by the manuscript name of *Aph. epilobii*.

Note: The name *Trioza assimilis* Crawf. is now changed to *Trioza flori*, since the former name is preoccupied by *T. assimilis Flor.*

In a paper just received from Dr. Kuwayama of Sapporo, Japan, a genus in Triozinæ has been named by him *Epitrioza*. Since the paper was published in 1909-1910 this name has the right of priority over the genus of the same name published in a previous number of this Journal (Vol. III, No. 1, 1911). The later name, therefore, may be changed now to *Kuwayama* Crawf. Also, a species of *Trioza*, occurring in Japan has been named by him *Trioza nigra*. This also antedates the species of the same name described by myself in the Journal of December, 1910. This species may be known hereafter by the name *Trioza nigrilla* Crawf., instead of *Trioza nigra* Crawf. The name *Neotrioza* Crawf. is, also, preoccupied by *Neotrioza machili* Kieffer (1905). My *Neotrioza* may be known as *Neotriozella* Crawf.

STUDIES IN ACARINA I

H. V. M. HALL, POMONA COLLEGE, CLAREMONT, CALIFORNIA.

In the working up of large collections of Acarina recently made by me in the Eastern United States and in the Southwest, there appear a number of forms apparently undescribed, and I shall present fascicles of these from time to time, with carefully prepared descriptions and illustrations.

Damaeus cephalotus n. sp.

(Figure 161)

Length .62-.64 mm.; color chestnut, polished.

Abdomen hemispherical, without wings. Mandible chelate; cephalothorax quite large, anchylosed to abdomen, but with deep suture between. Without lamella or tectopedium. Rostral hairs stout and pectinate. Pseudostigmatic organ with long pedunele and gradually clavate head, not pointed at distal end. Interlamellar hair, fine and pectinate. Abdomen with scattering, stout, pectinate hairs near the edge. Legs thin, a little longer than abdomen, sparsely set with fine hairs.

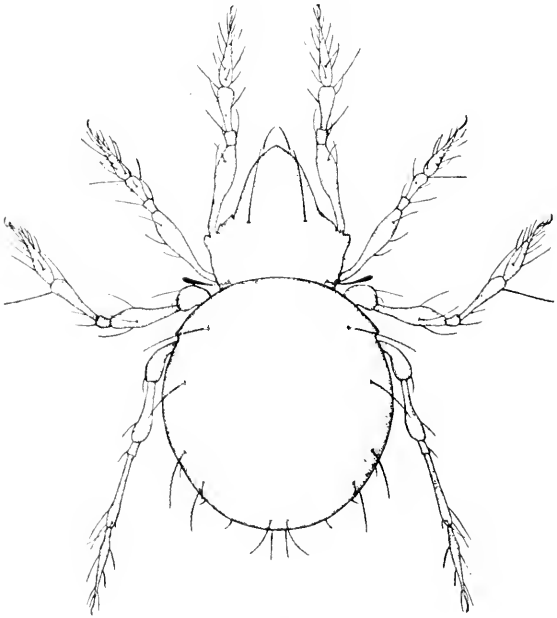

Figure 161. Damaeus cephalotus

A long hair on apex of penultimate joint. A few hairs on tarsi II, III and IV are fine and pectinate. Unguis monodactyle. Femora gradually clavate, projection between legs I and II blunt anteriorly. Leg I on a chitinous projection of cephalothorax, coxæ and trochanters I and II drawn into cephalothorax and apparently missing. This species is easily distinguished from *D. tenuipes* Michael, *D. geniculatus* Koch, and *D. concolor* Koch, by difference in length; also by general shape of pseudostigmatic organ and by absence of furrows or other markings on cephalothorax. Under rotting boards, New Haven, Conn.,

Notaspis bilamellatus n. sp.

(Figure 162)

Length .79-.96 mm. Light chestnut, smooth, but not polished. Abdomen broader than long, globular, without wings. Cephalothorax large, anchylosed to abdomen. Mandible large chelate. Lamellæ blades on edge, running from pseudostigmata and meeting forward; cusps of lamella thickened, free, and projecting forward horizontally. Lamellar hairs long, stout and smooth. Rostral hairs half as long,

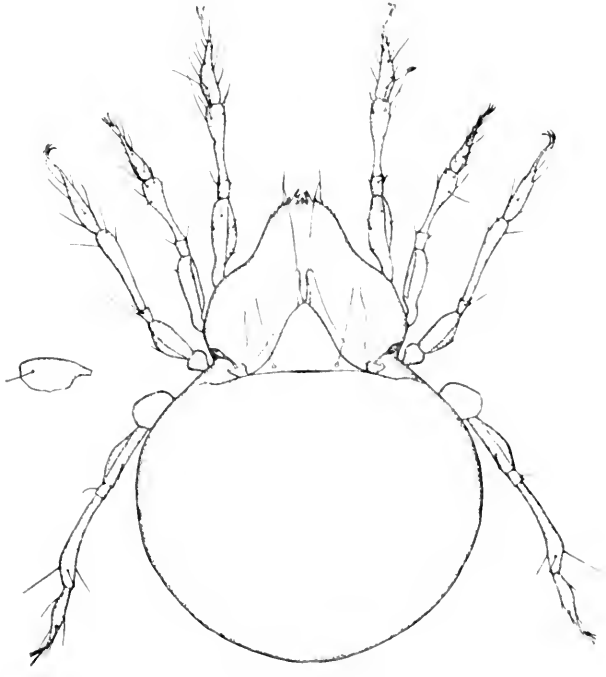

Figure 162. Notaspis bilamellatus

stout and smooth. No translamella; pseudostigmatic organ with medium length stem and fusiform head. Interlamellar hairs long, stout, smooth. Femora with blades. Abdomen hairless. Legs about the length of abdomen, moderately set with long fine hairs. Unguis tridactyle. Last three pairs of legs inserted at edge of body. Anterior corners of abdomen not projecting. Several specimens under large stone, Claremont, Cal. In classifying this species in the genus *Notaspis* I have followed Michael. Michael and Banks disagree about this genus, Michael describing *Notaspis* as having the body smooth, while Banks affirms that the body is more or less rough. As this feature is used in both keys it is apt to cause confusion if the disagreement is not noticed. This species is most like *N. burrowsi* Michael, but differs in having no hairs on the abdomen, no translamella, and simple hairs on the legs.

Oribata setiformis n. sp.

(Figure 163)

Length .90-.96 mm. Color dark chestnut, polished. Abdomen globose with large wing-like expansions. Mandible thick and stout. No lamella. Dorsal covering extends forward to rostrum without break. Rostral hairs are pectinate. No translamella. Interlamellar hairs stout and pectinate. Pseudostigmatic organ seti-

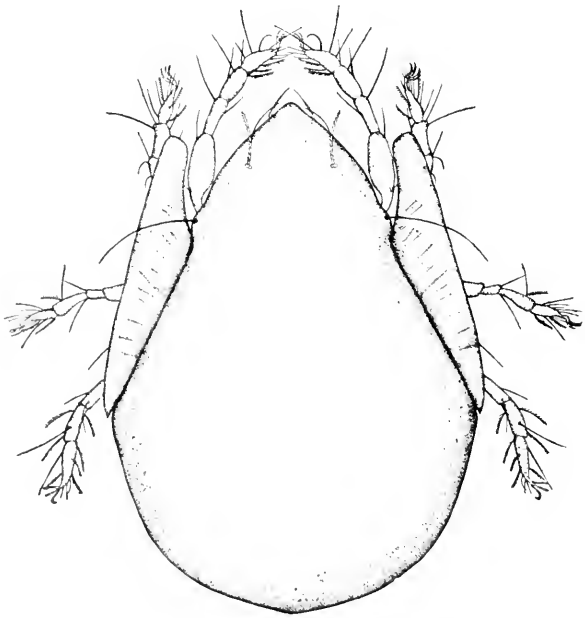

Figure 163. Oribata setiformis

form, smooth and one-fourth the length of body. Femora without blades. Abdomen smooth, hairless, and as broad, just behind the wings, as three quarters the length of the body. The wings project forward almost as far as rostrum, and are rounded anteriorly. Wings are sculptured transversely. The legs bear rather long bristles, several on each tarsus being feathered. Unguis tridactyle. Legs not quite half the length of body. Under rotting boards, New Haven, Conn. This species is distinguished from *O. alata* Hermann, *O. dorsalis* Koch and *O. rugifrons* Stoll, by its large size and by its setaform pseudostigmatic organ.

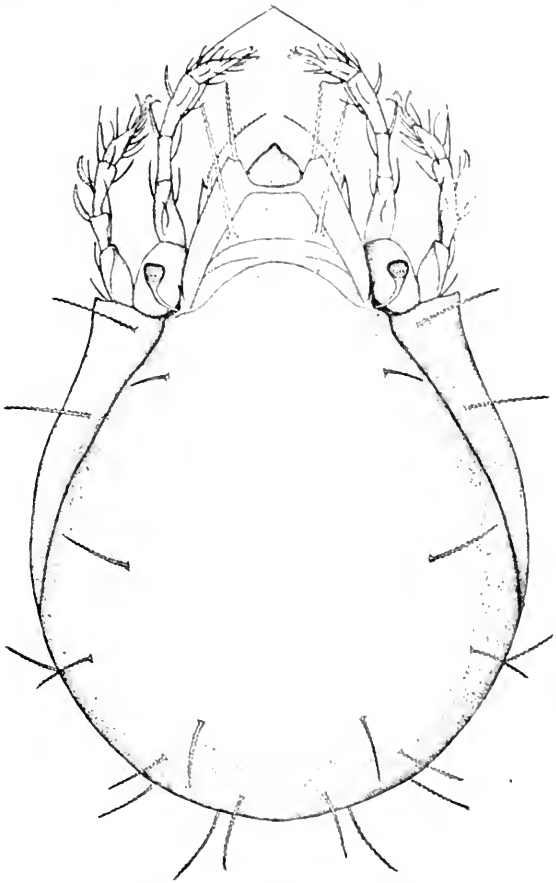

Figure 164. Oribata latincisa var gigantea

Oribata latincisa Ewing var. gigantea n. var.

(Figure 164)

Length .80-.98 mm. Color dark chestnut, polished. Abdomen globose with narrow, chitinous, wing-like expansions. Mandible, thick and stout. Lamella blade-like, horizontal. Cusps of lamella short, truncated, lamellar hair rising from shorter corner. Lamellar hairs stout, pectinate. Tectopedium I projects even with translamella; tectopedium I bears stout, curved, pectinate hair projecting in front of rostrum. Rostral hairs not apparent. Pseudostigmatic organ capitate. Interlamellar hairs erect, stout, pectinate. Anterior end of abdomen rounded. Femora with blades. Abdomen and wings set with scattering, stout, pectinate hairs, not as stout as lamellar or interlamellar hairs. *Wings* of abdomen truncated anteriorly. Legs about one-third the length of body, sparsely covered with fine, pectinate hairs. A long, fine, bristle at apex of penultimate joint of legs I and II. Unguis tridactyle. A swollen, pectinate, specialized hair on the outer apex of antepenultimate joint, and another midway on outside of penultimate joint of legs I and II.

Under rotting boards, New Haven, Conn. Somewhat like *Oribatella bidentata* Banks, but much larger and without the characteristic color markings of that species.

Hoploderma capitata n. sp.

(Figure 165, above)

Length .8-.83 mm. Color yellow with black internal organs. Abdomen elliptical, about as broad as high, without wings. Cephalothorax hinged so as to fold down on ventral surface. Aspis without carina; genital and anal covers separate. Anal covers with short spines. No elliptical depressions on aspis. Pseudostigmatic organ capitate. Four long bristles on each side of aspis, and two similar bristles on anterior end of dorsal abdomen. Legs half the length of body, sparsely set with fine hairs of which some on legs III and IV are pectinate. A long, thin bristle on apex of penultimate joint of leg I. Unguis monodactyle. Under drift-wood, Pawson Park, Conn.

This species differs from *H. globosum* Koch, by having the pseudostigmatic organ capitate and with quite a stalk instead of sessile and fusiform, and by having only four hairs on the dorsum of abdomen and those placed well forward.

Genus Pelopsis n. gen.

Mandible broad at base, suddenly becoming styliform, terminated by minute chelæ. No spatulate hairs on any part. Rectangular projection from anterior margin of abdomen. Unguis tridactyle. Pteromorphæ attached to cephalothorax.

Near to *Pelops*, but wholly without spatulate hairs.

Pelopsis nudiuscula n. sp.

(Figure 165, below)

Length .51 mm. Color dark chestnut, polished. Abdomen with large, chitinous, wing-like expansions. Mandible broad at base, suddenly becoming and continuing slender and rod-like, chelæ small. Interlamellar hairs wanting. Lamella blade-like, horizontal, cusps of lamella deeply emarginate, the two tips being subequal

in length. Lamellar hairs wanting. Tectopedium I ending in a long hair. Rostrum rounded; rostal hairs stout, curved, pectinate. No translamella. Pseudostigmatic organ clavate, smooth. Abdomen without hairs, pyriform. Legs less than half the length of body, sparsely set with fine hairs, a few being pectinate, and one long bristle on apex of penultimate joint of leg I. Unguis heterodactyle, median claw much the heaviest. Lateral claws small and almost transparent. Rectangular projection from anterior margin of abdomen with a median chitinous point reaching almost to rostrum. Dorsum of abdomen hairless, not pitted. Under driftwood on salt marsh, Pawson Park, Conn.

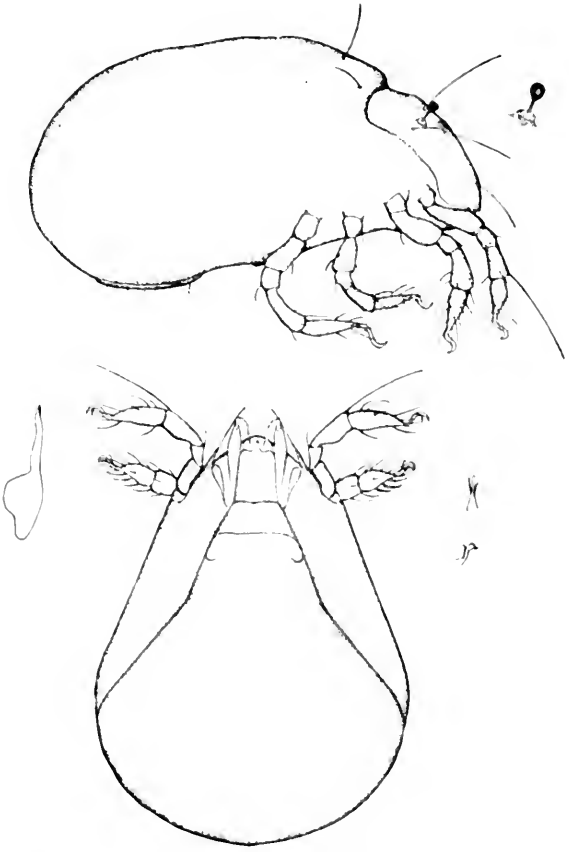

Figure 165. Hoploderma capitata, above; Pelopsis nudiuscula, below

Paraphytoptus californicus Hall

1910—Pomona Journ. Ent. II, p. 280.

This was inadvertently described as an *Eriophyes*, to which genus, strictly speaking, it does, of course, not belong. An opinion of Nalepa, kindly communicated by Mr. P. J. Parrot, states that this is probably the same as the European *P. peravorus*. His reasons for such a reference are not given. The galls of *P. californicus* as known here, are very characteristically distinct from any other known American phytoptid.

NOTES ON RHOPALOCERA

KARL R. COOLIDGE

Terias linda Edwards

This species, as Godman and Salvin long ago pointed out, is synonymous with *T. tenella*, Boisduval, an excessively common insect in Mexico, Central and South America. While *linda* is placed in our lists and given the habitat Arizona, I am not aware that any definite captures have been recorded from within the limits of our fauna. Edwards, in his original description, Papilio, Vol. IV, p. 53, 1884, writes, "From 1 m., 1 fm., taken in Mexico, a short distance from the boundary line of Arizona, by Mr. Morrison." *T. tenella* is exceedingly prone to variation, as can be attested by its synonymy, which includes *T. circumcincta* Bates, *T. nisella* Felder, *T. nelphe* Felder, *T. stygmula* Boisduval, *T. venustula* Standinger and *Thecla xami* Reakirt. It seems to be an overlooked fact that *T. blenina* Hewitson, is a synonym of this species, as was shown in the Biol. Cent. Americana, Rhop. Vol. II, p. 48, 1887. *Sira* Edwards, is known to be a synonym of *blenina*, and I would also place here *castalis* Edwards. Strecker, Cat., p. 89, 1878, puts *castalis* under *damon*, Cramer, but erroneously so. The chief difference between *blenina* and *castalis* seemed to be in the presence of a white spot at the base of the secondaries beneath in the latter, but as this character is variable, I can see no need in further separating them. The case is somewhat similar to that of *T. dumetorum* Boisd., and equal *T. affinis* Edwards. *T. xami* seems to be a rather rare insect in Mexico.

Melitaea colon Edwards

There appears to be no apparent reason why this species should not be united with *M. chalcedon* Boisduval. I have gone over the original description carefully and find that in a series of *chalcedons* quite a few answer the description perfectly. Holland, Butt. Bk., p. 140, 1898, writes, "Of the same size and general appearance as *M. chalcedon*, with which I believe it to be identical, the only possible satisfactory mark of distinction which I am able to discover on comparing the types with a long series of *chalcedon* being the reduced size of the marginal row of yellow spots on the upper side of the primaries, which in one of the types figured on the plate are almost obsolete. They appear, however, in other specimens labeled type." Wright says, Butt. West Coast, p. 147, 1905, that "*Colon* is a hill species of Northern California," and that "The types are said to have been taken on Mt. Hood, but I believe that the collector made a little mistake about that locality." Edwards, in his description, Papilio, Vol. I, p. 45, 1881, remarks, "From 3 ms., 2 fms., taken at Mt. Hood, Oregon," but this is corrected later by Morrison, Papilio, Vol. III, p. 48, 1883, to "Sides of hills which line the banks of the Columbia river in West Washington territory and Oregon, being especially common near Kalama."

Doxocopa cocles Lintner

Described in Papilio, Vol. IV, p. 141, 1884, from two specimens taken in Texas, presumably in the neighborhood of the Rio Grande. Has been standing in our lists as a valid species, although Messrs. E. M. and S. F. Aaron correctly noticed

shortly after the appearance of its description that it was identical with *leilia* Edwards, f. *Leilia* itself I believe will eventually prove to be a synonym of *celtis* Boisduval and Leconte, the differences characterized by Edwards disappearing in long series. *Antonio* Edwards, is the same as *leilia*, and *montis* Edwards, is but a geographical form not worthy of rank.

Lycaena hilda Grinnell and Grinnell

This species, described in the Journ. N. Y. Ent. Soc., XV, p. 47, 1907, from the San Bernardino mountains of California is synonymous with *L. daedalus* Behr, which has long priority. The authors of *hilda* remark that "This species is readily distinguishable from *Cupido daedalus* Behr, and other described forms by the bright red bands on the upper sides (in the female), which make a decided contrast with the ground color." Also, "This is the same thing that is figured in Wright's Butterflies of the West Coast as *daedalus*, but *hilda* is easily separable from *daedalus* by the characters just indicated." Wright's figure of the upper surface of plate XXIX, fig. 361, b is unusual, and in fact it may not represent *daedalus* at all. The figure of the above, 361, and the lower surface of the c, are quite typical, however, and agree exactly with the description of *hilda*. Dr. Holland gives a good representation of the female in his Butterfly Book, pl., 31, fig. 12. Behr himself applied the name *aechaja* to the reddish female before he was cognizant that it was the other sex of his *daedalus* m. These reddish bands vary considerably, in some cases being extensive, and again they may be more or less obsolete. *Lycaena daedalus* I would place subspecifically with *icariodes* Boisduval (*mintha* Edwards), with which it has been placed erroneously in our lists as a synonym. They are quite indistinguishable on the upper surface, but below may be differentiated as follows: 1. Spots edged with whitish; first submarginal series subobsolete; no terminal line on secondaries. *L. icariodes icariodes* Boisduval. 2. Spots wholly black, except the red sagittate series on the secondaries; two distinct submarginal series; a fine black terminal line on secondaries. *L. icariodes daedalus* Behr.

Moreover, there is an obviously different coloration of the wings beneath. This group is in need of thorough revising. Specimens of *L. icariodes daedalus* are in the collection of the Agricultural college at Fort Collins, Colorado, credited to Colorado by David Bruce, but I very much doubt its occurence in that state.

Eumaeus atala Poey

Mr. John L. Healy, in an article on the habits of this species, Ent. News, p. 179, 1910, remarks that it is curious that nothing should be known of the life-history of this butterfly, so common in certain portions of Florida. Schwarz has, however, Insect Life, Vol. I, p. 39, given a general outline of the life-history, and S. H. Scudder, Mem. Bost. Soc. Nat. Hist., Vol. III, p. 413, describes quite fully the larva and pupa. Dr. Holland in his Butterfly Book says of the early stages that "these await description," but this statement is corrected in a supplementary note to the second edition, and the above references noted. Schwarz states that *E. atala* swarms in the pine woods between the Everglades and the shores of Biscayn bay, this being the region where Mr. Healy found it. The food-

plant is *Zamia integrifolia* Willdenow, a plant known by the natives as the "*coontie.*" It unfortunately seems to be the general consensus of opinion among lepidopterists that once the life-history of a butterfly has been published there remains nothing to be known of that species. Mere stereotyped egg, larval, pupal descriptions do not, however, constitute the full biology. The late lamented W. H. Edwards created a wonderful change in our knowledge of *Rhopalocera*, but to the present and future generations there still remains an ever increasing field of observation.

Thecla simaethis Drury

This species has apparently been recorded in our fauna from Texas only, but I have recently seen a specimen in the collection of Mr. F. Grinnell, Jr., from the Chiracahua mountains of Cochise county, Arizona, collected there by Mr. Virgil Owen. It was taken April 14, 1906.

Papilio mylotes

This is given in our catalogues as inhabitating Southern California, on the authority of Reakirt. Strecker, Cat., p. 68, 1878, in a note under *mylotes* says: "Two males, formerly in coll. Tyron Reakirt, were taken in Southern California and received from Dr. Heerman in 1862." I can see no reason for still retaining this species in our faunal lists, for had it really occurred here it certainly would have been again met with long before this. Moreover, Reakirt, as is well known, was notoriously careless in his handling of data. In the Proc. Ent. Soc. Phi., Vol. V, 1865, he records, p. 249, *Ceratinia lycaste* from Los Angeles, California, and describes *var. negreta* from the same locality. Further, p. 223, he publishes *Mechantis californica* from Los Angeles. *Negreta* is but an individual variant, and *M. californica* is a local form of the protean *M. polymnia* Linnæus. None of these have been taken within the limits of the United States, and until definite captures are reported they should not be given a place in our lists.

P. mylotes has a considerable synonymy, embracing *P. Caleli* Reakirt, *P. tonila* Reakirt, *P. alcamedes* Felder, *P. aristomenes* Felder, and *P. eurimedes* Boisduval.

It occurs in Mexico, Guatemala, Honduras, Nicaragua and Costa Rica, and is a close ally of *P. iphidamas*, and very probably but a local form of *P. eurimedes* from Guiana.

Euchloe sara Boisd.

The *Pierid* genus *Euchloe*, so far as my experience goes, is remarkably free from aberrations, although it is notorious for the variation and dimorphism displayed. I have taken hundreds of *E. ausonides* and *E. sara*, and a few *E. lanceolata australis*, but only once have I met with a true monstrosity. This sport of *E. sara*, form *reakirtii*, I netted in Millard canyon, on the west slope of the San Gabriel mountains, on March 28 last. It is strikingly weird and, I believe, worthy of notice. The primaries differ at once from normal examples in being more elongate, the outer margin somewhat incurved, and the apex sharply cut. In the cell is a large quadrate black bar, and from it runs the usual orange patch, but the coloration is decidedly different from that of the normal example. Along the outer margin, nearly to the inner margin, is a wide, jet black margin, rounding

the apex, and separated from the orange directly at the apex by a wide, white band, which is itself slightly lined with black interiorly. The secondaries are also produced, of the usual soiled appearance, but more so than normally, and the margins are more or less bordered with a greenish line which, for a short distance at the anal angle, is heavy. Beneath, the primaries have the orange patch repeated, but the cell spot is diminished, and the black margins of above are replaced by greenish blotching. The secondaries have the marginal lining heavier, and the marbling is much stronger than in the average specimen.

Had this individual come from a new locality, and not in company with other *Euchloeids,* one would almost certainly describe it as new.

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VOLUME THREE NUMBER THREE

Pomona College Journal of Entomology

SEPTEMBER 1911

Contents

1. MESSENGER, C. B. — A Commissioner Makes Good
2. ESSIG, E. O. — The Natural Enemies of the Citrus Mealy Bug IV
3. ESSIG, E. O. — Aphididae of Southern California VII
4. SMITH, J. B. — Noctuidae of California III Pantheinae, Raphia, and Acronyctal
5. DISTANT, W. L. — A New Species of Cicadidae
6. STOUT, V. R. — A New Subterranean Freshwater Amphipod
7. STAFFORD, B. E. — A New Subterranean Freshwater Isopod
8. COOK, A. J. — Three Alarming Insect Pests
9. GRINNELL, JR., FORDYCE — West Coast News Notes

PUBLISHED QUARTERLY BY THE

Department of Biology of Pomona College

A. J COOK, D Sc., Head Professor

CLAREMONT, CALIFORNIA, U. S. A.

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During 1909 the existence of the Journal was credited to the support of the Ontario-Cucamonga Citrus Association. It is to be noted, however, with due appreciation, that one member of that Exchange, Mr. A. P. Harwood, was the donor of one-half of the amount from that source. During 1911, the Journal is pleased to acknowledge a wider support, including the Ontario-Cucamonga Exchange, with Mr. A. P. Harwood, The Call Fruit Company, The A. C. G. Fruit Exchange, The Covina Fruit Exchange, The Semi-tropic Fruit Exchange, The Arlington Heights Fruit Exchange, The Santa Paula Fruit Exchange, The Tulare Fruit Exchange and the San Antonio Fruit Exchange.

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Volume III SEPTEMBER 1911 Number 3

A COMMISSIONER MAKES GOOD

[The following editorial article in the "California Cultivator" of May 4, 1911, by Mr. C. B. Messenger, the Managing Editor, was written after a visit to Ventura County, during which he made a thorough inspection of the work of the Ventura County Horticultural Commissioner.

Again and again, through the South, we have advocated with all our strength, the taking of the County Horticultural Commissionerships wholly out of politics, and the employment of trained men only, for this most important work. It has seemed strange to us sometimes to have to champion so self evident a proposition. It has only needed, after all these years, to have just one trained man employed in one of our counties, to make us wake up, rub our eyes, and come to a rather painful realization of all that we have been missing through these hard fought years, when the services of the best experts obtainable were urgently required. Countless thousands of dollars would have been saved to our people if this important work had been administered throughout by experts.

Even with such a demonstration as the present one in progress, politics still governs this most important appointment in most of our counties, and the people still suffer sorely where they might, by choice, be benefited very materially. *"An expert horticultural commissioner is the most effective known form of horticultural insurance."* Ed.]

No state in the Union has given the attention to horticultural quarantine and protection of its fruit and other products from the depredations of insects and fungi that California has. With the State Horticultural Commission and its deputies and employees in many sections of the state, and with most of the counties of the state conforming to the state law and maintaining county commissions, all sections are fairly well guarded. We say they are well guarded, and this is true theoretically, though it must be admitted that in some counties results have not justified the expense. In contrast, others show results most remarkable. We believe this latter class, however, may be counted easily upon one's fingers. We would not discourage the work being done under the county commission law because of some of these failures or partial failures. The effort is in the right direction, and where politics has been obliterated, promise is given for proper results from the funds expended. In some counties results have not been what they should, because of lack of harmony between various producers rather than lack of ability on the part of the commissioner and his helpers.

It was our pleasure recently to inspect one county where harmony and ability unite in accomplishment of remarkable results. It is not a big county, though it is big in some of its products. For instance, in lemons it produces over 200,000 boxes valued at well up towards a million dollars, oranges a couple of millions, dried apricots over five million pounds valued at nearly a half million dollars. Walnuts again is where it shines in the production of practically 4,000,000 pounds

valued at nearly a half million dollars, and when it comes to Lima beans it is the greatest county in the state and the greatest producer of any small section in the world.

As agriculture, or more particularly horticulture, predominates, its board of supervisors, not one member of which is a farmer, yet with keen business judgment, picked a young man fresh from college who has an ambition to make his county the cleanest in the state. We refer to Ventura County, whose commissioner is Mr. E. O. Essig. The board of supervisors has granted to the commissioner practically every request for supplies and appliances. His central office is located in Santa Paula, not the county seat, but in the center of the producing section of the county,

EDWARD OLIVER ESSIG
Horticultural Commissioner of Ventura County, California

and this office is thoroughly fitted with cases containing specimens of insects and fungi, a fairly complete library, almost perfect filing appliances, and incubators for developing fungous growths, nearly everything needed in a laboratory for original investigation.

In return for this confidence manifested by the board of supervisors, Mr. Essig has given his days to work in study and inspection in the field and his nights to work in the laboratory, and the result is that for original research and actual accomplishment we do not believe there is a commissioner in the state superior. Especially along the lines of wither-tip and mealy bug investigations has Mr. Essig been persistent. We do not recall any man or body of men that has gone

after the matter as he has. This work has been treated of more at length in former Cultivators; the carbolic spray which is proving so successful is the result of Mr. Essig's investigations.

The orchards of the Little Santa Clara Valley are practically all thrifty and well cared for. This little valley, but a few miles wide, extending from the northern end of the Southern Pacific tunnel in Los Angeles County through Ventura County, bending toward the ocean near the little city of Ventura, is one of the prettiest in the state of California. The orchards are watered either from the Santa Clara or its tributaries coming down from the mountains along the eastern side of the valley. The section about Santa Paula is largely devoted to lemon and apricot culture, though the English walnut groves cover many acres. Plantings of the last few years are more given to citrus than to deciduous fruits, and while some apricots are still being planted, we believe there are a far greater number of walnut trees being uprooted to make way for lemons than are being set out. The thrift of citrus trees was manifest on all sides, though in occasional instances the twig ends give evidence of the wither-tip fungus. The wither-tip has lost its terror now, for it has been proven both by work conducted under the direction of Mr. Essig and others that the application of Bordeaux is abundantly able to care for it; it is simply a question of carefulness on the part of the operator.

In the matter of red spider control we saw work being done in the large orchards of the Teague-McKevett Company, and it was easy even for the layman to see the vast difference between trees recently sprayed and those not sprayed. Scarcely a leaf could be picked from the latter that was not covered with myriads of eggs and young of the red spider, while on the sprayed trees many leaves could be examined without detection of a single insect. The best part of this treatment is that it is economical. The ordinary commercial sulphur-lime mixture, $2\frac{1}{2}$ gallons to 100 gallons of water, is used. Mr Essig assured us that this was an absolute remedy for the red spider. Formulas for the Bordeaux mixture and the carbolic have been given in former Cultivators. The carbolic acid mixture has been successful not only on mealy bug but many other pests, and it, too, is a remarkably cheap mixture.

Part of the day was spent on the great Limoneira ranch, with its 3,000 rich acres, of which 520 acres are in lemons, 450 acres in walnuts, and the balance in beans, hay and grazing land. It is a beautiful ranch, a profitable ranch, because given the very best of care. A visit to such a place is an education which other fruit growers should avail themselves of.

THE NATURAL ENEMIES OF THE CITRUS MEALY BUG IV

E. O. ESSIG
HORTICULTURAL COMMISSIONER OF VENTURA COUNTY

Among the less important coccinellids predaceous on the citrus mealy bug should be included *Rhizobius lopanthae* Blaisd., *Hyperaspis lateralis* Mul., and *Scymnus sordidus* Horn. Of these forms I have not been able to procure enough of the larval stages in the orchards here to make a careful study or drawings, so am simply giving a short description of the adult forms, with illustrations, so that the growers may know them whenever found. It will be remembered that these lady-bird beetles are more efficient feeders on insect pests, other than the mealy bug, but that they do much towards lessening the numbers of the latter.

Rhizobius lopanthae Blaisdell

Rhizobius toowoombae Blackb.

Scymnus marginicollis Mann.

The adult form of this insect (Figure 166 B) is from 1.66 mm. to 2.0 mm. in length, and width from 1.1 mm. to 1.4 mm. Elytra uniform in coloration and black throughout. Pronotum pale, with a median parabolic black spot at the base, which is normal in the males throughout but much extended in the female, where it involves all of the disk except the apical angles and a fine apical margin. Surface polished, the pronotum evidently punctate, the punctures of the elytra more or less coarse and distinct. The entire surface is densely covered with fine

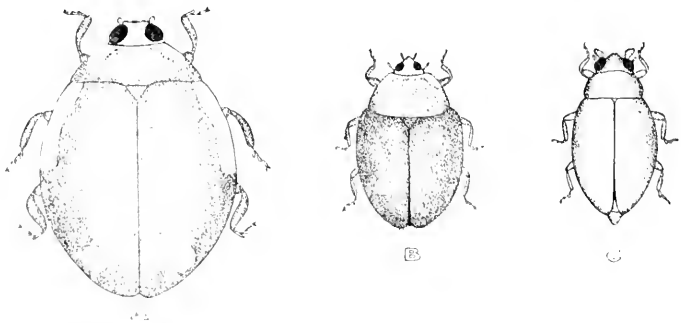

Figure 166
A, Hyperaspis lateralis; B, Rhizobius lopanthae; C, Scymnus sordidus.

hair. Carinæ entire. Pronotal punctures equal in size throughout the disk, male modifications at the middle of the first ventral segment generally pronounced. Pronotal punctures very small and sparse throughout; male with a tubercle in the middle near the apical margin of the first ventral, the coloration (as stated above) of pronotum different in the two sexes, the male having a small transverse black spot at the middle of the basal margin, the female having the sonnite black, with pale apical angles and fine apical margin (See Fig. 166B). Legs brown or blackish throughout. Abdominal lines arcuate throughout, curving forward externally. Plates entire, the bounding arc extending to the basal margin of the first segment; prosternum rather narrow and convex between the coxæ, with two strong and well developed carinæ, which are but rarely abbreviated in front. (After Casey on *Scymnus marginicollis* Mann.) This insect was found to abound along the Pacific Coast from Humboldt County to San Diego, and was introduced into this state by Mr. Koebele, but it was found to have existed here before his introduction. It is predaceous on San Jose Scale (*Aspidiotus perniciosus*), Red Scale (*Chrysomphalus aurantii*), Yellow Scale (*Chrysomphalus citrinus*), Ivy Scale (*Aspidiotus hederae*), Oleander Scale (*Aspidiotus nerii* Bouche at Melbourne) and Mealy Bugs (*Pseudococcus citri*- Citrus Mealy Bug, and *Pseudococcus adonidum* Long-Tailed Mealy Bug). It has also been reported as feeding upon Purple Scale (*Lepidosaphes beckii*) at San Diego. I believe that the greatest good comes from its work on Red Scale. Last fall I had an opportunity to visit certain orchards in Orange County with Commissioner Roy K. Bishop and he showed me countless numbers of the larvæ of this insect feeding on Red Scale and apparently doing much good work.

In Ventura County, we have very little red, yellow, or purple scale, so it is impossible to find *R. lopanthae* extensively, excepting in the orchards infested with the Citrus Mealy Bug. It is doubtful if any material good is done by it in holding this pest in check. The larvæ are light brown in color, slightly longer than the adult and are easily recognized by a light yellow, oblong blotch on the dorsum.

Hyperaspis lateralis Mulsant

(Figure 166 A. Male)

Length .2 mm. to 3.0 mm., with 2.15 mm. to 2.4 mm. Form very short and broad with body broadly rounded and strongly convex. Head of male light, while black in female. Pronotum of male dark with lateral margins and fine apical margin light as shown in cut. Pronotum of female dark throughout. Eyes black. Elytra shiny black, punctures sparse and fine, but distinct. There are three red or pale spots on each as follows: Long and narrow spot on the margin at the humeral angle, a sub-marginal or oval rounded spot near the apex, another on the dorsum near the middle, and near the inner third of the width. The long humeral spot, or vitta, extends to the middle of the elytra. Legs black.

This insect is a native of the southwestern portion of the United States and has been found in California, Arizona, New Mexico and Texas. It feeds almost entirely upon the mealy bugs and has been reported from New Mexico as feeding on *Phenacoccus helianthi* by J. D. Tinsley. In California it has been found

feeding upon *Pseudococcus ryani* Coq., *Erium lichtensioides* Ckll., and *Pseudococcus citri* Risso. The adult form is nearly as predaceous as is the larva. The larva is covered with a white woolly secretion not unlike that of the larva of *Cryptolaemus montrouzieri* Mul., a picture of which was printed in the last number of this article. Due to the fact that it is very heavily parasitized it can do little effective work. From a single larva I succeeded in hatching seven internal parasites.

Both larval and adult forms are met with frequently in the mealy bug infested orchards of Ventura County.

Scymnus sordidus Horn

(Figure 166 C)

This is a small dark or light brown lady-bird beetle which is a native of Ventura County as well as of all Southern California.

Body elongate oval. Length 1.65 mm., width 0.9 mm. Pronotum piceous, minutely, not very closely, punctulate, the sides not quite continuous. Elytra pale, with margins nubilously blackish, more broadly at base, finely and rather closely punctate. Abdominal lines extending outward externally parallel to edge of the segment and a slight distance therefrom, prosternum relatively slightly wider between coxæ, flat and wholly devoid of carinæ; genital or "sixth" ventral segment, usually developed. (Casey, Cocill. of Am., Jr. N. Y. Ent. Soc. Vol. VII, pp. 139-156.)

The larvæ of this insect are small and covered with long white filaments resembling the larvæ of *Scymnus guttulatus* Lec. Of the three coccinellids here mentioned this is the most effective worker on the citrus mealy bug. It may be found in large numbers in the orchards wherever the mealy bugs exist. I was able to procure this insect in great numbers in a nursery at Santa Ana last summer, where it was feeding on mealy bugs which infested a Broom (*Cytisus*).

INTERNAL PARASITES

There have been a number of attempts on the part of the State to introduce internal parasitic enemies of the mealy bug along with the predaceous coccinellids. Some three years ago Geo. Compere was able to import three species, the names of which were not known at the time. Some of these were liberated in San Diego County, but none in Ventura County. Strange as it may seem, I was able to breed out two distinct internal parasites from mealy bugs here, and one of these appears to be the same as one of the three introduced from the Philippine Islands by Compere. It is *Chrysoplatycerus splendens* Howard. How it was ever introduced into this county is not known, but it has now become widely distributed and quite numerous. Another internal parasite bred from the citrus mealy bug is *Cheiloncurus dactylopii* Howard. A dipterous parasite, *Leucopis bella* Loew., was also raised in considerable numbers.

I am indebted to Dr. L. O. Howard and J. C. Crawford for the determinations of the *Hymenoptera* and to D. W. Coquillett for the determination of *Leucopis bella* Loew.

Chrysoplatycerus splendens Howard

Female—(Figure 167). Length 2.4 mm., expanse 1.93 mm., greatest width of forewing 0.51 mm., greatest length of forewing 1.28 mm., width of thorax 0.65 mm. *Color* Black throughout, somewhat iridescent, which make the scutellum appear light in color. *Head* Wider than prothorax, at least much wider than anterior portion. *Antennae* (Figure 168 A, B, C). Large, and situated much below the middle of the forehead. Length 1.05 mm.

Scutellum with a clump of hairs or bristles at apex. Abdomen pointed with a small tuft of hairs on the lateral margins just in front of the middle.

Wings—(Figure 168 D, E). Apical two-thirds of forewings dark and hairy as shown in cut. Secondary wings slightly darkened and hairy. Veins as shown in drawing (Fig. D, E).

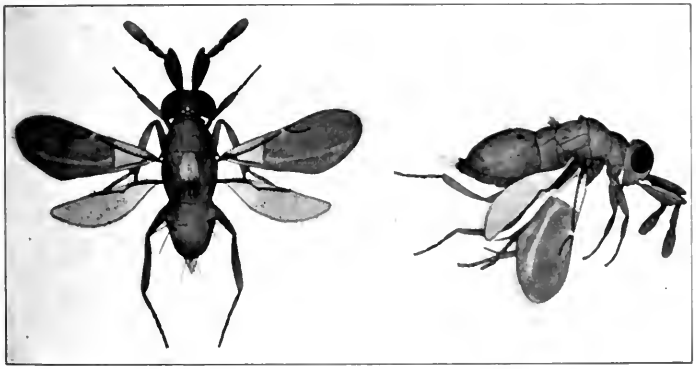

Figure 167. Chrysoplatycerus splendens

Legs—(Figure 168 F, G, H). Tarsi V articled. Foreleg much smaller than other two. Femur longer than tibia. First tarsal joint as long as II and III, II longer than III or IV, which are co-equal, I and V co-equal, but the latter much narrower. Large spine at base of tibia. Middle leg largest. Tibia longer than femur, with long spur on inner apical end, which is nearly as long as first tarsal article. Article I of tarsus as long as II, III and IV together, article II longer than III or IV (which are co-equal), article V not quite as long as II and much narrower. The hind leg is nearly as large as the middle leg. The tibia is only slightly longer than the femur, and has a single spine at the apical end (inner margin) which is not as long as the spine on the tibia of the foreleg. Article I of the tarsi is as long as II and III, II is longer than III or IV, III and IV are co-equal, V is longer than either III or IV, but not quite as long as II. All of the legs are hairy.

The female is rather deliberate in her actions and may remain in a very small area for an hour or so, all the time busy examining the host. In doing this she holds her antennæ, as is shown in the lateral view in Figure 167, and does all of the feeling with the tips of her antennæ. These she moves very rapdily and when a suitable mealy bug has been found (those selected are about half-grown) she turns around and punctures it with the ovipositor and deposits her egg. From observations it is very probable that she deposits but one egg in an individual mealy bug. When touched or disturbed she jumps and may even fly away. She rests with the body close to the supporting fruit or leaf with the legs spread out at the sides and the antennæ flattened out in front, not unlike two front legs.

As stated above it was possible to obtain a large number of these internal parasites from small breeding cages filled with adult mealy bugs and their egg masses, but the good they do is very difficult to estimate. In breeding cages great numbers were kept confined for a year, but the number of mealy bugs increased enormously while the parasites almost entirely disappeared. In mounting hundreds of adult mealy bugs, I have been unable to procure one that contained the larval form of the parasites, but the empty cases, from which have issued the parasites are plentiful on the trees in the orchards

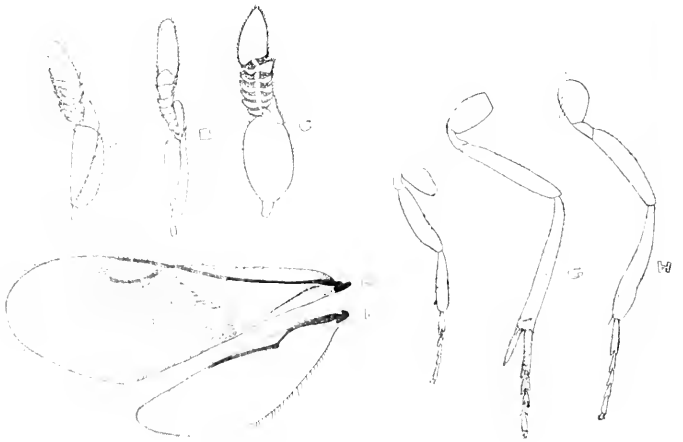

Figure 168. Chrysoplatycerus splendens

APHIDIDÆ OF SOUTHERN CALIFORNIA VII

E. O. ESSIG
HORTICULTURAL COMMISSIONER OF VENTURA COUNTY

These descriptions and drawings were made from fresh specimens, either living or immediately after they were killed. I did this in order to make the color notes as complete and exact as possible and to get the exact shape and proportions of each insect as it really appears before being mounted. All of the drawings were made with a camera lucida and no pains were spared to make them correct in the minutest detail.

In determining these species I have sought freely the aid of the older workers and best authorities on this group. I wish especially to acknowledge the valuable help of Mr. J. T. Monell, Mr. John J. Davis, Prof. O. W. Oestlund and Prof. W. M. Davidson and for their ready co-operation in every way.

Aphis brassicae Linne

1735 *Aphis brassicae* Linn. Syst. Nat. 1, 2, p. 734.

CABBAGE LOUSE

WINGED VIVIPAROUS FEMALE (Figure 169 A).

Length of body 2.4 mm., width of mesothorax 0.7 mm., greatest width of abdomen 0.95 mm., wing expansion 6.9 mm.

Prevailing color—Dark greenish-yellow or brownish, slightly covered with fine whitish powder. *Head*—Slightly wider than long, anterior portion darker than the base, ventral surface greenish. *Antennae*—(Figure 169 H). Reaching just beyond the middle of the abdomen—not quite to base of cornicles—dark, imbricated, sparsely haired, length of articles: I, 0.07 mm.; II, 0.08 mm.; III, 0.6 mm.; IV, 0.25 mm.; V, 0.28 mm.; VI, 0.65 mm. (spur 0.5 mm.), total 1.93 mm. Large number of circular sensoria on article III. *Rostrum*—Reaching to third coxæ, light with dark tip and base. *Prothorax*—Dark except narrow greenish band at base. *Mesothorax*—Black. *Metathorax*—Amber with black basal band. *Abdomen*—Dark green, yellowish brown or amber with dark transverse dorsal markings and marginal spots, ventral surface distinctly segmented, evenly colored, genital plate slightly dusky. *Cornicles*—(Figure 169 D). Cylindrical, slightly wider just before tip, short, black, length 0.15 mm. *Legs*—Normal, dark amber brown, coxæ dark; femora with apical one half darker; tibia with base and apex darker; tarsi dusky at base and tip. *Wings*—Hyaline, normal (see drawing). *Primary*—Subcostal wide, amber; stigma long, narrow, length 0.8 mm., width 0.15 mm., amber; veins amber brown. *Style*—Conical, as long or nearly as long, as cornicles, light green or dusky, length 0.15 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 169 B and C).

Length of body 2. mm., greatest width of body 1.2 mm., robust and nearly globular in shape.

Prevailing color—Silvery gray due to quite a thick covering of fine whitish powder, ground color yellowish or pale green throughout. *Head*—Much narrower than the prothorax, dark. *Antennae*—(Figure 169 I). Half as long as the body, articles I and II dusky, remaining articles light with apical portions dark, lengths

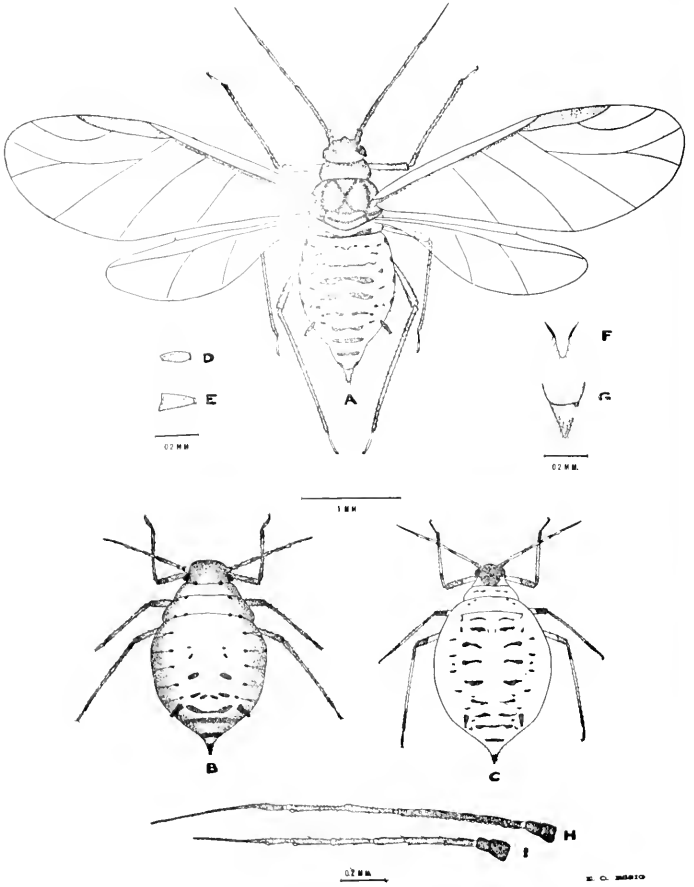

Figure 169. Aphis brassicæ

A, winged viviparous female; B, C, apterous viviparous females; D, cornicle of winged female; E, cornicle of apterous female; F, style of winged female, dorsal aspect; G, style of apterous female, ventral aspect; H, antenna of winged female; I, antenna of apterous female.

of articles: I, 0.09 mm.; II, 0.07 mm.; III, 0.5 mm.; IV, 0.2 mm.; V, 0.19 mm.; VI, 0.48 mm. (spur 0.35 mm.), total 1.53 mm. *Rostrum*—Reaching just beyond first coxae, dusky. *Prothorax*—Dark except basal margins which are lighter. *Meso-* and *Metathorax*—Each with four small black spots on dorsum. *Abdomen*—With transverse dark markings and dark spots on the dorsum, segmentation obscure dorsally and distinct ventrally, genital plate dusky. *Cornicles*—(Figure 169 E). Cylindrical, slightly wider at base, short, black, length 0.17 mm. *Legs*—Normal, dusky, coxae color of body; femurs darker at apices; tibiae dark at bases and tips; tarsi dark. *Style*—(Figure 169 G). Triangular or conical in shape, dark; length 0.17 mm., width at base 0.13 mm.

Hosts—Occurs in great numbers upon Cabbage and Cauliflower (*Brassica oleracea* L.), Wild Mustard (*B. campestris* L.), Black Mustard (*B. nigra* Koch.), Wild Radish (*Raphanus sativus* L.).

Locality—Throughout the entire state. Date of collection—Nov. 2, 1910. Serial number 8.

This insect often does considerable damage to cabbage, cauliflower and other cruciferous plants in the garden. It collects in great colonies and may completely cover the host. It is partially controlled by natural enemies, the predaceous ones being *Hippodamia convergens* Guer., *Coccinella californica*, *Hippodamia maculata* DeG., and the larvae of the Syrphid flies. The internal parasite, *Diaeretus californicus* Baker, does good work in the southern part of the state.

It may be controlled artificially by spraying with Kerosene Emulsion, Whale-oil soap, Tobacco decoction, or Carbolic Acid Emulsion.

Aphis ceanothi-hirsuti n. sp.

WINGED VIVIPAROUS FEMALE (Figure 170 A)

Length of body 1.48 mm., width of mesothorax 0.6 mm., wing expansion 6.8 mm.

Prevailing color—Very dark brown to almost black. *Head*—As wide as prothorax, black. *Eyes*—Very dark red. *Antennae*—(Figure 170 a). Dusky throughout, reaching nearly to base of cornicles, very sparsely haired, lengths of articles: I, 0.06 mm.; II, 0.06 mm.; III, 0.38 mm.; IV, 0.22 mm.; V, 0.2 mm.; VI, 0.44 mm.(spur 0.3 mm.); a large number (19-23) circular sensoria on III. *Rostrum*—Reaches just to metathorax, light yellow, brown at base and dusky at tip. *Prothorax*—Black, with distinct lateral tubercles. *Mesothorax*—Black with well developed muscular lobes. *Metathorax*—Dusky, but not as dark as mesothorax. Ventral surface of thorax very dark brown or black. *Abdomen*—Dark amber brown, with marginal and transverse dark markings, all black behind a transverse line drawn across abdomen in front of the cornicles one-quarter the distance from the base of the cornicles to the base of the abdomen. This seems to be characteristic. Ventral surface dusky or dark brown. *Cornicles*—(Figure 170 b). Cylindrical, straight, black; length 0.3 mm. *Legs*—Normal, coxae black, femora of prothoracic legs amber with tips only dusky; femora of meso- and metathoracic legs amber at base and remainder dusky; tibiae of all legs dark at extreme base and the tips; tarsi dark. *Wings*—Hyaline. *Primary*—Length 3.2 mm., width 1.1 mm.; costal vein

light, narrow, subcostal wide, light; stigma three times as long as broad, nearly a parallelogram in shape, dark to nearly black; stigmal vein well curved throughout its entire length; basal two-thirds of the first and second discoidals light, remainder dark; third discoidal obsolete at base, second branch arising two-thirds the distance from the union of the first branch to tip of vein. *Secondary*—Length 2 mm., width 0.55 mm., subcostal deeply curved at the base of the second discoidal. *Style*—Dark, conical, less than half the length of the cornicles and a trifle shorter than tarsi, hairy.

APTEROUS VIVIPAROUS FEMALE. (Figure 170 B)

Length of body 1.8 mm., greatest width of abdomen 1.1 mm., body well rounded.

Prevailing color—Dark olive green to a greenish brown or amber. *Head*—Brown. *Eyes*—Very dark red. *Antennae*—(Figure 170 d). Slightly more than

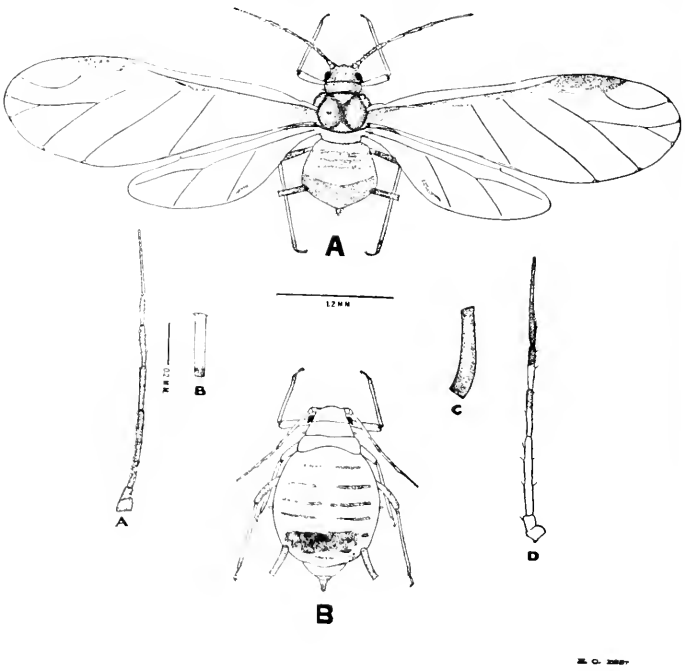

Figure 170. Aphis ceanothi-hirsuti

A, winged viviparous female; B, apterous viviparous female, a, antenna of winged female; b, cornicle of winged female; c, cornicle of apterous female; d, antenna of apterous female.

two-thirds the length of the body, articles I and II color of head, III and IV lemon yellow, the latter dusky at tip, remaining articles dusky, lengths: I, 0.05 mm.; II, 0.01 mm.; III, 0.38 mm.; IV, 0.22 mm.; V, 0.2 mm.; VI, 0.42 mm. (spur 0.29 mm.), total 1.28 mm. *Rostrum*—Light yellow, brown at base with dark tip, reaching to third coxæ. *Prothorax*—With lateral tubercle, deep brown. *Mesothorax*—Same color as the prothorax. *Metathorax*—Much lighter in color, amber. *Abdomen*—Pale green with dark transverse dorsal markings, lateral dark marginal markings on ventral surface, small tubercle on lateral margin near middle. *Cornicles*—(Figure 170 C). Cylindrical, black, curved outwardly, slightly wider at base than at apex, length 0.45 mm. *Legs*—Coxæ brown; femora of two first pairs yellow, with dusky tips, apical two-thirds of third pair dusky; tibiæ dark at extreme bases and tips; tarsi dark. *Style*—Half as long as cornicles and as long as tarsi, dark.

Host—On the undersides of the older leaves of *Ceanothus hirsutus* Nutt. Usually scattering and not in thick colonies.

Locality—Santa Paula Canyon, in mountains near Santa Paula, Cal., at an altitude of from 700 to 1500 feet. Date of collection—April 29, 1914. Serial number 32.

This form was first believed to be *Aphis ceanothi* Clarke, but according to his original description in Canadian Entomologist XXXV, p. 250, 1903, the following differences are noticeable and appear to justify separation:

Aphis ceanothi Clarke

General—Winged form larger than apterons.

Winged—Antennal articles IV and V sub equal.

Cauda inconspicuous and yellow-brown.

Abdomen clouded yellow-brown.

Veins dark green.

Apterous—Antennal articles IV and V sub-equal.

Legs and antennæ of a uniform color.

Body globular.

Hosts—Infesting tender tips and on blossoms of *Ceanothus integerrimus*.

Aphis ceanothi-hirsuti n. sp.

Apterous form much the largest.

Antennal article IV slightly longer than V.

Cauda plainly visible and dusky.

Abdomen with distinct dark dorsal markings and black posteriorly.

Veins yellow and dusky.

Article IV longer than V.

Legs and antennæ not of a uniform color.

Body elongated to globular.

On older leaves of *Ceanothus hirsutus* Nutt. Never found on blossoms, although there were plenty on the trees.

Aphis medicaginis Koch.

1857 *Aphis medicaginis* Koch, Pflz., p. 94

1879 *Aphis medicaginis* Koch, Monell, U. S. Geol. Surv. V, No. 1, p. 24.

1880 *Aphis medicaginis* Koch, Thomas, 8th. Rept. Ent. Ill., pp. 101, 192.

1910 *Aphis medicaginis* Koch, Williams, Aphid. Nebr., pp. 50-51.

WINGED VIVIPAROUS FEMALE (Figure 171 A)

Length of body 2.2 mm., width of mesothorax 0.6 mm., wing expansion 7.2 mm.

Prevailing color—Shiny or dull black, some forms may appear very dark brown. *Head*—Considerably narrower than prothorax, black or very black. *Eyes*—Dark red. *Antennae*—(Figure 171 C). On inconspicuous frontal tubercles, reaching nearly to the middle of the abdomen, sparsely haired, articles I, II, color of the body, III amber with dusky middle, IV, V and VI light with apical halves dusky, length of articles: I, 0.09 mm.; II, 0.06 mm.; III, 0.3 mm.; IV, 0.26 mm.; V, 0.25 mm.; VI, 0.39 mm. (spur 0.25 mm.), total 1.35 mm.; five large sensoria on III. *Rostrum*—Reaching to second coxæ, lemon yellow with black base and tip. *Prothorax*—Black, with distinct lateral tubercles. *Mesothorax* and *Metathorax*—Black. *Abdomen*—Smooth, dark olive green or nearly black with darker lateral

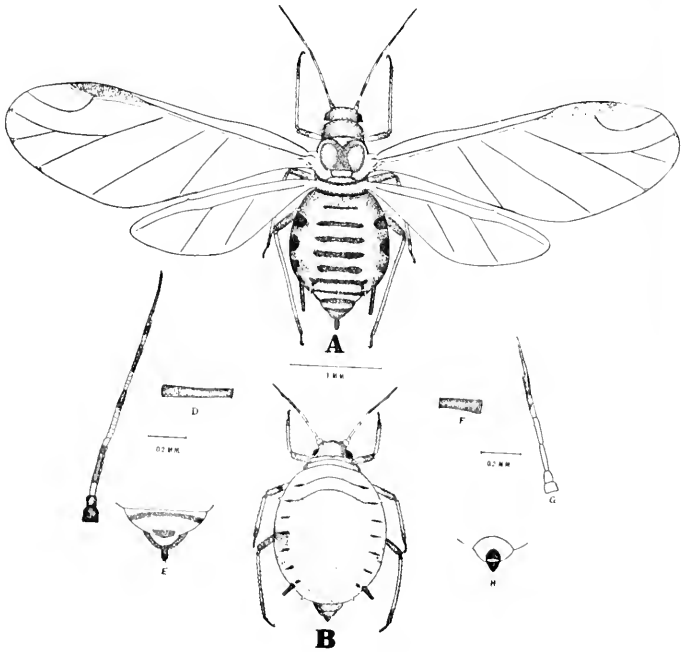

Figure 171. Aphis medicaginis

A, winged viviparous female; B, apterous viviparous female; C, antenna of winged female; D, cornicle of winged female; E, pygidium of winged female, dorsal aspect; F, cornicle of apterous female; G, antenna of apterous female; H, pygidium of apterous female, ventral aspect.

marginal and transverse dorsal markings, one pair of small lateral tubercles near the base of the abdomen and a second pair just behind the cornicles, genital plate dusky. *Cornicles*—(Figure 171 D). Cylindrical, imbricated, wider at base and gradually narrowing to apex, black, three times as long as style, length 0.36 mm., width at base 0.07 mm. *Legs*—Moderately long and hairy, coxæ dark; femora lemon yellow with apical halves dusky; tibæ lemon yellow with extreme bases and tips dusky; tarsi dusky. *Wings*—Hyaline, normal. *Primary*—Length 3.4 mm., width 1.25 mm., costal and subcostal veins and the stigma dark brown, remaining veins light yellow. *Secondary*—Length 2.4 mm., width 0.65 mm., veins light yellow. *Style*—(Figure 171 E). Conical, black, nearly as long as tarsi.

APTEROUS VIVIPAROUS FEMALE (Figure 171 B)

Length 1.9 mm., greatest width of abdomen 1.2 mm., small robust species.

Prevailing color—Dull green or black with often a shade of maroon, many individuals slightly covered with fine white powder, others shiny black. *Head*—Dull reddish-green or black. *Eyes*—Dark red. *Antennæ*—(Figure 171 G). Not half as long as the body, on slight frontal tubercles, articles I and II color of head, III, IV, and V lemon yellow—the latter with apical one-half dusky, VI dark, lengths of the articles: I, 0.05 mm.; II, 0.06 mm.; III, 0.14 mm.; IV, 0.13 mm.; V, 0.12 mm.; VI, 0.3 mm. (spur 0.2 mm.); total 0.7 mm. *Rostrum*—Lemon yellow with dark base and tip, reaches to third coxæ. *Thorax*—Dark green, maroon, or black, lighter ventrally. *Abdomen*—Somewhat globular, smooth, shiny or dull, varying from dark green or maroon to black, ventral surface lighter in color, genital plate dusky. *Cornicles*—(Figure 171 F). Cylindrical, black, shorter than in winged specimens, imbricated, wider at base than at apex, length 0.21 mm. *Legs*—Same as in winged specimens. *Style*—(Figure 171 H). Conical, dark with black spot at the ventral base, the distance across the base equals the length.

Hosts—This species was obtained in rather limited numbers from the flower sheets of the native Rattle Weed or Loco Weed (*Astragalus leucopis* Torr.). It also feeds upon *Medicago falcata*, *Caragana arborescens*, *Robinia viscosa*, *Melilotus italica*, Wild Licorice (*Glycyrrhiza lepidota*), *Artemisia californica* Less., and Clovers.

Locality—Along the foothills of the Upper Ojai Valley, two miles from Nordhoff, at an altitude of 1,000 feet. Date of collection—May 15, 1911. Serial number 35.

The species, as it occurs here, conforms remarkably well with the original description given by Koch, and there can be little doubt regarding its identity. In the description by Williams (Aphid. of Nebr. pp 50-1) the following differences are noted:

Species Described by Williams	Species as Found at Nordhoff
Cornicles of the apterous female longer than those of the winged females.	Cornicles of the apterous females shorter than those of the winged females.
Antennal article III of the apterous forms longest.	Article VI and the spur of it (which is commonly termed VII) is always longest.

However, in spite of these rather indefinite differences, I believe this to be the true *Aphis medicaginis* Koch.

Aphis nerii Fonscolombe

1841 *Aphis nerii* Fonsc., Ann. Soc. Fr. X, p. 157.

OLEANDER APHID

WINGED VIVIPAROUS FEMALE (Figure 172 A)

Length of body 2.2 mm., width of mesothorax 0.6 mm., greatest width of abdomen 1.1 mm., wing expansion 6.8 mm.

Prevailing color—Deep rich yellow and black. *Head*—Narrower than prothorax, wider than long, dark. *Eyes*—Dark red. *Antennae*—(Figure 172 C). Black throughout, on a slight frontal tubercle, sparsely haired, reaching to base of the cornicles, lengths of articles: I, 0.09 mm.; II, 0.05 mm.; III, 0.48 mm.; IV, 0.38 mm.; V, 0.26 mm.; VI, 0.54 mm. (spur 0.42 mm.); total 1.80 mm.; ten circular sensoria on III. *Rostrum*—Reaching to third coxæ, yellow with dusky base and tip. *Prothorax*—Yellow, with lateral tubercles. *Mesothorax*—Yellow with muscle lobes black. *Metathorax*—Dusky yellow with muscle areas dark (see drawing). *Abdomen*—Smooth, bright saffron yellow with a black blotch behind each cornicle and in some instances there may be small dark patches on the dorsum. *Cornicles*—(Figure 172 D). Black, margins slightly serrate, cylindrical, with base slightly wider and gradually narrowing to tip, length 0.45 mm., width at base 0.12 mm., width at apex 0.08 mm. *Legs*—Normal, coxæ of first and second pairs yellow, of third pair dusky; femora yellow with apical one-half black; tibiæ with extreme bases and tips black; tarsi black. *Wings*—Hyaline, normal. *Primary*—Costal vein wide, dusky; subcostal wide, yellow; stigma long and narrow, dusky; stigmal vein well curved; first and second discoidals nearly straight; third discoidal nearly straight with first branch arising near its middle, second branch arises nearly two-thirds distance from the base to the apex of the first branch; length of wing 8.2 mm., width 1.4 mm. *Posterior*—Normal, with extreme base of first discoidal obsolete, length 1.55 mm., width 0.5 mm. *Style*—(Figure 172 E). Sickle-shaped black or dark brown, not quite half as long as cornicles. *Anal plate*—Dark.

APTEROUS VIVIPAROUS FEMALE (Figure 172 B)

Length of body 2.2 mm., greatest width of abdomen 1.1 mm.

Prevailing color—Clear, bright saffron yellow. *Head*—Nearly as long as broad, dusky yellow. *Eyes*—Dark red. *Antennae*—(Figure 172 F). Not reaching to bases of cornicles, dusky with base of article III light, lengths of articles: I, 0.1 mm.; II, 0.08 mm.; III, 0.36 mm.; IV, 0.28 mm.; V, 0.25 mm.; VI, 0.57 mm. (spur 0.47 mm.), total 1.64 mm. *Rostrum*—Reaching just beyond second coxæ, dusky with tip and base slightly darker. *Thorax*—Yellow. *Abdomen*—Smooth, shiny, yellow throughout. *Cornicles*—(Figure 172 G). Cylindrical, slightly wider at base, margins serrate or rough, carried nearly at right angles to the body, length 0.47 mm., width at base 1.11 mm., width at mouth 0.08 mm. *Legs*—Coxæ dusky yellow; femora with basal one-quarter yellow and apical three-quarters dark; tibiæ dusky yellow with bases and apices darker; tarsi dark, small. *Style*—(Figure 172 H). Conical, sickle-shaped, black, half as long as the cornicles, length 0.24 mm.

Host—*Nerium oleander* L. It occurs in great numbers upon the tender shoots and suckers, but does not infest the older growth.

Locality—Throughout Southern California. I have taken it at Claremont, Los Angeles, Nordhoff, and Santa Paula. Date of collection May 24, 1911. Serial number 38.

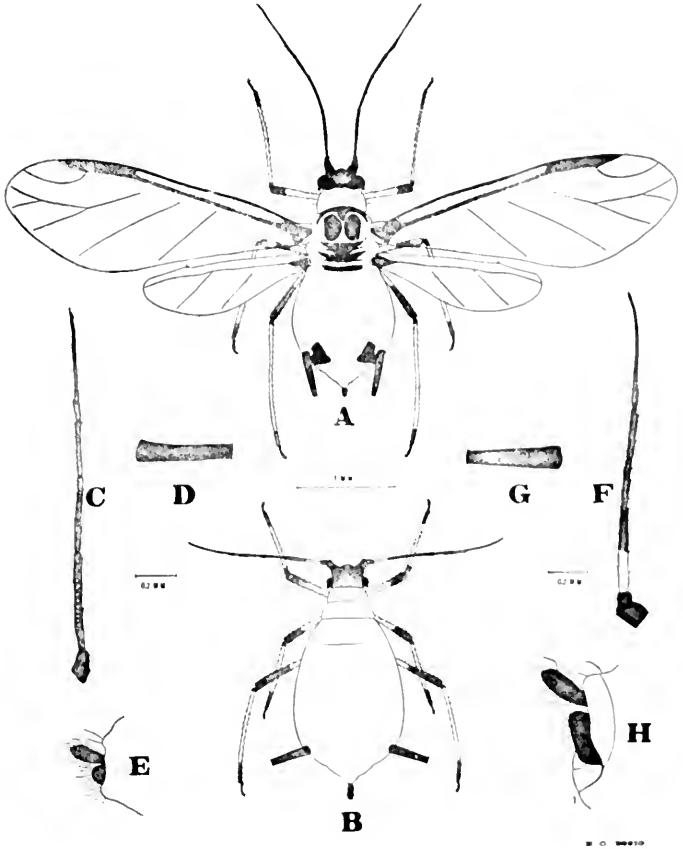

Figure 172. Aphis nerii

A, winged viviparous female. B, apterous viviparous female. C, antenna of winged female; D, cornicle of winged female. E, pygidium of winged female, lateral aspect; F, antenna of apterous female. G, cornicle of apterous female. H, pygidium of apterous female, lateral aspect.

This species corresponds exactly with the one by Thomas in his Eighth Report of the Ent. of Illinois, p. 95, 1880. It is strange to note that it does not appear to be the species described as *Aphis nerii* by Kaltenbach (Mon. Pflz. pp. 118-119), his species being darker and with green markings. I do not have the description of Fonscolombe, so can not compare it with the original, but take it that it is his species.

Chaitophorus salicicola n. sp.

WINGED VIVIPAROUS FEMALE (Figure 173 B)

Length of body 1.6 mm., width of mesothorax 0.5 mm., greatest width of abdomen 0.69 mm., wing expansion 5.25 mm.

Prevailing color—Very dark olive green to black. Entire body covered with fine hairs which are situated on small tubercles. *Head*—Black, narrower than prothorax, slightly wider than long. *Eyes*—Dark reddish-brown. *Antennae*—(Figure 173 e). Reaching to middle of abdomen, articles I and II color of head, III yellow, remaining articles dark, normally haired, lengths of articles: I, 0.06 mm.; II, 0.08 mm.; III, 0.31 mm.; IV, 0.17 mm.; V, 0.15 mm.; VI, 0.35 mm. (spur 0.25 mm.), total 1.12 mm.; four or five large circular sensoria on article III. *Rostrum*—Reaching to second coxæ, light yellow with base and tip dusky. *Abdomen*—Plainly segmented, dark with lateral dorsal margins and a narrow strip between each segment olive green, ventral surface olive green with lateral margins somewhat darker, hairy. *Cornicles*—(Figure 173 c). Truncate, much wider at base than at mouth, nearly as wide as the length, mouth slightly flared, length 0.08 mm., width at base 0.07 mm., dark olive green. *Legs*—Normal, hairy, coxæ dark; femora of first pair light, of second and third pairs dark; tibiæ light with bases and tips dark; tarsi dark. *Wings*—Hyaline. *Primary*—Length 2.4 mm., width 0.8 mm., costal and subcostal veins well developed; stigma nearly oval in shape, length 0.5 mm., width 0.1 mm., rich olive green; stigmal vein well curved, arising near apical end of stigma; first and second discoidals nearly straight, arising 0.075 mm. apart; first branch of third discoidal arising one-third and second branch arising two-thirds the distance from the base of the discoidal to the end of the third branch; all veins olive green in color. *Posterior*—Length 1.5 mm., width 0.4 mm., normal. *Style*—(Ventral side Figure 173 a). Short, conical, longer than tarsi, olive green.

APTEROUS VIVIPAROUS FEMALE (Figure 173 A)

Length of body 1.5 mm., width of abdomen 0.9 mm. Very narrow at head, gradually widens posteriorly to middle of abdomen and then rounds off rather abruptly.

Prevailing color—Dark olive green or dusky brown with light yellow longitudinal band on the middle of the dorsum extending from base of the head to the posterior end, lateral margins lighter in color than is the general body color. *Head*—Dark with yellow area at widdle of base on the dorsum. *Eyes*—Dark reddish brown. *Antennae*—(Figure 173 f). Reaching nearly to the middle of the abdomen, hairy, articles I, II, apical one-third of IV, V and VI dusky, III and basal two-thirds of IV light yellow, lengths of articles: I, 0.08 mm.; II, 0.07 mm.;

III, 0.8 mm.; IV, 0.17 mm.; V, 0.14 mm.; VI, 0.35 mm. (spur 0.25 mm.), total 1.11 mm. *Rostrum*—Reaching to second coxae, light yellow with dusky base. *Cornicles*—(Figure 173 d). Truncate, base nearly twice as wide as apex, either entirely light or light except base which is dark, length 0.1 mm., width at base 0.09 mm., width at mouth .05 mm. *Legs*—Short, stout, colored as in winged form. *Style*—(Figure 173 b, ventral side). Conical, light yellow, does not extend beyond tip of abdomen so cannot be seen from above.

Young—The young nymphs vary from a light to a dark green in color, the young apterous forms are first light or yellow, becoming dusky after the first

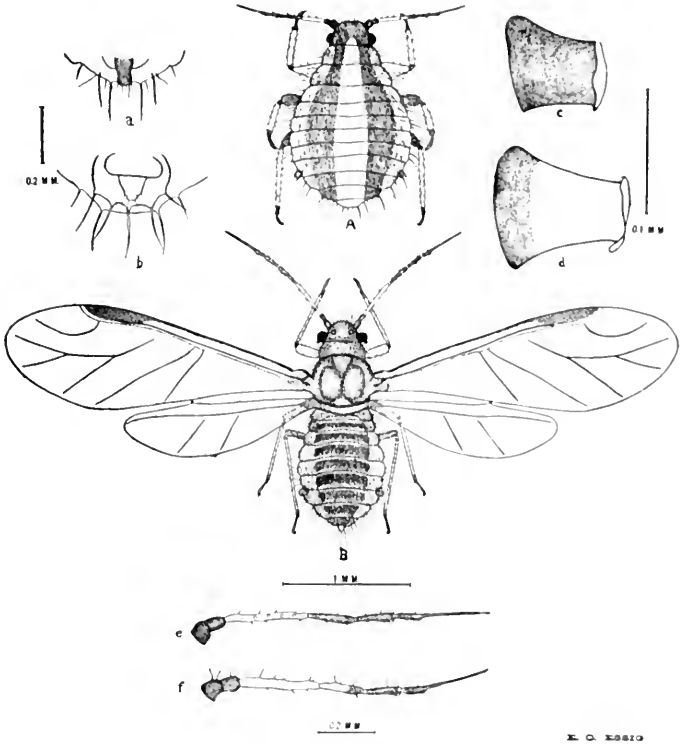

Figure 173. Chaitophorus salicicola

A, apterous viviparous female; B, winged viviparous female; a, pygidium of winged female; b, pygidium of apterous female; c, cornicle of winged female, d, cornicle of apterous female. e, antenna of winged female, f, antenna of apterous female.

moult and early begin to show the light longitudinal dorsal band, which is very characteristic of this species.

Host—This species occurs in small compact colonies on the dorsal sides of the leaves, or in large colonies on the tender shoots of the Narrow-leaved Willow (*Salix laevigata* Bebb.) Also taken in considerable numbers on Cottonwood (*Populus trichocarpa*).

Locality—Along the inland streams near Santa Paula, Cal. A very common species. Date of collection—March 31, 1911. Serial number 18.

Hyadaphis pastinacae (Linn.) Schout.

SYNONOMY

1767 *Aphis pastinacae* Linn. Syst. Nat. I, 734.
1767 *Aphis acgopodii* Scopoli, Carn. 399.
1794 *Aphis caprae* Fabr., Ent. Syst., IV, 213.
1854 *Rhopalosiphum cicutae* Koch, Pflz., p. 24.
1854 *Rhopalosiphum pastinacae* Koch, Pflz., p. 41.
1854 *Aphis umbellatarum* Koch, Pflz., p. 116.
1860 *Siphocoryne pastinacae* Pass., Gali Afid.
1879 *Rhopalosiphum salicis* Monell, Bull. U. S. Geol. Surv. V. 26.
1860 *Siphocoryne pastinacae* Pass., Gali. Afid.
1905 *Hyadaphis pastinacae* (Linn.) Schout., Aphides Belgique, p. 229.

WINGED VIVIPAROUS FEMALE (Figure 174)

Length of body 2.3 mm., width of mesothorax 0.8 mm., greatest width of abdomen 0.8 mm., wing expansion 7.0 mm.

Prevailing color—Green with dark brown, dark green or black markings. *Head*—Small, nearly as long as wide, narrower than prothorax, slight projections on the inner sides of the bases of the antennæ instead of frontal tubercles. *Eyes*—Dark red. *Antennae*—(Figure 174 D). Reaching to third abdominal segment (a little longer than half of the body length), dark throughout, sparsely haired, lengths of articles: I, 0.06 mm.; II, 0.05 mm.; III, 0.58 mm.; IV, 0.19 mm.; V, 0.13 mm.; VI, 0.18 mm. (spur 0.38 mm.), total 1.49 mm.; circular sensoria on III very numerous and on short tubercles. *Rostrum*—Reaching to, or nearly to, second coxæ, light yellow with extreme base and the tip dark. *Prothorax*—Long, widest at base, light green band around anterior end, narrow central marginal light green area at base, remainder dark or dusky. *Mesothorax*—Very dark or black, posterior end of muscular lobes highest and pointed, ventral surface, except coxæ, dark. *Metathorax*—Dark dorsally and green ventrally. *Abdomen*—Distinctly segmented, rich green color with dorsal black or very dark green markings as shown in cut. Small characteristic tubercle or horn located on the middle dorsum of the penultimate segment, ventral surface dull green, anal plate (Figure 174 A, B, C). Area just above style appears glandular and dusky. *Cornicles*—Figure 174 G, H). Clavate, reaching nearly to tip of abdomen, light green with apical two-thirds (the swollen area) dusky, trumpet-mouthed, length 0.42 mm. *Legs*—(Figure 174 E, F). Rather long and slender, normal, hairy, coxæ of first and second pairs green;

femora light; tibiæ light with dusky tips; coxæ of third pair slightly dusky, femora light with apical one-third dark; tibiæ light with tips dark; tarsi dark. *Wings*: Hyaline. *Primary*: Length 3.2 mm., width 1.2 mm., venation normal, insertions and veins greenish-yellow; stigma dusky, long and narrow (length 0.85 mm., width 0.18 mm.) *Secondary*: Normal. *Style*: (Figure 174 A, B, C). Triangular or conical from dorsal view, sickle-shaped from lateral view, not half as long as the cornicles, dark.

APTEROUS VIVIPAROUS FEMALE (Figure 175)

Length of body 2.3 mm., greatest width of abdomen 1.2 mm., body well rounded posteriorly.

Prevailing color: Shiny light green, may or may not have red spots on dorsum. *Head*: Yellowish. *Antennæ*: (Figure 175 B). Half as long as the body, articles I, II and III yellowish green, IV with dark apex only, V and VI with bases and apices dark, middle yellow, lengths of articles: I, 0.09 mm.; II, 0.05 mm.; III, 0.33 mm.; IV, 0.12 mm.; V, 0.1 mm.; VI, 0.1 mm. (spur 0.3 mm.), total 1.09 mm. *Rostrum*: Reaching to third coxæ, light green with dusky base and tip. *Abdomen*: Rather bluntly rounded posteriorly, dorsal posterior tubercle on penultimate segment large and prominent with two apical spines (Figure 175 D, E, F.) *Cornicles* (Figure 175 A). Clavate, yellowish-green with only the extreme

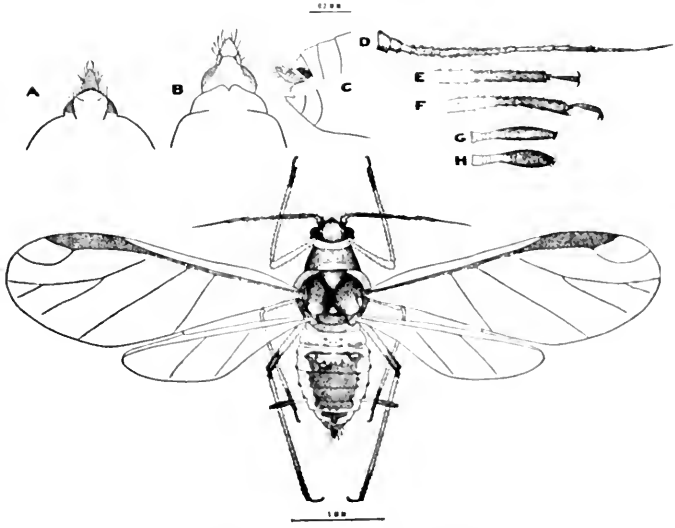

Figure 174. Hyadaphis pastinacæ

A, ventral view of pygidium; B, dorsal view of pygidium; C, lateral view of pygidium; d, antenna; E and F, tips of tibiæ and the tarsi; G and H, cornicles.

tip dark, length 0.52 mm. *Legs*—Bright yellowish-green throughout; tarsi (Figure 175 C) dark. *Style* (Figure 175 D, E, F), conical and slightly sickle-shaped, light green; anal plate, dusky.

Male—"Walker describes male as small, with a red or yellow abdomen, and having black antennæ, eyes, and head." Buckton, Brit. Aphid. II, 29.

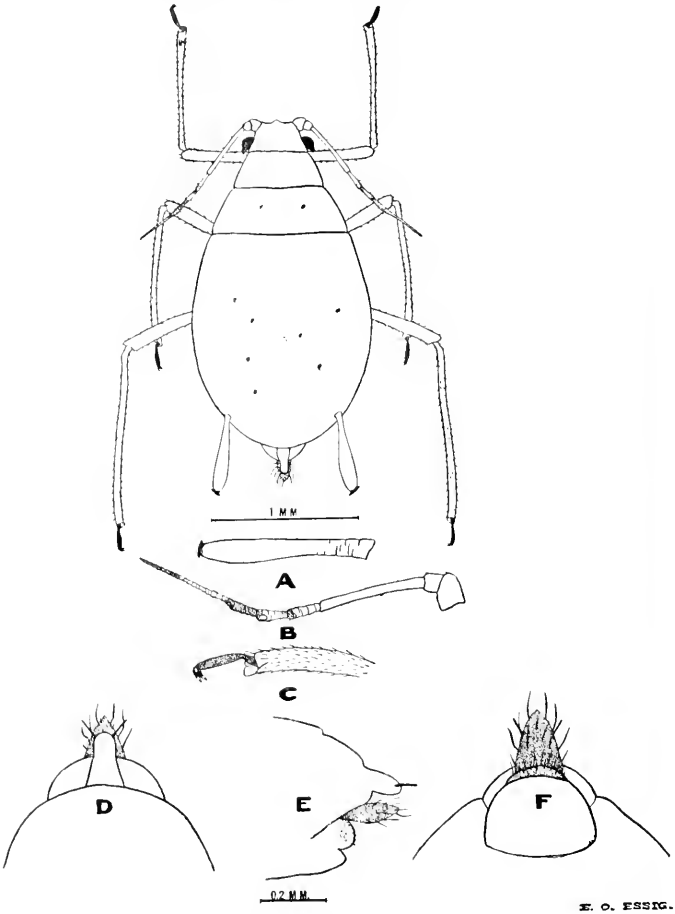

Figure 175. Hyadaphis pastinacæ

A, cornicle; B, antenna; C, tip of tibia and the tarsus; D, dorsal view of pygidium; E, lateral view of pygidium; F, ventral view of pygidium.

Hosts—Occur in very large and widely spread colonies on the leaves and tender shoots of willow (*Salix lacrigata* Bebb.) Other writers have reported it upon the following hosts:

Schouteden
Salix aurita.
Pimpinella magna.
Pimpinella saxifraga.
Erysimum vulgare.
Daucus carota.

Buckton
Apium graveolens.

Monell
Salix lurida.
Salix nigra.

Oestlund
Archangelica atropurpurea.

Davis
Zizia aurea.

Davidson
Salix sp.

Linne
Pastinaca sativa.

Fabricius
Salix caprea.

Kaltenbach
Salix babylonica.
Salix amygdalina.
Salix alba.

Koch
Cicuta virosa.
Heracleum sphondylium.
Angelica sylvestris.
Aegopodium podagraria.
Chaerophyllum temulum.

Locality—Along the Santa Clara River, Santa Paula, Cal. Date of collection—April 11, 1911. Serial number 28.

This species has been the source of no little confusion as may be told from the long list of synonyms above. I am especially indebted to Mr. J. T. Monell and Mr. John J. Davis for their aid in determining it. Mr. Davis writes: "Have just looked at the slides which you sent and consider them as *Siphocoryne capreae*, in other words what I called *Siphocoryne* (*Hyadaphis*) *pastinacae* Linn. I consider *Hyadaphis* the correct name of this genus. Even the European students seem to be unable to say whether *capreae* and *pastinacae* are synonymous or distinct and so I simply follow Schouteden and used the name *pastinacae*. *S. salicis* Monl. and *S. archangelicae* Oest. are synonyms of *capreae*. I intended to say above that the tubercle on the penultimate abdominal segment seems to be a good specific character of this species. I know of no other *Hyadaphis* bearing this tubercle." May 27, 1911.

OTHER DESCRIPTIVE LITERATURE

1843 *Aphis capreae* F.-Kaltenbach Mon. Pflz., p. 109.
1879 *Siphocoryne pastinacae* L.-Buckton, Mon. Br. Aph. II, 24.
1879 *Siphocoryne capreae* Fab.-Buckton, Mon. Br. Aph. II, 27.
1880 *Siphocoryne pastinacae* L.-Thos. 8th Dept Ent. III, p. 84.
1880 *Rhopalosiphum salicis* Mon.-Thos. 8th Rept Ent. III, p. 194.
1887 *Siphocoryne archangelicae* Oestl. Aphid. Minn, p. 70.
1887 *Siphocoryne salicis* (Mon.)-Oestl. Aphid. Minn, p. 70.
1891 *Aphis pastinacae* Koch-Riley-How., Ins. Life, IV, 213.
1893 *Siphocoryne salicis* Mon.-Weed, Trans. Am. Ent. Soc. 20, p. 297.
1910 *Siphocoryne pastinacae* (L.)-Williams, Aphid Nebr., p. 62.
1910 *Siphocoryne pastinacae* L.-Davis, Jr. Ec. Ent., III, 493.

Idiopterus nephrelepidis Davis

1909 *Idiopterus nephrelepidis* Davis, Ann. Ent. Soc. Am. II, 3, p. 199.

1910 *Macrosiphum kirkaldyi* Fullaway, Rept. Hawaii Agrcl. Exp. Sta., pp. 22-23, 1910.

WINGED VIVIPAROUS FEMALE (Figure 176 A)

Length of body 1.50 mm., width of mesothorax 0.47 mm., greatest width of abdomen 0.65 mm., wing expansion 5.20 mm.

Prevailing color— Very dark olive green to black, may be slightly brownish, especially mounted specimens. *Head*—Broader than long, olive green to brownish. *Eyes*—Very dark red. *Antennae*—(Figure 176 B, D, E, F). Situated on prominent approximate, frontal tubercles, slender, longer than the body, nearly hairless, whitish in color with articles I, II and III dusky throughout and the articulations of the remaining articles also black, lengths of articles: I, 0.1 mm.; II, 0.08 mm.; III, 0.42 mm.; IV, 0.25 mm.; V, 0.23 mm.; VI, 0.65 mm. (spur 0.5 mm.), total 1.73 mm.; sensoria are distributed on articles as follows: III with ten large circular (Figure 176 E), IV three large circular (Figure 176 D), V with two to three large

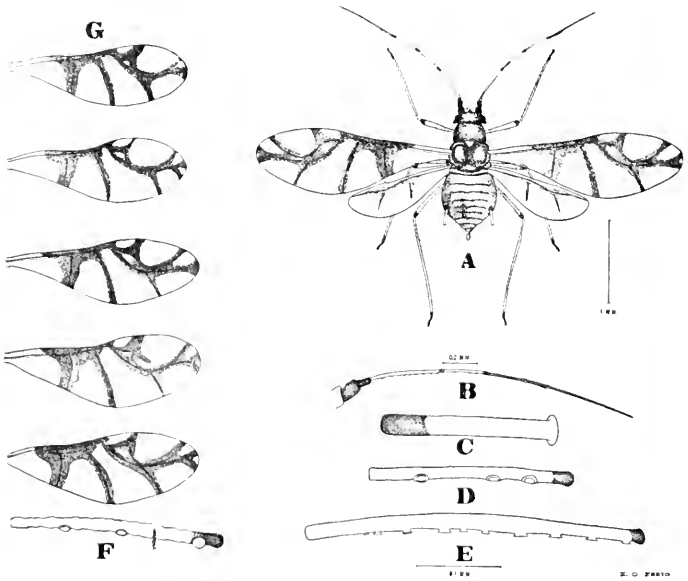

Figure 176. Idiopterus nephrelepidis

A, winged viviparous female; B, antenna of winged female; C, cornicle of winged female; D, article IV. of antenna; E, article III. of antenna; F, article V. of antenna; G, showing variations in wing venation.

circular (Figure 176 F), VI one large circular. *Rostrum*—Reaching third coxæ, light with base and extreme tip dark. *Thorax*—Dark olive green, nearly black. *Abdomen*—Olive or brownish green, not as dark as head and thorax, segmentation on dorsum plainly marked by depressions. *Cornicles*—(Figure 176 C). Cylindrical, slightly widest at base, with trumpet mouth, basal one-third dark, remainder very light. Length 1 mm., average width 0.21 mm. *Legs*—Long and slender, transparently-light in color, with coxæ, tips of femora, tips of tibiæ, and all of tarsi dark, normally haired. *Wings*—Clouded along the veins. *Primary*—(Figure 176 A and G). Length 2.3 mm., width 0.8 mm., venation very variable as shown in drawings of "G," costal and subcostal normal and distinct, with apical one-half clouded along borders; stigma nearly as broad as long with transparent area in center; stigmal vein, variable, clouded, when entire, is well curved throughout entire length, deeply curved so as to nearly touch first branch of third discoidal. This vein is sometimes only indicated by mere fragments and the clouded band, but the band is sometimes broken, as shown in drawings; first discoidal curving slightly inwardly, almost at right angles to the subcostal, short with very wide clouded borders; second discoidal vein curving inwardly, extending towards wing-tip; third discoidal with distinct first branch and rudimentary or indicated second branch; first branch arising nearly in center of the vein, second branch indicated near the very tip. *Secondary*—Length 1.25 mm., width 0.4 mm., veins lightly clouded, subcostal strongly bent at the junction with the second discoidal, first discoidal straight, short, arising just inside of the basal half of the subcostal, clouded borders, widest at base and tapers to point at end of the vein; second discoidal arising two-thirds the distance from the base to the tip of the subcostal, short, basal half clouded. Discoidals extend only three-quarters distance from subcostal vein to lower margin of wing. *Style*—Ensiform, sickle-shaped, color of abdomen, one-half as long as cornicles.

APTEROUS VIVIPAROUS FEMALE (Figure 177 A and C)

Length of body 1.3 mm., width of body 0.78 mm.

Prevailing color—Very dark olive green to black throughout, dorsum with six longitudinal rows of small tubercles, a tubercle on every segment in each row, every tubercle of the two median rows with two white capitate hairs, while the tubercles of the four lateral rows have but one white capitate hair each, several such hairs on head and frontal tubercles. *Head*—Nearly square. *Antennæ*—On prominent, approximate frontal tubercles, longer than body, nearly filiform, color same as in winged form, lengths of articles: I, 0.1 mm.; II, 0.08 mm.; III, 0.48 mm.; IV, 0.3 mm.; V, 0.28 mm.; VI, 0.7 mm. (spur 0.55 mm.), total 1.78 mm.; article III with one large circular and two smaller circular sensoria near base (Figure 177 D). *Rostrum*—Reaching slightly beyond third coxæ, very light with dark base only. *Cornicles*—(Figure 177 B). Cylindrical, widest at base, with trumpet mouth, very pale with basal one-quarter dark, length 1.14 mm., width 0.14 mm. *Legs*—Slender, coxæ color of body; femora transparently white; tibiæ

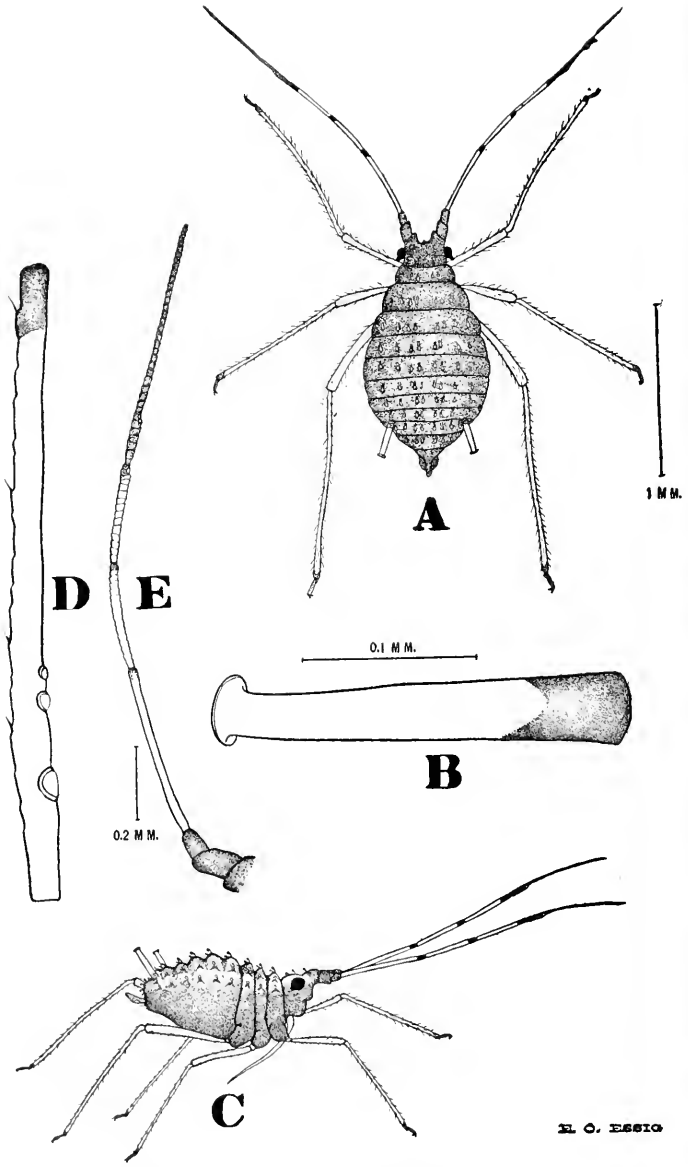

Figure 177. Idiopterus nephrelepidis

A, apterous viviparous female; B, cornicle of apterous female; C, apterous viviparous female, lateral aspect; D, article III of antenna of apterous female.

white with dark tips; tarsi black. *Style*—Ensiform, sickle shaped, one half the length of the cornicles.

Hosts—Feeding in large numbers upon the young and tender fronds of the Boston fern (*Nephrolepis exaltata*). Davis reports this species as feeding upon Sword ferns, and Fullaway collected specimens from *Acrostichum reticulatum*. Neuls found it on cultivated violet at Claremont, Cal.

Locality—House ferns at Santa Paula, Cal. Date of collection—March 18, 1911. Serial number 19.

Davis first obtained this species from greenhouses in Chicago where it had no doubt been imported from other places. Since his description was published, Fullaway, of the Hawaii Agricultural Experiment Station, has described what I believe to be the same species from the Hawaiian Islands. It is, therefore, without doubt, a native of those islands and has been imported into the larger greenhouses on the Pacific Coast and from these to the various parts of the United States. It is yet a rare species and a very beautiful one. Davidson has collected it in the central part of the State and, as stated above, J. Neuls collected it on the Pomona College Campus at Claremont, Cal.

Lachnus juniperi DeGeer

JUNIPER LOUSE

1773 *Aphis juniperi* DeGeer, Ins. III, 56.
1773 *Aphis juniperi* DeGeer, Uberes III, 38.
1775 *Aphis juniperi* Fabr., Ent. Syst. IV, 248, 40.
1801 *Aphis juniperi* Schrank, Fauna Boica II, 119.
1843 *Lachnus juniperi* (DeGeer) Kaltenbach, Pflz., 153.
1857 *Lachnus juniperi* Fabr. Koch., Pflz., 243.
1881 *Lachnus juniperi* Fabr.-Buckton, III, 14.

WINGED VIVIPAROUS FEMALE (Figure 178 A)

Length of body 2.5 mm., width of mesothorax 0.8 mm., wing expansion 8.9 mm., body robust, flat, hairy.

Prevailing color—Dark grayish-brown; the grayish color is produced by a slight covering of very fine, white powdery wax. *Head*—Brown, narrower than prothorax. *Eyes*—Very dark red or brown. *Antennae*—(Figure 178 C). Reaching to base of the abdomen, amber with the tips of articles III, IV, V, VI dark brown, covered with long fine hairs, lengths of the articles: I, 0.07 mm.; II, 0.07 mm.; III, 0.31 mm.; IV, 0.16 mm.; V, 0.19 mm.; VI, 0.2 mm.; total 1 mm.; with four large sensoria on III, one on IV, and two on V. *Rostrum*—Reaches just beyond third coxæ, amber with base and tip dusky. *Prothorax*—Dark brown or black. *Meso-* and *Metathorax*—Black, hairy. *Abdomen*—Dark brown with whitish, powdery markings on dorsum, ventral surface a rich reddish brown. *Cornicles*—(Figure 178 D). Truncate, base nearly twice as wide as mouth, basal half color of abdomen while the apical half is dark, nearly black, basal two-thirds hairy, length 0.13 mm., width at base 0.29 mm., width at mouth 0.1 mm. *Legs*—Stout, covered with long fine hairs; coxæ color of body; femora amber or light yellow with apical

half dark; tibae light yellow with apical tip dark; tarsi dark. *Wings*—Large, hyaline. *Primary*—Length 4.1 mm., width 1.3 mm., costal vein narrow, amber; subcostal vein wide, amber; stigma long and narrow, amber, length 1.3 mm., width .025 mm.; stigmal vein short, basal half straight, apical half slightly curved; first discoidal straight; second discoidal curved slightly inwardly, base 0.02 mm. from base of first discoidal; third discoidal very faint, nearly obsolete, simply indicated by trace, first branch arising one-third and second branch arising two-thirds from its base to tip. *Secondary*—Length 0.25 mm., width 0.08 mm., subcostal slightly curved; first discoidal arising a distance of one-third and the second discoidal arising two-thirds the distance of the basal half of the subcostal, both slightly curved inwardly. *Style*—Rounded, inconspicuous, hairy.

APTEROUS VIVIPAROUS FEMALE (Figure 178 B)

Length of body 2.4 mm., greatest width of abdomen 1.5 mm., robust, wide across abdomen, hairy, flat.

Prevailing color—Rich reddish brown or yellowish, somewhat rounded in shape and flat. *Head*—Very narrow, whole body widening from head to middle of abdomen, and then narrowing again to cauda. *Antennae*—(Figure 178 F). Reaching just to base of abdomen, hairy, light yellow with tip of IV, apical one-third of V

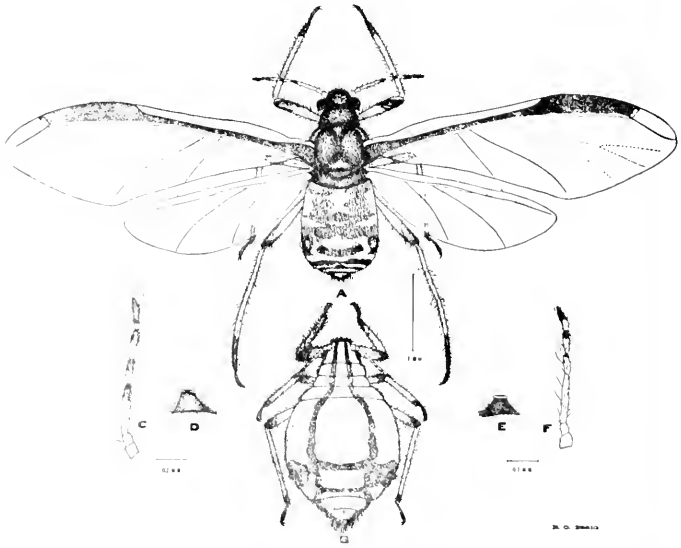

Figure 178. Lachnus juniperi

A, winged viviparous female; B, apterous viviparous female; C, antenna of winged viviparous female; D, cornicle of winged viviparous female; E, cornicle of apterous viviparous female; F, antenna of apterous viviparous female.

and apical one-half of VI dusky, lengths of the articles: I, 0.08 mm.; II, 0.07 mm.; III, 0.3 mm.; IV, 0.12 mm.; V, 0.13 mm.; VI, 0.15 mm.; total .85 mm. *Thorax*—Widening from prothorax, which is very narrow, to base of abdomen. *Mesothorax*—Much wider than the pro- or metathorax. *Abdomen*—Widest in middle, ground color is reddish-brown with two broad lateral and one broad central dorsal, white longitudinal stripes with a whitish transverse stripe between cornicles and several white blotches behind the cornicles. These white stripes and blotches are produced by the powdery wax and very noticeable irregularities may be observed because of uneven removal of this wax by some external means. The dark areas in the drawing show the ground color of the body while the white areas show the powdery wax. *Cornicles*—(Figure 178 E.) Truncate, much wider at base than at tip, entirely dark brown or dusky, basal two thirds hairy. *Legs*—As in winged form. *Style*—Rounded, hairy, inconspicuous.

Nymphs and Young—Brownish-red in color, without powdery secretion.

Host—This species was found in great colonies on the bare twigs of *Thuya occidentalis*. European writers report it upon *Juniperus communis* only.

Locality—Taken by the writer at Santa Paula and Claremont, California. I am indebted to Mr. J. Neuls, a student of Pomona College, for winged specimens, which I had been unable to secure. The apterous forms are plentiful, but it took nearly three years to obtain the winged specimens, although a sharp look-out was maintained all of the time. Date of collection—March 7, 1911. Serial number 7.

This species seemed to be a new one at first, for it was hardly probable that the European species could have been first reported in America on the Pacific Coast, and not have been obtained in the Eastern states (a fact which I have not been able to ascertain). After a close study and comparison with the descriptions given in the works of Koch, Kaltenbach and Buckton, I am satisfied that this is the Juniper Aphid of Europe and has been introduced into the United States on nursery stock. Buckton gives this interesting note: "Mr. Hardy has found the black eggs on the twigs, and sometimes plentifully." "DeGeer states that the male is apterous." Mon. Brt. Aphides, III, p. 44, 1881.

Macrosiphum albifrons n. sp.

LUPINE APHID (Figure 179)

WINGED VIVIPAROUS FEMALE (Figure 180 A)

Length of body not including style 3.8 mm., width of mesothorax 0.85 mm., greatest width of abdomen 1.8 mm., wing expansion 11.02 mm., large, robust form.

Prevailing color—Grayish-green, the body proper is bright green and appears so immediately after moulting. The gray color is produced by the secretion of a fine, white, powdery wax. This powder may be thick enough to cause the insects to appear silvery. The winged forms do not secrete as much of this covering as do the apterous ones and the green body may appear through the thin coating. *Head*—Somewhat darker than the remainder of the body, nearly as long as wide. *Eyes*—Small, dark red. *Antennae*—(Figure 180 a). Situated on slightly gibbous, prominent tubercles, longer than the body, sparsely haired, dusky with

lighter areas at articulations, lengths of articles: I, 0.18 mm.; II, 0.11 mm.; III, 1.1 mm.; IV, 0.90 mm.; V, 0.8 mm.; VI, 1.6 mm. (spur 1.4 mm.); total 4.75 mm. Article III with about thirty large circular sensoria (Figure 180 a). *Rostrum*—Reaching to second coxae, color of body with dark tip. *Prothorax*—Very narrow, light green. *Mesothorax*—Light green with muscular lobes pink or amber. *Metathorax*—Slightly dusky. *Abdomen*—Nearly globular in shape (many more so than the drawing shows), lightly covered with fine, white powder. *Cornicles*—(Figure 180 c). Cylindrical, longer than style, light green with apical one-third dusky, length 0.88 mm., width at base 0.08 mm. *Legs*—Long, slender and very

Figure 179. Macrosiphum albifrons

Adult winged and apterous females on fruit clusters of Lupinus albifrons. Notice body form and the white powdery covering.

hairy, coxae color of body; femora amber with apical half dark; tibiae amber with apical tip dark; tarsi dark. *Wings*—Hyaline. *Primary*—Length 5.2 mm., greatest width 1.7 mm.; costal vein narrow; subcostal broad emerging into stigma; stigma long and narrow, length 1.1 mm., width 0.2 mm., basal half of stigmal vein sharply curved with apical half slightly curved to tip; first and second discoidals nearly straight; third discoidal with first branch arising near base at a distance from it of one-fourth from base to tip, second branch arising two-thirds distance from base of first branch to tip of second branch, all veins and stigma greenish-brown. *Secondary*—Length 3.4 mm., width 0.9 mm.; subcostal twice curved; first discoidal arising one-fourth the distance and second discoidal arising one-half the distance from the base to the tip of the subcostal. *Style*—Ensiform, two-thirds as long as the cornicles, green.

APTEROUS VIVIPAROUS FEMALE (Figure 180 B)

Length of body 4 mm., greatest width of abdomen 2.4 mm., body robust

Prevailing color Gray or silvery white due to the white powdery covering over the green body. *Head* and *thorax* Very much narrower than the abdomen *Eyes* Dark red, larger than those of winged form. *Antennae* Much longer than the body, all articles dusky except I, II and basal one fourth of III which

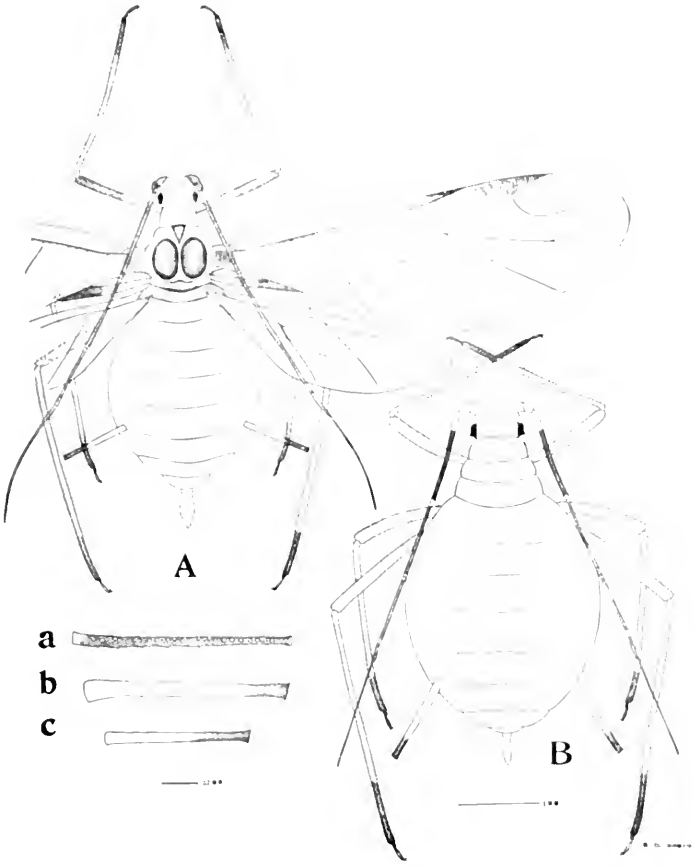

Figure 180. Macrosiphum albifrons

A, winged viviparous female; B, apterous viviparous female; a, article III of winged female; b, cornicle of apterous female; c, cornicle of winged female

are the color of the body, articulations light, lengths of articles: I, 0.15 mm.; II, 0.13 mm.; III, 1.2 mm.; IV, 0.95 mm.; V, 0.85 mm.; VI, 1.7 mm. (spur 1.4 mm.); total 4.98 mm. *Rostrum*—Reaching to second coxæ, green with dark tip. *Cornicles*—(Figure 180 b). Apical one-fourth dark, remainder green, length 1.3 mm., width 0.12 mm. at base. *Legs*—Long, slender, hairy; coxæ green; femora amber; tibiæ amber with dusky tips; tarsi dark, very small. *Style*—Ensiform, green, may be slightly dusky at marginal tip.

Young—Green and covered with the powdery wax when very small.

Host—Occurs in great colonies on the flower racemes of *Lupinus albifrons*.

Locality—Santa Paula Canyon, near Santa Paula, Cal. Altitude 700 to 1500 feet. Date of collection—May 7, 1911. Serial number 34.

This species greatly resembles *M. destructor* (John.), but is more robust, larger, and covered with the whitish powder. The abdomen of the winged form is distinctly globular and very characteristic. The abdomen of the apterous form is much wider than in *M. destructor*. It is quite effectually preyed upon by larvæ of Syrphid Flies, Coccinellids, and by internal parasites, which are very large.

Macrosiphum frigidae Oestlund

ARTEMISIA APHID

LITERATURE AND SYNONYMY

1886 *Siphonophora frigidae* Oestl., List. of Aphid. of Minn., p. 20.
1887 *Nectarophora frigidae* Oestl., Aphid. of Minn., p. 83.
1910 *Siphonophora frigidae* Oestl., Williams, Aph. of Nebr., pp. 78-9.

WINGED VIVIPAROUS FEMALE (Figure 181 A)

Length of body 2.1 mm., width of mesothorax 0.65 mm., greatest width of abdomen 0.76 mm., wing expansion 7.5 mm., medium sized species, body sparsely covered with rather long fine hairs.

Prevailing color—Very dark olive green or nearly black, shiny, iridescent green, very striking and beautifully colored, unless observed very closely will appear jet-black. *Head*—Wider than long, very dark or black. *Eyes*—Black or dark brown, medium in size. *Antennae*—(Figure 181 D). On distinct frontal (somewhat gibbous) tubercles which are very wide, as long as the body, but not reaching to tip of the style, dark throughout except the base of article III which is light, covered with many long fine hairs, lengths of articles: I, 0.12 mm.; II, 0.07 mm.; III, 0.69 mm.; IV, 0.45 mm.; V, 0.40 mm.; VI, 0.84 mm. (spur 0.7 mm.); total 2.57 mm.; at least fifteen large circular sensoria on article III. *Rostrum*—Reaching to second coxæ, black. *Thorax*—Shiny black. *Abdomen*—Little wider than thorax, deep green with metallic luster, dorsal surface with many broad shallow pits which indicate the segmentation, hairy. *Cornicles*—(Figure 181 C), Cylindrical, widest at base, imbricated, black, with one or two hairs, reaching slightly beyond tip of style, length 0.50 mm., width at base 0.13 mm. *Legs*—Coxæ dark; femora dark with light base; tibiæ with middle portion light and ends dark; tarsi dark; hairy. *Wings*—Hyaline, normally veined. *Primary*—Length 3.6 mm., width 1.25 mm.;

costal vein narrow, green; subcostal vein wide, merging into the full width of the stigma; stigma long, narrow, four times as long as broad, beautiful bright green; veins amber. *Secondary*— Length 2.2 mm., width 0.6 mm., base of the second discoidal obsolete, all veins amber. *Style* (Figure 181 D)— Ensiform or nearly cylindrical, black, little more than half the length of the cornicles, hairy, length 0.3 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 181 B)

Length of body 2.2 mm., width of abdomen 1.25 mm., robust nearly globular form, with tuberculate, hairy dorsum.

Prevailing color— Rich, dark olive green, shiny, iridescent, metallic. *Head*— Narrow, but wider than long. *Eyes*— Small, black or very dark brown. *Antennae* (Figure 181 G)— Situated on prominent frontal tubercles, reaching to tip of style, hairy, basal two-thirds of article III light, remaining dusky throughout, lengths of articles: I, 0.11 mm.; II, 0.08 mm.; III, 0.71 mm.; IV, 0.49 mm.; V, 0.4 mm.; VI, 0.8 mm. (spur 0.65 mm.); total 2.59 mm. *Rostrum*— Reaching to second coxae, black. *Prothorax*— Scarcely wider than the head. *Meso-* and *Metathorax*— Widening into abdomen so as to form a nearly globular body. *Abdomen*— Nearly as wide as

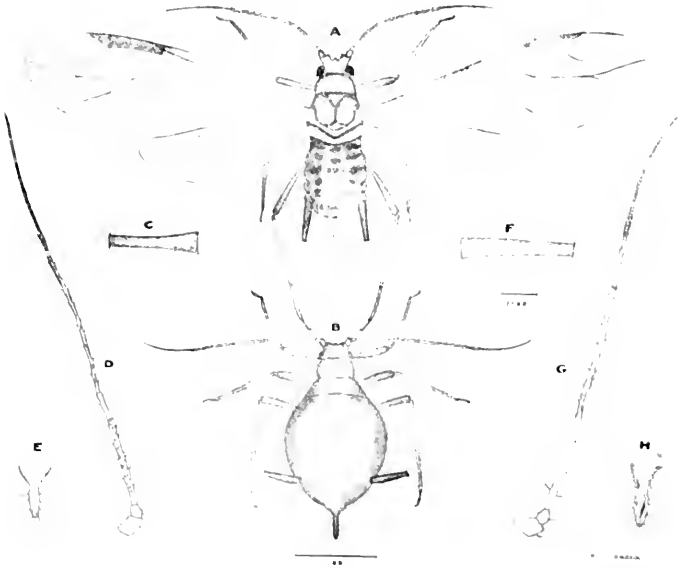

Figure 181. Macrosiphum frigidæ

A, winged viviparous female; B, apterous viviparous female; C, cornicle of winged female; D, antenna of winged female; E, style of winged female; F, cornicle of apterous female; G, antenna of apterous female; H, style of apterous female

long, rather flattened, hairy, iridescent green. *Cornicles*—(Figure 181 F). Cylindrical, slightly wider at base and tapering gradually to tip, imbricated, black, with one or two hairs as shown in drawing, carried at nearly right-angles to the main axis of the body, length 0.65 mm., width at base 0.12 mm. *Legs*—Normal, hairy, coxæ dark; base of femora light, apex dark; middle of tibiæ light, remaining dark; tarsi dark. *Style*—(Figure 181 H). Ensiform, black, half or slightly more than half as long as the cornicles, length 0.35 mm.

Young—Dark metallic green.

Male—Oestlund reports the male as small, apterous, reddish-brown, antennæ as long or longer than body, black, except base of III light. Eyes with blunt tubercles, no ocelli. Beak reaching second coxæ. Legs black with base of femora and tibia light. Abdomen longer than broad, flat above, with a row of black impressed dots above the insertion of the honey-tubes. Honey-tubes black, cylindrical, hardly twice the length of the tarsi. Style two-thirds the length of the honey-tubes. Anal plates black, upper rounded at end, lower divided into two diverging lobes or projections which are cylindrical, black and very hairy on the under surface. List. Aphid Minn., pp. 21-22. I have not obtained this form here.

Hosts—Taken in great numbers from the tender shoots of the common California Sage (*Artemisia californica* Less.) Oestlund collected it from *Artemisia frigida*.

Locality—Santa Paula, Cal., in the dry washes at the mouth of the Santa Paula Canyon. Altitude 550 feet. Date of collection—April 4, 1911. Serial number 23.

Macrosiphum laevigatae n. sp.

WINGED VIVIPAROUS FEMALE (Figure 182 A)

Length of body not including style 2.4 mm., width of mesothorax 0.49 mm., greatest width of abdomen 0.73 mm., wing expansion 7.4 mm., body very long and slender.

Prevailing color—Green. *Head*—Nearly as wide as long, pinkish or yellowish green, with base slightly darker. *Eyes*—Red. *Antennae*—(Figure 182 a). Situated on prominent frontal tubercles, the inner margins of which are nearly at right angles to the head, (tubercles very slightly gibbous), reaching far beyond tip of abdomen or tip of cornicles, articles green, except apical tips of III and IV, the apical half of V and all of VI dusky, lengths of articles: I, 0.16 mm.; II, 0.09 mm.; III, 0.83 mm.; IV, 0.77 mm.; V, 0.73 mm.; VI, 1.7 mm. (spur 1.52 mm.); total 4.28 mm.; ten circular sensoria on III. *Rostrum*—Reaching to second coxæ, light yellowish-green with dark tip. *Prothorax*—Slightly wider than the head, without lateral tubercles, darker green than head with two dorsal lighter blotches. *Mesothorax*—Light green, muscle lobes amber or pinkish. *Metathorax*—Light green. *Abdomen*—Long and slender, dark green with two lighter green longitudinal stripes extending full length on dorsum. *Cornicles*—(Figure 182 b). Very long, cylindrical, with slightly wider base and mouth, curved outwardly, green, apical one-seventh dusky and irregularly marked (Figure 182 c), slightly restricted before apex, length 1.4 mm., width 0.05 mm. *Legs*—Very long and slender, slightly hairy, coxæ light green; femora dusky with basal one-third light green;

tibiæ somewhat dusky with tips darker; tarsi very small and dark. *Wings* Long, narrow, hyaline. *Primary* Length 3.1 mm., greatest width 0.1 mm.; costal vein narrow; subcostal wide, light green; stigma long and narrow, widens from base to stigmal vein and narrows to point abruptly, length 0.8 mm., width at base of stigmal vein 0.2 mm., very light green; first and second discoidals nearly straight,

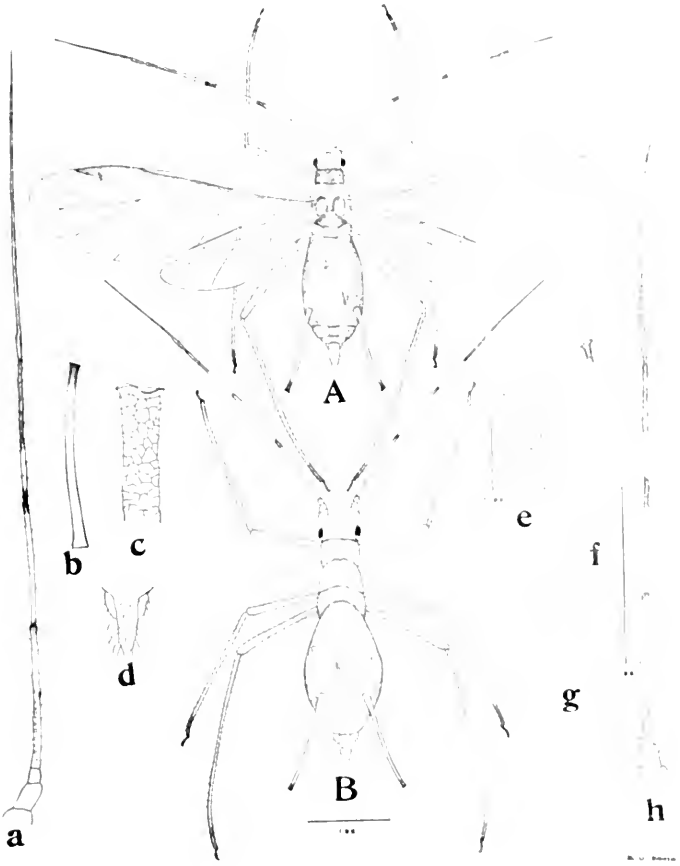

Figure 182. Macrosiphum lævigatæ

A, winged viviparous female; B, apterous viviparous female; a, antenna of winged female; b, cornicle of winged female; c, tip of cornicle of winged female; d, style of winged female; e, tip of cornicle of apterous female; f, cornicle of apterous female; g, style of apterous female; h, antenna of apterous female

curving slightly inwardly, bases far apart; first branch of the third discoidal arising one-third the distance from the base, second branch arising three-fourths distance from base of first branch to apex of second branch; all veins except subcostal dark brown. *Secondary*—Length 2 mm., width 0.55 mm., veins normal. *Style*—(Figure 182 d). Ensiform, somewhat sickle-shaped, light green, length 0.37 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 182 B)

Length not including style 2.6 mm., width of mesothorax 0.51 mm., greatest width of abdomen 0.95 mm., very long and slender body, ofttimes the abdomen is no wider than the head and thorax.

Prevailing color—Green with yellowish-green head and two such colored longitudinal stripes extending from head to tip of abdomen. *Head*—Very little narrower than thorax, lighter than rest of body. *Thorax*—Quite long and slender, general color of the body. *Eyes*—Red. *Antennae*—(Figure 182 h). Very long reaching far beyond tip of style, articles I and II yellowish, color of head; III and IV amber with dusky tips, V amber with base and apical three-fifths dusky, VI dusky throughout, lengths of articles: I, 0.19 mm.; II, 0.09 mm.; III, 0.8 mm.; IV, 0.65 mm.; V, 0.69 mm.; VI, 1.33 mm. (spur 1.1 mm.); total 3.75 mm. *Rostrum*—Reaching to third coxæ, light green with dark tip. *Cornicles*—(Figure 182 e and f). Long, cylindrical, curved slightly outwardly, wider at base and mouth, restricted just before mouth, apex dusky and marked, length 1.1 mm., width 0.05 mm. *Legs*—As in winged form. *Style*—Ensiform, green, length 0.5 mm.

Young—Very long and slender with abdomen no wider than head and thorax, green.

Host—Large colonies infesting the tender shoots of the Narrow-leaved Willow *Salix laevigata* Bebb. Apterous forms present in considerable numbers on a few trees in different localities, but winged forms scarce.

Locality—Along the streams near Santa Paula, Cal., and along the Sespe Creek. Date of collecting—April 26, 1911. Serial number 30.

Macrosiphum rosae (Linn.) Schouteden

ROSE APHID

IMPORTANT SYNONOMY AND LITERATURE

1735 *Aphis rosae* Linn., Syst. Nat., II, 734.
1737 *Aphis rosae* Reaum., Mem., V, III, 21.
1761 *Aphis rosae* L. Sulz., Ins. Tab., 12.
1773 *Aphis rosae* Linn., DeGeer, Ins. III, 65.
1791 *Aphis rosae* Linn., Fabr., Ent. Syst., 216.
1801 *Aphis dipsaci* Schrk., Fr. Boica, II, 104.
1804 *Aphis rosae* Linn., Schrk., Fr. Boica, II, 117.
1822 *Aphis rosae* Linn., Fabr., Syst. Rhyng., 298.
1843 *Aphis rosae* Linn., Kalt., Mon., Pflz., 3-4.
1855 *Siphonophora rosae* Linn-Koch, Pflz., 178-9.
1876 *Siphonophora rosae* Reaumer-Buck, Mon. Brt. Aph., I, 103-9.
1880 *Siphonophora rosae* Reaumer-Thos. 8th Rept. Ent. Ill., p. 50-1.
1887 *Siphonophora rosae* (Linn)-Oestl., Aph. Minn., p. 81.
1905 *Macrosiphum rosae* (Linn) Schout. Aph. Belg., p. 240.
1910 *Macrosiphum rosae* (Linn)-Fullaway, Ann. Rept. Haw. Exp. Sta., 25.

WINGED VIVIPAROUS FEMALE (Figure 183 A)

Length of body not including style 2.2 mm., width of mesothorax 0.6 mm., greatest width of abdomen 1.1 mm., wing expansion 9.4 mm., a large species.

Prevailing color—Green or pink, with dark dorsal markings as shown in the drawing. *Head*—Dark or black. *Eyes*—Dark red. *Antennae*—On prominent frontal tubercles, much longer than the body, dark throughout, lengths of articles: I, 0.14 mm.; II, 0.06 mm.; III, 1.3 mm.; IV, 0.8 mm.; V, 0.7 mm.; VI, 1.2 mm. (spur 1 mm.); total 4.2 mm.; article III (Figure 183 C) with very many circular sensoria. *Rostrum*—Reaching to second coxæ, light green or pinkish with dark tip. *Prothorax*—Dark. *Meso-* and *Metathorax*—With muscle lobes black, remainder light dusky. *Abdomen*—Smooth, shiny, with lateral dorsal black spots and a few median ones; these may vary in size and distribution. *Cornicles*—(Figure 183 E). Long, cylindrical, wider at base and restricted just before apex (the restricted area marked as shown in drawing), dark throughout, length 1.2 mm. *Legs*—Long, slender, hairy, coxæ pale or dusky green or pink, depending upon whether the body is green or pink; femora with apical portions dark; tibiæ dark at extreme bases and the apical tips; tarsi dark. *Wings*—Normal, hyaline. *Primary*—Length 4.4 mm., width 1.5 mm., costal and subcostal veins wide, pale yellowish green; stigma long and narrow, opposite sides nearly parallel, length 1.2 mm., width 0.13 mm., pale yellowish-green in color; veins amber (see drawing for venation). *Secondary*—Length 2.5 mm., width 0.7 mm. *Style*—(Figure 183 G). Ensiform, length 0.5 mm., width at base 0.2 mm., lemon yellow in color.

APTEROUS VIVIPAROUS FEMALE (Figure 183 B)

Length of body not including style 2.7 mm., width of abdomen 1.75 mm., a large and long body.

Prevailing color—Pale green or pink throughout. *Head*—Wider than long, apical portion dusky, basal light. *Antennae*—Situated on large, prominent, frontal tubercles, reaching beyond tips of the cornicles, articles I, II and VI dusky throughout, III light with extreme tip dusky, IV with both base and tip dusky, V with slight light area in middle only, lengths of articles: I, 0.14 mm.; II, 0.08 mm.; III, 1.1 mm.; IV, 0.72 mm., V, 0.58 mm.; VI, 1 mm. (spur 0.8 mm.); total 3.62 mm.; article III (Figure 183 D) with from ten to twelve circular sensoria. *Rostrum*—Reaching to second coxæ, lemon yellow with dark tip. *Thorax* and *Abdomen*—Shiny, without marking or with very few. *Cornicles*—(Figure 183 F). Cylindrical, long, narrow, reaching nearly to tip of style, extreme base may be color of body, remainder dark with a lighter spot near the tip just in front of the constricted and mottled area shown in the drawing, length 2.3 mm., width 0.19 mm., cornicles of all forms curved slightly outwardly. *Legs*—Long and slender, hairy, coxæ color of the body; femora with apical one-third dark; tibiæ amber dark at apical ends; tarsi dark. *Style*—(Figure 183 H). Ensiform, very light lemon yellow, length 0.62 mm., width at base 0.25 mm.

Host—Infesting the tender tips and buds of all roses, wild and cultivated.

Locality—Throughout the State. Taken by the writer in Humboldt, Sacramento, Los Angeles, Santa Barbara and Ventura Counties. Date of collection—Santa Paula, Cal., April 8, 1911. Serial number 3.

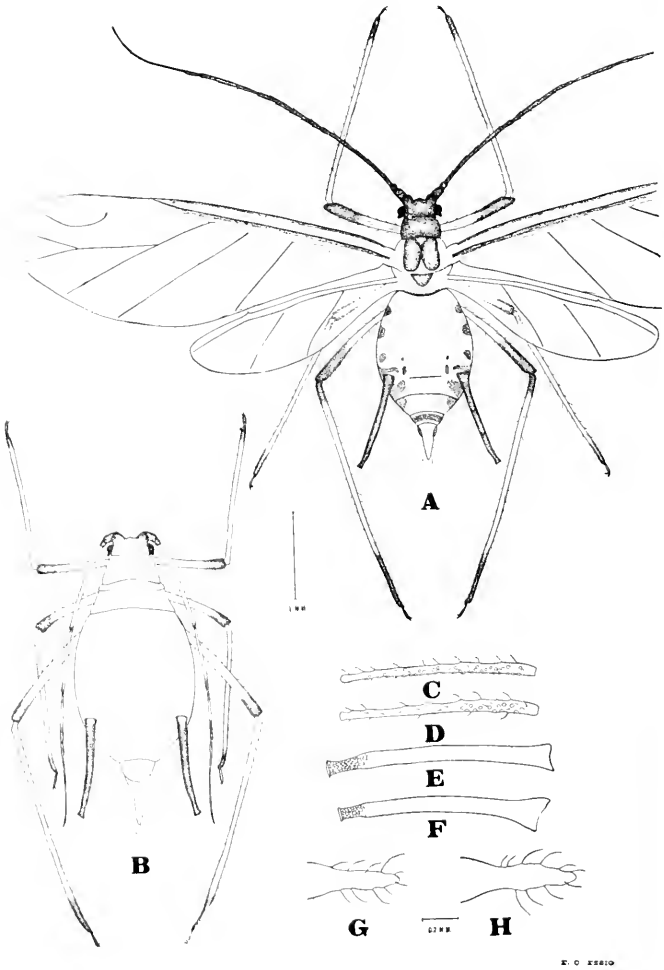

Figure 183. Macrosiphum rosæ

A, winged viviparous female; B, apterous viviparous female; C, antenna of winged female; D, antenna of apterous female; E, cornicle of winged female; F, cornicle of apterous female. G, style of winged female; H, style of apterous female.

Pemphigus fraxini-dipetalae n. sp.

(Figure 185)

CALIFORNIA MOUNTAIN ASH LOUSE

WINGED VIVIPAROUS FEMALE (Figure 186 A)

Length of body 3.50 mm., width of mesothorax 1.15 mm., greatest width of abdomen 1.75 mm., wing expansion 12.00 mm., very large species.

Prevailing color—Black, abdomen covered with long bluish white flocculence, which extends posteriorly. *Head*—Black, much wider than long, narrower than prothorax. *Eyes*—Dark red or brown, nearly black. *Antennae* (Figure 186 D)—Six-articled, reaching just beyond metathorax, brownish black in color, very few hairs, length of articles: I, 0.4 mm.; II, 0.14 mm.; III, 0.63 mm.; IV, 0.32 mm.; V, 0.35 mm.; VI, 0.37 mm., (unguis 0.08 mm.); total 1.91 mm.; sensoria large,

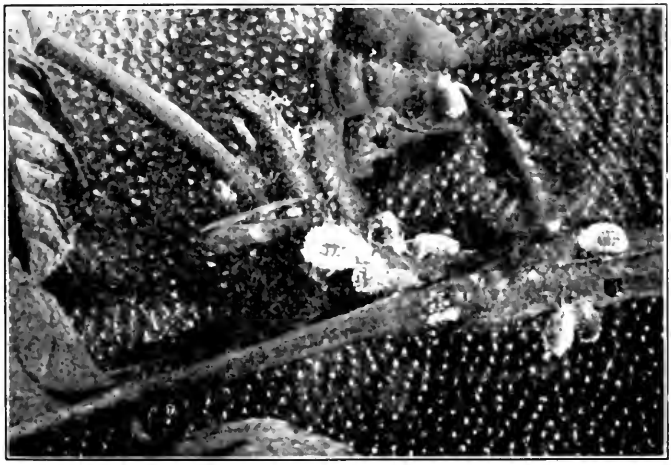

Figure 185. Pemphigus fraxini-dipetalæ

On twigs of Fraxinus dipetala. Note the winged viviparous female and flocculently covered nymphs

transverse, twelve on article III, three on IV, usual number on V and VI. *Rostrum*—Reaches just to metathorax, light yellowish with dark base and tip. *Prothorax*—Very dark brown or black, three times as wide as long. *Mesothorax*—Very black, muscle lobes well developed and shiny. *Metathorax*—Black, short. *Abdomen*—Of living specimens very dark green or black, (in mounted specimens it may appear brown, orange or yellowish due to bleaching), covered with long bluish-white flocculence which is thickest posteriorly and decreases towards the base, where there is scarcely any, wax glands not distinct, row of small dark

spots, each of which bears one or two hairs on lateral dorsum, (these do not show in fresh specimens, because the color is so dark), there are usually seven spots in each row. *Legs*—Stout, hairy, black throughout. *Wings*—Dusky throughout. *Primary*—Length 1.51 mm., greatest width 1.54 mm.; costal vein well developed, black, quite broad at base; subcostal wide, black; stigma nearly four times as long as broad, oposite sides nearly equal and parallel, black, darker along lower border, length 1.1 mm., width 0.3 mm.; stigmal vein arising two-thirds distance from base of stigma to apex, sharply curved throughout basal third with remaining apical third straight, brown; third discoidal straight, obsolete at base, arising quite distant from second discoidal; second discoidal arising near base of first discoidal (distant 0.19 mm.), first half straight, latter half curves inwardly as it approaches wing margin; first discoidal curves slightly outwardly, both veins brown. *Secondary*—Length 3.2 mm., width 0.96 mm.; subcostal vein deeply curved at the junction of the discoidals, so sharp as to make it appear that the second discoidal was a continuation of it, brown; discoidals arise from a common short or narrow brown spot, bases may be close or approximate as shown in drawing (they may even arise from the same point); first discoidal curved outwardly, second discoidal nearly straight. *Style*—Obsolete, rounded, hairy.

LARVAE OF THE WINGED VIVIPAROUS FEMALE (Figure 186 C)

There were to be found only a very few of the apterous stem-mothers, but these few were giving rise to great colonies of the winged forms. The very young are reddish brown to very light yellow in color, naked. The legs are large—nearly as large as in the mature forms. Rostrum reaching far beyond the end of the abdomen. At the base, and in front of the antennæ, are two anterior lobes which are very noticeable in the mounted specimens. In the very young the antennæ consist of four articles as follows: I very large but poorly defined and scarcely annulated, short; II twice at long at I; III as long as I, II and IV together; IV half as long as III. The drawing shows a more advanced stage.

NYMPHS OF THE WINGED VIVIPAROUS FEMALE (Figure 185)

By far the greatest numbers of individuals present are the nymphs, which with their cottony coat appear to be the apterous forms. As shown in the photograph, they are entirely, or nearly, covered with long white flocculence. This flocculence is arranged in rows, each row having a large number of individual patches. In the younger stages these patches show the flocculence to be arranged so as to form whorls. In the advanced stages the appearance of these whorls is destroyed. The color of the bodies is very varied and may be pink, rose, amber, yellow, or slate. In every case the color is constant for each individual. *Antennae*—Normally VI-articled, which are colored as follows: I and II color of body, III and IV color of body with dusky tips, V and VI dusky throughout. *Rostrum*—Reaching to the third coxæ, apical one-half dusky. *Legs*—Dusky, articulations and tarsi darker. *Cauda*—Dark.

APTEROUS VIVIPAROUS FEMALE (Figure 186 B)

Length of body 3.75 mm., greatest width of abdomen 3.6 mm., very globose in shape.

Prevailing color Very dark brown or black throughout, nearly shiny, with very little or no powdery covering, and no flocculence. *Head* Very small, half as wide as the thorax. *Antennae* (Figure 186 E) Reaching just beyond thorax, black, hairy, lengths of articles: I, 0.12 mm.; II, 0.15 mm.; III, 0.26 mm.; IV, 0.18 mm.; V, 0.16 mm.; VI, 0.22 mm. (unguis 0.01 mm.); total 1.09 mm. *Rostrum*

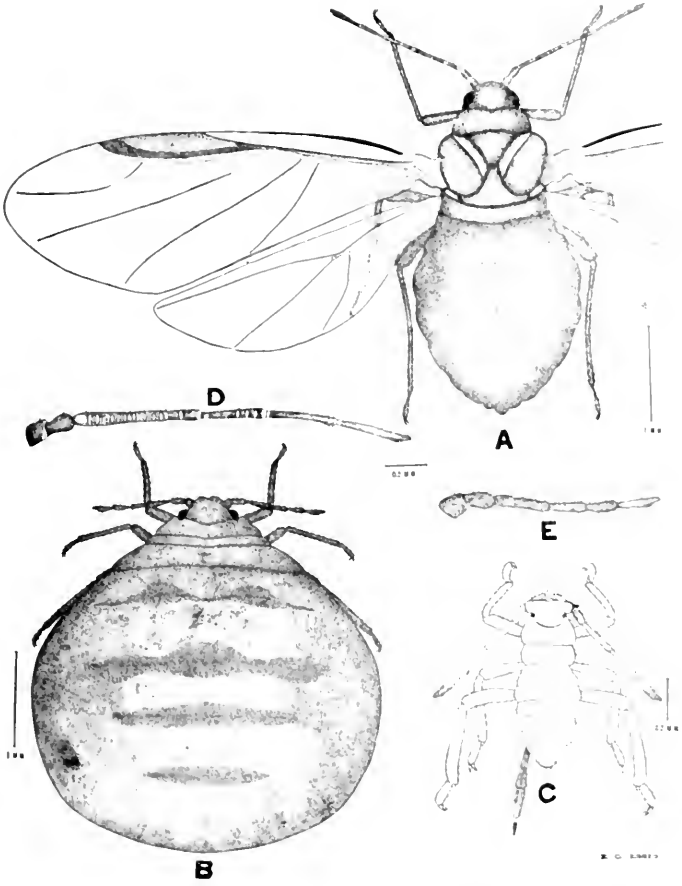

Figure 186. Pemphigus fraxini-dipetalæ

A, winged viviparous female. B, apterous viviparous female, stem mother. C, young winged viviparous female. D, antenna of winged female. E, antenna of apterous female.

Reaching to metathorax, lemon yellow, dusky at tip. *Thorax*—Gradually widens from prothorax backwards, segments compact and pushed up dorsally to form transverse lobes. *Abdomen*—Globular, as wide as long, several transverse depressions on dorsum, smooth. *Legs*—Short, stout, hairy. *Style*—Rounded, hairy, not visible in more robust forms, but distinct in smaller individuals.

Apterous females are very scarce and I was able to obtain but a very few. Those found were in the curled leaves and producing great numbers of young. They appear to be true stem-mothers.

Host—On Mountain Ash (*Fraxinus dipetala* H. & A.). Winged forms and nymphs were found feeding on the undersides of the leaves, which they curled into knots of various shapes, upon the stems of the younger growth, at the bases of the suckers and hidden by the decayed and fallen leaves, while some forms were taken around the trunk of the trees at quite a depth underground. The nymphs, especially, were often found in large colonies on the young stems. The few adult apterous forms were found only within the masses of curled leaves, which usually occur at the tips of the new growth.

Locality—The infested ash trees are located on the north slope of the mountains, six miles north of Santa Paula, at an elevation of from 1000 to 2000 feet. Date of collection—May 7, 1911. Serial number 33.

This species differs from *Pemphigus fraxinifolii* Thos. in the following:

Pemphigus fraxinifolii Thos.	Pemphigus fraxini-dipetalae n. sp.
Wings—Transparent with mealy white tinge.	Dusky, with bluish tinge, transparent.
Third discoidal vein arising near base of second, almost invisible, not obsolete at the base.	Third discoidal not arising near base of second, plainly visible and distinct, obsolete at base.
Obliques in hind wing connected.	Obliques in hind wing arising from a common dark spot, their bases may be at a common point or somewhat distant.
Wing expanse 5.7 mm.	Wing expense 12. mm.
Body—Length of body 2 mm. Abdomen dark green, with large roundish spots on each side.	Length of body 3.5 mm. Body almost or black, side spots very small.
Antennae Article III of winged form as long as IV and V together.	Article III of winged form not as long as IV and V together.
Medium in size.	Very large.

APHID SYNONYMY

In connection with the Host Index to California Aphididae and the synonymy of the genera and species, it was stated that all additions and corrections would be added as fast as possible. I am therefore taking this opportunity to make the first additions and corrections.

In a letter from Mr. John Davis he called attention to the following:

First That *Calaphis betulaecolens* Fitch is wrong in that the species *betulaecolens* does not belong to this genus, it being a fact that only the species *betulella* Walsh belongs to the genus *Calaphis*.

Second—Regarding *Monellia caryae* (Mon.) Gill. This species does not belong to this genus, but was placed there by mistake—the only species belonging to this genus being *caryella* Fitch.

Third—*Megoura solani* is not a synonym of *Myzus persicae* (Sulz.), but a good and distinct species.

Fourth—That *Pemphigus vitifoliae* Fitch should have priority of *P. vastatrix* Planch., because it was so described twelve years before the latter.

Fifth—That it has never been positively proven that *Lachnus dentatus* Le Baron is a synonym of the European *Lachnus viminalis* Boyer.

I believe that this information will be valuable to all workers of this group and wish to state that if all would send criticisms and suggestions such as these from Mr. Davis the work would soon be placed upon a more certain and definite basis. It is my sincere wish that no mistake shall go without immediate correction and always extend an invitation for corrections such as the above.

NOCTUIDÆ OF CALIFORNIA III
(Pantheinæ, Raphia and Acronycta)

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The little group of genera here included are generally considered together, although the *Pantheinae* are almost as well separated from the *Noctuidae* proper as these are from some of the allied families. *Raphia* is, however, a distinctly intermediate form in many characters, and for practical purposes warrants the present association.

The Californian species are not well known, and it is very likely that the list will be materially increased when proper collecting has been done. None of the species here considered come freely to light, nor are they easily seen or taken by the casual or general collector. They do not come to sugar; are rarely seen on flowers and, except when bred, are generally "accidental" captures, being noted on tree trunks, fences or stones, at rest during the day.

The larvæ are usually quite striking in appearance, altogether unlike the cut-worm type, open feeders and not difficult to rear. A really good and representative collection of the species of *Acronycta* cannot be secured except by breeding.

So far as eastern collections go, the representation of Californian species of *Acronycta* is extremely scant. None of the species are really well represented, and most of them have a few specimens only. The collections made many years ago in the Sierra Nevada region by Henry Edwards, form the backbone of our present knowledge of the California fauna, and nearly all the described species are based on insufficient material. There are two distinct elements represented: one that comes down the mountain ranges from British America and does not extend much if any south of Central California; the other a continuation of the desert fauna of Arizona and New Mexico, which extends to the coast and probably through a considerable part of the desert area of southern and southeastern California.

During the decade or two last past, our knowledge of the *Noctuid* fauna of Vancouver, Washington and Oregon to the north and of Arizona to the east and southeast, has increased out of all proportion to that of California. Some mountain sections of the State are almost absolutely unknown, entomologically, and from the San Diego region I have recently had a lot of specimens for determination that makes me feel that practically all the Arizona desert species may be expected from it.

(Since writing the above I am informed that the specimens sent me really come from east of the mountains, yet not over ninety miles directly west of San Diego.)

Pantheinæ.

This sub-family, termed *Mominae* by Hampson, differs essentially from the remainder of the *Noctuidae* by having vein

V of the secondaries as well developed as any other, and arising from the median vein close to IV. It is therefore typically quadrifid, although differing altogether in habitus from the quadrifid section of the more typical *Noctuidae*. The habitus is rather that of the *Notodontidae* and some of the species resemble these very closely in type and maculation. Other *Notodontid* characters are the short, rather weak, thorax, the longer, cylindrical abdomen of the female, the retracted head in which the tongue tends to become aborted and, except in *Meleneta*, the pectinated antennæ of the male (and sometimes female) in which the joints are short and the branches in consequence are very closely approximated. All the genera typically referred here have hairy eyes, and this combination of venation, hairy eyes and *Notodontid* habitus, makes the sub-family an easily recognizable one.

Four genera are recognized in the American fauna, north of Mexico:

Tongue short and weak, useless for feeding.

Antennæ pectinated in the male, simple in the female.

Primaries trigonate, inner and outer margin approximately equal in length. *Panthea*

Primaries more abruptly widening at base; apices more obtuse; inner margin longer than outer. *Demas*

Tongue moderate, useful for feeding.

Antennæ pectinated in both sexes; though shortly in female. *Charadra*

Antennæ merely thickened in the male. *Meleneta*

Demas has no representative on the Pacific Coast so far as we know at the present time, all but one of the species thus far known occurring on the Atlantic slope. *Demas palata* Grt. occurs in Colorado and Arizona, and it is not unlikely to occur in Southeastern California. It is easily the prettiest species of the genus with its clear black and white powderings, and the narrow black lines that resemble the ornamentation in *Raphia* most nearly.

Panthea is, on the whole, more northern in distribution, and extends to the Pacific Coast: *P. portlandia* Grt., having been taken in Oregon and Washington, as well as in Vancouver and elsewhere in British Columbia. It is not improbable that this species also will be found in Northern California and it may be differentiated from the other species of the genus by its whitish gray, ground color, the transverse lines broad and diffuse, and the reniform spot obvious.

No representative of the genus *Charadra* has been taken nearer than Texas, nor is it known from any point west of the Rocky Mountains.

The *Charadra decora* Morr., described from California, is Mexican, but may occur in Lower California and almost certainly does in Arizona.

Meleneta is from the Huachuca Mountains in Arizona, and may perhaps occur in the desert areas of Southern California. The habitus and type of maculation is somewhat as in *Charadra*, or rather intermediate between that and *Raphia*.

Raphia Hbn.

For convenience the genus *Raphia* may be considered here because of its habitual and even structural resemblance to the other genera more strictly referred

to the *Pantheinae*. The secondaries have vein V as strong as the others, but there is a tendency to remove it further from IV, and from its strong and direct association with the median. The head is retracted, small, front flattened, the tongue short and weak though perhaps useful for feeding; but the eyes are naked, unlike those of the Pantheid genera, which are hairy. The thorax is short and quadrate, the legs weak and short, and the general resemblance to the Notodontid structures quite as strong as in *Demas*. The antennae of the male are pectinated, while those of the female are simple.

Six nominal species have been described of which two, *abrupta* and *frater*, occur in the Atlantic coast; but extend west to the Rocky Mountain region and through British America, almost across the continent; *frater* being the most abundant and widely distributed. A series of very much paler, more powdery forms, with the general type of maculation of *frater*, makes its appearance in the foothills of the Rocky Mountains in Colorado, and extends to the south and southwest into New Mexico, Arizona and Southern California. These are *coloradensis* Cram., *elbea* Sm., *pallula* Hy. Edw., and *cinderella* Sm.

Of these the latter only is known to occur in California, and all my examples are from Los Angeles County.

Cinderella is at once the smallest, most evenly colored and least contrasting of all the species. It is a pale, powdery, ashen gray, with all the normal markings present; but all powdery and diffuse—none of them sharply defined or contrasting. There is no connection between the median lines and the lower part of the median space is no darker than the rest of the wing.

I should expect to find *pallula* and probably *elbea* as well, in California.

ACRONYCTA

Species of moderately robust form, tending to become slight in the smaller species. Head tending to become sunken, front flat or only convex, tongue moderate in length, tending to become soft and without function, palpi moderate or rather short, usually reaching about the middle of the front, eyes naked and without lashes. Thorax almost quadrate, without tuftings, vestiture a mixture of flattened hair and scales, tending to hairy. Abdomen untufted, reaching to or exceeding anal angle of secondaries and usually rather large in proportion to thorax. Legs moderate in size, tibiæ not spinose, anterior without armature at tip.

The primaries vary quite a bit in form, ranging from broadly trigonate to narrow, almost lanceolate, so that sections of the genus may be conveniently based on the difference. There is a certain uniformity of color and maculation which renders the species rather easily recognizable, independent of structure. The ground color is almost always of some shade of gray, ranging from almost pure white with a scant powdering of black, to an almost black suffusion over the entire surface. The maculation is always in black, almost always more or less broken, and many species have short black dashes crossing the t. p. line opposite the cell or anal angle, which has given the term "dagger moths" to the members of the genus.

The species of this genus were monographed by myself in the Proc. U. S. Nat. Mus. Vol. XXI, in 1898, and Dr. Harrison G. Dyar supplied descriptions and a classification of the then known larvæ. In 1909, Sir George F. Hampson described the species of the world in Vol. VIII of his Catalogue of the species of *Noctuidae* in the British Museum, and Dr. Dyar there adds further information on the early stages in that publication.

The species included here are those that are recorded as from California in the publications above cited, with a very few additions of species almost certain to occur within the State.

My own collection is very deficient in California material.

1.	Primaries evenly trigonate, outer margin oblique, apices somewhat drawn out; markings tend to break up into spots or blotches on transverse lines; *psi* marks prominent	2
	Primaries abruptly widening at base, apices rectangular or a little rounded, outer margin a little arcuate; vestiture smooth, *psi* or dagger marks prominent.	7
	Primaries broader, more evenly trigonate, apices rectangular, outer margin more even; vestiture rough or squammose, *psi* or dagger marks wanting	9
	Primaries short, trigonate, stumpy in appearance	10
	Primaries longer, narrow, subequal, apices rectangular or a little produced	11
2.	No longitudinal basal dash, line or streak	3
	A longitudinal black basal line, not joined to t. a. line	4
3.	Secondaries yellowish white in male, smoky yellow in female; primaries with an ochreous tinge; a dagger mark opposite anal angle, defined and crossing t. p. line	*hastulifera*
	Secondaries grayish white in male, smoky gray in female; primaries bluish ash gray; dagger mark opposite anal angle less distinct and does not cross t. p. line	*hesperida*
4.	Primaries with ground color white, maculation tending to obsolescence	*felina*
	Primaries with ground color blue gray	5
	Primaries with ground color ash gray	6
5.	Orbicular and reniform both present	*frigida*
	Orbicular absent, reniform present	*cyanescens*
6.	Black powdered, veins somewhat smoky, giving a strigate appearance	*pacifica*
7.	Internal margin of primaries darkened by a black shading from base below the dash, to the t. p. line	*mansueta*
	Internal margin concolorous	8
8.	Very dark, even blue gray, t. a. line scarcely traceable, t. p. line and dashes distinct	*tritona*

Paler, with a reddish tinge, transverse lines distinct, a quadrate black patch between ordinary spots *quadrata*

9. Dark ashen gray, washed with smoky; black shadings tend to become strigate *liturata*

Bluish white, markings black, so that primaries appear marbled *marmorata*

10. Primaries blotchy black and white, all the normal *Noctuid* markings present; secondaries smoky yellowish *noctivaga*

11. Maculation of primaries normal, median lines in usual relation to each other, black basal marks present; disc of thorax not uniformly blackish *perdita*

Disc of thorax blackish; t. a. line of primaries unusually remote from base, median lines abnormally close together, no black basal marks *othello*

Acronycta hastulifera S. & A.

This is a large species, expanding up to two inches in the female, smooth, evenly whitish gray with a creamy tinge, all the maculation easily traceable but not contrasting. There is no basal streak, but a neat little black dash crosses the t. p. line opposite the anal angle.

The species has a wide distribution, extending from the Atlantic to the Pacific; but is by no means common. I have male and female from California without specific data, and these do not differ from a bred pair from the Atlantic Coast. The species was not known to Hampson in 1909, and is not generally represented in collections. The larvæ feeds on alder and has been described and figured.

Acronycta hesperida Smith

This is even a larger species than *hastulifera*, the female reaching two and one-half inches in expanse. It is blue gray in color, very powdery, with all the maculation powdery and diffuse, broken and not contrasting. There is no dagger mark crossing the t. p. line opposite the anal angle, but there is a little black marked angle in the line that indicates its usual position.

This seems to be a Pacific Coast species, extending northward into British Columbia and eastward to Manitoba. Exact Californian localities are not available, but the Sierra Nevada Mountains are indicated.

The larvæ of this species also is known and is said to feed on alder.

Acronycta felina Grt.

This is a moderate sized, rather narrow winged species, the female reaching an extreme of nearly two inches. The ground color is white with a yellowish tinge and the maculation is not well marked. There is a narrow, slightly sinuous basal line, the t. a. line is indicated on the costa, and the t. p. line is continuous across the wing, consisting of an almost continuous paler shading, followed by a slightly darker one. Slender, inconspicuous black lines or daggers cross the

t. p. line opposite the cell and anal angle. The orbicular is elongate, pointed, slightly defined; the reniform is a dusky, lunate spot.

The type locality is Sierra Nevada, California, and the species is rare; most of those standing under that name in collections being erroneously determined. There are none in my collection.

The larvæ is said to feed on poplar.

Acronycta frigida Sm.

Similar to *felina* in general type of maculation, but decidedly blue gray in ground, with all the maculation represented more clearly and cleanly marked. The t. a. line is at least indicated and the t. p. line is obvious throughout. The basal black streak is obvious and there is a line of black scales in continuance, joining it to the black streak crossing the t. p. line, which latter streak continues across the terminal space to margin above anal angle. The black dash crossing the t. p. line opposite the cell is equally distinct, and both orbicular and reniform are well marked.

The type localities are Truckee and Sierra Nevada, California, and the species seems to be rare. The larvæ is said to feed on willow.

Acronycta cyanescens Hamps.

Resembles *frigida* so closely that I had considered it identical. It is, however, much more powdery and obscure, the markings diffuse and ill-defined, the daggers crossing the t. p. line less obvious, the orbicular wanting. I am inclined to consider the latter character variable, and quite expect that well marked examples will have this mark at least traceable.

The type locality is Vancouver, and my own single example is from Victoria, British Columbia; but I have little doubt that the species will be found to extend down the coast, and into California along the mountain ranges.

Acronycta pacifica Sm.

Rather a smaller and more fully marked species than the three just preceding. The ground color is pale, but the surface is densely black powdered and the veins are black marked, so that the insect has a strigate appearance, which is especially marked beyond the t. p. line. The basal streak terminates at the t. a. line and has an obvious tendency to fork, as in the more eastern *Cinderella*. Both dagger marks crossing the t. p. line are obvious but no conspicuous, and both orbicular and reniform are present.

The type locality is Sierra Nevada, California, and besides the types I know of no other examples at present.

Acronycta mansueta Sm.

This is a smaller, broader-winged species than any of the preceding, the ground color of a smooth, even, pale blue gray. All the ordinary lines and marks are obvious, but not contrasting, the distinctive feature being the broad, blackish shading along the inner margin. This extends from base to outer margin, but is broken before the t. p. line. It is quite similar to *falcula* in general type of

maculation but differs from all other related forms by the shading just described. The secondaries are white.

The species seems not rare and has been recorded from Los Angeles County, Nevada County, and Sierra Nevada, California.

It expands not quite one and one-half inches.

Acronycta tritona Hbn.

This is even shorter and more obtuse-winged than *mansueta*, with very dark blue gray primaries and dull, smoky yellowish secondaries. The t. a. line is practically wanting, the median shade is marked over the costal area, and the t. p. line is distinct across the wing, outwardly shaded with black and crossed opposite anal angle by a conspicuous black dash. There is a short black streak which tends to become furcated. Both orbicular and reniform are incompletely marked.

This is a wide-spread though hardly a common species: it ranges along the Atlantic Coast from Maine to Florida and has been reported across the country to Portland, Oregon, and the Pacific Coast generally. I have no Californian examples myself and no definite localities within that State are reported so far as I know.

The larvæ feeds on Vaccinium.

Acronycta quadrata Grt.

This is a striking species, expanding about 1.75 inches, broad-winged but with distinct apices, very pale bluish gray in color, with distinct maculation and conspicuously contrasting black marks as follows: a broad basal streak, terminating against basal line; a quadrate patch between orbicular and reniform, a short broad streak from the outer portion of t. p. line nearly to hind angle. The t. p. line is outwardly shaded with black, and the median shade is diffuse and brownish. Altogether a very easily recognizable and unmistakable species.

I have only one Californian example, without date or definite locality, and no definite records as to distribution within the State seem available. In British Columbia and in Alberta it occurs in July and seems not rare.

Acronycta liturata Sm.

This is a dark ashen gray species, the primaries washed with smoky blackish, the secondaries white. The wings are rather elongate, of moderate width only, and the apices are well marked but not drawn out. The normal maculation is all present but obscure and diffuse, a blackish shade extends through the submedian interspace the full length of the wing, and a less obvious shading extends outward from the orbicular. The latter is characteristic, round, pale, with a round, dark central spot. The species expands nearly two inches and is very readily recognizable.

It is perhaps a question whether this species actually occurs in California; but I have seen it from Oregon and have had a doubtful Californian reference, which may justify noting the insect in this connection.

Acronycta marmorata Sm.

Similar in type of maculation to *liturata;* but decidedly smaller, the pale shadings nearly white, so that the insect seems marbled. The mottling is less

powdery and diffuse and the longitudinal shadings are absent. The rather large, white, round orbicular, with its small dark central spot, is characteristic and helps to define the species; the secondaries are soiled whitish.

The type locality is Folsom, California, and my example is dated May 7, 1885. It may be accounted rare.

Acronycta noctivaga Grt.

This is a comparatively small species, with stumpy primaries, the maculation a contrasting mottled black and white. The orbicular is small, round, black ringed, with a blackish central dot; the reniform is large, blotchy, not sharply defined. In general type of maculation it is not unlike *lituratа*, but in all points more contrasting and less diffuse. The secondaries are smoky, with a yellowish tinge in both sexes. The average expanse is about one and one-half inches or a little less, and the larvæ are somewhat general feeders on low bushes.

I have no definite California locality for this species; but it has been recorded from Portland, Oregon, and New Mexico, and is of general occurrence throughout the Eastern and Central United States; therefore Northern California is at least not improbable.

Acronycta perdita Grt.

In this species the primaries are again more narrow and somewhat elongated, with somewhat pointed apices and oblique outer margin. The ground color is a dark blue gray and the maculation is black, diffuse, tending to become strigate. There is a dusky shading from base to outer margin throughout the lower half of wing, none of the transverse lines are completely marked, and the ordinary spots tend to become obscure or to disappear especially the orbicular.

There is more difference than usual between the sexes: In the male the secondaries are almost pure white, the primaries distinctly narrow and pointed, the maculation diffuse throughout. In the female the secondaries are smoky throughout, the primaries decidedly broader, apices less marked, and maculation better defined. The females expand two inches or more; the males usually a little less. The larvæ is reported as feeding on alder, etc.

Sierra Nevada is the only California locality, and from that point it extends northward into British Columbia. I have it from Oregon and Washington as well; but it seems nowhere common.

Acronycta othello Sm.

Differs markedly in many respects from all the other Californian species. The primaries are narrower and more pointed in both sexes, although broader in the female than in the male. The median lines are very close together so that, with the broad, diffuse median shade, the lower portion of median space is almost continuously dark. The basal and terminal area are dark blue-gray without conspicuous maculation, and contrast oddly with the contracted median space. The thoracic disk is uniformly blackish, and that shade extends over the collar and to the front. In the male the secondaries are white, in the female they are smoky with a blackish tinge. Expanse as in *perdita*.

The only specimens known to me are from San Diego, California, and were sent in by Mr. George H. Field.

Merolonche Grt.

This has the same general appearance as *Acronycta*, but the vestiture is coarser, more divergent, and this gives the species a heavier appearance. The head is small, rather closely applied to the thorax, front a little protuberant, eyes small, tongue weak and useless for feeding, antennæ shortly pectinated toward base in the male, simple in the female. Altogether, while the habitus is unmistakable, the structural differences from *Acronycta* are strongly marked.

There are only three species thus far known and these in such small series that they can scarcely be said to be well known. In my synopsis of the species in 1898, I separated them as follows:

Median shade line distinct, angulated, forming the most prominent feature of the primaries; ordinary spots obsolete — *spinea*

Median shade line subordinate or wanting; ordinary spots present

Less powdery; all the ordinary markings fairly evident; with a vague yellowish tinge — *lupini*

Densely powdered, obscuring the ordinary markings; total impression a bluish ash gray — *ursina*

I had only the types of *spinea* from the Edwards collection, seven examples of *lupini*, and a series of *ursina* from Colorado, with which I associated three examples from Sierra Nevada, California, rather doubtfully.

In 1909, Hampson, in his catalogue, makes quite a different separation while making no suggestion of an error in the identification on my part. He writes:

A. Forewing with strong black medial diffused line — *lupini*

B. Forewing with the medial shade indistinct

a. Forewing thickly irrorate with black — *ursina*

b. Forewing suffused with purplish gray — *spinea*

Hampson had of *lupini* three types from the Grote collection; of *ursina*, two females from British Columbia and Colorado, of *spinea* three examples—types—from the Grote collection. All the *lupini* and *spinea* came originally through Mr. Henry Edwards and Mr. Grote labeled all the specimens "type", some remaining in the Edwards collection, now in the American Museum of Natural History; the others going with his collection to the British Museum.

It appears from the above that the species are variable, especially in so far as the median shade is concerned, Hampson finding it indistinct in his three examples of *spinea*, while in my seven it stood out strongly as compared with the same ornament in *lupini*. A better difference is, perhaps, that in *spinea* the ordinary spots are only indicated at best, or entirely absent; while in *lupini* they are well defined. Neither of the species is known in the larval stage.

Ursini Smith, was described from Colorado, and is recorded by Hampson from British Columbia. I have California examples, from the Sierra Nevada, which I believe to be the same; but there is at least a doubt, and a thorough collecting for the species of this genus should give interesting and important results.

Arsilonche Lederer

Moderately stout species, resembling *Leucania*, with fine hairy vestiture, rather narrow, somewhat pointed primaries which bear no trace of transverse maculation. The head is not so large as in *Acronycta*, yet scarcely retracted, and the eyes are of good size. Tongue weak, not used for feeding, palpi small, antennæ simple in both sexes. Thoracic vestiture close, forming no tufts.

The only Californian species is *A. alborenosa* Goeze, which occurs throughout Europe and the United States. In color the wings are very pale luteous gray, fading to almost white, the veins are whitish, margined with slate gray, the intervening spaces of the ground color. A more prominent slate-gray streak runs through the sub-median interspace from the base, fading out toward the margin, another starts in the median cell and widens outwardly, becoming diffuse. The secondaries are white or whitish, and the species average an expanse of 1.50 inches.

There is considerable variation in the depth of ground and in the relative distinctness of the longitudinal markings; but the general appearance of the insect is remarkably constant.

The larvæ is said to feed on grasses, smartweed and willow. It is an early species and California examples are dated from January to March.

The American form was described as distinct by Grote, as *A. henrici*, but practically every student who has compared series from the European and American faunal districts in early and adult stages has united the two. In his recent catalogue Hampson again separates them, differentiating the American form by the somewhat more acutely produced primaries, while the streaks and irroations are said to be bright red-brown as against darker brown for the European form. Neither of these characters is constant although, as a rule, the European specimens are more dull in appearance—in which respect this species agrees with most others which are common to both countries. In the east the larvæ sometimes appear in very large numbers, although scarcely as an economically important species.

A NEW SPECIES OF CICADIDÆ

W. L. DISTANT, LONDON, ENGLAND

Rihana Bakeri n. sp.

Head with the front black and a small ochraceous spot at apex, vertex ochraceous with a large transverse black maculate fascia; ocelli red; pronotum ochraceous, a central longitudinal fascia angularly dilated anteriorly and posteriorly, and the furrows, black; the anterior margin narrowly and the posterior margin broadly, pale ochraceous; mesonotum ochraceous, with a large central quadrate spot united to a long obconical spot on each lateral area, black, the central spot is marked by a looped ochraceous line, and each lateral spot is outwardly ochraceous, the central spot is also narrowly longitudinally united with the basal cruciform elevation, before the anterior angles of which is a small black spot; abdomen above black, the segmental margins testaceous; body beneath and legs ochraceous, basal margin of face black with a central ochraceous spot; tegmina and wings hyaline; tegmina with the costal membrane, postcostal area, and basal half of venation ochraceous, a longitudinal streak to basal cell, about apical half of venation and suffusions to the bases of the first, second, third, fourth and fifth apical areas, black; wings with the venation greenish-ochraceous, the veins to the apical areas mostly black, the anal area outwardly and inwardly broadly ochraceous; length of head more than half the breadth of space between eyes; length of abdomen in male about as long as head and pronotum together; face moderately prominent, centrally longitudinally black, the lateral areas obliquely transversely striate; opercula in male short, oblique, apically rounded, not extending beyond base of abdomen, their internal angles almost meeting.

Long. excl. tegm. male 17, female 18 mm. Exp. tegm. male 55 mm., female 57 mm.

Habitat.—Cuernavaca, Mexico. (Coll. Pomona College and Coll. Distant).

By the markings of the tegmina, allied to *R. swalei* Dist. This species was collected by Mr. D. L. Crawford.

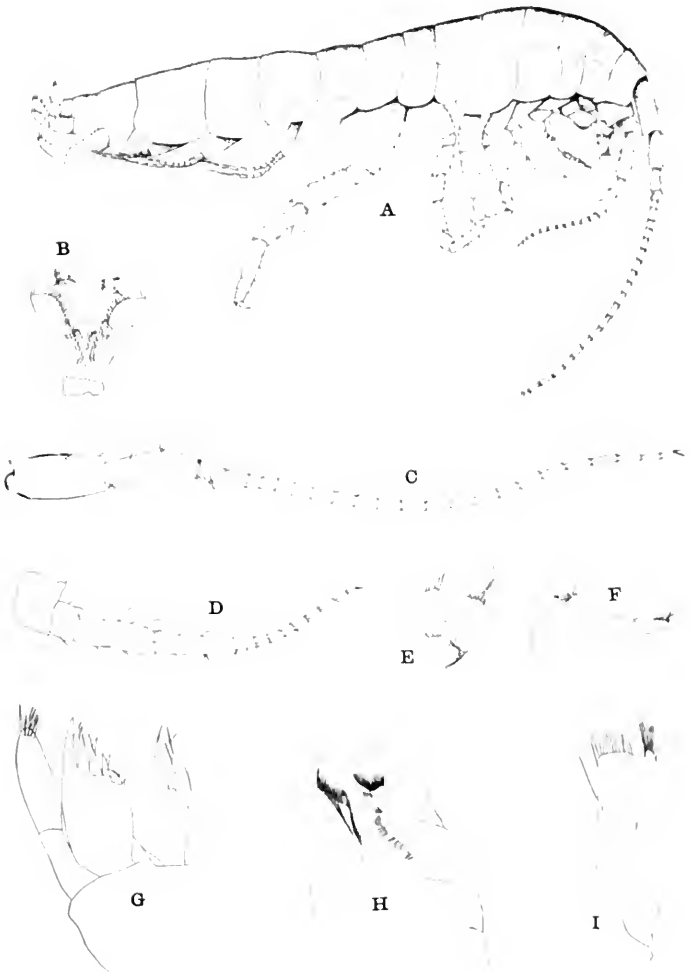

Figure 187. Crangonyx alabamensis

A, adult female; B, maxillipeds; C, first antenna; D, second antenna; E, palp of mandible; F, mandible; G, first maxilla; H, cutting edges of mandible; I, second maxilla.

A NEW SUBTERRANEAN FRESHWATER AMPHIPOD

VINNIE R. STOUT
POMONA COLLEGE, CLAREMONT, CALIFORNIA

The specimens examined were collected near Auburn, Alabama, in October, 1898, by Prof. C. F. Baker, from the bottom of a well through which ran a living stream.

Crangonyx alabamensis n sp.

(Figures 187 and 188)

Length 5 to 7 mm. Entirely blind. Antennæ a little longer than half the body; flagellum with about twenty-two joints and much longer than the peduncle; accessory flagellum very small, two-jointed. Second antennæ more than half as long as first antennæ, peduncle longer than flagellum, which is 9-11-jointed. Second gnathopod longer that first gnathopod and differing from it as follows: basal joint one-third longer than first gnathopod and lacking the long hairs on posterior margin; other hairs longer; carpus bearing a finely plumose palp-like epiphysis of three or four branches; palm more oblique and armed in both pairs with a row of stout, obtuse, notched spines. Periopod five was not present on any of the specimens but probably very closely resembles periopod four. Uropod one with rami subequal, two-thirds as long as peduncle; second uropod with rami unequal, outer a little more than half as long as inner; third uropod about half as long as telson, ramus small and tipped with two or three spines. Telson about two-thirds as broad as long, and tapering but little to the entire, slightly rounded apex, which is armed with eight or nine slender spines.

This species is closest to *Crangonyx tenuis* (S. I. Smith), taken in Connecticut, but differs from it in that the side-plates are not so shallow; first antennæ much longer than second antennæ, and with more joints than in *C. tenuis;* first gnathopod stouter, but second gnathopod more oblique; second uropod extending farther than either first or third; telson not arcuate.

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*Miss Stout and Miss Stafford, advanced students in the Department of Biology, who have been making special studies of certain Amphipoda and Isopoda, have now worked out thoroughly these two interesting blind species taken many years ago in a well in Southeastern Alabama. The locality is far from any previous locality recorded for either of these genera. Only by accident, while fishing for large slugs on the walls of a well, for use in the zoological laboratory, was running water discovered in the bottom of the well. A trap composed of old pieces of ragged wood was effectual in raising many specimens to the surface.—Ed.

Figure 188. Crangonyx alabamensis

A, first gnathopod; B, second gnathopod; C, first pereipod; D, second pereipod; E, third pereipod; F, fourth pereipod; G, first pair of pleopods; H, second pair of pleopods; I, third pair of pleopods; J, second and third pairs of uropoda and telson; K, first pair of uropoda.

A NEW SUBTERRANEAN FRESHWATER ISOPOD

BLANCHE E. STAFFORD
POMONA COLLEGE, CLAREMONT, CALIFORNIA

These specimens of *Caecidotea* were found by Prof. C. F. Baker in the waters of a well in Auburn, Alabama, and represent an interesting new species.

Caecidotea alabamensis n. sp.

(Figures 189 and 190)

The body without the antennæ and the uropoda measures in length about 9 mm., in width about 1.50 mm. It is narrow and elongated, about six times as long as wide. The head is wider than long and a little narrower than the first thoracic segment. The anterior margin of the head is slightly excavate and distinctly narrower than the posterior margin. The eyes are absent.

The first pair of antennæ has three basal articles and a flagellum. The first article is about twice as long as wide. The second article is a little longer than the first. The third is about two-thirds as long as the second and much narrower. The flagellum has about ten articles. The second antennæ have six articles and a flagellum. The first four are small and about equal in size. The fifth is as long as the first four and about three-fourths as long as the sixth. The sixth is a little narrower than the fifth; the flagellum has about eighty-five articles.

The maxilliped has a palp of five articles, the mandible a palp of three articles.

The segments of the thorax are very loosely articulated and the lateral margins of the segments are not contiguous. The second and third segments are slightly shorter than the first. The fourth and fifth are shorter than the third. The sixth and seventh are about equal to the second and third; they are more loosely articulated than the other segments. The epimera of the first segments are near the antero-lateral margin; they are near the middle of the fourth segment and on the last three segments they have a post-lateral position.

The first two segments of the abdomen are short. The third is long and narrow with a medial lobe on the posterior margin and is once and two-thirds as long as wide. The uropoda are a little longer than the terminal abdominal segment. The peduncle is long and narrow, more than half as long as the abdominal segment. The inner branch is two-thirds as long as the peduncle. The outer branch is about one-half as long as the inner branch.

The first pair of legs is sub-chelate, has propodus armed with two triangular processes and three spines. The other legs are ambulatory.

These specimens resemble *Asellus* in many features, very closely, and show the close affinity of *Caecidotea* to that genus. The pleopoda are very similar to those of *Asellus communis*. The second pair in the female is missing as also in *Asellus communis*. The third, fourth and fifth pairs are more elongate and narrower than those of *Asellus*. The form of the legs and mouth parts is also similar

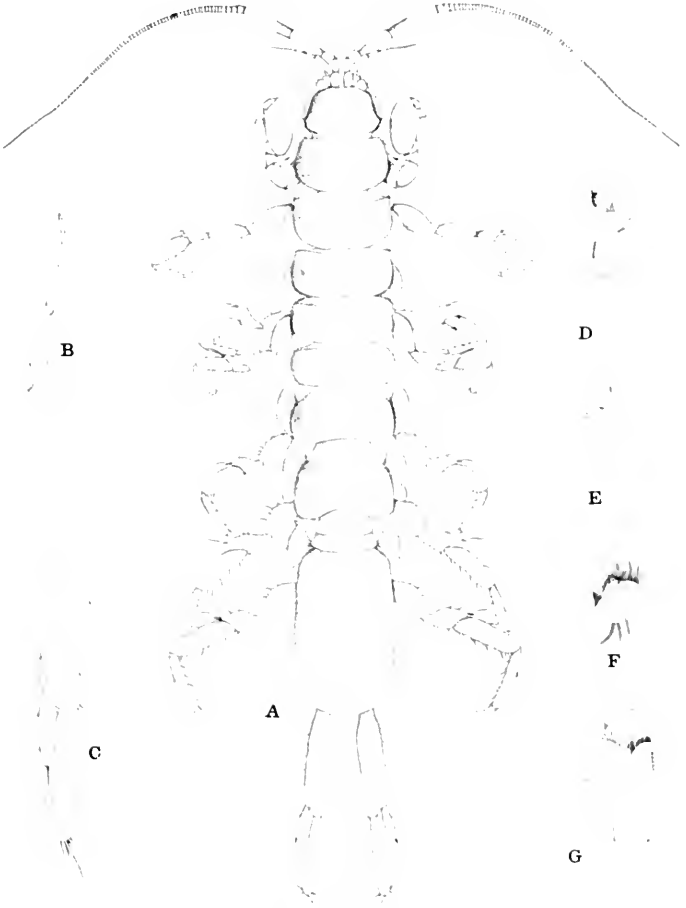

Figure 189. Caecidotea alabamensis

A, dorsal view of male; B, first antenna; C, uropod; D, mandible; E, first maxilla; F, second maxilla; G, maxilliped

Figure 190. Cæcidotea alabamensis

A, first pair of pleopoda of female; B, first pleopod of male; C, second pleopod of male; D, fourth leg of male; E, fifth leg of male; F, sixth leg of male; G, seventh leg of male; H, third leg of female; I, second leg of male; J, first leg of male; K, third pleopod of male; L, third pleopod of female; M, fourth pleopod of male; N, fourth pleopod of female.

to that in *Asellus communis*. The body is much longer and the segments of the thorax are much more loosely articulated than in *Asellus communis*. The terminal abdominal segments and the uropoda are also much longer and narrower than in *Asellus communis*.

This Isopod is evidently not allied to either *Caecidotea richardsonae* or to *Caecidotea smithsii* since the propodus of the first leg is armed with triangular processes. It falls much nearer to *C. stygia* and *C. nickajackensis*. It differs from *C. nickajackensis* in having the first pair of legs armed with two triangular processes instead of with one triangular process at the distal end and one spine at the proximal extremity; also in the length of the uropoda, which are shorter than the abdominal segment in *C. nickajackensis*. It is therefore most closely allied to *C. stygia*. But it differs from *C. stygia* in having the propodus of the first leg armed with two large triangular processes only, and three spines whereas *C. stygia* has two large and three small triangular processes and no spines. The uropoda of this Isopod, *C. alabamensis*, are somewhat longer than the terminal abdominal segment. The outer branch of the uropoda is half as long as the inner branch whereas in *C. stygia* the outer is two-thirds as long as the inner.

In *C. stygia* the first two articles of the first antennæ are subequal in length but in *C. alabamensis* the second is longer than the first. In the former the flagellum of the first antennæ has twelve articles, in the latter it has but ten articles. In *C. stygia* only five articles are given for the peduncle of the second antennæ whereas this Isopod appears to have six, four small articles instead of three, although this may be merely a difference in observation. The flagellum of the second antennæ of *C. alabamensis* has about eighty-five articles; that of *C. stygia* has but seventy. The terminal abdominal segment of *C. stygia* is less elongated than that of *C. alabamensis*, one and one-half times as long as wide in the former, once and two-thirds as long as wide in the latter. In *C. stygia* the median terminal lobe is less prominent than in *C. alabamensis*.

THREE ALARMING INSECT PESTS

DR. A. J. COOK
POMONA COLLEGE, CLAREMONT, CALIFORNIA

The fact that the owners of a single citrus grove paid out, in a single year, $25,000 to combat the red scale; that another orchardist lost $10,000 in the same time by the ravages of the mealy bug, and that thousands upon thousands of dollars are expended each year to stay the fell work of our orchard pests should arouse every rancher—yea, every citizen of our favored State—to the transcendent importance of this insect question.

Just now there are three species of insects that menace our orchards and our business interests to an alarming degree, and should cause every one of us to take notice.

The Mexican Orange-Maggot not only destroys the orange, but the mango and the guava. It is a grievous pest and its natural enemies are most remarkable for their absence. It is hard to suggest any way to control it should it gain a foothold in our groves. Mr. David L. Crawford, it will be remembered, found it widely distributed in the republic to the south of us. It would be easy to introduce it by rail or by boat. Quarantine is the only weapon at present available against this formidable scourge, and this should be used with the greatest skill and energy. Ports and railroad stations should be guarded with the most diligent effort and the most thorough vigilance. Any possible imperfection in our present quarantine should be speedily remedied, cost what it may of effort and money. Everyone should know the life history of this insect, so that the finding of several footless maggots in a fruit would at once cause an alarm to be sounded, that extirpation at any cost might be secured.

The Mediterranean Fruit-Fly belongs to the same family of insects as the above, and in one respect is more to be dreaded than is the above, as it is the fatal enemy of nearly all—twenty or more—of our most valued fruits! Its destruction would be as difficult as that of the other Trypetid. Moreover, it is already present in our island possessions of the west—Hawaii. *We must keep both these arch enemies from our shores!* We have the advantage in this case, as we can search every arrival, as we would a suspect who might be smuggling diamonds or other precious stones into our country or bringing cholera or bubonic plague. We must stand close behind our State Commissioner of Horticulture in his effort to keep this unequaled pest from our orchards.

The third enemy that must be kept out at any cost is the new alfalfa pest, the Alfalfa Weevil. This snout-beetle bids fair to be a close rival of the terrible Cotton Boll Weevil of our Gulf States. The Cotton Boll Weevil has already robbed the cotton planters to the tune of millions. This new enemy is devastating the alfalfa fields of Utah, and unless we can find some more effective remedy than any yet discovered its presence among us would be ruin to our most valued and profitable forage crop. This little weevil, scarce a quarter of an inch long,

is very prolific. More than one hundred eggs have been found on a single alfalfa plant. Though most abundant in spring and early summer, they may be found as eggs and larvae well into the fall. Both larva and imago feed on the plants. They winter as mature beetles and so are easily introduced into new localities by the transporting of alfalfa hay. The weevils have often been found in cars, even the sleeping cars, and as the Salt Lake road runs direct from an infested region to our own Southern California, it is hard to see just how we can quarantine against this dreaded pest.

We must all become acquainted with this insect (see Bulletin from Department of Agriculture, No. 137), and keep close vigil of all alfalfa fields, especially those along the Salt Lake Railroad, that any infestation may be quickly and thoroughly exterminated. The splendid work against the White Fly in such case must be repeated. There must be no half-way work or trifling in case of any one of these three pests.

WEST COAST NEWS NOTES

FORDYCE GRINNELL, JR., PASADENA, CALIFORNIA

"The field is vast. No one can explore it all. But one here and another yonder can gather and make record of new facts, correct past errors, diffuse new light. So, the more perfect knowledge, which here as in all departments of science, men work for, yet wait for, will be attained."—Dr. E. L. Greene, in *West American Oaks*.

Dr. J. M. Aldrich, of the State University, Moscow, Idaho, a leading student of the *Diptera*, has been granted an appropriation from the trustees of the Elizabeth Thompson Fund to "investigate the fauna of the waters and shores of western salt and alkaline lakes." He is planning a trip of at least six weeks this summer, beginning his studies at Great Salt Lake, Utah, where he has already done some work, and extending from there, westward through the Great Basin, as far as Mono Lake, California, making stops at a dozen points or more to collect and study the insect life in particular. From Mono Lake he may go into the Yosemite Park for a short visit, and then on to Owen's Lake, and via Mojave to Los Angeles. He will visit Pasadena and do some collecting in the vicinity, and also at Long Beach, the Biological Station at La Jolla, and return to Moscow by way of San Francisco, and Portland, Oregon. In a letter he writes: "The best feature is that my main object, the salt and alkaline lakes, will surely yield some fine results. The few things now partially known, and my brief observations at Great Salt Lake, show me that a big field lies here almost untouched; and the *Diptera* are the main order of insects in their adaptation to such an environment." We, in the Southwest, must give to Prof. Aldrich a royal welcome, and some boxes of flies.

Mr. Theodore H. Hittell has written a history of the California Academy of Sciences, which will probably be published this year by the Academy. It will be of great interest and inspiration to the present and future naturalists of California. The early development of science in California centered around the San Francisco Academy. The history of California science is unique and very interesting.

Mr. W. M. Mann, of Stanford University, is a member of the Branner Expedition to Brazil. It can safely be assumed that a large quantity of interesting material will be collected by that enthusiastic collector.

Mr. W. M. Davidson is in United States Department of Agriculture work near San Jose.

Mr. W. G. W. Harford, one of the pioneer students of natural history in California, died at Alameda on March 1. Mr. Harford was eighty years of age and had long been associated with the University of California and the California Academy of Sciences as curator and collector. He and Albert Kellogg, the botanist, often worked together. He was interested especially in conchology; but

did some collecting and study in other lines. A Southern California butterfly was named in his honor by Henry Edwards, *Colias harfordii*.

Dr. Fenyes, of Pasadena, will go East in May, to Cambridge and Washington, to do some work in the libraries there. He will also do some collecting in Kentucky, Virginia and Carolina.

Mr. J. R. Haskin, of Los Angeles, has recently made trips to San Diego and Arizona, getting a lot of interesting and valuable material, including the rare *Melitaea neumoegenii* of Northern Arizona.

Mr. J. C. Bridwell, of the University of California, has been stationed in the Imperial Valley for some time engaged in certain problems in economic entomology.

The Biological Society of the Pacific Coast was organized at Berkeley on April 1, with Dr. V. L. Kellogg as President. It starts with a membership of seventy.

Mr. C. W. Metz, of Pomona College, will enter work in September as a fellow-assistant under Dr. Jordan at Stanford University. Mr. Metz has just had an extensive paper on the American bees of the genus *Prosopis* published by the American Entomological Society. He has brought order out of chaos in this most difficult genus. The work of Swenk, and now of Metz, marks a radical departure from the extraordinarily superficial and confusing methods of work in American bees and wasps heretofore current, and is most timely and salutary.

Mr. D. L. Crawford, of Pomona College, enters work in September as a fellow-assistant under Dr. V. L. Kellogg, of Stanford University. Mr. Crawford has just finished very extensive work on the *Psyllidae* of the world. His studies have embraced the comparative anatomy of all the genera of the world, and he is presenting for the first time a complete systematic treatment of the whole group.

Mr. J. W. Prizer, of Pomona College, has been appointed technical assistant in economic entomology and plant pathology to the Manager of the San Diego Land and Town Company, one of the largest horticultural enterprises in Southern California.

Prof. Baker, with a large party of special students, will spend the summer on the Coast where they have established a laboratory for work in marine zoology.

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VOLUME THREE NUMBER FOUR

Pomona College Journal of Entomology

DECEMBER 1911

Contents

DR. ALBERT J. COOK
CALIFORNIA STATE COMMISSIONER OF HORTICULTURE

1. ESSIG, E. O. — Plant Lice of Citrus Trees
2. KUWANA, S. I. — White Flies of Japan
3. CRAWFORD, D. L. — American Psyllidae V
4. BANKS N. — Pseudoscorpions of California
5. HALL, H. V. M. — Studies in Acarina II

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A. J. COOK, D. Sc., Head Professor
CLAREMONT, CALIFORNIA, U. S. A.

POMONA COLLEGE JOURNAL OF ENTOMOLOGY

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During 1909 the existence of the Journal was credited to the support of the Ontario-Cucamonga Citrus Association. It is to be noted, however, with due appreciation, that one member of that Exchange, Mr. A. P. Harwood, was the donor of one-half of the amount from that source. During 1911, the Journal is pleased to acknowledge a wider support, including the Ontario-Cucamonga Exchange, with Mr. A. P. Harwood, The Call Fruit Company, The A. C. G. Fruit Exchange, The Covina Fruit Exchange, The Semi-tropic Fruit Exchange, The Arlington Heights Fruit Exchange, The Santa Paula Fruit Exchange, The Tulare Fruit Exchange and the San Antonio Fruit Exchange.

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Pomona College Journal of Entomology

Volume III DECEMBER 1911 Number 4

Dr. Albert J. Cook

As he looked eighteen years ago when he came to California to live. These eighteen years have been given with wholly characteristic earnestness, energy and enthusiasm to the upbuilding of Christian citizenship in California. His appointment to the very important office of State Commissioner of Horticulture comes as a highly appropriate recognition of these long years of splendidly unselfish service to the public as a professional expert, and as a citizen. This Journal owes its existence first and foremost to the energy and enthusiasm of Dr. Cook.

The following tribute to Prof. Cook was adopted as a formal resolution by the Claremont Pomological Club, and was published in "The Student Life" of Pomona College, and in the Claremont "Courier":

"Pomona College is losing a man acknowledged by many very competent to judge as one of the greatest teachers and college professors in this country. Southern California is losing one of her most active and useful citizens. The whole State is gaining for the first time in her history, a professional man in an office which absolutely requires a professional expert of the broadest and best training.

"The loss to Pomona College will be felt most keenly by all of the students who have known Prof. Cook personally. His genial nature, his great heart, his tremendous and infectious enthusiasm, his keen interest in the personal welfare of every student under him—these things have made him greatly beloved to all. His interest in his students has never, through all the years, been a perfunctory one, but always a living, active interest, that went right out and fought for them; an interest that not only helped them to find their life work and get into it, whatever it might be, but ever afterward supported and encouraged them to great efforts. In a quiet way, unknown to the public, he has even financially assisted deserving students to complete their work, and for this he has been repaid in some things beyond the value of money—loyalty and love.

"The efforts of Prof. Cook to place his department in the College upon the most efficient working basis have been unexampled, involving the most strenuous and unending endeavors, and leading even to severe personal sacrifices. The public has known little of this, so that the fight has to a great extent been a lone one for Prof. Cook. Without just such a man through these days of formative struggle in the building of the College the Department of Biology would never have amounted to anything. All that it has accomplished is simply a measure of this man!

"Prof. Cook's services to the general public are warmly acknowledged by grateful men and women throughout the length and breadth of the State. His correspondence on horticultural and agricultural matters has for many years been of very extensive proportions—all religiously attended to with love and interest and on his own time and expense. He has for years been the main mover in the Claremont Pomological Club, a large organization, of great strength and usefulness. For all of these great services he has previously had no public acknowledgment, because the extent of his work has been known in the aggregate to but few. His reward has been found in the high regard of great numbers of our best people.

"Now comes this appointment to the State Commissionership of Horticulture —which is, as Governor Johnson well says, one of the most important offices in the State—as the crowning event of Prof. Cook's remarkable career, and it is an appointment that will be a lasting monument to the critical discernment and good judgment of Governor Johnson. No man in the State or in the country at large could bring to just this particular work greater clean-cut and indubitable fitness than can Prof. Cook. No man would be able more surely to gather about

him a staff of the best working material in the whole country, for no man knows our American workers better, and no man is more favorably known to them in the light of a chief under whom they might 'jump in and do things' without any of the petty repressive supervision that spoils so much good material in our public offices. Prof. Cook is large-hearted, sympathetic, kindly, and broad enough and big enough to make a good executive. The office is not only a great one in this State, but the greatest of its sort in the whole United States. No other office of the kind involves such great responsibilities. It carries a large corps of well paid assistants and princely support. For the first time in the history of the State a professional man is now entering the office who knows thoroughly well the means by which these great possibilities may be practically developed to their greatest efficiency. Congratulations are due Prof. Cook, Governor Johnson and the State of California!"

At farewell exercises given in honor of Prof. Cook by the College, the following remarks may be quoted from the several speakers:

Prof. Baker said, in part: "Are we here to honor this man for his own sake or for his success? Success is an erratic will-o'-the-wisp, missing many who might use it well. This *man* is the same man today as he was last month. Governor Johnson says that he was appointed solely upon his merits. What would we have been thinking of him today had he *not* received this appointment? We have to consider these things at Pomona, where we are supposed to learn how to look through the mask of pretence, sham and insincerity, straight into the face of the eternal verities. So I am going to speak of Prof. Cook in just such terms as I would have spoken of him *as a man*, last year.

"I like to think of Prof. Cook as a plain human being like the rest of us. We all have our good points—and our faults. So has Prof. Cook! I've told *him* about all his faults! Now I wish to tell you about some of his traits worthy of emulation. Wouldn't the world be a fine place to live in if we always did that way—it has always been Prof. Cook's way. And wouldn't the world be a great place to live in if we didn't have to die or be appointed Horticultural Commissioner in order to hear the finest things that might in justice be said of us! Not long ago I was blowing off to Prof. Cook about what *I* thought of a very unkind and inconsiderate thing someone had done. What *he* said was this: 'I do not understand it at all—I will *talk with him* about it.' Prof. Cook always *lives in the open*, and says nothing behind a man's back that he would not say to his face. If we could only all say that of *ourselves*, Claremont would be an annex of Paradise!

"In the twenty-five years I have known him intimately the Moving Finger has written much for Prof. Cook. He could not get away from even 'half a line' of all his history any more than you can get away from yours—and he does not need to make the attempt. It is only *acts* that really *characterize* a man! 'By their *fruits* shall ye know them!' All of Prof. Cook's mental processes lead him ultimately to action. A matter is either deemed wholly unwise, and laid away, still-born, or else his line of thought runs something like this: 'Is it worth

while? Is it of value to the human race? Is it within the bounds of human possibility? Then it can be done! *Let us do it!* The men who transmute the intangible waves of thought and the sounding brass of talk into the throbbing engines of action are the men who really bless the world! Prof. Cook knows no obstacles. Constantly throughout his extraordinarily active life he has been facing the apparently impossible and always winning through it all to success. It is great to work *with* such a man—not *under him* unless you are in good health! His is the only spirit that gets work under way and *gets it done*. It is the spirit that *wins!*

"Pomona has lost a tremendous opportunity in not being able to discover some way in which to permanently harness up in her behalf the potent and far-reaching influences of which Prof. Cook is master. He is now no longer Prof. Cook of Pomona College, but the Hon. A. J. Cook of the State of California! He goes into a field with extraordinary possibilities of usefulness to a vast number of people. But traditions of Prof. Cook, his matchless vigor and enthusiasm, his charity to all and his devotion and loyalty to his great ideals as a teacher and a citizen, will always linger about these halls and prove an inspiration to you and to me and to all students coming after us."

Prof. Hitchcock then spoke of his relation to the college and to the community, saying among other things: "Prof. Cook has done an heroic service in bringing Science to men. He was always interested in the advancement of the community. He originated the first Pomological Club in Claremont. Its immediate success brought about similar clubs in other places. Prof. Cook looks upon his appointment as an enlarged opportunity to carry on the same work he has been doing here. He will never lose an opportunity to say a good word for Pomona. He is going away, but he will not forget us; his heart will still be with us."

Following a farewell response by Prof. Cook, President Blaisdell spoke as follows: "Men and women, this is a teacher who has spoken to us. He has not had large monetary rewards, but the particular, wonderful and unique reward of a teacher. Some here ought to hear the call to be teachers. *There* is a great field for our best manhood and womanhood! We have heard this morning the call of high citizenship, the ringing challenge that no man shall go into office, unless he has the *ability to fill the position!* That call of large citizenship is upon you. We shall miss much if we fail to keep floating that flag of high and noble citizenship."

The Associate Editor of "The Student Life" gives what may be taken as the viewpoint of the student body regarding Prof. Cook:

"A man living in the unselfish and effective service of others; a scientist always working for the perfection of his department; a teacher with the faculty of inspiring in his pupils an interest in all things of Divine Creation—these and

more is Prof. Cook, who leaves Pomona for broader fields of service. We honor him as a great scientist; we admire him as a successful teacher; as a friend we entertain toward him a sentiment closely akin to love. Faculty and students join in a deep and sincere regret at the departure from Pomona of this man who, during his eighteen years of service here, has worked so hard and with such marvelous success in the upbuilding of the Biological Department and of the College as a whole. Through his influence and training, men have gone from here to reflect credit upon their Alma Mater in the scientific world. He has directed their thought and work into channels that have brought success to them and honor to the College. He is indeed a great man who is the means to such ends.

"Although the loss to our teaching force is a serious one, yet who can estimate the honor that comes to Pomona in giving to the State of California such a man? So we bid him Godspeed and unmeasured success in his new field of labor as State Horticultural Commissioner."

It will be of interest to all concerned to know that Prof. Cook has taken to Sacramento with him from Ventura county our Mr. E. O. Essig, "the best County Commissioner of Horticulture ever known in the State of California." He has also obtained for the work in Plant Pathology one of the most active and efficient men for all southern phases of that important work in the United States, Prof. Fawcett of Florida. He is also gathering about him many other good men, every one a man of ability and energy. Prof. Cook will not suffer any other kind.

APHIDIDÆ OF SOUTHERN CALIFORNIA VIII

Plant Lice Affecting the Citrus Trees*

E. O. Essig

HORTICULTURAL COMMISSIONER OF VENTURA COUNTY

There has been much speculation in the minds of many of the citrus growers and horticultural commissioners in Southern California regarding the plant lice which affect the citrus trees. In fact, the ignorance regarding these insects, as expressed by the secretary of the horticultural commissioner in a neighboring county, certainly justifies the publication of a study such as this is intended to be. At a recent meeting held in Los Angeles by the Los Angeles County Horticultural Society, for the purpose of discussing the topic, "Insect Pests and Methods for Their Control," it was emphatically argued by members of the Los Angeles Horticultural Commission that the Black Peach Aphis, *Aphis niger* Smith, was attacking certain orange groves in Southern California. When it was said that the Black Peach Aphis did not work on citrus trees there was such a confusion created in the minds of all present that I do not wonder if many of the citrus growers, especially in the districts where entire peach orchards are now being uprooted because of that insect, are not afraid that the citrus trees may go next. Though this is an extreme and remote possibility even under most ignorant direction, still it shows how little is actually known regarding these aphids, which are designated by the orchardists as small beetles, gnats, flies, etc., and it shows also how great the value of a thorough knowledge of them will be.

Practically every locality in which citrus trees are grown, has been visited, and extensive collections of plant lice made for the purpose of this study. Perhaps some of these insects have been passed unobserved, but all the common injurious forms are here presented, and comprise four genera and five species as follows: *Aphis cookii* n. sp., *Aphis gossypii* Glover, *Macrosiphum citrifolii* (Ashmead), Green Peach Aphis, *Myzus persicae* (Sulz.), and the Citrus Aphid, *Toxoptera aurantiae* Koch. All of these have been carefully drawn and described from fresh and living specimens so as to get accurate color notes and body shapes.

In connection with the following descriptions I have also worked up, as thoroughly as possible, all of the natural parasites and predaceous enemies which prey upon the plant lice and which are responsible for their not doing greater damage; in fact, these practically control all infestations on citrus trees, with the exception of sometimes a few localized cases during the early spring and summer months.

For the specific cases where the aphids are not controlled by natural enemies and where it is necessary to employ artificial means of control I have prepared spray formulæ, which are specially adapted for citrus trees, and which will usually bring immediate relief if applied as directed. It is sometimes very important to have these at hand, particularly in cases of heavy infection of very young trees, where considerable damage may be done in a very short time.

*This masterly study of the Citrus Plant Lice, indicates again most clearly and indubitably, the preeminent importance of having only men with some technical training, for the important work in the office of County Horticultural Commissioner. It is not possible for men without this training to work either intelligently, or with safety to the important interests which they are supposed to guard.—*Ed.*

It will be my aim to continually improve this first article by adding descriptions of new aphids, natural enemies and better means of artificial control. I invite the aid of all growers and other interested parties and ask them to send specimens which have not been included here, and I shall be glad to make my determinations of plant lice, provided they are shipped in large quantities with the host plant in a strong box so that the natural color and body shape can be studied in connection with the anatomical characters."

Aphis cookii n. sp.

WINGED VIVIPAROUS FEMALE (Figure 191, A).

1910 *Aphis gossypii* Glover Essig, Pomona Jr. Ent. Vol. II., pp. 223-224.

Length of body not including style 1.75 mm., width of mesothorax 0.70 mm., greatest width of abdomen 0.78 mm., wing expansion 7.20 mm., rather large and robust form.

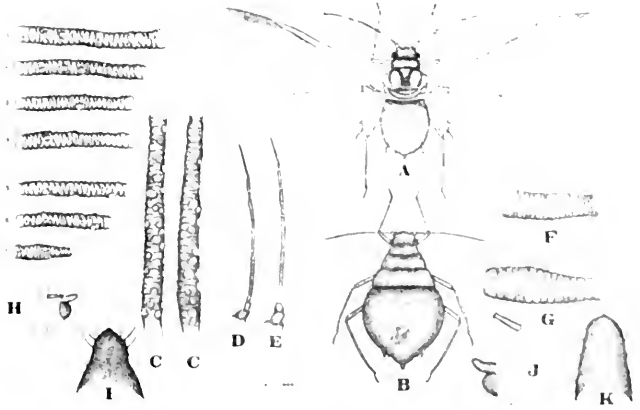

Figure 191. Aphis cookii

Prevailing Color. Dark gray or black with a whitish flocculence which makes it appear whitish. *Head*. Black or dark brown, nearly twice as wide as long, with rather large antennal tubercles, but these are not at all prominent. *Eyes*. Very dark red or brown, tercte tubercles extending nearly at right angles to the eye surface. *Antennae* (Fig. 191, D). On small frontal tubercles, not as long as the body, reaching to the bases of the cornicles, very sparsely haired, dark throughout, imbricated; lengths of articles: I, 0.08 mm.; II, 0.08 mm.; III, 0.35 mm.; IV, 0.22 mm.; V, 0.22 mm.; VI, 0.44 mm. (spur 0.3 mm.); total 1.39 mm. It will be seen from the above that I and II are cocqual, III longer than either IV or V, but shorter than VI; IV and V cocqual. The sensoria are distributed as follows: Article III (Fig. 191, C, C) with from seventeen to twenty-eight large

circular sensoria scattered over the surface; IV (Fig. 191, 1, 2, 3, 4) with from one to three large circular sensoria, which may be scattered at the base or near the apex of the article, but they are usually on the basal half; V with from two to three large circular sensoria (Fig. 191, 5, 6) and in some instances one small one as shown in drawing. There is usually but one sensorium. The small group in the nail-like process of article VI is shown in Fig. 191, 7. *Rostrum*—Reaching to second coxæ, with dark base and tip. *Prothorax*—More than twice as wide as long; dark, with very small lateral tubercles. *Meso-* and *Metathorax*—Wide, black, with prominent muscle lobes. *Abdomen*—Well rounded, dull green or brownish-green, bearing a transverse row of quite long white flocculence on each segment (not shown in the cut), which may nearly cover the entire body. Anal plate (Fig. 191, H) dark, hairy, three small marginal tubercles on each side. *Cornicles*—(Fig. 191, F). Short, somewhat cylindrical, with wide mouth, base little wider than apex, narrowest just before the mouth, imbricated, black, longer than the style, length 0.16 mm. *Legs*—Moderately long and hairy, black or dark brown throughout. *Wings*—Large, hyaline. *Primary*—Length 3.3 mm., width 1.25 mm. Costal vein stout, dark brown; subcostal wide, brown; stigma long and narrow, widest at the base of the stigmal vein, from whence it narrows to a point at the wing margin, the opposite sides are nearly parallel, length 0.95 mm., width 0.16 mm., amber brown; stigmal vein arising three-fifths the distance from the base of the stigma, strongly curved throughout first half and slightly curved throughout the apical half, rather long, brown or amber; first and second discoidals straight; third discoidal twice branched, first branch arising one-third the distance from the base to the tip, short, parallel with the apical one-third of the stigmal vein, brown arising very near to the tip of the first branch (three-fourths the distance from the base to the tip), short, parallel with the apical one-third of the stigmal vein, brown or amber. *Secondary*—Length 1.8 mm., width 0.65 mm.; subcostal vein curved downwardly just beyond the base of the second discoidal and then curves downwardly to original level to tip of the wing; first discoidal arising just beyond one-fourth the distance from the base to the tip of the subcostal, slightly curved outwardly, does not touch the subcostal vein or the wing margin; second discoidal arising from the middle of the subcostal and nearly straight, does not touch subcostal vein, but extends to wing margin; all veins brown. *Style*—(Fig. H and I). Bluntly ensiform, or conical, beset with stiff hairs, rough, dark, curving upward, length 0.12 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 191 B)

Length of body not including style 2.2 mm., width of abdomen 1.3 mm.

A larger and more robust form than the winged female.

Prevailing color—Very dark green or brown, covered with transverse rows of rather long white flocculence on the body, giving it a grayish appearance. Body gradually widening from head to the middle of the abdomen and then rounds off to the style, robust. *Head*—With slight frontal tubercles, much wider than long, dull green or brown. *Eyes*—Red. *Antennæ* (Fig. ..., E)—On very slight

frontal tubercles, much shorter than the body, very sparsely haired, dark throughout except the base of article III, imbricated. The lengths of the articles are as follows: I, 0.1 mm.; II, 0.07 mm.; III, 0.4 mm.; IV, 0.21 mm.; V, 0.21 mm.; VI, 0.4 mm. (spur 0.26 mm.); total 1.39 mm. With sensoria on V and VI articles as in normal forms. *Rostrum*—Reaching just beyond second coxae, amber brown with darker base and tip. *Prothorax*—Slightly wider than head, with small lateral tubercles. *Abdomen*—Well rounded, dull green, covered with flocculence, three small marginal tubercles on the sides. *Cornicles* (Fig. , G)—Incrassate, nearly vasiform, imbricated, widest in middle and narrowest just before the mouth, often appear cylindrical with swollen tip, black, length 0.2 mm. *Style* (Fig. , J and K)—Conical or bluntly ensiform, rough, hairy, black, length 0.14 mm., shorter than the cornicles.

Young—Much lighter in color than the adults and almost destitute of the white flocculence.

Host—Orange trees, where it occurred in great numbers.

Locality—Collected by Horticultural Inspector C. H. Vary at Pomona, Calif. It has never been located anywhere else and cannot even be found there just now.

Date of Collection—April 4, 1909. Serial number 36.

The general appearance of this insect with its short antennae and cottony covering is not unlike that of one of the members of the genus *Lachnus* and was so recorded by me at the time it was first obtained. Strange to say, when first collected by Mr. Vary it occurred in such numbers as to nearly ruin the infested trees. Prompt measures were taken to hold the pest in check and it soon disappeared. Since then I have been unable to obtain fresh material. From the very beginning it did not appear to be *Aphis gossypii* Glover, but I thought it might be one of the various forms of that species and so described it as such. Since that I time have sent specimens to various of the authorities on this group and have received the following replies:

"Your letter of the 13th ult. at hand and I have gone over the slides you sent. I am returning them under separate cover and will say that those labeled *Aphis gossypii* are not that species. . . ." H. L. Wilson, Oreg. Agrcl. Exp. Sta., Mar. 2, 1911.

"I feel certain that the insect that you have figured as *Aphis gossypii* is quite wide from that species. This insect is a very abundant one in Colorado upon our cucurbitaceous plants, especially infesting the cantaloupe. I have also material from the cotton plant in Texas and am quite certain that we have the species correctly determined. . . ."—C. P. Gillette, Colo. Agrcl. Exp. Sta., June 9, 1910.

"*Aphis* sp.? No. 36. It appears to be nearest related to *A. gossypii*, though there are too many sensoria in the third antennal joint." —Theo. Pergande, Bur. Ent., U. S. Dept. Agrcl., June 12, 1911.

Not being able to place this as an already described species, I have felt justified in calling it a new species, and have named it in honor of Prof. A. J. Cook of Pomona College, whose work for the upbuilding of the citrus industry in this State is well known throughout the entire country.

Aphis gossypii Glover

1854 *Aphis gossypii* Glover, Pat. Off. Rept., p. 62.
1882 *Aphis citrulli* Ashmead, "Florida Dispatch," vol. 1, p. 241.
1883 *Aphis cucumeris* Forbes, 12th Rept. Ent. Ill., pp. 83-91.

WINGED VIVIPAROUS FEMALE (Figure 192 A)

Length of body not including style 1.35 mm., width of mesothorax 0.42 mm., greatest length of abdomen 0.65 mm., wing expansion 5.10 mm. Very small form.

Prevailing color—Dark, black or very dark green or brown. *Head*—Much wider than long, black. *Eyes*—Very dark red or brown. *Antennae* (Fig. 192, c and h)—Arising directly from the head, not as long as the body, reaching to the bases of the cornicles, sparsely haired; articles I and II dusky, III with light base and remainder dusky, IV and V light yellow with apical halves dusky, VI dusky throughout; length of the articles: I, 0.07 mm.; II, 0.04 mm.; III, 0.22 mm.; IV, 0.17 mm.; V, 0.17 mm.; VI, 0.37 mm.; (spur 0.26 mm.); total 1.04 mm.; from seven to eight large circular sensoria on article III (Fig. 192, h), remaining article normal. *Rostrum*—Reaching to or slightly beyond third coxæ, lemon yellow with the base and tip dusky. *Prothorax*—Slightly wider than the head, but no longer; black, with distinct lateral tubercles. *Meso-* and *Metathorax*—Black, with prominent muscle lobes. *Abdomen*—Smooth, dark green or greenish brown, with an irregular lighter area on the dorsum, ventral surface dull green, small lateral marginal tubercles extending from sides, anal plate (Fig. 192, a and b) dusky, hairy. *Cornicles* (Fig. 192, g)—Cylindrical, wider at base and gradually tapering to tip; imbricated, black, curved slightly outwardly in some specimens, length 0.2 mm. *Legs*—Normal, hairy, coxæ black, femora of first and second pairs light yellow, femora of third pair yellow with apical three-fourths dusky, tibiæ yellow with dark tips, tarsi dark. *Wings*—Rather large for the size of the species, hyaline. *Primary*—Length 2.3 mm., width 0.95 mm.; costal vein dark and well defined; subcostal wide, yellow; stigma long and narrow, tapering from the base of the stigmal vein to a point at the tip, amber in color, length 0.65 mm.; first discoidal straight, second discoidal curved inwardly toward the body, third discoidal twice-branched and curved slightly inwardly, first branch arising near the middle of the vein, the second branch arising nearer the tip than the middle of the first branch—both of these branches curve toward the third vein. All veins are amber. *Primary*—Length 1.5 mm., width 0.55 mm.; subcostal curved downwardly at the base of the second discoidal and then curves upwardly to point of wing; discoidals nearly straight. *Style* (Fig. 192, a, dorsal, and b, ventral)—Conical or nearly cylindrical, hairy, green, with dusky tip, length 0.11 mm.—a little more than half as long as the cornicles.

APTEROUS VIVIPAROUS FEMALE (Figure 192 B)

Length of body not including style 1.8 mm., width of abdomen 0.9 mm. Larger than the winged form and more robust, although many are oblong in shape, not as robust as the apterous forms of *Toxoptera aurantiae* Koch. Some slightly pruinose giving them a gray color.

Prevailing color—Black or dark olive green. *Head*—Well rounded in the front, nearly as long as wide, black. *Eyes*—Dark red or brown. *Antennae* (Fig. 192, f)—Not arising from frontal tubercles, but direct from the head, much shorter than the body—not reaching to the bases of the cornicles; articles I and II dark, III and IV light lemon yellow, V light lemon yellow with a dark tip, VI

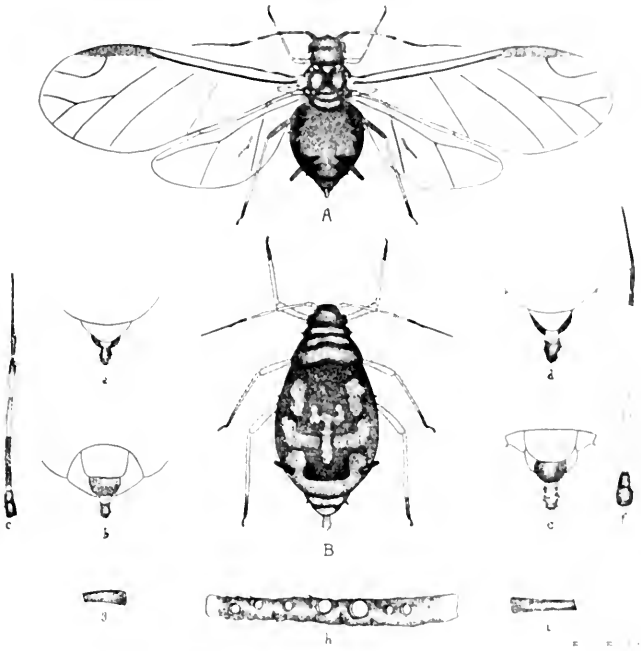

Figure 192. Aphis gossypii

dusky throughout; lengths of the articles: I, 0.08 mm., II, 0.06 mm.; III, 0.32 mm., IV, 0.25 mm.; V, 0.24 mm.; VI, 0.35 mm. (spur 0.25 mm.); total 1.27 mm.; all articles sparsely haired; sensoria on articles V and VI normal. *Rostrum*—Reaching just beyond the third coxae, lemon yellow with dark base and tip. *Prothorax*—Very short, with distinct lateral tubercle. *Meso-and metathorax*—Narrow transversely. *Abdomen*—Smooth, dark green with irregular lighter markings on the dorsum and with small marginal tubercles on the sides, ventral surface dull green. Anal plate (Fig. , d ,dorsal, and e, ventral)—Dusky, hairy. *Cornicles* (Fig. 192, i)—Cylindrical, widest at base and gradually tapering to tip, imbricated, black, length 0.27 mm. *Legs*—Normal, coxae dark, femora light yellow, tibiae

light yellow with dark tips, tarsi dark. *Style* (Fig. 192, d and e)—Conical or nearly cylindrical, hairy, dusky green to dark brown, length 0.13 mm.

Young—Dark green or brownish. Some are slightly pruinose.

Hosts—This insect has been taken in this locality only upon the tender growth of orange trees. Near Pomona it was found by the writer several years ago in great numbers feeding upon the tender shoots of young Valencia trees. At Santa Paula it has been found only upon the suckers of the Havana Seedling Sweet Orange.

This insect is indeed a very extensive feeder and has been taken from over fifty different plants throughout the United States. It was originally found upon the cotton plant and has since proven a great melon pest. It is known by the common names "Cotton Aphis" and "Melon Aphis." In this particular locality there are numerous melon vines growing near orange groves which have been infested with this louse, but I have never yet found a single vine infested with this louse. I recently received a shipment of eight distinct species of plant lice from Imperial County, where the melons suffer from their depredations, but none of them proved to be this species, although this does not prove that it does not exist in that locality. It was not the most abundant this year if I may judge from this sending.

Locality—On citrus trees throughout this State and also reported on various other plants. Taken in Orange, Los Angeles, San Bernardino and Ventura Counties by the writer.

Date of Collection—This species, like *Toxoptera aurantiae* Koch, is most abundant during the early spring months from February to June. Collected in large numbers at Santa Paula, May 17, 1911. Serial number 6.

Natural Enemies—Subject to the attacks of the same natural enemies as are described under *Toxoptera aurantiae* Koch.

In the Pomona College Journal of Entomology, Vol. I, pp. 47-48, 1909, I described this insect as *Aphis citri* Ashmead. In the same Journal, Vol. II, pp. 223-224, 1910, the species described as *Aphis gossypii* Glover has proven to be a new and distinct species and is herein described as *Aphis cookii* n. sp. resembling the Pea and Rose Aphids.

Macrosiphum citrifolii (Ashmead)

1882 *Siphonophora citrifolii* Ashmead, Can. Ent. Vol. XIV, p. 92.

WINGED VIVIPAROUS FEMALE (Figure 193 A)

Length not including style 2.2 mm., width of mesothorax 0.7 mm., greatest width of abdomen 0.9 mm., wing expansion 9.0 mm. A large green louse greatly

Prevailing color—Bright pea green, shiny. *Head*—Slightly wider than long, amber to pinkish yellow in color, with rather large antennal tubercles. *Eyes*—Red. *Antennae*—(Figure 194 a). On rather large tubercles, longer than the body, with very few hairs, articles I and II dusky green, III dusky amber with extreme base light, IV, V and VI dusky throughout; the lengths of the articles are as follows (although these vary greatly): I, 0.14 mm.; II, 0.08 mm.; III, 0.74 mm.; IV, 0.7

mm.; V, 0.67 mm.; VI, 1.0 mm. (spur 0.76 mm.); total 3.3 mm. There are from fourteen to fifteen large circular sensoria in a row on article III and usual number on V and VI. *Rostrum*—Reaches nearly to the second coxae, dark at tip only, remainder, color of body. *Prothorax*—Much wider than long, light green in color, without lateral tubercles. *Meso- and Metathorax*—Dorsum light green with the muscle lobes pinkish or amber, ventral side darker on middle. *Abdomen*—Long and regularly rounded, light shiny green with a darker green longitudinal band

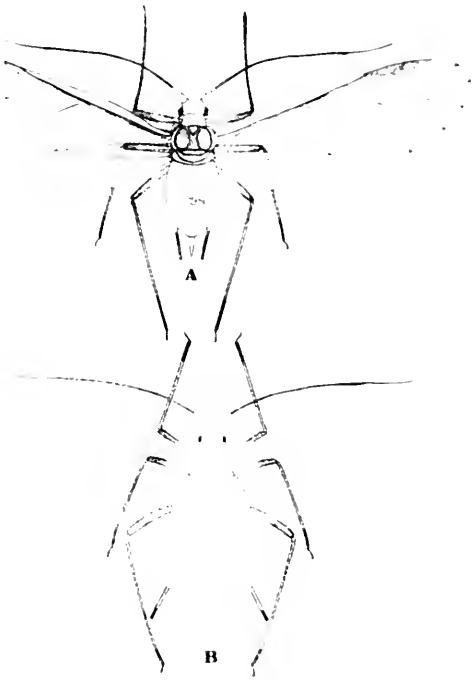

Figure 193. Macrosiphum citrifolii

on the middle of the dorsum, all green ventrally, may, or may not, have red spots on dorsum. *Cornicles*—(Figure 194 g). Cylindrical, long, restricted before apex, with mosaic markings in the restricted area, nearly twice as long as style, color of body with the apical two-thirds dusky, length 0.7 mm. *Legs*—Long and slender, normally haired, coxae color of body, femora green with apical half dusky, tibiae dusky throughout, tarsi dark. *Wings*—Hyaline. *Primary*—Length 4.2 mm., width 1.45 mm.; veins ending in dusky spot at wing margin; costal well defined, but narrow, light yellowish green; subcostal wide, light yellowish green;

stigma long and narrow, light yellowish green, stigmal vein well curved and arising from the stigma at its widest point (just beyond the middle from the body); first and second discoidals nearly straight; third discoidal nearly straight, first branch slightly curving downward, second branch arising near the middle of the branch. All veins except those already specified are amber in color. *Secondary*—Length 2.4 mm., width 0.65 mm.; subcostal curved upward near the tip, first and second discoidals straight and arising one-third and two-thirds respectively, the distance from base to tip of subcostal; amber. *Style*—(Figure 194 m). Ensiform, hairy, color of body or slightly dusky, length 0.32 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 193 B)

Length of body not including the style 2.6 mm., greatest width of abdomen 1.35 mm. Larger and more robust than the winged form.

Prevailing color—Bright, shiny green. *Head*—Yellow. *Eyes*—Red. *Antennae*—(Figure 194 b). On rather prominent frontal tubercles (more prominent than those of the winged form), longer than the body, slightly hairy, articles I and II color of the head, III dusky with light base, remaining articles dusky throughout, the lengths of the articles are as follows: I, 0.12 mm.; II, 0.08 mm.; III, 0.79 mm.; IV, 0.65 mm.; V, 0.59 mm.; VI, 1.2 mm. (spur 0.86 mm.); total 3.25 mm.; there are three or four circular sensoria on article III (Figure 194 b). *Rostrum*—Reaching just beyond second coxæ, dark at tip only. *Thorax*—Widening from the prothorax to the abdomen, yellowish green. *Abdomen*—Smooth, shiny green, with or without red dorsal spots. *Cornicles*—Same shape as those of the winged form, basal one-third or half green with remainder dusky, length 0.97 mm. *Style*—(Figure 194 n). Ensiform, hairy, green with margins slightly dusky, length 0.6 mm.

Young—Young are green and greatly resemble the adults in all characters.

Host—Found abundantly feeding on young seedling orange trees and upon the tender shoots and suckers of old seedling orange trees. Not taken on Valencia trees or on lemon trees, although it is not improbable that this insect does feed upon them as well as upon the seedling trees. The young shoots and buds may become so badly infested as to be entirely killed in a few weeks and care must be taken to keep this insect in check. Due to its green color it is seldom noticed until the twigs are beginning to show an unhealthy color.

Locality—Santa Paula, Cal. This insect has also been collected from nearly every citrus-growing section in Southern California. Wm. Davidson reports this species from Lindsay, Tulare County, Cal. (Jr. Ec. Ent. III, p. 380, 1910).

Date of Collection—April 7, 1911. Serial number 25.

In 1880 Wm. Ashmead described several forms under the heading of this insect, some of which were certainly not of this species, but were of the species *Aphis gossypii* Glover. His description is as follows:

"From observations made this year I find that from an egg laid by a fall oviparous female, which I described as follows:

"'*Young*—Length .02 inch. Dark greenish brown, with dark eyes and glassy white antennæ and legs.

"'*Male*—Length .04 inch. Color brown and brown-black; antennæ brown, legs pale or yellowish, posterior femora slightly shaded above with brown or black; feet reddish; nectaries shorter than in female; wings hyaline, stigmal spot pale. These are rare among the first broods, and afterwards almost or entirely disappear.

"'*Female*—Apterous, length 0.05 to 0.06 inch. Broadly ovate. Dark brownish-black. Head between antennæ reddish; antennæ seven-jointed, pale yellowish, apical ends of joints, three, four and five brown, six shortest, seven long, setaceous; legs pale yellow, latter two-thirds of the femora brownish or blackish, tips of tibiæ and claws brown; nectaries slightly thickest at base, black and cylindrical, cauda distinct.

"'*Winged Viriparous Female*—Length 1.06 inch. Color black and shining; eyes red-brown, tubercles of antennæ black, vertex of head reddish; rostrum reaching back of middle coxæ; antennæ not quite reaching to tip of abdomen; abdomen variable, brown-black, brown or olive-green; wings hyaline; stigma rather broad, brown, obliquely sharpened to a point at outer edge towards apex; stigmal vein strongly curved, dark; three oblique veins, the third forked; hind wings with two oblique veins in all specimens but one, nectaries long, cylindrical and black; cauda long and recurved, dark.

"'I have watched these viviparous females breed on my orange trees and the rapidity with which this is done is simply astonishing. In a few days broods upon broods, or young colonies, seem to exist on all the tender new leaves and shoots, and still the parthenogenetic young keep coming. Verily, if it were not for the chalcid flies, ichneumons and other parasites, they would be the death of the trees. By the middle of March a change takes place in the broods. The young differ from their parents in shape, color and size. So different are they as to discredit belief, and had I not watched them breeding day by day on my orange trees, I should have felt justified in describing them as a distinct species. They are undoubtedly a dimorphic form, and I give below a description:

"'*Dimorphic, Viviparous, Apterous Female*—Length, 0.08 to 0.09 inch. Elongate; color of a uniform pale pea-green with more or less of a longitudinal shading of darker green on the dorsum, with the surface more or less corrugated; eyes bright red, with a prominent facet or ocellus springing out from hinder edge of same, giving it a tooth-like appearance; antennæ VII jointed, pale glassy green, in mature specimens the tip from the fifth joint is reddish; legs of the same uniform pale green; cauda small, conical. Beak does not quite reach to tip of middle coxæ.'

"The winged form agrees in every respect with the above description, and can only be distinguished by having wings, the veins of which are very pale. These are rare, the majority being wingless.

"The mature viviparous female continues breeding and can often be found surrounded by from twenty to thirty pale green young; occasionally a brown one will be found among them. These continue breeding for several generations, ultimately giving place to the original type, and by the last of April none can be found. Why this change of form occurs is yet a mystery, and needs further investigation. Towards the end all seem to be parasitized by a *Trioxys*, *T. testaceipes* Cresson,

which thoroughly eradicates them." Wm. H. Ashmead, Can. Ent. XIV, p. 88, 1882.

For no little time *Siphonophora citrifolii* Ashm. was considered a distinct species, but with the study of *Aphis gossypii* Glover it was learned that many of the above dimorphic forms were of this latter species and that after all Ashmead had not described a new species at all, but had redescribed *Aphis gossypii* Glover. This is what Theodore Pergande writes concerning *Aphis gossypii* Glover:

"In 1880 Mr. Wm. Ashmead redescribed this species in his pamphlet on 'Orange Insects,' under the name of *Siphonophora citrifolii*, which he found to be infesting his orange trees, without being aware that the same insect infests also cotton and had been described previously.

"Again in 1882, Mr. Ashmead, in a paper on the 'Aphididæ of Florida' in the Canadian Entomologist (Vol. XIV, p. 91), in discussing dimorphism among insects, besides reproducing his original description, makes the serious mistake of describing on page 92 another species as a dimorphic form of his *citrifolii*, which, however, according to the characters given in this description, is neither a true *Aphis* nor a *Siphonophora*, but appears to belong to the genus *Rhopalosiphum*. Mixed colonies of closely related and other species of aphides are frequently found infesting the same plant at the same time, which, however, does not indicate dimorphism." Insect Life, Vol. 7, pp. 310-311, 1895.

No doubt Mr. Pergande was referring to the description of the dimorphic, viviparous, apterous females as described by Mr. Ashmead and this is without doubt the *Siphonophora citrifolii* of Ashmead. Although this may not be the insect which he originally described under that name, he, nevertheless, describes it as a dimorphic form and his description of this is adequate to decide that the *Macrosiphum* found on citrus trees in this state is the same as the *Siphonophora citrifolii* described by Ashmead. In spite of the fact that this species has been regarded, by many, as a synonym of *Aphis gossypii* Glover, this so-called dimorphic form is a good and distinct species and I trust that this description and the accompanying drawings shall serve to give it a proper place in the literature of the family Aphididæ.

The species resembles in a number of ways the Rose Aphid (*Macrosiphum rosae* Linn.) and the Pea Aphid (*Macrosiphum destructor* John.) and might easily be taken for either. Figure 194 shows a comparison of the antennæ, cornicles and styles of these three species. It will be seen that the number of sensoria on the third antennal article of the winged female vary greatly, there being more than twice as many on *M. rosae* than on either of the other two; more on *M. destructor* than on *M. citrifolii*. The third antennal article of *M. citrifolii* and *M. destructor* have three or four sensoria each, while there are thirteen or fourteen on the third article of *M. rosae*. The third article of *M. rosae* is longer than that of *M. citrifolii*, while that of *M. destructor* is longer than either. The cornicles of *M. rosae* and *M. citrifolii* have a restriction at the tip with a mosaic figure in the restricted area, while the cornicles of *M. destructor* are not restricted near the tip. Those of *M. rosae* are dusky throughout, those of *M. citrifolii* are dusky on the apical half or two-

thirds, while those of *M. destructor* are dusky only at the tips. The styles of *M. citrifolii* are the smallest, of *M. rosae* next in size (both of these are quite hairy) while those of *M. destructor* are much larger and are nearly destitute of hairs. The general appearance of *M. rosae* is also easily told by the rosy forms and by the dark legs, the black markings of the head, thorax, and abdomen. Neither of the

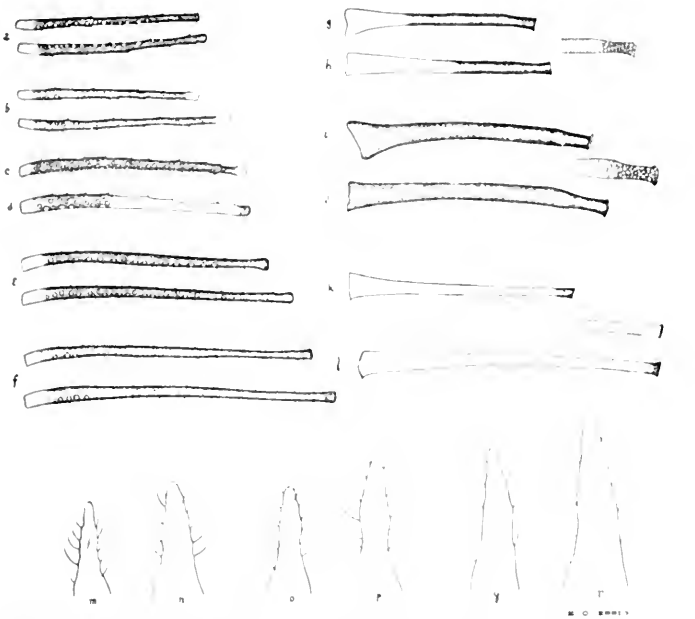

Figure 194. Details of Macrosiphum citrifolii (a, b, g, h, m, n); Macrosiphum rosæ (c, d, i, j, o, p); Macrosiphum destructor (e, f, k, l, q, r)

latter forms have these characters, except the darkened areas on the legs and these are much fainter.

Natural enemies—*Macrosiphum citrifolii* Ashm. is very effectually held in check in California by the predaceous ladybird beetles, *Coccinella californica* Mann, *Hippodamia convergens* Guer. and *Coccinella abdominalis* Say and by the larvæ of the Syrphid Flies *Syrphus americanus* Wied., *Allograpta obliqua* Say., and *Lasiophthicus pyrastri* L.

I am indebted to Mr. John June Davis for his aid in the determination of this species.

Myzus persicae (Sulzer) Passerini
GREEN PEACH APHIS

1761 *Aphis persicae* Sulzer, Kenz. Insect P. 105.
1843 *Aphis dianthi* Schrank, Fauna Boica, II.
1843 *Aphis persicae* Kalt., Mon. Pflz., pp. 93-94.
1847 *Aphis persicophila* Rondani, Ann. Sci. Nat. Bolog. 337-432.
1857 *Rhopalosiphum dianthi* Schrank, Koch, Die Pflz., p. 42.
1857 *Aphis institutiae* Koch, Die Pflz., pp. 58-59.
1860 *Myzus persicae* Pass., Gali Afidi.
1867 *Aphis persicaecola* Boisduval, Mon. Aley.
1876 *Myzus persicae* Sulz-Buckton, Mo. Brt. Aphid. I, 178.
1879 *Myzus achyrantes* Monell, Bull. U. S. Geol. Survey, V. I, p. 18.
1880 *Rhopalosiphum dianthi* Schr., Thos. 8th Rept. Ent. Ill., p. 80.
1880 *Myzus persicae* Sulz., Thomas, 8th Rept. Ent. Ill., p. 76.
1886 *Myzus malvae* Oestlund. List. Aphid. Minn., p. 31.
1908 *Myzus persicae* Sulz., Taylor, Jr. Ec. Ent., I, 83.
1908 *Myzus persicae* Sulz-Gill. and Taylor, Bull. 133-134 Colo. Exp. Sta.
1908 *Myzus persicae* Sulz-Gillette, Jr. Ec. Ent. I, 359
1909 *Myzus persicae* (Sulz), Fullaway, Ann. Rept. Hawaii Agrcl. Exp. Sta., 28-29.
1910 *Myzus achyrantes* (Monell), Williams, Aphid. Nebr., p. 63.
1910 *Rhopalosiphum dianthi* (Schrank), Williams, Aphid. Nebr., p. 69.

SPRING MIGRANT

WINGED VIVIPAROUS FEMALE (Figure 195 A)

Length of body 1.9 mm., width of mesothorax 0.5 mm., greatest width of abdomen 0.82 mm., wing expansion 6.8 mm.

Prevailing color—Green with dark dorsal markings. *Head*—Dark with lighter line at base, nearly as long as broad, with prominent, approximate, frontal tubercles. *Antennae*—(Figure 195 G). Gibbous on the inner basal sides, longer than body, dark except base of article III, sparsely hairy, lengths of articles: I, 0.1 mm.; II, 0.08 mm.; III, 0.58 mm.; IV, 0.43 mm.; V, 0.30 mm.; VI, 0.7 mm. (spur 5.2 mm.); total 2.49 mm.; at least twelve sensoria on article III. *Rostrum*—Reaching to or nearly to second coxæ, light with apical half dark. *Prothorax*—Black or dark with light band at central base and lateral basal corners light. *Meso-* and *Metathorax*—Shiny black. *Abdomen*—Green, brownish, or amber with darker dorsal markings as shown in drawing, ventral surface dusky. *Cornicles*—(Figure 184 E.) Cylindrical or slightly clavate, reaching beyond tip of abdomen, dark, length 0.42 mm., width at base .05 mm., greatest width 0.065 mm.; in some cases there is a light spot on the apical half which does not quite reach to the apex. *Legs*—Normal, coxæ light green; femora of prothoracic legs with apical half dusky, of the second and third pairs the apical two-thirds dusky; tibiæ with dark tips; tarsi dark. *Wings*—Normal, hyaline. *Primary*—Subcostal vein wide, dusky; stigma long and narrow, dusky; veins amber brown (see drawing), length

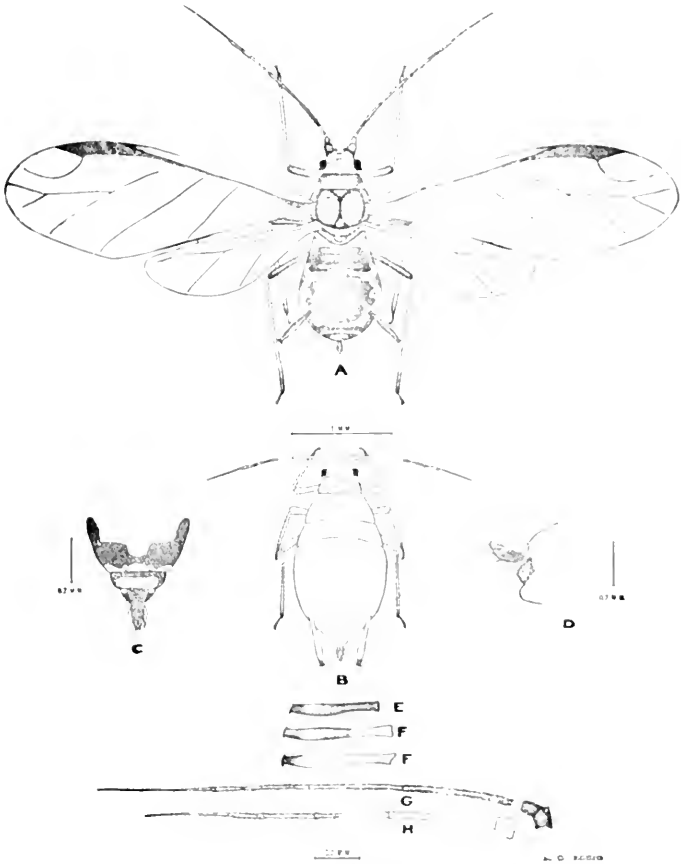

Figure 195. Myzus persicæ

A, winged viviparous female; B, apterous viviparous female; C, pygidium of winged female, dorsal aspect; D, pygidium of apterous female, ventral aspect; E, cornicle of winged female; F, cornicle of apterous female; G, antenna of winged female; H, antenna of apterous female

8.2 mm., width 1.2 mm. *Posterior*—Normal, length 1.8 mm., width 0.53 mm. *Style*—(Figure 195 C). Ensiform or nearly conical, sickle-shaped, dusky, length 0.2 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 195 B)

Length of body 1.8 mm., greatest width of abdomen 0.95 mm.

Prevailing color—Bright yellowish green, shiny throughout. *Head*—Nearly as long as wide, with very prominent approximate and somewhat gibbous, frontal, antennal tubercles. *Eyes*—Red. *Antennae*—(Figure 115). On prominent tubercles, first article somewhat gibbous, reaching to base of the cornicles, articles I, II, III and basal two-thirds of IV light yellow, remainder dusky, lengths of articles: I, 0.09 mm.; II, 0.08 mm.; III, 0.43 mm.; IV, 0.34 mm.; V, 0.21 mm.; VI, 0.53 mm. (spur 0.38 mm.). *Rostrum*—Reaching to second coxæ, light with dusky tip. *Abdomen*—Smooth, light green, anal plate dusky. *Cornicles*—Figure 195 F1 and F2). Slightly clavate, light green with apical two-thirds or but one-fifth dark, reaching beyond tip of style, length 0.5 mm. *Legs*—Light green throughout with dark tarsi. *Style*—(Figure 195 D). Conical, sickle-shaped, length 0.2 mm., light green.

This species is one of the most widely distributed and most variable of the entire family. It presents a number of distinct forms, each of which has been described as a separate and distinct species, causing much confusion in the literature of the family *Aphididae*. Perhaps no one has worked it out more thoroughly than has Prof. C. P. Gillette of the Colorado Agricultural Experiment Station. In the Journal of Economic Entomology, Vol. I, p. 359-362, may be found his full descriptions. He separately describes the following forms: Young Stem-Mother, Adult Stem-Mother, Apterous Viviparous Female, Spring Migrant, Winged Viviparous Female, Fall Migrant, Oviparous Female, and Male. Of these I have described the Spring Migrant and the Apterous Viviparous Female, the forms most common in this locality. For the full descriptions see his article.

Hosts—I have obtained this species on citrus trees (Orange and Lemon), Potatoes, *Malva parviflora* L., and Tomatoes. It has also been reported as feeding upon the following plants: *Amsinckia spectabilis* F. & M., *Brassica oleracea* (Cabbage, Cauliflower), Celestial pepper (*Capsicum annum var abbreviatum* Fing.), *Chrysanthemum indicum* L., *Cynoglossum* sp., Carnation (*Dianthus caryophyllum* L.), English Ivy (*Hedera helix* L.), Plum (*Prunus domestica* L.), Peach (*P. persica* B. & H.), Groundsel (*Senecio vulgaris* L.), *Sonchus asper* Vill., *Sonchus oleraceus* L., Nettle (*Urtica urens* L.), *Prunus amygdalus amygdalus*, Cherry (*P. cerasus* L.), German Ivy, *Prunus insititia*, *Malva rotundifolia*.

Locality—Taken by the writer in many parts of Southern California, at Claremont, Santa Ana, Santa Paula and Pomona. Date of collection—April 14, 1911. Serial number 22.

Note—I am indebted to Mr. J. T. Monell for the specific determination of this species.

Toxoptera aurantiae Koch

CITRUS APHID

1857 *Toxoptera aurantiae* Koch, Pflanzenlause pp. 254-255.

1880 *Toxoptera aurantiae* Koch-Buckton, Mon. Brit. Aphid. p. 135.

1910 *Toxoptera aurantiae* Koch-Fullaway, Rept. Hawaii. Agrcl. Exp. Sta. pp. 341-342, for 1909.

WINGED VIVIPAROUS FEMALE (Figure 196 A)

Length of body not including style 1.6 mm., width of the mesothorax 0.55 mm., greatest width of abdomen 0.75 mm., wing expansion 6.5 mm. A small black form very common on Citrus in this State.

Prevailing color—Black, shining. *Head*—Narrow, but wider than long, black, with inconspicuous frontal tubercles. *Eyes*—Very dark red, almost brown. *Antennae*—(Figure 196 D). On inconspicuous frontal tubercles, longer than the body, but not reaching to tip of style, slightly hairy, articles I and II dark throughout, III, IV and V all transparently light or amber with dusky tips, VI amber with dusky band at nail-like process and at the tip. The lengths of the articles are as follows: I, 0.1 mm.; II, 0.08 mm.; III, 0.37 mm.; IV, 0.31 mm.; V, 0.31 mm.; VI, 0.52 mm. (spur 0.42 mm.); total 1.69 mm.; article III (Figure 196 G) has from six to eight large circular sensoria, IV (Figure 196 H) has one large circular sensorium three-fourths the distance from the base to the tip, V has a large circular sensorium near the tip, VI has the usual number of sensoria in the nail-like process. *Rostrum*—Reaching just beyond second coxæ, light yellow with dark base and tip. *Prothorax*—Twice as wide as long, shiny black, with distinct later al tubercles. *Mesothorax*—Shiny black, muscle lobes prominent, making the mesothorax much higher than the other part of the body. *Metathorax*—Narrow transversely, black. *Abdomen*—Well rounded and smooth, shiny black or very dark brown with several small lateral tubercles on the margins. *Cornicles*—(Figure 196 C). Short, cylindrical, widest at base and narrowest at tip, with inconspicuously rimmed mouth, imbricated, black, length 0.2 mm., usually carried at right angles to the main axis of the body. *Legs*—Rather large, hairy; coxæ black, femora of fore-legs dark at tip only; femora of middle and hind legs amber with all but extreme bases black; tibiæ amber with bases and tips dark; tarsi dark. *Wings*—Rather large and hyaline. *Primary*—Length 3 mm., width 1.1 mm.; costal vein narrow and well defined, brown; subcostal wide and dark; stigma, the most characteristic feature of this insect, is very black and can be readily distinguished by the naked eye, long and narrow with the longest sides parallel, pointed at the tip, length 0.1 mm., width 0.15 mm.; stigmal arising near tip of stigma, well curved; first discoidal straight, light brown; second discoidal curved slightly inwardly, light brown; third discoidal once-branched, the branch arising near the middle of the vein (slightly nearer the tip from the middle), light brown. *Secondary*—Length 1.7 mm., width 0.5 mm.; subcostal extending to tip of the wing, curved upwardly between discoidals, downwardly just beyond base of the second discoidal, and thence upwardly to the tip; veins light brown. *Style*—Conical, hairy, black, length 0.1 mm., half as long as the conicles.

APTEROUS VIVIPAROUS FEMALE (Figure 196 B)

Length not including the style 1.65 mm. or slightly longer, greatest width of the abdomen 1.25 mm. A dark robust form somewhat larger than the winged individuals.

Prevailing color—Velvety black, may or may not be shiny, some forms are slightly brownish-black. *Head*—Black, much wider than long. *Eyes*—Dark brown. *Antennae*—(Figure 196 F). On inconspicuous frontal tubercles, reaching to the bases of the cornicles, slightly hairy, articles I and II color of the body, III, IV and V light yellow with dusky tips, VI light with dark band at nail-like process and dusky tip, lengths of the articles; I, 0.1 mm, II, 0.07 mm.; III, 0.37

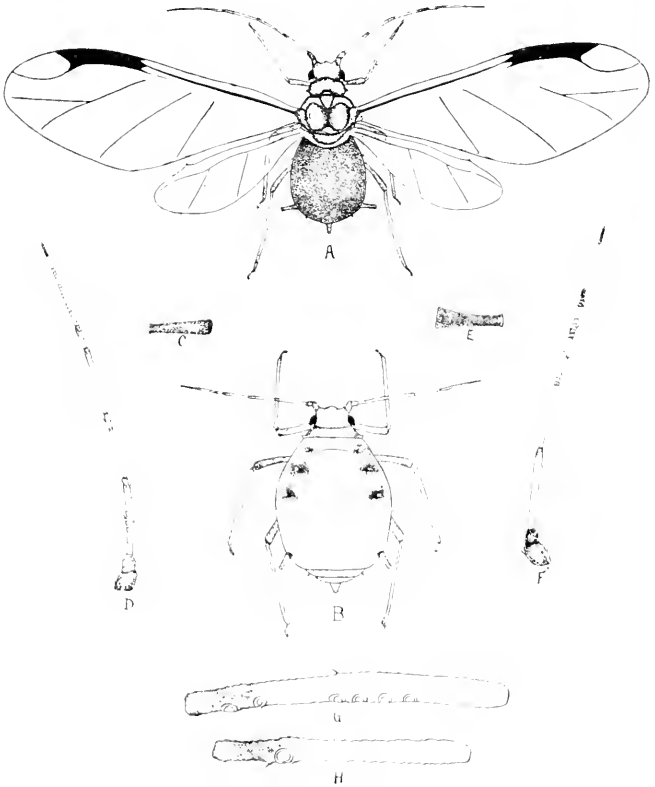

Figure 196. Toxoptera aurantiæ

mm.; IV, 0.31 mm.; V, 0.31 mm.; VI, 0.15 mm. + spur 0.36 mm. = total 1.04 mm.; circular sensorium at apex of article V and usual ones in the nail like process. *Prothorax*—With lateral tubercles at the base. *Meso and Meta thorax*—Not distinctly defined. *Abdomen*—Robust, smooth with lateral depressions near front margins, two marginal tubercles on each side, black or dark brown. *Cornicles* (Figure 196 E).—Cylindrical, widest at base and gradually tapering to tip which is slightly rimmed, imbricated, black, length 0.2 mm. *Legs*—Normal, hairy, colored as in the winged form. *Style*—Conical, much wider at base than at apex, hairy, black, half as long as cornicles, 0.1 mm.

Young—The young apterous forms are from dull brown to black, while the nymphs are reddish brown.

Hosts—This species settles in great colonies on the tender twigs of orange and lemon trees and may entirely destroy the new top on a young tree. They also feed upon the undersides of the leaves of suckers and tender shoots of old trees. In not a few cases old, tough leaves are attacked by this species. The presence of the insect upon the older leaves is usually recognized by the curling and twisting of the foliage so as to form a place of protection for them on the insides of the cup-shaped leaves. While this insect has been found feeding on Orange, Citron and Camellia in Europe and on *Pelea*, *Straussia* and *Coffea* in the Hawaiian Islands, I have been able to find it only upon citrus trees in this locality, where it seems to exist during the entire year.

Locality—Throughout the entire southern part of California. Taken by the writer in San Diego, Orange, San Bernardino, Los Angeles and Ventura counties. Wm. Davidson also reports it at San Jose.

Date of Collection—Occurs in this locality during the spring and early summer months in abundance. Collected April 3, 1914, when most numerous. Serial number 14.

This species is easily mistaken for another small black aphis working in a similar manner and nearly always associated with it on seedling trees, *Aphis gossypii* Glover. It is easily distinguished from *A. gossypii*, with the unaided eye, by the black stigma on the primary wings as referred to above, and most easily distinguished under the microscope by the third discoidal vein being but once branched instead of twice as in *A. gossypii*.

Natural enemies—This insect is most effectually held in check by the two internal parasites described hereinafter and by the larvae of the large Syrphid Fly, *Lasiophthicus pyrastri* L., although the larvae of the *Syrphus americanus* Wied., and of *Allograpta obliqua* Say, play an important part in this. Of the ladybird beetles, *Coccinella californica* Mann. is the most important enemy here.

Mr. John June Davis, Mr. J. T. Monell, Prof. Theo. Pergande and Prof. Wm. Davidson have aided me much in the determination of this species.

Natural Enemies of the Citrus Plant Lice

CHRYSOPIDÆ

Chrysopa californica Coq.

CALIFORNIA GREEN LACE WING OR APHIS LION

One of the most common insect predators, preying on all sorts of soft bodied insects, is the common green lace wing, called Aphis Lion because of its destructiveness to all plant lice (aphids). The eggs, larvæ, pupæ and adults are to be found everywhere in the fields, woods and orchards; wherever there are infestations of plant lice one is almost sure to find the larvæ of the *Chrysopa.* In the citrus orchards of Southern California they are very abundant and play an important part in the control of many bad pests, but more important in keeping down the aphids which have already been described. When there is no prey in the orchards they go to the fields and brush to seek other game and return as soon as the lice begin to appear. The part played by this insect in an economic way certainly justifies a short description here in connection with the predaceous Coccinellids and Syrphid Flies.

Eggs—(Figure 197 B). The eggs are very small, pearly white in color, oblong in shape with the base drawn out to connect with a fine hair or pedestal which supports it nearly half an inch above the surface to which the hair is attached. The egg itself is not more than one-eighth of an inch in length. The adult insect has no doubt employed the method of placing her eggs on long stalks for the purpose of putting them out of the reach of other crawling insects which would otherwise devour them. They are deposited singly or sometimes in small groups on the upper sides of the leaves, or in fact on most any part of a tree, plant, or any other support.

Larva—(Figure 197 A). When first hatched the larva is, of course, very small, but grows very rapidly. The first born vary from a very light yellow to a gray color. As soon as it leaves the egg the search for food is begun and apparently there are few insects which escape its appetite. At first only the very youngest plant lice are devoured, but it is not long before insects twice and three times as large as the chrysopid larva are destroyed. The full-grown larva varies from half to nearly a full inch in length, is bright yellow with dark red markings distributed as shown in the drawing. The head is equipped with a large pair of mandibles, grooved on the inner side, curved like a sickle and pointed. With these it penetrates the body wall and sucks out the contents through the grooves. The legs are short with sharp claws to clasp firmly the footing which it may have in order that it might, as is the habit, lift the prey bodily into the air where its struggles are in vain, and jog it there until all of the body juices have been extracted. This operation can easily be observed in the field. So fierce are they that they devour not only mealy bugs, the larvæ of Coccinellids, but their own kind. I have placed from four to eight in a small box or bottle and after a few days would find only two, or more often, only one left. In order to make sure

this point the operation has also been observed repeatedly, but cannibalism is not uncommon among predaceous insects. Though the good from this insect is often great, I have often thought that the harm done, by eating other beneficial insects, more than overbalanced the good done. For instance we imported the Coccinellid enemy (*Cryptolaemus montrouzieri*) of the citrus mealy bug into our orchards at Santa Paula and it was impossible to go into the field without finding nearly every chrysopid larva with the young of this ladybird beetle. In not a few instances entire colonies were entirely destroyed, and though many of the mealy bugs also fell a prey to the chrysopids, they seemed to prefer the larvae of the Cryptolaemus. But other than this I have seen very little to count against it, and as an aphid feeder alone the good is very marked.

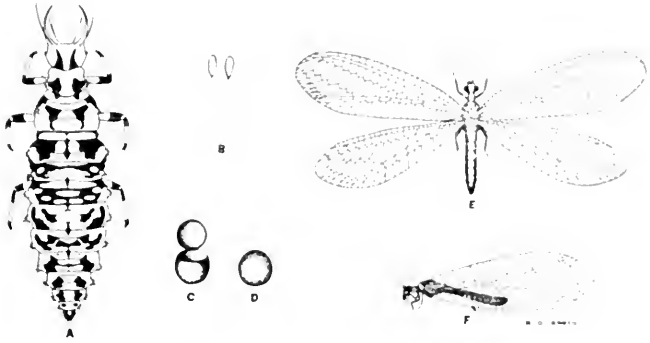

Figure 197. Chrysopa californica

Pupa—(Figure 197 C and D). When fully developed and ready to undergo transformations it spins a thin, hard-walled, globular, pupa case about itself (Figure 197 C shows mouth open after escape of the adult, D shows the cocoon) in some crack or crevice and remains dormant for some time. These globular pupa cases are often nearly covered with long white filaments—not unlike cotton—by which they are fastened, and are grouped together in small lots or may be single. It is this stage that is subject to severe attacks of internal parasites, which plays havoc with rapid development of numbers. The parasite, *Isodromus iceryae* How. is common here and has been reared in large numbers from the pupa cases of the green lace wing and also from the pupae of the Brown Lace Wing (*Symphorobius augustus* Banks).

Adult—(Figure 197 E and F). The adult insect is from five-sixteenths to three-eighths of an inch long and twice as long including the length to the tip of the folded wings, of a beautiful green color with a longitudinal, dorsal, yellow band extending from the front of the head to the penultimate abdominal segment. There are four large, membranous wings, wonderfully nerved (from which comes

the name lace wing), and bright transparent green. The head is yellow above, green beneath, and amber or brown on the sides. The thorax and abdomen are green excepting the dorsal yellow band. The legs are green with tips of the tibiæ and the tarsi amber. Eyes large, iridescent green. Antennæ long and setaceous, light yellow or transparent white with amber tips. The wing veins and the entire body are clothed with fine hairs.

COCCINELLIDAE

Feeding upon plant lice are always to be found the young or larvæ of the Ladybird Beetles (Coccinellidae). There are three common aphid feeders which are to be found in nearly every orange orchard and which should receive special attention here. They are the common Red Ladybird Beetle *Coccinella californica*, Mann, the Red Spotted Beetle *Hippodamia convergens* Guer., and the Ashy Gray Ladybird Beetle *Coccinella abdominalis* Say. Besides these there are a few specimens of the genus *Scymnus* to be found, the most common and efficient being a small brown native species, *Scymnus sordidus* Horn.

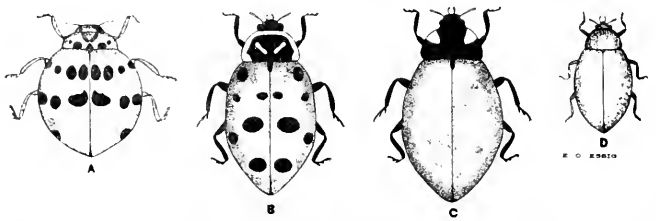

Figure 198. A, Coccinella abdominalis; B, Hippodamia convergens; C, Coccinella californica; D, Scymnus sordidus

The eggs of these ladybird beetles are laid in clusters not unlike bunches of cigars on end, and may be found almost anywhere, from board fences to the various parts of the foliage of a tree. They are small, pointed at both ends, and salmon colored. The accompanying photographs give a fair representation of different clusters. The eggs of *S. sordidus* are deposited singly and are very difficult to find.

The larvae as they emerge from the upper ends of the eggs soon begin their search for food, which consists of very small insects at first. They grow very fast and develop tremendous appetites. The body is long, very rough, hairy and dark with red or yellow markings on the dorsum. They have six legs and are capable of traveling very rapidly. As soon as they are fully matured they hang themselves up by the tail-end to some twig, leaf, limb, or any other convenient place of support and transform into the pupal stage. These pupæ may be seen in considerable numbers almost anywhere in the orchards. They are of a reddish brown or gray color with dark markings. When touched or disturbed they will suddenly throw up the head as if to strike the assailant. From this stage emerges the adult beetle

which produces more eggs and begins another life cycle. All of these stages may be found throughout the entire summer and fall months, while the adult forms are found at any season of the year in Southern California.

Coccinella californica Mann. (Red Ladybird Beetle)

(Figures 198 C and 199)

A scarlet-red beetle very common throughout this State. Head black, thorax black with white or pale spot on each margin; elytra orange or scarlet red with no other marking than a small rhombodal dark spot at the middle base, known as the scutellar spot. Length 5.0 to 6.0 mm., width 4.0 mm. to 4.7 mm. Feeds on many different species of aphids.

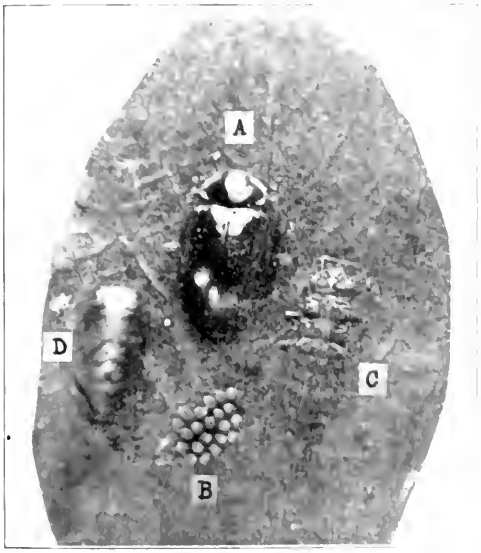

Figure 199. Coccinella californica. A, adult; B, eggs; C, larva; D, pupa.

Hippodamia convergens Guer. (Black Spotted Red Ladybird)

(Figures 198 B and 200)

Red beetle with twelve black spots on the dorsum. Head black; thorax black with two narrow white lateral margins and a very small median white spot at the base; elytra varying from light to very dark red, each with six black spots, the posterior three invariably isolated among themselves and usually constant, the anterior spots usually smallest and variable; scutellar spot black, small; legs black throughout. Average length 5.2 mm., average width 3.2 mm.

The larvæ when fully developed vary from one-quarter to nearly three-quarters of an inch in length. They are dull black with bright orange or yellow markings on the back.

The pupæ are amber or reddish brown with transverse dark bands across the body and numerous dark spots on the dorsum.

This is the most common form we have in the southern part of the State and is a very important and helpful insect. It is being sent in great numbers by the State Commission to the melon fields of Imperial County to prey upon the melon aphis there as is also *Coccinella californica.*

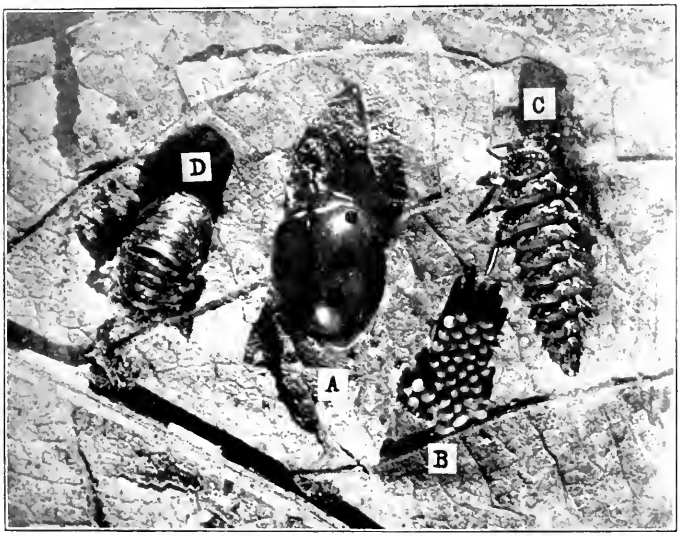

Figure 200. Hippodamia convergens
A, adult; B, eggs; C, larva; D, pupa.

Coccinella abdominalis Say. (Ashy Gray Ladybird)

(Figures 198 A and 201)

Gets its common name from its gray color. The following is a description after Thos. Casey:

"Broadly oval and strongly convex, very finely and obsoletely punctulate (the side margins as in Cycloneda); upper surface pale brownish-yellow, the head pale and immaculate; pronotum with a basal black spot at two-fifths from the middle and a short transverse spot before the scutellum, also with two posteriorly converging black spots at the center and a narrow elongate spot on the median line

joining the ante-scutellar spot, and, at lateral eight and basal third, a small rounded spot; scutellum black in the male; elytra each with a sub basal transverse series of four small black spots, a median series of three spots, the inner the largest and transversely crescentiform and, at apical fourth near margin, another small rounded black spot; under surface and legs pale. Length 4.25 to 5.25 mm., width 3.4 to 4.0 mm. Jr. N. Y. Ent. Soc. Vol. VII, p. 93, 1899.

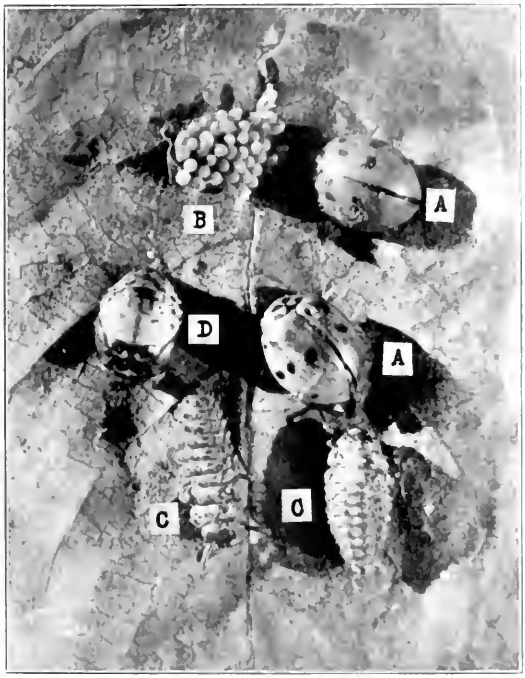

Figure 201. Coccinella abdominalis
A, adults; B, eggs; C, larva; D, pupa

In all there are seven black spots on the thorax and eight on each elytra or wing cover.

The larvæ resemble those of *Hippodamia convergens*, but are a little larger and have very light or yellow spots on the dorsum instead of orange spots.

This insect works on various plant lice of the orange, but is the most effectual check we have in this county on the Walnut Louse, *Callipterus juglandi-*

icola Koch., which it seems to prefer to all other aphids. There are millions of the eggs, larvæ, pupæ and adults to be found in every walnut orchard in Ventura County and large numbers are found in the citrus orchards in the early spring before the walnuts begin to leaf out. It is by far the most important beneficial insect of the three herein described.

Scymus sordidus Horn.

(Figures 198 D and 202)

This is one of the smallest of the aphid feeders, but very common in localities near the foothills, where it feeds especially upon *Aphis gossypii* Glover.

The larva is considerably larger than the adult, being nearly a quarter of an inch long and half as wide. It is easily recognized by its heavy coating of rather long, white, cottony wax and is often mistaken by citrus growers for a mealy bug.

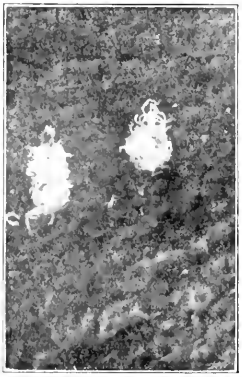

Figure 202. Larva of Scymnus sordidus

The adult is scarcely more than one-eighth of an inch long and two-thirds as wide, light brown to very dark brown in color, and with elongated body. It is technically described by Thos. Casey (See P. C. Jr. Ent. Vol. III, No. 3, p. 520, Sept. 1911) briefly as follows: "Body elongate oval. Length 1.65 mm., width 0.9 mm. Pronotum piceous, minutely, not very closely, punctulate, the sides not quite continuous. Elytra pale, with margins nubilously blackish, more broadly at base, finely and rather closely punctate. Abdominal lines extending outward externally parallel to the edge of the segment and a slight distance therefrom, prosternum relatively slightly wider between coxæ, flat and wholly devoid of carniæ; genital or 'sixth' ventral segment, usually developed."

This insect is a native of California and especially abundant in the southern citrus counties, where it also does good work on the citrus mealy bug.

SYRPHIDAE

Always among the plant lice are to be found greenish, flat, sticky-looking "worms" which are decidedly pointed at one end and which do not have a distinct head, eyes or legs. These so-called "worms" are the larvae or maggots of a two-winged insect or fly of the order Diptera and the family *Syrphidae*, which are commonly called Syrphid or Flower-Flies. The larvae (Figure 203 A) vary from the minutest first-hatched maggot to nearly an inch in length, according to the species to which it belongs. They are usually light or dark green, but some may be brown, orange, very light or nearly black. Those feeding upon the citrus plant lice and herein described are green with a longitudinal darker green or brownish stripe on the dorsum. The mouth is situated at the small end and all of the food is obtained by puncturing the body walls of the lice and then sucking out the contents. This operation is easily observed in the field. The maggot firmly supports itself by the large posterior end, raises itself up and begins to blindly move its mouth-end about in quest of food. If it touches a plant louse it immediately raises it into the air and sucks it dry. This is very rapidly repeated, with very disastrous results to the lice. When the larva is full grown it seeks some sheltered spot in which to pupate (transform into the adult fly). This it may do on the stems or upon the surface of a leaf. The pupa stage is shown in Figure 203 B and is a long, roundish or oval, brown body, which shows no signs of life. From this emerges the adult fly, which removes one end of the pupa case to escape. The adults under consideration are dark with transverse yellow bands across the abdomen as shown in the accompanying cuts. They are very swift fliers and are often mistaken for bees. They are common around flowers, feeding upon the nectar and from this habit get the names "Flower or Honey Flies." On hot days they are sometimes very numerous and are called "Sweat Flies" in the Eastern states. They deposit their eggs singly upon leaves and twigs which are infested with plant lice and these give rise to the green larvae.

While these insects do much to prevent the spread of the plant lice, they are in turn preyed upon by other insects. Ants, which foster and protect the plant lice, kill and carry off the larvae in large numbers and greatly reduce their efficiency. Internal parasites also prey upon them. I have hatched a large one from the pupa of *Syrphus americanus* Wied. Insect Life, Vol III, p. 153, reports the internal parasite *Hemiteles syrphicola* Ashm. as being reared from *Allograpta obliqua* Say.

There are three species here which are doing good work in keeping down the Citrus Plant Lice: a very large species, *Lasiophthicus pyrastri* Linn., the common Syrphid, *Syrphus americanus* Wied., and the small species *Allograpta obliqua* Say. The following brief descriptions of the adult forms have been prepared:

*Lasiophthicus pyrastri Linn.

(Figure 203)

This is the largest of the three species named above and measures seven-sixteenths of an inch long. The large compound eyes occupy most of the head

*NOTE. I am indebted to Prof. C. F. Baker, of Pomona College, for the identification of these species.

and they are dark Indian red or brown. The face is yellow and hairy, with median dark line. Antennæ are black with long dorsal arista. Thorax iridescent dark blue or green, covered with long fine hair or pubescence. Scutellum same color as the mesothorax. Legs—coxæ dark; femora dark with tips light; tibiæ amber or yellowish, slightly darker at tips; tarsi dusky. Abdomen velvety black with three pairs of marginal curved transverse bands on the dorsum. These bands do not come together in the middle and really form six bands.

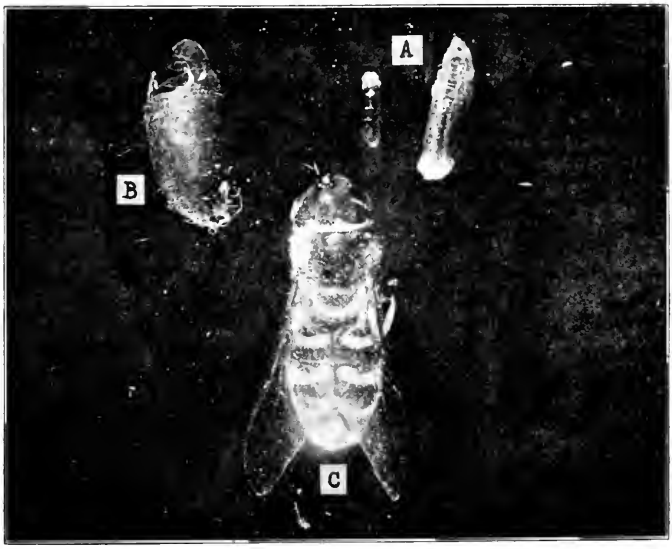

Figure 203. Lasiophthicus pyrastri
A, larva; B, puparium; C, adult.

This is a very widely distributed and common species and feeds on nearly every species of plant lice. It is especially abundant on twigs infested with *Macrosiphum citrifolii* Ashm., *Toxoptera aurantiae* Koch., and *Aphis gossypii* Glover.

Syrphus americanus Wied.

(Figure 204 A)

Although this species is much smaller than the above described species, it is considered to be one of the largest species in the genus, averaging three-eighths of an inch in length. It greatly resembles *Lasiophthicus pyrastri* L. in general form and color. The eyes are dark reddish brown. Face amber yellow with dark band in the middle extending from base of the antennæ to the mouth. Antennæ

black, with dorsal arista. Thorax iridescent green, covered with fine long hair Legs—Coxæ dark; bases of femora dark; remainder of legs amber brown Abdomen rich shiny black with three pairs of transverse yellow bands along the dorsal margins. These bands do not unite in the middle by one-half their lengths There are also two very narrow transverse yellow bands extending across the dorsum near the posterior or anal end.

This, too, is a very common and widely distributed species and has been reported from nearly every section of this country.

Specimens were reared from twigs infested with *Macrosiphum citrifolii* Ashm., *Toxoptera aurantiae* Koch, and *Aphis gossypii* Glover as well as from a great number of infestations of other common aphids.

Figure 204. A, Syrphus americanus; B, Allograpta obliqua

Allograpta obliqua Say

(Figure 204 B)

This is the smallest of the three species taken from citrus aphids. It is not as plentiful as either of the two species above, but is by no means rare. Length one-quarter of an inch. The body is dark and very slender. Eyes dark red. Face yellow with dark median line. Antennæ amber brown. Thorax iridescent green. Scutellum light yellow. Legs light yellow. Abdomen dark with four transverse yellow bands on the dorsum and yellow longitudinal markings at the base of the ovipositor, which is amber brown or dark.

Reared from *Toxoptera aurantiae* Koch and *Aphis gossypii* Glover.

INTERNAL PARASITES

Of the natural enemies of the citrus plant lice, by far the most effective are the internal parasites. The adult females of these true parasites deposit their eggs, by means of a long, sharp-pointed ovipositor, which pierces the body wall of the lice, within the living tissues, inside the bodies of the plant lice. The outside wound heals over in a short time leaving the egg tightly sealed within the body ready to hatch. As soon as the egg is hatched the small legless larva begins to feed upon the tissues of the aphid and its development means the extinction of a louse. When the larva is fully developed and ready to leave the "mummied" louse it cuts a circular hole in the top of the body and escapes a winged insect ready to

produce more eggs and to thereby destroy more insects. The life-cycle varies according to the time of year. In the colder months it covers from about ninety to one hundred days, while during the summer months it covers from eight to fifteen days.

The so-called "Mummied" plant lice (Figure 205) are easily recognized before the adult parasite escapes by the inflated and discolored bodies which appear among the healthy individuals. These bodies are usually of a lighter color and finally become entirely bleached. The circular hole cut by the escaped parasites is always a sure sign of the presence of these beneficial insects. The "mummies" are fastened to the leaf, as soon as the louse is dead, by the larva of the parasite,

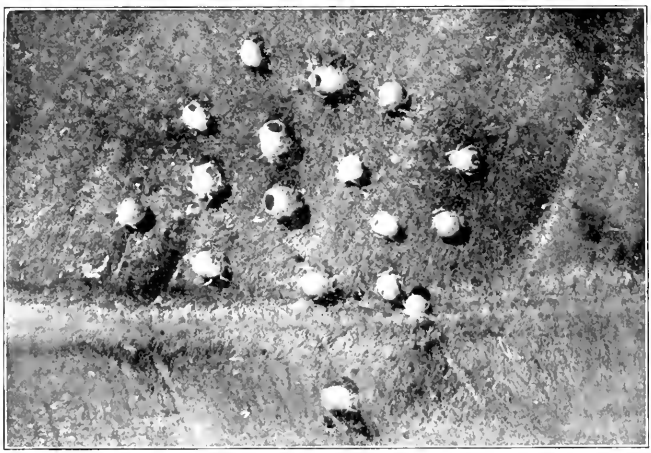

Figure 205
Mummied bodies of parasitized plant lice.

which cuts a slit in the lower side of the body and fastens the sides to the leaf or twig by excreting a mucilageous or web-like substance for this purpose.

So far, I have been able to collect two distinct forms of these hymenopterous parasites—one a very common Braconid, *Aphidius testaceipes* Cresson, and the other a Cynipid of the genus *Charips* (*Allotria*). Brief descriptions of these insects are as follows:

Aphidius testaceipes (Cresson)

(Figure 206, left)

1879 *Trioxys testaceipes* (Cresson) Comstock, U. S. Dept. Agrcl. Rept. p. 208. Original description.

1888 *Lysiphlebus testaceipes* (Cresson) Ashmead, Proc. U. S. Nat. Mus. p. 667.

Cresson's Original Description

"*Female*—Piceous or shining black, smooth and polished, impunctured; mandibles and palpi pale; antennæ brownish black, sometimes more or less pale beneath, thirteen-jointed, the joints faintly fluted or grooved, the last one longest and thickest; wings hyaline, iridescent, stigma pale; legs, including coxæ, yellowish-testaceous, the posterior pair generally more or less fuscous or blackish; abdomen often brown or pale piceous, with the first, and sometimes part of the second, segment more or less testaceous. Length 0.07 inch.

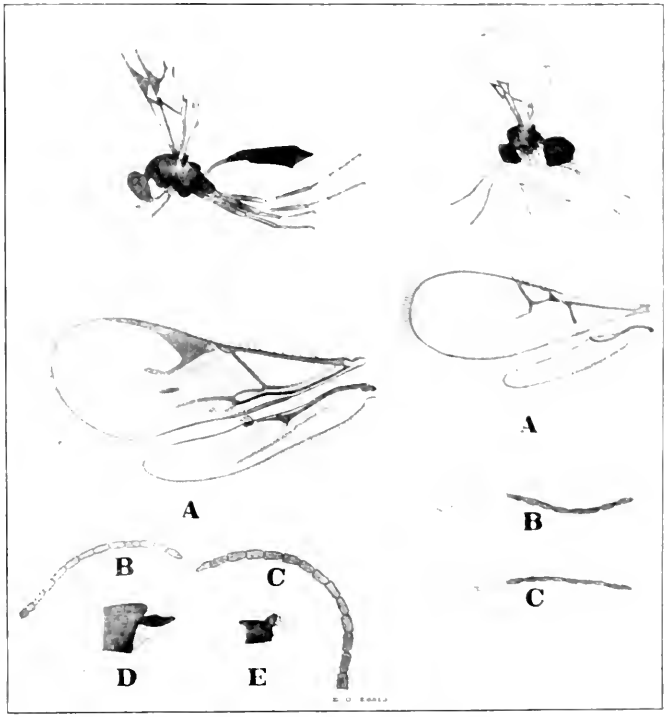

Figure 206. Aphidius testaceipes, on left. Charips xanthopsis, on right

"*Habitat*—Rock Ledge, Florida; Selma, Ala., and Pocomoke City, Md. Parasitic upon an aphid infesting twigs of orange, an aphid on the cotton plant, and *Aphis avenae* Fabr."

In Southern California this insect is parasitic on *Aphis gossypii* Glover (the orange and cotton aphid) and on *Toxoptera aurantiae* Koch. Collected by the writer at Santa Paula, California.

I am indebted to Mr. C. L. Marlatt for the identification of this species.

Charips xanthopsis Ashm.

(Figure 206, right)

1896 *Allotria xanthopsis* Ashmead, Trans. Amer. Ent. Soc. XXIII., p. 185.

Ashmead described this parasitic cynipid as having been reared from *Siphonophora citrifolii* in Florida. The species we rear here quite commonly from *Aphis gossypii*, and *Toxoptera aurantiae*, is very near to *xanthopsis*, if not the same thing. Only minute comparison with the type could settle the matter, however.

REMEDIES FOR PLANT LICE ON CITRUS TREES

Though it is seldom necessary to employ artificial means in dealing with these insects, yet any of the forms described may almost entirely overrun young trees. I know of such a case at Claremont in the year 1909, where a young Valencia orange orchard was badly infested and nearly all of the new growth killed back as fast at it grew out. But even greater damage may be done to young buds placed in old trees. On these tender shoots the green louse, *Macrosiphum citrifolii* Ashm., is especially bad, and in such cases should be controlled by sprays.

In using sprays for these aphids, we must first take into consideration the tree and what it can stand. Though the citrus trees are evergreen and do not admit of severe winter sprayings, as do the dormant deciduous trees, yet the leaves are more resistant than are the tender leaves of the latter, and will stand more summer spraying, when it is most necessary for the insects under discussion. So far I have never found any of the aphids depositing eggs to bridge over the winter months. Adult insects, however, may be found in limited numbers throughout the entire year in Southern California, so we do not have to deal with a distinct egg-laying stage, which is difficult to handle except with very strong sprays. Neither do we have to deal with root forms, like the underground forms of the Black Peach Aphis (*Aphis persicae-niger* Smith) and the Woolly Aphis of the Apple (*Schizoneura lanigera* Haus).

The sprays recommended, then, are such as might be used on citrus trees and are not intended as remedies for aphids on all trees and plants, though many of them are standards and need but little additions of water to serve any purpose.

Spray Formulae

TOBACCO SPRAYS

TOBACCO DECOCTIONS

(1).	Tobacco stems, dust or waste	2 pounds.
	Water	4 gallons.
(2).	Tobacco leaf	1 pound.
	Water	4 gallons.

Steep the tobacco in the water for one hour and apply in two applications of five days apart.

COMMERCIAL TOBACCO SPRAYS

(1).	Black Leaf Extract	1 gallon.
	Water	30 gallons.
(2).	"Black Leaf 40"	1 gallon.
	Water	1000 gallons.

By adding one pound of soap to every fifty gallons of these sprays the efficiency is greatly increased.

TOBACCO DECOCTION AND SOAP

Tobacco leaves or waste	1 pound.
Water	6 gallons.
Soap	1 pound.

Dissolve the soap in the water and steep the tobacco in this solution for one hour.

SOAP SPRAYS

WHALE OIL SOAP

Whale oil soap	1 pound.
Water	6 gallons.

EMULSIONS

KEROSENE EMULSION

STOCK SOLUTION

Kerosene	2 gallons.
Whale oil or laundry soap	½ pound.
Water (must be soft)	1 gallon.

PREPARATION

Dissolve the soap in hot or boiling water; add the kerosene (be careful of fire); agitate thoroughly with a hand pump until a rather thick, creamy liquid results. (This thorough agitation, by pumping back into the same vessel, is necessary to insure a proper emulsion, which will not damage the foliage.) For use add one gallon of the above stock solution to every twelve gallons of water.

CARBOLIC ACID EMULSION

STOCK SOLUTION

Whale oil soap	40 pounds.
Crude carbolic acid	5 gallons.
Water to mix	40 gallons.

PREPARATION

Dissolve the whale oil soap in the water, heating it to the boiling point (soap must be thoroughly dissolved); add the crude carbolic acid and cook for twenty minutes over a good fire (reserve five gallons of water to add in case the mixture begins to boil over). For use add twenty gallons of water to every gallon of the stock solution. This emulsion needs no agitation while being applied.

RESIN SPRAY

RESIN WASH

Resin	10 pounds.
Caustic soda (76 per cent)	3 pounds.
Fish oil	1½ pints.
Water	50 gallons.

Place resin, soda and fish oil in a kettle with water to cover them to a depth of three or four inches. Boil and add water from time to time to make half or a third of the final amount for a stock solution, and for use dilute this according to the above formula.

QUASSIA CHIPS AND WHALE OIL SOAP

STOCK SOLUTION

Quassia Chips	1 pound.
Water	1 gallon.
Whale oil soap	½ pound.

PREPARATION.

Boil the quassia chips in water for one-half hour; add the soap and stir until all is dissolved in the boiling water. For use dilute with ten gallons of water.

APPLICATIONS

It will often be necessary to apply a single spray a number of times in order to get all satisfactory results. These applications should be made at intervals of from four to six days until the insects disappear or greatly diminish in numbers.

One of the greatest successes of a spray is thorough application under high pressure. With a common bucket or knapsack pump only the first can be accomplished, but if even this is observed good results may be obtained. If, however, a power outfit can be had and a pressure of from one hundred to two hundred pounds maintained, one spraying will usually suffice with excellent results. Young buds are not secure enough to be sprayed with a power sprayer, and must be treated with a hand pump.

An Aphid Note

According to the later revisions of the tribe *Chaitophorini* and its included genera, the species described as *Chaitophorus salicicola* n. sp. (Pomona College Journal of Entomology, III, No. 3, p. 532, 1911) should be *Thomasia salicicola* n. sp.

THE WHITE-FLIES OF JAPAN*

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In this paper are listed eleven species of Japanese Aleyrodidæ which have been collected by the writer and others, during the last few years. Three of these species were previously recorded and eight are new to science and described herewith.

The writer's thanks are due to Prof. A. L. Quaintance, Bureau of Entomology, United States Department of Agriculture, Washington, D. C., for his courtesy in examining the specimens, and for his assistance in the determinations.

Aleyrodes citri Riley and Howard

Aleyrodes citri Riley-Howard, Insect Life, Vol. V, p. 219, 1893.

Aleyrodes citri Kuwana, The Insect World, Vol. XIV, No. 1, pp. 13-15, 1910.

On orange, in Nagasaki, collected by the writer in 1907, for the first time in this country. Since then it has been found by him on ivy in Tokyo, Kanagawa, Okayama, Yehime and Miye. It is not a serious pest in Japan.

Aleyrodes giffardi Kotinsky

Aleyrodes giffardi Kotinsky, Bul. 2, Div. Ent. Board Comm. Agr. and Forestry, Hawaii, p. 94, 1907.

Aleyrodes giffardi Okada, The Insect World, Vol. XIII, No. 11, pp. 7-10, 1909.

Aleyrodes giffardi Kuwana, Engei no Tomo, Vol. V, No. 12, pp. 52-54, 1909.

Aleyrodes giffardi Kuwana, The Insect World, Vol. XIV, No. 2, pp. 8-9, 1910.

On orange, in Shizuoka, collected by Mr. Okada and the writer, during the summer of 1908 for the first time in this country. It is a very serious pest of orange in some sections of Shizuoka, but it is not found in any other part of Japan as yet.

Aleyrodes shizuokensis n. sp.

(Figure 207, A-E)

Pupa case—Size about 0.99 by 0.70 mm. Broadly elliptical or subcircular. Colorless. No lateral fringe nor wax covering of any kind. Segmentation of abdominal region distinct. Margin crenate, separated from rest of case, forming a narrow border all around.

*This article is an exceedingly important one for California interests. It is the first extended study of the White Flies of Japan. It is of especial importance, on account of our very extensive importations of nursery stock from that country to know just what white flies we are likely to receive sooner or later. The fact that the Citrus White Fly is generally distributed there is of especial moment to us, and means that our vigilance in connection with Japanese shipments must be redoubled.

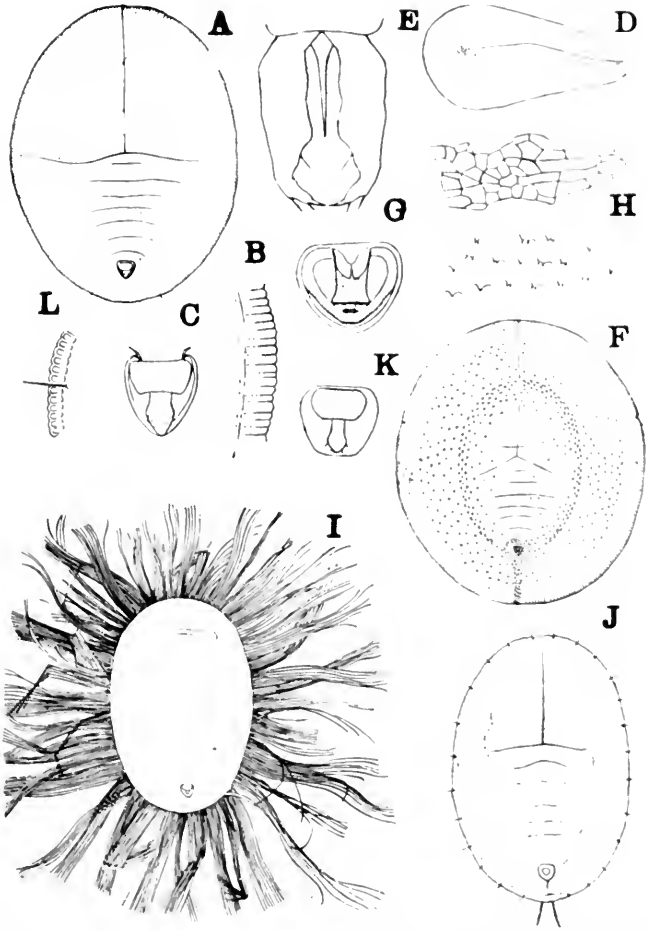

Figure 207. A-E, Aleyrodes shizokænsis; F-H, Aleyrodes tokionis; I-L, Aleyrodes akebiæ.

Vasiform orifice subovate or subtriangular in form. Caudal end pointed. Operculum not one-half the length of orifice, and in width not quite filling the open space, distal, free end truncate. Lingula well developed, nearly as long as the orifice, spatulated distal portion convex, enlarged, rather bulbous, the bulbous portion of which projects beyond the operculum setose.

Adult male—Length, 0.93 mm.; forewing, 1.28 by 0.57 mm.; hind femur, 0.27 mm.; hind tibia, 0.40 mm.; hind tarsus, 0.25 mm. Eye less constricted than in female, red in color. Body yellow, sutures of thoracic region dark, antennæ and legs pale; forewing with one rather indistinct dusky spot, near the apex. The third joint of antenna very long, longer than the rest of the joints together; the seventh joint is shorter than sixth. Tibia of second pair of legs less than two-third is also covered with minute markings as showing in the figure. Marginal rim penis tapering, much shorter than valves.

Adult female—Length, 1.26 mm.; forewing, 0.68 mm. Larger than male. Eyes undivided, but deeply constricted about the middle.

Habitat—On *Oxalis corniculata* L. in Shizuoka, collected by Mr. Masuda in 1908. Prof. Sasaki says that he has found a species of *Aleyrodes* on the same plant at Komaba, Tokyo, which may be the same as this new species.

Type in the entomological collection of the Imperial Agricultural Experiment Station, Japan, and cotype in U. S. N. M.

Aleyrodes tokyonis n. sp.

(Figure 207, F-H)

Pupa case—Size about 0.70 by 0.46 mm. Elliptical in form. With hand lens ish in color, with margin pale. There is neither lateral nor dorsal secretion. Dorsum convex but slightly, with many faint polygonal markings; the outer third is also covered with minute markings as showing in the figure. Marginal rim rather wide, crenulation shallow. Abdominal segments well defined along the dorsimeson.

Vasiform orifice small, tubercled, subcircular; operculum relatively the same shape, filling the orifice; lingula slender, distal end enlarged and densely setose.

Habitat—On *Ilex integra* Thunb., Shibuya, Tokyo, collected by Baron N. Takachiho, Sept., 1909.

Type in the entomological collection of the Imperial Agricultural Experiment Station, Japan, and cotype in U. S. N. M.

Aleyrodes akebiae n. sp.

(Figure 207, I-L)

Pupa case—Size about 0.70 by 0.46 mm. Elliptical in form. With hand lens pale yellow, while head and abdominal region are brown. Lateral fringe much longer than the body. This fringe is made up of slender, crystalline rods. The marginal rim is narrow and minutely crenulated. Margin with many spiny setæ.

Vasiform orifice subcordate, anterior margin straight; operculum not as broad as the orifice, about half its length, somewhat rectangular in form; lingula

spatulate, as long as orifice, distal part enlarged and apex bearing two pairs of setæ.

Habitat—On *Akebia quinata* Dene., at Mito city, collected by C. Tukaya, August, 1907.

Type in the entomological collection of Imperial Agricultural Experiment Station, Japan, and cotype in U. S. N. M.

Aleyrodes marlatti Quaintance

(Figure 208, A-C)

Aleyrodes marlatti Quaintance, The Canadian Entomologist, Vol. XXXIV, p. 61, 1902.

Aleyrodes marlatti Kuwana, The Insect World, Vol. XIV, No. 3, pp. 7-8, 1910.

On orange, collected by the writer during the summer of 1907, in the following localities: Fukuoka, Nagasaki, Kumamoto, Kagoshima and Oita. It was also found by Mr. Kuroyuwa, in Rinkin Island.

Aleyrodes taonabae n. sp.

(Figure 208, D-I)

Egg—Size 0.16 by 0.09 mm. Elliptical in form; stalk very short; pointed at distal end. Pale yellow in color with dark brown stalk.

Pupa case—Size about 1.1 by 0.88 mm. Broadly oval in form, broadest about the middle. Color under hand lens, shining black; under microscope, the color is brown, with sutures dark brown. Mature specimens moderately convex. There is a very short and sparely trimmed marginal fringe all round from the lateral wax tubes, extending out flat on the surface of leaf. Dorsum of case is much corrugated, keeled for entire length. The thoraco-abdominal suture is sinuate and extends to the marginal rim, somewhat wider on the sides. This rim is plainly demarked from dorsum by a thickened line all around. The margin is crenulated, the incisions quite uniform and acute. On cephalic end of case the transparent, subreniform "eye spots" are very distinct.

Vasiform orifice elongate cordate; about three-fourths as broad as long, cephalic margin nearly straight, caudal end bluntly rounded; operculum subelliptical, cephalic margin straight, about one-third as long as orifice; lingula usual, broad, extending quite to caudal end of orifice.

Adult female—Length about 1.2 mm.; forewing 1.1 by 0.64 mm., hind tibia 0.41 mm., hind tarsus 0.20 mm. Color of body, uniformly pale yellow, except the frons, which is deep brownish; antennæ and legs pale; eyes red, constricted in the middle; forewings marked with two irregular broken bands of orange red each crossing wing about equidistant on each side of caudal flexure of vine. There is also a small central spot, almost caudad of flexure. A small, irregular spot also occurs caudad of veinlet, near base of wing.

Adult male—Very like female, but small. Genitalia rather slender, slightly curved at tip and acute.

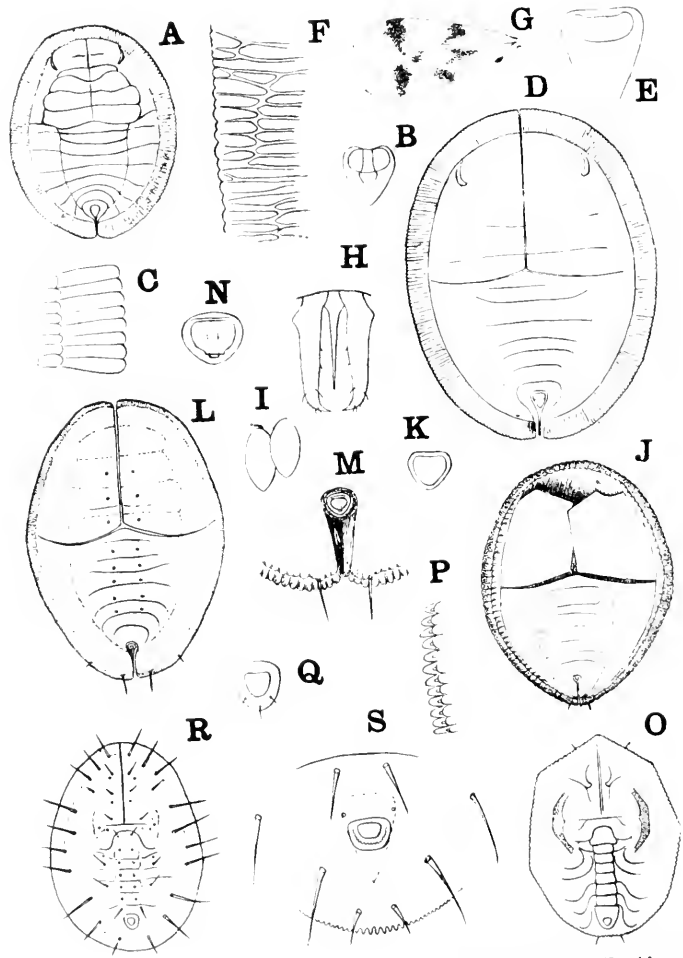

Figure 208. A-C, Aleyrodes marlatti; D-I, Aleyrodes taonabæ; J-K, Aleyrodes aucubæ; L-N, Aleyrodes euryæ; O-Q, Aleyrodes camelliæ; R-S, Aleyrodes spinosus.

Habitat—On grape leaf, in Okaya, collected by Mr Matsumoto, during summer of 1910. It was also found on *Taonaba japonica* Syz. in Okaya and Tokyo.

This species is closely allied to *A. marlatti*, but differs in the dorsal marking of pupa case and also the wing marking of adult.

Type in the entomological collection of Imperial Agricultural Experiment Station, Japan, and cotype in U. S. N. M.

Aleyrodes aucubae n. sp

(Figure 208, J-K)

Pupa case—Size 0.80 by 0.66 mm. Broadly oval in form, prolonged caudad until it is lobelike at end. Color under hand lens, shining black; under microscope, the color is brown, with sutures and rim dark. Slightly convex and without lateral fringe, covered thinly with white wax, centrally the body segments are distinct; the margin is distinctly crenulated on the dorsum of thoracic region with many small transparent spots. On the dorsum near the outer limit of the abdominal segments are two rows on each side of small transparent spots. A pair of very small setæ near posterial margin.

Vasiform orifice rather small, broadly ovate; operculum almost as large as the orifice; lingula cannot be made out with certainty.

Habitat—On *Aucuba japonica* Thunb., at Asukayama, Tokyo, collected by the writer in May, 1908.

Type in the entomological collection of the Imperial Agricultural Experiment Station, Japan, and cotype in U. S. N. M.

Aleyrodes euryae n. sp.

(Figure 208, L-N)

Pupa case—Size about 0.83 by 0.55 mm. Subelliptical, broadest at middle, and somewhat narrowed caudad and cephalad. Color on leaf under hand lens, shining black; under microscope dark brown. Dorsum with meso dorsal ridge; abdominal segments distinct. The margin without fringe. Marginal rim wide, somewhat wider on the side. The margin is finely crenulated, the incisions quite uniform and acute. There are two rows of small pores. On caudal end of dorsum, just within margin, is a pair of prominent setæ.

Vasiform orifice small, subcircular slightly wider than long; operculum large, broader than long; lingula almost as long as orifice.

Habitat—On *Eurya ochnacea* Sez., at Nishigahara, Tokyo, collected by the writer, May, 1907.

Type in the entomological collection of Imperial Agricultural Experiment Station, Japan, and cotype in U. S. N. M.

Aleyrodes camelliæ n. sp

(Figure 208, O-Q)

Egg—Size 0.20 by 0.07 mm., pale yellow. Stalk short, shape oblong, tapering toward apical end, which is bluntly rounded, curved.

Pupa case—Size about 1.20 by 0.88 mm. Somewhat octahedral in outline, widest at thoracic region, acute cephalad. Color, under hand lens, shining black; under microscope, deep black in color. Covered with a thin, glassy substance. The dorsum with a characteristic keel extending from the cephalic margin to the vasiform orifice. There is in the thoracic region, on each side, a short distance within the margin, a curved, depressed line, extending caudad to about the first abdominal segment. Abdominal segments extending out to marginal rim and strongly reflexed caudad. Along the abdominal segments with somewhat trachea-like structures which extend from the thoracic region to the vasiform orifice. Thickened, subovate rim, extending to the vasiform orifice. A pair of setæ on the caudal end of the large, thickened, subovate rim.

Vasiform orifice semicircular, as broad as long; operculum subsemicircular, but larger than broad.

Habitat—On *Thea japonica* L., at Nishigahara, Tokyo, collected by the author, winter, 1908.

Type in the entomological collection of the Imperial Agricultural Experiment Station, Japan, and cotype in U. S. N. M.

Aleyrodes spinosus n. sp.

(Figure 208, R-S)

Pupa case—Size 0.92 by 0.68 mm. Oval in outline. On the leaf, with hand lens, shining dark brown, with brown spines projecting in all directions, mainly upwards. Medio-longitudinal ridge on dorsum. Abdominal segments distinct. The lateral fringe is very short or almost wanting. Under microscope pale brown; margin finely crenulated; the arrangement and comparative length of spines is shown in the figures.

Vasiform orifice small, subcircular, but broader than long, bounded by a chitinized band; operculum subsemicircular, but longer than broad; lingula obscure.

Habitat—The host is unknown. This species was found by the writer among Coccidæ from Formosa, 1909.

Type in the entomological collection of Imperial Agricultural Experiment Station, Japan, and cotype in U. S. N. M. (Nishigahara, Tokyo, August, 1911.)

Explanation of Figures

Figure 207

A, *Aleyrodes shizokaensis*, Pupa-case

B, *Aleyrodes shizokaensis*, Detail of marginal rim of pupa-case.

C, *Aleyrodes shizokaensis*, Vasiform orifice of pupa-case.

D, *Aleyrodes shizokaensis*, Forewing.

E, *Aleyrodes shizokaensis*, Male genitalis.

F, *Aleyrodes tokyonis*, Pupa-case

G, *Aleyrodes tokyonis*, Vasiform orifice of pupa-case.

H, *Aleyrodes tokyonis*, Marking of skin about vasiform orifice.

Ha, *Aleyrodes tokyonis*, Marking of dorsal skin of pupa-case.
I, *Aleyrodes akebiae*, Young stage.
J, *Aleyrodes akebiae*, Pupa-case.
K, *Aleyrodes akebiae*, Vasiform orifice of the same.
L, *Aleyrodes akebiae*, Detail of marginal rim of the same.

Figure 208

A, *Aleyrodes marlatti*, Pupa-case.
B, *Aleyrodes marlatti*, Vasiform orifice of pupa-case.
C, *Aleyrodes marlatti*, Marginal rim of pupa-case.
D, *Aleyrodes taonabae*, Pupa-case.
E, *Aleyrodes taonabae*, Vasiform orifice of pupa-case.
F, *Aleyrodes taonabae*, Detail of marginal rim of pupa-case.
G, *Aleyrodes taonabae*, Forewing.
H, *Aleyrodes taonabae*, Male genitalia.
I, *Aleyrodes taonabae*, Eggs.
J, *Aleyrodes aucubae*, Pupa-case.
K, *Aleyrodes aucubae*, Vasiform orifice of pupa-case.
M, *Aleyrodes euryae*, Pupa-case.
M, *Aleyrodes euryae*, Vasiform orifice with the end of pupa-case.
N, *Aleyrodes euryae*, Vasiform orifice of pupa-case.
O, *Aleyrodes camelliae*, Pupa-case.
P, *Aleyrodes camelliae*, Detail of marginal rim of pupa-case.
Q, *Aleyrodes camelliae*, Vasiform orifice of pupa-case.
R, *Aleyrodes spinosus*, Pupa-case.
S, *Aleyrodes spinosus*, Vasiform orifice with the end of pupa-case.
Ha, *Aleyrodes tokyonis*, Marking of dorsal skin of pupa-case.

AMERICAN PSYLLIDÆ V

BY D. L. CRAWFORD
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Since completing the work of recasting the family and redescribing many species as based upon the collections then at hand, other accessions have come in from various localities. Among a collection sent to me by Mr. E. P. Van Duzee are three new species; two species have been sent by Prof. T. D. A. Cockerell, and others of interest have been collected in Southern California. Among the latter are several very interesting, though previously known species, inhabiting coniferous trees at an altitude of about ten thousand feet above the sea.

Paratrioza ocellata Crawf.

This species, originally described from Colorado, has been collected in Milford, Utah (Bradley), and in Imperial County, California (J. C. Bridwell). On a spruce (species unknown to writer) on the summit of Old Baldy, near Claremont, Calif., this species was found in countless thousands, infesting the leaves and small twigs. A slight disturbance of the branches would drive them forth to swarm about like gnats or midges. This apparently was limited to the one species of spruce.

Trioza varians Crawf.

Two specimens, a male and a female, were sent to me by E. P. Van Duzee, collected in the Selkirk mountains, British Columbia (Bradley).

Trioza aurantiaca Crawf.

Specimens of this common species were taken by the writer on wild willow *(Salix lasiolepis)* at Laguna Beach, Calif., and near Stanford University, Calif., on the same food-plant.

Psylla americana Crawf.

This species is very abundant, especially throughout the west, at all altitudes. Several specimens were collected at Laguna Beach, Calif. (Crawford) on *Salix lasiolepis* and some on the summit of Old Baldy at 10,000 feet altitude on *Pinus ponderosa* and spruce.

Psyllopa magna n. sp.

(Figure 209, B, D)

Length of body, 2.3 mm.; length of forewing, 2.7 mm.; greatest width, 1.1 mm.; width of vertex between eyes, 0.61 mm.; with eyes 0.92 mm. General color yellowish brown to brown; notum faintly striped; facial cones a little lighter; cubital cell of forewing brown. Insect quite large, robust.

Head broad, deflexed, with eyes fully as broad as thorax or broader; vertex almost plain, with a slight foveal impression on each side of median line in rear center; anterior margin strongly elevated above base of cones, slightly emarginate at median line, with anterior ocellus in front. Facial cones moderately large,

parallel to plane of vertex, but deflexed strongly therefrom at base, broadly rounded at apex, not strongly divergent, pubescent. Eyes prominent, dark, ocelli brown. Labrum not large; rostrum short. Antennæ almost as long as body, quite dark.

Thorax board, almost flat, quite coarsely punctuate. Pronotum quite long, with lateral tubercle pronounced; pleurites long, large; forecoxæ large. Hind tibiæ with small spur at base. Wings large, hyaline, with maculæ, rounded at apex, but not broadly so, about two and a half times as long as broad, broadest subbasally; marginal cells subequal, radial cell very large, long; pterostigma small, narrow; with a macula at apex of clavus, one in both marginal cells and at apex of cubital cell; with a long macula covering posterior two-thirds of discoidal cell and extending as far in as base of radial cell.

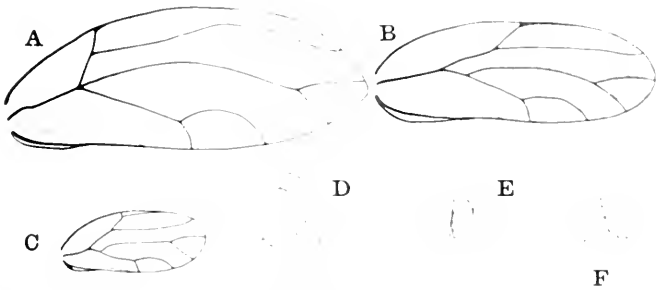

Figure 209. A, Trioza montana; B, Psyllopa magna; C, P. floridensis; D, P. magna; E, T. montana; F, P. floridensis.

Male—Abdomen large, robust; genital segment large; claspers short, stout, almost as long as anal valve, very broad at base, converging toward apex; anal valve short, only slightly overreaching claspers, simple, slightly pubescent. *Female*—Genital segment large, darker than rest of abdomen, almost as long as same; dorsal plate slightly longer than ventral; both quite acute at apex.

Described from numerous males and females collected at Woods Hole, Massachusetts, by Prof. T. D. A. Cockerell.

Psyllopa floridensis n. sp.
(Figure 209, C, F)

Length of body, 1.2 mm.; length of forewing, 1.3 mm.; greatest width, 0.5 mm.; width of vertex between eyes, 0.27 mm., with eyes 0.41 mm. General color light yellowish to yellowish orange, with whitish stripes or spots on vertex and notum; pronotum with several light spots; dorsulum with median stripe; scutum with three dorsal stripes. Insect very minute.

Head quite strongly deflexed, small, with eyes about as broad as thorax; vertex relatively long, strongly descending, broadly rounded on front margin,

quite deeply impressed discally on each side of median line, emarginate above anterior ocellus. Facial cones very short, broad at base, broadly rounded at apex, not projecting much beyond vertex, almost parallel to it and depressed therefrom, slightly pubescent. Eyes relatively very large, globular; labrum moderately large; rostrum short. Antennæ short, relatively quite stout, not as long as dorsum, black at tip.

Thorax quite strongly arched, not very robust, striped yellow and whitish; pronotum rather short; lateral tubercle small but pronounced; propleurites rather narrow, extending almost subhorizontally toward coxæ. Wings small, quite hyaline, about two and a third times as long as broad, broadly rounded at apex; first marginal cell large; pterostigma small; cubital petiole short.

Male—Abdomen short; genital segment small, rounded; claspers relatively large, with a projection near apex extending toward anal valve; anal valve scarcely longer than claspers, simple. *Female*—Abdomen stout; genital segment not as long as rest of abdomen, acutely pointed at apex; dorsal plate very slightly longer than ventral.

Described from one male and one female from Seven Oaks, Florida, collected in May by E. P. Van Duzee. This species resembles rather remotely the European species *Aphalaroida succincta* (Heeg.) but is a true *Psyllopa.*

Psyllopa ribesiae n. sp.

Length of body, 2.2 mm.; length of forewing, 2.7 mm.; greatest width, 1.1 mm.; width of vertex between eyes, 0.55 mm.; with eyes, 0.87 mm. General color light brown to rather dark brown, sometimes a whitish pulverulence on notum; darker specimens with light median stripe on scutum and a narrow white stripe midway laterally, remainder dark; dorsulum brown with dorsal light stripe; pronotum lighter with dark maculæ; vertex quite light with a few dark maculæ. Body moderately large.

Head quite strongly deflexed, broad, with eyes fully as broad as thorax, or broader; vertex elevated narrowly on occipital margin; discally impressed quite deeply on each side by a fovea; anteriorly bulging, rounded, emarginate at median line, not acute on each side. Facial cones moderately long, depressed a little below vertex at base, porrect, slightly divergent, subacute to rounded at apex, pubescent. Eyes large, black; ocelli brown, conspicuous; genæ large. Antennæ quite long, almost as long as body, brown, black apically.

Thorax broad, large, rather strongly arched, striped, punctate; pronotum long, with lateral tubercle quite large, rather indistinct on margin; pleurites not large. Wings large, hyaline, broadly rounded at apex; pterostigma quite large; marginal cells large, subequal; veins set biseriately with very minute setæ; a dark macula at tip of clavus.

Male—Genital segment moderately large, rounded; claspers quite short and slender, simple, well separated to base, acute at apex; anal valve slightly longer than claspers, simple, broadest at base, narrow at apex. *Female*—Abdomen stout; genital segment short, about half as long as rest of abdomen, stout, acute at apex; plates subequal in length.

Described from three males and seven females taken by Ellsworth Bethel at Boulder, Colorado, on leaves of *Ribes longiflorum*. This species somewhat resembles members of the genus *Psylla* in the wing characters, but in others it is very close to the genus *Psyllopa*.

Psylla alni trimaculata n. var.

Body dimensions approximately the same as for the variety *americana* Crawf. Body large; general color yellowish orange, with a large, dark, brownish orange macula on dorsulum cephalad, and two on each side of scutum with a narrow stripe of yellow between; eyes black.

Head and vertex similar to var. *americana;* vertex broadly excavate, short; facial cones of medium length, almost as long as vertex, scarcely differentiated sharply from vertex at base, divergent, quite acutely pointed at apex, scarcely pubescent. Thorax as in other varietal forms. Wings large, hyaline, broadly rounded at apex; venation quite similar; pterostigma narrow. *Female*—Abdomen large; genital segment moderately stout, almost as long as rest of abdomen, quite acute at apex.

Described from two females from Gowanda, New York (E. P. Van Duzee). It is possible that future study will show this to be a distinct species, but hardly probable.

Trioza montana n. sp.

(Figure 209, A, E)

Length of body, 2.7 mm.; length of forewing, 3.3 mm.; greatest width, 1.8 mm.; width of vertex between eyes, 0.54 mm.; with eyes, 0.88 mm. General color greenish yellow throughout. Body quite large. This species is very similar in many respects to *Trioza albifrons* Crawf. The characters not mentioned here may be inferred to be the same as in that species.

Vertex discally with a foveal impression on each side, sulcate at anterior extremity; roundly bulging forward over antennal bases, rather whitish to whitish yellow. Facial cones rather short, divergent, subacute at apex, strongly depressed from plane of vertex at base.

Thorax arched; pronotum moderately long; episternum moderately large; forecoxæ not large; dorsulum long. Wings large, hyaline, quite acutely rounded at apex, about two and a half times as long as broad; second marginal cell smaller than first; second cubital very long; radius long, curved; apex of wing within second marginal cell.

Male—Genital segment relatively small; claspers short, stout, subacute at apex, not strongly arched laterally; anal valve scarcely longer than claspers, simple, roundly acute at apex, broad at base. *Female* —Abdomen large; genital segment distinctly shorter than rest of abdomen; dorsal plate scarcely longer than ventral, quite acute at apex.

Described from three males and six females collected at the summit of Old Baldy, near Claremont, Calif. (Crawford), on foliage of *Pinus ponderosa*, white fir *(Abies)* and a spruce (species unknown to writer). This species, though

resembling somewhat *T. albifrons*, differs from it in the characters of the male genitalia and the form of the wing, and to a less degree in cephalic characters.

Psyllopa ilicis (Ashmead) Crawf.

Psylla ilicis (nymph) Ashmead, Can. Ent. XIII (1881), p. 225.

Note—This species has been named *ilicis*, retaining the name given by Ashmead to a larval form which he found producing galls on *Ilex cassine*, in Florida. He describes very briefly the nymphal forms and states that "judging from the size of the pupa, it is probably the smallest species known." Although the food plant of these specimens at hand is unknown, yet it seems, almost beyond doubt, that this is the adult form of the same insect which Ashmead discovered on *Ilex*. It would be very interesting if this fact could be determined by some resident entomologist in Florida, and the same reported so that it might be known. The writer would be very glad to receive specimens which were taken on such a food plant, or similar specimens taken on any food plant.

The generic name *Cardiaspis* Schwarz in Psyllidæ is preoccupied by Amyot in Hemiptera: *Cardiaspis* Amy., Annales Soc. Ent. de France (1846), p. 158. Also, in Coleoptera, by Saunders (1866). I suggest as a substitute for this, *Cardiaspina* n. n. Schwarz describes it in Proc. Ent. Soc. of Washington, Vol IV. (1896), p. 72.

THE PSEUDOSCORPIONS OF CALIFORNIA

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The Pseudoscorpions are a very strongly circumscribed group of the Arachnida. Of the general appearance of diminutive scorpions they differ in so many important structures as to be far removed from them in the system. They lack the post-abdomen or "tail" of the scorpions, and consequently the sting; they have no median pair of eyes, no sternum, no pectines, and there are various differences in the legs and mandibles. The scorpions have four pairs of stigmal orifices on the venter of the abdomen, whereas the pseudoscorpions have but two pairs of stigmata. Practically all authors put them in an order by themselves, variously called *Chelonethi, Chernetidea or Pseudoscorpionida.* Their relationships are considered to be closer to the Phalangida and Acari than to the scorpions. The body of a Pseudoscorpion, or Chelifer, is seen to be of two principal parts, a large front part, not or only indistinctly segmented, the cephalothorax; and a segmented posterior part, broadly attached to the cephalothorax, the abdomen. Attached to the front of the cephalothorax are the mandibles, chelicerae (or antennæ of some authors), and a pair of long palpi ending in a large claw, these are the pedipalpi. The legs are attached to the under surface of the cephalothorax, their coxæ being approximated. The dorsal surface of the cephalothorax often bears on each anterior side one or two eye-spots, but there are a number of eyeless species. In some forms there are one or two transverse furrows or grooves on the cephalothorax, and the surface is often granulated or roughened.

The mandibles, or chelicerae, are rather small, but in some forms large and conspicuous; they are of two joints, a large basal joint called the hand, or paturon, and a slender, curved apical joint or finger; the tip of the paturon is prolonged in a process of similar size and shape to the apical joint, the two fingers forming a claw. The apical joint is called the movable finger, and the other the immovable finger of the mandibles. The basal joint often bears a more or less branched process, the flagellum; while the movable finger often has a comb-shaped process attached more or less closely to its inner edge; this is the serrula. The movable finger bears an apical process, sometimes reduced to a tubercle, but usually slender, called the galea, or stylet; this contains the aperture of the silk glands, which are situated in the cephalothorax. The structure of these parts is of great value in classification. The pedipalpi consist of six joints; the basal is the coxa; then follow trochanter, femur, tibia, and the hand ending in two curved fingers which form a claw; one finger is movable, the other but an extension of the previous joint. Each leg is composed of a coxa, trochanter, femur (usually divided), tibia and a tarsus of one or two joints. The femur usually shows at its base a triangular part cut off by a suture from the main portion. This basal piece is the trochantin. In some species it is so distinctly separated from the femur as to appear as a separate joint. The tarsi end in a pair of simple claws, and in some cases a membranous ambulacrum, or arolium.

The abdomen usually shows eleven segments above and nine below. Each segment has a chitinous plate on the dorsum; in many forms divided longitudinally so that there is a pair of sclerites on each segment.

There are four stigmata near the base of the venter. Close up to the hind coxæ is the genital lobe, which is sometimes traversed by folds, or grooves. The body and appendages are sparsely covered with hairs, in some species some or all are elavate.

There is but little external difference between the sexes; the abdomen of the male has the segments more closely pressed together, and often the edges are more angulate, or more roughened than in the female; the legs may be more slender in the male, or the pedipalpi more thickened. There are few, if any, specialized secondary sexual characters, and no cases of protective coloring or of mimicry are as yet known. There is rarely any pattern of markings, their color being of a yellowish to reddish brown, or sometimes nearly black; a few are more or less greenish.

Chelifers occur nearly all over the world, except in very cold regions, but are more abundant in the tropics than elsewhere. In the tropics a few species live exposed on the foliage, but the great majority of species shun the light and are only to be found under bark, among dead leaves, on the ground, under stones or in caves. A few species occur on the seashore, and do not appear to mind the salt water.

Normally they walk slowly forward, with the pedipalpi extended; when disturbed they retreat quickly backward by a sort of jerky motion. It is evident that their eyes are not useful in recognizing objects, and touch seems to be their most important sense. They feed on minute, soft insects and mites; many eatch Collembola. Some, perhaps all, species hibernate in the adult condition, often in a little nest formed of bits of wood held together by silken threads; one such nest was 4 mm. long and 2 mm. broad. Some species, perhaps all, mate in the spring, and the female carries her eggs in a mass attached to the base of the abdomen; the young (of *C. cancroides*) hatch in July; probably there is but one brood a year, and the individuals live for several years.

Various species, mostly of the genus *Chelanops,* have been found attached to insects, often to flies. Several explanations have been suggested, such as for migration, accidentally seizing the leg under the impression it was food, etc. Some species have been taken from under the wings of beetles. The genus *Chelanops* is blind, and it apparently seizes any moving object that comes close to the palpi; thus clasping a fly's leg it holds on under the impression that the prey will soon tire. It undoubtedly also serves as a means of distribution. A summary of these cases of insects carrying pseudoscorpions is given by H. W. Kew.*

The genera known from the Pacific coast may be distinguished by the following table, two of them have not yet been recorded from California:

1. Cephalothorax with a transverse groove; abdominal scutæ divided; mandibles small, with a stylet; the serrula attached above to the

*Amer. Naturalist, 2 July, 1901, pp. 193-215.

movable finger, cephalothorax rounded in front; clavate hairs often present; trochantins present at least in legs III and IV. (*Cheliferidae*) 2

Cephalothorax without transverse groove; abdominal scutae entire, no clavate hairs; cephalothorax usually truncate in front; mandibles usually large, the stylet often lacking, and the serrula usually detached above; usually no trochantins. (*Obisiidae*)

2. Four eyes; cephalothorax narrowed quite suddenly in front of the eyes; no trochantins to femora I and II, but of two joints. (*Garypinae*) 4

Two or no eyes; cephalothorax evenly rounded in front; trochantins to all legs. (*Chiferinae*) 3

3. Femur of palpus not pedicellate, gradually and slightly enlarged from base to tip; palpi very long and slender; usually two distinct eyes (except cave forms). *Chelifer*

Femur of palpus distinctly pedicellate, suddenly enlarged near the base; palpi short and stout; eyes usually wanting. *Chelanops*

4. Anterior corners of cephalothorax prolonged; trochantins of hind legs indistinct. *Pseudogarypus*

Anterior corners of cephalothorax not prolonged; trochantins distinct. *Garypus*

5. Mandibles small and with a stylet; legs III and IV with trochanters. *Olpium*

Mandibles large, usually with stylet, no trochantins to any legs. 6

6. Tibia of palpus largest at tip. 7

Tibia of palpus largest before tip. 8

7. Four eyes; palpi long. *Chthonius*

Two eyes; palpi shorter. *Lechytia*

8. No eyes; palpi long and slender. *Blothrus*

Two eyes; stylet present. *Ideoroncus*

Four eyes. 9

9. Stylet present. *Ideobisium*

No stylet. *Obisium*

GARYPUS

This genus includes large forms with four eyes, and a tapering cephalothorax. a number of the known species occur on the seashore.

Garypus californicus Banks

(Figure 210, B)

Dark brown or greenish brown, hand more red-brown; legs pale; each of the abdominal scutae with a dark central spot; anterior margin of ventral scutae also with dark dots. Cephalothorax emarginate; femur of pedipalp longer than the cephalothorax, tibia hardly convex on the inner side, hand about as long as the tibia, fingers longer than hand; legs long and slender. Length 4.5 mm.

From Palo Alto and San Nicolas Island. Readily known by its tapering cephalothorax, four eyes and large size.

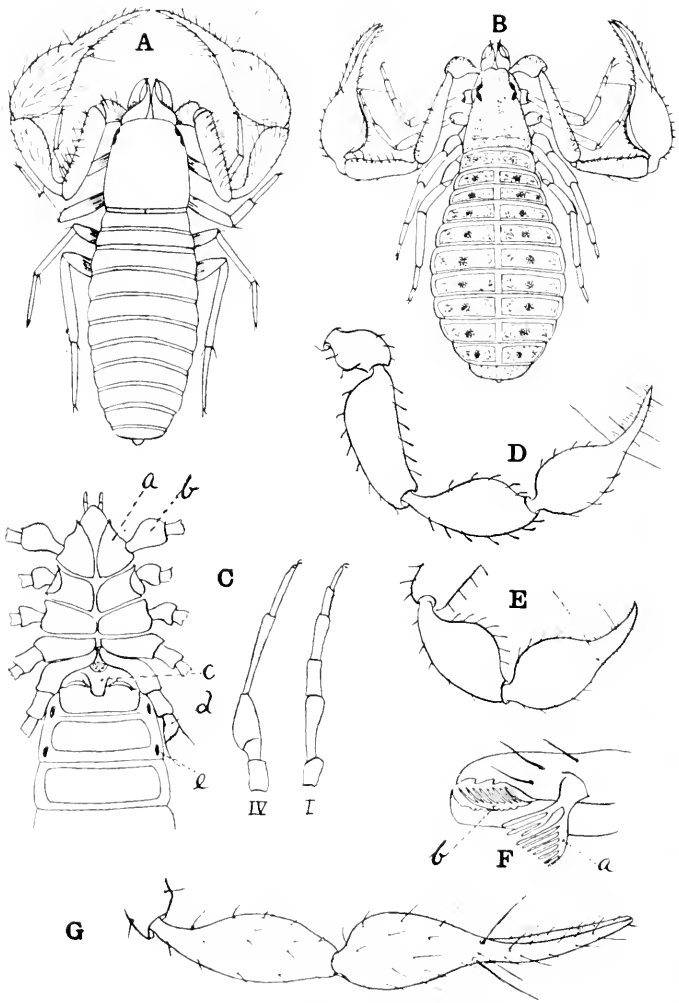

Figure 210.

A, Idiobisium threveneti; B, Garypus californicus. C, under surface of Chelifer: a, coxa; b, trochanter, c, genital area; d, trochantin; e, spiracle; D, pedipalp of Chelanops pallipes; E, pedipalp of C. acuminatus; F, jaw of Chthonius; a, flagellum; b, serrula; G, pedipalp of Obisium macilentum.

PSEUDOGARYPUS

This genus was but recently made for a form originally placed in *Garypus*, to which it is nearly allied.

Pseudogarypus bicornis Banks

Cephalothorax with a high elevated ridge on each side; each lower anterior corner of the cephalothorax prolonged into a cone tubercle. Pedipalpi long and slender, fingers much longer than the hand, all hard parts coarsely granulate. Brownish yellow, cephalothorax and pedipalpi darker. Two and a half millimeters long.

Recorded by Silvestri from Shasta Springs; described from the Yellowstone National Park.

CHELIFER

(Figure 240, C)

To this genus belongs the common *C. cancroides* frequently occurring in buildings in all civilized parts of the world. Three species have been recorded from California, but there are probably several others.

1. Tibia of pedipalp a little convex on the inner side; fingers a little shorter than the hand. 2
   Tibia not convex on the inner side; fingers as long as the hand. *cancroides*
2. Legs brown. *fuscipes*
   Legs pale. *scabriculus*

Chelifer cancroides Linn.

Dark reddish-brown or paler. The pedipalpi very slender, especially in the males; the cephalothorax has some small, sharp-pointed tubercles, larger than the ordinary granulations. The species occurs in and around buildings all over the civilized world, often abundant in barns.

From Claremont and Lake Tahoe.

Chelifer fuscipes Banks

This species is also reddish or yellowish brown, but has brown legs; the cephalothorax is minutely granulate; the outer ends of the dorsal abdominal scutæ are prolonged behind into acute spines.

From Claremont.

Chelifer scabrisulis Simon

This species is yellowish brown, with pale legs. The fingers are shorter than the hand and the tibia is convex on the inner side; the cephalothorax is strongly granulate, and with some larger acute tubercles scattered over it.

From Claremont, Mariposa, Lake Tahoe and Grant; quite common in the neighboring States.

CHELANOPS

This, the largest genus of the family, is often kept as a section or subgenus of *Chelifer*, but the pedipalpi are so much heavier and the femur pedicellate that

it stands out as a well marked group, although the character (no eyes) upon which the genus was based is not constant. Five species are known from the State, but probably as many more will yet be recognized when these obscure Arachnids are more thoroughly collected.

1. Hairs on pedipalpi long and simple; abdomen long and of nearly equal width throughout. *oblongus*
   Hairs on pedipalpi short and ofter clavate, or thickened; abdomen broader in middle than at ends. 2
2. Fingers much shorter than the hand. *acuminatus*
   Fingers as long or nearly as long as the hand. 3
3. Inner margin of hand greatly swollen at base, two eye-spots. *validus*
   Inner margin of hand evenly convex. 4
4. Fingers nearly as long as hand and rather stout; tibia strongly convex on inner side. *dorsalis*
   Fingers longer than hand and very slender; tibia also more slender. *pallipes*

Chelanops oblongus Say.

Body elongate, with subparallel sides; cephalothorax smooth and shining, this and pedipalpi with long, simple hairs of various lengths, the joints short and heavy, the fingers shorter than hand, femur about as long as cephalothorax.

From Palm Springs.

Chelanops validus Banks

Cephalothorax and palpi dark red-brown, scutæ brown, legs brownish; cephalothorax and palpi with clavate hairs. Two eye-spots. Hand very large and strongly swollen on the inner side at base; fingers nearly as long as the hand.

Recorded from Lake Tahoe and Grant.

Chelanops dorsalis Banks

Cephalothorax and scutæ brown, palpi red-brown, all with clavate hairs; no eye-spots; hand evenly swollen on inner side at base, fingers a little shorter than hand, body short and broad. Two millimeters long.

Described from Lake Tahoe, also from San Francisco.

Chelanops pallipes Banks

Similar to *Ch. dorsalis*, but fingers longer than hand and very slender; tibia also slender, less convex on the inner side; hard parts with clavate hairs. Three millimeters long.

Taken in Southern California, probably near Los Angeles.

Chelanops acuminatus Simon

Cephalothorax and palpi reddish brown, with short but not clavate hairs; no eye-spots; pedipalpi rather short, hand evenly convex on inner side at base, fingers much shorter than the hand and quite stout. Three millimeters long.

Described from Mariposa, also occurs at Claremont, Los Angeles and Siskiyou County.

OBISIUM

The species of this genus are rather uncommon, several occur under stones, so that more thorough collecting will probably discover more than the one species now known from California.

Obisium macilentum Simon

(Figure 240, G)

Pale yellowish brown, legs paler; hard parts shining, cephalothorax one fourth longer than broad, sides parallel; mandibles about one-half the length of the cephalothorax; pedipalpi very long and slender, with long, fine, scattered hairs; femur as long as the cephalothorax, fingers longer than hand.

From Mariposa, Claremont and Mt. Shasta.

IDEORONCUS

The single species of this genus is very common in the Northwest, among fallen leaves and in moss.

Ideoroncus obscurus Ehs

Abdomen elongate, slender; cephalothorax a little longer than broad, slightly narrowed and rounded in front, with few scattered hairs; pedipalpi rather short, femur hardly as long as cephalothorax, fingers shorter than hand, which is about twice as long as broad, all with fine, short, simple hairs.

From Lake Tahoe.

IDEOBISIUM

One of the two species (*I. threveneti*) is the most common Pseudoscorpion on the Pacific Coast; the other species is known from only one specimen.

1. Cephalothorax broadest at eyes; fingers more curved; very large species; dark, red-brown. *magnum*

   Cephalothorax broadest behind; fingers nearly straight, of moderate size, more yellowish brown. *threveneti*

Ideobisium magnum Banks

Cephalothorax and palpi dark red-brown, sculpture brown, legs pale. A rounded tubercle in middle of front margin of cephalothorax; eyes less than one-half their diameter apart; stylet slender, with an outer bifid branch toward tip; pedipalpi much as in *I. threveneti*, with fine hairs, those on fingers quite short and dense. Length 6.5 mm.

From Mt. Shasta.

Ideobisium threveneti Simon

(Figure 240, A)

Pale reddish brown to yellow-brown; cephalothorax nearly square, but broader behind, and the front slightly rounded; eyes almost touching each other;

pedipalpi quite heavy, femur as long as the cephalothorax, fingers about as long as the hand, but little curved. Length 3 mm.

From Mariposa, Marin County, San Francisco and Claremont.

BLOTHRUS

1. Fingers scarcely if any longer than the hand, curved and heavy. *magnus*
   Fingers much longer than hand, very slender and nearly straight. *californicus*

Blothrus magnus Ewing

Hard parts reddish brown; cephalothorax a little longer than broad. Pedipalpi rather large and heavy, but femur longer than the cephalothorax; tibia long pedicellate; hand not twice as long as broad; fingers heavy, curved, shorter than hand. Length 4 mm.

From Shasta Springs.

Blothrus californicus Banks

More yellowish; cephalothorax plainly longer than broad, anterior margin obtusely angled. Pedipalpi very slender; femur much longer than cephalothorax; tibia nearly as long as femur, long pedicellate; hand slender; fingers much longer than hand, slender, curved only near tip. Length 2.2 mm.

From Southern California.

CHTHONIUS

(Figure 210, F)

An undetermined species of this genus has been recorded from Southern California.

STUDIES IN ACARINA II

H. V. M. HALL
POMONA COLLEGE, CLAREMONT, CALIFORNIA

Notaspis nuda, n. sp

(Figure 211)

Length 527 micrm. Black, smooth and polished. Abdomen longer than broad, ovate without wings. Mandible chelate. Lamellae blades on edge, horizontal, running from pseudostigmata sp. two-thirds of way to tip of rostrum. No cusps of lamella, the lamellae tapering anteriorly so that the lamellar hairs arise

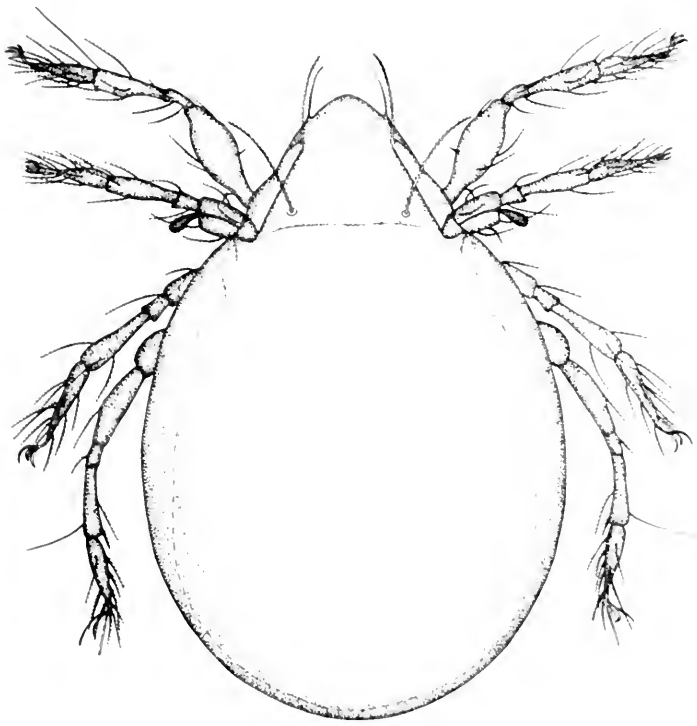

Figure 211. Notaspis nuda

from the front end of their basal line. Lamellar hairs, interlamellar hairs and rostral hairs all pectinate; the rostral hairs arising from apophyses. Rostrum rounded. No translamella. Pseudostigmatic organ with rather long stem and gradually clavate head bearing a few short spines on distal end. Femora of anterior pairs of legs swollen but without apparent blades. Legs a little more than half the length of body, moderately set with long, fine, pectinate hairs; a longer simple bristle projecting from distal end of penultimate joint. Unguis tridactyle. Abdomen hairless.

Differs from *N. microptera* (Berl.) in having a rounded rostrum, lamellæ tapering anteriorly instead of widest anteriorly, no terminal hair on pseudostigmatic organ and abdomen longer than broad. Three specimens under boards Claremont, Cal.

Figure 212. Oribata humida

Oribata humida n. sp.

(Figure 212)

Length 596 to 627 microns. Color chestnut, polished. Abdomen with wings. Mandible chelate. Lamillae blade-like but attached nearly the whole length bluntly tapering to tip of rudimentary cusps. Lamellar hairs, rostral hairs and interlamellar hairs stout, pectinate. Tectopedium blunt anteriorly. Translamella a mere line running between the lamellae just back of tips of cusps. Pseudostigmatic organ slender, slightly fusiform, and uniformly pectinate. The suture marking the anterior edge of abdomen with two notches near the median line. Abdomen hairless, almost as broad just behind the wings as long, and roundly pointed posteriorly. Wings extending nearly to rostrum and rounded anteriorly. Legs slender, rather thickly set with hairs, most of them finely pectinate. One simple bristle at distal end of each penultimate joint. Unguis tridactyle. Several specimens under board near hydrant, Laguna Beach.

Key to near relatives of **O. alata**

1. A distinct suture on dorsum between cephalothorax and abdomen. 2
   No suture on dorsum between cephalothorax and abdomen. 4
2. Pseudostigmatic organ short, clavate, length 600 microns. *O. alata*
   Pseudostigmatic organ with long recurved peduncle and fusiform head. 3
3. Dorsum of abdomen with fine longitudinal wrinkles, length 850 microns. *O. rugifrons*
   Dorsum of abdomen plain. *O. dorsa[illegible]*
4. Pseudostigmatic organ setiform. *O. setiformis* [illegible]
   Pseudostigmatic organ with long slender peduncle and gradually clavate head. *O. alata* var. *californica*

Oribata alata var. californica n. var.

(Figure 213)

Length 471 microns. Color black, polished. Abdomen globular, with wings. Mandible chelate. No lamella. Dorsal covering extends forward to rostrum without break. Rostral hairs pectinate. No translamella. Interlamellar hairs not apparent. Pseudostigmatic organ straight with a long, thin peduncle and gradually clavate head which bears a few short spines on the distal end. Abdomen smooth, hairless and almost as broad behind the wings as three-fourths the length of body. Wings project forward almost to tip of rostrum and are rounded anteriorly as shown by the right wing. The other wing shows the normal position and appearance, and as the species are divided on whether the wings are pointed or rounded anteriorly, this instance shows the care which must be taken in determination, even when seemingly definite and non-confusible characters are used. The wings are transversely sculptured. Legs sparsely clothed with pectinate hairs and a long simple bristle projects from the end of penultimate joint of leg one, the two bristles almost meeting in front of rostrum. Unguis heterodactyle, the middle claw being the heaviest and opposed to the others as

shown in the small figure. Legs short and of moderate size. Tarsus tapers at the tip. Two specimens, under boards, Claremont, Cal.

This form differs from *O. alata* (Herm.) by the longer peduncle of the pseudostigmatic organ. In this respect it is more like *O. dorsalis* (Koch) which as Michael suggests may be a variety of *O. alata*. *O. dorsalis* has not been reported from America and it might be well to consider it and my specimens as varieties of *O. alata*. My specimens differ sharply from the figure of *O. dorsalis* given by Michael in his article on the Oribatidæ in "Das Terreich," 1898, by having no line across the dorsum between cephalothorax and abdomen.

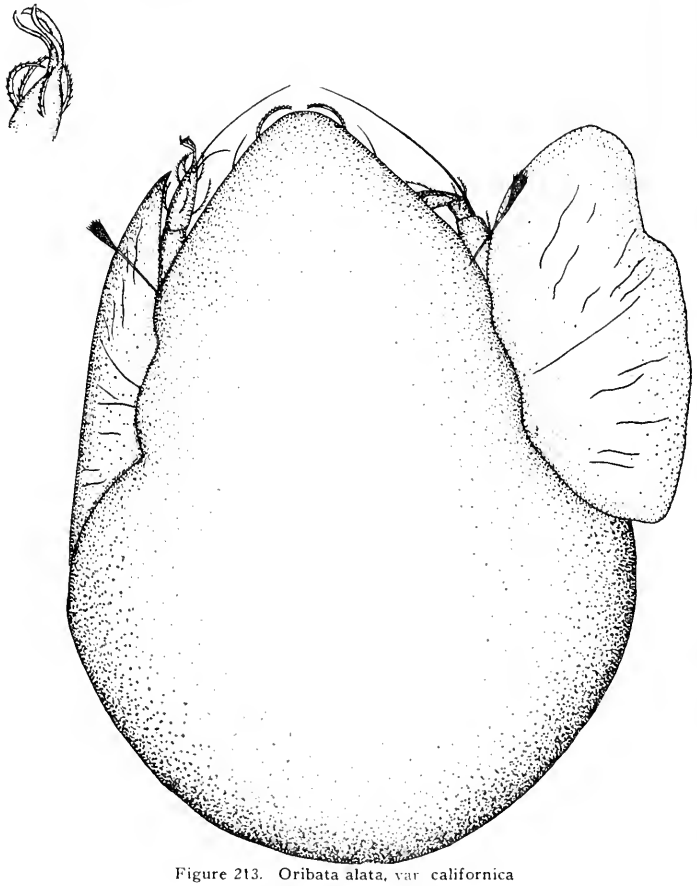

Figure 213. Oribata alata, var californica

Lohmannia spinosa n. sp.

(Figure 214)

Length .514 mierm. Legs colorless. Body showing black and brown internal organs but integument colorless. Abdomen without wings. Mandibles heavy and chelate. No lamellae, translamella nor tectopedium. Pseudostigmatic organ with moderately long peduncle and gradually clavate head which is pectinate on distal half. Abdomen viewed dorsally is almost circular in outline with prominent tubercles from which arise long pectinate bristles. Side view seems to agree more easily with the generic feature "almost cylindrical." The suture separating cephalothorax and abdomen becomes double ventrally. Maxillary palpus more than once and a half times the length of movable arm of chela of mandible. Legs about half the length of body. Unguis monodactyle sp. On each side of cephalothorax are three superior bristles and two lateral bristles similar in size, shape and pectination to those on abdomen. Legs moderately set with fine pectinate hairs; a simple bristle, slightly longer, on the apex of penultimate joint. Under rotting board. Claremont, Cal. One specimen.

Figure 214. Lohmannia spinosa

This species being placed in *Lohmannia* necessitates a slight modification of the generic description, i. e., the clause in regard to the relative length of the palpus and the movable arm of chela of mandible must be moved to the specific descriptions of *L. murcioides* and *L. paradoxa*. Since my species fits the generic description so well in other respects, and since the number of species in the genus is so small, I would prefer to make this correction rather than to establish a new genus on such slight characters.

Paraliodes n. g.

Abdomen not segmented, dorsum of abdomen convex, smooth, fully chitinized, not carrying cast nymphal skins. Unguis tridactyle. Genital and anal covers widely separated.

Paraliodes incurvata, n. sp.
(Figure 215)

Length 595 to 720 microns. Color dark brown, almost black. Abdomen without wings. Mandible stout chelate. No lamellae nor tectopedium. Rostral hairs curved, stout and smooth. Lamellar and interlamellar hairs arising from tubercles, straight, stout, smooth and separated but slightly more than rostral hairs. Pseudostigmatic organ rather short; with large, gradually clavate, finely pitted head, pointing forward, upward and slightly to the side. Femora swollen, with rudimentary blades. Abdomen broadly ovate with three rows of stout smooth hairs on each side of dorsum, similar to those on the cephalothorax. The first row of hairs are slightly curved and lie about half way from the median line to the margin. The hairs of the sub-marginal row are also only slightly curved, while

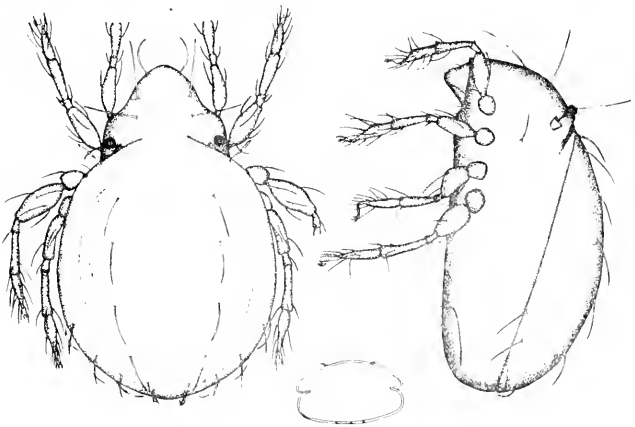

Figure 215. Paraliodes incurvata

those in the marginal row are strongly bent. The marginal and sub-marginal rows of hairs extend about half as far forward as the other row. On the front, upper portion of the abdomen, almost directly over the angle between cephalothorax and abdomen is a broader hair which is coarsely serrate on the anterior edge. The legs are short, about half the length of the body and moderately set with fine pectinate hairs. A simple, longer hair on distal end of penultimate joint. Unguis tridactyle. A deep re-entrant fold of the integument, shown in side view and by dotted line in dorsal view, marks the suture between dorsal and ventral plates. Many specimens, under boards, Claremont, Cal.

Hermannia hieroglyphica n. sp.
(Figure 216)

Length 374 microns. Color brown with black markings, rough and deeply sculptured. Abdomen without wings. Mandibles chelate; no lamellae, translamella,

lamellar or interlamellar hairs. Rostral hairs simple and similar to hairs on legs. Pseudostigmatic organ with a short peduncle and large spherical head. Three pairs of short simple hairs on posterior margin of abdomen. Dorsum of abdomen with a lateral margin in which the sculpturing is heavier than in the central portion; the two portions separated by a double ridge around the posterior half, which continues as a single ridge around the anterior half of abdomen. While the shape of the sculpturing is unsymmetrical, noticeably so on the cephalothorax,

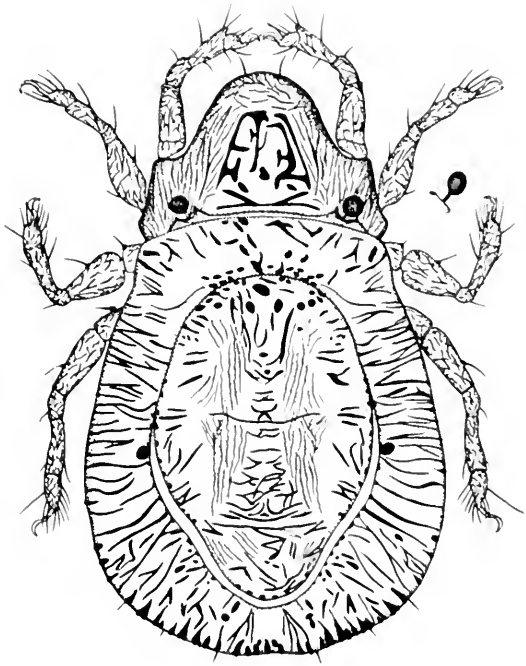

Figure 216. Hermannia hieroglyphica

the sculptured areas are symmetrically distributed. The marginal area of the abdomen is crossed by heavy irregular black ridges radiating more or less from the center of the abdomen. On the posterior margin they are thicker and more bead-like. The central area of the abdomen is more irregularly marked, the heaviest markings running across the anterior end of this area and thence scatteringly down the center and around the lateral and posterior margins of this central area. Finer parallel wrinkles lie latidudinally beside the heavier central mark-

ings. The cephalothorax has a central area of heavy hieroglyphics around which are irregular wrinkles. The legs are also much irregularly wrinkled. There is an unbroken line marking the anterior margin of the abdomen. The tarsi are very short, unguis monodactyle. Several specimens, under black scale (*Saissetia oleæ*), Claremont, Cal.

Differs from *H. bistriata* (Nic.) in having a very short capitate pseudostigmatic organ, no interlamellar hairs, and no basin-shaped depression in center of posterior margin between the two median ridges nor curved hairs around posterior margin.

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Pomona College Journal of Entomology

FEBRUARY 1912

Contents

1. CHAMBERLIN, R. V. — Chilopoda of California III
2. SCHRADER, WILHELM — Breeding of Junonia coenia
3. BERNHAUER, M. — New Staphylinidae V
4. CRAWFORD, D. L. — Note on Certain Psyllidae
5. GRINNELL, FORDYCE — West Coast News Notes

PUBLISHED QUARTERLY BY THE
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CLAREMONT, CALIFORNIA, U. S. A.

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During 1909 the existence of the Journal was credited to the support of the Ontario-Cucamonga Citrus Association. It is to be noted, however, with due appreciation, that one member of that Exchange, Mr. A. P. Harwood, was the donor of one-half of the amount from that source. During 1911, the Journal was pleased to acknowledge a wider support, including the Ontario-Cucamonga Exchange, with Mr. A. P. Harwood, The Call Fruit Company, The A. C. G. Fruit Exchange, The Covina Fruit Exchange, The Semi-tropic Fruit Exchange, The Arlington Heights Fruit Exchange, The Santa Paula Fruit Exchange, The Tulare Fruit Exchange and the San Antonio Fruit Exchange.

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Pomona College Journal of Entomology

Volume IV FEBRUARY 1912 Number 1

RETROSPECT AND PROSPECT

BY THE EDITOR

The beginning of the fourth volume of this Journal is an event to us. The Journal has been an experiment from several points of view. Although it has had contributors from many parts of the world, still it is distinctively a Southern California product, supported largely by this region, and in large part serving the economic and scientific interests of this particular commonwealth.

Competent men throughout the world have been appreciative enough to name it an important accession to scientific literature. We have labored hard to make it thoroughly worthy of the progressive and highly intellectual community from which it draws its support. Practical men have found in it, from time to time, matter of immediate usefulness, or have seen in it that activity in matters of basic importance which spells a safer and sounder practical life to humanity in years to come. As Mr. Harwood said of Crawford's work on the Mexican Orange Maggot, "Those results alone justify the expense of all these enterprises." We cannot all be expert entomologists, even though our modern life is granted to be one long battle between human beings and insects for the possession of the earth —a battle which is yearly costing humanity countless millions in money and myriads of lives—a battle which grows increasingly more complex as higher development proceeds. Just as we cannot all be electrical engineers, even though electricity is of daily use among us, or expert chemists, even though chemical knowledge be the basis of most of our industrial activity.

We desire the rapid development of electrical engineering, the deepest technical investigation of every possible phase of it; we want the subject to be absolutely mastered, with the ultimate end that electricity may become more perfectly the servant of mankind —a universal source of strength. To serve this purpose there are many technical electrical journals. We desire the existence of these most earnestly even though they read like Greek to the layman, we commend them, we recommend them, and we would think ill of any electrical engineer who did not keep them at hand and use them as tools in his work and his studies. The same principle holds in the relation of chemistry to industrial development, and in the relation of entomology to agriculture, horticulture, and to public health. The number of professional entomologists is as yet entirely too small to even begin to support their necessary publications. So in this case we have turned to practical men of broad intelligence and great outlook, and the response has been hearty and vigorous. At the beginning of this year when Prof. Cook again laid the matter before some of the most prominent citrus men we have in the South, in all its varied and important bearings, they said, "This enterprise must be kept alive and active."

Apart from all other considerations the importance of the relation of these Journals to our educational interests is unquestioned. They have been the direct means of producing better horticultural commissioners, of better fitting students for advanced work along these important lines, and of furnishing an outlet for important results obtained here through the activities of our own people. They are persistently holding up higher ideals in our county and state horticultural commission work, and these ideals must be built up and held up, pointedly and unceasingly. We are coming to demand as great scientific knowledge and technical skill in these lines as we do in electrical engineering or in industrial chemistry. For this influence alone it is said that our Journals are worth all that has ever been put into them and much more.

Each year this movement in upbuilding of scientific research and technical investigation has attracted to its support a greater and greater number of our strongest men, so that as the enterprise has grown in strength and extent, there has been support forthcoming. The services of many devoted men have been given to it without stint and without remuneration, to match the subscriptions of funds to cover the cost of publication.

So we enter upon another year of assured existence, with high hopes, and may the successes of this year make possible still other years of great work—work of which all Southern California and the scientific world may be proud.

THE CHILOPODA OF CALIFORNIA III

RALPH V. CHAMBERLIN
UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA, PA.

Suborder Geophiloidea

The members of this suborder are distributed over the entire earth but prefer the warmer and damper regions, the majority occurring in the northern hemisphere. They are to be found in damp places under stones, logs, leaves, the bark of trees and logs, and in the humus of woods and gardens into which they descend, especially during dry periods such as occur in California.

In all the body is elongate and very slender and consists of from thirty one up to one hundred and eighty-one segments, as in a California species here described for the first time. The number of segments varies not only from genus to genus and species but, with few exceptions, also within the species, the range in some species being very great. The number in most cases is quite regularly longer in females than in males, though the maximum for the one ordinarily overlaps the minimum for the other. The antennæ are short and consist invariably of fourteen articles, excepting in occasionally met cases where the antennæ have been broken and are in process of regeneration. Eyes are always lacking. A basal plate, the tergite to which the prehensorial feet belong, is always well developed; while a small plate, remnant of a preceding tergite, may or may not show between it and the caudal margin of the cephalic plate. The cephalic plate may or may not possess a transverse suture, the frontal suture, setting off the frontal region. The mandibles may bear only so-called pectinate lamellæ, which consist of comb-like rows of slender bristles borne upon a common base or plate; or they may in addition, bear a strongly chitinized plate dentate along its distal edge, the dentate lamella, which, while usually entire, may be subdivided. The first maxillæ usually have their coxæ fused together at the median line to form a single plate or coxosternum, but, more rarely, they may be entirely separate; distad each maxilla presents an inner division and an outer one, the latter, the palpus, being usually biarticulate but sometimes entire; at the distal exterior angle of each coxa and of the first joint of the palpus proper there may be a membranous process or lappet. The second maxillæ, often spoken of together as the labium, usually have the coxæ fused in the middle line, though, as with the first pair, they may remain distinct; the palpi are, in all known California species, triarticulate and may or may not terminate in a claw. Each leg-bearing segment excepting the first and the last bears a pair of spiracles, each spiracle opening through a sclerite in the pleural region. The coxopleuræ (pseudopleuræ, pleuræ) of the last segment give exit through the so-called coxopleural pores to a number of glands which may be many or few and may open separately or into one of two common larger pits at the edge of the last ventral plate.

The fauna of California includes an exceedingly interesting representation of this suborder, showing a greater variety and richness than in any other section of the United States. The Californian families known may be thus separated.

Key to Families of the Suborder Geophiloidea

a. Mandible with a dentate lamella and with one or more pectinate lamellæ.
  b. Antennæ flattened, broad at base and attenuated distad; mandible with several pectinate lamellæ. Family *Himantariidae*
  bb. Antennæ cylindrical, filiform, not broad at base and attenuated distad; mandible with a single pectinate lamella. Family *Schendylidae*

aa. Mandible without any dentate lamella; with one or several pectinate lamellæ.
  b. Mandible with two or more pectinate lamellæ; coxæ of first maxillæ entirely separate from each other; pleuræ of prehensorial segment exposed each side of basal plate.
    c. Coxæ of second maxillæ broadly coalesced at middle; mandible with several pectinate lamellæ. Family *Mecistocephalidae*
    cc. Coxæ of second maxillæ entirely separate; mandible with but two pectinate lamellæ. Family *Arrupidae* fam. nov.
  bb. Mandible with but a single pectinate lamella; coxæ of first maxillæ fused with each other at least proximally; pleuræ of prehensorial segment not exposed each side of basal plate.
    c. Labrum entire, uniformly chitinized, coalesced with the cephalic plate excepting at ends; hypopharynx strongly developed; palpi of first maxillæ thick, strongly arched together in a semicircle. Family *Tampiyidae* fam. nov.
    cc. Labrum free (in ours); tripartite, or with the divisions clearly traceable if secondarily coalesced; hypopharynx not unusually developed; first maxillæ not thus strongly arched in a semicircle.
      d. Median piece of labrum extending along surface of the lateral with which it is fused at least in part; at middle the edge bears two conspicuously larger and more strongly chitinized teeth; chitinous lines of prosternum well developed. Family *Soniphilidae*
      dd. Median piece of labrum entirely free, not bearing at middle two teeth conspicuously larger and more strongly chitinized than those adjacent; chitinous lines absent or but weakly developed. Family *Geophilidae*

Family Mecistocephalidæ

In this family the cephalic lamina is long and relatively narrow. The antennæ are filiform. The prehensorial feet are strongly developed and much exposed at sides of head from above, the pleuræ of the segment also being distinctly exposed at the sides of the basal plate which is narrow. A prebasal plate is never present. The labium is tripartite with the median piece very narrow, its sides being parallel or nearly so. The mandibles bear several pectinate lamellæ but no truly dentate plate. The coxæ of the first maxillæ remain entirely distinct. No suprascutella or plates between tergites and spiraculiferous sclerite are present. The coxopleuræ are pierced with numerous pores which are mostly

scattered over the entire surface. Anal legs with six articles distad of the coxopleurae.

Mecistocephalus is the only North American genus of the family at present known.

Genus Mecistocephalus Newport

In this genus the head is very large with the cephalic lamina much longer than wide and uniformly narrowed from the front caudad. The antennae are rather large and are a little attenuated from the proximal and distad. The labrum has the middle piece very narrow and acutely pointed distad while the side pieces bear a fringe of very short pectinae. In the first maxillae the branches are membranous distad. Anal legs without claws.

So far as known the number of legs is invariable for each species.

In California there are two species of this genus, *M. limatus* Wood and *M. anomalus* Chamberlin, which are easily separated on the basis of the number of pairs of legs, the former having forty five and the latter forty-one pairs.

Mecistocephalus limatus Wood

This is one of the commonest members of the Geophiloidea in the central portion of the state and also ranges to the southern portion, though it is not often met with during the dry season. During the rainy months it often occurs in great numbers under the fallen leaves of wooded areas. It seems to be especially abundant about San Francisco Bay

A large robust species often attaining a length of 60 mm. or more, while the head as a whole may be 2.5 to nearly 3 mm. across in large individuals. The body is conspicuously attenuated from the head caudad. The head and body are polished shining. Head and antennae dark reddish or chestnut in color; body and legs orange or rusty yellow, the dorsal scuta, especially on anterior portion of body, often with a narrow dark band along caudal edges. Antennae long, attenuated distad. The claws of the prehensors when closed extend nearly to the distal end of the first antennal article, each prehensor armed with four strongly chitinized teeth, one on each article, of which those of the first article and claw are largest. Anterior sterna with a deep longitudinal median sulcus which becomes less strongly developed caudad. First spiracle much larger than the second, vertically elliptical, the others circular or nearly so. Last ventral plate strongly narrowed caudad, triangular. Coxopleurae of last segment with numerous small pores and usually one larger one distributed over most of the surface, the number few in immature individuals. Pairs of legs in both sexes, so far as observed invariably forty-five.

Specimens have been examined from the following localities: Mill Valley, Sausalito, Berkeley (author); Stanford (Mann); and Claremont (Pomona College collection).

Mecistocephalus anomalus Chamberlin

This species in size, coloration and general structure is very close to the preceding one. It is readily separated in having invariably forty-one pairs of

legs as against the forty-five in limatus. The antennæ are typically smaller and shorter.

Found by the author to be very common during the wet season about Monterey Bay. Also taken at Oroville (April, 1911). In both of these places it appears wholly to replace *limatus*.

Family **Arrupidæ** fam. nov.

Differs from the preceding family (as represented in California) in having the three divisions of the labrum, of which the median is larger, entirely unarmed; in having the coxæ of the second maxillæ entirely separate; and in having the mandible with but two pectinate lamellæ.

Verhoeff's superfamily name *Placodesmata*, proposed for the *Mecistocephalidae*, may now, with better service, be employed to indicate the group formed by this family and the *Arrupidae*.

Genus **Arrup** gen. nov.

Labrum strongly chitinized, edges all smooth; the median piece broadly triangular, with the apex directed caudad. First maxillæ with the outer branch long, entire, membranous distad; no lappets. Palpus of second maxillæ triarticulate, without a claw. Last ventral plate wide, triangular; coxopleural pores few, small. Antennæ thick, sub-filiform. First joint of prehensors with a large, conical, strongly chitinized tooth; other joints unarmed. Anal legs unarmed.

Type.—*Arrup pylorus* sp. nov.

Arrup pylorus sp. nov.

Attenuated cephalad, more strongly caudad. Dorsum with a sharply impressed longitudinal median sulcus. Fulvous in color; head light reddish brown. Head widest anteriorly, narrowed to caudal margin which is truncate; anterior margin extended forward from sides to middle. Antennæ short, thick; all articles short, decreasing from basal ones to the penult; ultimate longer than the two preceding taken together. Basal plate overlapped by the cephalic; exposed portion very short, but little more than one-seventh as long as the cephalic, 4.8 times wider than long. Spiracles all circular, the first very much larger than the second. Last ventral plate wide, triangular, the sides converging caudad to meet at an angle. Coxopleural pores three or four on each side, small, adjacent to edge of last ventral plate. Anal legs in male crassate. Pairs of legs, forty-one. Length, 22 mm. (type).

Localities.—Sausalito and Berkeley (author, April, 1911).

Family **Tampiyidæ** fam. nov.

Labrum of one, uniformly chitinized piece, which is firmly coalesced with the labrum excepting at the ends where the suture may be detected; median portion conspicuously protuding, armed caudad with few stout teeth, the lateral portions pectinate. First maxillæ with outer branch distinctly biarticulate, the first article with a lappet, the apical joint thick, strongly bent inward and contiguous with its fellow. Palpi of second maxillæ triarticulate, ending in claws, which are simple, not toothed or pectinate. Prosternum with strongly developed

chitinous lines; its anterior median margin armed with two stout conical teeth. Suprascutella absent. Ventral pores absent. Antennæ flattened but of equal width from base to apex, being not at all attenuated. Pores of coxopleuræ scattered.

This family is evidently very close to the *Gonibregmatidae*, a family occurring in the Philippines and East Indies, with which it forms a natural group. One genus at present known.

Genus **Tampiya** gen. nov.

Lateral portions of the labrum concave, each pectinate with few lightly chitinized processes or spines, the middle portion protruding caudad and distally truncate, bearing a row of stout, conical, highly chitinized teeth. Lappets of first maxillæ very long. The claw of palpus of second maxillæ long, smooth. Cephalic plate not wholly covering the prehensorial feet. Basal plate short, wider than cephalic plate. Chitinous lines very strongly developed. Anal legs with large claws. Hypopharynx strongly developed, bifurcate anteriorly. Spiracles all circular. Last ventral plate moderate; pores scattered over coxopleuræ.

Type.—*Tampiya pylorus* sp. nov., the only species thus far known.

Tampiya pylorus sp. nov.

Cephalic plate truncate caudad, the sides conspicuously convex, anterior portion sub-triangular; about equal in length and breadth. Antennæ rather narrow, flattened, of uniform width throughout. Palpi of second maxillæ conspicuously flattened. Basal plate very wide, wider than head, about three and a half times, or a little more, wider than long. Prehensors when closed with claws almost even with front margin of head; joints all unarmed. Anterior median margin of prosternum armed with two stout conical teeth. Spiracles all circular, the first not specially enlarged, those of ultimate segments becoming very small. Last ventral plate rather narrow, short, caudal margin a little incurved. Coxopleural pores large, eight or more on each side, mostly scattered over coxopleura, free from plate but a few covered by edge of the latter. Anal legs short, ending in stout claws. Pairs of legs, one hundred and twenty-five.

Locality.—Sausalito.

Family **Geophilidæ**

In this family the labrum is tripartite, the middle piece varying in relative size. The mandible bears but a single pectinate lamella and no dentate lamella. The coxæ of the first maxillæ are coalesced at the middle. No suprascutella are present. The subfamilies represented in California may be distinguished by means of the following key:

Key to Subfamilies

a. The coxosternum of second maxillæ with halves nearly separated at middle; on each side a strongly chitinized suture running from the ecto-caudal angle cephalo-mesad (pleuro-sternal suture). Subfamily *Chilenophilinae*

aa. Coxosternum with halves well united at middle; no such pleuro-sternal suture present.

b. First maxillæ without lappets; middle piece of labrum very large, overlapping the ends of the short lateral pieces, which are unarmed, dentate along its anterior edge; dorsum not bisulcate.

Subfamily *Linoteniinae*

bb. First maxillæ with well developed lappets; middle piece of labrum small, the dentate margin caudad, lateral pieces pectinate, dorsum biculeate.

Subfamily *Geophilinae*

Subfamily Geophilinæ

The two California genera belonging to this subfamily may be separated thus:

Key to Genera

a. Joints of prehensorial feet not dentate within; anal legs ending in claws.

Genus *Geophilus* Leach

aa. Joints of prehensorial feet dentate within; anal legs not terminating in claws, the claw being replaced by a small seventh article.

Genus *Arenophilus* Chamberlin

Genus Geophilus Leach

In this genus the prehensorial feet, for the most part, do not extend beyond the front margin of the head and are unarmed within or with but rudiments of denticles at base of claw. The basal plate is wide. In most species the last ventral plate is wide but in some it is but moderate or even narrow. The anal legs end in claws. The middle piece of the labrum is usually dentate and the lateral ones pectinate. In the species here included as belonging to the Californian fauna the ventral pores are numerous and arranged in a transverse band immediately in front of the caudal margins of sternites.

The three known Californian species may be separated by means of the following key.

Key to Species

a. Prebasal plate exposed; last ventral plate very wide; coxopleural pores in adults covered by edge of ventral plate.

b. All spiracles circular; claws of prehensorial feet extending beyond front margin of head. *G. rubens* Say.

bb. Anterior spiracles elliptical; claws of prehensorial feet not extending beyond front margin of head. *G. regnans* Chamberlin

aa. Prebasal plate not exposed; last ventral plate narrow; coxopleural pores small, a dozen or more on free surface of coxopleura.

G. nasintus Chamberlin

Geophilus rubens Say.

Robust; attenuated caudad but not cephalad. Typically there is a geminate and often interrupted black band along the dorsum, though this may be entirely

absent; the body otherwise testaceous, the head with prehensorial feet darker as usual. The spiracles are all circular. In the eastern states, where this species is common, the pairs of legs number most frequently forty nine to fifty-one in the male and fifty-one to fifty-three in the female; but in Californian specimens studied, the numbers are most frequently fifty-nine to sixty-one, though in one specimen but forty-seven were present.

Two of the Californian specimens studied were collected on a sandy beach at Pacific Grove by Miss Helen Nagel of Stanford, to whom I am indebted for the same. They are large specimens which are paler than usual and lack the dorsal dark band. The author has collected it also at Oroville (April, 1911). A specimen collected at Claremont is among material received from Prof. Baker. Wood reported three specimens, presumably this same species, from the Santa Cruz Mountains under the name *G. lacris*.

Geophilus regnans Chamberlin

A large species in which the body is wide anteriorly and attenuated caudad much as in the preceding species. The anterior spiracles are obliquely elliptical, the median and caudal ones circular. The number of pairs of legs is mostly from seventy-seven to eighty-five, seventy-nine and eighty-one being perhaps commonest. The length may be up to 70 mm.

Evidently an abundant species in southern California. Numerous specimens have been seen from the following localities: Claremont (Baker), Los Angeles and Pacific Grove (author). It seems to be the commonest *Geophilo* about Claremont.

Geophilus nasintus Chamberlin

Of nearly same form as the preceding, being narrowed but little cephalad and strongly caudad. Fulvous in color, the head and prehensorial feet darker, reddish. No frontal suture evident. The claws of the prehensorial feet when closed about even with the front margin of the head. Spiracles all circular. The pairs of legs in the type specimen number seventy-three and the length of body is 42 mm.

The exact locality from which the type came is uncertain; but the vial was among material from southern California received from Prof. Baker and is assumed to be from that region.

Genus Arenophilus Chamberlin

In the species belonging to this genus at present known a frontal suture is evident and the prebasal plate is absent or covered. The basal plate is trapeziform and conspicuously narrowed cephalad. The tripartite labrum has the free margin of all the divisions pectinate, the processes of the lateral ones being long and close set. The prehensorial feet are large and much exposed from above and the claws when closed extend well beyond the front margin of the head; the articles dentate within. The ventral pores are numerous and arranged in a single condensed area on each sternite upon which occurring. The last ventral plate is very wide. Each coxopleura with one or two large pits at or beneath edge of

ventral plate. Anal legs clawless, the claw in each being replaced by a small additional article.

One species occurs, somewhat doubtfully, within the state.

Arenophilus bipunticeps Wood

Cephalic plate truncate caudad and extending over the anterior border of basal plate; bearing two sharply impressed sulci on caudal portion which diverge but little cephalad. Claws of prehensorial feet when closed extending much beyond anterior margin of head, the teeth of joints usually small. First spiracle vertically elliptic, larger than the second; the immediately following spiracles may also be similar in shape, those of more caudal segments becoming gradually circular. Ventral pores in a large area in front of caudal margin which is truncate cephalad and extended angularly at middle caudad. Coxopleuræ typically with two large porigerous pits at each lateral edge of ventral plate; in some specimens the more caudal pit on each side may be broken into two distinct but contiguous pits.

A large species which has a large head from which the body is narrowed caudad.

Two specimens in a vial containing no locality label but among others from Claremont and undoubtedly collected at that place. In the eastern section of the United States this is one of the commonest and most widespread members of the suborder.

Subfamily Linoteniinæ

Of the two American genera at present known as belonging to this subfamily, one, *Linotenia*, occurs in California.

The labrum has the middle piece relatively very large and toothed along the margin directed cephalad whereas the side pieces are small, in part overlapped by the median, and with edges wholly smooth or free from teeth or pectinæ. The palpi of the first maxillæ lack lappets. The dorsal plates are smooth, not bisulcate as in the preceding subfamily. Ventral pores in a well marked transverse band in front of caudal margin, the band on more caudal segments usually divided at median line.

Genus Linotenia C. Koch

This is a compact and clearly delimited genus. The species all have the body decidedly narrowed cephalad with the head small and characteristically narrowed anteriorly. The frontal suture is distinct. Antennæ filiform. The claws of the prehensorial feet, which when closed, do not extend beyond the front margin of head and usually fall considerably short of it, bear at base within each a conspicuously large tooth. The coxosternum, or prosternum, is without lateral chitinous lines. The coxopleuræ bear several to many small pores. The anal legs terminate in claws.

Most species of the genus in life are bright reddish in whole or in part; but in alcohol the red pigment fades leaving the color mostly some shade of brown.

But one species is known at present as occurring in California, this being the large and widespread *L. laevipes* Wood.

Linotenia lævipes Wood

Syn. *Strigamia parviceps* Wood
Strigamia epileptica Wood
Scolioplanes imperialis Brolemann
Linotenia rubelliana Chamberlin

This handsome species occurs throughout most of California and ranges northward into Washington. It may attain a length of 90 mm. or more. In life the entire animal is red, but quickly fades in alcohol, the head with prehensorial feet and antennæ usually retaining a deeper color. The body is robust and conspicuously attenuated at the ends as usual. While usually free, the caudal angle of the head may be covered by the basal plate, this being more frequently the case apparently in the males than in the females. The tooth at base of claws

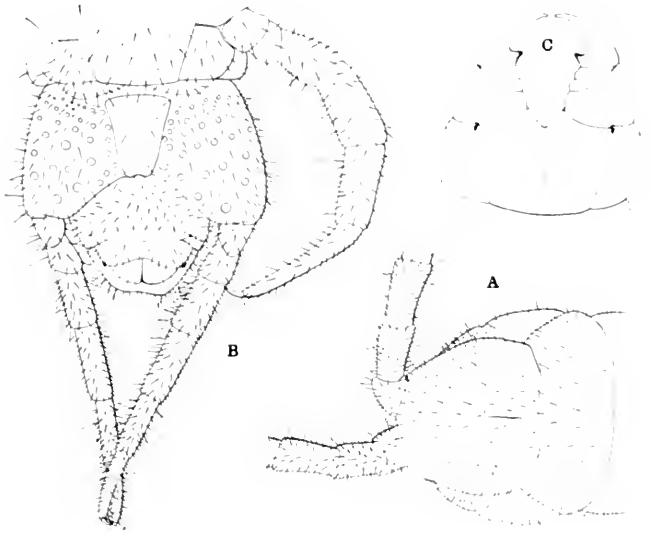

Figure 217

A, Dorsal view of anterior region of a female specimen of Linotenia fulva (Sager) from Saluda, N. C., showing cephalic plate crossed by frontal suture, the broad basal plate overlapping the caudal angle of the cephalic, the prehensorial feet partly exposed at sides of head, and the proximal portion of antennae. B, Ventral view of the posterior end of the same specimen, showing the enlarged coxopleurae pierced by the numerous coxopleural pores, the narrow last ventral plate or sternite between them, etc. C, The prosternum and prehensorial feet of the Californian Linotenia lævipes (Wood), showing the characteristically large tooth at the base of each claw within.

of prehensorial feet very large (see figure). Spiracles all circular, the first not visibly larger than the second. Last ventral plate very wide, strongly narrowed caudad. Coxopleuræ with numerous small pores and usually on two larger ones, all arranged along and beneath the edges of the ventral plate. In immature specimens often only the two larger pores on each side evident. Anal legs in female slender, about equalling the penult in length, ending in a long claw; in the male greatly enlarged and flattened dorso-ventrally. In the Californian specimens examined the number of pairs of legs varies mostly from sixty-nine to seventy-five but often falls to sixty-seven and may be as large as ninety-one, as in a specimen from Oroville.

I have seen specimens from the following localities: Oroville, Pacific Grove, Berkeley, Stanford and Santa Barbara (author's collection), and from Claremont (Prof. Baker).

Subfamily **Chilenophilinæ**

(**Ribautiina** of Brolemann)

This recently established subfamily is proving to be a large one, a considerable number of genera now having been found to belong to it. The group is readily distinguished by characters of the second maxillæ, these having the two halves of the coxosternum almost separated at the middle and each presenting a very conspicuous, strongly chitinized suture extending from the caudo-external angle meso-cephalad. Three genera are represented in California.

Key to Genera

a. Side pieces of labrum extending over the middle one and meeting at the median line; and legs ending in a strongly developed claw.
Genus *Gnathomerium* Ribaut

aa. Side pieces of labrum completely separated by the middle one; anal legs clawless or ending in a rather weakly developed claw.

b. Femur of palpus of second maxillæ with a distinct process at distal meso-dorsal angle; anal legs ending in a small membranous seventh article which replaces the claw. Genus *Watophilus* Chamberlin

bb. Femur of palpus of second maxillæ with no such process; anal legs with but six joints and clawless or with a weak claw.
Genus *Taiyuna* gen. nov.

Genus **Gnathomerium** Ribaut

This genus is represented in North America by several species of which one is known to occur in California. A second species, *G. utahensis* Chamberlin, common in Utah, may range into the mountains of this state.

The species of this genus are typically widest anteriorly and attenuated from the head caudad. The lateral pieces of the labrum extend mesad over the middle piece and are contiguous with each other at the middle line, the edge of the middle piece bearing teeth which project out from beneath, the lateral pieces fronged with pectinæ. Palpus of second maxilla triarticulate, all articles lacking special processes. Ventral pores not in definite areas. The anal legs consist of the usual six articles, the ultimate ending in a well developed claw.

Gnathomerium melanonotum Wood

Syn. *Mecistocephalus limatus* Wood
Mecistocephalus quadratus Wood
Geophilus glaber Bollman

This is a widespread species on the Pacific Coast, ranging throughout most of California and northward to Canada. It is conspicuously attenuated from the head caudad, resembling in its proportions a *Mecistocephalus*. The head and antennæ are reddish brown, the latter tipped with pale; the body is of the usual brownish yellow color but having in most a decided greenish or olivaceous tinge; along the dorsum there is commonly a black stripe which is mostly geminate or double. The cephalic plate is attenuated caudad, widely rounded posteriorly. Frontal suture distinct. Prebasal plate not exposed. The claws of the prehensorial feet when closed extend beyond the front margin of the head much; first joint and claw armed within with well developed teeth, the intermediate articles with inconspicuous denticles. The first spiracle nearly circular, being slightly vertically elliptic, and it is much larger than the second. The last ventral plate is moderately wide. The coxopleuræ bear a number of mostly small pores both below and above. The number of pairs of legs varies mostly from forty-seven to fifty-five, forty-nine and fifty-one being common, and in the southern part of the state the number ranges prevailingly from fifty-nine to sixty-five pairs. Adults mostly from 35 to 50 mm. in length.

Specimens from within the state have been seen from the following localities: Shasta Springs, Oroville, Pacific Grove, Point Lobos, Sausalito, Berkeley and Stanford (collected by writer), and from Claremont and neighboring mountains (Prof. Baker, collector).

Genus Taiyuna gen. nov.

Head large, the body scarcely narrowed cephalad, strongly so caudad. The labrum with side pieces lapping well over the ends of the middle one but not contiguous mesally; middle pieces with many closely set, stout spines on free edge, the lateral pieces with comparatively few, these being bent strongly mesad. Palpi of first maxillæ with long membranous lappets. Palpi of second maxillæ wholly without processes. Ventral pores not detected. Last ventral plate narrow. Coxopleuræ with a number of small pores. Anal legs composed of six articles beyond Coxopleura; claw absent or rather slender if present.

Type.—*Taiyuna occidentalis* Meinert.

Taiyuna occidentalis Meinert

Syn. *Geophilus californicusis* Bollman.

This species is widespread in the state and shows corresponding variation. The number of pairs of legs in specimens about San Francisco, the type locality, varies from sixty-seven to seventy-five, seventy-one and seventy-three being commonest; but, as usual with members of the group, in going south the number increases. At Los Angeles the author found individuals with as high as eighty-seven pairs (*isantus* Chamb., var.) which seemed distinct until more abundant

material indicated intergradation. Mr. Bollman's *californiensis* seems to have been based on partly grown specimens of this species, his description agreeing completely with such so far as it goes.

Body as wide or nearly as wide anteriorly as at the middle, but strongly narrowed caudad. Head and prehensorial feet with prosternum brownish red; antennæ brown, pale distad; body fulvous, more brownish cephalad; legs yellow. Cephalic lamina longer than wide, narrowed from in front caudad. Prebasal plate not evident, the cephalic overlapping the anterior border of the basal. Claws of prehensorial feet when closed reaching well beyond the first antennal article; first joint of prehensor with a tooth at meso-distal angle, the claw at base also with a somewhat smaller tooth. In large specimens the first spiracle is distinctly vertically elliptic and much larger than the second, all others circular. The last ventral plate moderate in width, longer than wide, narrowed caudad. Coxopleuræ with from four or five to thirty-nine or so, the larger numbers occurring in individuals not fully grown; some of the pores usually covered by edges of ventral plate, while one, often larger, usually stands apart from the rest on the more caudal surface of the coxopleura. Pairs of legs sixty-seven to eighty-seven. Length up to nearly 70 mm.

Localities.—San Francisco, Sausalito, Berkeley, Stanford, Pacific Grove, Monterey, Santa Barbara and Los Angeles, collected by the writer. A single specimen is also in the material received from Pomona College (Pillsbury, collector).

Taiyuna claremontus Chamberlin

This species is known from but few specimens, mostly from Claremont. It differs from the preceding in having the anal legs armed with a distinct claw. The number of pairs of legs in the type is sixty-five and the length 49 mm.

Genus Watophilus Chamberlin

Labrum with middle piece fully separating the lateral. First article of palpus and coxa at disto-ectal angles bearing long lappets. Coxæ of second maxillæ nearly separated mesally; the palpus with femur at meso-dorsal distal angle with a conical process and usually the succeeding article less distinctly produced at disto-ectal angle. Prosternum without chitinous lines. Claws of prehensorial feet extending beyond front margin of head; articles of feet dentate within. Ventral pores absent. Last ventral plate wide. Coxopleural pores small, few. Anal pores present. Anal legs clawless, the claw being replaced by a small, membranous, seventh article. There is a tendency for the number of pairs of legs to be fixed for each sex in each species, variations from this mode not being frequent. The two California species known may thus be separated.

Key to Species

a. Pairs of legs forty-one to forty-three; exposed portion of basal plate eight times wider than long. *W. errans* sp. nov.

aa. Pairs of legs forty-seven to fifty-five; exposed portion of basal plate about three and one-half times wider than long. *W. lactus* sp. nov.

Watophilus errans sp. nov.

A small species under 13 mm. in length and seeming to have constantly forty-three pairs of legs in the female and forty-one in the male. The body is yellowish white with the head of a pale reddish cast. The cephalic plate is elongate with the sides weakly convex, a little converging at ends, more so cephalad; caudal border truncate, overlapping considerably the basal plate, the exposed portion of which is very short, being eight times wider than long, and is marked with a distinct longitudinal median sulcus. No frontal suture is present. The antennæ are short and strictly filiform. The claws of the prehensorial feet when closed extend beyond front margin of head; claw armed at base with a stout conical tooth, the first joint armed near distal end with a somewhat larger conical tooth. First spiracle subelliptic, larger than the second, others circular. Last ventral plate wide. Coxopleural pores small, few, mostly covered.

Locality.—Berkeley, Cal., (author, April, 1911).

Watophilus lætus sp. nov.

Head with sides nearly parallel, a little converging caudad, but slightly excurved; caudal margin truncate. The anterior nearly so; corners not strongly rounded; much longer than wide (5:4). Basal plate much covered by cephalic, the exposed portion about three and one-half times wider than long, one-quarter as long as head. Antennæ longer than in the preceding species. Claws of prehensorial feet when closed extending a little beyond front margin of head; tooth of claw small. Prosternum wider than long (11:9). Last ventral plate wide, sides converging caudad, caudal margin a little incurved. Coxopleura pores few, partly covered. Distal joint of anal legs long and slender. Anal legs in male crassate proximally, the four distal articles slender. Pairs of legs, forty-seven to fifty-five. Length about 15 mm.

Localities.—Stanford (Mann), Pacific Grove and Berkeley (author). The type is from Berkeley.

Family Soniphilidæ

Of the three genera at present known to belong to this family, two occur in California. They are characterized by having a coalescence between the parts of the labrum, the middle piece widely extending along the lateral to their outer ends in most cases where, at least fusion is evident; at the middle of the free edge two decidedly larger and more strongly chitinized teeth are borne, the adjacent ones being abruptly smaller, these middle teeth with in some several adjoining pairs in two of the genera extending directly; ventrad rather than caudad; lateral portions of edge pectinate. The first maxillæ may or may not bear well developed lappets. Second maxillæ without pleuro-sternal suture, the coxæ broadly joined at middle. Chitinous lines of prosternum strongly developed. Anterior border of each anterior sternite is furrowed transversely, the furrow being guarded ventrally as a rule by a chitinous rim or flange beneath which fits the edge of the preceding plate.

The three genera may be separated by means of the following key:

Key to Genera

a. Joints of prehensorial feet not dentate within; claws not extending beyond the front margin of head; last ventral plate very wide.

b. Edge of labrum bent ventrad at middle, its teeth extending in same direction; coxa of first maxilla without lappet, the proximal article of palpus with a conical process or lappet which is shorter than the distal article. Genus *Soniphilus* Chamberlin

bb. Edge of labrum at middle with teeth directed caudad; first maxilla with coxa and proximal joint of palpus with long lappets.
Genus *Tabiphilus* gen. nov.

aa. Some joints of prehensorial feet dentate within; claws when closed extending beyond front margin of head; last ventral plate but moderate in width.
Genus *Poaphilus* Chamberlin

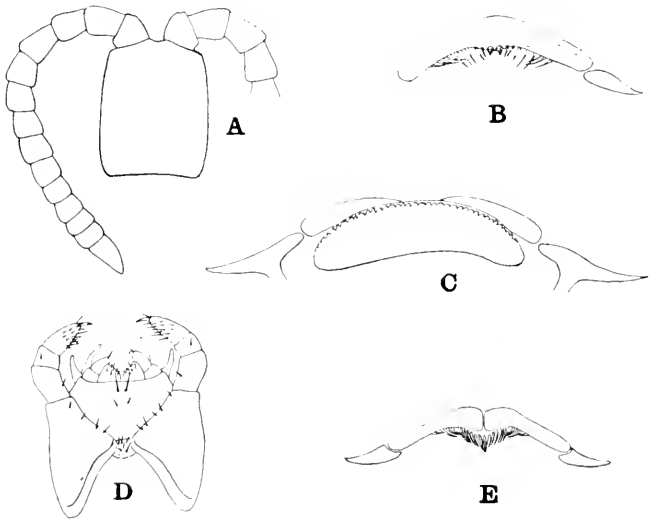

Figure 218

A, Dorsal view of cephalic plate and antennæ of Soniphilus secundus sp. nov. B, Cephalo-ventral view of labrum of the same, showing the two large middle teeth and the outlines of the lateral pieces over which the median extends. C, Labrum of Limotenia lævipes (Wood), showing the large median piece which is dentate along the edge directed anteriorly, and the smooth lateral pieces with the lateral supports or laminæ fulcientes. D, First and second maxillæ of Gnathomerium melanonotum (Wood), showing the divisions of the first with the membranous lappets on each side, and, in the second, the conspicuous pleura-sternal sutures. E, Labrum of the same, showing how the lateral pieces extend over the median and meet at the median-line.

Genus Soniphilus Chamberlin

This genus as at present known embraces two species, the one described below and *S. embius* Chamberlin, the type of the genus, a closely related species from Iowa which is but 13 mm. long. In this genus the prehensorial feet are short, not attaining the front margin of the head, and its joints are all unarmed within. The first maxillæ have but one lappet on each side, this being an outgrowth from the proximal article of the palpus. The last ventral plate is very wide. Coxopleural pores few and small, mostly covered by the edge of the ventral plate.

Soniphilus secundus sp. nov.

Chitinous lines of prosternum not wholly complete. Claws of prehensorial feet with a minute or obsolete denticle within, not attaining front margin of head. Cephalic plate widest a little in front of caudal margin, narrowing moderately forward. Frontal suture not present. Basal plate very wide. Prebasal plate not exposed. The labrum has two very stout conical teeth at middle, the adjacent processes being abruptly less strongly chitinized and longer like those of lateral fringes. Spiracles all circular, the first larger than the second. First legs a little shorter and more slender than the second. Last ventral plate very wide, narrowed caudad. Two moderate sized pits on each coxopleura covered, or mostly so, by edge of last ventral plate. Anal legs in female slender, longer than the penult, ending in a well developed claw. The body is attenuated strongly caudad and less strongly, though considerably, cephalad. Fulvous; head light reddish yellow; antennæ yellow. Length ad 18 mm. Pairs of legs, in female forty-three, male forty-one.

Localities.—Sausalito (author, April, 1911), Pacific Grove (author, July, 1909).

As indicated previously, this species is very close to the type species *S. embius* found in Iowa and Wisconsin; but it differs clearly in the character of the armature of the labrum, in the shape of the cephalic plate, in the larger basal plate and in details of the last ventral plate and the coxopleuræ. The chitinous lines of the prosternum are also less strongly developed.

Tabiphilus gen. nov.

This genus is in general structure most clearly allied with the preceding; but it differs in having the edge not twisted ventrad at the middle, the teeth extending caudad as in most genera and not having the middle two quite so strongly differentiated from the others, and clearly in having two long membranous lappets on each of the first maxilla, the distal lappet being clearly longer than the distal article of the palpus. The one species known is larger and has a much larger number of pairs of legs than any one in the two other genera of the family.

Tabiphilus rex sp. nov.

Body light ferruginous. Attenuated cephalad and more decidedly caudad. The cephalic plate is truncate anteriorly and also posteriorly; the sides are straight and parallel from the caudal angles forward to about the beginning of

the anterior third where they rouund in mesad to the anterior margin; longer than wide in ratio 17:15. Frontal suture not present. Antennæ three times as long as the cephalic plate; proximal article wide, nearly touching its fellow; ultimate article equalling in length the two preceding taken together. Prebasal plate very slightly exposed. Basal plate three and eight-tenths times wider than the median length of the exposed portion. Claws of prehensorial feet when closed not attaining front margin of head; joints unarmed. Chitinous lines of prosternum strongly developed; prosternum much wider than long (about 4:3). Ventral pores few, in a transverse band in front of caudal margin of sternite. Legs of first pair a little shorter and more slender than those of the second, the succeeding few pairs gradually a little longer and thicker; anterior pairs clearly more robust than the posterior. First spiracle obliquely elliptic, larger than the second which with all the succeeding ones is circular. The last ventral plate is very wide with its sides convex, the caudal margin subtruncate. Coxopleural pores mostly covered, one or two only being partly exposed. Anal legs much stouter and longer than the penult. Pairs of legs, seventy-five. Length about 30 mm.

The type specimen was taken at Claremont by Prof. Baker and is the only specimen of the species seen.

Family Schendylidæ

In this family the antennæ are thin and filiform. The labrum is composed of a single piece, the free edge of which is concave and dentate. Mandible with one dentate lamella, which may be divided into three parts, and one pectinate lamella. Suprascutella never present. The ventral pores when present, as they are in all Californian forms, are condensed in a circular or elliptic area.

Pectiniunguis is the only genus now known to occur in California; but *Schendyla* is likely to occur. These two genera may be separated as follows:

Key to Genera

a. Claw of second maxilla excavated and pectinate; dental lamina tripartite; coxosterna of first and second maxillæ grown together.
Genus *Pectiniunguis* Bollman

aa. Claw of second maxilla not excavated on one side and pectinate; dental lamina of mandible entire; coxosterna of first and second maxillæ not grown together. Genus *Schendyla* Bergsoe and Meinert

Genus Pectiniunguis Bollman

Labrum entire, deeply incurved, mesally dentate. Mandible with dentate plate in three divisions. Coxosterna of first and second maxillæ fused together. Claw of pallus of second maxillæ concave on mesal side and finely pectinate along the ventral pores in a small circular field in front of caudal margin of sternites. Last ventral plate wide, each coxopleura with two porigerous pits at or beneath edge of ventral plate. Anal legs six jointed, with or without claws.

Key to Species

a. Anal legs without claws. *P. americanus* Bollman

aa. Anal legs with claws.

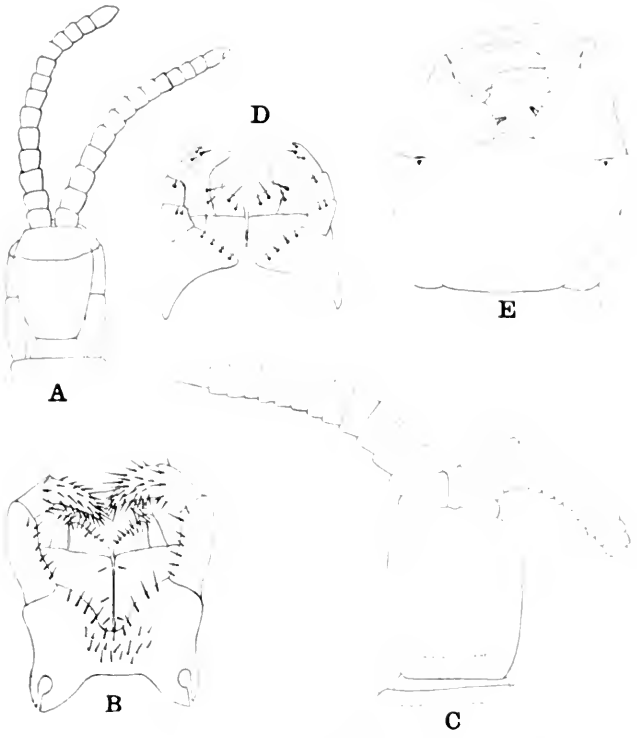

Figure 219

A, Dorsal view of anterior end of Mecistocephalus limatus (Wood), showing the characteristic form of cephalic plate and its frontal suture, the narrow basal plate with the pleuræ exposed each side, the much exposed prehensorial feet, and the antennæ. B, First and second maxillæ of the same showing the separation of the coxæ of the first and the long palpus membranous apically and bearing no lappets; note also the extensive fusion of coxæ of second maxillæ. C, Dorsal view of anterior end of Arrup pylorus gen. et sp. nov., with the prehensorial feet removed; it shows the cephalic plate with antennæ, the much overlapped basal plate with the pleuræ each side. D, First and second maxillæ of the same, showing particularly the complete separation of the coxæ of the second pair as well as those of the first; contrast with B. E, Prehensorial feet and prosternum of the same; note the characteristic teeth borne on mesal margin of first joint

b. Prebasal plate not exposed; pairs of legs, forty-five to fifty-three.

c. Basal plate, so far as exposed, but four times wider than long; cephalic plate longer than wide. *P. heathi* Chamberlin

cc. Basal plate very short, exposed portion about eight times wider than long; cephalic plate nearly equal in length and breadth. *P. heathi catalinae* subsp. nov.

Pectiniunguis americanus Bollman

While this species has not been taken actually within the state, it was originally described from Lower California and its occurrence within our limits is therefore very probable. In this species the body is depressed and but little attenuated. It is brownish yellow in color with an interrupted geminate dark band along the dorsum. The cephalic lamina is equal in length and breadth, with the caudal margin a little incurved. Prebasal plate exposed. Spiracles large, elliptical. Coxopleural pits covered by last ventral plate. Anal legs entirely without trace of claws. Pairs of legs near sixty-five.

Pectiniunguis montereus Chamberlin

This species seems to occur quite commonly along the California coast from the southern portion north at least as far as Monterey Bay, from which it was first described. It is essentially littoral in habit, though it has been occasionally taken some distance inland. Specimens have been seen from the following localities: Dead Man's Island, San Pedro, (Baker); Santa Barbara, Pacific Grove, etc. (author).

In general structure similar to *P. americanus*. In alcohol specimens are light brown to yellowish with the head somewhat darker. There may be two parallel dark stripes along the dorsum as in the preceding species. In life the adults are deeper colored, some appearing red like a *Linotenia*. The body is decidedly though very gradually attenuated cephalad and more abruptly caudad. The prebasal plate exposed. Cephalic plate considerably longer than wide, truncate caudally. Ultimate article of antennæ shorter than the two preceding taken together. Pairs of legs, so far as noted, fifty-five to sixty-one. Length up to 50 mm.

Pectiniunguis heathi Chamberlin

Body of same general habit as the preceding but smaller. Cephalic plate with sides widely excurving. Prebasal plate not exposed, the cephalic lapping over the basal. Ultimate article of antennæ about equal in length to the two preceding taken together. The first ten sternites have each a caudal median process which fits into a corresponding pit in the succeeding plate, this feature apparently more strongly developed than in monæreus. Pairs of legs, forty-five to fifty-three. Length 22 mm.

Known from Cypress Point, Monterey County, where a specimen was dug up from an Indian mound in sandy soil, and from Los Angeles, where the author secured a specimen also by digging.

Pectiniunguis heathi catalinæ subsp. nov.

Head yellowish; antennæ and body pale yellowish white. Cephalic plate widest anteriorly, narrowed caudad; anterior margin rounded, the caudal truncate; equal in length and breadth or very nearly so. Basal plate largely covered by the cephalic, the exposed portion being very short, about eight times wider than long. Claws of the prehensorial feet when closed extending a very little beyond front margin of head; joints of feet all unarmed. Prosternum with chitinous lines; wider than long (about 23:17). Antennæ strictly filiform, not at all attenuated. Last ventral plate wide, sides converging caudad. Coxopleural pits two on each side, covered by edge of ventral plate. Anal legs in male crassate, ending in a claw. Pairs of legs, forty-five to fifty-one. Length about 16 mm.

Localities.—Catalina Island; Claremont (Baker).

Family Himantariidæ

Antennæ short, strongly flattened, broad at base and markedly attenuated distad. Labrum well developed, composed of a single piece which is free, and incurved and dentate along the margin. Mandible with a single dentate and with several pectinate lamellæ. Prehensorial feet weakly developed, not dentate within. The ventral pores are in a sharply delimited central area. Anal pores never present.

The two genera included in the key below are the only Californian genera at present known; but *Haplophilus*, which is known from Montana and Mississippi, may be found to occur.

Key to Genera

a. Anal legs ending in small claws; on some of the middle segments suprascutella are present. Genus *Notobius* Cook

aa. Anal legs clawless; no suprascutella present. Genus *Gosiphilus* gen. nov.

Genus Notobius Cook

Some of the segments in middle portion of the body with a row of suprascutella or paratergites above the level of the spiraculiferous sclerites. Labrum deeply incised at median line. Coxosternum of first maxillæ deeply incised at middle, almost completely divided but still coalesced proximally. Last ventral plate very wide; coxopleural pores numerous, small, arranged along edge of ventral plate. Spiracles all circular. Anal legs terminating in a slender claw in adults.

One species known. A second form, *inermis* of Wood, is listed here tentatively.

Notobius teniopsis Wood

Syn. *Chomatobius mexicanus* Schiwanoff
Notobius californicus Cook

This is a very long species with from one hundred and twenty-nine to one hundred and forty-nine pairs of legs in individuals thus far observed, most having from one hundred and thirty-three to one hundred and forty-one pairs. Con-

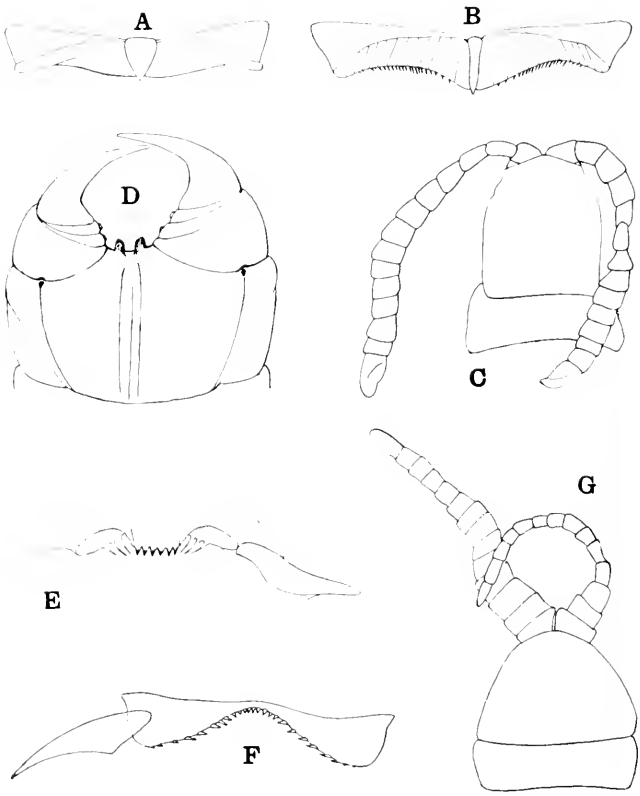

Figure 220

A, Labrum of Arrup pylorus gen. et sp. nov. B, Labrum of Mecistocephalus limatus (Wood). C, Dorsal view of cephalic and basal plates with antennæ of Tampiya pylorus gen. et sp. nov. D, Prosternum and prehensorial feet of the same, showing the characteristic teeth of the anterior median margin of the prosternum. E, Labrum of the same. F, Labrum of Pectiniunguis montereus Chamberlin, showing also one lamina fulcientis. G, Dorsal view of anterior end of Gosiphilus minor gen. et sp. nov., showing basal and cephalic plates with antennæ, the prehensorial feet being completely covered.

spicuously narrowed from third fourth of length cephalad and abruptly narrowed caudad; the head relatively very small. The cephalic plate is relatively wide, well rounded in front, almost completely concealing the prehensorial feet from above. The flat antennæ are short, contiguous at base and pointed distad. Claw of prehensorial feet not attaining front margin of head. Ventral pores in a sharply delimited median area which varies from circular to transversely elliptical in outline. Last ventral plate very wide, the numerous small coxopleural pores aggregated mostly along its edges.

Specimens have been seen by the author from Stanford, Claremont and Los Angeles. It is also known from San Diego and Margarita Island.

Notobius inermis Wood

Under the name *Himantarium inermis*, Wood described an individual from the Santa Cruz Mountains. He states that it is very similar to *teniopsis* but differs in having only one hundred and fifteen pairs of legs. The head is described as triangular and moderately wide, the antennæ short and said not to be acuminate. Feet robust, short.

Genus Gosiphilus gen. nov.

Body much flattened dorso-ventrally. Labrum deeply incised at middle. The coxosternum of first maxillæ deeply incised at median line but coxæ not separated proximally. Dentate plate of mandible rather narrow. Paratergites or suprascutella absent. Last ventral plate wide. Coxopleural pores few, mostly covered. Anal legs clawless.

Apparently most closely allied with *Haplophilus*. Established for three species, all of which occur in California and two of them known from nowhere else.

Key to Species

a. Pairs of legs near one hundred and eighty-one. *G. bakeri* sp. nov.

aa. Pairs of legs less than one hundred.

b. Pairs of legs mostly fifty-five to sixty-one. *G. minor* sp. nov.

bb. Pairs of legs in the neighborhood of eighty-one. *G. laticeps* Wood

Gosiphilus minor sp. nov.

Cephalic plate widest caudad, conspicuously narrowed anteriorly, subtriangular, wholly covering the prehensorial feet; caudal margin weakly produced from lateral corners to a very obtuse angle at middle; much wider than long (as 31:23). Basal plate very wide, narrowed from its anterior end caudad, two and one-half times wider than long. Antennæ short, thick, contiguous at base. Prosternum much wider than long (28:17); chitinous lines very strongly developed. Prehensorial feet weak, joints unarmed, claws not attaining front margin of head. Spiracles all circular, the first considerably larger than the second. Ventral pores in a sharply defined transversely elliptical area. Last ventral plate very wide, almost wholly covering the coxopleuræ, subquadrate, the sides but slightly converging caudad. Coxopleural pores few, partly covered. Anal legs in male

crassate, clavate, the apical portion conspicuously thicker than the proximal. In the female slender, not attenuated distad. Pairs of legs, fifty-five to sixty-one.

Locality.—Berkeley (author, April, 1911).

Gosiphilus bakeri sp. nov.

Cephalic plate widest caudad, being a little narrowed cephalad to anterior corners, the border in front of corners triangular; wider than long (in ratio 15:13). Basal plate short, a little narrowed caudad, not quite as wide as the cephalic, about two and eight-tenths times wider than long. Prehensorial feet completely covered by cephalic and basal plates; claws weak, not strongly curved, not touching distally, short of attaining front margin of head. Prosternum very much wider than long (28:15); chitinous lines strongly developed and complete as usual. Spiracles all circular. Ventral pores in a circular or subcircular area just caudad of center of sternites. Last ventral plate wide, sides straight, moderately converging caudad; caudal margin truncate. Coxopleural pits two on each side, the more caudal one partly covered and the anterior one wholly so by ventral plate. Anal legs clawless. Pairs of legs, one hundred and eighty-one.

One specimen from Claremont collected by W. C. Spencer.

Gosiphilus laticeps Wood

A long and slender species with the body conspicuously flattened dorso-ventrally. Pairs of legs somewhere near eighty-one, which is a common number. The antennæ are short and conspicuously attenuate distad, contiguous at base. The cephalic plate is wide caudad and strongly narrowed forward. Spiracles small, all circular. Ventral pores in a transversely elliptic area. Last ventral plate wide, sides straight, moderately converging caudad. Coxopleural pores usually, at least, not evident.

Specimens have been examined from Pacific Grove, Claremont, Los Angeles and Catalina Island. It is common in Texas, the type locality, and the author has also secured it at Las Vegas, Nevada, where it was dug up in a garden.

INBREEDING OF JUNONIA COENIA UNDER HIGH TEMPERATURES THROUGH TWENTY-TWO SUCCESSIVE GENERATIONS

WILHELM SCHRADER
LOS ANGELES, CAL.

Breeding butterflies in hot and cold temperatures is not a new idea. German entomologists, especially, have experimented in that line for many years, and have published their experiments, and I have no doubt they will be followed by many interested entomologists, who have the time and patience. I hope that my little experience published here, will interest others in joining me in this most interesting work, in which, to obtain best results, many students of widely separated regions must co-operate. I wish to thank Mr. Lordyce Grinnell, Jr., of Pasadena, Cal., for his valuable help.

In the spring of the year 1906 I sowed some seed of *Linaria cymbalaria*, a little trailing plant, which is very useful for rockwork, and found later on this plant some caterpillars, at that time unknown to me. I gathered all I could find, and obtained later sixteen chrysalides. As I had contemplated for some time prior to try some temperature experiments, I bought a little chicken incubator, and bred the chrysalides in 90 degrees warm, damp air, and in darkness. After five days the butterflies emerged, and they were all our well known *Junonia coenia*. I noticed that all were somewhat dark in the ground color. However, I was disappointed. As is the case with all experimental work, we commonly expect great things, so much the more when we read condensed accounts of what other experimenters have accomplished. Yet it is a great thing to have patience to try things out, so I figured that all our thousands of different species of butterflies were not made at once; they must have developed by the slow process of evolution.

Anybody who is interested in insect life will have marveled how quick the transformations from the egg to the imago take place in nature. In the summer-time with us, this cycle is repeated once, and by some butterflies twice. However, what will our readers say, to hear that by the use of artificial warmth, I was able to breed from the first generation in April, 1909, to November, 1911, that is, within two years and seven months time, twenty-two successive generations; and by keeping the caterpillars in 80 to 90 degrees temperature day and night, I succeeded, in a few generations, in finishing a complete cycle in one month. This could not be kept up as trouble arose with contagious diseases. Other experimenters have made temperature experiments, by breeding butterflies in artificial temperatures, hot as well as cold, and we have learned many new facts; yet there is still much to learn, as almost every experimenter formed a somewhat different theory, as to why these changes in color and markings, from the winter to the summer generation, take place. I have not heard that any experimenter, here or abroad, has succeeded in breeding from his own stock of butterflies at any

rate, twenty-two successive generations without crossing. To pair butterflies in captivity, they need plenty of sunshine; and to grow the food plant for the caterpillars outside all the year around, needs a very mild winter, and we have both here. My first female in this experiment I caught near Los Angeles on April 25, 1909. It was very small, as are most of our butterflies which remain

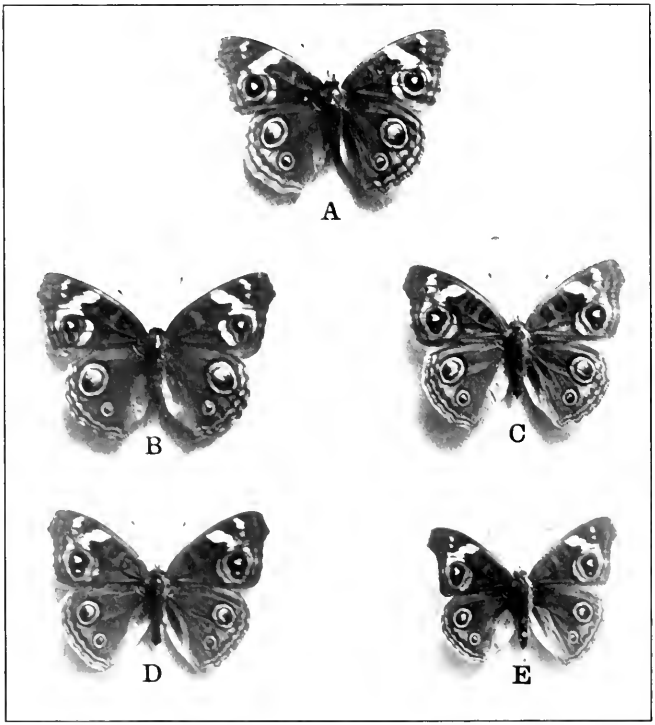

Figure 221. Junonia cœnia
A, normal; B, C, D, E, specimens inbred under high temperatures.

for a long time in the chrysalis; the first generation bred in 90 degrees were all somewhat larger, and I have kept up the size of this butterfly to the now twenty-second generation. Of course they need the very best care; it is no easy task to keep the food plant always fresh for a hundred or more caterpillars to each experiment, without too much dampness in the breeding case, which will soon prove fatal to the young caterpillars.

My first generation, of the year 1906, were all somewhat darker in color, as is the case with many other butterflies, when they are bred in darkness. I determined to try to emphasize this dark color, by selecting the darkest males, and pair them with the darkest females, and then breed the descendants in the same way in 90 degrees warm, damp air, and in darkness. The second generation came out in August, 1906. They were only five days in the chrysalis; the ground color was dark, as in the first generation, except a few, which reverted to the normal color (see Figure 224A, representing a female, caught in Los Angeles August 1, 1909). I bred a female in this second generation which had a black appendix on the large eye spot of the forewing (see Figure 224B). The black eye spot of the forewing is always of the same color on the under side of the wing, but it is a little smaller there. In my bred specimen of this generation the appendix is only on the upper side of the wing, the under side has the usual dark round center with a ring around it; only in later generations, when this new appendix becomes very large, is it visible also on the under side. This specimen seemed too valuable to me to put in the pair cage, as all butterflies which are used for pairing lose so much color that they are not good for a collection. Beside this one just described, I got two more females with only a black point on the same place as this appendix, though not connected with the black eye spot, but just below the dark ring and connected with it. I separated these two females in a pairing cage, with enough males to secure a mating, and in the next or third generation, obtained two females with a point, as above described, and two others had a small spot, connected with the black eye spot, but not quite so large as in Figure 224B. The females with an appendix amounted to about ten per cent in the third generation; as I knew only one food plant at that time, and had only a few plants, I could not raise very many caterpillars to each generation, so my calculation may be not very exact. As I obtained not one male with an appendix, I supposed the males would never get it, or the female must be progressive in this new development; the last named conclusion proved true later. I bred up to November four generations, and as my food plants were almost consumed, I stored a dozen chrysalides in the warm room, to hatch them all out at once. But, alas! Over night the ants got in the room, and there was nothing left, except a few empty cases of the chrysalides.

As Junonia does not fly in great abundance near Los Angeles, I had to wait two years before I caught a fertile female, on April 25, 1909. At that time I found by chance that the caterpillars also take as a food plant our garden variety of Pentstemon, which I have used ever since; and I found that these different food plants have no influence on the color of the butterflies. I bred this new line the same way as before, in 90 degrees warm, damp air, and in darkness. In the second generation I got out of ten females two with a point below the large eye spot of the forewing; and I noticed that all the females had the eye spot of the forewing enlarged, and the very small spot in the apex of the forewing was also enlarged; so was the small double white spot. From one generation to the other, the enlargement of the eye spot of the forewing became more marked; also the appendix became larger, and the percentages slowly increased. In the ninth

generation, I got, out of thirty males, one with a small appendix; this was the first appearance of this character in a male, although the eye spots began to enlarge several generations before. The very small spots in the apex of the forewing are now quite visible, whereas in the males of our local form, there is only a trace of it in the apex; the very small double spots are in the male blue, whereas in the female these spots are always white; this is the best color sexmark in *Junonia coenia*. In the thirteenth generation appeared for the first time four females which have in the appendix a small light spot (see Figure 221C). While the eye spots of the forewings got larger in each generation, the eye spots in the hindwings were reduced in size. The large eye spots are in our local form elliptical, while in my breeding experiments, these ocelli became almost round. I bred in the twentieth generation twenty-seven females, all showing appendices, seventeen of these had double ocelli (see Figure 221D). The same generation produced twenty-nine males, seventeen showing appendices, two of these had double ocelli (see Figure 221E).

Beside these regular lines of experiments, I carried on many side lines; in one of these, I took a part of the chrysalides from the regular line, and bred them 90 degrees warm, damp; this time in a light breeding cage. To produce as much light as possible, I built a mirror case, to reflect the light, without direct sunshine in it, as this would soon get too hot; here I hung up the chrysalides. After five days the butterflies emerged. As I expected, all were lighter in ground color, some were more yellow near the border of the hindwings, just as in our local form with which I started. This seventh generation out of the damp and dark breeding case, and bred in a damp and light breeding case, produced about the same percentage with an appendix as the seventh generation bred in the dark. I carried on this line in the mirror case, damp air, for seven generations; and in each generation about the same ratio of increase of the new appendix was seen as in the old line bred in the darkness.

I now picked out only males and females without appendices; paired these, raised the caterpillars and bred the chrysalides, in normal temperature, in daylight without direct sun, the average temperature being in the daytime 80 degrees, at night 65 degrees. That was in August, 1910. The result was surprising! I got twenty females, ten with an appendix, two of these with double eye spots; and twenty-five males, seven with an appendix. Up to that time I had never obtained more than one or two males with an appendix, in one generation; and now came seven males at once, and that among limited numbers. I can't help but believe that this resulted from a little change in the temperature from the usual steady warmth of 90 degrees. I now paired these seven males with appendices, with the very best females with appendices; breeding the resulting chrysalides in 90 degrees temperature, in a damp and dark case. To my astonishment I got very few with appendices. In the next generation, from one hundred and eighty caterpillars, I only got twenty-eight butterflies, nineteen females, seventeen with appendices, nine of these with double eye spots; and nine males, six with appendices.

In all my experiments, I have used as parents only normal colored individuals, and bred the descendants the second time in a normal temperature, with the results noted above.

As I desired to make other experiments, by breeding *Junonia* chrysalids in dry air, but could not obtain any new ones from outside, I used these just described butterflies, and picked out again all normal colored males. However, I had to use some females with appendices, as I had only one normal colored. The chrysalides of this third generation, I put in the mirror case with much light, 90 degrees warm, but this time dry air, as I had believed dry air would produce small eye spots. Nevertheless, I got seven females, six of which had appendices; and sixteen males, three with appendices. In the fourth generation bred in dry air, I got sixty females, forty with appendices, five of these with double eye spots; and fifty-nine males, three with appendices. Most of these butterflies were somewhat lighter in color than our local form. I bred another generation with the same result. Then I raised six caterpillars on a pot plant in the mirror case, as dry as possible, got the chrysalis there, and bred them there in 90 degrees. The result was striking, all the eye spots being reduced in size. I hope to repeat this experiment again later on.

I am also developing some most interesting results in breeding out continuous generations in cool air, and these will be recounted later.

It is now of exceeding importance that other species of the genus be bred under similar widely varying conditions in order that we may possibly come to understand the origin of some of the striking variations that may appear in these bred specimens, and perhaps work out the relationships and phylogeny of all the species more fully. Dr. Dyar expresses the opinion to me that *Junonia vellida* of Australia is the most primitive type in the genus. I am exceedingly anxious to obtain eggs or chrysalids of that species, or any others of the genus and shall be glad to correspond with lepidopterists in any part of the world relative to the matter.

ZUR STAPHYLINIDENFAUNA VON NORD-AMERIKA 5. BEITRAG.

DR. MAX BERNHAUER
GRUENBURG, OB. OESTERREICH

Proteinus densipennis nov. spec.

Niger, subopacus, antennarum articulo primo pedibusque testaceis, parum convexus, thorace haud sulcato, elytris densissime punctatis. Long 1.2-1.8 mm. Kalifornien: Sugar Pine, leg Dr. Fenyes.

Dem *Pr. macropterus* Gyll. am naechsten verwandt, von derselben Grosse oder Kleiner, von demselben durch die viel dichter punktierten Fluegeldecken, weniger gewoelbte Gestalt und die auf das erste Fuehlerglied Beschraenkte gelbe Farbung leicht zu unterscheiden. Durch die sehr dicht punktierten Fluegeldecken unterscheidet sich die neue Art auch von den uebrigen nordamerikanischen Arten mit nicht glaenzenden Halsschilde hinlaenglich. Die Faerbung ist schwarz bis braunschwarz, das erste Fuehlerglied der im uebrigen pechfarbenen Fuehler und die Beine hellgelb.

Der Halsschild ist nur wenig schmaler als die Fluegeldecken an der Wurzel mehr als doppelt so breit als lang, ohne Mittelfurche, nur wenig glaenzend.

Die Fluegeldecken sind mehr als doppelt so lang als der Halsschild, fein und sehr dicht, mindestens doppelt so dicht als bei *macropterus*, der im uebrigen meines Wissens bisher, aus Nordamerika nicht nachgewiesen erscheint punktiert.

Beim Maennchen sind die zwei ersten Glieder der Vordertarsen erweitert, die Mittelschenen schwach gekruemmt.

Es sei mir an dieser Stelle die Feststellung erlaubt, dass der im arktischen Nordamerika heimische *Proteinus limbatus* Makl. mit der unter diesem Namen verbreiteten europaeischen Art nicht identisch ist, weshalb fuer letztere Art der Namen *crenulatus* Pand. einzutreten hat.

Anthobium orientale nov. spec.

Rufotestaceum, submitidum, capite thoraceque alutoceis abdomine maris nigro, antennarum apice infuscata, articulis penultimis transversis, capite thoraceque fere impunctatis, hoc modice transverso, elytris plus duplo longioribus, densius punctatis. Long 1.8-2.2 mm. New Hampshire (leg. Fall), Massachusetts (Mensel).

Von *Anthobium sorbi* Gyl., von welchem ich bisher ein amerikanisches Stueck nicht gesehen habe, in folgenden Punkten verschieden.

Der Kopf ist viel breiter, der Halsschild dagegen schmaeler und laenger, ungefaehr um die Haelfte breiter als lang und um ein gutes Stueck schmaeler als die Fluegeldecken, die Scheibe meist mit einigen schwachen Eindruecken.

Die Fluegeldecken sind laenger und bedecken einen groesseren Theil des Abdomens, die Punktierung derselben ist weniger dicht. Endlich sind die Fuehler gegen die Spitze staerker verdickt, die vorletzten Glieder ziemlich starkquer.

Die Faerbung ist aehnlich wie bei *sorbi*, jedoch weniger hellgelb.

Beim Maennchen ist das sechste Sternit ziemlich tief, breit bogig ausgeschnitten, die Schenkel verdickt.

Von dieser Art liegen mir sechs Maennchen vor. Dieselbe steht dem *rectangulum* Fauvel noch nacher, ist jedoch durch viel flachere Gestalt und weniger gerundeten Halsschild, sowie kuerzere Fuehler auch von diesem ohn Muehe zu unterscheiden.

Anthobium fenyesi nov. spec.

Testaceum, subnitidum, abdomine maris praeter apicem testaceam nigro, antennarum apice parum infuscata, thorace abdomine, sparsissime punctato, medio haud canaliculato, elytris modice elongatis, postice subtruncato. Long 1.7-2 mm. Washington: Baring, leg. Dr. Fenyes.

Dem *Anthobium atriventre* Cas. sehr nahe verwandt, in der Koerpergestalt sehr aehnlich, jedoch in nachfolgenden Merkmalen verschieden. Die Farbe ist lichter, der Hinterlieb beim Maennchen an der Spitze, und beim Weibchen ganz rostlichgelb. Der Halsschild ist viel feiner und dreimal weitlaeufiger punktiert; die Fluegeldecken sind bei beiden Geschlechtern hinter breit abgestutzt, waehrend sie beim Weibchen des *atriventre* Cas. hinten einzelnen spitzig ausgezogen sind.

Endlich ist die Geschlechts auszeichnung des Maennchen vollstaendig verschieden, indem naemlich das sechste Sternit an der Spitze einfach breit bogenformig ausgeschnitten ist und keine weitere Auszeichnung traegt.

Ich besitze von dieser Art zwei Maennchen und ein Weibchen, welche ich saemmtlich von meinem lieben Freunde, Dr. A. Fenyes, in Pasadena gleich den uebrigen hier beschriebenen Arten erhalten habe.

Artochia californica nov. spec.

Nigerrima, subnitida, dense punctatus et pubescens, antennis, palpis pedibusque piceis; thorace sensim latiore quam longiore, lateribus rotundatis, elytris thorace plus duplo longioribus. Long 2.5 mm. Kalifornien: Sugar Pine, leg. Dr. Fenyes.

Durch die langen Fluegeldecken und den seitlich gerundeten Halsschild sowie die dunkeln Beine von der zweiten Art: *productifrons* Casey, den ich nicht keine gewiss verschieden.

Tiefschwarz, mit pechbraeunen Fuehlern, Tastern, und Beinen, trotz der dichten Punktierung und Behaarung deutlich glaenzend.

Kopf halb so breit als der Halsschild spitzig dreieckig mit ruesselartig vorgezogenem Munde, vor den Augen mit zwei schwachen Eindruecken, fein und dicht punktiert, mit grossen Augen und fast ganz geschwundenen Schlafen. Die Ocellen sind von einander dreimal so weit entfernt als vom Augenrande. Fuehler maessig gestreckt, die vorletzten Glieder kaum laenger als breit.

Halsschild viel schmaeler als die Fluegeldecken deutlich breiter als lang, fein und dicht, gleichmassig punktiert, an den Seiten gerundet etwas vor der Mitte am breitesten, nach rueckwaerts ziemlich gerade verengt, vorn stark gerundet verjungt, in der Mitte der Seiten mit einer ziemlich tiefen gruebe, welche rueckwaerts in den breit gekehlt abgesetzten Seitenrand uebergeht.

Fluegeldecken mehr als doppelt so lang als breit, nachrueckwaerts schwach erweitert, etwas staerker, dichter wie der Halsschild punktiert.

Ephelinus arizonensis nov. spec.

Niger, subnitidus, densissime fortiter punctatus, elytris immaculatis, thorace longitudine brevior, postice vix attenuato. Long 2.2-2.6 mm. Arizona: Flagstaff, leg. Dr. Fenyes.

Obgleich ich keine der drei bisher bekannten *Ephelinus* Arten besitze, nehme ich keinen Anstand, die vorliegende Art in dieses Genus zu versetzen. Von den drei Leconte'schen Arten muss sich die neue Art sehr markant schon durch die tiefdunkte Faerbung, die nicht gefleckten Fluegeldecken den kuerzeren, nach hinten nicht verengten Halsschild unterscheiden lassen.

Einfaerbig schwarz, die Beine und manchmal die Fluegeldecken an den Schultern unbestimmt heller oder auch ganz dunkel-schwarzbraun werdend.

Kopf breiter als der Halsschild, breiter als lang, mit zwei grossen Gruebchen vor den Augen, ziemlich kraeftig und dicht punktiert, die Ocellen von einander viel weiter abstehend als von Augenrande, die Schlafen ungefaehr so lang, als der von oben sichtbare Auegendurchmesser. Die Fuehler massig lang, die mittleren Fuehlerglieder nur wenig langer als breit.

Halsschild halb so breit als die Fluegeldecken, gewoelbt deutlich um ein gutes Stueck breiter als lang, nach rueckwaerts kaum, nach vorn stark verengt, ziemlich uneben mit einem erhabenen Spiegelfleck vor dem Schildchen, kraeftig und sehr dicht punktiert.

Fluegeldecken fast dreimal so lang als der Halsschild, in einiger Entfernung von der Naht mit einer schwachen, wenig hervortretenden Laengsschwiele, kraeftig und sehr dicht ruenzelig punktiert, zwischen den Punkten glaenzend.

Abdomen mattchagriniert und sehr fein und wenig dicht punktiert.

Bolitobius californicus nov. spec.

Niger nitidus, thorace elytrisque, antennarum basi pedibusque pallide flavis, marginibus posticis segmentorum abdominalium palpisque rufulis, thorace utrinque, elytris ante angulos posticos nigro-maculatis, capite latitudine paulo longiore, elytris seriebus dorsalibus 7-11 punctatis, abdomine sat fortiter, parce punctato basi laeviusculo. Long 3-5 mm. Kalifornien: Mountains near Claremont, leg. Baker.

Dem *Bol. thoracicus* F. sehr nahe stehend von dem selben jedoch sofort durch den laengeren Kopf, welcher gerade die Mitte zwischen den Arten der Subgenera *Lordithon* Thoms. und *Bolitobius* s. st haelt, zu unterscheiden.

Der Kopf ist sehr wenig laenger als breit, glaenzend schwarz, die Fuehler maessig gestreckt, die vorletzten Glieder bei breitester Ansicht etwas breiter als lang, die zwei oder drei ersten Glieder gelb, die uebrigen schwarz.

Halsschild etwas breiter als lang, glaenzend blassgelb, vorn jederseits mehr oder minder ausgedehnt geschwaerzt.

Fluegeldecken mehr als um die Haelfte laenger als der Halsschild, in den Dorsalreihen mit sieben bis elf Punkten, blassgelb, vor den Hinterecken mit einer groesseren Schwarzen Makel.

Abdomen zugespitzt, pechschwarz mit rothlichen Hinterraendern der Segmente, kraeftig und ziemlich weitlaeufig punktiert, am dritten Tergit in grosser, am vierten in geringeren Ausdehnung glatt, unpunktiert.

Bolitobius arizonensis nov. spec.

Niger, nitidus, elytris, antennarum basi, palpis pedibusque testaceis, marginibus posticis segmentorum abdominalium rufulis, macula magna ante angulos posticos elytorum nigra, capite brevi, transverso, elytris seriebus dorsalibus circiter quinque punctatis, abdomine subtilius parce punctato. Long 3.8-4 mm. Arizona: Williams, leg. Dr. Fenyes.

Mit *Bolitobius thoracicus* F. aeusserst nahe verwandt und fast nur durch die Faerbung verschieden.

Der Halsschild ist naemlich einfaerbig tiefschwarz, waehrend bei *thoracicus* F. selbst bei den dunkelsten Stuecken der Form *biguttatus* Steph., Welche auch in Nordamerika (Kalifornien, Pasadena) vorkommt, immer ein breiter Basal und Seitenrand hellgelb erscheint.

Da ich bisher an den allerdings nur wenigen bekannten Exemplaren einen auffaelligen anderen Unterschied nicht nachweisen konnte, ist es sehr wahrscheinlich, dass dieselben nur einer auffallenden auf Nordamerika beschraenkten passe des *thoracicus* F. angehoeren, welche jedoch jedenfalls einen eigenen Namen verdient.

Bolitobius elefas nov. spec.

Rufo-testaceus, nitidus, capite, pectore postico antennisque nigris, harum articulis quatuor primis testaceis, pedibus flavis, abdomine rufo, segmenti septimi apice late albida, capite valde elongato, latitudine fere triplo longiore, abdomine fortius parce punctato. Long 7-9 mm. New Jersey: Pike, leg. Warren.

Eine durch die stattliche Groesse, den langen Kopf und die Faerbung hinreichend charakterisierte Art, die in die Nache des *Bol. quaesitor* Horn zu stellen ist.

Roethlichgelb mit helleren Beinen, der Hinterleib roetlich, die Apikalhaelfte des siebenten vollkommen freiliegenden Tergites weisslichgelb, die Fuehler, der Kopf und die Hinterbrust Schwarz, die vier ersten Fuehlerglieder gelb, die Fluegeldecken vor den Hinterecken, mit einer unbestimmten braeunlichen Makel.

Der Kopf sehr schmal und lang, fast dreimal so lang als breit, spiegelglatt, neben und hinter den Augen deutlich maessig weitlaeufig punktiert; die Fuehler lang, die vorletzten Glieder bei breitester Ansicht so lang als breit.

Halsschild so lang als breit, nach vorn stark verengt, spiegelblank. Fluegeldecken um ein Drittel laenger als der Halsschild, in den Dorsalreihen mit ungefaehr sex Punkten. Hinterleib zugespitzt, ziemlich kraeftig und weitlaeufig, laengs der Mitte spaerlich punktiert, die zwei ersten freiliegenden Tergite in der Mitte in groesserer Ausdehnung unpunktiert.

Bolitobius nepigonensis nov. spec.

Piceus thoracis basi, elytris basi apiceque, marginibus posticis segmentorum abdominalium, antennis, palpis pedibusque rufotestaceis; elytris thorace multo

longioribus, seriebus dorsalibus quinque punctatis. Long 4.5 mm. Ontario: Nepigon, Juni.

Mit *Bol. dimidiatus* Er. am naechsten verwandt, jedoch sicher durch die groessere Gestalt, viel laengere Fluegeldecken, die verwischte dunklere Faerbung auf den letzteren und laengeren Kopf verschieden.

Die Farbe ist unausgesprochen pechbraun bis pechschwarz, die hintere Partie des Halsschildes, die Basis der Fluegeldecken breiter, der Spitzenrand schmaeler roetlich gelb, die Hinterleibsringe an der Spitze roetlichgelb.

Der Kopf ist fast laenger als breit, die Fuehler gegen die Spitze schwaecher erweitert als bei *dimidiatus* Er. die vorletzten Glieder weniger quer, bei breitester Ansicht etwas um die Haelfte breiter als lang.

Der Halsschild ist deutlich breiter als lang, die Fluegeldecken um ein gutes Drittel laenger als jener, in den Dorsalreihen mit ungefaehr funft feinen Punkten.

Hinterleib gleichbreit, goldgelb grob behaart, ziemlich kraeftig und an der Basis der Tergite namentlich an den Seiten ziemlich dicht punktiert. Ein einziges Exemplar.

Longipeltina nov. gen. Aleocharidarum

Elongata, fusiformis, antice posticeque sat attenuata. Antennæ filiformes, elongatæ. Caput postice modice constrictus, thorax oblongus latitudine sat longior, elytra ampla. Tarsi omnes quinque articulati, valde elongatis, posticorum articulus primus tribus sequentibus conjunctis fere æqualis.

Die neue Gattung ist systematisch wohl zweifellos in die Nahe von *Chilopora* Kraatz zu stellen, wenn ich auch vorlaeufig beim Vorhandensein nur eines einzigen Exemplars die Mundtheile nicht untersuchen konnte. Sie unterscheidet sich jedoch von *Chilopora* sehr markant durch den nach vorn und rueckwaerts verschmaelerten Koerper, viel laengere Beine und Tarsen, sowie durch den verlaengerten Thorax, welcher viel langer als breit ist.

Longipeltina bakeri nov. spec.

Rufotestacea, nitida, capite infuscato, abdomine picco, ano rufulo, antennis, palpis pedibusque flavis; capite oblongo, subtilissime parcissime, thorace subtiliter modice dense, elytris parum densius punctatis, his illo paulo brevioribus, abdomine subtiliter parum dense punctato, postice sat attenuato. Long 3 mm. Kalifornien: Claremont, leg. Prof. Baker.

Roetlichgelb, ziemlich glaenzend, fein grau behaart, der Kopf etwas angedunkelt, das Abdomen bis auf die hellen Hinterraender der Segmente und der Spitze pechschwarz, die Fuehler Taster und Beine hellgelb.

Kopf wenig schmaeler als der Halsschild, laenger als breit, parallelseitig; sehr fein und spaerlich punktiert, die Schlaefen lang, fast doppelt so lang als die Augen. Fuehler langgestreckt, laenger als Kopf und Halsschild, ihr dritte Glied so lang als das zweite, das vierte Glied viel laenger als breit, die folgenden allmaehlich breiter und kurzer werdend, die vorletzten Glieder nicht quer, das Endglied laenger als die zwei vorhergehenden zusammengenommen. Die Schlaefen sind unten vollstandig geradet.

Halsschild viel schmaeler als die Fluegeldecken an den Schultern, um ein gutes Stueck laenger als breit, an den Seiten fast parallel, vor der Mitte etwas gerundet erweitert, hinter der Mitte deutlich ausgeschweift, ueberall maessig fein und maessig dicht punktiert, glaenzend, hinter der Mitte jederseits mit einem schwachen Schraegeindruck.

Fluegeldecken etwas kurzer als der Halsschild, nach ruckwaerts erweitert, am Hinterrande innerhalb der Hinterecken deutlich ausgerandet, deutlich staerker und etwas dichter als der Halsschild punktiert.

Hinterleib nach ruckwaerts stark verengt, glaenzend, kaum feiner aber viel weitlaufiger als die Fluegeldecken, hinten viel feiner und nur spaerlich punktiert.

Beine sehr lang und schlank, die Hintertarsen fast so lang als die Hinterschienen, ihr erstes Glied sehr lang gestreckt, fast so lang als die drei folgenden zusammengenommen, das zweite, dritte und vierte Glied ziemlich gleichgebildet, ungefaehr viermal so lang als breit, das Endglied kurzer als die zwei vorhergehenden zusammengenommen.

Ein einziges Exemplar.

A NOTE ON CERTAIN PSYLLIDAE

D. L. CRAWFORD
STANFORD UNIVERSITY, CALIFORNIA

By an unavoidable delay in the publication of a more extensive paper on the Psyllidæ, the manuscript of which has for some time been in the hands of the publishers, the description of the new genus *Psyllopa*, and of *Psylla americana* have not yet appeared. Reference was made to both of these names in my last paper on American Psyllidæ V, in this Journal, pages 628-32. These descriptions will be published very soon.

On page 629 of the above mentioned article, the name *Psyllopa floridensis* should be replaced by *Psyllopa ilicis* Ashmead, and the note on page 632 relating to this species should follow the description.

WEST COAST NEWS NOTES

FORDYCE GRINNELL, JR.
PASADENA, CALIFORNIA

"It is not enough to toil in our little corner of the field. We must keep ourselves in touch with what is going on now, and what has been done during the past in that and surrounding parts of the domain of science. Many a time we may find that the results obtained by some fellow laborer, though they may have had but little significance for him, flash a flood of light on what we have been doing ourselves."— Geikie, in "The Founders of Geology."

Mr. H. H. Newcomb, formerly of Boston, an ex-president of the Cambridge Entomological Club, has become a permanent resident of Southern California.

The Monthly Bulletin of the State Horticultural Commission promises to be a useful publication. It is devoted largely to entomology; and can be had free by any citizen of *this* state.

Mr. E. K. Harvey, of Los Angeles, lectured on butterflies before the Southern California Academy of Sciences, on December 16; exhibiting his large collection of beautifully mounted specimens from all parts of the world.

At a meeting of the Entomological Club, held on December 14, at the residence of Mr. J. R. Haskin, in Los Angeles, Mr. Haskin reviewed Poulton's recent papers on the mimicry of North American butterflies and adding some original ideas of his own. It was followed by a general and enthusiastic discussion. Mr. H. H. Newcomb was the leader of the opposition to the theory of mimicry.

Mr. Karl R. Coolidge, who was in Los Angeles during December, is planning to leave for Southern Arizona, for entomological collecting during the spring and summer.

The last number of the "Transactions of the San Diego Society of Natural History," issued in December, contained a valuable illustrated article on the Honey Ants of Point Loma, near San Diego, by Percy Leonard.

Dr. Edwin C. VanDyke, of San Francisco, president of the Pacific Coast Entomological Society and Curator of Entomology in the California Academy of Sciences, spent January in Los Angeles and Santa Barbara.

The San Diego Society of Natural History held its annual meeting on Thursday afternoon, January 11. Its new building is nearing completion; and they will then move their library and collections into the rooms.

Mr. Francis X. Williams, of the University of Kansas, spent the Christmas holidays at his home in San Francisco. He is a candidate for the Master of Arts degree at the University; and is monographing the Larrid wasps of Kansas.

"Most attractive as an advertisement is that glass hive in which the bees are at work, in front of a Broadway grocery store; where there is in progress a sale of comb honey. Thousands stop to look at the busy little creatures in their work; and doubtless recall the many lessons drawn from the 'busy bee.'"—Los Angeles Daily Times, Jan. 16.

Dr. A. J. Cook, State Horticultural Commissioner of California, was in Southern California in January, and talked at Pomona on the warfare against the Mediterranean Fruit Fly. In a recent number of The California Outlook, there was an article on the same subject by Prof. Cook, with a photo of our Commissioner.

A bulletin on "Honey Plants of California," compiled by M. C. Richter, has been issued by the University of California recently.

Mr. Wilhelm Schrader, of Los Angeles, is commencing the construction of a specially planned building for his experimental work on butterflies, to be completed about March 1.

On Thursday evening, January 18, the Entomological Club met at the residence of Mr. V. W. Owen, in Hollywood, near Los Angeles, with eleven men present. Dr. Edwin C. VanDyke, of San Francisco, President of the Pacific Coast Entomological Society and Curator of Entomology in the California Academy of Sciences, gave a very interesting and suggestive talk on the origin, dispersal and distribution of insects, especially *Coleoptera*, on the Pacific Coast. His ideas and theories, divergent from those of Merriam and others, are based on his studies for many years on the distribution of the *Coleoptera*. In California he recognizes four faunal areas; the southern extension of the Vancouverian fauna, the Sierran offshoot of the latter, the Californian area, and the Sonoran area; above the Sierran are the Canadian, Hudsonian and Arctic zones, which, however, more or less intermingle. It is to be hoped that Dr. VanDyke will publish at least a preliminary account of his researches, so that the coast students may be able to study and test them in detail. A general and enthusiastic discussion followed the talk of VanDyke; exhibitions of specimens; and other entomological matters discussed. Finally those present adjourned to the dining room, where a sumptuous and elegant repast was served by the hostess.

The Second International Congress of Entomology will be held at Oxford, England, from August 12th to 17th, 1912. Further particulars will be announced shortly. The Executive Committee proposes to find for the members of the Congress lodgings in the town, or rooms in one or more of the Colleges at a moderate rate; rooms in College will be available for men only. The Executive Committee invites an early provisional notice of intention to join the Congress, in order to be able to make the arrangements for the necessary accommodation. Proceedings of the First Congress are in press and will be published shortly. All communications and inquiries should be addressed to the General Secretary of the Executive Committee, Malcolm Burr, care the Entomological Society of London, 11 Chandos St., Cavendish Square, London, W. England.

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Contents

1. CRAWFORD, D. L. — The Petroleum Fly of California
2. ESSIG, E. O. — Aphididae of Southern California VIII
3. DYAR, H. G. — Some Lepidoptera from Mexico
4. HALL, H. V. M. — Studies in Acarina III
5. FELT, E. P. — Diarthronomyia Californica (Diptera, Itonidae)

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THE PETROLEUM FLY IN CALIFORNIA
Psilopa petrolei Coq.

D. L. CRAWFORD
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That crude petroleum, so constantly used as a very effective insecticide, should be the habitat in which an insect passes its larval existence, seems very remarkable, to say the least. Yet such is exactly the case. The larva of an Ephydrid fly lives, feeds, and swims about in the pools of crude petroleum which are so numerous in the various oil fields of California. That any animal could exist in such a medium, to say nothing of its apparent preference for it to other media, at once demands our closest attention in order to determine *how* the organism exists therein. What special modification in adaptation, structure and physiology to fit it for successful life in its unusual life conditions does it possess?

It is the purpose of this study to show the external and internal anatomy particularly in relation to its adaptation for its life, and, also, to determine the facts of nutrition and protection against the protoplasmic poisons which are in the oil itself.

Not being where I could have access to any of the oil-fields and see the larvæ and adults in their natural conditions, and because of the necessary limitations attendant to the scanty numbers of larvæ at my disposal and the unnatural surroundings in which they must be placed, it is not possible to give here many facts of their life-history. Dr. C. O. Esterley of Occidental College, to whom I am indebted for sending me many live specimens for study, is studying the reactions to various stimuli and their life-habits, so that my paper need not go into that phase at all. I wish here to acknowledge with hearty thanks the assistance rendered to me in this study by Dr. V. L. Kellogg of the Department of Entomology, under whose supervision this study has been made, and to Prof Robert E. Swain, Professor of Physiological Chemistry in this University, who is responsible for the facts herein related to nutrition.

The adult and larva have been known to science for only a comparatively short time, having been described by Coquillet in 1899 (Canad. Ent., Vol. XXXI, p. 8). This original description is as follows: "Black, polished, not light colored, pruinose except the lower part of the occiput, cheeks and sides of face, which are thinly grayish pruinose; halteres yellowish, the knobs white. Eyes densely hairy, most approximate at middle of face. Third joint of antennæ slightly longer than second, the spines of the latter not reaching beyond the apex of antennæ. Wings hyaline, tinged with gray on nearly the costal half,

except sometimes a spot towards apex of submarginal cell; apex of second vein nearly twice as far from the first as from the apex of the third vein. Length 2 mm. Described from eight specimens reared from larvæ living in crude petroleum near Los Angeles, California." In February, 1899, Dr. L. O. Howard (Scientific American, LXXX, p. 75) published a short article on the life-history and gross anatomy of the fly and its larva; a brief resume of which is given here:

On May 20, 1898, Dr. Howard received from Mr. C. G. Kellogg alcoholic specimens of maggots said to live in crude petroleum near Los Angeles in very great numbers.* After a fruitless attempt to send live specimens in petroleum to Washington, Mr. Kellogg bred several adults from larvæ in Los Angeles. Fifty larvæ were placed in petroleum in a shallow dish in a glass-covered box on June 18. In nine days the first maggots emerged from the oil, crawled to the under side of the glass cover of the cage and pupated the following day. On July 9 the first adults issued, twenty-two days after the larvæ were placed in the cage. Live maggots were later sent to Washington in moss saturated with petroleum and one adult reared there. From these specimens Mr. Coquillet described the species as new to science. There are no records in our entomological literature of the habits of the species of *Psilopa*, to which genus this fly belongs. The records of other related genera are as follows: *Ephydra* and *Halmopota* in salt pits in Europe, the former in salt pits in this country and in alkaline lakes in the west; *Teichomyza* in human urine; *Notiphila* in stems of water plants; *Hydrellia* in sap of trees; *Pelina* and *Parhydra* in water—character of water not mentioned. The family is apparently subaquatic—some forms breathe by tracheal branchiæ, others by protected spiracles which can be elevated above the water. The petroleum larva breathes by the latter method; only the two spiracles at the posterior end of the body are functional, and these well protected. Therefore the habitat is not so remarkable as might seem at first. The adult is easily killed by petroleum. The food probably consists of dead organic matter ("insects") caught in these pools of oil. Mr. S. F. Peckham in his Report on the Technology and Uses of Petroleum, in the Tenth Census Reports, mentions the presence of maggots in the oil and seeks to prove thereby the animal origin of the petroleum. Dr. Howard thinks, however, that the food is entirely foreign to the oil, thereby indicating nothing as to its origin.

So far as is known to me this is the only article in entomological literature dealing with the habits and structure of the larva.

The insect is probably found in many parts of the west where there are petroleum fields. The type locality is Los Angeles where the oil-fields are very extensive. Prof. Esterley has seen them in the Whittier oil-fields so abundant as to give the appearance of "maggotty carrion." In small pools of oil shipped in for fuel at Pomona College, Claremont, Cal., I have found the maggots in considerable numbers. In fewer numbers I have found them as far north as Stanford University. Further than this the distribution remains un-

*The larvae were first discovered by Mr. George Compere, then Horticultural Inspector in Los Angeles County. Heretofore he has not received due credit nor recognition.

known. It is quite probable, however, that careful search will reveal them in many other localities.

As mentioned in the resume of Dr. Howard's article, the fly, *Psilopa petrolei* Coq., belongs to the family *Ephydridae* (Diptera), all the members of which are more or less subaquatic in the larval stage and live in all sorts of peculiar and unexpected places, such as brackish water of all kinds, slime and ooze, human urine and excrement, etc.

The method of oviposition is as yet unknown, but in all probability the eggs are deposited on the soil or sticks or leaves close to the petroleum pools, and the larvæ on hatching immediately find their way into the oil. It scarcely seems possible that oviposition is on or in the oil itself. However that may be, I have found exceedingly minute larvæ, scarcely more than one or two millimeters in length, swimming about in the petroleum.

The swimming, if it may be called such, is very slow and resembles closely the movements of any maggots in liquified carrion or decaying fruit. The larva usually remains and moves about near or on the surface of the oil, although frequently it goes entirely under the surface for a considerable length of time. In fact the specimens which were sent to me by Professor Esterley came in a small bottle half full of petroleum and were more than twenty four hours in transit before they were opened in the laboratory here. Many of them were at the bottom of the bottle and still alive and active when transferred to a shallow dish of petroleum. The explanation of the possibility of this will appear soon.

In watching the habits of the larva it was noted that when one, in swimming about in the dish, came to the edge of the oil it immediately turned back towards the center of the dish. Some were found, however, to leave the oil and crawl off across the table. These soon became clean, without oil clinging to them, and a little later seemed to be drying up. A few hours after their emergence from the oil they became almost motionless, apparently very weak, and more or less shrivelled and dried. Death followed in twelve to eighteen hours. The cause of death is probably two-fold; no opportunity of getting food when removed from the oil, and the drying of the body tissue when not protected by the petroleum.

I do not know how many days or weeks the larva lives, but when it attains the length of seven to ten millimeters, it crawls out of the oil to pupate. The pupating habits in its native haunts have not been determined yet, but in the laboratory it pupates in various places outside of the oil, such as on the cover of the cage as noted by Dr. Howard, or on the table surface within the confining bell-jar as I found. In one dish I placed a little soil which soon became saturated; also a small cork an inch long was placed in it. No pupæ were found outside the dish, so it would seem that pupation took place either in or on the soil, though none was found there. Two pupæ were found in the small cavities of the cork, but there were several adults that emerged from this one dish, showing that pupation must have occurred somewhere else, also. These facts, however, throw but little light on the natural habits, and these habits must be determined by actual field observation. Probably pupation takes place in the oily

soil surrounding the pool. About two weeks' time is required between pupatio and the emergence of the adult.

The adult fly is small and black and conspicuous. It always remains near the petroleum pools, flying about and over them when disturbed, and soon alighting again on the margin or on some projecting stone or stick within the pool. In this respect it is not at all different from the other flies of this family, which seem to frequent the larval habitat closely.

An examination of the larva externally shows that it is not strikingly abnormal in any way, except for the terminal spiracles, and even these are mor or less similar to other related maggots. The body consists of twelve segments distinctly marked, is elongate-ovate in form, roundly acute at the anterior end and less so posteriorly, with four processes at the posterior end projecting backwards. The body is rather transparent, showing the alimentary canal easily to the naked eye. It is covered entirely with minute chitinous, spine-like processes, of the same color as the body surface, more or less variable in length and rather close together, though not crowded.

On each side of the venter of each segment, except the first two, there is a knob-like projection and two large ones on the dorsum of the next to last segment. The anal segment is produced inferiorly into two long knob-like projections, as in many other maggots, and superiorly into two similar projections, directed upward and backward, with the tips of each heavily chitinized and black. Near the tip of the heavily chitinized portion are four fan-like groups of cilia projecting out horizontally. These serve the same purpose as the flaps on the spiracular processes of the mosquito larvæ, that is, keeping the tip of the process which bears the stigmata above the oil surface. The posterior segment which bears these processes is retractile into the pre-anal segment. When the larva goes under the surface the caudal segment is drawn forward and upward in a somwhat rotating fashion into the pre-anal segment and the latter closes over it. In this way the spiracular processes are entirely covered and protected from the oil. A maggot with its spiracles "telescoped" gives the appearance of being broadly rounded posteriorly with two black spots (the black tips of the spiracles) near the end.

At each side of the second segment near the front margin and rather dorsad there is a smaller projection directed forward and outward, which protects another pair of spiracles.

These, too, are telescoped, but in a different manner from the posterior ones; these are simply drawn straight in, truly telescoped, while the posterior pair are drawn forward into a definite cavity. Beside these four spiracles there are no others that are functional, so that their ability to swim on, in, or even *under* the petroleum is easily understood. It is very interesting, indeed, to watch them under the binocular microscope go through the contortions of telescoping their exposed organs. That they should exist as long as they must have done in coming to my laboratory is very remarkable, even though it is learned that the spiracles may be drawn under cover.

The head, as in related forms, is retractile and thus capable of being protected. The mouth parts are normal with the usual hooks, and nothing that is at all abnormal.

Two methods were followed in studying the internal structure of the larva. In order to see the tracheal system clearly, live maggots were put into melted glycerine jelly directly, thus preventing the air within the trachea from being driven out. The transparency of the body and the perfect retention of the air within them made the main tracheæ and even the finer net work of the system beautifully distinct (Figure 222 A). One straight, continuous tube extends from each posterior spiracle to the corresponding one near the anterior end, giving off in its course numerous branches outwardly which branch and rebranch many times; between and connecting the two main tubes are seven arches or loops directed forward, most of which give off minute branches at the apex of the arch forward. Near the base of each main tracheal trunk there is an inferior branch, quite large, which extends down and forward, one branch extending back to the anal tip, the remainder going toward the head end, supplying oxygen to the ventral tissues. So far the respiratory system is quite normal.

If there is any adaptational variation from the normal we would naturally look for it at the entrance to the tracheal trunks, and, in fact, it is just here that we find it. At the dorsal invaginating fold at the base of the posterior spiracular processes the tracheal trunks each turn abruptly upward into the processes. About the middle of the process the trunk enlarges to form a sub-globose pocket; from this enlargement it extends on to the tip, opening out at five spiracular foramena, or stigmata.

Transverse and longitudinal sections through the tracheal trunks at the posterior end show that the intima from the spiracle to the anterior end of the globose pocket is densely lined with long cilia, which apparently serve to strain the air, as it were, by removing the particles of dust and oil which might find entrance (Figure 222 D). The spiracular openings themselves are protected by a thin, sieve-like, ciliate cover, easily visible in cross section. Looking at them from above, *in situ*, they appear as five light pinkish spots on the black background, arranged four around a central stigma. As nearly as can be determined this cover consists of many cilia radiating from the circumference. No traces of a valve or of occlusor muscles are visible, and this is readily explained by the substitution for these of the telescoping of the entire stigma.

The anterior spiracles are much smaller, less conspicuously chitinized, and situated well forward near the posterior end of the head. These also are retractile, but, as already described, differently from the posterior pair. As in the others the tracheal trunk enlarges abruptly into a large sac near the surface and thence continues to the surface in the form of a slender, thickly chitinized tube which expands at the tip into a large caput with a number of facet-like stigmata. Internally the sac and tube are lined with cilia, as in the case of the posterior tracheæ. Extending in as far as the base of the tracheal sac is an invagination of the cuticular wall. When the spiracles are extended for breathing, the invagination is continued outward in an evagination to the base of the tracheal caput.

When the spiracles are retracted, the tracheal tube between the sac and caput shortens (it seems to be very elastic), drawing the evaginated portion after it into the invaginated pocket. These stigmata, also, are covered with a thin sieve-like, ciliate membrane.

The other method used in the internal study was imbedding in paraffine and sectioning serially with the microtome. Two killing reagents were tried. Hot water at about 95 degrees Centigrade was found to be very effective in both killing them quickly, and, also, distending the body and preventing its contraction. After being in the hot water for a few seconds the larvæ were run up through increasing grades of alcohol to harden the tissue, remaining in each at least three hours or often longer. Xylol was used as the clearing agent. The other method of killing was Tower's Solution, slightly warmed—Cl2 in 35% alcohol 95 parts, glacial acetic two parts, nitric acid three parts—was tried, but the larvæ seemed to be too impervious and resistant even to the nitric acid to die quickly. They wriggled about violently for fully five minnes, death resulting only after about ten minutes or longer. A combination of the two was then tried, killing them in hot water and then immersing them in Tower's Solution for two hours, then through the alcohols as above. The latter method seemed to yield the best results, when the sections were stained with Mayer's alcoholic carmine.

For examining the alimentary canal entire and *in situ* a very good method was found to be the mounting of the entire larva, cleaned, directly in Canada balsam. Slight clouding resulted, but after some time had elapsed it cleared up enough to present a beautiful view of the entire alimentary canal. This was supplemented, of course, with transverse and longitudinal serial sections.

The gullet is large, elongate-ovate, and has at its posterior end a movable valve at the entrance to the œsophagus. In feeding, the maggot draws its head in and out rapidly, and at intervals the valve is seen to recede and open the passage to the œsophagus. When the valve opens a black droplet of oil can be seen to pass down through the œsophagus into the proventriculus.

The œsophagus is long and slender and passes into and traverses completely the proventriculus. The latter is large and spherical in shape and lies between the ventricular cæcæ. Between this and the ventriculus, or so-called stomach, there is a deep constriction. The ventricular cæcæ are four in number, and in proportion to the size of the ventriculus are long and rather thick. The ventriculus is long, coiled once, thence passes on into the intestine, which is long, rather thick and coiled several times. Because of the contents these coils of the ventriculus and intestine are very conspicuous in the live larva, in contrast to the rest of the body which is almost transparent. The rectum is somewhat enlarged. The anus is on the venter of the pre-anal segment. The entire alimentary canal pulled out from the anus is several times longer than the larva.

A very striking character of the ventriculus, as seen in section, is the immense size of the epithelial cells and their large nuclei. These cells, in addition to having the large nuclei, are filled with numerous minute globules, which are probably the result of the absorption of the oily foods.

Of four larvæ sectioned transversely and eight longitudinally all but one of each were found to be normal in their digestive canal, except for the large size of

the epithelial cells as described above. In one sectioned transversely, however, and one longitudinally, a very remarkable variation from the normal was found. In these two individuals, there is an inner tube within the ventriculus, with its walls made up of large cells which appear to be very similar to those of the ventriculus. The exact origin and nature of this most extraordinary structure is not yet established with certainty. It possibly is a continuation of the œsophagus into the ventriculus, but if this is so the cellular structure of the tube makes it widely different from the peritrophic membrane of Balbiani and others. In all cases in which the latter occurs it is not cellular as in the present instance. It appears to me that the tube originates from a lateral invagination of the ventriculus wall near the front end, for, to all appearances at least, it has no connection with the œsophagus and is blind at the posterior end. Figure K of the plate shows this as it appears to me by the examination of the sections thus far made. The certainty of this, however, has by no means been established and for that reason I will pass over this phase of the anatomy for the time being. At some future time the result of further study of larger series of individuals will be published, and it is hoped that this matter will be more definitely established. Whatever this structure may be, it is an astounding thing that it should be found in a few individuals and not in others.

The salivary glands are large and extend far back on each side of the alimentary canal. Just what role the saliva plays in the digestion and the breaking up of the oil is not known, but judging from the extent of the glands, the role must be very important.

The secretory system is normal, consisting of two small malphighian tubules on each side of the ventriculus. The circulatory and nervous systems, also, present no abnormalities nor any special peculiarities worthy of note here. The musculation, also, is normal as in other dipterous larvæ, except that the muscles are very thick and powerful. This might be expected from their having to swim about in such a thick medium.

A very striking peculiarity in regard to the adipose tissue is noticeable both from examination of the entire specimen and from serial sections. The body cavity immediately within the chitinous wall is very clear and transparent, appearing very much as though it were gelatinous in composition. Surrounding the alimentary canal and extending almost from one end of the larva to the other is the adipose tissue in extremely large cells, either grouped in clusters of five or six cells each or sometimes chain-like in disposition. They are unusually large, almost spherical in shape, with several large clear areas within each, representing globules of clear animal oil. These cells show the typical reaction to the alcoholic carmine stain. Their function is probably the assimilation of the necessarily oily foods, and for that reason, no doubt, adaptation has increased their size greatly.

An organism passing all its larval existence in petroleum, if it takes food at all, must of course get its nutrition in the oil. From the normal structure of its mouth it is perfectly apparent that the only way to get the nutrition is to swallow the oil and let the digestive canal take from it whatever nutriment there is. What this nutriment is is rather difficult to demonstrate actually. The petroleum pools

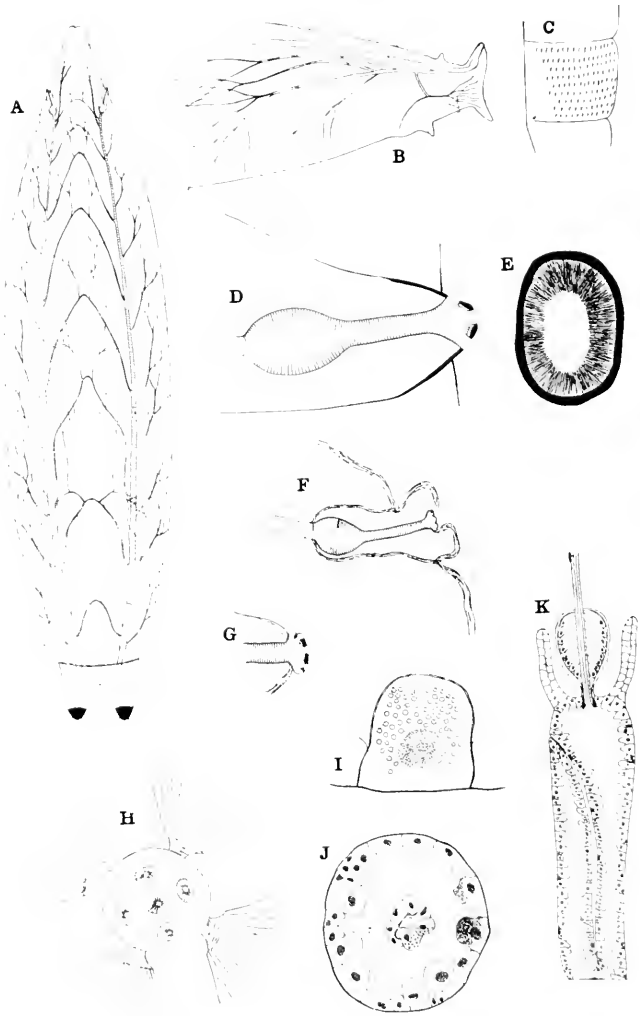

Figure 222. Details of larva of Psilopa petrolei Coq

in which the maggots are always found are exposed to the air, and consequently collect a large amount of foreign organic matter, such as insects that fall into the oil and die, bits of floating organic particles, bacteria, etc., which compose a considerable part of the dust in the atmosphere, and, third, plant and animal juices which would be found therein. It is conceivable that the maggots might swallow the oil and remove from it this foreign organic matter. This view, moreover, is strengthened by the fact that when bits of raw meat are crushed and placed in the oil the larvæ cluster about them and crawl onto them a very short time after the meat has been placed in it.

We encounter a difficulty, however, in this regard, because of certain experiments that have been carried out by Dr. Esterley. The oil, as it comes fresh from the well, may be considered quite free from the organic matter mentioned above. By placing larvæ in such oil and keeping the oil carefully sterilized and covered, it would seem that nothing but the actual organic components of the oil itself would be available for the nutrition of the larvæ therein. Yet young larvæ have been so placed and they have pupated and emerged as imagines. From this it appears that they are able to derive nutriment from something beside the foreign organic matter. Other experiments are reported by Dr. Esterley, such as rearing adults from young larvæ placed in oil filtered through a Gooch filter, sterilized and carefully covered. This, however, would probably not remove all foreign organic matter, leaving the plant or animal juices which might be in the oil. There is a paraffine base in the natural petroleum, and it is probably this which serves as the food of the larvæ, in addition to the foreign matter.

It is very remarkable that an organism is able to take into its alimentary canal such a substance as petroleum and not only survive, but actually derive its nutriment from it. By a remarkable adaptation and physiological changes from the normal the epithelium of the digestive canal is able to extract from the oil that part which is nourishing and reject the poisonous part. This process, no doubt, is assisted by the large size of the epithelial cells and by the large amount of surface obtained by the length of the ventriculus.

To show the effect of petroleum on an unadapted alimentary canal some of the oil was forced down the mouth of a large tomato worm. The worm showed signs of "sickness" in a short time, and died after about four days. During all this time it remained in a contracted form, although it was offered fresh leaves to feed on. Similar results were produced on a large caterpillar by feeding it kerosene, as reported by Mr. Shafer, to whom further reference will be made shortly.

That this physiological adaptation of the digestive epithelium to poisons is very remarkable, is shown further by the following experiment. A considerable amount of white, powdered arsenic was thoroughly mixed with a small dish of petroleum and four larvæ placed therein. They were watched closely for a long time and appeared to act perfectly normal, all the while swimming about and feeding as in pure oil. After three days one died very gradually, the other three lived for four days before succumbing to the poison. The significance of such an extraordinary test is obvious.

It is remarkable, too, that the petroleum does not have a fatal effect on the larvæ from the external contact. In this connection the timely paper by Mr. George D. Shafer of the Michigan Agricultural Experiment Station, Lansing, on "How Insecticides Kill" is apropos. Mr. Shafer has established several facts which have heretofore been mere conjectures or theories. Chief among these facts is that insecticides, such as kerosene, creosote, etc., kill the insect not by suffocation by plugging the spiracles or tracheæ, but by contact with the protoplasm and resulting poisoning. The entrance to the body, Mr. Shafer states, is through the spiracles and not through the chitinous wall of the insect, except to a slight extent possibly. In a personal interview with him a number of facts were learned which are not mentioned in his paper. By immersing an insect in a liquid containing a stain which could be followed in its course through the insect tissue, and then dissecting the insect after a certain length of time, he found that the liquid enters through the spiracles, passes through the tracheal walls and thus has access to the protoplasm of the cells. Very slight, if any, traces were found of the liquid having entered through the chitinous cuticula.

This is borne out by some tests that I have made of the effect of crude petroleum on insects. A small droplet was placed on a number of plant-lice (Aphids) in such a way as to prevent its entrance into any of the spiracles if possible. In every case the insect was agitated, either by the unnatural and uncomfortable feeling of a heavy, sticky substance clinging to it, or perhaps by some pain occasioned by the oil. After the plant-louse had quieted down it seemed to be more nearly normal, though quiescent, and lived for nearly twelve hours. Leaf-beetles (*Diabrotica soror*) treated in a similar manner lived for thirty-six hours or more. Any insects, however, immersed in the petroleum died within a very few minutes.

With these facts before us it is much more conceivable that an organism might exist in petroleum, provided that certain adaptations had taken place. First the spiracles must be thoroughly protected, and, second, the absorption of the oil through the bony wall, however slight, must be counteracted. The first of these requirements is provided for, first, by the ciliate fans which are kept above the surface of the oil by surface tension and thus protect the stigmata from the entrance of oil into the spiracles, and, second, by the telescoping of the spiracular processes when the larva goes under the surface. The other requirement is met, probably, by the mass of clear, gelatinous (?) tissue beneath the cuticula. This prevents whatever oil might be absorbed through the body wall from being taken up by the protoplasm of the inner tissue.

Tests were made of the larvæ in other liquids, to determine what effect these would have on the insects. It was found that in a liquid of a thinner consistency than the petroleum the larvæ were unable to come to the surface, and, therefore, would be killed in a comparatively short time. Even if the liquid were not deep enough to cover the larvæ, the latter could not protect its spiracles on account of the inability of the ciliate fans to support the spiracular processes when the surface tension was lessened. If petroleum, however, was mixed with other liquids so that the consistency of the mixture was thick enough to support the

body of the larvæ, it was found that they were apparently as happy as if it were pure petroleum. For instance, petroleum was mixed with kerosene, half and half, with xylol, benzine, clove oil, cedar oil, and turpentine, and none of these mixtures had any apparent evil effect upon the larvæ, even after they had been in the liquids for as long as four or five days. Beyond this length of time the test was not made, but I have no doubt but that larvæ could be reared to maturity in any of the above combinations with petroleum.

Animal and plant life seems to be able to adapt itself to almost any conceivable conditions of environment, and this instance only adds one more illustration, though a most extraordinary one, to the list which is already long. Both to the popular reader who is always interested in "strange" things, and to the man who is interested in all evolutionary adaptation, this study should be of both interest and value.

Explanation of Figure

A. Tracheal system of larva, dorsal view, showing two pairs of spiracles and connecting tracheæ.
B. Lateral view of posterior portion of same, showing inferior branch.
C. Posterior portion of one segment, showing chitinous spines on surface.
D. Section through posterior spiracular process, enlarged, showing three stigmata.
E. Cross section of tracheal tube between stigmata and sac, showing heavily chitinized wall and internal cilia.
F. Anterior spiracle, with retraction begun.
G. Tip of same, more enlarged, showing facetted stigmata.
H. Terminal view of posterior spiracular process, showing five stigmata and four ciliate fans.
I. Epithelial cell of ventriculus greatly enlarged, showing large nuclei and vacuoles.
J. Cross section of ventriculus, showing inner invagination (?) with lumen collapsed.
K. Longitudinal section of proventriculus and ventriculus to its first turn, showing what appears to be an invagination of the lateral wall. (cf. description in text).

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APHIDIDÆ OF SOUTHERN CALIFORNIA VIII

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Southern California with its varied flora and mild climate affords an excellent place for the collecting and studying of Plant Lice (Aphididæ). At first the field seemed unfavorable, especially was this impressed upon me during the first two years of my work on this family. This is accounted for, in a great measure, by lack of experience in field collecting and in close observation. Then too, the first operations were carried on in a much drier region than is usually found nearer the coast. In Ventura County, and particularly in the vicinity of Santa Paula, I have been able to take a great number of new species and even a few new genera, and all of this is practically the work of a single spring and summer. No doubt the same is true throughout a great part of the State and especially further south, the entire field being practically new. In fact I know of only one new species being reported south of Los Angeles and that by Prof. Cockerell, who described *Aphis tetrapteralis* Ckll. taken on *Atriplex canescens tetraptera* at La Jolla. (Bull. So. Calif. Acad. Sci., I, No. 4, April 1, 1902). From some ten species received from Imperial County this summer, only four were known to me, but the material received was in such poor condition that a careful study could not be made, so as to warrant descriptions of new species.

As stated, further on, several of the new species and two of the genera are close links between other species and genera already described.

I wish to acknowledge, here, the special and most valuable aid of my brothers, S. H. Essig and F. M. Essig, in collecting and in discovering many of these most interesting forms.

PEMPHIGUS Hartig.

Type **Aphis bursarius** Linn.

Key to California Species

1. Not a gall-forming species; subterranean, or partially so, in habits. 2
   Forming galls, pseudogalls, or curling the leaves; distinctly ærial in habits. 3
2. Transverse sensoria only on antennal articles III and IV, distinctly subterranean. *betae*
   Transverse sensoria on articles III, IV and V; only partially subterranean in habits. *californicus*
3. Forming distinct galls. 4
   Forming pseudogalls or simply curling the leaves. 6
4. Forming large, singular galls on the petioles near the bases of the leaves; large numbers in each gall. 5
   Forming many moniliform galls on the surfaces of the leaves, a single individual in each gall. *populimonilis*
5. Galls globular in form, antennæ rough with transverse sensoria on antennal articles III, IV, V and VI. *populicaulis*

Galls elongate oval, antennæ smooth without distinct transverse sensoria. *populitransversus*

6. Forming pseudogalls causing the upper surfaces of the leaves to fold together along the mid-ribs; antennal articles III, IV, V and VI with transverse sensoria, spur or unguis with constricted neck *populiconduplifolius*

Curling the leaves or on the younger stems close to the ground; transverse sensoria only on articles III and IV, unguis without constricted neck. *fraxini dipetalae*

P. betae Doane. On common beet (*Beta vulgaris* L.). First reported by Clarke on Beet, Red Dock, and Canaigre (*Rumex hymenosepalus*), from Berkeley, Placer County, and Palo Alto, California. Can. Ent. XXXV, p. 248, 1903. Davidson reports it from Palo Alto on Dock (*Rumex occidentalis*). Jr. Ec. Ent., III, p. 372, 1910.

P. californicus Davidson. First taken on *Ranunculus californicus* Benth at Palo Alto, California, by Davidson. Jr. Ec. Ent., III, p. 373, 1910. Later taken by the writer on the same plant near Nordhoff, California. Originally described as *P. ranunculi* Davidson, but renamed *P. californicus* by same author. Jr. Ec. Ent. IV, p. 414, 1911.

P. populimonilis Riley. "Abundant in Tulare County on *Populus fremonti* during the summer months at least." Davidson, Jr. Ec. Ent., III, p. 374, 1910. Also abundant on *Populus trichocarpa* T. & G. at Santa Paula, California, (see description). Also taken by Davidson in Placer County, California. P. C. Jr. Ent. III, p. 398, 1911.

P. populicaulis Fitch. On *Populus trichocarpa* T. & G. at Palo Alto, California. Davidson, Jr. Ed. Ent. II, p. 299, 1909. Also taken in large numbers on the same host at Santa Paula, California (see description).

P. populitransversus Riley. Abundant on *Populus trichocarpa* T. & G. at Palo Alto, California. Davidson, Jr. Ec. Ent. III, p. 372, 1910. Also taken by same authority in Placer County, California, on *Populus fremonti* Wats. P. C. Jr. Ent. III, p. 398, 1911.

P. populiconduplifolius Cowen. Occurring on *Populus trichocarpa* T. & G., in April. Palo Alto, California. Davidson, Jr. Ec. Ent. III, p. 374, 1910.

P. fraxini-dipetalae Essig. Quite abundant on Mountain Ash (*Fraxinus dipetala*) in the mountains near Santa Paula, California. P. C. Pr. Ent. III, pp. 353-356, 1911.

TRIFIDAPHIS Del. Guercio.

Type Pemphigus radicicola Essig

T. radicicola (Essig) Del Guercio. First taken by the writer at Claremont, California, where it occurred on the roots of *Amaranthus retroflexus* L. (Pigweed) and *Solanum douglasii* Dunl. (Nightshade). P. C. Jr. Ent. I, pp. 8-10, 1909. Taken also at Oxnard, California, on roots of Nightshade. At Santa Paula, it is frequently found on the roots of Nightshade, Pigweed, and on Potatoes and garden Beets (always underground).

Bibliography

1909 *Pemphigus radicicola* Essig, P. C. Jr. Ent., I., pp. 8-10, original description.

1909 *Trifidaphis radicicola* (Essig) Del Guercio, Rivista di Patal. Vegetale, Anno. III, p. 332. Placed in new genus.

1909 *T. radicicola* Essig Del Guercio-Baker, P. C. Jr. Ent., I., pp. 73-75. Translation of Del Guercio's article.

1910 *T. radicicola* Essig Del Guercio-Wilson, Ent. News, XXI, p. 155. List of Genera.

1910 *T. radicicola* Essig Del Guercio-Essig, P. C. Jr. Ent., II, pp. 283-285. Wing variations.

1911 *T. radicicola* Essig Del Guercio-Essig, P. C. Jr. Ent., pp. 141-152. Host plants and synonymy.

Pemphigus californicus Davidson

(The Woolly Plant Louse of the Buttercup)

1910 *Pemphigus ranunculi* Davidson, Jr. Ec. Ent. III, pp. 372-373. Original description.

1911 *Pemphigus californicus* Davidson, Jr. Ec. Ent. IV, p. 414. Renamed.

WINGED VIVIPAROUS FEMALE (Figure 223 A)

Length of body without flocculence 2.6 mm., width of mesothorax 0.9 mm., width of abdomen 1.4 mm., wing expansion 6.7 mm. *Body*—Covered with a long white or bluish-white flocculence. Naked body of the typical *Pemphigus* shape, thorax little wider than abdomen. *Prevailing color*—With the flocculence white and black, without flocculence, black head, and thorax and dull green abdomen with brown appendages. *Head*—Broad base and well rounded in front between the antennae, much wider than long, with two compound and three ocellar eyes, black. *Eyes*—Compound eyes very dark red with a marginal terete tubercle on the after part; this tubercle is composed of two small ocelli (Figure 223, 2). This is the only instance of this kind I have ever noticed and a character not mentioned by Davidson in his description. *Antennae*—(Figure 223 C, E, F). Arising from near the sides of the head, bases widely distant, reaching to second abdominal segment; usually dark throughout; three apical articles with lighter bases, all light at articulations, apical half imbricated, with very few short hairs; article lengths as follows: I, 0.12 mm.; II, 0.12 mm.; III, 0.45 mm.; IV, 0.19 mm.; V, 0.25 mm.; VI, 0.21 mm. (unguis or spur 0.03 mm.); total 1.34 mm. Articles I and II usually coequal, III longest, nearly as long as IV and V together and longer than IV and VI together, IV shorter than VI, V longer than either IV or VI, and more than twice as long as either I or II, VI, with base approximately six times as long as the unguis. Articles traversed by numerous long transverse sensoria which are very unevenly distributed. III has from nineteen to twenty-five, more often with twenty-one; IV, four to eight. In examining eight articles there were to be found one with four, one with five, two with six, three with seven and one with eight; article V, with from one to four, three and

four being most common; VI has usually the ordinary sensoria in the process, which may consist of three. *Rostrum*—Reaches to third coxae, light yellow with dusky base and extreme tip dark. *Prothorax*—Smooth, wider than the head, but very short, black or very dark green, without tubercles. *Meso-* and *Metathorax*—Muscle lobes well developed, dark brown to black, ventral surface green between coxae. *Abdomen*—Well rounded and distinctly segmented, dull green in living specimens, but turning orange or yellow shortly after mounting, with four rows of large, nearly circular, wax areas which differ little in color from the body and which are difficult to see in fresh specimens; for this reason they are not indicated in the drawing. The four glands or wax areas occupy nearly an entire abdominal segment, and each is filled with fine pores. In the living forms the abdomen is covered with a thick coating of long flocculence, while there is little or none on the head and thorax of the winged forms. There are to be noticed dark spots along the lateral sides of the abdomen in cleared specimens only these being located at the union of the segments. Anal plate, well rounded, dark. *Cornicles*—Wanting. *Legs*—Normal, dark, rich brown, with very few hairs. In fresh specimens the coxae are dark, femora, tibiae, and tarsi greenish brown. Article I of the tarsus (Figure 223 G) is very short and triangular, the second article long with the upper end extending to the tibia, nearly seven times as long as I. *Wings*—Dusky hyaline throughout, normal in size. *Primary*—Length 3 mm., width 1 mm. Venation normal for this genus. Costal vein widest at base and narrowing to the stigma, dark brown. Subcostal much wider than the costal, dark brown. Stigma short, bluntly pointed at the end, nearly three times as long as broad, dark brown, with the lower margin darkest, with the entire shading somewhat mottled, lower margin with a row of short curved hairs. Stigmal vein arising from the stigma slightly beyond the middle, curved throughout the basal one-third, may or may not be slightly undulate, rather long, wider at base. First and second discoidals with bases close together, and arising near the middle of the subcostal, slightly curved with the convex surface towards the tip of the wing, diverging from bases to tips, which are far apart (the tip of the second discoidal is midway between the tips of the first and third discoidals. Second discoidal with much deeper bend than has the first. Third discoidal obsolete for a considerable part of the base, the basal tip being nearly even with the middle point of the second discoidal and midway between it and the lower margin of the stigma, straight, slightly curved downward, or undulate, tip reaching the wing margin slightly nearer the tip of the stigmal vein than midway between the tips of the stigmal vein and the second discoidal. All veins yellowish to amber. *Secondary*—Length 2 mm., width 0.6 mm. Subcostal vein strongly bent downward at the bases of the discoidals, one-third the distance from its base to tip. Discoidals with bases close together. First discoidal short, slightly undulate. Second discoidal much longer than the first, nearly in a line with a continuation of the subcostal before it bends, well curved, with convex surface upwards. All veins yellowish. *Style*—(Figure 223, I). Tubercle-shaped, with base nearly twice as wide as the length, green or dusky brown, does not project beyond the last abdominal segment or the anal plate.

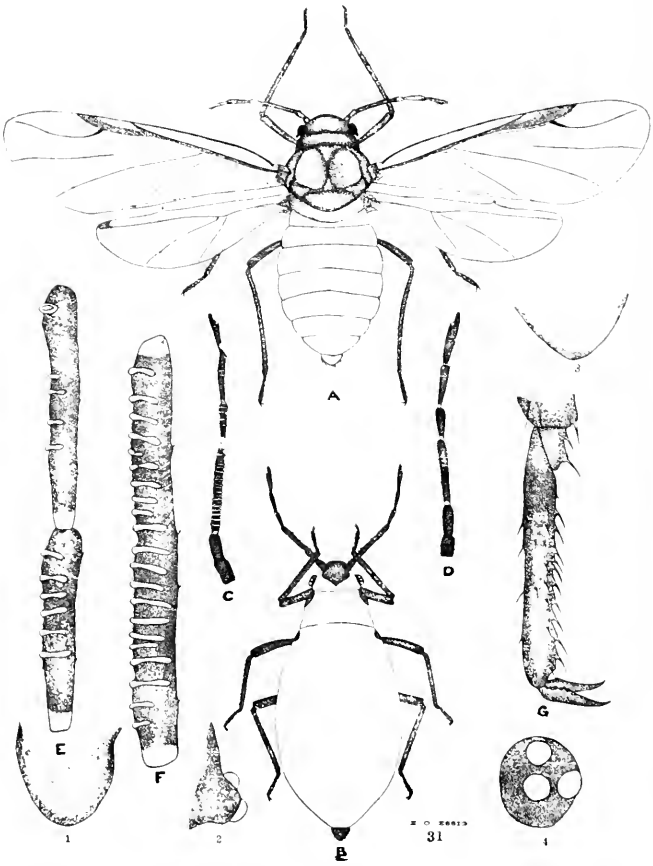

Figure 223. Pemphigus californicus Davidson

APTEROUS VIVIPAROUS FEMALE (Figure 223 B)

Length of naked body 2.9 mm., width 1.3 mm. When covered with the long flocculence the measurements are nearly twice as great. *Body*—Entirely covered with long white or bluish-white flocculence. *Prevailing color*—Naked body of living specimens dull green, of mounted specimens rich yellow. *Head*—Light green with median brown spot on the frontal between the antennæ, somewhat triangular in shape with base widest and the front straight, but narrow. *Eyes*—Each composed of a group of three ocelli which resemble a compound eye, the background of which is red (Figure 223, 4). *Antennæ*—(Figure 223 D3). Reaching nearly to the middle of the abdomen, slightly imbricated, with very few hairs, brown throughout with articulations lighter, (in mounted specimens they appear brown or even amber). Lengths of articles: I, 0.11 mm.; II, 0.15 mm.; III, 0.32 mm.; IV, 0.17 mm.; V, 0.22 mm.; VI, 0.24 mm. (spur 0.04 mm.); total 1.21 mm. Article II is usually longer than I in the apterous form, being nearly a fourth longer; III is the longest, being more than twice as long as II, and nearly three times as long as I, but not twice as long as IV, though very nearly so; IV is shorter than III, V or VI; V is much longer than IV and nearly as long at VI. The spur or unguis of the apterous female composes about one-sixth of the article. Sensoria at the apical end of V and in the process of VI. *Rostrum*—Reaches to or slightly beyond the third coxæ, light green or yellow, with brown base and tip. *Prothorax*—Green with a brown marginal spot on the front side, little wider than the head. *Mesothorax*—With a similar brown spot on each front margin. Entire thorax otherwise green. *Abdomen*—Smooth, light green. Entire body traversed by four longitudinal rows of large oval glandular spots, which are concolorous with the body. These occupy nearly all of each abdominal segment on the dorsum. Anal plate sometimes projecting beyond tip of abdomen, brown. *Cornicles*—Wanting. *Legs*—As in the winged form. *Style*—(Figure 223, 3). Blunted, base much wider than the length, brown.

Young—Covered with the long white flocculence from a very early stage, a few may be seen to be naked. The body is a pale light green.

Host—This insect feeds on the California Wild Buttercup (*Ranunculus californicus* Benth) and collects in great numbers on the stems, at or slightly below the surface of the ground. In a few cases individuals were observed feeding on the stems a few inches above ground and on the undersides of the older leaves which lay on the ground. They are usually grouped in quite large colonies which are easily recognized by the large surplus of the white flocculence which has been rubbed from various individuals. As soon as disturbed each insect immediately lets go its hold and seeks shelter among the particles of earth or leaves. Small, white, elongated eggs were also observed on various parts of the stems.

Locality—Collected by the writer on a small hill where the buttercups were growing plentifully under the shade of the live oak trees, near Nordhoff, Cal., at an altitude of 450 feet. W. M. Davidson has collected this insect in the vicinity of Stanford University, Palo Alto, Cal.

Date of Collection—April 29, 1911. Serial number 31.

Pemphigus populimonilis Riley

(The Bead-like Cottonwood Gall-louse)

1897 Bull. U. S. Geol. Surv., V, pp. 13-14. Original description.
1880 Thomas. 8th Rept. Ent. Ill., p. 205. Notes and description.
*1880 Mendenhall. Minn. State Hort. Soc. MSS. Listed.
1887 Oestlund. Aphid. Minn., p. 24. Listed.
1890 Packard. Forest Insects, p. 134. Listed.
1891 Niswander. Bull. No. 2, Wyom. Agrcl. Exp. Sta.
1895 Cowen. Hem. Colo., p. 116. Listed.
1901 Hunter. Aphid. N. A., p. 78. Bibliography.
1908 Jackson. Syn. of Gen. Pemphigus. Colum. Hort. Soc., pp. 204-206. Description and notes.
1909 Gillette. Plant Louse Notes, Jr. Ec. Ent., V, p. 356. Listed.
1910 Williams. Aphid. of Nebr., pp. 10-12. Description and notes.
1910 Davidson. Calif. Aphid., Jr. Ec. Ent., III, p. 374. Listed.
1911 Essig. Host Index to Cal. Aphid., P. C. Jr. Ent., III, p. 461. Hosts in California.

WINGED VIVIPAROUS FEMALE (Figure 224 A)

Length of body 3.3 mm., greatest width of the thorax 1.2 mm., greatest width of the abdomen 1.6 mm., wing expansion 10.4 mm. Large species. *Prevailing color*—Body dark, covered with long white flocculence which gives it a bluish-white color. The flocculence may be very short or be replaced by a fine white powder, which always covers the ventral surface. *Head*—Black or dark slate, dorsal surface usually naked, ventral surface covered with fine white powder, very small and narrow, being less than half as wide as the mesothorax, evenly rounded anteriorly and fitting tightly against the prothorax. *Eyes*—Very dark reddish brown or black, large. *Antennae*—(Figure 224 B). Reaching to base of the posterior wings or only to the base of the primary wings, black or very dark brown throughout; articles III, IV and V somewhat clavate; lengths of the articles: I, 0.07 mm.; II, 0.08 mm.; III, 0.24 mm.; IV, 0.15 mm.; V, 0.14 mm.; VI, 0.21 mm.; total 0.89 mm. The sensoria are large, transverse and situated as follows: III, six to nine; IV, three to five; V, one to four; VII one. *Rostrum*—Reaches to or nearly to the second coxae, dark throughout, but darker at tip. *Prothorax*—Slightly wider than the head, but very short, black. *Mesothorax*—Black, lobes well developed and extending much higher than any other part of the body. *Metathorax*—Black with muscle lobes well developed. *Abdomen*—Dark olive green to brown, covered with long white flocculence or fine powder (always so ventrally), widest near the middle and somewhat pointed at the posterior end, lateral margins of each segment with darker spot, which shows after the body has been cleared for mounting. *Legs*—Normal, hairy, black or very dark brown throughout. *Wings*—Subhyaline, large. *Primary*—Length 4.5 mm., width 1.6 mm. Costal vein heavy, dusky; subcostal wide, dusky; stigma oval to oblong in shape, lower margin well-rounded, lower portion much darker than remainder, with several rows of short hairs, all dusky; length 0.90 mm.,

width 0.30 mm. Stigmal vein undulate, arising near the tip of the stigma and rather sharply curved downward until near the middle, then curves upwardly until near the tip where it turn down, curves well rounded and not at all abrupt, brown; first discoidal arising near the middle of the subcostal vein and extending almost straight to the wing margin at an angle of nearly 45 degrees to it, usually curves slightly inwardly towards the body; second discoidal rises near the base of the first, and extends nearly parallel to the third discoidal, curves slightly inwardly, much longer (nearly twice) than the first discoidal; third discoidal obsolete at base, nearly parallel with second discoidal but diverges towards the tip of the wing, the tip is midway between tips of the stigmal and second discoidal; veins brown or amber. *Secondary* Length 3.2 mm., width 0.9 mm.; subcostal with two downward curves, one at the bases of the discoidals and the other two

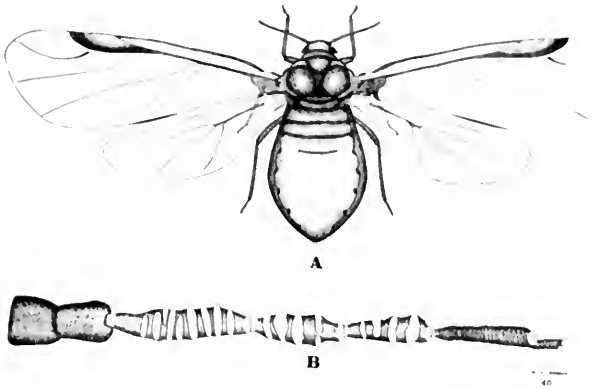

Figure 224. Pemphigus populimonilis Riley

thirds its length; discoidals arising at one-third the length of the sub-costal, where it makes a rather sharp bend, from a rather narrow brown or amber spot, their bases close together; first discoidal curving towards the tip, while the second curves toward the base of the wing; veins amber. *Cauda* Well rounded and inconspicuous.

Nymphs—The nymphs of the winged viviparous females are often very large before their wings are fully developed. The color varies from a light yellowish to a dusky green. The head is usually darker. The entire body is covered with a very fine white powder and there is no sign of flocculence until the adult stage is reached.

APTEROUS VIVIPAROUS FEMALES

Apparently there are no apterous forms occurring in the galls observed in this locality.

Hosts Infesting the common Cottonwood (*Populus trichocarpa* T. & G.), forming rows of the head-like galls on the leaves. The galls are formed more

often on the undersides of the leaves, though not a few are formed from above, and along the margins or midway between the margins and the midrib in longitudinal rows. From the photograph (Figure 225) it will be seen that they are arranged indiscriminately also and may be very near the midrib in a single row or the rows may extend transversely to the main axis of the leaf. They are formed by a pushing up of the leaf tissues and the infolding of the tissues around the margins of the galls so as to almost completely close the mouth. The surface of the galls varies from a light green to a dark red in color and is usually rather rough. Each gall is just large enough to conceal a single individual and grows with its occupant.

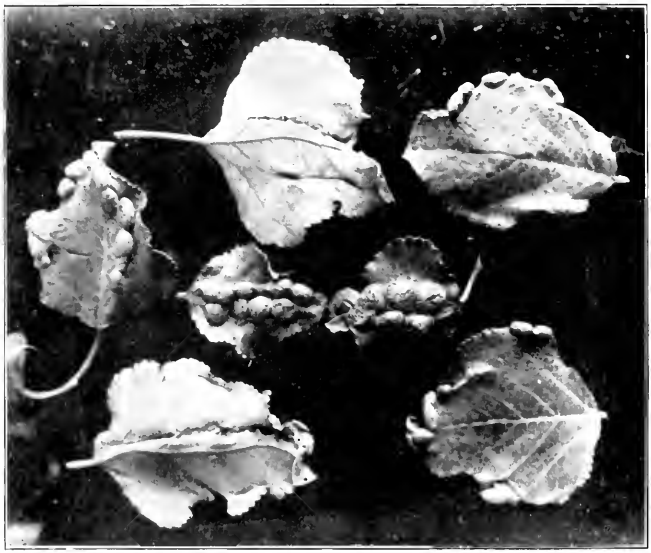

Figure 225. Pemphigus populimonilis Riley
Showing moniliform galls from ventral and dorsal surfaces of leaves.

Never more than one insect is found in a single gall, but often there are several guests in the form of the larvæ of syrphid flies which completely destroy large numbers of the lice before they mature. Figure 226 shows the opened galls and in some are to be seen these maggots. It is difficult to find a single gall that does not contain at least one of them. The adult fly deposits her eggs in the gall while it is being formed and before the mouth closes up and thus defeats the object of protection which the galls should furnish the lice. If anything, the larvæ of the syrphid flies are protected from their natural enemies while they are feeding upon them.

Pemphigus populimonilis Riley was first reported on the narrow-leaved Cottonwood (*Populus balsamifera* L. var. *angustifolia* Torrey), but has since been found feeding upon *Populus trichocarpa* T. & G. first by Gillette in Jr. Ec. Ent. II, p. 356, 1909, near Portland, Oregon. Davidson reports it from *Populus fremonti* in Jr. Ec. Ent. III, p. 374, 1911.

Locality—The species as described was taken in large numbers along the banks of the Santa Clara River near Santa Paula, Cal.

Date of Collection—June 22, 1914. Serial number 10.

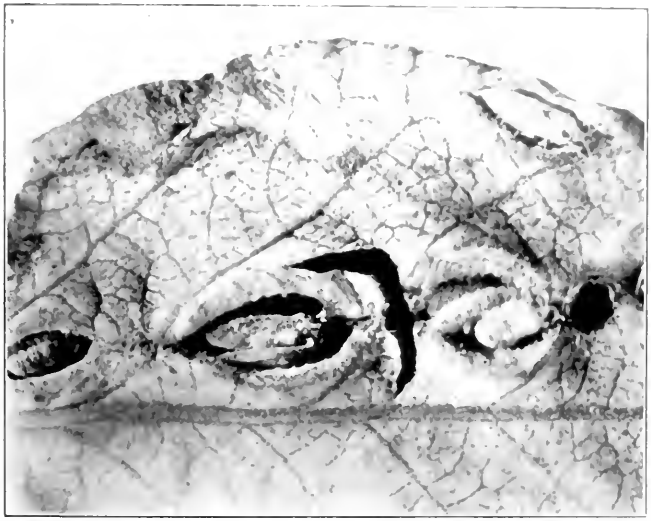

Figure 226. Pemphigus populimonilis Riley
Underside of a leaf with the galls opened so as to show the aphids and the larvae of syrphid flies.

I have been able to procure three descriptions of this insect; by Thomas (who practically duplicates the original description given by Dr. Riley), Jackson and Williams. From them I am led to believe that they are all practically the same as that of the original description of Riley. Either the species was originally and afterward very poorly described, or the species which I have described varies a great deal from the individuals taken in the East. The following differences are noted:

Size—All of the above descriptions agree exactly regarding the size of the species and their measurements are much less than those of the above specimens. For instance, Thomas gives 6.4 mm. as the average wing expanse, while the

average wing expanse of the species as taken here is slightly over 10 mm. All measurements were made with a camera lucida.

Antennal Articles—Antennal articles I, II, IV and V are given subequal, while I have found that I and II are nearly equal and that IV and V are practically sub-equal, but that the articles IV and V are much longer than I and II (nearly twice as long or a third longer). Articles III and VI correspond very well.

Rostrum—In the specimens taken here the rostrum rarely reaches beyond the second coxæ. Thomas reports it as reaching to the third coxæ.

Wings—The venation of the wings agrees very well in all respects except the shape of the stigma. I have found it well rounded or nearly oblong instead of angular.

Though these differences are considerable, the general descriptions agree well and I feel perfectly satisfied that the species is as named. No doubt that with our early warm springs the young develop more lustily and this may account for the difference in size, which may also influence other characters.

Pemphigus populicaulis Fitch

(The Poplar-stem Gall-louse)

1859 Fitch. Rept. Ent. N. Y. V, pp. 845-849. Original description.
1868 Walsh-Riley. Am. Ent. III, p. 57 and p. 245. Description and notes.
1873 Le Baron. Rept. Ent. Ill. III, p. 193. Notes.
1879 Thomas. 8th Rept. Ent. Ill., p. 149. Description.
1880 Henry. Am. Ent. I, p. 205. Reference to galls.
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1887 Oestlund. Aphid. Minn. p. 21. Description.
1890 Packard. Forest Insects, p. 434. Listed.
1892 Osborn. Cat. Hem. Ia., p. 130. Listed.
1895 Cowen. Cat. Hem. Colo., p. 115. Listed.
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1903 Clarke. List. Cal. Aphid., Can. Ent. XXXV, p. 134. Listed.
1908 Vickary. Comp. Study of Ext. Anat. Plant Lice, pp. 4-5 and 15. Anatomy.
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1909 Davidson. Aphid. In Vic. Stanford Univ., Jr. Ec. Ent. vol. II, p. 299. Listed.
1910 Davis. Ill. Aphid. Jr. Ec. Ent., III, p. 411. Listed.
1910 Williams. Aphid. Nebr., pp. 9-10. Description and notes.
1911 Essig. Calif. Aphid. P. C. Jr. Ent. III, p. 461. Calif. Hosts.

WINGED VIVIPAROUS FEMALE (Figure 227 A)

Length of body 2 mm., width of thorax 0.6 mm., width of abdomen 0.75 mm., wing expansion 6.7 mm. *Prevailing color* Nearly black body almost or entirely covered with a long whitish flocculence which gives the body a bluish tinge. The

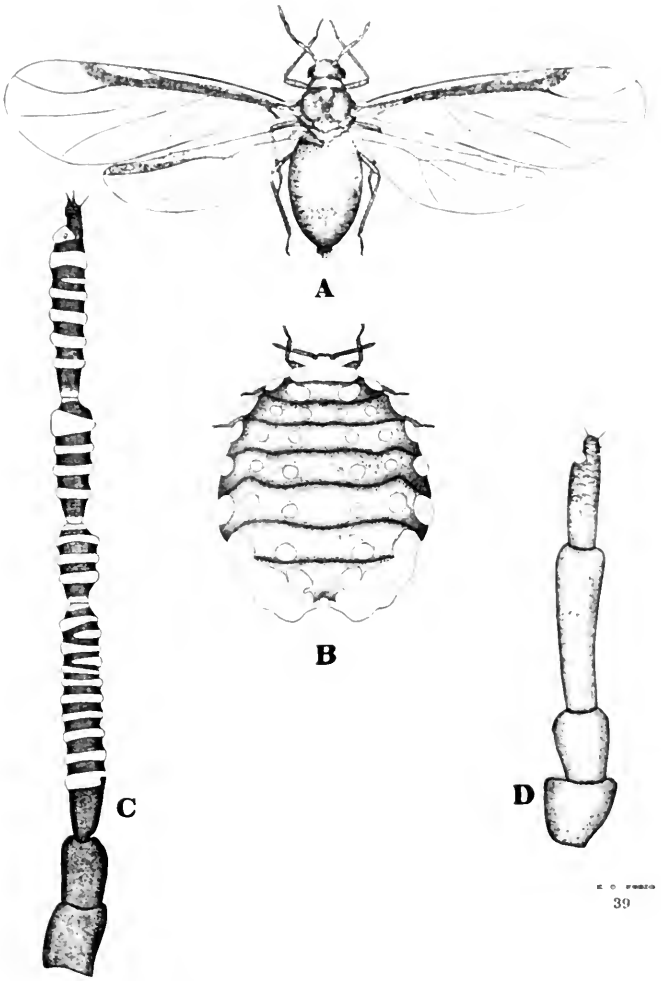

Figure 227. Pemphigus populicaulis Fitch

abdomen is dull green or brownish. *Head*—Small, nearly as long as wide, black. *Eyes*—Rather large and very dark—from dark brown to almost black. *Antennae*—(Figure 227 C). Reaching nearly to posterior end of the thorax, black throughout except the base of article III, which is dull green. The lengths of the articles are as follows: I, 0.06 mm.; II, 0.068 mm.; III, 0.24 mm.; IV, 0.078 mm.; V, 0.12 mm.; VI, 0.2 mm.; total 0.766 mm. The last four articles are traversed by large transverse sensoria which extend almost entirely around the articles and which are distributed as follows: III with from ten to fourteen; IV, usually three; V, three to five; VI, seven to eight. *Rostrum*—Dull green with dark base and tip, reaching to the base of the second coxæ. *Prothorax*—Black or dull greenish,

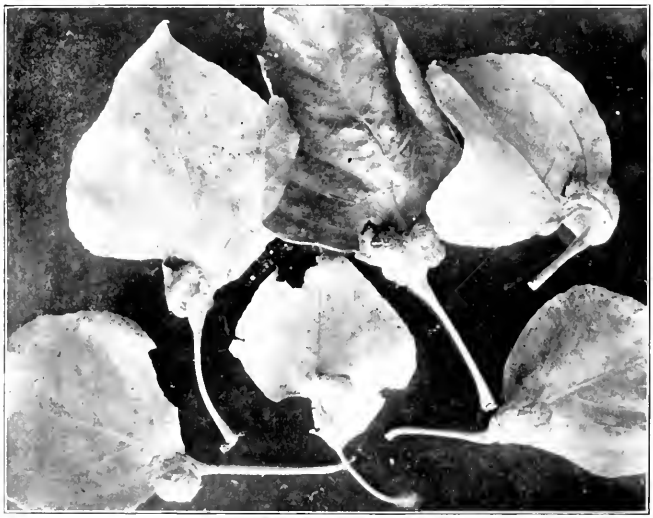

Figure 228. Pemphigus populicaulis Fitch
Showing the galls from both dorsal and ventral aspects of the leaves.

slightly wider than the head and narrower than the meso-thorax. *Mesothorax*—Well developed with raised muscle lobes, black. *Metathorax*—Black with prominent muscle lobe. Thorax covered with fine white powder. *Abdomen*—Oblong, dull green to brown, covered with whitish flocculence and fine white powder, with a row of darker spots along the lateral margins—a spot on each abdominal segment. *Legs*—Dark throughout, normal, slightly hairy. *Wings*—Subhyaline, sometimes of a very dark cast, but always with a constant coloring. *Primary*—Length 3 mm., width 1 mm. Costal vein dark and well defined to the stigma; subcostal widening as it approaches the stigma, dusky; stigma nearly three times

as long as wide, rounded at apex, opposite sides nearly parallel, dusky with basal half much darker than the upper portion, hairy on lower border; stigmal vein arising near the tip of the stigma, evenly curved throughout its entire length, but not deeply curved; first and second discoidals arising near the middle of the subcostal, bases close together; first discoidal nearly straight; second discoidal nearly twice as long as the first and curving inwardly; third discoidal obsolete for a considerable part of the base, curving slightly towards the upper wing margin, running nearly parallel to the main axis of the wing. All veins dusky. *Secondary*—Length 2.1 mm., width 0.6 mm. Subcostal vein with sharp downward bend one-third its distance at the base of the discoidals and a more gradual downward bend two-thirds its distance from the base to the tip. Discoidals arising from the first bend with their bases close together. First discoidal short, curves toward the wing tip, with little slant; second discoidal with a sharp slant towards the apical lower wing margin, straight, considerably longer than the first vein; veins dusky. *Cauda*—Obsolete.

Nymphs—The winged viviparous females as well as the stem mothers or apterous viviparous females were giving rise to great numbers of the young of the winged females, there being none of the apterous young produced in this way within the galls. These nymphs vary from almost transparent white or yellowish to a dusky green color with amber or pinkish thoraxes. Legs dull yellowish or whitish with dusky articulations. Rostrum light with dark tip and extending just beyond posterior base of the first coxæ and not quite to the second coxæ. The bodies are early covered with a fine white powder which gives them a grayish or whitish appearance.

APTEROUS VIVIPAROUS FEMALE OR STEM-MOTHER (Figure 227 B)

Length 2.5 mm., width 2.2 mm. Nearly globular in shape, though the body is distinctly flattened. Prevailing color dull brown or green with white patches of flocculence distributed as shown in the drawing. *Head*—Black, entirely covered with white flocculence excepting the anterior tip, very small. *Eyes*—Simple and located in position of compound eyes. *Antennæ* (Figure 227 D). Four articled, short, reaching to base of mesothorax; article I dull blackish, II dusky green, III and IV dull green or brown. The lengths of the articles are as follows: I, 0.06 mm.; II, 0.07 mm.; III, 0.16 mm.; IV, 0.12 mm.; total 0.41 mm. *Rostrum*—Dull green or brown with dusky tip and base, reaching to the second coxæ. Thoracic segments well developed and extending much higher than the head. *Prothorax*—Almost entirely covered with white flocculence. *Mesothorax*—With two marginal and two dorsal white patches. *Metathorax*—With two marginal and four dorsal patches. *Abdamen*—Two marginal (one on each margin) of every body segment and four longitudinal rows of dorsal patches. At the posterior end of the abdomen are two large marginal patches which nearly cover up the last segments and in front of these patches are but two dorsal patches instead of the usual four on the abdominal segments, body color dull green or brown. Ventral surface covered with fine powder. *Legs*—Short, dusky throughout, hairy. *Style*—Obsolete.

At the date of collection, June 22, 1911, there was to be found in every globular gall a single stem-mother which was giving or had given birth to great numbers of the winged viviparous females. That this stem-mother produced the original gall is without doubt, for though great numbers of the winged forms have been continually leaving the galls, no new ones are being formed without containing a stem-mother. Either the stem-mothers are produced as a very late brood or they arise from eggs which are deposited by the late broods. The latter idea has been held by writers in the past and is more probable than the first, though in this state it is almost impossible to find any of the Aphids laying eggs, though they are known to do so in the Middle West and East.

Hosts—This species occurs associated with and on the same branches of the common Cottonwood (*Populus trichocarpa* T. & G.) as is *Pemphigus populimonilis* Riley, though it is easily told by its characteristic galls (Figure 228). These galls vary from the size of a large pea to a marble and are nearly globular in shape. They are formed at the base of the leaf at the base of the midrib or stem. The stem or midrib so twists as to form a semi-circular opening usually on the underside of the leaf with the opening down, while the leaf tissues serve to cover the twisted area so as to form a very perfect gall. So well is this made that after examining great numbers of them there were to be found no parasitic guests in the colonies and internal hymenopterous parasites could not be bred out of a large number of collected galls. The color varies from a light green to a deep bright red. The wall is thin so as to admit of a large space within. Figure 229 shows a cross section containing from fifty to two hundred individuals of all stages. It is noticeable that the gall remains completely closed until the winged forms are ready to emerge and then the opening is forced at a single point so as to allow but one to leave at a time. The older galls, however, are opened clear across.

This species has also been reported as feeding upon *Populus monilifera* and *Populus tremuloides*, by Eastern and Middle Western writers.

Locality—On the cottonwoods along the banks of the Santa Clara River near Santa Paula, Cal.

Date of Collection—June 22, 1911. Serial number 39.

Tribe CHAITOPHORINI

General Characters

Body—Rather short, wide, flat, covered with fine hair-like bristles, which are often placed on quite large tubercles, especially in the young.

Antennae—Six articled, except in one genus (Sipha), which has but five articles, short, seldom longer than the body. Not on prominent frontal tubercles. Covered with hair-like bristles same as the body. Usually carried at right angles to the main axis of the body or against the sides (especially so in feeding).

Legs—Short and rather stout, hairy.

Wing venation, as in *Aphidini*, veins sometimes with clouded borders.

Cornicles—Short, truncate, variable in length, and not longer than one-tenth the length of the body.

Style—Short, variable in shape, usually blunt at tip.

From these general characters it will be seen that this tribe includes very diverse elements. However this may seem, from the very beginning of the work on Aphididæ in America this particular tribe has almost entirely been thrown into two genera, or I might say into but one, since the genus *Siphα* claims but few species. This genus is of course *Chaitophorus* Koch. The typical American species, and so recorded by Prof. Oestlund (Last Minn. Aphid., p. 48, 1886,) has long been the type for comparing most of the species belonging in the above tribe, without paying much attention to the original European type or endeavor

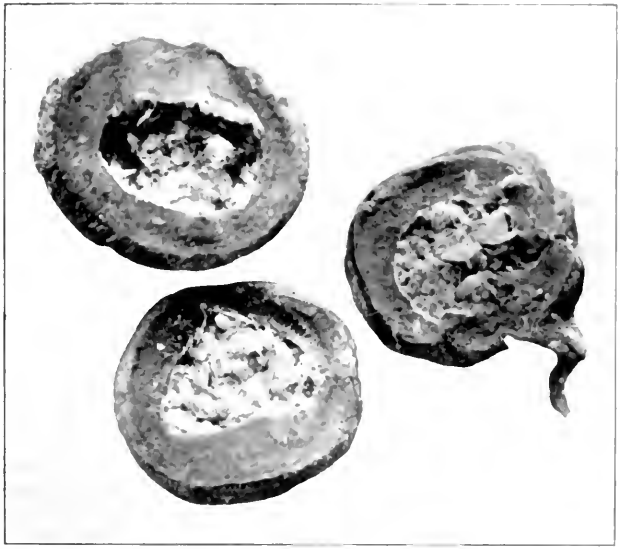

Figure 229. Galls of Pemphigus populicaulis Fitch
Split to show the great number of inhabitants

ing to separate the widely varying forms into new genera. Prof. H. F. Wilson in the Canadian Entomologist, Vol. XLII, December, 1910, pages 384 to 388, has taken the first step in the direction of revision by creating a new genus, *Thomasia*, out of what has been considered the American type form for the genus *Chaitophorus*.

If one attempts to make any extensive determinations of the various species of this tribe by means of the literature of today, he cannot but have it forcibly brought to his mind, how poor the descriptions really are, and how difficult it is to accurately place a new insect even in the right genus. This is, of course, largely

because of the loose characterization of the genera. Because of the past complications, I have accepted the revision as proposed by Prof. Wilson and in attempting to place new species found it necessary (and I believe the characters of the species necessitate it) to form three new genera.

In examining the key it will be seen that the principal characters for separating the genera are the comparative lengths of the spur of the antennal article VI with the base, the length and shape of the cornicles, and the length and shape of the style, all characters which are perhaps the most constant in this tribe. There are but five genera represented as follows: *Aretaphis* Walker, *Chaitophorus* Koch, *Symdobius* Mordwilko, *Thomasia* Wilson, and *Sipha* Passerini. To these, I have added the following new genera: *Eichochaitophorus*, *Micrella* and *Fullawaya*. If I accepted Wilson's classification at all I found that I could not place *Micrella* in the genus *Thomasia* because of the longer spur of antennal article VI; it was impossible to place it with *Aretaphis* because of the shape of the style; it is certainly an intermediate between these two. *Eichochaitophorus*, because of the shorter antennal spur, cannot be placed with *Aretaphis*, though the style is of the same general character. This might have been overlooked, had it not been that the species described has a very distinct, constricted anal-plate which seems to place the genus somewhere between the present genus *Aretaphis* and the genus *Callipterus*. The long stipe of the style is different from that of the former, and in consideration of all the characters, I could not find a place for it in any of the older genera, so created the new one. *Fullawaya* is a splendid new genus, combining to a remarkable degree characters of several widely separated genera. The body, in shape and construction, resembles greatly some of the species of *Aphis*, while the lack of cornicles suggests some other genera. The general clothing of hair is as in this tribe. The feeding habits differ from all other members of the tribe, so far as I know, this being a root and subterranean form rather than an aerial and leaf- or bark-eating form. It falls just between *Symdobius* and *Thomasia*, though it is widely different from either.

According to the following Key to Genera and Species it will be seen that nearly all of the Eastern *Chaitophorus* fall in the new genus *Thomasia* and into this genus also fall the species recently described by me as *Chaitophorus salicicola* (P. C. Jr. Ent. III, p. 534, 1911). Also into this new genus fall *Ch. populifoliae* Fitch, *Ch. negundinis* Thomas, *Ch. viminalis* Monell (though this is somewhat difficult to handle because of the varied forms and contradictory descriptions), and a new species, *crucis*, described in this article

Provisional keys to the present known genera and to the California species are as follows:

Key to Genera

1. Antennæ six articled — 2
   Antennæ five articled. — 8
2. Spur of article VI at least three times as long as the base. — 3
   Spur of article VI not three times as long as the base. — 6
3. Spur of article VI not more than five times as long as the base, cornicles not longer than the base. — 4

Spur of article VI more than five times as long as the base, and cornicles longer than the base. *Chaitophorus*

4. Spur of article VI more than four times as long as the base, cauda constricted at the base. 5

Spur of article VI not four times as long as the base, and the cauda not constricted at the base. *Micrella*

5. Stipe of cauda well developed and on a conical base, anal plate constricted in the middle. *Eichochaitophorus*

Stipe of cauda obsolete or not well developed and on a quadrangular base, anal plate well rounded. *Arctaphis*

6. Antennæ about half the length of the body and the spur of article VI considerably longer than the base. 7

Antennæ nearly as long as the body and the spur of article VI shorter or scarcely longer than the base. *Symdobius*

7. Cornicles absent, body with lateral tubercles. *Fallawaya*

Cornicles present, lateral body tubercles wanting. *Thomasia*

8. Antennæ shorter than the body, cornicles very short and tapering with flanged mouth. *Sipha*

KEYS TO CALIFORNIA SPECIES

CHAITOPHORUS Koch.

Type Aphis aceris Linn.

No California representative in this State to date.

MICRELLA n. gen.

Type M. monelli n. sp.

One species described.

M. monelli n. sp. On *Salix lasiolepis* Benth. and *S. laevigatae* Bebb., at Oxnard and Santa Paula, Cal.

EICHOCHAITOPHORUS n. gen.

Type E. populifolii n. sp.

One species as herein described.

E. populifolii n. sp. On *Populus trichocarpa* T. & G., Santa Paula, Cal.

ARCTAPHIS Walker

Type A. populi Linn.

No California species reported.

SYMDOBIUS Mordwilko

Type A. oblongus Heyden

1. Body small, nearly black, abdomen of apterous female with lateral body tubercles. *macrostachyae*

Body large, never black, abdomen of apterous female without lateral tubercles. *salicicorticis*

S. macrostachyae n. sp. On *Salix macrostachya* Nutt., Santa Paula, Cal.

S. salicicorticis n. sp. On base and roots of *Salix laevigata* Bebb., near Santa Paula, Cal.

FULLAWAYA n. gen.

Type **D. saliciradicis** n. sp.

F. saliciradicis n. sp. On roots of *Salix laevigata* Bebb., from four to six inches underground. Santa Paula, Cal.

THOMASIA Wilson

Type **Ch. populicola** Thos.

1.	Article III of the antennæ as long or longer than VI.	2
	Article III of the antennæ not as long as VI.	4
2.	Article III of the antennæ co-equal with VI.	*populifoliae*
	Article III of the antennæ decidedly longer than VI.	3
3.	Veins of wings with clouded borders.	*populicola*
	Wing veins not clouded.	*negundinis*
4.	Antennæ nearly as long as the body.	*viminalis*
	Antennæ little more than half as long as the body.	5
5.	Body of adult female nearly black with longitudinal, light-yellow on dorsum.	*salicicola*
	Body of adult female green with light green or yellow cross on the dorsum.	*crucis*

T. populifoliae (Fitch). On *Populus fremonti* Wats. Collected in the central part of the State by Davidson. Jr. Ec. Ent. III, p. 375, 1910.

T. populicola (Thos.) Wilson. On *Populus trichocarpa* T. & G. Collected in various parts of Ventura County by the writer. P. C. Jr. Ec. Ent. I, p. 99, 1909.

T. negundinis (Thos.). On *Negunda aceroides* Moench. Collected by Davidson in the vicinity of Stanford University, Palo Alto. Jr. Ec. Ent. III, p. 376, 1910.

T. viminalis (Mon.). On *Salix* sp. In the central part of the State by Clarke. Can. Ent. XXXV, p. 248, 1903.

T. salicicola Essig. In Ventura County on *Salix laevigata* Bebb. and *Populus trichocarpa* T. & G. P. C. Jr. Ent. III, p 534, 1911.

T. crucis Essig. In Ventura County on *Salix macrostachya* Nutt.

SIPHA Passerini

Type **A. glyceriae** Kalt.

No species reported in this State.

MICRELLA n. gen.

Type **M. monelli** n. sp.

General Characters

Body—Very small, rather flat, covered with long, curved hair-like spines which are strongly tuberculate at their bases in the young, but less so in the adult forms. The general shape is not unlike the members of the genus *Thomasia* Wilson, but much smaller.

Head—Narrower than the prothorax and noticeably small in the adult apterous females. Antennæ arising from the sides and not on even slight frontal tubercles.

Eyes—Three large ocelli which are red and very noticeable in the winged females; compound eyes with terete tubercles.

Antennae—Nearly as long as the body, reaching beyond the bases of the cornicles. Article III not as long as IV and V together and not as long as VI, or the spur, with single row of large circular sensoria. Spur of VI slightly more than three times as long as the base, but never four times as long, very thin or setaceous.

Rostrum—Tip coming between first and second coxae.

Cornicles—Nearly as wide or wider at the bases than the length, very slightly constricted before the mouth which has a very small rim or flange.

Legs—Small and frail.

Style—Strongly tapering to a blunt tip which is usually straight across, not rounded or constricted at the base, no longer than the cornicles, with very few hairs.

Anal Plate—Well developed, semi globular, hairy.

Wings—Hyaline, normal in size, venation as in *Thomasia* or *Chaitophorus*, and fairly constant, incision in the upper wing margin at the tip of the stigma.

Micrella monelli n. sp.

WINGED VIVIPAROUS FEMALE (Figure 230 A)

Length of body 1.2 mm., width of the mesothorax 0.39 mm., width of the abdomen 0.48 mm., wing expansion 4.1 mm. *Body*—Very small, slender, hairy. *Prevailing color*—Light green and black. *Head*—Small, nearly as wide as the prothorax, slightly wider than long, nearly straight across the front, hairy, no frontal tubercles, very dark green or nearly black on dorsal and ventral surfaces. *Eyes*—Large, with tubercles, dark red, three large ocelli. *Antennae* (Figure 230 C, D, E). Not on frontal tubercles, nearly as long as the body, slender, imbricated, with few hairs, articles I and II dark green, but not as dark as the head, III light green throughout, IV light green with tip faintly dusky, V light green with tip nearly black, VI with base dark and base and apical one-third of the filament, or spur, dark. Lengths of the articles: I, 0.05 mm.; II, 0.038 mm.; III, 0.24 mm.; IV, 0.16 mm.; V, 0.18 mm.; VI, 0.42 mm. (base 0.10 mm., filament or spur 0.32 mm.); total 1.088 mm. Article I is wider and longer than II, III is shorter than VI or the filament of VI, not twice as long as either IV or VI and not nearly so long as the sum of the two, IV not so long as V and half as long as the spur of VI, VI with base much shorter than either IV or V and not quite one-third so long as the filament, which is very slender. The large circular sensoria are arranged in a row on III, varying from four to seven in number. There is but one large one at the apex of V and one large one and many small ones on VI at the base of the filament. *Rostrum*—Reaches to the second coxae, light green or yellow with dark tip. *Prothorax*—Scarcely wider than the head and not so long, hairy, dusky green, but lighter than the head or the other two thoracic segments. *Mesothorax*, dorsum dark green with muscle lobes black, ventral surface all black except the coxae, which are light green. *Metathorax*—Green with dark dorsal markings which appear in shape like a goblet with the base at

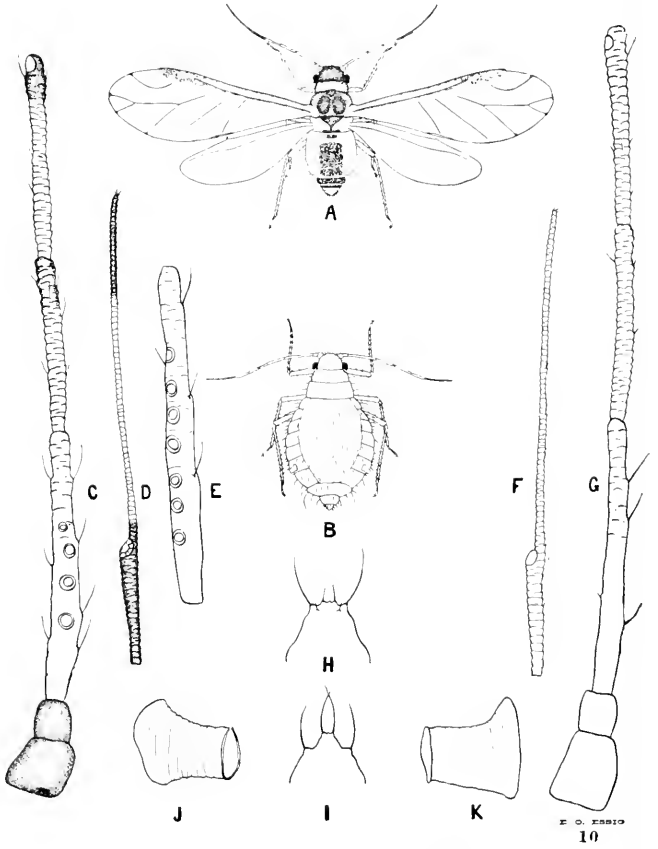

Figure 230. Micrella monelli Essig

the base of the segment and the top against the mesothorax. *Abdomen*—Scarcely wider than the thorax, not distinctly segmented, hairy, light green with median dorsal black patches and transverse dorsal dark bands across the last two abdominal segments. Of the dorsal patches the first is very small and is on the first segment, the second is large and extends to the lower margins of the cornicles. Anal plate rounded and dusky green. *Cornicles*—(Figure 230 A).—Slightly longer than the width of the base, base widest, very slightly or not constricted before the apex, mouth flaring but very little or none, with parallel broken lines around surface, light green (concolorous with surrounding body area), length 0.08 mm., width of the base 0.073 mm., width of mouth 0.046 mm. *Legs*—Small, slender, hairy, transparently white or light green throughout. *Wings*—Normal, hyaline. *Primary*—Length 1.8 mm., width 0.65 mm., margin constricted at the tip of the stigma, venation fairly constant, but variable as in nearly all members of this tribe. Costal, wide and distinct, dusky brown. Subcostal little wider than the costal, dusky brown. Stigma quite oval, tip blunt or rather sharp, short, dusky brown, of a uniform color throughout, lower margin hairy, length 0.45 mm., width 0.4 mm. Stigmal vein short, well curved throughout, but strongest in basal half, tip clouded, arises nearer the tip than the middle of the stigma. First discoidal arising beyond the middle of the subcostal, straight or curved inwardly. Second discoidal sub-obsolete at the base, straight, not reaching the margin of the wing, base midway between the bases of the first and second discoidals. Third discoidal normally twice-forked, obsolete at the base, first fork one third the distance from the base to the tip of the lower branch of that fork, second fork one-half the distance from the first fork to the tip of the wing, or more often nearer the tip of the wing. Tips clouded. This vein is often but once forked as has been observed in so many of the small species taken here. All the veins are dusky brown in color. *Secondary*—Length 1.25 mm., width 0.4 mm. Normally with subcostal and two discoidals. Subcostal undulate with strongest downward curve below hooklets and beyond the base of the second discoidal. Discoidals very light, bases not very far apart, the base of the second near the middle of the subcostal, bases also obsolete, or nearly so. First vein slightly curved inwardly, second straight. *Style*—(Figure 230 H). Short, tip nearly straight across with large spine on each lateral corner, base much wider than apex, slightly dusky or light green, length 0.055 mm., width of base 0.075 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 230 B)

Length 1.4 mm., width of the abdomen 0.8 mm. *Body*—Wide and very flat, covered with long tuberculate hairs. *Prevailing color*—Transparently light green throughout. *Head*—Small, narrower than the thorax, rounded, hairy, without antennal tubercles, pale light green. *Eyes*—Compound eyes, bright red, with tubercles. *Antennae*—(Figure 230 F, G). Nearly as long as the body, reaching beyond the bases of the cornicles, very slender throughout, but a mere filament; apical third and remaining articles imbricated, colorless or transparently white throughout, very few hairs. Lengths of the articles: I, 0.065 mm.; II, 0.01 mm.; III, 0.25 mm.; IV, 0.17 mm.; V, 0.18 mm.; VI, 0.42 mm. (base 0.12 mm., filament

0.3 mm.); the relative lengths compare well with those of the winged form. Usual sensoria on V and VI. *Rostrum*—Not reaching to the second coxæ, transparently white. *Thorax*—Prothorax and mesothorax considerably narrower than the metathorax and the abdomen, light green. *Abdomen*—Well rounded, wide, flat, margins show segmentation plainly, but it is not carried across the dorsum, very light green. Anal plate, well rounded, light, hairy. *Cornicles*—(Figure 230 K). Same general shape as those of the winged female, but larger, light yellow to concolorous with body, length 0.08 mm., width of the base 0.09 mm., width of the mouth 0.05 mm. Usually slightly longer than broad. *Legs*—Slender and frail, hairy, transparently white throughout. *Style*—Short, nearly conical, concolorous with body, length 0.05 mm., width of base 0.065 mm., with few hairs.

Young—Transparently light green or yellow to colorless. Body bearing many large tubercles, each supporting a large curved hair or spine.

Host—Found feeding only upon the leaves of the tender shoots and suckers of *Salix lasiolepis* Benth. During the year 1910 they were exceedingly abundant and attacked all of the leaves, young and old, but never the bark. Very much honey dew was excreted, smutting the trees until they appeared black. This summer I was able to collect but very few, although a sharp lookout was maintained throughout the year. The winged forms were exceedingly rare. This scarcity is probably due to the ravages of the internal and predaceous enemies, which were exceedingly numerous both last year and this summer, the larvæ of a syrphid fly being predominant. On September 14, 1911, I took this species in small numbers from *Salix Lævigata* Bebb.

Locality—Found only on willows growing near the ocean beach on a fresh-water marsh just inside the sea-wall, three miles from Oxnard, Cal., on what is known as the McGrath Estate. Though a careful search has been made of all species of willow trees in every other part of the county, I have never been able to locate this species in any other place except late in the fall along the Santa Clara River near Santa Paula, Cal.

Date of Collection—July 1, 1910, and September 14, 1911. Serial number 10.

Because of its long antennal filament and other characters which exclude this species from *Aretaphis* (the constricted style) I have placed it in the genus *Micrella*. Having never collected what I believe to be the true *Chaitophorus* Monell, and without comparative material except published descriptions, I sent this species on to Mr. Monell, asking him if it was identical with *C. viminalis* Mon. His reply was as follows: "No. 10 on *Salix* is a new species of *Chaitophorus*" (St. Louis, Mo., Oct. 3, 1910). Because of his valuable aid in this work I am naming this species for him. A comparison of *Micrella monelli* n. sp. with the descriptions of *Chaitophorus viminalis* Monell and its synonym *Chaitophorus nigrae* Oestlund brings out some most notable differences, as follows:

Ch. viminalis Mon.

Body—
Length 1.52 to 1.65 mm.
Apterous forms often dark.
Antennae—
Filament slightly longer than III.
IV a little longer than V.

Ch. nigrae Oestl.

Length 1.50 mm.
Apterous forms dark.
III longest.
IV longer than V.
Tips of segments dark.

M. monelli n. sp.

Length 1.2 to 1.4 mm.
Smaller species.
Apterous forms very light with none dark.
Filament of VI much longer than III.
IV shorter than V in winged and apterous forms.
Legs robust, tips dark throughout.

EICHOCHAITOPHORUS n. gen.

Type E. populifolii n. sp.

Body—In winged individuals the head little narrower than thorax, and abdomen little wider than thorax. In apterous forms the body is broad across the middle of the abdomen, tapering anteriorly to a rather broad head and rounding off posteriorly to a blunted point, flat. Covered with long and short stout spines which are situated on rather large body tubercles. Small species.

Head—Broad across the front which is straight or well rounded. Antennae arise from sides of the head just in front of the eyes, leaving a wide space between their bases. Without antennal frontal tubercles. Front hairy.

Eyes—With terete marginal tubercles behind.

Antennae—Not as long as the body, reaching to or slightly beyond the bases of the cornicles. Carried close to the sides of the body when the insect is feeding, at right angles with the main axis of the body when moving about. Article I wider, but little or no longer than II, III nearly or as long as IV and VI together, but shorter than VI or the spur of VI, the spur of VI less than four times as long as the base and always longer than III and never so long as the sum of the lengths of IV, V and the base of VI. Sensoria large, circular, from three to nine on article III, none on IV, one at the apical end of V, and one large and six small in the process of VI. Sensoria on III situated in a single row, if three or four they are usually within the basal half, if eight or nine they extend nearly the full length of the article. Articles imbricated.

Rostrum—In winged forms reaching just beyond the second coxae. In apterous forms reaching to third coxae.

Thorax—Wider than head, but not wider than the abdomen.

Cornicles—Truncate or nearly so, longer than wide, approximately as long as the style including the wide base. Wider at the base, slightly flaring at the mouth, but not as wide as at the base, narrowest just before the mouth, with net work of lines on the surface.

Legs—Rather small and slender, but not abnormally so, well in proportion with the rest of the body, hairy as in *Chaitophorus*. Article I of tarsi one-third as long as article II.

Style or *Cauda*—Distinctly knobbed, restricted below knob and enlarged again at base, which is wider than the diameter of the round or globular knob,

with many long and short curving spines. Style usually hid beneath the projecting pygidium or last abdominal segment which is well rounded and hairy.

Anal Plate—Distinctly bifurcated, but not as deeply forked as in the genus *Callipterus*, situated well under the body, with long and short curved spines which are set on slight tubercles.

Wings—Rather slender, normally typical Aphis venation, but very variable as shown in accompanying cuts (Figure 231, 1-19). Stigma rather short and oval in shape, about three times as long as broad, light streak near lower margin, below which is an irregular row of short hairs. Stigmal vein and first and second discoidals as in Chaitophorus, third discoidal variable, from once to thrice forked, though it is normally twice forked, locations of forks exceedingly difficult to fix and seldom constantly located, usually obsolete at the base. Veins without clouded borders. Membrane hyaline or slightly darkened. Finely punctured or scaled. Secondary wings with normally two discoidals, but often with but one.

It has been with a great deal of reluctance that I have created this new genus, and not without a vast amount of examination of both literature and specimens. I have also sent specimens to Prof. Davidson, who wrote: "I do not know of any aphid like No. 16. It seems to resemble *C. nigrae* Oestl. slightly but is not same species of course. Williams in his 'Aphididae of Nebraska' p. 27, says of *Ch. nigrae*, 'tail knobbed'." The species cannot belong to the genus *Chaitophorus* as it now stands for in looking at the characters which determine the genus we find the following, which does not agree with the above description: "Antennæ on indistinct frontal tubercles; spur of the sixth segment longer than the third, and about six times as long as the sixth segment. Cauda very short, being but a knob. Wing venation regular. Nectaries six times the length of the cauda and constricted in the middle." Wilson, A Second Paper on the Genera in the Subfamily Callipterinae, Can. Ent. Dec. 1910.

The genus which it seems to most resemble is *Arctaphis* Walker, the type of which is *Aphis populi* Linn. According to Wilson, in the article referred to above, the cauda is a knob on a quadrangular base. The anal plate is broadly rounded. In the new genus the style has a distinct neck and is situated on a very distinct conical base. The anal plate is deeply notched in the middle so as to make it somewhat forked as in the genus *Callipterus*.

In a general way the genus under consideration lies between the old genus *Chaitophorus* and the genus *Callipterus*, having the general body characteristics of the former and the style and anal plate of the latter.

Eichochaitophorus populifolii n. sp.

WINGED VIVIPAROUS FEMALE (Figure 234 A)

Length of body 1.6 mm., width of mesothorax 0.5 mm., width of the abdomen 0.6 mm., wing expansion 5 mm. A very small and active species. *Prevailing color* Dull green head and thorax and light green abdomen. *Body*—Very thin and flat. *Head* Well rounded anteriorly, bristled, dull or dusky green, sometimes nearly black. *Eyes* Dark red, small with distinct tubercle. *Antennae*—(Figure 232, 1-6). Not quite as long as the body, not on frontal tubercles, hairy.

imbricated. Article I dusky olive green, but lighter than the head, II light yellow, often slightly dusky, III and IV light yellow throughout, V yellow with dusky tip, VI dusky throughout. The lengths of the articles are as follows: I, 0.05 mm.; II, 0.05 mm.; III, 0.36 mm.; IV, 0.23 mm.; V, 0.15 mm.; VI, 0.475 mm. (spur 0.375 mm.); total 1.315 mm. Articles I and II are co-equal, III is nearly as long as IV and V together, but shorter than VI, IV is much longer than V, the spur of VI is nearly four times as long as the article and is longer than article III. The lengths of the articles vary considerably as the drawings of the article III show in the cut, but the comparative lengths are fairly constant. Article III bears from three to nine rather large circular sensoria, V and VI bear the usual

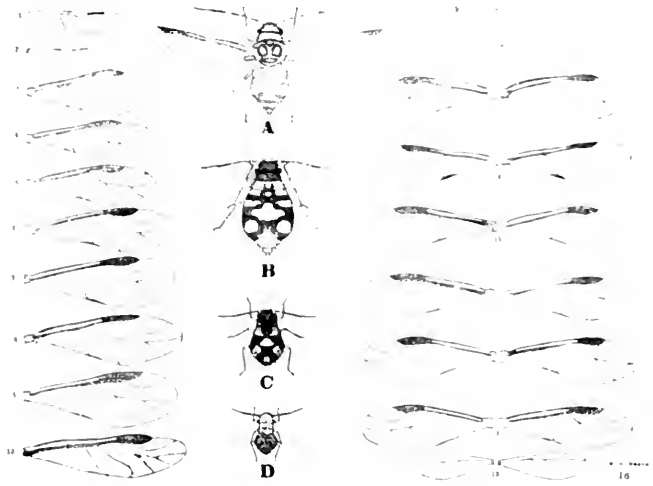

Figure 231. Eichochaitophorus populifolii Essig

number. *Rostrum*—Reaches just beyond the second coxæ, transparently white with red or brownish tip. *Prothorax*—Concolorous with the head, and very little wider. *Meso-* and *Metathorax*—Dull olive green with lobes well developed and black, shiny. *Abdomen*—Flat, hairy, yellowish with dull or light green dorsal markings as follows: Large green transverse irregular band just behind the thorax; irregular green transverse band near middle of abdomen, this band curves deeply toward the cauda in the middle; two green blotches just back of the cornicles, the bases of which blend into a transverse green band which extends across the dorsum; a green transverse band near the caudal end. Tip of abdomen light yellow. These markings may vary, but there is always a large yellow blotch just behind the first green band, yellow areas around the bases of the cornicles,

and a yellow tip. Anal plate (Figure 232, 18) very distinctly bifid, but not as much so as in the genus *Callipterus*, very hairy or covered with long spines. The anal plate is usually hid by the pygidium which extends over it dorsally, light yellow in color. Ventral surface pale uniform green. *Cornicles*—(Figure 232, 10). Longer than broad, somewhat truncate, broader at the base and flaring at the mouth, narrowest just before the mouth, longer than broad, light transparent yellow, the base surrounded by a yellow area, surface covered with irregular mosaic figures which are nearly circular parallel lines at the base. Length 0.1 mm. *Legs*—Normally long and hairy, transparently yellow with femora and tips of the tarsi (Figure 232, 12) dusky amber. The femora of the metathoracic legs are darker than those of the other two pairs. *Wings*—(Figure 231, 1-19). Slender, hyaline to faint sub-hyaline and venation very variable. *Primary*—(Figure 231, 3-18). Length from 1.95 mm. to 2.4 mm., width from 0.65 mm. to 0.8 mm. Venation exceedingly variable within the species and within the same individuals. The most typical venation is shown in the wings of the winged female and may be expressed as follows: Costal wide to base of stigma, dusky brown; subcostal wider than the costal, dusky brown; stigma (Figure 231, 11) dusky brown, rather short and oblong, narrowest at base and widest at the base of the stigmal vein with both sides uniformly sloping to form a blunt tip, light streak near the ventral border and the area between the light streak and the bottom margin covered with about sixteen short curved hairs which are situated on slight tubercles, length 0.1 mm., width at stigmal vein 0.03 mm. Stigmal vein arises near the apical end of the stigma and is usually strongly curved downward in the first half and more gradually curved in the remaining half—may even be undulate. The discoidal veins are the most variable, but normally the first discoidal is slightly curved outwardly at the base and from thence continues almost straight to the wing margin, it arises from the middle of the subcostal; second discoidal arises from the subcostal nearly midway between the bases of the first and third discoidals, but slightly nearer the base of the first, is usually bent outwardly; third discoidal is obsolete at the base, twice-branched, nearly parallel to the second discoidal, first branch arises near the middle and extends nearly straight towards the middle of the wing tip, the second fork being formed near the middle of the first branch, the lower branch runs parallel to the third vein. From this normal venation will be found almost every conceivable graduation. The wings represented by Figure 231, 13 to 17 inclusive, are pairs, while the wings from 3 to 10 inclusive are taken from individuals whose other wings were normal. The *costal* and *subcostal* veins are normal and constant throughout; the *stigmal vein* is constant in a large majority of cases as in 3, 4, 8, 10, 14, 15, one of 16, 17 and 18, but in 5 the base is obsolete and the curve slight, in 6 the base is also obsolete with a portion isolated from the remainder, in the right wing of 13 it is undulate as is also the case in the right wing of 16. In all it is noticeable that the greatest amount of curvature is in the basal half of the vein. *First discoidal* is straight as shown in 6, 8, 9, 10, 15, 16, 17, in 3 and 5 undulate, in 4, 7, 14, 17 and 18 curved outwardly. *Second discoidal* is straight in the drawing of the winged female and in 8 and 11, slightly undulate in 5 and 6, bent outwardly

in the remainder. *Third discoidal* normally twice branched as shown in A, 3, 8, 9, and the right wings of pairs 11 and 18. In 6, right wings of pairs 13, 14, 16 and 18, and both wings of 15, the right wing of 13 shows a rudiment of a second branch near the wing tip; the great difference in the position of the forks of all of these veins are noticeable. In one case, the left wing of 17, there is a third fork near the wing margin and a reverse third fork near the margin of the right wing. The base of the third discoidal is normally obsolete as is shown in nearly every wing. In 10 the base of the first fork is broken up very badly, and in many cases the lower branches of the two forks are badly twisted, but in spite of this it will be seen that they are usually parallel. All veins dusky brown. *Secondary*—(Figure 231, 1,2, 11, 12 and 19). Also variable in venation. Length from 1.3 mm. to 1.44 mm., width from 0.35 mm. to 0.37 mm. Normally with two discoidals,

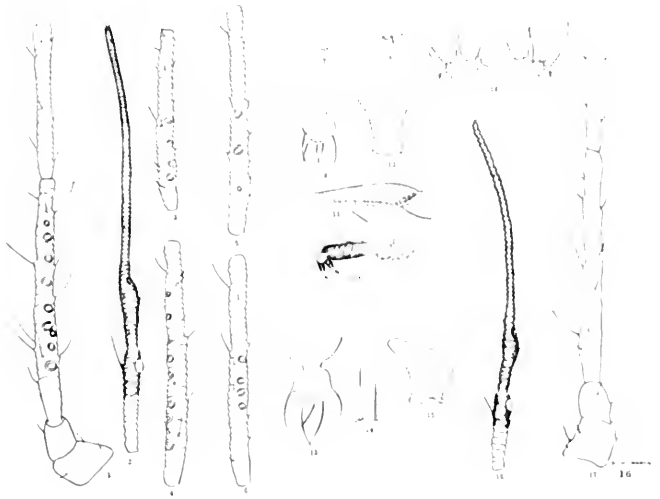

Figure 232. Eichochaitophorus popalifolii Essig

but often with only one. Subcostal undulate, usually most strongly curved at the base of the second discoidal, may or may not extend to the tip of the wing. First discoidal arises slightly beyond one-third the distance from the base to the apex of the subcostal, may be obsolete at the base or wanting as shown in 11 and left wing of pair 12, straight, does not extend to wing margin, dusky brown. Second discoidal arises near the middle of the subcostal at its greatest bend, is considerably longer than the first discoidal, nearly straight or slightly bent outwardly. *Style*—(Figure 232, 7, 8, 9). Distinctly globular with a very narrow neck and a base wider than the knob, yellow, with rather long coarse spines.

Resembles the style of the genus *Callipterus*, but is more knobbed than any of the members of the genus *Chaitophorus* which have been under my observation. Length 0.08 mm., width or diameter of knob 0.045 mm., width of base 0.06 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 231 B and C)

Length of body 1.4 mm., width of abdomen just in front of the cornicles 0.76 mm. A thin, flat and very small species. The entire body is covered with long and short spines, each of which is situated on a tubercle (Figure 232, 14). *Prevailing color*—Green and yellow, variegated, or reddish brown and yellow, markings nearly always constant. *Head*—Broad across the front and nearly rectangular in shape, hairy, dusky green or dusky yellow, often with yellow median markings, nearly twice as wide as long. *Eyes*—Bright red, with lateral marginal tubercle behind. *Antennae*—(Figure 232, 16 and 17). Arising from near the sides of the head, reaching nearly to the bases of the cornicles, hairy; imbricated; article I yellow, II dusky yellow, III and IV transparently white or yellow, V transparently yellow or white with a dusky tip, VI dusky throughout; lengths of articles: I, 0.06 mm.; II, 0. 55 mm.; III, 0.295 mm.; IV, 0.16 mm.; V, 0.115 mm.; VI, 0.45 mm. (spur 0.34 mm.); total 1.135 mm. I and II are practically subequal, III is as long or longer than IV and V together, but shorted than VI or the spur of VI. IV is longer than V, V slightly shorter or nearly co-equal with the base of VI. The spur of VI not as long as the sum of IV, V and VI. Sensoria normal on V and VI. *Rostrum*—Reaches to third coxæ, transparently white or yellow with red tip. *Prothorax*—Of the older and larger individuals dusky green, in the younger reddish females there is a distinct lateral yellow blotch on each side of the dorsum. *Meso-* and *Metathorax*—With irregular green blotch on the median dorsum or a large red blotch covering the median third of the dorsal area and a yellow margin on each side in all cases. *Abdomen*—Flat, widest near the middle, rounded or pointed posteriorly, covered with stout hairs, markings fairly constant and as follows: ground color either dark green or reddish brown (the larger specimens are usually green, while the smaller ones sometimes appear red or brown). In the larger green forms there are two marginal, transverse yellow blotches near the base which extend about one-third the width of the abdomen from each side, in the middle of the dorsum is a large somewhat triangular yellow spot, a yellow spot around the base of each cornicle, and a median quadrangular or diamond-shaped yellow spot at the posterior end including the pygidium. In the smaller reddish individuals the markings are nearly the same, but lack the lateral yellow transverse spots near the base. These are partly included in the large yellow spots on the sides of the meso- and metathorax. The median dorsal spot is distinctly triangular, and the posterior yellow spot is slightly dusky near the extreme end. The anal plate is slightly, but distinctly bifurcate as in the winged forms and covered with long stout spines, color of the ventral body surface which is yellowish or greenish. *Cornicles*—(Figure 232, 15). In general shape, size and color they resemble those of the winged individuals, but perhaps a trifle shorter and wider at the base. *Legs*—Normal, hairy, transparently white or yellow, with femora slightly amber and tibiæ and tarsi dusky amber.

Style—(Figure 232, 13). Distinctly globular with small neck and wide base as in winged specimens, yellow, hairy, length 0.09 mm., width or diameter of knob 0.055 mm., width of base 0.085 mm.

Young—(Figure 231 C). The first born are pale yellowish green without color markings at all and with transparently white antennae and legs. The older forms gradually assume the distinct dorsal markings either reddish or green with yellow spots until they have become as described under the adult forms. In some of these the style is pinkish instead of yellow.

Host—Found only on the upper surfaces of the tender, but most often on the older leaves of the common wild Cottonwood (*Populus trichocarpa* T. & G.). It is never a stem feeder. A great producer of honey-dew upon which grows great quantities of the black fungus. All infested trees are easily told by their dirty black appearance. The insect is able to cling to the surface of the leaves with a remarkable tenacity and it is almost impossible to jar or shake them off.

Locality—Obtained on cottonwoods growing along the Santa Clara River from Santa Paula to Sespe and along the Sespe River far up into the canyon at an altitude of 2000 feet.

Date of Collection—First taken in the Sespe Canyon May 20, where it occurred in great numbers on a single small tree. Again collected at Santa Paula August 4 and still shows up in considerable numbers at this date (Sept. 15, 1911). Serial number 16.

Symdobius macrostachyae n. sp.

WINGED VIVIPAROUS FEMALE (Figure 233 A)

Length of body 2.2 mm., width of the mesothorax 0.7 mm., width of the abdomen 0.9 mm., wing expansion 6 mm. *Body*—Medium in size, rounded, hairy. *Prevailing Color*—Black or very dark, shiny or dull. *Head*—Large, much wider than long, broad across the front between the antennae, hairy, very dark green to black with light transverse basal band. *Eyes*—Three large red ocelli on the dorsum of the head. Compound eyes large, red, with tubercles. *Antennae*—(Figure 233 C and D). Not on frontal tubercles, bases far apart, reaching to the third abdominal segment (a little more than half the length of the body), with long curved spines or hairs, three apical articles imbricated, articles I and II nearly as dark as the head, remaining articles amber brown to nearly black. Lengths of articles: I, 0.07 mm.; II, 0.07 mm.; III, 0.36 mm.; IV, 0.183 mm.; V, 0.173 mm.; VI, 0.26 mm. (base 0.13 mm., spur 0.13 mm.); total 1.116 mm. I and II usually subequal though the first is often longer and always wider, III is by far the longest article, being nearly twice as long as IV, more than twice as long as V, and more than twice as long as the spur of VI, IV longer than V, VI with base and spur equal in length, in not a few instances the spur is slightly the longest. The sensoria are large, circular, irregularly arranged, and situated as follows: About seventeen on III, usually two within the apical half of IV, one on V, and the usual ones at the base of the spur of VI. *Rostrum*—Reaches to, nearly to, or slightly beyond the tip of the abdomen, dusky yellow with dark base and tip. *Prothorax*—Considerably wider than the head, but not as

wide as long, with small semi-globular lateral tubercles near the base, black. *Meso-* and *Metathorax*— Dark brown with muscle lobes well developed and black. *Abdomen*—Little wider than the thorax, dark brown, amber, or nearly black, with amber or brownish markings on the dorsum, between the dark transverse bands, and amber around the bases of the cornicles, as well as along the sides. Dark markings along extreme margins, covered with rather long spines. Anal plate well rounded, hairy, dark. *Cornicles*—(Figure 233, 1). Short, widest at the base and constricted just below the mouth, which is flared, dusky amber to dusky green throughout, length 0.08 mm., width of base 0.09 mm., width of mouth 0.06 mm. *Legs*— Normally developed, very hairy, coxæ dark brown to nearly black,

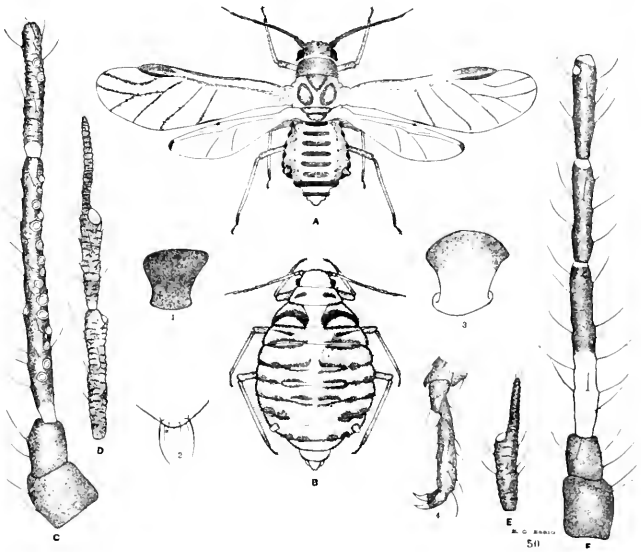

Figure 233. Symdobius macrostachyæ Essig

femora dark throughout, tibiæ amber with dark bases and tips, tips with a sharp spur or point on the inner side, tarsi dark (Figure 233, t). Article 1 composing about one-fifth of the entire tarsi, including the claws, hairy. *Wings*—Normally large and venation fairly constant. *Primary*— Length 2.7 mm., greatest width 0.9 mm. Veins slightly clouded, with a depression in the margin at the tip of the stigma. Costal vein wide and dark. Subcostal wider than the costal, amber to the stigma. Stigma short, oval with blind tip, dark with lighter streak which is a continuation of the subcostal vein, below this light area the color is darkest and the area is hairy, length 0.55 mm., width 0.18 mm. Stigmal vein arises near

the middle of the stigma, may or may not be sub-obsolete at the base, clouded darker near the base, curved throughout the basal half, slightly undulate, apical half nearly parallel with the upper branch of the second fork of the third discoidal, dusky amber. First discoidal arising beyond the middle of the subcostal, straight, often heavily clouded, more so than the other veins. Second discoidal with base nearer the first discoidal than the third discoidal, nearly straight with apical one-fourth curved inwardly, does not reach the wing margin, dusky amber with faint clouded borders. Third discoidal only slightly variable, normally twice-forked, with first fork about one third distance from the base and the second fork half the distance from the first fork to the tip of the wing, the upper branch of the second fork longer than the lower, slightly clouded, dusky amber. In only a few cases is this vein once forked. *Secondary* Length 1.8 mm., greatest width 0.5 mm., dark clouded area at the extreme tips, veins not clouded, venation normal with two discoidals. Subcostal vein strongly bent downward at the base of the second discoidal, which is below the hooklets; hooklets just beyond the middle of the upper wing margin. Discoidals with bases distant, one on either side of the middle of the subcostal, both obsolete for a very short distance at their bases, and both curve so that the convex surfaces are towards the wing tip, the second vein curved most, equal in length, do not touch lower margin of the wing. All veins dusky amber. *Style* (Figure 233, 2). Very short and broadly conical, base three times as wide as the length, dark green, length 0.03 mm., width 0.09 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 233 B)

Length 2.75 mm., width of abdomen 1.6 mm. *Body* Well rounded and slightly plump, but not short, hairy, medium in size, dorsum with many lobes and depressions. *Prevailing Color* Very dark brown, reddish brown with black markings or black with dull brown areas between the segments and along the middle dorsum, shiny or dull. Head, rather small, wider than long, hairy, dark reddish brown with dark margins or nearly black. *Antennae* (Figure 233 E and F). About half as long as the body, bases distant, on the sides of the head, not on frontal tubercles, hairy, articles I and II dark amber or reddish brown, III with base yellow or amber and the remainder dark brown, IV, V and VI dark amber brown with lighter areas at their articulations. Lengths of articles: I, 0.077 mm.; II, 0.055 mm.; III, 0.236 mm.; IV, 0.14 mm.; V, 0.14 mm.; VI, 0.18 mm. (base 0.105 mm., spur 0.075 mm.). I is longer or equal to II in length, but wider, III is the longest article, being nearly twice as long as IV and V together, IV and V are subequal and each shorter than VI, but longer than the base, VI with base longer than the spur, though these are sometimes subequal. Sensoria on apical end of V and at the base of the spur on VI. *Rostrum* Reaching to the middle of the abdomen, yellow with dark base and tip. *Prothorax* Amber brown to dark brown with dark margins and amber middle, two depressions, one on each side, near the middle, two fleshy lateral lobes near the base. *Mesothorax*—Dark, nearly black, with middle amber or reddish brown area, sides distinctly lobed with curved depression in middle of each. *Mesothorax* Short, nearly all dark, with amber or reddish middle, depressions on each side,

lateral tubercle on each margin. *Abdomen*—With six rather fleshy lateral tubercles on each margin, large depressions between the segments near the lateral margins, color dark, nearly black, with dorsal median line and slight area between segments dark reddish brown, and with a reddish band across the base of the last segment. *Cornicles*—(Figure 233, 3). Same shape as those in winged form, basal half color of the body, apical half yellow, length 0.115 mm., width of base 0.115 mm., width of mouth 0.08 mm. *Legs*—Front pair very short, and middle pair shorter than the hind pair, hairy, colored as in winged form. *Anal plate*—Rounded, dusky. *Style*—Short, broad at base, about three times as wide as the length, broadly conical, hairy, yellow, pinkish or amber, slightly dusky.

Young—Young of the apterous females are amber, reddish or dark brown with a lighter longitudinal band on the median dorsum occupying most of the head, one-third the width of the thorax and considerable of the abdomen, where it is the widest.

Host—Feeding only on the younger stems of the white willow, (*Salix macrostachya* Nutt.), and associated on the same twigs with the small green aphid, *Thomasia crucis*. It is not a leaf feeder at all, lives in dense colonies, and produces large quantities of honey dew, so that the infested trees are very black with smut. Usually found near the tips of the twigs and does not seem to feed upon the old bark at all. The apterous forms are very plentiful while winged individuals are scarce.

Locality—On low willow trees growing along the banks of the Santa Clara River in the vicinity of Santa Paula, Cal.

Date of Collection—August 25, 1911. Serial number 50.

This species resembles most *Chaitophorus nigrae* Oestl. (now a synonym of *Chaitophorus viminalis* Monell) in shape and general color, but differs from that insect as described by Prof. Oestlund in the following:

Chaitophorus nigrae Oestl.	Symdobius macrostachyae n. sp.
Antennae	
Article IV a little shorter than V.	Article IV usually a little longer than V or subequal.
Base of VI about half as long as V.	Base of VI nearly as long as V.
VII (spur of VI) as long as IV.	The spur of VI nearly as little over half as long as IV.
Rostrum	
Rostrum rather short, reaching second coxae.	Rostrum long, nearly as long, as long or longer than to the tip of the abdomen.
Style	
Style tubercle-like, or even knobbed as in *Callipterus*.	Style broadly conical and not knobbed as in *Callipterus*.

Symdobius salicicorticis n. sp

(The Willow Bark Louse)

WINGED VIVIPAROUS FEMALE (Figure 234 A)

Length 2.4 mm., width of mesothorax 0.7 mm., width of the abdomen, 1.15 mm., wing expansion 7 mm. *Body*—Rather large, but considerably smaller than the apterous forms, wide and flat, covered entirely with long fine hairs which are situated on small tubercles. *Prevailing color*—Dark greenish brown. Often slightly pruinose giving it the grayish color. *Head*—Nearly as long as wide, rounded in front, broad between the antennæ, black, with indistinct frontal tubercles. *Eyes*—Large, with tubercles, dark red. *Antennæ*—(Figure 234, 1 and 2). On very indistinct frontal tubercles, reaching to the middle of the abdomen (a little longer than half the length of the body), hairy, articles I and II dark, nearly as dark as the head, the remaining articles amber or light brown. Lengths of the articles: I, 0.08 mm.; II, 0.07 mm.; III, 0.48 mm.; IV, 0.265 mm.; V, 0.21 mm.; VI, 0.31 mm. (base 0.145 mm., spur 0.165 mm.); total 1.445 mm. I and II nearly cocqual with the former, the largest and usually the longest, III is by far the longest article, being nearly twice as long as IV, more than twice as long as V and much longer than VI. IV is slightly longer than V, but shorter than VI. The spur and the base of VI are nearly cocqual, though in the winged forms the spur is slightly the longer, imbricated throughout. The sensoria are all circular and vary greatly in size and distribution. On III they are scattered the entire length, varying in numbers from twelve to twenty, the average being sixteen or seventeen. On article IV there are from one to two, the first very near the base and the second near the middle. Out of ten average articles, six had one sensoria and four had two. There is but one near the apex of V and five small ones and a single large one on VI at the base of the spur. *Rostrum*—Reaches just beyond the middle of the abdomen, whitish-yellow with a dark tip. *Prothorax*—Without lateral tubercles, hairy, wider at base than at the apex, black. *Meso- and Metathorax*—Black, with muscle lobes well developed, hairy. *Abdomen*—Flat, wide, last two segments narrow and extended, brownish-green with large and small transverse black markings, as shown in the drawing, dark spots along the lateral margins, light around the bases of the cornicles. Ventral surface greenish. Anal plate extended, small, clouded green, hairy, rounded. *Cornicles*—(Figure 234, 4). Short, widest at the base, constricted just before the mouth, which is flaring very slightly, surface covered with fine network of lines forming a mosaic of long figures at the base and five or six-sided mosaic figures throughout the apical two-thirds, light yellowish green, length 0.08 mm., width of base 0.12 mm., width of mouth 0.07 mm. *Legs*—Rather slender, hairy, hind legs considerably longer than the first two pairs, coxæ dark, femora with basal halves yellow and apical halves amber brown, tibiæ amber brown with apical half yellowish, tarsi (Figure 234, 8) dusky yellow to dark amber brown; basal segment short and with prominent projection on lower side from which arises a spine, one-half as long as the second segment not including the claws. *Wings*—Normal, hyaline with all veins very faintly clouded. *Primary*—Length 3.2 mm., width 1.1 mm. Veins faintly clouded, dark brown, margin constricted at the tip of the stigma. Costal wide, brown.

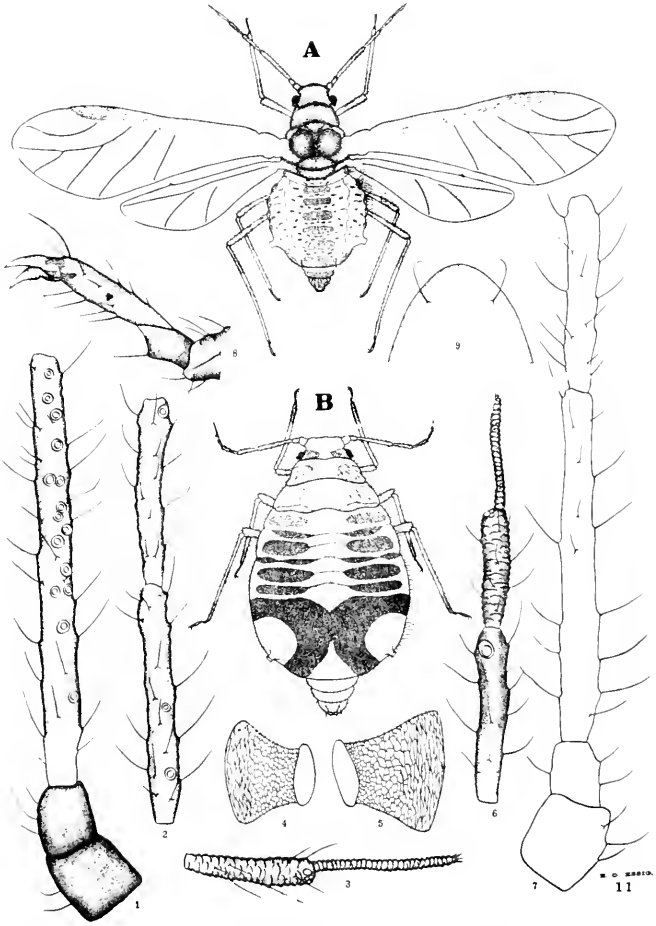

Figure 234. Symdobius salicicorticis Essig

Subcostal exceptionally wide, occupying the entire base of the wing, rich brown. Stigma short, oval, blunt at tip, lower margin as well as apical half of the subcostal with a row of short hairs, entirely brown and of a uniform color, length 0.6 mm., width 0.16 mm. Stigmal vein arising from the middle of the stigma evenly curved throughout its length except the extreme tip, which is curved slightly the opposite way. First discoidal arising from the middle of the subcostal vein, with slight curve near the tip so as to have convex surface towards the wing tip. Second discoidal arises nearly midway between the first and second discoidal, a little nearer the first, undulate, but may be nearly straight. Third discoidal twice forked and fairly constant, obsolete at the base, which is nearly midway between the bases of the second discoidal and the stigmal veins, first fork about one third the distance from the base to the tip of the vein, second fork about half the distance from the first fork to the tip of the upper branch of the second fork, upper branch of second fork longer than the lower. *Secondary*—Length 1.9 mm., width 0.55 mm., with hooklets two-thirds the distance from the base to the tip of the upper margin. Subcostal vein slightly undulate with no strong curves, brown. Discoidals arising, one on each side of the middle of the subcostal, obsolete at the bases, both curved with convex surfaces towards the wing tip, the second vein with more slant towards the wing tip than the first. Veins brown and very faintly clouded. *Style*—Short, rounded or slightly conical, hairy, about as long as the cornicles, dusky green.

APTEROUS VIVIPAROUS FEMALE (Figure 234 B)

Length 3.2 mm., width of the abdomen 1.8 mm. *Body*—Decidedly wide and flat, covered with long fine light hairs, much larger than the winged individuals, naked if taken underground and pruinose if above. *Prevailing color*—Grayish to amber brown with darker brown markings, which may also be nearly black. A thin coating of white powder gives it the gray color. The ground color may vary from a light yellow, pink, or dark amber. *Head*—Nearly trapezoidal in shape with the base and front parallel, wide and flat between the antennae, with very short, indistinct frontal tubercles, reddish or yellowish brown to gray, with two darker spots near the base. *Eyes*—Small, with distinct tubercles, red. *Antennae*—(Figure 234, 6 and 7). Not half as long as the body, on indistinct tubercles, hairy-hairs on tubercles; articles I and II concolorous with head, III and IV transparently yellow to whitish, V dusky yellow with dark amber apical one-half, VI dark amber brown throughout. Lengths of the articles: I, 0.09 mm.; II, 0.07 mm.; III, 0.4 mm.; IV, 0.22 mm.; V, 0.2 mm.; VI, 0.26 mm. (base 0.13 mm., spur 0.13 mm.); total 1.24 mm. The comparative lengths of the articles correspond well with those of the winged females. *Rostrum*—Reaches beyond the third coxae, nearly to the middle of the abdomen, whitish with dark markings at the extreme tip only. *Thorax* and *Abdomen*—Ground color varying from whitish yellow, to rich yellow, amber, reddish brown to gray with distinct darker markings which may be rich dark yellow, brown or nearly black. These markings, usually darker shades of the ground color, are quite variable in extent. The drawing shows an average type. The median dorsum is usually yellow or lighter

from the front to the middle of the abdomen with faint cross-lines connecting darker transverse areas on both sides (usually a single area on the side of each segment) which do not usually extend to the lateral margins of the body, the posterior half of the abdomen is decidedly darker than the rest of the body with light areas surrounding the cornicles and a light pygidium. In not a few individuals this dark area extends forward, covering nearly all of the abdomen, but in such cases the light longitudinal median line is always distinct to the middle of the abdomen. The last two or three segments are extended and much narrower than the rest of the body. This extension is usually light, with dusky, small, anal plate at the tip. *Cornicles*—(Figure 234, 5). Of the same shape as those of the winged females, but larger, marked with mosaic lines, transparently white or yellow. Length 0.1 mm., width of base 0.14 mm., width of mouth 0.08 mm. *Legs*—Rather short and slender, first and second pairs very short, hairy, coxæ dark amber brown, femora dark amber brown, tibiæ yellow with dark brown tips, tarsi brown. *Style*—(Figure 234, 9). Bluntly conical, smooth, short, width of base greater than the length, light yellow, with dusky margins, with very few hairs.

The adult insects move very rapidly and are active for a semi-underground form.

Young—The young vary from almost transparently white to yellow and dark amber, with or without dorsal markings.

Host—Found associated with *Fullawaya saliciradicis* at the surface of the ground, but mostly under ground feeding upon the bark of the Willow (*Salix laevigata* Bebb.). It collects in large colonies, some of which were found four inches under the surface of the sandy soil. The individuals collected underground are not so dark nor so distinctly marked as those taken near the surface. Both winged and apterous females were abundant and were being preyed upon by the larvæ of a red syrphid fly, which has not been determined.

Locality—Collected from the willow trees growing in the sand along the banks of the Santa Clara River in the vicinity of Santa Paula, Cal.

Date of Collection—August 16, 1911. Serial number 11.

This species somewhat resembles *Melanaxarantherium rufulus* (Davidson) in size and general color, but differs in habits and in generic characters as both descriptions show. Fearing that it might be *Melanoxarantherium saliceti* (Harris), specimens were sent to Mr. Davidson at San Jose, who has collected that species at Stanford University. His reply was that No. 11 compared favorably with William's *Chaitophorus bruneri*. Comparing it with this species we note the following differences:

Chaitophorus bruneri Williams	Symdobius salicicorticis n. sp.
Color	
Green, light or very dark.	From a light yellow to amber brown, sometimes with greenish brown cast.
Cornicles	
In apterous form longer than broad.	In apterous form, the base is broader than the length.
In winged form, as long again as broad.	In winged form, the width of the base is much greater than the length.

Hosts	
Feeds on the leaves of *Populus tremuloides*.	Feeds on the bark of Willow (*Salix laevigata* Bebb.), and is a subterranean form, or nearly so.

Williams' description of the specific characters including the lengths of the antennal articles is deficient and a more extensive comparison is impossible. True that in many ways the descriptions agree very well, but from the differences given above and especially its habits, it seems to be a new species.

FULLAWAYA n. gen.

Type F. saliciradicis n. sp.

Body—Robust forms, the body of the winged female narrow at head, but mesothorax, metathorax and abdomen nearly the same width. The body of the apterous female widest at the middle and tapering to a point posteriorly and to a rather broad front anteriorly. Covered with short fine hair and may or may not be slightly pruinose. Large species.

Head—Considerably narrower than the thorax, slightly pointed or straight across the front, with very indistinct frontal tubercles, especially so in the apterous forms. Covered with fine hairs. Nearly quadrangular in shape with the antennae arising from the sides near the front.

Eyes—Large, with terete tubercles on the back margin.

Antennae—In the winged form a little over half the length of the body, not half so long as the body in the apterous form; not reaching beyond the third abdominal segment. Arising from the front sides of the head on very indistinct tubercles, or no tubercles at all. Covered with long hairs, each on a large tubercle. Slightly imbricated and rough because of the hair tubercles. Article I usually shorter than II, never longer than II, though they may be coequal. I always wider, III much longer than either IV or V, though not nearly so long as the two together, not so long as VI, but longer than the spur. IV and V nearly subequal, the former usually a little shorter; VI the longest article, the spur nearly twice as long as the base and nearly coequal with articles IV and V, but usually a little shorter that either. The transition from the base of VI to the spur is not so great as in most aphids, the spur is nearly as wide as the base.

Rostrum—Reaching nearly to the tip of the abdomen, to the tip or even beyond the tip (in the winged and young forms the rostrum may project beyond the tip of the abdomen), but in the robust apterous forms it does not quite reach to the tip. Hairy along margins of the last joint.

Prothorax—Wider than the head, nearly rectangular in shape, with large, semi-globular, lateral tubercles near the middle.

Abdomen—With lateral smaller semi-globular and rather pointed tubercles on each side. Practically all semi-globular in the apterous forms and two semi-globular ones near the middle on each side of the winged forms, the remainder rather pointed. Smooth, covered with fine hair, shiny or pruinose.

Cornicles—Entirely wanting.

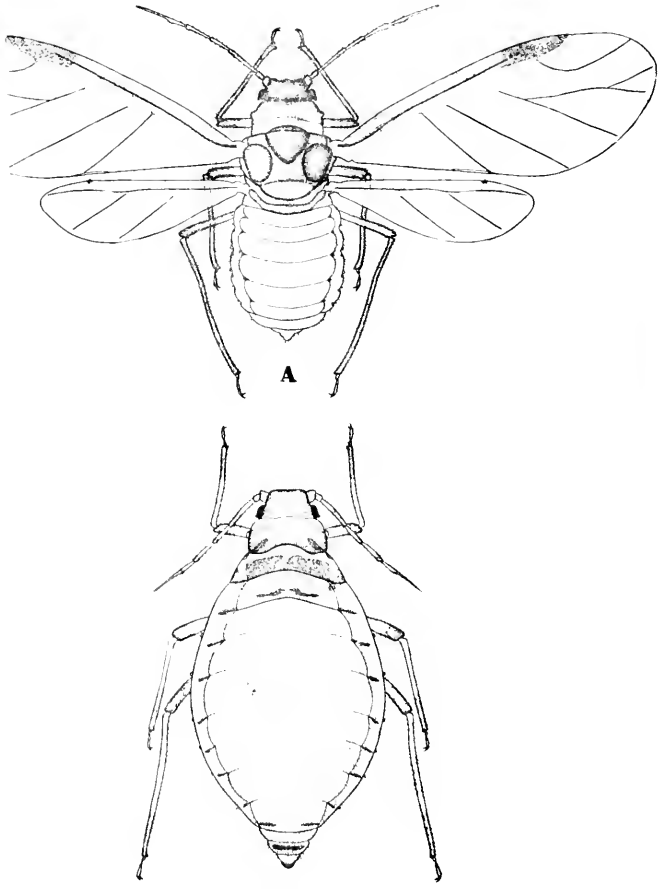

Figure 235. Fullawaya saliciradicis Essig

Legs Larger, the first two pairs nearly of the same size, the hind pair much larger, hairy. Tibia slightly flared at the extreme base. First article of the tarsi very small and scarcely longer on the under side than the width.

Style Broadly rounded, nearly semi-circular, hairy.

Anal Plate Rather large and well developed, nearly semi-circular in form.

Wings Short and broad, with venation fairly constant. Hyaline or dusky subhyaline. Stigma short and bluntly pointed at apex. Stigmal vein arising near the middle of the stigma and deeply curved throughout the first half. First discoidal straight and normal. Second discoidal obsolete at base, straight. Third discoidal normally twice-forked, obsolete at base, first fork near the base and second fork near the apex of the wing. Secondary with two parallel discoidals.

This genus is widely separated from all other genera by its unique combination of distinct characters. It has the rostrum and legs of the genus *Lachnus*, the wing venation of *Chaitophorus* and the body resembles somewhat that of the genus *Aphis*, though there are no cornicles. In considering the antennæ alone the insect might be placed in the tribe *Chaitophorini*, but a study of the individual articles excludes it from *Arctaphis* which has the spur of the sixth segment above five times as long as the segment. In *Chaitophorus* the spur of the sixth segment is about six times as long as the sixth segment and also longer than article III. In *Symdobius* the spur of the sixth segment is shorter than the segment. In *Thomasia* the spur of the sixth segment is shorter than the segment. From the description as given above it seems hardly worth while to make further comparisons with the genera which it most resembles. *Fullawaya* has not the antennæ segmentation, stigma, or stigmal vein of *Lachnus*, nor the specific characters of *Aphis*. Though a subterranean form it has neither the antennæ nor the wing venation of any yet described. In consideration of these facts I have not hesitated to call it a new genus. With others this species was sent to W. M. Davidson of San Jose who writes as follows: "No. 20 is certainly a peculiar insect. I am very glad to have specimens of it. Very likely it is a new genus." The genus is named in honor of Mr. Fullaway, who has worked extensively on the Aphididæ of Hawaii.

Fullawaya saliciradicis n. sp.

(Willow-Root Louse)

WINGED VIVIPAROUS FEMALE (Figure 235 A)

Length of body 3.2 mm., width of mesothorax 1.4 mm., width of the abdomen 1.35 mm., wing expansion 9 mm. A large and robust species. *Body* Smooth, covered with fine hair and purvelent throughout. *Prevailing color* Black and silvery gray which is due to a heavy coating of fine powdery white wax. Some specimens are almost entirely destitute of any of this powder. *Head* Nearly twice as wide as long, dull black, with very indistinct or no frontal antennal tubercles, fine hair on the front. *Eyes* Dark red with distinct marginal tubercle. *Antennæ* (Figure 236, 8 and 9). On indistinct frontal tubercles, half or a little longer than half as long as the body, reaching to the base of the third abdominal segment; covered with long hair; color of segments: I and II

dusky amber, darker than any of the rest; III, IV, V and VI amber brown. Lengths of the articles: I, 0.12 mm.; II, 0.12 mm.; III, 0.46 mm.; IV, 0.38 mm.; V, 0.38 mm.; VI, 0.6 mm. (spur 0.36 mm.); total 2.06 mm. Sensoria are distributed as follows: from fourteen to sixteen large circular ones irregularly situated on III, thickest near the middle of the article, sensoria uneven in size; one large sensoria at apical end of V, and one large and six small ones in process of article VI. *Rostrum*—Very long reaching to or almost to the tip of the abdomen, yellow with dark tip, margins of tip hairy. *Prothorax*—Much wider than

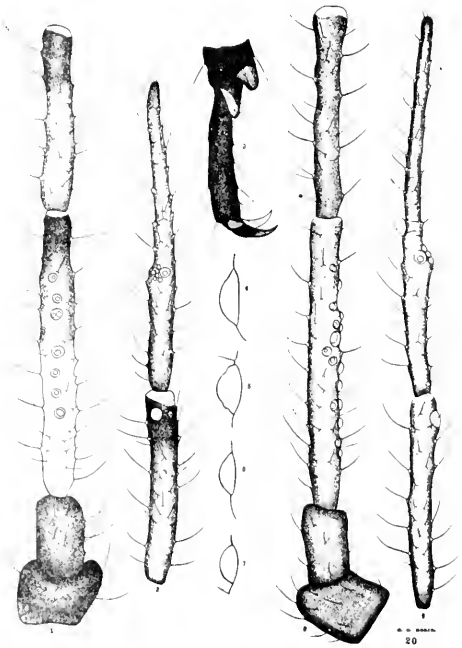

Figure 236. Fullawaya saliciradicis Essig

the head and nearly as wide as the mesothorax, with large oval lateral tubercle (Figure 236, 5) near the middle margin, very dark, almost black with brown side and lighter basal transverse band. *Meso-* and *Metathorax*—Dark reddish brown with muscle lobes, except scutellum, velvety black and covered with fine hair. Scutellum grayish brown, hairy. *Abdomen*—Thick, nearly the same width throughout and rounding off abruptly at posterior end, ground color reddish brown, amber or nearly flesh color, covered with fine white powder which is specially thick in the depressions between the segments, lateral margins with

pointed and rounded tubercles, those near the middle are rounded (Figure 236, 7) while those near the base and the pygidium or posterior end are more or less pointed as in many of the species of genus *Aphis*. In no other case have I ever seen these semi-globular tubercles on either the thorax or the abdomen; there is also a row of lateral marginal dark spots on each side near the base, or slightly behind the base, of each tubercle. Anal plate is rounded, hairy and dark. Ventral surface of the abdomen is same as the dorsal. *Cornicles* Wanting. *Legs*—Rather long and very hairy, hind legs much longer than the rest; coxæ amber, covered with powder. Femora, bases yellow with remainder amber brown, tibiæ dark amber brown, tarsi (Figure 236, 3) dark amber brown, first article very short, ventral surface as long as the width. *Wings* Rather shorter and wider than common, hyaline or dusky sub-hyaline. *Primary*—Length 4 mm., width 1.7 mm. Costal wide to the stigma, brown; subcostal wider than costal with vein area in middle distinct, brown; stigma short, oblong, nearly four times as long as wide, widest at base of stigma which is near the middle, rounds off to a blunt point near the apex, wing margin contracted at the apex of the stigma, dusky brown, length 0.85 mm., width 0.25 mm.; venation normal and fairly constant considering that this is a subterranean form; stigmal vein arising from the middle of the stigma sharply curved, downward and upward bend throughout the first half and nearly straight throughout the apical half, although there is a slight curve upwardly, brown, reaches the wing margin beyond half the distance from the stigma to the apex of the wing. First discoidal arises inside the middle half of the subcostal and is nearly straight, base connected to the subcostal by a dark or dusky area or an extension of the subcostal area, brown, sometimes curved slightly outwardly with the convex surface towards the body. Second discoidal obsolete at the base, straight, apex meets the wing margin midway between the apices of the first and third discoidals, brown, seldom even slightly curved. Third discoidal sometimes slightly variable, base obsolete, the third vein proper continuing to the wing margin in a direction nearly parallel to the second discoidal, though the apex gradually tapers towards the tip of the wing, in one instance this tip was forked thus making three forks in all (this is the only instance where this vein has been found forked), normally twice-forked, the first branch arising about one-third the distance from the base to the apex, this branch extends in almost a straight line towards the apex and does not branch until near the tip—about two-thirds its distance from the first fork, brown. *Secondary*—Length 2.5 mm., width 0.7 mm., subcostal vein distinct and with two downward curves, one at the base of each of the two discoidals, and with two upward curves, one between the discoidals, and one under the hooklets, basal half is bordered by a rather wide brown area not unlike that of the subcostal in the primary wings; discoidals are obsolete at the base and run parallel; first discoidal arises just within the basal half of the subcostal, and the second discoidal just outside the basal half of the subcostal vein; all veins brown. *Style* Short rounded, concolorous with the body, hairy.

APTEROUS VIVIPAROUS FEMALE (Figure 235 B)

Length of body 4.5 mm., width of abdomen 2.25 mm. A larger form than the winged female with more robust body. *Body*—Smooth, even shiny, covered with fine soft hairs, often pruinose, especially if found near the surface of the soil—in some cases densely covered with fine white powder, widest at middle and tapering towards both ends. *Prevailing color*—From a yellowish white, to flesh, rose, or grayish or even silvery due to the covering. The forms taken from deep under ground are very light and almost colorless and always without the pruinose substance. *Head*—Gray or dusky, with broad straight front and little or no signs of antennal tubercles, nearly quadrangular in shape, wider than long, with narrow

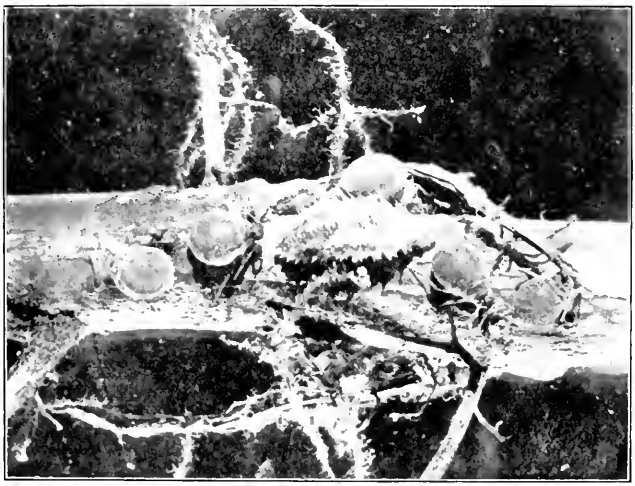

Figure 237. Fullawaya sal.ci-radicis Essig
On root of willow. Showing adult apterous viviparous females and a large horny larva of the red syrphid fly, which is the only natural enemy found preying on this aphid.

lighter band across the base. *Eyes*—Dark red, rather large, with tubercle. *Antennae* (Figure 236, 1 and 2). Not half as long as the body, usually reaching to the middle of the second abdominal segment, hairy, the transition from the article VI to the spur very gradual; articles I and II dark gray, concolorous with head, III yellow with apical one-half amber, tip of segment distinctly constricted from last sensoria to the tip, IV, V and VI dusky amber with slightly darker tips. Lengths of the articles: I, 0.07 mm.; II, 0.13 mm.; III, 0.45 mm.; IV, 0.29 mm.; V, 0.30 mm.; VI, 0.49 mm. (spur 0.29 mm.); total 1.73 mm. Thus it will be seen that I is shorter than II, while in the winged form they were subequal; III is longer than IV or V but not so long as both together, neither is it

so long as all of VI, but is longer than the spur; IV is slightly shorter than V, but these are approximately subequal; VI is not so long as IV and V together, though much longer than either; the spur is not quite twice so long as the base and is not so long as the base and V together. On article III there is usually a single row of circular sensoria, usually from four to five, but often with but two and again with seven, as shown in the drawing; V has large sensorium near apical end and several (one large and six small) in the process of VI. *Rostrum*—Nearly as long as the body, and in the younger forms longer, color of the body or lighter with dark hairy tip. *Prothorax*—With rounded lateral tubercle (Figure 236, 4), much wider than the head and about as wide, with light anterior portion and dull gray basal two-thirds, with lateral dark spot on each basal side. *Mesothorax*—Light at anterior end, one-third with dark lateral spot on each margin, with also a basal lateral dark blotch which extends on to the metathorax, and a large dark median basal blotch covering nearly the entire dorsum. *Metathorax*—With a continuation of the black blotch from the mesothorax and two median transverse dark bands near the basal border which do not touch in the middle. *Abdomen*—With a uniform pale color of from almost transparent white to a flesh, rose, gray or lead color, with a row of lateral dark spots at the union of the segments and a median dark band on the last segment and a dark tipped style. Ventral surface of a uniform color such as the ground color of the dorsum, it is more liable to be pruinose. With large semi-globular lateral tubercles (Figure 236, 6) as described in the winged form. Anal plate well rounded, dusky, hairy. *Cornicles*—Entirely wanting. *Legs*—Rather stout and hairy; coxæ light yellow, pruinose; femora yellow with dusky tips; tibiæ amber brown with dark brown tips; tarsi dark brown. *Style*—Short, rounded, dull grayish brown, hairy.

Young—The young resemble the adult apterous females in color, being somewhat lighter.

Both the winged and apterous forms are rather slow and sluggish in their movements, but drop from the roots as soon as they are disturbed.

Host—Taken from the roots of the common Willow (*Salix laevigata* Bebb.), near the surface and as far as from fourteen inches under ground. They are found in light sandy soil along the river banks. It is a bark feeder and no forms were found above ground. They occur in rather large and compact colonies, but may also be very scattered (Figure 237).

Locality—Along the banks of the Santa Clara River, near Santa Paula, Cal.

Date of Collection—August 16, 1911. Apterous forms were fairly abundant, but the winged females scarce. Associated with another Aphid, No. 11. Serial number 20.

Thomasia crucis n. sp.

WINGED VIVIPAROUS FEMALE (Figure 238 A)

Length of body 1.2 mm., width of the mesothorax 0.35 mm., width of the abdomen 0.54 mm., wing expansion 3.84 mm. *Body*—Small, distinctly marked and colored, covered with long curved spines, flat, and rather short, but wide. *Prevailing color*—Rich green and black. *Head*—Large, rounded in front, nearly as long as wide, without antennal tubercles, dorsum very dark olive green to

black, ventral surface very dark, front hairy. *Eyes*—Large, with distinct tubercles, dark red. *Antennae*—(Figure 238, 1 and 2). Reaching to the base of the abdomen, slightly longer than half the length of the body, arising from the head just in front of the eyes, all except first two articles imbricated, covered with a few long spines. Articles I and II dusky yellow or amber, III light at base with amber or very dark apical four-fifths and the extreme tip darker, IV, V and VI dark throughout. Lengths of articles: I, 0.05 mm.; II, 0.045 mm.; III, 0.205 mm.; IV, 0.1 mm.; V, 0.08 mm.; VI, 0.21 mm. (base 0.07 mm., spur 0.14 mm.); total 0.69 mm. Articles I and II are often the same length, but the former is always much wider; III is not quite so long as VI, though very nearly so, but is much longer than the spur, IV is equal to or slightly longer than V, each of

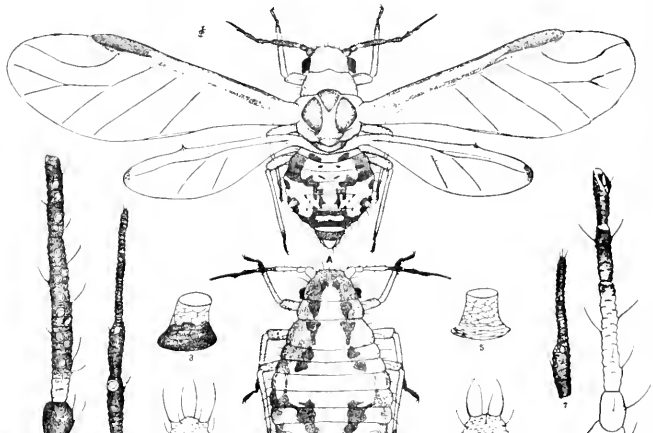

Figure 238. Thomasia crucis n. sp.

which is about half of III or VI. The sensoria are large and circular, being arranged irregularly on articles III, IV, V and in the process of VI as follows: from four to nine. Forty-four articles were examined and the following number of sensoria recorded: three had four, three had five, eleven had six, eight had seven, sixteen had eight, and three had nine, four had from one to three, sixteen were found with one, twenty-four with two, and six with three; V has from one to two—twenty-eight had one, and thirteen had two; article VI has the usual number (five to six) at the base of the spur. On III the sensoria are situated usually within the apical two-thirds; on IV there is usually one in the middle and the others within the apical one-half; on V there is usually one in the middle

and the other near the apical end. *Rostrum*—Reaches to the second coxæ, light green with dusky tip. *Prothorax*—Without lateral tubercle, wide and short, hairy, dark green with lighter green transverse strip at apical border, ventral surface dusky green. *Mesothorax*—Dark green with muscle lobes black, or nearly so, ventral surface very dark with green area connecting the coxæ. *Metathorax*—Dark green with muscle lobes nearly black. *Abdomen*—Well rounded and flat, covered with long spines, light green with dark dorsal markings—there are three large distinct green areas, one on the middle dorsum at the base and one surrounding each cornicle, with lesser areas as shown in the drawing. Ventral surface light green. Anal plate well rounded or slightly depressed near the middle, dusky or light green. *Cornicles*—(Figure 238, 3). Short, base much wider than the mouth, gradually narrowing from base to the tip and smallest at mouth, which is not flared, covered with fine network of lines, basal half dusky, apical half green to yellowish, length 0.065 mm.; width at base 0.075 mm., width at mouth 0.04 mm. *Legs*—Short, stout, hairy, light, with coxæ dusky green, femora dark amber brown, tibiæ light amber with dark bases and tips, tarsi dark brown. *Wings*—Rather long for so small an insect, narrow, hyaline, venation variable, but usually of the normal "Chaitophorus" type. *Primary*—(Figure 239, 1 to 11). Length 1.75 mm., width 0.63 mm. Costal vein wide to stigma, light amber to yellow; subcostal twice as wide as costal and of same color; first discoidal arises near the middle of the subcostal and is usually straight though in many cases it curves with the convex surface towards the tip of the wing (in one case this is reversed—right wing of pair 3); second and third discoidals with a tendency to unite at their bases (Figure 239, 6, 7, 10 and 11), though normally they are separated. Second discoidal curved or straight—when curved, with the convex surface towards wing tip, the base usually midway between the bases of the first and third discoidals, but a little nearer the latter, tip may show a tendency to fork as shown in 2, 5, 6 in Figure 239. In one instance (Figure 239, 2) there is a strange figure connecting the first and second discoidals; third discoidal very abnormal and variable as shown in the drawings. It may be once, twice or thrice forked. In the normal vein (if there be such) the first fork is just inside the middle and the second fork near the middle of the second branch. In not a few wings there are faint but distinct clouded borders along the stigmal and discoidal veins, darkest along first discoidal. Stigma short, oblong with blunt tip, margin of the wing is depressed or set in at the apex of the stigma, color dusky with basal margin lighter and hairy. Stigmal vein arising just beyond the middle of the stigma, mostly curved throughout the first half, slightly undulate, long, apical half nearly parallel with the upper branch of the second fork of the third discoidal. Tips of the veins often clouded. *Secondary*—Length 1.1 mm., width 0.31 mm., normally with two discoidals, though out of some fifty mounted specimens two wings were found without either discoidal, and five wings were found with only one discoidal and that the first one. Subcostal is always present and curved downward under the hooklets, reaches to tip of wing which has a dusky spot at its apex. First discoidal arising from the subcostal just inside its middle, straight, short, does not reach to the wing margin. Second

discoidal arises just outside the middle of the subcostal, obsolete, just a base, curves so as to have convex surface towards tip of wing, no longer than the first discoidal. All veins brown. *Style*—(Figure 238, 4). Short, wider at the base than at the apex, which is nearly straight across, rough, with long hairs or spines, green, length 0.07 mm., width at base 0.08 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 238 B)

Length 1.3 mm., width of the abdomen 0.7 mm. *Body*—Flat, widest just in front of the cornicles, covered with long curved hairs or spines, well segmented, very small. *Prevailing color*—Rich green with a distinct light green or yellow cross on the dorsum (hence the name *crucis*), light spots or areas

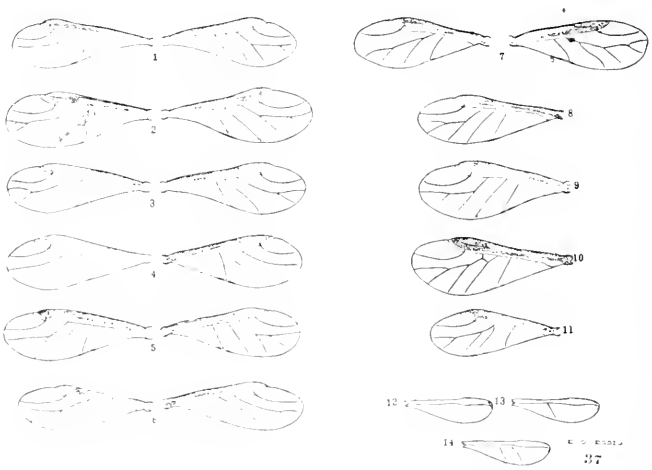

Figure 239. Thomasia crucis n. sp.

around the bases of the cornicles and a light posterior spot. The main axis of the cross extends in a longitudinal line on the dorsum from the base of the head to the end of the style, while the cross bar is a transverse band across the middle of the body. Surrounding the light area of the cross are dark green areas, which are darker than the rest of the body and which help to bring out the distinctness of the markings. Due to the smallness of this species the cross cannot be distinctly seen without the air of a hand lens. *Head*—Large, considerable wider at the base than at the front, rounded between the antennæ, which are far apart, covered with long hairs, dark green with median base lighter. *Eyes*—Large, dark red, distant from the bases of the antennæ. *Antennae*—(Figure 238, 7 and 8). Reaching to the middle of the abdomen, slightly longer than half the length of the body, with few long hairs or spines, imbricated, light yellow with the tip

of III dusky amber, IV slightly dusky throughout with very dark tip, V and VI very dark throughout. Lengths of the articles: I, 0.05 mm.; II, 0.05 mm.; III, 0.138 mm.; IV, 0.07 mm.; V, 0.07 mm.; VI, 0.175 mm. (base 0.065 mm., spur 0.11 mm.); total 0.553 mm. Articles I and II usually equal in length, with the former much wider; III nearly twice as long as either IV or V, but not so long as VI, though shorter than the spur; IV and V coequal, and both short, each being but slightly longer than the base of VI; VI longer than III, the spur nearly twice as long as the base. Sensoria normal on V and in the process of VI. *Rostrum*—Reaching nearly to the third coxæ, green with amber base and dark tip. *Thorax*—Green with light yellow upper portion of the cross on the medium dorsum, ventral surface green. *Abdomen*—Green, the basal portion bearing the transverse bar of the yellow cross and the posterior portion bearing the lower main axis of the cross, a light spot at each end of the transverse bar, and light areas around the inner bases of the cornicles, covered with long curved spines. Ventral surface of a uniform dull green. Anal plate well developed and rounded, green. *Cornicles*—Light yellow or very light yellowish green, wider at the base than at the apex, not constricted before mouth, which is not flared, surface covered with a fine network of lines, which form a mosaic near the apex. Length 0.06 mm., width of base 0.07 mm., width of the mouth 0.04 mm. *Legs*—As in the winged forms. *Style*—(Figure 238, 6). Rounded at tip with sides nearly parallel, rough, spiny, little wider at the base than at the tip, green, length 0.07 mm., width of base 0.07 mm.

Young.—The young vary from a light yellow to a light green, usually have dusky head, antennæ, tips of tarsi and tibia. The heads in the older individuals have a light dorsal, median line.

Host.—This species has been observed feeding only on the undersides of the leaves of the White Willow (*Salix macrostachya* Nutt.), on which it collects in dense colonies and produces considerable smutting.

Locality.—On the white willows growing along the banks of the Santa Clara River in the vicinity of Santa Paula, Cal.

Date of Collection.—August 25, 1914. Serial number 37.

In general appearance this insect at first appears to be *Eichochaitophorus populifolii*, because of the light dorsal markings and the size, but as shown by the descriptions, is quite distant from that species. I know of no other species which is even near to the one just described.

SOME LEPIDOPTERA FROM MEXICO

HARRISON G. DYAR
U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

Prof. C. F. Baker has handed me for identification a lot of *Lepidoptera*, taken in Mexico by Messrs. McConnell and D. L. Crawford. The following species are represented:

NYMPHALIDAE

Phyciodes elada Hewitson, two ♂♂, Guadalajara (McConnell).

LYCAENIDAE

Lycaena marina Reakirt, one ♂, Guadalajara (McConnell).

SYNTOMIDAE

Chrysocale principalis Walker, two ♀♀, Oaxaca (Crawford).
Syntomeida melanthus Cramer, one ♀, Vera Cruz (Crawford).
Dinia ægrus Cramer, two ♂♂, Tapachula, Chiapas and Vera Cruz (Crawford).
Sphecosoma cognata Walker, one ♂, one ♀, Vera Cruz (Crawford).
Isanthrene perboscei Guerin, one ♀, Jalapa (Crawford).

LITHOSIIDAE

Ptychoglene hæmatodes, n. s.

Black; forewing with a large crimson patch, occupying most of the wing, leaving a very narrow black costal edge, a broader inner margin and a rather wide outer margin, which is oblique, widening toward tornus; the patch varies in size in the individuals, in some extending down only to submedian fold, in others to vein one or below; the outer margin is a little indented at about vein four. Hind wing with a broad costal ray, not attaining apex, nor crossing cell.

Seven specimens, mountains near Cuernavaca (Crawford); Popocatepetl Park, 8000 feet, June, 1906 (W. Schaus); Salazar, 10,000 feet (W. Schaus).

Type No. 11429, U. S. National Museum.

Nearest to *P. erythrophora* Felder, but the red patch much larger.

ARCTIIDAE

Apantesis proxima Guerin, one ♀, Vera Cruz (Crawford).

NOCTUIDAE

Chloridea obsoleta Fabricius, one ♂, Cuernevaca (Crawford).
Eupanychis mexicana Hampson, one ♀, Cuernavaca (Crawford).
Prorachia daria Druce, one ♂, one ♀, Cuernavaca (Crawford).
Oxycnemis mexicana Dyar, one ♀, Cuernavaca (Crawford).

Pleonectyptera cuernavacalis, n. s.

Brown, not reddish; lines pale, even, the outer a little bent over cell, marked on the costa with blackish shades; reniform present, dark brown filled; subterminal line irregular, powdery, dotted, with a rounded black cloud at veins 3-4.

Hind wing more grayish but dark, whitish only on the disk, with a faint dark discal mark and an outer mesial pale line. Abdomen with a lateral tuft of black hair near base. Expanse, 23 mm.

Male, Cuernavaca (Crawford).

Type No. 14430, U. S. National Museum.

The species resembles *P. cumulalis* Dyar, but the subterminal line is broken powdery and indistinct.

Yrias prophronis, n. s.

Dark, lustrous, violaceous brown; lines black; inner irregularly flexuous; reniform upright, narrow; outer line excurved over cell and inward to near origin of vein two, then to inner margin with a slight out-curve; subterminal lines wavy, pale. In the male, the tint is light violaceous, the subterminal line slightly relieved. The hind wings in this sex have three nearly straight black lines across the middle and a subterminal light macular one; a crenulate terminal black line on both wings. In the female the color is darker, more irrorate with blackish; a dark shade occupies the space between the outer and subterminal lines, the latter being rather distinctly relieved. The hind wing is also more darkly shaded than in the male, only the outer of the three median lines distinct, while the subterminal punctiform line has a crenulate black inner edging. Expanse 24 mm.

Two males, one female, Cuernavaca (Crawford).

Type No. 14434, U. S. National Museum.

Near to *Y. repentis* Grote, but the outer line is less indented and angled, while the sexual dimorphism is rather pronounced.

PYRALIDAE

Glyphodes quadristigmalis Guenée, one ♂, two ♀♀, Cuernavaca (Crawford).

Glyphodes infimalis modialis, n. subs.

Like *G. infimalis* Guenée in markings, but larger and of more robust build. Expanse 25 mm.

One male, Cuernavaca (Crawford). ♂♀

Type No. 14433, U. S. National Museum.

Loxostege autocratoralis, n. s.

Fore wing yellow, the costa yellow-brown; inner line nearly perpendicular to costa, a little curved; orbicular and reniform brown, solid; outer line excurved over cell to vein two, then perpendicular to inner margin; subterminal line brown, slender, close to the brown-shaded margin. Hind wing subhyaline whitish, shaded with yellow; a brown line on the disk, slightly crenulate over the nervules, stopping below vein two, where it is sharply bent upward; a brown marginal band, the fringe more reddish brown. Expanse 20 mm.

One female, Cuernavaca (Crawford).

Type No. 14432, U. S. National Museum.

Near *L. mancalis* Lederer, but the markings more distinct, the subterminal line narrow and close to the margin.

ZYGAENIDAE

Gingla phonicoruma, n. s.

Black; abdomen crimson except the basal and last two segments. The wings are without markings; fore wing with veins 7-8 stalked; hind wing with veins six and seven separated, vein eight with a long oblique cross-bar to end of cell. Expanse 16 mm.

One female, mountains near Cuernavaca (Crawford).

Type No. 11134, U. S. National Museum.

SESIIDAE

Four specimens, too much injured for identification.

GELECHIIDAE

Avacampsis, n. s.

Cuernavaca (Crawford). The specimen has been turned over to Mr. August Busck, to be described later in another connection.

STUDIES IN ACARINA III

H. V. M. HALL
POMONA COLLEGE, CLAREMONT, CAL.

Notaspis pectinata n. sp

(Figure 240)

Length 750 to 865 micrm. Yellow brown, smooth, polished. Abdomen hemispherical, without wings. Cephalothorax broader than long. Lamellæ slight ridges converging in front where they are united by a translamellar line about as long as the lamellæ. The cusps are reduced to mere tubercles. Lamellar, interlamellar and rostral hairs long, stout and pectinate, the rostral hairs being less than half as long as the others. Pseudostigmatic organ pectinate, with rather

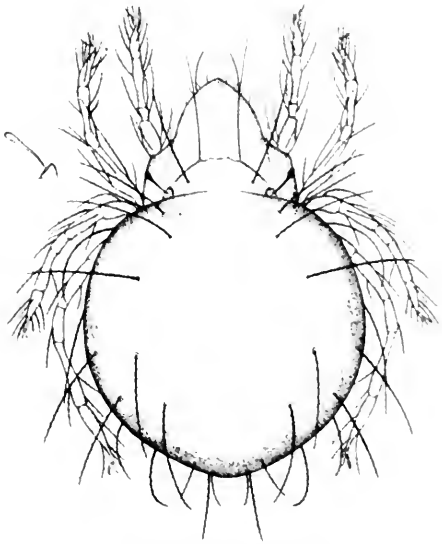

Figure 240. Notaspis pectinata n. sp.

long peduncle and very gradually clavate head. Abdomen with two rows of stout pectinate hairs on each side, similar to the interlamellar hairs. Legs not quite so long as abdomen, sparsely set with pectinate hairs similar to the rostral hairs. Unguis tridactile, last three pairs of legs inserted at the edge of the body. No blades apparent on femora. Several specimens under boards, Claremont, Cal.

This species is almost identical with Pergande's figure of *Eremaeus pilosus* in Bank's "Treatise." My specimens lack the simple bristle on the apex of the penultimate joints of the legs, and the body is slightly broader. Michael's key places this species as a *Notaspis*, close to *N. serrata*. The species *E. pilosus* is referred to by Banks in his Catalogue to his description of *Scutovertex pilosus*

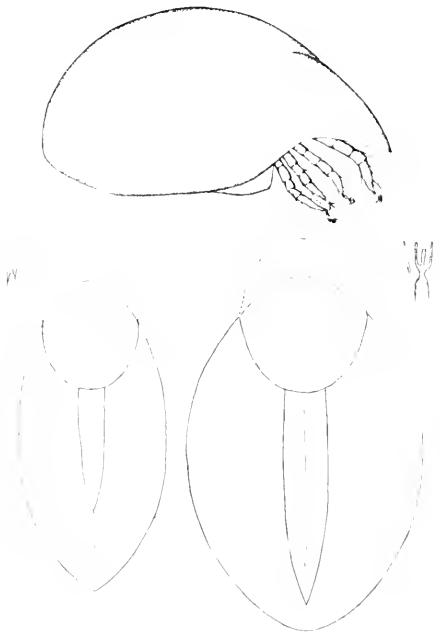

Figure 241. Phthiracarus retalticus (on left); Phthiracarus contractilis (on right); Phthiracarus retalticus (side view, above).

in Trans. Amer. Ent. Soc. XXII, p. 11, which as Michael remarks is "apparently not a *Scutovertex*, probably a *Notaspis* (said to be so by Banks, in litera)."

I also present the following illustrations of mites which I have identified as:

Phthiracarus retalticus (Stoll)

(Figure 241)

This species was described from Guatemala. My specimens were found under drift-wood on salt marsh, Pawson Park, Conn., during August. The length of my specimens (from tip of abdomen to dorsal suture) is 685 micrm.

Phthiracarus contractilis (Perty)

(Figure 241)

This species was described from decayed wood in Germany. My specimens were found under drift-wood on salt marsh, Pawson Park, Conn., in August. Length of my specimens is 838 microm. to 1 mm. (measured from tip of abdomen to dorsal suture). The side view is identical with *P. retalticus*. Differs from that species as shown in figures by rounded tip of abdomen and different forms of unguis as shown in the corresponding small figures. The ventral views, with cephalothorax closed down are shown, while the position of the cephalothorax when open is indicated by the dotted line.

Figure 242. Rhizoglyphus longitarsus var. californicus n. var.

Rhizoglyphus longitarsus var. californicus n. var.

(Figure 242)

Differs from the species as described by Banks in the following particulars:

The bristle at the tip of the penultimate joint is not as long as the tarsus. The two spines on the hind tarsus are proximal to the middle of that joint. Length of my specimen, a male, .7 mm. Tarsus I in my specimen is much longer and thinner than that illustrated by Banks in Bulletin 13. Tarsus I also has a curved spine at the tip which is almost as large as the claw.

Sent from Banning, Cal., where a colony was injuring the bark of an apple tree.

DIARTHRONOMYIA CALIFORNICA n. sp. (Diptera, Itonidæ)

DR. E. P. FELT
STATE ENTOMOLOGIST, ALBANY, NEW YORK

The species described below was reared by Mr. C. F. Stahl, March 12, 1912, from galls on *Artemisia californica*, at Claremont, Cal. This species is most easily separated from *D. artemisiae* Felt, by the smaller number of antennal segments.

Gall—Length 1.5 mm., diameter .5 mm. A brownish or reddish, sub-conical, thin-walled growth protruding at an oblique angle from the under side of the narrow leaflets. The slender, darker tip of this monothalamous gall is pushed off by the escaping midge.

Male—Length 1.25 mm. Antennæ nearly as long as the body, sparsely haired, fuscous yellowish; fourteen segments, the fifth with a stem three-fourths the length of the cylindric basal enlargement, which latter has a length nearly twice its diameter; terminal segment reduced, obtuse. Palpi probably biarticulate. Mesonotum reddish brown. Scutellum yellowish red, postscutellum fuscous. Abdomen yellowish. Wings hyaline, costa light straw. Halteres probably pale yellowish. Coxæ and legs apparently fuscous yellowish, the claws slender, unidentate, the pulvilli shorter than the claws. Genitalia; basal clasp segment stout; terminal clasp segment short, greatly swollen; dorsal plate short, deeply and roundly emarginate, the lobes broadly rounded; ventral plate short, broadly and roundly emarginate, the lobes narrowly rounded.

Female—Length 1.5 mm. Antennæ extending to the base of the abdomen, sparsely haired, yellowish; fourteen subsessile segments, the fifth with a length nearly twice its diameter; terminal segments slightly produced, tapering. Color characters nearly as in the male, except that the abdomen is deep reddish, the ovipositor nearly as long as the body, being yellowish; terminal lobes narrowly oval, with a length nearly twice the width. Type Cecid a2269.

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Pomona College,

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VOLUME FOUR NUMBER THREE

Pomona College Journal of Entomology

NOVEMBER 1912

Contents

1 FELT, E. P. — The Gall Midge Fauna of Western North America
2 ESSIG, E. O. — Aphididae of Southern California X
3 KELL, D. — The "Longulus" Scale
4 SCHRADER, WILHELM — Cool Air Experiments With Junonia Coenia
5 BRYANT, H. C. — Some Insects and Other Arthropods in the Diet of the Western Meadowlark
6 HILTON, W. A. — Sensory Setae of Tarantula and Some of Its Relatives
7 LONGSTAFF, C. B. — Butterfly Hunting in Many Lands (Book Review)
8 GRINNELL, FORDYCE — West Coast News Notes

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Pomona College Journal of Entomology

Volume IV NOVEMBER 1912 Number 3

THE GALL MIDGE FAUNA OF WESTERN NORTH AMERICA

E. P. FELT, ALBANY, N. Y.

The following list summarizes our knowledge of the gall midges in the western half of North America and should be of service in directing the efforts of future investigators. There are in the Lestremiinae, no representatives of the genus Catocha, Neptunimyia and Neocatocha, while the five American genera referable to the Heteropezinae are remarkable for their absence from the list. Investigation in the eastern United States shows that Miastor, with its peculiar pedogenetic larva, is widely distributed, and it and its allies should be found in the moister wooded areas of the west. There are eight American genera of Epidosariae known, only three represented by four species having been recorded from the west. The oak flora must support a characteristic Cinctiocornia fauna, yet none have been recorded, while the allied Schizomyia is represented by only one species. The prolific and varied Itonidinariae are represented by relatively few species. The list is longer than we anticipated, yet it must be considered as only an introduction to what systematic collecting will disclose.

LESTREMIINAE

Lestremia barberi Felt, New Mexico.
L. kansensis Felt, Kansas.
L. dyari Felt, Kaslo, B. C.
L. vernalis Felt, Kansas.
Microcrata cockerelli Felt, New Mexico.
M. spinosa Felt, Texas.
M. texana Felt, Texas.
Joannissia neomexicana Felt, New Mexico.
Mycophila fungicola Felt, reared from mushrooms, California.
Campylomyza texana Felt, Texas and Colorado.
Prionellus sitkana Felt, Kokanee Mountain, B. C.
P. monilis Felt, Texas.
P. simulator Felt, Kaslo, B. C.
P. boulderensis Felt, Colorado, Oregon.
P. montana Felt, Colorado.
Monardia tuckeri Felt, Texas.
Cordylomyia brevicornis Felt, Kaslo, B. C.

C. coloradoensis Felt, Colorado.
C. kaslonsis Felt, Kaslo, B. C.
Corinthomyia curreí Felt, Kaslo, B. C.

ITONIDIDINAE
EPIDOSARIAE

Porricondyla tuckeri Felt, Kansas, ? New Mexico.
P. barberi Felt, Arizona.
Dirhiza hamata Felt, Kaslo, B. C.
Holoneurus occidentalis Felt, Panama.

DASYNEURIARIAE

Rhabdophaga racemi Felt, reared from a small, clustered, rosette gall on willow, Manitoba.
R. rosacea Felt, reared from loose apical bud gall on wild rose, Manitoba.
R. californica Felt, California.
R. occidentalis Felt, California.
R. normaniana Felt, reared from a small apical gall on willow, Manitoba.
R. rhodoides Walsh, reared from a large, loose gall on willow, Manitoba.
Dasyneura glandis Felt, reared from acorns, Missouri.
D. yuccae Felt, reared from pods of Yucca angustifolia.
D. pergandei Felt, reared from fruit of wild cherry, Colorado.
D. californica Felt, reared from bud galls on willow, California.
Lasiopteryx schwarzi Felt, reared from decaying wild fig branch, Panama
L. arizonensis Felt, Arizona.
Diarthronomyia artemisiae Felt, reared from sage bush, Colorado.
D. californica Felt, reared from a leaf gall on Artemisia, California.
Cecidomyia erii Felt, reared from *Erium lichtensioides* Ckll. on Artemisia, California.
Lasioptera quercifloraе Felt, reared from galls on oak blossoms, Arizona.
L. allioniae Felt, reared from a stem gall on Oxybaphus (Allionia), Colorado.
L. arizonensis Felt, reared from stem gall on Senecio, Arizona.
L. ephedrae Ckll., reared from stem gall on Ephedra, New Mexico.
L. spinulae Felt, reared from stem galls on unknown plant, Arizona.
L. willistoni Ckll., reared from twig galls on Atriplex, New Mexico.
L. ephedricola Ckll., reared from twig gall on Ephedra, New Mexico.
L. tripsaci Felt, reared from leaf blades on Tripsacum, Texas.
L. cassiae Felt, reared from stem galls on Cassia, Arizona.
L. murtfeldtiana Felt, reared from sunflower seeds, Kansas.
L. verbenae Felt, reared from flower stalk gall on Verbena, California.
L. diplaci Felt, reared from avoid stem gall on Diplacus, California.
Neolasioptera trimera Felt, reared from stem gall on sunflower, Arizona.
N. major Felt, Colorado.

N. hirsuta Felt, reared from stem gall on unknown plant, Arizona.

N. coloradensis Felt, Colorado.

N. erigerontis Felt, reared from stem gall on Erigeron, Missouri.

N. mimuli Felt, reared from twig gall on Mimulus, California.

Asteromyia chrysothamni Felt, reared from leaf of Chrysothamnus, Colorado.

A. agrostis O. S., reared from gall on Muhlenbergia, New Mexico.

A. rubra Felt, reared from blister gall on Solidago, Missouri.

A. grindeliae Felt, reared from blister leaf gall on Grindelia, California.

OLIGOTROPHIARIAE

Phytophaga californica Felt, reared from currant, Ribes, California.

P. rigidae O. S., reared from club-shaped twig gall on willow, Manitoba Missouri.

P. celtiphyllia Felt, reared from oboenic leaf gall on Celtis, Iowa.

P. perocculta Ckll., reared from stem galls on willow, Colorado.

Janetiella coloradensis Felt, reared from oval swelling at base of pine needles, Colorado.

Oligotrophus betheli Felt, reared from bud gall on Juniperus, Colorado.

Rhopalomyia californica Felt, reared from Baccharis, California.

R. cockerelli Felt, reared probably from heads of Senecio or aster, Colorado.

R. crassulina Ckll., reared from bud galls on aster, Colorado.

R. gnaphalodis Felt, reared from a woolly, polythalamous gall on Artemisia, Colorado.

R. bigelovioides Felt, reared from galls on Bigelowia, California.

R. pilosa Felt, reared from dense, woolly apical gall on ? Antennaria, North West Territory.

R. cruziana Felt, reared from Solidago, California.

R. betheliana Ckll., reared from flower gall on Artemisia, Colorado.

R. alticola Ckll., reared from globular, woolly gall on Artemisia, Colorado.

R. gutierreziae Ckll., reared from oval flower galls on Gutierrezia, New Mexico.

R. bigeloviae Ckll., reared from gall on Bigelowia, Colorado.

R. audibertiae Felt, reared from gall on Audibertia.

Sackenomyia portoricae Ckll., reared from twig gall on Salix, Colorado.

Walshomyia juniperina Felt, reared from fruit of Juniperus californica, California.

ASPHONDYLIARIAE

Asphondylia brevicauda Felt, Arizona.

A auripila Felt, reared from gall on Larrea, Arizona.

A. betheli Ckll., reared from Opuntia, Colorado.

A. bumeliae Felt, reared from Bumelia, Texas.

A. integrifoliae Felt, reared from flowers of Rhus, California.

A. baroni Felt, Arizona.

A. artemisiae Felt, reared from galls on Artemisia, Arizona.

A. ceanothi Felt, reared from a terminal gall on Ceanothus, California.

A. hydrangeae Felt, reared from bud galls on Hydrangea, Missouri.

A. autumnalis Beutm., reared from bud gall on Helenium, Missouri.

A. atriplicis Ckll., reared from twig gall on Atriplex, New Mexico.

A. neomexicana Ckll.

A. opuntiae Felt, reared from Cactus, Arizona, California, Colorado, Texas.

A. conspicua O. S., reared from flower gall on Rudbeckia, Arizona, Missouri.

A. arizonensis Felt, reared from prickly pear, Arizona, Colorado.

A. prosopidis Ckll.

A. menzeliae Ckll.

A. cecliae Felt, reared from leaf bud gall on Encelia, California.

A. diplaci Felt, reared from apical bud gall on Diplacus, California.

Schizomyia macrofila Felt, reared from galls on Ambrosia, California.

Ubella mexicana Felt, reared from stem gall on Pisonia, Mexico.

ITONIDINARIAE

Endaphis americana Felt, reared from Eriophyes galls, Arizona.

Contarinia sorghicola Coq., reared from seeds of Sorghum, Arkansas, Texas, Indian Territory, Kansas, Missouri.

Contarinia coloradensis Felt, reared from budlike gall on *Pinus scopulorum*, Colorado.

Thecodiplosis piniradiatae, Snow & Mills, reared from deformed needles of *Pinus radiata*, California.

T. zauschneriae Felt, reared from rosette galls on Zauschneria, California.

Youngomyia quercina Felt, reared from globular leaf galls on *Quercus pumila*, California.

Y. umbellicola O. S., reared from flower buds of Sambucus, Missouri.

Dicrodiplosis californica Felt, reared from a *Pseudococcus* on Solanum, California.

D. gillettei Felt, reared from bud gall on *Pinus scopulorum*, Colorado.

Aphidoletes meridionalis Felt, reared from *Aphis gossypii*, Colorado.

Mycodiplosis acarivora Felt, reared from larvae feeding on red spider, California.

Arthrocnodax apiphila Felt, reared from debris from bee combs, California.

A. macrophila Felt, reared from a fungus, New Mexico.

A. occidentalis Felt, reared from red spider, California.

Harmomyia coloradensis Ckll., Colorado.

Lestodiplosis yuccae Felt.

Paradiplosis partheniicola Ckll., reared from Parthenium, New Mexico.

Honida hopkinsi Felt, reared from larvae in Scolytid burrows, California.

I. texana Felt, Texas.

I. resiniveloides Whts., reared from resinous exudations of *Pinus radiata*, California.

Species Not Referable to Well Defined Genera

Cecidomyia Coloradella Ckll., reared from deformed flower heads of Artemisia.

C. feata Ckll., reared from willow cabbage gall, probably an inquiline.

Asphondylia garryae O. S., reared from subovate, irregular swelling on Garrya, California.

Cecidomyia aequadinis Gill., reared from terminal buds of box elder, Minnesota.

C. palmeri Ckll., a manuscript name proposed by Prof. Cockerell for a gall in the dry stems of Amarantus.

Dasyneura strobiloides, reared from a cone like gall on Bigelowia, possibly a Rhopalomyia, New Mexico.

APHIDIDÆ OF SOUTHERN CALFIORNIA X*

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Tribe CALLIPTERINI

Certainly I cannot do better in presenting the chief characteristics, with the genera, and synonymy of the tribe *Callipterini* than to give *verbatim* or the substance of the work of Mr. W. H. Wilson, who has published "A Key to the Genera and Notes on the Synonymy of the Tribe Callipterini, Family Aphididæ," in the Canadian Entomologist, Vol. XLII, No. 8, pages 253-259, August, 1910. The chief characteristics of the tribe, the key to the genera, and characters and synonymy of the genera as well as those of the type species are all taken from his work. The keys to the California species I have worked up as fully as descriptions and material will allow. Though this article will add little to the general working public, yet it should be of some value to aphid workers in this state, and it is with this aim in view that it is undertaken.

Chief Characters

Body—Small, slender, delicately and beautifully colored. Young are usually covered with fine or glandular hairs, each arising from a small body tubercle, and which are sometimes retained in the adult apterous forms.

Antennæ—Variable in length, slender, seldom shorter than the body, six-articled with the spur of article VI variable in comparison with the length of the base.

Rostrum—Short and stout.

Legs—Normally long, slender, with short fine hair, delicately shaded.

Wings—Rather long and slender, beautifully shaded or hyaline, venation as in Aphidini, constant.

Cornicles—Variable in length, or almost entirely wanting, usually short and tubercular.

Style—Globular with constricted base, hairy.

Anal plate—Large, distinctly bi-lobed.

Key to Genera

1.	Antennal tubercles prominent antennæ always exceedingly long.	3
2.	Antennal tubercles wanting or very small; antennæ variable in length, sometimes shorter than the body.	4
3.	Nectaries very long and large.	5
	Nectaries very short and more or less constricted at the middle.	6
	Nectaries little more than pores.	10
4.	Nectaries distinct, usually being longer than broad at middle.	7
	Nectaries little more than pores and broader than long.	10

*The last of this series of articles was numbered VIII by mistake. It should have been IX.

5. Nectaries as long as one-fourth the length of the body, or more, and swollen in the middle. *Drepanosiphum*
   Nectaries large and nearly one-fourth the length of the body, swollen at the base and tapering toward the middle. *Drepanaphis*
6. Spur of sixth antennal segment longer than the segment. *Calaphis*
   Spur of sixth segment not longer than segment. *Euceraphis*
7. Antennae longer than the body, spur of the sixth segment long, and about the same length as the segment. 8
   Antennae shorter than the body, spur very short, often being little more than a nail-like process, segment short. 9
8. Antennae with spur at least as long as sixth segment, and with little or no antennal tubercles. Nectaries twice as long as broad and constricted in the middle. *Myzocallis*
   Antennae with spur shorter than sixth segment, nectaries much broadened at base. *Eucallipterus*
9. Antennal spur less than one-half the length of the sixth segment, nectaries not longer than broad at base, constricted in the middle. *Chromaphis*
   Antennal spur at least half as long as the sixth segment, nectaries short, about as long as broad and placed on a broad base. *Callipterus*
10. Antennae situated on distinct tubercles and much longer than the body, nectaries but pores with raised edges, spur of sixth segment long and tapering. *Monaphis*
    Antennae not on tubercles and scarcely longer than the body, nectaries reduced to pores, spur of the sixth joint nearly as long as the joint. *Monellia*

DREPANOSIPHUM Koch, 1855

Type **Aphis platanoides** Schrank

Antennae—On distinct frontal tubercles which are elevated on the inner side, exceedingly long, first article gibbous on the inner side, third segment longest, spur of the sixth segment much longer than the base (Wilson gives six times as long).

Rostrum—Short, last segment long.

Legs—Moderately long.

Wings—Long and slender.

Cornicles—Long, one-fourth the length of the body, dilated at the base and middle.

Style—"One-fourth the length of the nectaries, oblong and globular at the tip; base broad, tapering to a constriction at the connection with the base."

Anal plate—"Broad and slightly emarginated."

D. platanoides (Schrank). On the European Sycamore (Platanus orientalis). Collected in the vicinity of Stanford University, Palto Alto, California, by W. M. Davidson. Jr. Ec. Ent. III, 377, 1910.

DREPANAPHIS Del Guercio, 1909

Syn. **Phymatosiphum** Davis

Type **Drepanosiphum acerifoliae** Thos.

Antennae—Twice as long as the body; situated on distinct frontal tubercles; very slender and tapering; article III shorter than the spur of VI, which is at least eight times as long as the base.

Body—Robust, bearing long slender projections on the dorsum of the abdomen.

Cornicles—Nearly one-fifth as long as the body, swollen at base and tapering outwardly.

Style—"One-half the length of the cornicles and globular at the tip, base broad and tapering towards the constriction between the base and the tip."

Anal plate—"Seemingly divided longitudinally and slightly emarginated in the middle."

*D. acerifolii** (Thomas) Del Guercio. On *Acer dasycarpum*. Collected by Davidson in the vicinity of Stanford University at Palo Alto, California, and listed as *Macrosiphum acerifolii* Thos. Jr. Ec. Ent. III, 380, 1910.

CALAPHIS Walsh, 1863

Type **C. betuella** Walsh

Body—Thorax long and slender, sides of abdomen with prominent tubercles, each bearing a single hair. Forehead narrow.

Antennae—Much longer than the body, on large broad frontal tubercles with bases so close together as to give the forehead an appearance of the letter "U," articles III, IV, and V hairy, the spur of VI about twice as long as the base.

Wings—Long and slender, veins thick and dark, deflexed when in rest.

Cornicles—Short, about as long as the style, spindle-shaped.

Style—Short, thick, base broad with globular tip, two-thirds as long as wide.

Anal plate—Slightly emarginated in middle, lobes rounded.

Key to California Species

Article III of the antennae longer than articles IV and V together, sensoria confined to the basal half of III. *castaneae*

Article III of the antennae not as long as IV and V together, sensoria confined to the basal two-thirds of III. *betulaccolens*

C. castaneae (Fitch) Gillette. Taken on Chestnut (*Castanea* sp.) at Berkeley, California, by W. T. Clarke. Can. Ent. XXXV, 249, 1903. Also collected at Palo Alto by Davidson. Jr. Ec. Ent. III, 376, 1910.

C. betulaccolens (Fitch) Gillette. On Birch (*Betula* sp.). Collected at Berkeley, California, by Clarke. Can. Ent. XXXV, 249, 1903. Davidson has also taken this species at Palo Alto, California. Jr. Ec. Ent. II, 301, 1909.

*This was first described as **Siphonophora acerifoliae** by Thomas, who afterwards changed it to **Drepanosiphum acerifolii**, thereby changing the genus and the ending of the species. 8th Rept. Ent. Ill., page 195, 1880.

EUCERAPHIS Walker, 1870

Type Aphis betulae Linnaeus

Body—Long, forehead narrow.

Antennae—Much longer than the body, nearly one and one-half times as long, situated on large, slightly gibbous antennal tubercles, article I gibbous on the inner margin, article III four or five times as long as article VI including both the spur and the base, spur of article VI slender and slightly shorter than the base.

Wings—Long.

Cornicles—Short, but slightly longer than broad, somewhat tapering, constricted in the middle, ends oblique to the main axes.

Style—Distinctly knobbed, constricted between the base and the knob, base tapering, longer than the cornicles.

Anal plate—Rounded, without middle emargination.

No species of this genus represented in California to date.

MYZOCALLIS Passerini, 1860
PTEROCALLIS Passerini, 1860
Syns. CALLIPTEROIDES Mordwilko, 1894
TUBERCULATUS Mordwilko, 1894
SUBCALLIPTERUS Mordwilko, 1894
? THERIOAPHIS Walker, 1870

Type Aphis coryli Goetze

Body—Prothorax and body elongated, forehead with extended frontal ocelli giving it a pointed effect.

Antennae—As long, nearly as long, or longer than the body, not on frontal tubercles, spur of article VI not more than twice as long as the base.

Wings—Long and slender.

Cornicles—Tapering from the base, nearly as broad as long, often constricted near the middle.

Style—Globular, with narrow constricted base.

Anal plate—Deeply emarginated so as to be strongly bi-lobed.

Key to California Species

1. Spur of antennal article VI not longer than the base. 2
   Spur of antennal article VI distinctly longer than the base. 4
2. Antennae longer than the body. *ulmifolii*
   Antennae not longer than the body, but may be as long. 3
3. Antennae usually as long as the body, apices of articles III-V only, dark. *quercus*
   Antennae seldom as long as the body, apices of articles III-VI dark. *alni*
4. Antennae shorter than the body. *coryli*
   Antennae as long or longer than the body. 5

5. Article III of antennæ dark at tip only, body without dorsal markings. *hyalinus*

Article III of antennæ dark at base and tip, or wholly dark; body with dark dorsal markings on abdomen. *arundicolens*

M. ulmifolii (Monell) Wilson. On *Ulmus americanus* L. Collected in the vicinity of Stanford University, Palo Alto, California, by Davidson. Jr. Ec. Ent., Vol. II, 301, 1909, and Vol. III, 376, 1910.

M. quercus (Kalt.). First reported by Davidson, who collected it on Blue Oak (*Quercus kellogii*[1]) and on White Oak (*Q. lobata*), in the vicinity of Stanford University, Palo Alto, California. Jr. Ec. Ent., II, 302, 1909. Again reported on Blue Oak (*Q. douglasii*) and the White Oak at Palo Alto by Davidson and also on Black Oak (*Q. californica*) near San Jose, California. Jr. Ec. Ent., III, 376, 1910. Later taken by the same author on English Oak (*Q. robar?*) and on the White Oak in Placer County, California. Davidson doubts if this is true *M. quercus* (Kalt). P. C. Jr. Ent., III, 399, 1911.

M. alni (Fabr.) Passerini. Collected by writer on undersides of leaves of the common Alder (*Alnus rhombifolia* Nutt.), on some of which it occurs in large numbers. More or less scattering in the vicinity of Santa Paula, California. (See description.)

M. coryli (Goetze) Pass. First reported by Clarke, who collected it on hazelnut (*Corylus* sp.) Berkeley, California. Can. Ent., XXXV, 249, 1903.

M. hyalinus (Monell). On Oak (*Quercus imbricata*). First collected by Clarke at Berkeley, California. Can. Ent., XXXV, 249, 1903.

M. arundicolens (Clarke). On Bamboo (*Arundo* sp.) at Berkeley, California. Collected and described by Clarke, Can. Ent., XXXV, 249, 1903. Davidson reports this species from Palo Alto, California, Jr. Ec. Ent., II, 301, 1909, and III, 376, 1910. C. W. Beers, Horticultural Commissioner of Santa Barbara County, collected this species at Santa Barbara, where it was badly infesting bamboo hedges.

M. alnifoliæ (Fitch). In The Host Index to California Plant Lice (*Aphididæ*), published in the Pomona College Journal of Entomology, this was listed as *Callipterus alnifoliæ* (Fitch) under Alder (*Alnus rhombifolia* Nutt.). It is wrongly listed, as the species has never been reported in this state, and should have been *Lachnus alnifoliæ* (Fitch), which was omitted in its place.

EUCALLIPTERUS Schouteden, 1906

Type **Aphis tiliae** Linnaeus

Body—Tapering; front of head wide with a tubercle on each side of the frontal ocellus, each of the tubercles bearing a single slender spine or bristle.

Antennæ—Not on prominent tubercles, slightly longer than the body, slender, tapering towards the tip; first segment straight on the inner side, spur of article VI not longer than the base.

[1] Quercus douglasii H. & A.?

Wings—Long and slender with dusky markings.

Cornicles—Short, very wide at the base, apical part cylindrical, mouth very irregular, with rough edges.

Style—Three times as long as the cornicles, tip knobbed, middle slightly constricted, basal portion as long as the apical, extreme base wider than the width of the knob.

Anal plate—Strongly bi-lobed, the constriction forming a "V" between the lobes.

E. tiliae (Linn.) Schoutedeu. On the leaves of the linden (*Tilia* sp.). Collected by Davidson at Palo Alto, California, Jr. Ec. Ent., II, 302, 1909. Again reported by the same author on *Tilia americana* at Palo Alto, California. Jr. Ec. Ent., III, 376, 1910.

CHROMAPHIS Walker, 1870

Type **Aphis juglandicola** Kaltenbach

Body—Short and stout; forehead wide, with large ocellar tubercle in center and small tubercle on each side.

Antennae—Shorter than the body, not on frontal tubercles, spur of article VI much shorter than the base (about one-eighth as long).

Wings—Long and slender.

Cornicles—Short, constricted in the middle, much wider at base than at the mouth, and tapering.

Style—Short, globular or knobbed at tip, constricted below the knob and wide at the extreme base.

Anal plate—Only slightly constricted in the middle to form lobes.

C. juglandicola (Kalt. Walker. Taken by the writer throughout the southern part of the state on the Cultivated English Walnut (*Juglans regia L.*). It occurs in great numbers on the undersides of the leaves. (Description follows.) P. C. Jr. Ent., I, 51, 1909.

MONAPHIS Walker, 1870

Syn. **Bradyaphis** Mordwilko, 1894

Type **Aphis antennata** Kaltenbach

Body—Elongated, forehead narrow and oblique to the sides of the antennal tubercles.

Antennae—Longer than the body; situated on prominent, broad tubercles; spur of article VI slender and twice as long as the base.

Wings—Long and slender.

Cornicles—Hardly more than pores with a chitinous ring around the edge.

Style—Short and broadly pointed with knobbed tip (in this respect it differs from the rest of the genera).

Anal plate—Deeply constricted in the middle and forming two distinct lobes; short.

So far no representatives of this genus have been reported in America.

MONELLIA Oestlund, 1887

Type **Aphis caryella** Fitch

Body—Long and tapering, forehead raised in the middle and projected at the inner side of the base of each antenna.

Antennae—Nearly as long as or longer than the body, not situated on frontal tubercles, spur of article VI equal to or slightly shorter than the base. (In Oestlund's description of M. caryella he gives these measurements: for the base 0.20 mm., spur 0.15 mm., Aphid. Minn. 45, 1887.)

Wings—"Folded horizontally close to the body in repose."

Cornicles—Little more than pores, sometimes very indistinct.

Style—Short, distinctly knobbed, with constriction below, base broad.

Anal plate—Long, deeply constricted in the center, forming a "V" shaped area between the two distinct lobes.

Key to California Species

Antennæ slightly shorter than, or as long, as the body; apices of antennal articles III-VI dark; legs entirely pale. *caryae*

Antennæ longer than the body; articles III-VI dark throughout; tibæ and tarsi of legs dark. *californicus*

M. caryae (Monell) Gill. On Black Walnut, Berkeley, California. First reported by Clarke. Can. Ent., XXXV, 249, 1903. Davidson reports this species at Palo Alto feeding upon the common English Walnut. (*Juglans regia L.*). Jr. Ec. Ent., II, 301, 1909, and III, 376, 1910.

M. californicus En. sp. Taken on Southern California Wild Walnut. (*Juglans californica* Wats.) in the mountains north of Santa Paula, California. (See description.)

Myzocallis alni (Fabr.) Passerini

(Small Alder Louse)

1794 *Aphis alni* Fabr. Ent. Syst. IV, 215, Syst. rhyng. 298.
Aphis alni De Geer Theres, III, 32.
1837 *Aphis maculata* Heyd. Mus. Sankerberg II, 297.
1843 *Aphis alni* Fabr. Kalt. Monogr. 137.
1857 *Callipterus alni* Fab. Koch. Pilz. 211.
1860 *Pterocallis alni* Pass. Gali Afidi 28.
1880 *Pterocallis alni* Fabr. Buck Brt. Aphid. III, 31.
1905 *Pterocallis alni* Fabr. Schout. Aphid. Belg. 210.
1905 *Pterocallis alni* Pass. Kirkaldy. Can. Ent., XXXVII, 117.
1910 *Callipterus alni* Fab. Davis. Jr. Ec. Ent., III, 416.

WINGED VIVIPAROUS FEMALE (Figure 243, A)

Length of the body 1.2 mm., width of the mesothorax 0.37 mm., width of the abdomen 0.5 mm., wing expansion 3.57 mm. *Body*—Very small, light in color, flat, smooth in winged and tuberculate in apterous forms. *Prevailing color*—very light to saffron yellow with green blotches on the abdomen. *Head*

—nearly as long as broad, yellow. *Eyes*—Large, tuberculate, bright cardinal red. *Antennae*—(Figure 1 4)—Nearly as long as the body, reaching to, or nearly to the bases of the cornicles, on slight frontal tubercles, with few or no hairs; apical half imbricated; articles I and II color of the head, III transparently white with apical half dark, VI transparently white with apical third dark, V white with apical half dark, VI white with apical part of the base and apical half of the spur dark. The sensoria are large, circular and arranged in a single row on III, and normal number on V and VI. On III there are from 4 to 6 (usually 4 or 5), all of which are more often confined to the apical half.

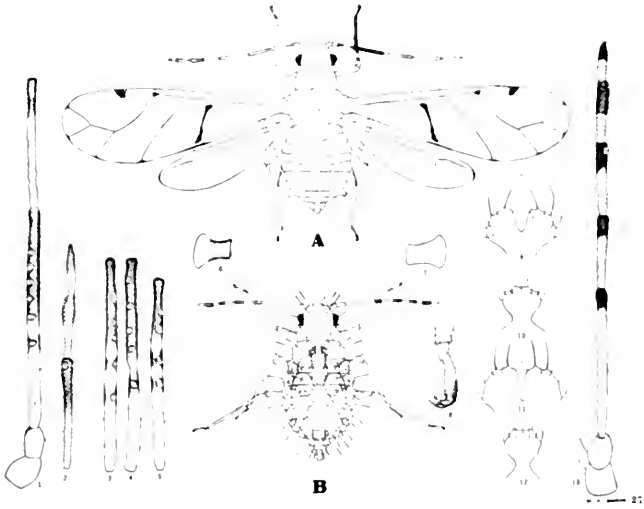

Figure 243. Myzocallis alni (Fab.) Passerini

A, winged viviparous female; B, apterous viviparous female. 1, antenna of winged female; 3-5, third antennal articles of winged females showing the arrangement of the sensoria; 6, cornicle of winged female; 7, cornicle of apterous female. 8, tarsi and claws of apterous female. 9, anal plate of winged female; 10, style of winged female; 11 and 12, anal plate and style of apterous female. 13, antenna of apterous female.

The areas around the lower two are darker than the surrounding areas. The lengths of the articles are as follows: I, 0.045 mm.; II, 0.045 mm.; III, 0.35 mm.; IV, 0.19 mm.; V, 0.16 mm.; VI, 0.168 mm. (base 0.09 mm., spur 0.078 mm.); total 0.958 mm. I and II are about equal, III is by far the longest, being equal or nearly equal to IV and V together. The measurements of the articles as given are less than those given by Davis,* but the comparative

*Jr. Ec. Ent. III, p. 416, 1910

lengths are about the same. *Rostrum*—Reaching midway between the first and second coxæ, color of the body with dark tip. *Prothorax*—Slightly wider than the head, rather long and narrow, yellow or yellowish green. *Meso-* and *Meta-thorax*—Concolorous with the rest of the body, the muscle lobes being small and yellow. *Abdomen*—Without hairs or body tubercles, distinctly segmented; rich or light yellow with darker green dorsal markings across the middle and near the posterior end. Anal plate—(Figure 9) conspicuously bifid, yellow, hairy. *Cornicles*—(Figure 6). Short, tubercular, longer than broad, light at base with apical two-thirds dark or dusky, length 0.052 mm. *Legs*—Normal, very light yellow to transparently white with dark spot on the outer base of the tibiæ of the hind legs, and the tarsi (Figure 8) with apical half dusky. *Wings*—Normal, rather slender. *Primary*—Length 1.6 mm., width 0.5 mm. Costal and subcostal wide but very light in color excepting the middle of the latter, which is distinct. *Stigma*—Rather short and blunt at the tip, light in middle with darker spot at the base (at the tip of the subcostal vein) and another larger dark spot at the tip. Stigmal vein very indistinct, especially at the base and tip, short and well curved (not nearly as long as the stigma). First discoidal vein arising from the middle of the subcostal, distinctly clouded (it being the only clouded vein), with clouded area wider at the base and tip. Second discoidal arising midway between the bases of the first and third discoidals, curved with convex surface towards the wing-tip, dusky at tip, amber and distinct. Third discoidal, arising very near the base of the stigma, well curved to the first fork, but branches of which are straight, second fork is midway from the first fork to the tip of the wing, upper branch of this fork slightly longer than the lower and arriving at the wing margin midway between the tips of the stigma and the lower branch. All dusky at the tips. *Secondary*—Length 1 mm., width 0.27 mm., tip dusky. Veins very faintly defined. Subcostal distinct, bent downward at the base of each discoidal. First discoidal arises near the middle of the subcostal, very faint, obsolete at the base, slightly curved with convex surface towards the body, does not extend to wing margin, nearly at right angles to the subcostal. Second discoidal arises from the subcostal midway between the base of the first and the wing tip (just under the hooklets), faint, slightly forked at base, which does not touch the subcostal, slants slightly towards the wing tip, nearly straight. *Style*—(Figure 10) distinctly knobbed and hairy, yellow, length 0.07 mm.

APTEROUS VIVIPAROUS FEMALE (Figure 243, B)

Length 1.2 mm., width 0.52 mm. *Body*—Covered with long glandular hairs arising from body tubercles; rather narrow; distinctly segmented. *Prevailing color*—Very light green or yellow with darker green dorsal markings near the middle and posterior end. *Head*—Large, nearly round, concolorous with the body or slightly dusky. Antennæ reaching nearly to the bases of the cornicles, transparently white or light yellow, articles III, IV, V with apical tips dusky, VI with middle portion dusky. Lengths of the articles: I, 0.036 mm.; II, 0.045 mm.; III, 0.22 mm.; IV, 0.105 mm.; V, 0.105 mm.; VI, 0.15 mm. (base 0.09 mm.,

spur 0.06 mm.); total 0.661 mm. I and II are usually equal in length, though the latter is more often longest, III is equal to IV and V together, and VI with the spur is longer then either IV or V. *Rostrum*—Reaches nearly to or slightly beyond the second coxae, transparently white with extreme tip dusky. *Thorax*—Very pale green or yellow with two darker green dorsal spots. *Abdomen*—Deeply segmented, and very rough, due to the large glandular tubercles; pale yellow with darker green dorsal band across the base and a small green patch just in front of the base of the style. Anal plate (Figure 11) as in the winged female. *Cornicles*—(Figure 7). Same as in winged form except that they are yellow throughout. *Legs*—Very light yellow or transparently white throughout. *Style*—(Figure 12). As in winged form, but slightly larger, yellow, length 0.08 mm.

Young—Are very light in color, varying from a pale whitish or yellow to light faded green. The entire body is covered with long glandular hairs, each of which is situated on quite a large body tubercle.

Host—This species is not plentiful, except in a very few instances. On nearly every Alder tree (*Alnus rhombifolia* Nutt.) there may be found a few individuals on the under sides of the leaves. On one small tree in the Santa Paula Canyon there were to be found thousands, the entire lower surfaces of the leaves being covered, but even here the winged individuals were very scarce. The presence of the insect is easily told by the smutting of the foliage of all infested trees.

Locality—On the trees growing along all of the streams in the vicinity of Santa Paula, California.

Date of Collection—August 16, 1911. Serial number 27.

MONELLIA californicus n. sp.

(Wild-walnut Plant-louse)

WINGED VIVIPAROUS FEMALE (Figure 24A)

Length of the body including the style, 2 mm., width of the mesothorax 0.6 mm., width of the abdomen at widest place near the middle 0.85 mm., wing expansion 5.5 mm. A medium-sized plant louse. *Prevailing color*—Rich saffron yellow varying to a much lighter shade, with dark appendages. *Head*—Rounded anteriorly and base straight, nearly the shape of a half circle, yellow with a black longitudinal stripe ventrally at the base of each antenna (Figure D) and two short black stripes extending from the front backwards between the bases of the antennae. *Eyes*—Large, light with red centers. *Antennae* (Figures D, G, H) considerably longer than the body, slightly imbricated; article I lemon yellow with inner apical margin dark, II lemon yellow with dark inner margin and dark apical tip; remaining articles dark (almost black) throughout; lengths; I, 0.12 mm.; II, 0.09 mm.; III, 0.68 mm.; IV, 0.5 mm.; V, 0.45 mm.; VI, 0.45 mm. (spur 0.18 mm.); total 2.29 mm. From these measurements it will be seen that I is longer than II, III much the longest, IV a little longer than V, V and VI sub equal (IV, V and VI nearly all equal), the spur

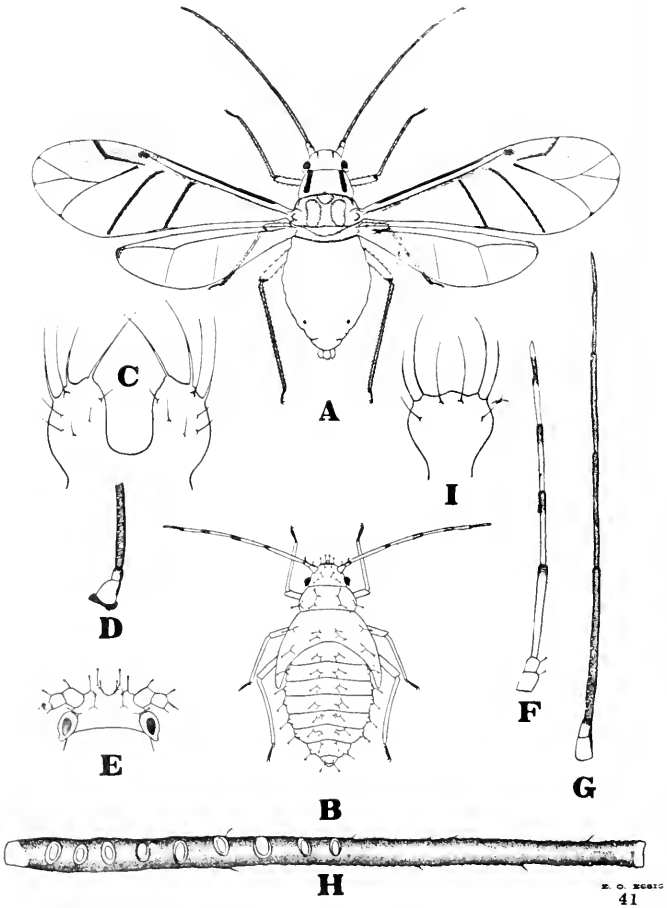

Figure 244. Monellia californicus n. sp.

A, winged viviparous female; B, nymph of the winged female; C, anal plate of the adult female; D, base of the antenna showing the dark ring at base of the first article; E, head of nymph, showing tubercles; F, antenna of nymph; G, antenna of the adult female; H, third antennal article of the adult, showing the location of the sensoria.

of VI comprises a little more than a third of the entire article and not as long as base. The sensoria on III are usually confined to the basal half of the article; large, somewhat elongated and the numbers vary as follow: 3 articles had 6, 6 had 7, 11 had 8, 13 had 9, 5 had 10, 3 had 11, and 1 had 12. None were found with less than six and none with more than 12. From 7 to 9 is the average. One sensorium on article V and the usual number in the process of VI. *Rostrum*—Yellow with extreme tip dark, reaching just beyond the first coxae. *Prothorax*—Gradually widening from the base of the head to the mesothorax, not as wide as the latter, yellow with two lateral dorsal black bands extending from the anterior almost to the base. These bands are narrow and do not reach to the mesothorax. *Mesothorax*—Well developed, yellow, the lobes sometimes pinkish or richer yellow. *Metathorax*—With well developed muscle lobe or scutellum. Slightly deeper yellow than the body proper. *Abdomen*—Well rounded, widest near the middle, bright yellow without darker dorsal markings, except a dark spot where the cornicles should be and even this is very obscure. *Cornicles*—Simply indicated by dusky spots on the abdomen. *Legs*—Normally long and haired; coxae yellow, color of the body; femora dusky yellow or light yellow at base with apical tip almost black; tibiae black; tarsi black. These markings of the legs are constant and very characteristic. The dark spot on the femora is simply a black band around the extreme apical tip. *Wings*—Normal for this genus. *Primary*—Length 2.5 mm., width 0.9 mm. Costal vein black and heavy to the base of the stigma; subcostal vein light yellow from base of wing to stigma, wide; *stigma*-sub hyaline, lightest in middle, dusky around edges with a dark spot or blotch at the tip of the subcostal (lower base of the stigma) and dark apical margin from the base of the third discoidal to the wing margin; sharp angle at base of stigmal vein and at apex; nearly a parallelogram, with angles very sharp at base of stigmal vein and at tip; stigmal vein nearly obsolete, but most distinct throughout its apical half, short and deeply curved, almost a semi-circumference, arises from near the apical end of the stigma where it forms a very sharp angle; first discoidal is very dark with margins narrowly and heavily clouded, arises from the subcostal at two-thirds its length from the base, nearly straight; second discoidal as dark as the first with a dark narrow border, arises near the base of the stigma and curves inwardly; third discoidal heavily clouded at its base, only becoming lighter and very narrow towards the tip, branching very variable, the first branch usually arising near the middle, and the second branch just before the middle of the first. However, the second fork is sometimes very near the tip of the wing and again it may be near to the third vein proper. In one such case the vein was thrice branched, the third branch arising very near the wing margin. Only one such instance was found. The drawing shows the normal wing. The stigmal vein and the tips of the third discoidal and its branches are amber brown with darker spots at the apices of all the veins. *Secondary*—Length 1.7 mm., width 0.5 mm., very light, with dusky tips; subcostal light amber, with sharp downward bend two-thirds the distance from base to tip; first discoidal arises from the subcostal beyond

one-third the distance from its base to apex, obsolete at base, straight, light amber; second discoidal arising from the bend of the subcostal, bends inwardly, light amber in color. *Style*—(Figure I) globular, yellow, covered with long stout hairs. Anal plate—(Figure C) bifid and bearing stout hairs.

The body of the adult winged female is free from stout hairs or spines.

NYMPH OF WINGED VIVIPAROUS FEMALE (Figure 244, B)

As large as the adult female before the last moult. *Prevailing color*—Yellow covered with dark or dusky capitate glandular hairs which are situated on body tubercles arranged in longitudinal rows—two rows of large tubercles, each tubercle bearing two hairs, and two lateral rows of tubercles, each tubercle bearing one hair. *Head*—(Figure E) covered with tubercles bearing the capitate hairs, yellow. *Antennae*—(Figure F) nearly as long or as long as the body. Articles I and II color of the head, each bearing a capitate hair, III, IV, V yellow with apical tips dark, VI with portion on each side of process dark, tip and base yellow. *Rostrum*—Same as in adult form. *Legs*—All transparently light yellow except the tarsi, which are amber or dusky (sometimes black).

Host—Commonly found feeding upon the undersides of the older leaves of the Southern California Wild Walnut (*Juglans californica* Wats.) but it sometimes occurs on the leaves of the tender shoots, infesting all parts of such foliage. The insects, like most of the members of this genus, produce great quantities of honey-dew upon which grows the black smut which gives the infested trees a very unsightly appearance.

Locality—At and in the vicinity of Sulphur Mountain Springs, about six miles north of Santa Paula, at an altitude of from 1000 to 1500 feet.

Date of Collection—July 1, 1911. Serial number 41.

This species resembles most *Monellia caryae* (Monell) Oestl., but varies in the following:

Monellia caryae Monell	**Monellia californicus** n. sp.
Prothorax	
Yellow (Thomas).	Yellow with two longitudinal black bands on dorsum.
Antennae	
Yellow with tips of the articles black. (Thomas.)	Articles I and II partly yellow, while all of the remaining articles are black throughout.
Shorter than the body. (Thomas.)	Longer than the body.
Article VII (spur of VI) equal to or one-third longer than the VI. (Some say shorter.) (Thomas.)	Spur of article VI much shorter than the base.

Wings

Held horizontally in rest. Veins pale. (Thomas.)	Never held horizontally. Costal dark, first, second and base of third discoidals dark and narrowly clouded.
Stigma blunt at apex. (Thomas.)	Stigma acute at apex.

Legs

All whitish except last joint of the tarsi of winged individuals. (Williams.)	Coxae and all but apex of femora yellow, tibia and tarsi dark throughout.

Named after the species of the Host Plant *Juglans californica* Wats.

Tribe LACHNINI

Body—Usually large, hairy, flattened, widest just in front of the cornicles.

Antennae—Short, scarcely longer than half the length of the body, not on frontal tubercles; six articled except Essigella, which has but five; rather slender; hairy; article III longest, usually as long as IV and V together.

Legs—First and second pairs rather short; third pair exceptionally long; stout; hairy.

Wing Venation—Primary wings with costal, subcostal, stigmal, and three discoidals, the third being twice forked. The first and second discoidals with bases often very close together. Third discoidal sometimes very faint. Stigma usually long and slender. Stigmal vein nearly always straight, but may be slightly curved. Secondary wing with subcostal and two discoidals.

Cornicles—Very short; conical; ring or pore-like or entirely obscure or wanting; base usually as wide as the length.

Style—Rounded; inconspicuous; or obsolete.

Of all the tribes in this family, perhaps there are none more difficult or obscure than the one under consideration. Wilson, in the Annals of the Entomological Society of America, Vol. IV, pp. 51-54, has made the first advance in bringing the various genera and their synonyms together. Using this as a basis, I have attempted to formulate, though in a very rude way, a key to these known genera. This has been especially difficult, because of the fact that most of the types as well as the genera and many of the known species have been described in Europe and have received little or no attention from American writers. It has been necessary to select characters as they are given in the original descriptions, and many of these are not fit material for formulating a key. My chief aim in so doing is to get the key before the public and asking all to join in its revision and correction. It is to be understood then that the following is but provisional:

Provisional Key to Genera

1.	Antennae with five articles.	8
	Antennae with six articles.	2

2. First segment of the tarsus equal to one-half of the second. *eulachnus*
   First segment of the tarsus not nearly equal to half of the second. 3
3. Winged females usually present, tarsi of all legs two-segmented. 4
   Winged females never found (as yet), tarsi of hind legs with but one segment, other two pairs of legs with two segments. *trama*
4. Wings carried pentwise (normally), rostrum scarcely reaching beyond middle of the abdomen. 5
   Wings carried horizontally (folded flat on the back), rostrum of apterous forms much longer than the body. *stomaphis*
5. Stigma not reaching to the wing tip, not exceptionally long. 6
   Stigma exceptionally long, and reaching around the tip of the wing. *longistigma*
6. Abdomen with a horn-like tubercle on the median dorsum between the cornicles. *tuberolachnus*
   Abdomen without the horn-like tubercle on the median dorsum. 7
7. Bases of the first and second discoidal veins usually close together, third discoidal often very faint, wings but slightly or rarely clouded. *lachnus*
   Bases of first and second discoidals farther apart than in "Lachnus," third discoidal plain, wings often darkly clouded. *pterochlorus*
8. Tarsi with first segment half as long as the second. *essigella*

Many of these genera are represented by but one species which forms the type, and but few are found in California. It is, therefore, unnecessary to give but the synonomy and type species of the most of them, while of those found in this state I shall also give a key to the species. (The type species and generic synonymy is strictly after Wilson.)

EULACHNUS Del Guercio
Type **Lachnus agilis** Kalt.

TRAMA Heyden
Type **T. troglodytes** Heyd.

STOMAPHIS Walker
Type **Aphis quercus** Linn.

LONGISTIGMA Wilson
Syn. **Davisia** Del Guercio
Type **Aphis caryae** Harris

Tuberolachnus Mordwilko
? Syn. **Schizolachnus** Mord.
Type **Lachnus viminalis** Fonsc.

T. viminalis (Fonsc.) Mord. On *Salix fluviatilis* Nutt. in Placer County by Wm. Davidson. P. C. Jr. Ent., III, p. 398, 1911. On *S. macrolachya* Nutt. and *S. lucigata* Bebb. in Ventura County by writer. (See in Litt.).

LACHNUS Burmeister

Syn. **Lachniella** Del Guercio

Type **L. fasciatus** Burm

LACHNUS Burm.

Key to California Species

1. Body very dark green or brown, or blackish. 2
   Body dull green or light green. 4
2. Body secreting rather long flocculence. *occidentalis*
   Body only purvelent. 3
3. Body blackish clouded with brown. *abietis*
   Body light amber brown. *juniperi*
4. Body with little or no purvelence, light green. *alnifoliae*
   Body with rather thick purvelence, dull green with reddish spots on dorsum. *pini-radiatae*

L. occidentalis Davidson. In large colonies on the underside of young shoots of *Abies grandis* Lindl. Jr. Ec. Ent., II, 300, 1909. Taken in the vicinity of Stanford University, Palo Alto, California. Winged form not described.

L. abietis Fitch. Reported by Davidson on *Abies concolor* Parry (White Pine), where it collects in large colonies on the limbs. At Palo Alto, California. Jr. Ec. Ent., II., p. 299, 1909.

L. juniperi De Geer. Taken by writer on *Thuya occidentalis*, where it gathers in quite large colonies on the stems. Claremont and Santa Paula, California. P. C. Jr. Ent., III, pp. 541-543, 1911.

L. alnifoliae Fitch. Reported on *Alnus* sp. (Alder) by Clarke, at Berkeley and Colfax, California. Can. Ent., XXXV, p. 248, 1909. Also reported on Alder by Davidson at Palo Alto, California. Jr. Ec. Ent., II, p. 300, 1909.

L. pini-radiatae Davidson. Found on needles of Monterey Pine (*Pinus radiata* Gord.), both in the green house and outside. Palo Alto, California. Jr. Ec. Ent., II, pp. 299-300, 1909.

Pterochlorus Rondani

Syn. **Cinara** Curtis
Dryobius Koch
Dryaphis Kirk

Type **Aphis roboris** Linn

No species of this genus yet taken in this State.

ESSIGELLA Del Guercio

Type **Lachnus californicus** Essig

E. californicus (Essig) Del Guercio. Taken by the writer on Cultivated Monterey Pine (*Pinus radiata* Gord.) on Pomona College Campus, Claremont, California, and at Santa Paula, California. P. C. Jr. Ent., I, p. 4, 1909. (See same in this paper.)

Tuberolachnus viminalis (Boyer de Fonscolombe) Mordwilko
(The Large Spotted Willow Aphid)

1841. *Aphis viminalis* Fonsc. Ann. Soc. Ent. Fr.
1846 *Aphis salicis* Curtis-Brt. Ent. Jr. Roy. Agrcl. Soc.
1848 *Aphis saligna* Walker-Ann. Nat. Hist.
1872. *Lachnus dentatus* Le Baron-Rept. Ins. Ill. II, p. 138.
1880. *Lachnus dentatus* Le Baron-Thos. 8th Rept. Ent. Ill., p. 116.
1881 *Lachnus viminalis* Fonsc.-Buck, Aphid. Brit. III, pp. 53-57.
1887 *Lachnus viminalis* Fonsc.-Oestl. Aphid. Minn. p. 32.
1890 *Lachnus dentatus* Le B.-Packard. Forest Ins. 593.
1890 *Lachnus dentatus* Le B.-Weed. Bull. A. E. S. O. Tech. Ser. I, 117-118.
id. Agr. Science 4, 155.
id. Rept. Columbus Hort. Soc. 166.
1892 *Lachnus dentatus* Le B.-Osborn. Cat. Hem. Ia. 129.
1904 *Lachnus viminalis* (Fonsc.)-Cockerell-Can. Ent. (Separate, date not given.)
1905 *Lachnus viminalis* Boyer-Schouteden-Cat. Aphid. Belg. 207.
1908 *Tuberolachnus viminalis* (Boyer)-Mordwilko Ann. Mus. Zool. Acad. Imp., Des. Sci. Tome XIII, 374.
1910 *Tuberolachnus viminalis* (Boyer)-Mord.-Wilson. Ent. News, XXI, p. 156.
1910 *Lachnus viminalis* Fonsc.-Davidson. Jr. Ec. Ent. III, p. 374.
1910 *Lachnus dentatus* Le B.-Davis. Jr. Ec. Ent., III, p. 413.
1911 *Lachnus viminalis* Boyer-Wilson. Ann. Ent. Soc. Am. IV, 52.
1911 *Tuberolachnus viminalis* (Boyer)-Wilson. Ann. Ent. Soc. Am. IV, 52.
1911 *Lachnus viminalis* (Boyer)-Essig. P. C. Jr. Ent. III, 462.
1911 *Tuberolachnus viminalis* (Boyer)-Mord.-Essig. P. C. Jr. Ent. III, 467.

WINGED VIVIPAROUS FEMALE (Figure 245, A)

Length of body 4.2 mm., width of the mesothorax 1.1 mm., width of the abdomen 2.1 mm., wing expansion 12 mm. The largest insect of this family which I have ever collected. *Body*—Large, rather flat, narrow anteriorly and bluntly-pointed abruptly behind. Covered with short fine hair and a thick coat of fine white powder. *Prevailing color*—From a dark brown to a rich gray, with black spots. *Head*—Small, much wider than long, rounded and broad in front, hairy, dark brown with very little white powder. *Eyes*—Large, dark brown, with terete tubercles. *Antennae*—(Figures D and E) short, reaching to the base of the thorax, rather slender, bases far apart, hairy, dark brown throughout, lengths of articles: I, 0.09 mm.; II, 0.09 mm.; III, 0.55 mm.; IV, 0.27 mm.; V, 0.27 mm.; VI, 0.25 mm. (spur or unguis 0.04 mm.); total 1.52 mm. Articles I and II are co-equal in length, though I is much wider and sometimes a little longer than II; III is by far the longest article

and is as long or a little longer than IV and V together; IV and V are usually co-equal, but either one may be longer than the other. The measurements of the articles IV, V and VI of four antennae are as follows:

	(1)	(2)	(3)	(4)
IV	0.11 mm.	0.31 mm.	0.26 mm.	0.27 mm.
V	0.12 mm.	0.30 mm.	0.27 mm.	0.27 mm.
VI	0.1 mm.	0.25 mm.	0.27 mm.	0.25 mm.

The sixth article is usually the shortest of the last three. The spur of VI is equal to about one-sixth of the length of the entire article. Large circular

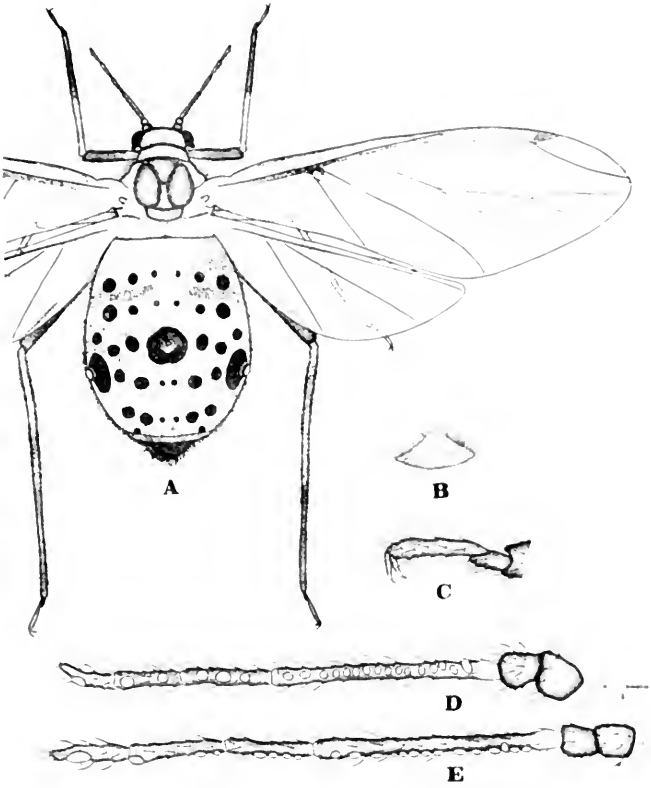

Figure 245. Tuberolachnus viminalis (Fonsc.) Mordwilko
A, winged viviparous female; B, cornicle; C, tarsi; D and E, antennae of the same

sensoria are well distributed on the articles as follows: III with from 14 to 17, IV with from 3 to 5, V with 1 to 3, VI with 1. The surface of the antennæ are roughened by the large hair tubercles. *Rostrum*—Extending just beyond the third coxæ, light amber near base and dark apical half. *Prothorax*—Scarcely wider than the head and not as long, widest at the base, dark brown with little powder. *Meso-* and *Metathorax*—Brown with black muscle lobes, which are high and well developed, covered with bluish powder, and with fine silky hairs. (These cover the entire body.) Front narrow and base nearly as wide as abdomen. *Abdomen*—Well rounded with abrupt posterior ending, robust, bluish-gray with black spots set on dorsum in transverse and longitudinal rows, ground color rich brown, the whitish powder giving the grayish appearance in the living specimens. On the lateral sides near the base are irregular brownish patches, two of which form transverse bands which do not quite reach across the abdomen. These are caused by the lack of powder in the areas described, the ground color of the abdomen showing. The circular black spots are slight depressions, velvety in appearance and arranged as follows: One spot just in front of each cornicle, a lateral longitudinal row on each side consisting of five large spots and one small posterior spot, first two anterior spots largest, a longitudinal row on each side just inside of the above-named row consisting of five spots, the two spots near the median tubercle the largest, two rows of small spots on the middle dorsum, two spots in each row in front of the median tubercle and two behind. The most characteristic thing about this species is the large dorsal tubercle, referred to above, which is situated on the middle of the dorsum just in front of the cornicles. The base of this dark tubercle is about as large as the base of one of the cornicles, and from this wide base arises a sharp cone nearly as high as the distance across the base. There are usually six small lateral tubercles on each side of the abdomen. The anal plate is well rounded, very dark brown and clothed with long fine hair. The ventral surface of the abdomen is light brown with a row of dark depressions near the lateral margins between each segment, covered with fine white powder. *Cornicles*—(Figure B) short, wide at the base, with surface concave to mouth, which is slightly flared, as shown in drawing, the diameter of the base is a little more than three times that of the mouth, twice as wide as long, very dark brown or black, covered with silky hairs; width of base 0.5 mm., length 0.25 mm. *Legs*—Front and middle pair rather short, while the hind pair are very long, hairy, amber brown throughout, with the apices of the articles darker brown. *Tarsi*—(Figure C) dark brown, article I about one-fourth as long as article II, hairy. Claws slender and very sharp. *Wings*—Large, hyaline. *Primary*—Length 5.5 mm., width near the tip of the second discoidal 2 mm. Costal vein wide to stigma, rich brown. Subcostal twice as wide as the costal, rich brown. Stigma narrow, about nine times as long as wide, rich brown throughout, pointed from the base of the stigmal vein to the tip. Stigmal vein arising near the tip of the stigma and extending nearly to the furthest tip of the wing, almost straight with slight bend downward, yellow. First and second discoidals with bases close together and near the middle

of the subcostal, very distinct throughout. First discoidal straight, second discoidal much more slanting than the first and bent outwardly through the apical half so that the convex surface is towards the tip of the wing. Third discoidal faint, much less distinct than the other veins, twice forked, base obsolete. First fork one-third distance and second fork two-thirds the distance from the base of the vein to the tip of the last branch. All yellow. *Posterior*—Length 3.4 mm., width 1.1 mm., subcostal vein nearly straight, basal half with yellowish insertion. Discoidals arising near the same place, their bases being 0.2 mm. apart, on the subcostal about one-third the distance from the base to the tip. They diverge strongly from their bases to the tips, both straight, well defined and yellow. *Style*—Obsolete.

APTEROUS VIVIPAROUS FEMALE (Figure 216, A)

Length of body 5.25 mm., width of abdomen 2.9 mm. *Body*—Widest just in front of the cornicles and tapering off gradually to the head and more abruptly to the pygidium; robust, but much flattened. An exceedingly large species. Covered entirely with short, fine silky hairs. *Prevailing color*—Gray to a bluish white or brown. Entirely covered with a fine white powder. Ground color of the body brownish, covered with black velvety spots. *Head*—Small, nearly as long as wide, nearly quadrangular in shape, rounding in front, wide between the antennae, which are nearly on the anterior sides, brown to pruinose. *Eyes*—Large, dark brown. *Antennae*—Figure C, reaching nearly to the second abdominal segment, hairy, rough, brown throughout; lengths of articles: I, 0.1 mm.; II, 0.1 mm.; III, 0.7 mm.; IV, 0.3 mm.; V, 0.25 mm.; VI, 0.25 mm. (spur 0.06 mm.); total 1.7 mm. Articles I and II are co-equal, III much longer than any of the rest, more than twice as long as either IV or V, IV longer than V or VI, which are about co-equal. A single large sensorium near apical end of IV and in the process of VI. *Rostrum*—Reaches nearly to the middle of the abdomen, amber brown with dark tip. *Thorax*—Gray, with two transverse dark depressions between the segments. These depressions are nearly straight across between the pro- and meso-thoracic segments, with lateral ends curved upwardly between the meso- and meta-thoracic segments, and straight, but narrow in the middle between the thorax and the abdomen. *Abdomen*—With small lateral marginal tubercles and large black median dorsal tubercle between the cornicles. This tubercle or cone is very large, occupying nearly one third of the dorsum, nearly as high as the width of the base. The tip is pointed. The black abdominal spots are nearly circular in shape and arranged in transverse and longitudinal rows. In longitudinal rows the arrangement is as follows: a single spot in front of each cornicle, a row of six large spots and one small spot on each side, just inside the base of the cornicles, another row between the cornicles and the tubercle on each side consisting of six spots each, two median rows of smaller spots, each consisting of three each in front of the tubercle (the spot in each row just in front of the tubercle very small and often not present), and one small spot just behind the base of the tubercle. The two posterior spots in the extreme lateral rows and

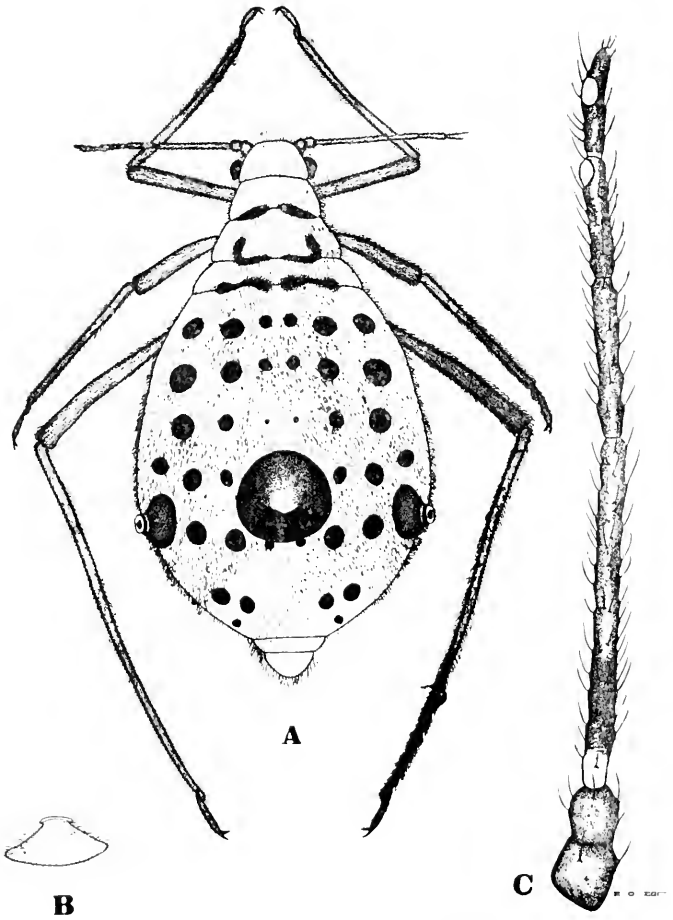

Figure 246. **Tuberolachnus viminalis** (Fonsc.) Mordwilko
A, apterous viviparous female; B, cornicle; C, antenna of the same.

the last spot in the row just inside form two groups of three spots each, near the posterior end. (The location of these spots can be easily ascertained from the drawing, which is accurate, having been made from a fresh specimen under the camera lucida.) Anal plate well rounded, hairy, brown. *Cornicles*—(Figure B*) similar to those of the winged form in shape and color, hairy, length 0.35 mm., width of base 0.53 mm. *Legs*—As in the winged form, but hind legs much longer. *Style*—Obsolete.

Young—The young are reddish-brown without the whitish powder, which is not secreted until the insects are nearly grown.

Hosts—Collected by the writer on the limbs of *Salix lucrogata* Bebb, and *S. macrostachya* Nutt, feeding in large colonies near the ground. In no case were they found more than four feet above the surface of the ground. Davidson reports it on the Narrow Leaved Willow *S. fluviatilis* Nutt. in the northern part of the State, and on *Salix* sp. in the middle part of the State. It has been reported on Willow in the Central States, in England on *S. daphnoides*, and in other parts of Europe on *S. viminalis*, from which it was probably named, and *S. cinerea*. So far as known, it feeds on nothing but the Willow trees.

Locality—This species has a very wide distribution in this country, having been reported from all parts. In California it is also widely distributed. Davidson reports it from the middle part of the State in the vicinity of Stanford University. The writer has obtained specimens from Frederick Maskey of the State Horticultural Commission, who collected it in the Imperial Valley, from Claremont, Ventura and Santa Paula. At the last-named place it is very abundant.

Date of Collection—August 11, 1910, and August 5, 1911. It is plentiful throughout the summer months. Serial number 4.

This is indeed a very distinct and interesting species. Though some have doubted the synonymy of the American form (*L. dentatus* Le Baron) and the European form (*L. viminalis* Fonsc.), there is no doubt in my own mind that they are the same species. I have studied the insect with great interest, comparing its habits with those of the English species, as described by Geo. B. Buckton in his Monograph of British Aphids, pages 53-57. As he states, the species collect in large colonies on the bark near the bases of the trees, each insect lying closely against its neighbor, forming a compact living mass. Then there is the method of keeping off preying insects. The long hind legs are so attached that they may be brought above the body in a perpendicular position, and whenever there is even the slightest disturbance the hind legs of every insect—great and small—are set into a furious kicking motion over the body. As all of the insects face the same way, any interfering object is soon kicked away from the colony. This action is accomplished without moving any other part of the body—the abdomen remaining always in its normal position. That the kicking is to ward off parasites and the predators, cannot be doubted, for, having examined thousands of colonies, I failed to see but a very few parasitized, and in no case were there to be found the larvae of the Syrphid flies, though it does not seem possible that the kicking of these creatures could keep

off such formidable enemies, unless it be accomplished by keeping away the adult flies and preventing them from depositing their eggs in the colonies. That the species is preyed upon by internal parasites is substantiated by Mr. Davidson, who states that the insect is "much parasitized by an *Ephedrus*." But worse than any insect parasite or predator is a peculiar plague which, in this section, kills off absolutely every colony in certain areas. The insects retain their shape until the very last, and as soon as dead simply melt away. If one is touched it immediately falls as a drop of dark brown liquid. The skins of thousands still hang to the former places of lodgment, showing the situations of a once prosperous colony. The contents of one of these melting bodies placed on a slide under a microscope shows thousands of small egg-shaped bodies, each with a small tubercle at one end. Whether these are the resting stages of bacteria, fungui or sporozoans I cannot say, but they are not to be found in the contents of healthy living specimens.

The attacks on the insects are greatest along the water's edge where the willows are growing in or near damp soil. In such places it is difficult to find a complete colony, while back from the river there are no evidences of the plague, if so it be. An experiment was made to see if the disease could be communicated to other species of aphids, and accordingly a large number of the diseased colonies of the common Cottonwood Aphid (*Thomasia populicola* (Thos.) Wil- and liberate the body contents. This mixture was then poured over large colonies of the common Cottonwood Aphid (*Thomasia populicola* Thos. Wilson), but none of them have yet succumbed to the disease. Specimens have been sent to the University of California to ascertain, if possible, the nature of the malady.

The winged forms are exceedingly scarce, but those found carried their wings vertically and not horizontally, as described by Buckton.

Essigella californicus (Essig) Del Guercio
(Monterey Pine Louse)

1909 *Lachnus californicus* Essig. P. C. Jr. Ent., I, pp. 1-4. Original description.

1909 *Essigella californicus* (Essig) Del Guercio. Riv. Pathol. Veg.-Pavia. Anno. III, N. 20-21. Formation of a new genus.

1909 *Essigella californicus* (Essig) Del Guercio- Baker. P. C. Jr. Ent., I, pp. 73-74. Translation of article by Del Guercio.

The description of this insect having been my first attempt, and a very poor one, it has been my constant aim to re-draw and re-describe it so as to give it a more substantial place in the literature of the Family Aphididæ. In the original description the body differentiations, especially of the thorax and abdomen, were omitted in the drawings; the measurements were taken without the aid of the camera lucida and therefore inaccurate; the text stated that the antennæ of the winged female was six-articled instead of five, which was a printer's error; so far as I can now tell, there are no sensoria on the legs at all.

WINGED VIVIPAROUS FEMALE (Figures 247, A and B)

Length of body 2.4 mm., width of the mesothorax 0.6 mm., width of the abdomen 0.7 mm., wing expansion 6.5 mm. Body long and narrow. *Prevailing color*—Green and dark brown, some specimens are rather dark throughout. *Head*—Wide, short, rounded in front, wider than the anterior portion of the prothorax, front with many long hairs extending forward, amber, yellow or green. *Eyes*—Nearly globular, with only an indication of a terete marginal

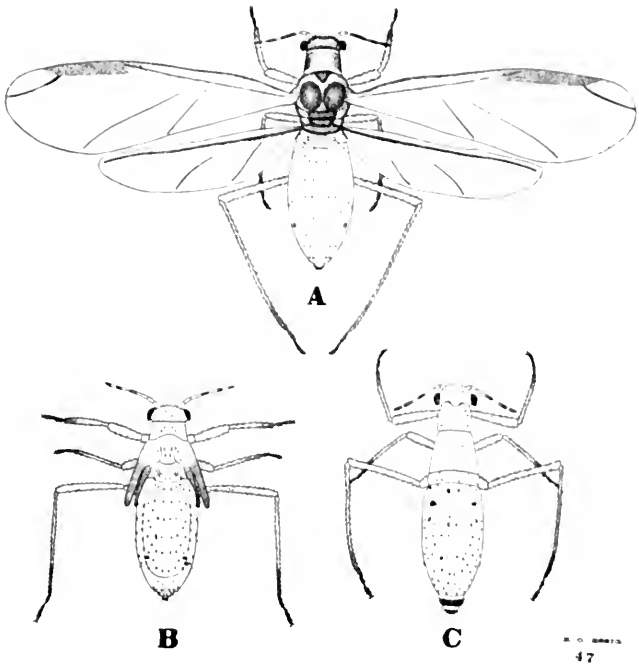

Figure 247. **Essigella californicus** (Essig) Del Guercio
A, winged viviparous female, B, nymph of the winged female, C, apterous viviparous female

tubercle, dark red. *Antennae*—(Figure 248, 1). Five-articled, short, reaching to the base of the primary wings, slightly hairy—the hairs short and stout, imbricated, darker than the body—the coloration of the articles being: I and II green or color of the head, III green or amber at base with remainder dark, IV and V dark throughout with articulations lighter; lengths of the articles: I, 0.05 mm.; II, 0.06 mm.; III, 0.21 mm.; IV, 0.1 mm.; V, 0.12 mm. From

these measurements it will be seen that I and II are nearly equal, III is twice as long as IV and nearly twice as long as V, IV and V are nearly equal, though the apical article is a little the longer of the two. The sensoria are large and oval to oblong in shape. There are from three to four on article III, one on article IV, one large one and several smaller ones on article V in the process. The unguis or spur occupies about one-fifth of the last article and is tipped with several (usually four) rather stout hairs. *Rostrum*—Reaches nearly to the base of the third coxae, light green or yellow with two marginal black spots nearly at the tip and a black tip. *Prothorax*—Much longer than the head, but not as long as wide, widens gradually from the head to the base though the sides are nearly parallel, amber green with lighter green base and apex dusky; ventral surface dusky green, but lighter than the dorsum, covered with few rather long fine tuberculate hairs. *Mesothorax*—Wider than the prothorax, dark brown or nearly black, muscle lobes slightly pruinose, sides dull green; ventral surface brown excepting the coxae, which are green. *Metathorax*—Narrower than the mesathorax, very short, muscle lobes black, pruinose, remainder dull green; ventral surface dull green. *Abdomen*—Oblong and evenly rounded, smooth, deep rich green (emerald), covered with small dark-red or dusky spots which are arranged in somewhat irregular transverse rows; from each of these spots arises a small tuberculate hair. Cleared specimens do not show these spots very well. Ventral surface of the abdomen dull green, distinctly segmented, may be slightly pruinose; anal and genital plates dusky; rather large tuberculate hairs on each margin near the posterior end and many long hairs on the anal plate. *Cornicles*—(Figure 248, 3, 4). Short, truncate, slightly wider at the bases and extending but a short distance above the body surface. When looking down upon the cornicle there appears a dark semi-circle in the center which suggests that one side of the cornicle is cut down nearly even with the body, but a lateral view of it does not show this to be the case. They are usually concolorous with the abdomen, but may be slightly amber or pinkish, or even slightly dusky. *Legs*—Hairy, lengths very uneven, first pair short and stout, second pair of medium length and stoutness, third pair very long and slender. These are used to clasp around the pine needles. The coxae are green, femora amber with front margin darker, tibiae amber with dusky tips, tarsi (Figure 248, 5) dark. Article I nearly half as long as the second; lengths, I, 1 mm.; II, 1.5 mm. *Wings*—Long and narrow, hyaline, subhyaline or dusky. *Primary*—Length 3 mm., width 0.95 mm.; costal vein well defined and wide to the stigma, though it is less than half as wide as the subcostal, basal half green, remainder dusky, subcostal wide, basal half green, remainder dusky, the color emerging from a light green at the base to the dark brown or dusky color of the stigma; stigma long and narrow, strongly angulate, opposite sides nearly parallel, sharp angle at the base of the stigmal vein, and at the apical end, dusky, almost black, length 1 mm., width 0.15 mm.; stigmal vein well defined and dark, arises from near the apical end of the stigma, slightly curved upwards, but oft-times straight, nearly parallel

with the third discoidal, tip emerges at the wing margin above the middle of the end of the wing; discoidals variable, especially the third discoidal which is very indistinct, sometimes simple, and once forked as shown in the drawings of the primary wings (Figure 248, 9-10), these variations may be found on the same insect as 9 and 10 are pairs; first discoidal well defined and dark, base near the middle of the subcostal, straight or curves slightly inwardly, second discoidal arises but a short distance from the base of the first, curves inwardly, may be undulate, well defined and dark, these two discoidals are fairly constant; third discoidal faint or sub-obsolete, simple and undulate, once branched, obsolete at base; if simple it is undulate and nearly parallel with

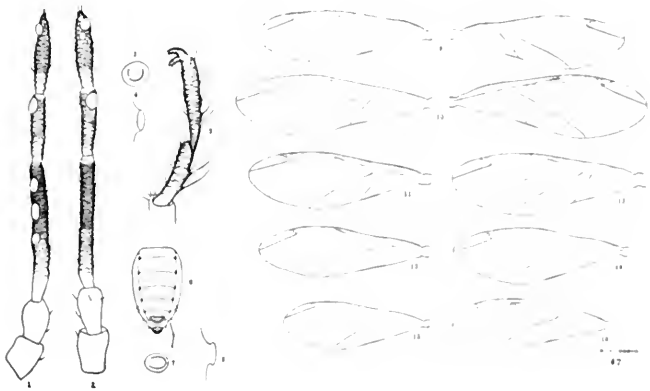

Figure 248. Essigella californicus (Essig) Del Guercio

1, antenna of the winged female; 2, antennae of the apterous female; 3, top view and 4, side view of the cornicle of the winged female; 5, tarsi of winged female; 6, ventral aspect of the abdomen of the apterous female; 7 and 8, top and side view of the cornicle of the apterous female; 9-16, wings showing differences in venation —9 and 10 are pairs from two specimens.

the stigmal vein; if once branched the fork is usually within the basal half of the length, though this is variable as 11 shows the fork to be beyond the middle. In 14 and 15 the two branches of the fork are visible while the vein and fork are obsolete. *Secondary*—Length 2.2 mm., width 0.5 mm., dusky or sub-hyaline. Subcostal wide and well defined, dark, nearly straight with an upward bend in the apical half, slightly undulate. Discoidals well defined, dusky, obsolete at bases, both arise within the basal half of the subcostal. First discoidal undulate, light at base and darkens towards apex; second discoidal curves inwardly, becoming darker from base towards the tip. Both discoidals may be nearly straight. *Style*—Obsolete. *Pygidium*—Well rounded, dusky, hairy.

NYMPH OF WINGED FEMALE (Figure 247, B)

General color and size of the adult winged female, with dark brown wing pads and more dorsal black spots and hairs, which are arranged in regular transverse rows. Pygidium dusky.

APTEROUS VIVIPAROUS FEMALE (Figure 247, C)

Length of body 2.4 mm., width of abdomen 0.65 mm. Body long and narrow, and in not a few the head and thorax are as wide as the abdomen, the body sides being nearly parallel. The drawing shows the typical shape. *Prevailing color*—Light yellowish-green with small red spots on the entire dorsum. *Head*—Rounded, wider than long but not as short as in the winged individuals, hair between the antennae often capitate, yellow or light green with several small red spots bearing hairs on the dorsum. *Eyes*—Nearly globular, red. *Antennae*—(Figure 248, 2). Reaching nearly to the middle of the mesothorax, imbricated, slightly hairy, coloration same as in winged forms, five-articles; length of articles: I, 0.06 mm.; II, 0.7 mm.; III, 0.2 mm.; IV, 0.1 mm.; V, 0.12 mm.; total 0.55 mm.; their comparative lengths about the same as the articles of the winged female. Large oval sensorium on article IV and the usual senseria in the process of V. *Rostrum*—Reaching beyond the third coxae, light green with dark tip. *Prothorax*—Narrow, nearly as long as broad, apex narrower than head, widening slightly towards the base, with many small red spots, each bearing a single fine tuberculate hair, light yellow. *Mesothorax*—Long and narrow, nearly as long as the width across the posterior end, green with red spots and hairs on the dorsum. *Metathorax*—Extremely short, not one-third as long as the mesothorax and a little wider, with a distinct transverse row of red spots on dorsum and several spots near the anterior margin, green. *Abdomen*—Green, nearly cylindrical, dorsum covered with transverse rows of small red spots, each bearing a fine tuberculate hair. Some of these spots are very irregular and differ greatly in size, while all may be very poorly arranged in rows and appear scattered. Last abdominal segment and pygidium dusky, hairy. Ventral surface pale green with two rows of five red spots each (Figure 248, 6) near the margins at the union of the segments. Anal and genital plates dusky. *Cornicles*—(Figure 248, 7, 8). Practically the same as those of the winged females. *Legs*—Lengths the same as in the winged individuals, hairy, amber yellow to amber brown throughout; coxae and bases of femora pale green; tarsi amber brown. *Style*—Obsolete. *Pygidium*—Dark, hairy.

Hosts—First taken by the writer from cultivated Pine trees (*Pinus radiata* Gord) Monterey Pines, which are growing on the Pomona College Campus. The insects are not in colonies but are scattered separately over the entire trees. They are usually to be found most plentiful on the terminals of the branches and feed upon the needles, along which they are able to move very rapidly. In moving they clasp around the needle with all feet, but particularly with the short front and the long hind legs. It is impossible to

shake them off except by violent and sudden jarring. Mr W M Davidson has described an aphid (*Lachnus pini-radiatae**) which is probably synonymous with this species, feeding upon the Monterey Pine (*Pinus radiata* Gord. and on the Silver or Digger Pine (*Pinus sabiniana* Dougl.). Am also in receipt of a single winged species from Edith M. Patch, Orona, Maine, which greatly resembles this species, and which is without doubt identical with it. It was taken from the White Pine (*Pinus strobus*) at Stillwater, Maine.

Locality—Collected by the writer at Pomona College, Claremont, Cal., and at Santa Paula, Cal.

Date of collection—During the winter months of 1908 1909 at Claremont and on July 27, 1911, at Santa Paula, Cal. Serial number 47.

Tribe PTEROCOMMINI

General Characters

Body—Usually large and somewhat flattened; very hairy, the hairs short and fine, may or may not have lateral body tubercles.

Antennæ—Usually shorter than the body, but variable in length, six-articled, not on frontal tubercles, covered with long rather stout hairs, which have large basal tubercles.

Legs—Stout, hind legs longest, very hairy.

Wing venation—As in Aphidini, with little or no variations.

Cornicles—Longer than those in the tribe Chaitophorini, usually considerably longer than broad, either cylindrical or vasiform, never very long.

Style—Thick, short, well rounded with broad base.

In the following arrangement I am again following Prof. Wilson and find that there has been considerable confusion in this tribe. Two genera are represented, *Melanoxantherium* and *Pterocomma*. It is strange too that the only California species listed or described in this tribe were placed in the latter genera under the name *Cladobius*, when both should have been placed under the former. These genera Prof. Wilson separates as follows:

Key to Genera

Cornicles swollen or vasiform.	*melanoxantherium*
Cornicles cylindrical.	*pterocomma*

MELANOXANTHERIUM Schouteden

Syn. **Melanoxanthus** Buckton

Type **Aphis salicis** Linn.

Key to California Species

Body grayish brown or amber, with distinct dorsal markings, slightly purvelent.	*rufulus* (Davidson)

***Lachnus pini-radiatae** Davidson cannot be this species, because in his description, Davidson gives the measurements of the antennal articles: III, 0.48 mm.; IV, 0.28 mm.; V, 0.28 mm.; VI, 0.23 mm. From these it will be seen that the insect has six antennal articles and it is not possible that the spur was counted as a separate article, because of the length of the sixth article. It must be a good and distinct species, though I have been unable to get specimens of it from Mr. Davidson for comparative study.

Body black, abdomen without dorsal dark markings, not purvelent. *saliciti* (Harris)

M. rufulus (Davidson). On *Salix* sp., in the vicinity of Stanford University, Palo Alto, Cal. Jr. Ec. Ent., II, 301, 1909.

M. saliciti (Harris). On *Salix* sp., in the vicinity of Stanford University, Palo Alto, Cal., Davidson. Jr. Ec. Ent., II, p. 300, 1909.

Pterocomma Buckton

Syns. **Cladobius** Koch
Aphioides Passerini
Aristaphis Kirkaldy

Type **P. pilosa** Buckton

No members of this genus reported from California.

Melanoxantherium rufulus Davidson

1909 *Cladoobius refulus* Davidson. Jr. Ec. Ent. II, pp. 300-301. Description.

WINGED VIVIPAROUS FEMALE (Figure 249, A)

Length 3.25 mm., width of the mesothorax 0.95 mm., width of the abdomen 1.15 mm., wing expansion 9 mm. This is not the largest specimen. Davidson gives the following measurements: Length of body 3.8 mm., expanse of wings 11.25 mm. *Body*—Rather broad and flat, large, entirely covered with rather long fine hair, often slightly powdery. *Prevailing color*—Dark grayish-brown or gray-ground color brown, covered with fine white powder giving it the gray color. *Head*—Small, widest at the base, much wider than long, broad between antennæ, dusky amber. *Eyes*—Dark red with terete tubercles. *Antennæ*—(Figure 250, 1 and 2). As long as the head and thorax, imbricated, hairy articles I and II dusky, III dusky brown with yellow base, IV dusky white with lighter base, V and VI dusky or dark throughout. Lengths of articles: I, 0.09 mm.; II, 0.07 mm.; III, 0.6 mm.; IV, 0.38 mm.; V, 0.38 mm.; VI, 0.55 mm. (spur 0.33 mm.); total, 2.09 mm. antennæ of one of the largest insects). I and II are nearly equal with the former, always longer and wider, III the longest article, IV and V equal or nearly so, in some cases IV is longest, in others V is longest, VI with spur much longer than the base, but not over one and one-third times as long, III with from eleven to thirteen large circular sensoria, V with one near the apex, and VI with one large and four or five small sensoria in the process. *Rostrum*—Reaching to or slightly beyond the third coxæ, transparently light with the extreme tip dark. *Prothorax*—As long as the head and much wider at the base, with distinct lateral tubercles (Figure 250, 4) just back of the middle, greenish or dusky amber, when pruinose with a lateral dorsal darker band parallel to the sides, ventral surface yellowish. *Mesothorax*—Deep amber, front median lobe and scutellar lobe lighter than the ground color, side muscle lobes dark, nearly black. All lobes well developed, ventral surface distinctly lobed—lobe on

each side pinkish amber, four on ventral surface black, portion connecting coxæ pink. *Metathorax*—Muscle lobe dark amber, remainder lighter, ventral surface dark around coxæ with a light band connecting them. *Abdomen*—Distinctly segmented, the lateral margin of each segment with a distinct tubercle (Figure 250, 5) shorter than those on the prothorax and a dark blotch around each tubercle, also with a transverse median brown band which may or may not be in two parts, and a spot between the segments near the lateral margins as shown in the drawing. Entire surface may be covered with a fine

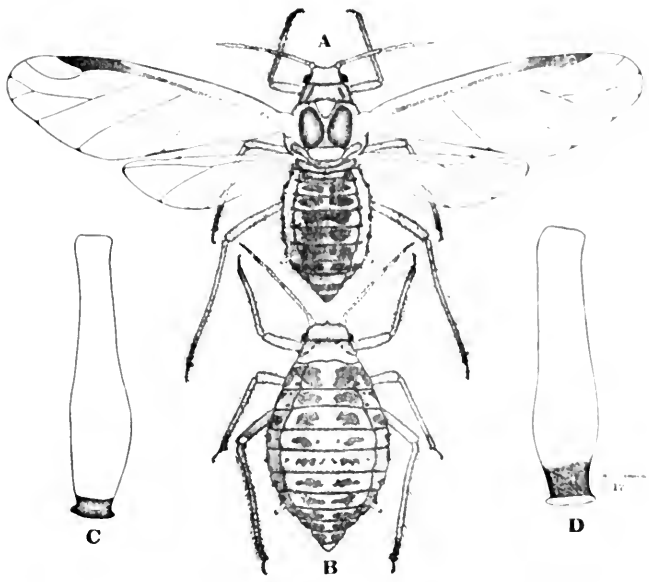

Figure 249. Melanoxantherium rufulus (Davidson)
A, winged viviparous female; B, apterous viviparous female; C, cornicle of winged female; D, cornicle of apterous female

white powder, which is usually thickest between the segments. Anal plate large, hairy, amber. *Cornicles*—(Figure 249 C). Vasiform, very narrow throughout the basal half and enlarged and contracted in the apical half so that the mouth is wider than the base but much narrower than the widest part, contracted just before the mouth, which is flaring, yellow or orange throughout, with often a dusky tip; length 0.38 mm., width at base 0.05 mm., width at narrowest place 0.04 mm., width at widest place 0.08 mm., width of contraction just before the mouth 0.45 mm., width of mouth 0.06 mm. *Legs*—Stout, hairy; front legs much shorter than the rest, middle legs longer than

the forelegs, but much shorter than the hind legs, hind legs long with exceptionally long femora; coxæ dusky white; femora dusky white with apical one-half dark brown; tibiæ yellowish amber with darker tips; tarsi (Figure 250, 3) dark; article I one-fourth at long as II. *Wings*—Normal, hyaline, with venation constant and normal. *Primary*—Length 4 mm., width 1.4 mm. Costal well developed to the stigma. Subcostal wide, rich brown. Stigma rather long and narrow, with opposite sides nearly parallel, four times as long as broad, pointed at tip, rich brown. Stigmal vein short and well curved, arising beyond the middle of the stigma, the tip slightly farther from the tip of the stigma than is the base. Discoidals well developed and normal; first and second with bases quite distant, first straight, second bent outwardly, with convex surface towards the tip of the wing, third obsolete for a short distance at the base, first fork near the middle, and second fork near the tip of the wing. All veins rich brown with a slight dusky area at their tips. *Secondary*—Length 2.4 mm., width 0.7 mm., venation constant, subcostal undulate, distinctly twice bent, first downward bend slight and at the base of the first discoidal which is not far from the base of the wing (one-fifth the length of the vein), the second downward bend is much greater than the first and at the base of the second discoidal, which is nearly the middle of the subcostal, first discoidal obsolete at the base, straight, reaching to tip of wing, second discoidal bending slightly outwardly. Veins brown with dusky spots at their apices. *Style*—Short, rounded, amber yellow or orange with dusky tip.

APTEROUS VIVIPAROUS FEMALE (Figure 249, B)

Length of body 3.2 mm., width of abdomen 1.7 mm. *Body*—Large, oval, tapering gradually towards both ends, covered with hair, pruinose, well segmented. *Prevailing color*—From reddish brown to gray, covered with a fine white powder which forms white or gray bands between the segments and a light longitudinal row on the middle of the dorsum. *Head*—Rather large, much wider than long, with front ocellus protruding forward, wide between the antennæ, amber brown. *Eyes*—Large, dark red. *Antennæ*—(Figure 250, 8 and 9). Half as long as the body, not on frontal tubercles, hairy, each hair on quite a large tubercle or swelling, I and II amber yellow, III and IV transparently white or yellow with dusky tips, V transparently yellow with apical one-third dark, VI dark with extreme base light. Lengths of articles: I, 0.1 mm.; II, 0.08 mm.; III, 0.5 mm.; IV, 0.34 mm.; V, 0.35 mm.; VI, 0.5 mm., (spur 0.29 mm.); total 1.87 mm. I is wider and longer than II, III as long or slightly longer than VI, IV and V approximately co-equal though V is often slightly the longer, VI as long or nearly as long as III, spur longer than the base, but not nearly twice as long. Usual number of sensoria on V and VI. *Rostrum*—Reaches to the third abdominal segment, transparently white with black tip. *Prothorax*—Light, reddish brown with few darker markings and a lighter basal band, with blunt lateral tubercle (Figure 250, 6) just below the middle. *Meso-* and *Metathorax*—Each with irregular trans-

verse dark bands on the dorsum, which nearly meet in the middle. *Abdomen*—Deeply segmented, each segment with lateral tubercle on both sides (Figure 250, 7) around which is a dark spot, and two or more irregular dark patches which form two dark longitudinal rows—one on each side of the light dorsal band (see drawing). *Cornicles* (Figure 249, D). A little stouter than in the winged form, but of the same general shape, yellow to orange in color

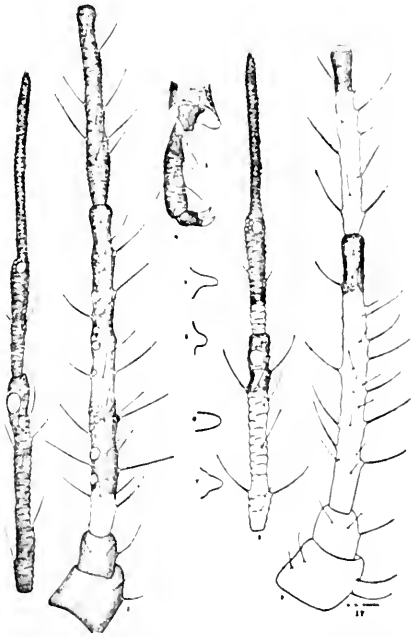

Figure 250. Melanoxantherium rufulus (Davidson)

1-2, antenna of the winged female, tarsi of winged female; 3, tarsi of winged female; 4 and 5, prothoracic and lateral abdominal tubercles of winged female; 6 and 7, same of apterous female; 8 and 9, antenna of apterous female

with the tip dusky in some instances, but not in all, length 0.36 mm. *Legs*—As in the winged form and colored as follows: coxae very light yellow, femora with base yellow and apical two-thirds dark amber, tibiae dusky brown with tips very dark brown, tarsi dark brown. *Style*—Large, nearly as wide as the anal plate, well rounded, nearly as long as wide, hairy, dusky.

Young—Amber brown to yellow, or even transparently white, without the powdery covering and dark dorsal markings.

Hosts—This insect is a bark feeder and may be found under the surface of the ground or away out on the very tender shoots. I have never found it feeding on the leaves, although Davidson states that it is found on the stems and the leaves. The favorite locality is on the bark which is at least one year old. In not a few cases it has been found four inches under the sand. In such cases the insects are very light green and the dorsal markings distinct, without any of the white powdery wax. I have collected it on Cottonwood (*Populus trichocarpa* T. & G.) infesting the younger twigs, and on *Salix lavigata* Bebb., usually on the older bark. Davidson simply reports it on *Salix* sp.

Locality—Occurs in many parts of Ventura County and collected at Ventura, Santa Paula, and Sespe. Davidson collected it in the vicinity of Stanford University.

Date of collection—From March 30 to August 5, 1911. It is still plentiful to date (Sept. 5, 1911). Serial number 17.

This species collects in large colonies, which in their compactness resemble the colonies of *Tuberculachnus viminalis* (Fonsc.) Mord, described further on. Among the colonies are to be found many of the Syrphid larvæ and not a few are parasitized. The species as it occurs here does not usually have the dusky tipped cornicles, though they are to be found. Instead of the cornicles being orange, they are more often light lemon yellow or nearly transparently white. Because of these variations I sent specimens to Prof. Davidson to compare with his types and he writes as follows: "No. 17 may be *rufulus*, although the third antennal joint is rather long, and the cornicles are pale at the apex." I can explain that the specimens sent to Mr. Davidson were obtained under ground and were somewhat bleached, which undoubtedly had something to do with the lightness of the cornicles. The difference in the length of the third antennal article is not sufficient to justify any separation, so I feel that the species is where it belongs.

Aphis maidis Fitch
(Corn Leaf-Aphis)

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1909 *Aphis maidis* Fitch-Fullaway. Ann. Rept. Agrcl. Dept., Hawaii, pp. 441-442.

1910 *Aphis maidis* Fitch-Williams. Aphididæ of Nebr., pp. 47-49.

WINGED VIVIPAROUS FEMALE (Figure 251, A)

Length of body 2.2 mm., width of the mesothorax 0.6 mm., width of the abdomen 0.9 mm., wing expansion 7 mm. *Body*—Normal size, slender, more than twice as long as wide, shiny. *Prevailing color*—From a dark olive green to a dull bluish-black. *Head*—Small, nearly as long as wide, with short but

distinct frontal tubercles, black. *Eyes.* Very dark red. *Antennæ.* Figure 251, 1-4 and 8 c. More than half as long as the body, reaching to the bases of the cornicles, slender, with very few hairs, imbricated, nearly black excepting base of article III and at the articulations. Lengths of articles: I, 0.09 mm.; II, 0.05 mm.; III, 0.15 mm.; IV, 0.26 mm.; V, 0.17 mm.; VI, 0.56 mm. (spur or filament 0.47 mm.); total, 1.38 mm. Article I is longer and larger

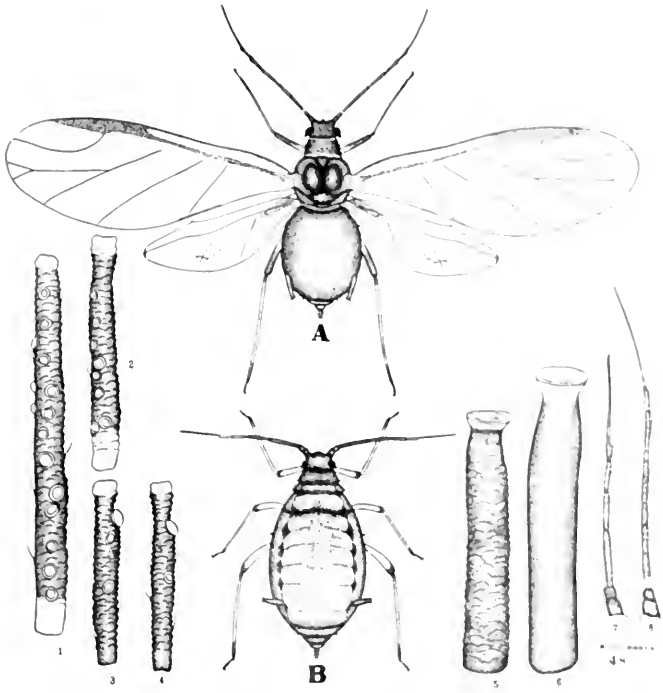

Figure 251. Aphis maidis Fitch.

A, winged viviparous female. B, apterous viviparous female. 1-4, antennal articles of winged female (1, third article, 2, fourth article, 3 and 4, sixth articles). 5, cornicle of winged female; 6, cornicle of apterous female. 7, antenna of apterous female. 8, antenna of winged female.

than II, III is longer than IV or V, but not as long as the spur of VI. IV always a little longer than V, and twice as long as the base of VI. It is noticeable that in most of the descriptions of the middle western forms the filament of VI is shorter than III, while in practically every specimen collected here it is much longer than III and in a few cases almost a third longer.

The sensoria are circular and irregularly distributed on articles III, IV, V, and VI as follows: III, from fourteen to twenty; IV, from four to eight; V, from two to four; VI, usually a single large one. *Rostrum*—Reaching to the second coxae, very light or dusky yellow with dark base and tip. *Prothorax*—Narrow, wider at base, as long or longer than the head, with distinct lateral tubercles just in front of the middle, very dark with lighter green transverse bands extending across the apical and posterior ends. *Mesothorax*—Much wider than the prothorax, muscle lobes well developed, lobes black, shiny, while the remainder of the segment is dark green. *Metathorax*—Not as wide as the mesothorax, dark green with muscle lobes black. *Abdomen*—Evenly rounded so that the posterior end is nearly as blunt as the base, with the exception of the protruding style and anal plate, smooth and shiny, evenly colored nearly black or very dark green—specimens do not show the marginal black spots referred to by eastern writers, probably because the dark color hides them. One minute posterior and one anterior lateral tubercle. Anal plate black. *Cornicles*—(Figure 251, 5). Cylindrical, constricted just before the mouth, which is flaring, not reaching to the tip of the abdomen, imbricated, very dark or black, length 0.27 mm., average width 0.045 mm. *Legs*—Normal, covered with few fine hairs; coxae black; femora amber yellow with apical two-thirds dark brown; tibiae amber yellow with dark tip and base; tarsi dark. *Wings*—Hyaline, normal "Aphis" venation. *Primary*—Length 3.1 mm., width 1.15 mm. Venation variable and not at all constant. Costal vein wide, amber. Subcostal much wider than the costal, yellow to the base of the stigma. *Stigma*—Long and narrow, nearly half as long as the subcostal vein, sharp, pointed at the tip, rich dark brown, length 1.05 mm., width 0.14 mm. Stigmal vein arises from near the middle of the stigma, strongly bent throughout first half and remainder nearly straight or undulate to tip of wing, rather long. First discoidal arising just inside the middle of the subcostal, nearly straight, rich brown; second discoidal arising just beyond middle of the subcostal, base often sub-obsolete, curving with the convex surface towards the wing tip, nearly twice as long as the first discoidal; third discoidal normally twice branched, with first fork near the middle of the vein and the second near the wing tip. In the specimens collected in this locality (fifty mounted specimens examined) more than half had the third discoidal only once-branched with the fork corresponding to the first fork of the normal wing, all branches a rich amber, base obsolete. *Secondary*—Length 1.8 mm., width 0.58 mm. Subcostal vein with deep downward bend under hooklets and beyond the base of the second discoidal. Discoidals straight, obsolete at their bases, nearly parallel. Veins brown. *Style*—Slender, nearly cylindrical, about half as long as the cornicles, dull green, hairy.

APTEROUS VIVIPAROUS FEMALE (Figure 251, B)

Length 2.3 mm., width of abdomen 1.1 mm. *Body*—Dull black, evenly rounded, showing little segmentation, smooth. *Prevailing color*—Dull greenish-black, bluish-black, or velvety-black, with no distinct body markings. *Head*

—Small, nearly as long as wide, with distinct, but short, antennal tubercles, pointed in front, dark with amber or brown front. *Eyes*—Dark red, to brown. *Antennae*—Figure 251, 7*a*. Longer than half the length of the body, reaching to the bases of the cornicles, with very few hairs, imbricated, articles I and II dark amber brown, III dark amber base and remainder amber, IV, V, VI dark brown to nearly black. Lengths of the articles, I, 0.09 mm., II, 0.06 mm.; III, 0.3 mm.; IV, 0.2 mm., V, 0.17 mm.; VI, 0.50 mm., spur or filament, 0.47 mm.); total 1.38 mm. From these measurements it will be seen that the articles bear a similar relation to each other as do the articles of the antennae of the winged female and that the filament is longer than article III. There seem to be no individuals in which this is reversed. Sensoria only on articles V and VI and on these normal. *Rostrum*—Reaching to back margin of the second coxae, amber with dark base and tip. *Prothorax*—Slightly wider than the head, with distinct lateral tubercles. All thorax black and distinctly segmented with mesothorax very short. *Abdomen*—Smooth, dull black or very dark green, with one lateral anterior and a lateral posterior tubercle on each side, segmentation on the dorsum partial or indistinct. Anal plate black or very dark. *Cornicles*—(Figure 251, 6). Cylindrical, smooth (not imbricated as in the winged forms) not reaching to the tip of the abdomen, sometimes slightly flaring in the middle, constricted just before the mouth which is flared, black, length 0.31 mm., average width 0.051 mm. *Legs*—Lighter than in winged form; coxae amber-yellow; femora with tip and front darker, tibiae same as femora; tarsi dark brown. *Style*—Slender, nearly cylindrical, half as long as the cornicles, dark green to nearly black, hairy.

Hosts—Occurs in more or less limited numbers on the ears and tassels of the common sweet corn. In the corn-growing States of the Mississippi Valley this insect is a most serious pest and much study has been given to perfect control methods. It attacks practically all members of the sorghum or corn family, and has been reported from practically every State in the United States and from the Hawaiian Islands. Prof. Clarke reported it from this State in the year 1903, but since that time it has received little or no attention.

Locality—Collected by the author in the vicinity of Santa Paula. Reported from the central part of the State by Prof. Clarke and W. M. Davidson.

Date of collection—Occurs throughout the summer months. Specimens studied were collected July 28, 1911. Serial number 48.

Natural Enemies—This species is quite extensively parasitized by internal parasites. The larvae of the native Scymnus (*S. sordidus* Horn) and the larvae of Syrphid Flies play an important part in keeping it down.

Rhopalosiphum nymphaeae Linn.
(Pond Lily Aphid

1767 *Aphis nymphaeae* Linn. Syst. Nat. II, p. 734.
1794 *Aphis nymphaeae* Linn. Fabr. Ent. Syst. IV, p. 214.
1801 *Aphis nymphaeae* Linn. Schrank. Fn. Boica. II, p. 117.
1801 *Aphis butomi* Schrank. Fn. Boica., p. 114.

1843 *Aphis nymphaeae* Linn. Kalt. Mon. Pflz., p. 104.
1854 *Rhopalosiphum nymphaeae* Linn. Koch. Pflz., pp. 44-45.
1854 *Rhopalosiphum alismae* Koch. Pflz., pp. 26, 44.
1854 *Rhopalosiphum najadum* Koch. Pflz., pp. 45-46
1879 *Rhopalosiphum nymphaeae* Linn. Buck. Mon. Brt Aphid., II, p. 12.
1893 *Rhopalosiphum nymphaeae* Linn. Osborne-Sirrine. Proc. Ia. Acad. Sci., III, p. 98.
1893 *Rhopalosiphum nymphaeae* Linn. Osborne-Sirrine. Insect Life, V, p. 236.
1895 *Rhopalosiphum nymphaeae* Linn. Cowen. Hem. Colo., p. 123.
1901 *Rhopalosiphum nymphaeae* Linn. Hunter. Aphid. N. A., pp. 106-107.
1905 *Rhopalosiphum nymphaeae* Fabr. Schout. Aphid. Belg., p. 236.
1905 *Rhopalosiphum nymphaeae* (Linn.) Kirkaldy. Can. Ent. XXXVII, p. 415.
1908 *Aphis aquaticus* Jackson. Ohio Natr., VIII, p. 243.
1910 *Rhopalosiphum nymphaeae* (Linn.) Williams. Aphid. Nebr., p. 70.
1910 *Rhopalosiphum nymphaeae* (Linn.) Davis. Ent. News, XXI, pp. 245-247.
1910 *Rhopalosiphum nymphaeae* Linn. Davidson. Jr. Ec. Ent. III, p. 377.
1910 *Rhopalosiphum nymphaeae* Linn. Davis. Jr. Ec. Ent., III, p. 494.

WINGED VIVIPAROUS FEMALE (Figure 252, A)

Length of body 1.5 mm., width of the mesothorax 0.4 mm., width of the abdomen, 0.65 mm., wing expansion 4.8 mm. *Body*—Small, oval to oblong in shape, dark, dorsum smooth and often shiny, ventral surfaces of the thorax, head, antennæ and legs covered with rather long white flocculence. This is secreted on the lower surface of the thorax and is evidently gathered up by the appendages coming in contact with it. *Prevailing color*—Light yellowish-green to a dark olive to almost blackish-green, with the white flocculence under the thorax. *Head*—Nearly as wide as the prothorax, pointed in front, with small frontal tubercles, dark olive-green, pruinose ventrally. *Eyes*—With distinct tubercles, large, red. *Antennæ*—(Figure 252, 1, 2). Reaching to the middle of the abdomen, but not to the bases of the cornicles, on short but distinct frontal tubercles, which are wide apart at the base, imbricated, with very few hairs, dull olive green to dark amber throughout. Lengths of articles: I, 0.05 mm.; II, 0.05 mm.; III, 0.25 mm.; IV, 0.14 mm.; V, 0.118 mm.; VI, 0.38 mm., (base 0.09 mm., spur 0.29 mm.); total 0.988 mm. Articles I and II large and co-equal; III longer than either IV or V, but not quite as long as the two together, IV always slightly longer than V, VI longer than any of the rest, the base much shorter than either IV or V, the spur longer than III and longer than IV and V together, the apical fourth is not imbricated at all, a very noticeable characteristic. The sensoria are circular and vary in size and shape as well as in number. Article III has from five to thirteen, but

usually nine or eleven, IV has none, V has one near the apex, and three or four on VI at the base of the spur. *Rostrum*—Yellow with dark tip, flocculent, reaching to the third coxae. *Prothorax*—Little wider than the head, with small lateral tubercles, dark olive green with lighter green transverse bands at base and apex, ventral surface dusky green, flocculent. *Mesothorax* and *Metathorax*—Dark olive green with black muscle lobes, ventral surface dusky green, flocculent. *Abdomen*—Well rounded, lateral edges lobed, with small tubercles, dull olive green with dark longitudinal dorsal and lateral bands with few dark cross bands. These markings are very irregular and often

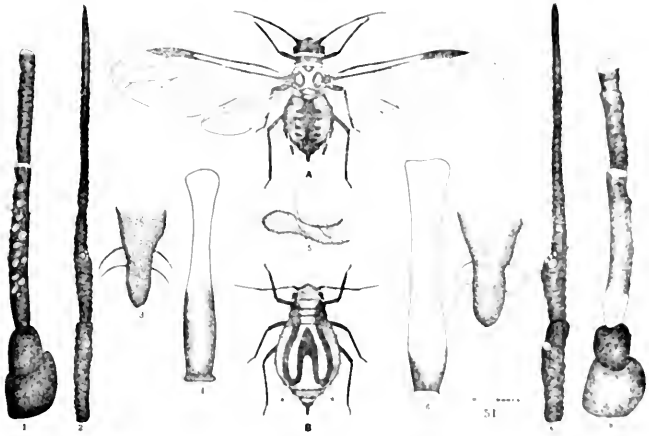

Figure 252. Rhopalosiphum nymphaeae (Linn.)

A, winged viviparous female; B, apterous viviparous female; 1 and 2, antenna of winged viviparous female; 3, dorsal aspect of style of winged female; 4, cornicle of winged female; 5, lateral aspect of the style of winged female; 6, cornicle of apterous female; 7, style of apterous female; 8 and 9, antenna of apterous female.

obscure; ventral surface dull green, smooth. Anal plate well rounded, rough, hairy and nearly black. *Cornicles*—(Figure 252, 4.) Long, clavical, extreme base wide, basal half very narrow and widening throughout the apical half, slightly constricted just before the flaring mouth, the swollen portion much darker than the remainder which is rather dark olive green. They do not reach to the tip of the style, length 0.25 mm., greatest width 0.04 mm. *Legs*—Very small, dark, with very fine and short hairs. Coxae dark; femora dull green with apical two-thirds nearly black; tibiae dull green with base and tip very dark; tarsi dark. All joints pruinose or flocculent on the under sides. *Wings*—Normal, hyaline. *Primary*—Length 2.2 mm., width 0.8 mm., rather slender; costal wide, brown; subcostal much wider than the costal, brown;

stigma rather long and slender with sharply pointed tip, nearly three times as wide as the length, rich brown in color, length 0.6 mm., width 0.16 mm. Stigmal vein arising a little nearer the tip than the middle of the stigma, strongly curved throughout the basal half, but slightly curved throughout the apical half, rich brown. Discoidals brown, well defined, and normal; first discoidal arising just inside the middle of the subcostal, straight, reaches to the wing margin; second discoidal arising just outside the middle of the subcostal, slightly curved with the convex surface towards the wing tip, not quite reaching the wing margin; third discoidal obsolete at the base, twice-forked, first fork just above the middle of the vein, second fork near the tip of the wing, the upper branch being nearly twice as long as the lower branch. *Secondary*—Length 1.2 mm., width 0.36 mm., normally veined with subcostal and two discoidals. Subcostal undulate, greatest downward bend at the base of the second discoidal; first discoidal obsolete at the base and not reaching to the wing margin, curved with the slightly convex surface towards the wing tip, arising inside the middle of the subcostal; second discoidal arising beyond the middle of the subcostal, which the base touches, straight, not quite touching the wing margin. *Style*—(Figure 252, 3 and 5). Rather long, ensiform from a dorsal aspect and sickle-shaped from a lateral aspect, covered with small rough scaly projections, with four rather long curved hairs arising near the middle, dull olive green (may be slightly covered with whitish powder), length 0.12 mm., or about half as long as the cornicles.

APTEROUS VIVIPAROUS FEMALE (Figure 252, 13)

Length of the body 1.5 mm., width of the abdomen 0.8 mm. *Body*—Oblong oval, to nearly globular in shape, small, shiny above and flocculent under thorax. *Prevailing color*—Light green, dull olive green, to almost black, dorsum perfectly smooth, ventral surface of head, thorax and appendages flocculent, as in the winged forms. This flocculence seems to be a striking characteristic of this species and is evidently a protection against the water. *Head*—Rather large for so small a body, with small, but distinct frontal tubercles, much wider than long, somewhat lighter than most of the body, being a dull amber brown dorsally with fine powder on ventral surface. *Eyes*—Large as in the winged form, red. *Antennae*—(Figure 252, 8, 9). Reaching to the middle of the abdomen, a little over half the length of the body; on short, but distinct frontal tubercles, with very few hairs; imbricated except articles I, II and the apical one-fourth of the spur of VI; dull blackish-green throughout with short, flocculent clinging to the under surface of the articles. Lengths of the articles: I, 0.055 mm.; II, 0.055 mm.; III, 0.186 mm.; IV, 0.134 mm.; V, 0.12 mm.; VI, 0.38 mm., (base 0.08 mm., spur 0.3 mm.); total 0.93 mm. The comparative lengths compare very well with those of the winged individuals, only III is not so long, and IV is but slightly longer than V. Sensoria normal on V and in the process of VI. *Rostrum*—Reaching beyond the third coxae and nearly to the middle of the abdomen, light yellow with extreme base and apical one-half dark. *Thorax*—Dull olive green with

slightly darker lateral margins, ventral surface covered with long white flocculence. Prothorax with small lateral tubercles. *Abdomen*. Smooth, dull olive green, with dark dorsal marking resembling a letter "W", but which is often designated by merely a median dorsal and two lateral longitudinal darker lines, with small lateral tubercles, ventral surface smooth, without powder or flocculence, dull green. Anal plate, rounded, large, rough, hairy, very dark green. *Cornicles* (Figure 252, 6). Same shape as those of the winged form, olive to lighter green with apical one fifth darkest, length 0.27 mm. *Legs*. As in winged forms. *Style* (Figure 252, 7). Ensiform or slightly conical with base widest and slightly tapering to a rounded point, sickle-shaped, rough, with four spines near the middle, dark olive green, length 0.13 mm. (about half as long as the cornicles).

Young—The young are usually much lighter in color, but many of these are very dark olive green.

Hosts—This peculiar aphid inhabits plants which grow in the water and is usually found near the water line. It was taken by the writer in great numbers from the common California Tule (*Typha latifolia* L.) on which it was gathered within the first foot above the water line. European writers have reported it on the White Water Lily (*Nymphaea alba*), Water Plaintain (*Alisma plantago*), Water Gladiole (*Butomus umbellatus*), Pond Weed (*Potamogeton natans*), *Typha major*, *Sagitta sagittifolia*, *Hydrocharis morsus-ranal*, and *Lemna gibba*. In the United States it has been reported on Pond Lily (*Nymphaea odorata*) in Iowa, on Arrow Leaf (*Sagittaria variabilis*) in Colorado, by Cowen, on *Philotria canadensis*, *Calla*, and *Lemna* sp., in Illinois, by Davis, and on *Polygonum* sp. in California by Davidson.

Locality—Taken on Tules growing in the water along the banks of the Santa Clara River about three miles east of Santa Paula, Cal.

Date of collection—It exists throughout the latter part of the summer and was collected August 28, 1911. Serial number 51.

Though this insect inhabits plants which grow in the water it has never been able to escape a host of enemies in the form of the larva of Syrphid flies and internal parasites, which are constantly destroying them.

THE "LONGULUS" SCALE

D. KELL
HORTICULTURAL INSPECTOR

This scale has been known in the Claremont and Pomona district some three or four years, during which time it has been steadily on the increase. It can now be found extending (in that part of the county of Los Angeles which lies east of San Antonio Avenue) from Fifth Street on the south, nearly to the Base Line on the north, mostly scattered thinly through the groves, but in certain localities focussed into serious infestations.

In the groves thus affected the black smut due to its presence is seen to cover the trees with a sooty pall.

Name—So far, we have been given no authoritative name for this scale, the name *Coccus hesperidum* var. *longulus* having been bestowed on it by Mr. Essig (now Secretary of the State Horticultural Commission) on the assumption that it was a variety of the Soft Brown scale. Mr. Essig, however, has recently informed the writer that he no longer holds this view.

Hatch—According to the writer's experience this scale has one very definite hatch every year, commencing about the beginning of May, and ending, the two years I have had it under observation, on practically the same date, August 21.

The young are born viviparously. Occasionally, on looking under a hatching female, I have found from one to four white, pellucid, egg-like bodies among the new-born scales. I have never found these under a greater proportion than about 5% of the old scales. I do not know whether these are the eggs of the scale, or of some parasite. Exit-holes of a parasite are occasionally found, but not very often.

One finds as many as twenty-five to thirty under the old females at one time, but I do not know the total number she would bring forth. Not more than 200, perhaps, but this is only a guess.

In the hatching season the old scales often vary considerably in size, giving the appearance of an uneven hatch, but one finds newly-born young under quite small females, and I think that probably all are almost equally mature. At any rate, I have so far found no new-born young before May, and no live adults after August 31. This would give about the same length of hatch as the normal hatch of the black scale in this district, but beginning and ending a month earlier in the year.

Appearance—The newly-born scales are lively, oval in shape, rather deep yellow in color. They soon settle on the young twigs and the leaves, favoring especially the under surface of the leaf. A few will be found along the midrib, but the majority are scattered over the under surface evenly, with fairly equal distances between individual scales. A few, also, will be found on the upper surface. Once they have settled down they remain quiescent. You may

occasionally get them to walk by detaching one gently from the leaf surface, or may even (rarely) find one walking of its own accord, but they now move slowly and uncertainly, in distinction to their brisk movements when they first emerge from under the old shell.

Before they have settled down for the first time they are opaque, but once settled they seem very quickly to become transparent, with the alimentary canal showing through as a darker streak down the middle, and two whitish streaks on each side extending from this median line to the edges of the scale. I believe these white streaks are caused by grooves on the under surface. The general color of the scale at this age is light green, but it is so transparent as to be almost indistinguishable from the leaf-surface with the naked eye. The shape is a blunt oval. The eyes show up as minute black dots. There is a deep, slit-like anal cleft. They resemble most the young of the Soft Brown scale, but are transparent and green, rather than yellow and opaque, and lie flatter on the leaf, appearing to adhere closely to it like a mere film, while the young of the Soft Brown is thicker and the central portion more raised, so as to be convex, or dome-shaped.

As they grow older they become more yellowish, and begin to retire from the leaves onto the twigs. By the end of January I have found this migration almost completed, though a few will occasionally be found to have stayed on the leaf till death. On the twigs they soon lose their yellowish tinge, and assume a sort of dull, mottled gray color (very different from the glazed appearance and yellowish or light brownish color of the hesperidium). They are now no longer flat or film-like, but convex in profile, oval in outline, and soft to the touch. (I think "Soft Gray scale" would be a good descriptive popular name for this scale.)

The full-grown scales would probably attain a length of about three-sixteenths to one-fourth inch. I have never found them on the fruit, nor on twigs thicker than a cedar pencil. I have found them on every kind of citrus tree, but not on any other. They are arranged on the twigs, when they occur in large numbers, in a characteristically imbricated manner, like fish-scales, and being now all in the adult stage, they look very different from the indiscriminately arranged masses of all sizes which is characteristic of *hesperidum*.

Death—Soon after the hatching begins the surface of the mother scale becomes dry, and light brown in color, and begins to adhere less closely to the twig. When the young are all born the shell is very apt to drop off, leaving a whitish mark. One does not often find old shells of the year before, as is the case with the black scale. The whitish mark referred to is formed by the debris, apparently, of some envelope which must invest the young before birth, for a little pile of this debris is always found under the old shell along with the new-born young.

Smut—This scale throws out a great deal of honey-dew, the resulting smut making the trees very dirty. The earliest date I have observed the honey-dew is April 20. As a rule, it does not smut up the trees till the navels are all picked, but the Valencia fruit becomes much soiled.

Fumigation—A very peculiar characteristic of this scale is its resistance to hydrocyanic gas fumigation quite soon after it has been hatched out, while it is still in the early greenish or yellowish stage, in fact, and should be easy to kill. Last year the latest date on which a good killing was obtained was October 9, but this year no useful work has been done on it since September 13. On the other hand, if fumigated before the young has all been born (August 21 the last two years) perfect results cannot be looked for, as though all the young scales, including those still under the old shells, can be killed, the mothers are not killed, and continue to bring forth young. Practically, however, the number of unborn young still remaining after, say, July 15, would probably not be large enough to be serious. This would give us a fumigating season lasting from July 15 to early in September. This would be too early, most years, to get a good killing with the black scale, while fumigating as early as July would be liable to drop fruit unless very cool nights happened to be available. With regard to the dosage, very good results have been obtained, between the dates mentioned, with doses as low as the half schedule, while after the end of August very poor results have been obtained with dose as high as one ounce of cyanide to the hundred cubic feet. I hope to be able to give more definite results before next fumigating season. I do not think there is much use in fumigating for "longulus" from now on until July 15.

Spraying—We have tried various sprays on this scale, and have killed a fair proportion, probably, of those reached by the spray, but in no case was a result obtained that could be looked upon as satisfactory.

COOL AIR EXPERIMENTS WITH JUNONIA COENIA

WILHELM SCHRADER

In my first article on temperature experiments, published in Volume IV No. 1 of this Journal, I described only breeding experiments at the warmth of 90 degrees, and as I found that cool air has a very different influence on the formation of the markings and color of this butterfly, I determined to give these experiments a very careful observation, and to repeat them several times, to be sure that it is the cool temperature only, which produces these changes.

In the fall of 1910 I took eighty-five young caterpillars from my thirteenth generation which were bred in 90 degrees damp air, and in darkness, and raised these young caterpillars in a shady place, in an open shed, where the lowest average temperature at night, for the first half of October, fell to 60 degrees and the highest average in the daytime from 11 to 9 o'clock was about 75 degrees. I obtained the first chrysalides on October 17th, and the first butterflies, bred in the same temperature on October 26th. In this part of the thirteenth generation, I got a high percentage with double ocelli on the fore wing; however, what was still more remarkable, all had both ocelli of the hind wing greatly enlarged; this was so much the more striking as in the previous generations bred in a warm temperature, the ocelli of the hind wing became slowly reduced in size, from one generation to another. This enlargement of the spots was not the only result, as many developed new small ocelli, which were between the large and small ones and just above the latter. This is shown in Fig. 253, 1. The remainder of the chrysalides from the caterpillars raised in a cool temperature I bred in 90 degrees warm, damp air, and in darkness; here also there was the same result, but there were not so many with the new small ocelli, and the ground color was darker (Fig. 253, 2). In all bred in a cool temperature the ground color is somewhat lighter near the border, and shows generally a yellow band on the outerside of the ocelli of the hind wing, the same as in our local form; the lighter ground color occurs in all bred in cool temperature, in darkness as well as in the light. The underside also changes in color. In all Junonia bred in warm, dry air, in darkness or in light, the under side of the hind wing is largely of a uniform gray, only the middle field is somewhat darker; this gray color occurred always in the twelve successive generations bred in a warm temperature; however, the thirteenth generation bred for the first time in a cool temperature shows the under side of the hind wing, and the tip of the fore wing a brownish red color, with the middle field somewhat violet; this color deepens with the fall in temperature, and the length of time the chrysalides are exposed to it. This change in shade will easily account for the variously colored undersides of *J. coenia* in our Eastern and Middle Western States, where it is cold enough to give the chrysalides a long rest.

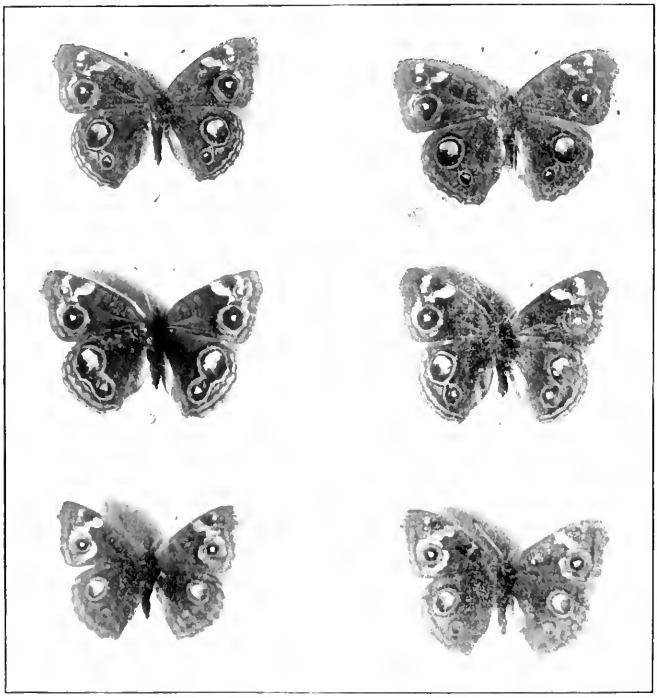

Figure 253

On the 27th of November, 1910, I took ninety half grown caterpillars, from my fourteenth generation bred in a warm temperature, and raised them in darkness, where the average coldest temperature at night was 56 degrees, and the average highest in the daytime was 66 degrees. I obtained twenty three chrysalides from December the 8th to the 21st; these were also bred in darkness, and in a cool temperature. During the last part of December the average was slightly cooler than in the first part of the month; and in January the coldest was at an average of about 45 degrees, and the warmest average for two hours daily 65 degrees; the last days were warmer, and on January 23d I got the first buttertlies; on the 28th I brought all chrysalides in to the warm temperature of 70 to 85 degrees, and on January 30, 1911, I obtained a female; see the reproduction, 3. From these twenty-three chrysalides bred in coolness, and in darkness, all the males and females had the ocelli of the hind wing greatly enlarged, and three of them were almost as good as 3; all four showed the confluence of the ocelli, and by many there were new small intermediate ones confluent with the small ocelli below, but not with the large ones, as shown in 4. It will be noticed that in this last one the black ocellus on the right side of the buttertly appears pale; however, it is really not so, but of a very deep black, and when one looks down upon it, in the direction of the overlapping scales, this black appears smooth like very dark blue silk. This smooth surface appears on the plate light in color; if this buttertly had been mounted on the left side of the plate, then the ocellus on the left side of the buttertly would appear pale. This female, with one other male, flew out ten days later, although the chrysalides were kept for the last thirteen days at 80 degrees. I put the last one on January 11th in a cool temperature again, and the buttertly emerged March 23d; it was a female, the black in the ocelli was not so smooth as in 4, but the ocelli of the hind wing were almost like 3. It may be asked why these three buttertlies did not emerge with the others. Perhaps my method of caring for them may make this clear. I was in the habit of cutting off all the leaves or part of the stem where the chrysalides or suspended caterpillars hung. I then put them in small boxes with a table outside on the box, registering the date, the number of the chrysalides, or suspended caterpillars, with notes as to where they were obtained. If any caterpillars had spun their silken tufts and were ready to hang, I cut the part carefully off where the caterpillars hung so that the others could not eat off the surrounding support. Now it often happens that these caterpillars will leave their first scaffold and seek another place in the box. However, in the case of these individuals which did not come out with the others it may have been that the cooler temperature prevented them from finding a good place to rest and they were delayed ten days in coming out.

As I have said in my first article, all generations bred at 90 degrees had the ocelli on the fore wing, and the appendix slowly enlarged, but the ocelli of the hind wing became slowly reduced in size. Now this thirteenth generation for the first time bred in a cool temperature had the ocelli of the hind wing greatly enlarged, and the appendix of the fore wing was in some still there;

in some specimens the black ocelli of the fore wing were not more perfectly round but appeared angular, one angle pointed upwards to the small ocelli in the apex, and these had a little appendix in the direction of the large ocelli; see 3 and 4. The longer I keep my stock by steady inbreeding, the more it seems to develop a tendency to connect these two ocelli of the fore wing, like those on the hind wing bred in a cool temperature; it may take a long time to accomplish this; however, it is not impossible. When I consider how the appendix developed below the large ocelli in the fore wing, in a few specimens to almost separate ocelli, surrounded by white, where no trace of an extinct ocellus exists, on the upper or under sides; then I have no doubt that I will sometime be able to breed specimens with these two existing ocelli connected. On the hind wing the confluence of both ocelli was more apparent; already in the first few generations bred in 90 degrees warm damp air, the large ocelli of the hind wing developed from an elliptical shape to a round one. When we view *J. coenia* on the under side, we find on the hind wing, in the outer field, five small spots, the second and the last one are generally somewhat larger, and are surrounded with a small ring; these two correspond in place with the two ocelli of the upper side. I do not know as yet whether these small spots on the underside are in progressive evolution, or are disappearing; however I find that the enlargement, and the development of new ocelli is progressive on the upperside, on the fore wing as well as on the hind wing. The enlargement and confluence of the ocelli of the hind wing, is as yet only visible on the upper side; however, it may develop later on the underside, and the enlargement and confluence is in the line of these small spots on the under side.

Besides these caterpillars raised in a cool temperature and in darkness, I kept another lot at the same temperature, but in a light glass, just to see if lightness or darkness would influence the color of the butterflies. I bred the chrysalides in light also, and I found, that the color and the markings of the butterflies did not differ in a marked degree from those bred in darkness. I obtained from this experiment the same enlargement of the ocelli as previously described.

Another lot of caterpillars raised in the same cool temperature, and the chrysalides bred at 90 degrees, and in darkness, just as all my twelve successive generations were bred which had only the enlargement of the ocelli of the fore wing, showed now, also the enlargement of both ocelli of the hind wing, however not confluent, like 3. This seems to prove that the beginning of the enlargement of the ocelli of the hind wing takes place previously in the caterpillar. This was a new phase of the work. I had some time before thought about it, and was now prepared to investigate it to some degree. I took the chrysalides from caterpillars which were raised at about 80 degrees and bred some of them in light, and some of them in darkness, and in about the same degree of coolness as the chrysalides from which the large ocelli came. As I had expected, I obtained none with marked enlargements of the ocelli.

Why is it that such great enlargement and confluence of the ocelli does not occur in nature? I have never seen any, and have not read any descriptions. Dr. W. Horn of Berlin, Germany, and Dr. H. Skinner of Philadelphia say that they are nowhere described. After all my experiments up to the present it seems to me that the tendency towards the enlargement of the ocelli develops slowly by breeding this butterfly always in 90 degrees warm, damp air; and that by selecting these small beginnings of the enlargement of the ocelli, and by steady inbreeding of the same, I was able to increase the percentage. This enlargement showed only on the fore wing, as long as the caterpillars and chrysalides were bred in a warm temperature, but it needed a change of temperature from steady 90 degrees to coolness, to produce these enlargements of the ocelli of the hind wing. This seems so strange to me, that I can not find a good explanation. After my last experiments, however, I think the solution of this strange phenomenon should be found in a study of the caterpillar.

In the fall of 1911 I tried these cool experiments again, with the same result; however, I lost all my chrysalides in one experiment, where I hatched the eggs in quite a cool temperature, and spent a long time trying to raise the caterpillars also in a cool temperature, and every chrysalis died later. I think they were too weak to develop the imago. However, I have one more interesting case: I caught an egg laying female on July 5, 1911, at Los Angeles and began to breed from these eggs a new line in 90 degrees warm, damp air, and in darkness, just the same as my old line bred in 90 degrees. In this newly caught female I could not see any marked difference from our local form; but as I wished to be sure about it, because when I change the food for the caterpillars, it happens sometimes, that I overlook a caterpillar or chrysalis and throw it away, and later see one of my buttertlies with an appendix fly in the garden. When *Junonia* finds its food plants for the caterpillars, it will stay for many days in the same surroundings, even when frightened it will always come back. I raised from the first eggs one hundred caterpillars and chrysalides in normal temperature, and thirty-one caterpillars in 80 degrees, and the chrysalides of these in 90 degrees warm, damp air, and in darkness. All the butterflies from the hundred caterpillars raised and emerged in normal summer temperature were like my newly caught female in markings and size. However, the other lot of butterflies whose caterpillars were raised in 70 to 80 degrees, and the chrysalides bred in 90 degrees warm, damp air, and in darkness, the males and the females were both very large, but the ocelli were small in proportion to the size of the wings. These small ocelli and other later developing differences constituting our local form, make me believe that the newly caught female, or its direct ancester, came from a dry region, perhaps Arizona. In the third generation I got a few females with a very small beginning of an appendix on the black ocellus of the fore wing, however these were lost again in later generations, only the large ocelli of the hind wing became more circular, like those in my old line bred in 90 degrees. From this new line from the fourth generation,

I took 140 very young caterpillars, and raised them in a cool temperature, and later bred the chrysalides in about the same degree of coolness as the chrysalides from which I bred 3, with the confluent ocelli. I got the butterflies from February 3d to the 11th, and here I obtained none with a marked enlargement of the ocelli of the hindwing—see two reproductions, 5 and 6. All were lighter in ground color, especially on the border; 5 has an unusual amount of yellow on the hind wing, it forms a band on the outer side of the ocellus; this yellow color shows in the plate dark, and so shows this specimen to be darker than it really is; 6 has no yellow band, and the fore wing has a dark blue ground color, especially on the inner field. As these caterpillars and chrysalides were bred in the same degree of coolness to produce the enlargement of the ocelli of the hind wings, and produced only ocelli of normal size, it seems to show that they were not yet bred long enough through successive generations in 90 degrees warm, and damp air, to develop the tendency towards the enlargement of the ocelli.

As I am to begin now, to build my new experimental station, I hope to have it in full working order by next fall, and will then experiment on a larger scale. Should my readers find this series of short articles interesting enough, I hope to be able to continue them next winter.

SOME INSECTS AND OTHER ARTHROPODS IN THE DIET OF THE WESTERN MEADOWLARK

HAROLD C. BRYANT

In connection with the investigation into the economic status of certain birds, now being carried on by the California State Fish and Game Commission and the University of California, many interesting things regarding their food habits are being discovered. For some time we have known that certain birds destroy quantities of insects. It has only been of late, however, that we have attempted to determine the real kind and quantity taken. Evidence furnished by the U. S. Biological Survey and economic ornithologists have revealed some facts of unusual interest. The present investigation is not only substantiating some of these facts but has furnished some interesting new evidence.

The quantity of food required by birds necessitates that the numbers of insects taken be very great. Stomach examination of the western meadowlark (*Sturnella neglecta*) has shown that this bird often takes as many as twenty large cutworms, thirty to forty ground beetles, ten to twenty crickets or grasshoppers, and fifty or more ants to a meal. As the time of digestion is between two and four hours the amount of food found in a meadowlark's stomach represents the amount taken during the four hours before the bird was killed. Sixty-six meadowlarks taken in the vicinity of El Toro, Orange County, California, averaged ten grasshoppers per stomach during the six months, June to November, 1911. Seventy three and twenty three hundredths per cent of all the food taken by these sixty six birds during these six months was made up of grasshoppers. Individual birds must have averaged over thirty grasshoppers a day during this time.

But perhaps of more interest than the quantity of life destroyed by this bird is some of the peculiarities of its diet. The ordinary articles of diet are ground beetles (Carabidæ, Tenebrionidæ), grasshoppers, crickets, cutworms, wireworms, plant bugs (Pentatomidæ), certain bees, wasps and ichneumon flies, and ants. The extraordinary articles of diet can be summed up as, centipedes, millipedes, scorpions, certain crustacea, snails, spiders, and protected and stinging insects.

Ground beetles are taken each month of the year. The following are those most often taken: *Pterostichus* sp., *Calathus ruficollis*, *Anisodactylus* sp., *Chlaenius* sp., *Elaphrus* sp., *Blapstinus* sp., and *Coniontis subpubescens*. Among the other beetles identified are *Silpha* sp., *Brachinus* sp., *Harpalus affinis*, *Limonius californicus*, *Limonius canus*, *Cardiophorus brachiosus*, *Saprinus* sp., *Sphenophorus* sp., and *Diabrotica soror*. Weevils and snout beetles including members of the family Curculionidæ form a considerable percentage of the beetles taken as food.

Grasshoppers usually form the largest percentage of insect food for the year. The following species have been identified: *Melanoplus differentialis*, *Camnula pellucida*, *Arphia* sp., *Conozoa behrensi*, and *Oedaleonotus enigma*. The common black cricket (*Gryllus* sp.) and the Jerusalem cricket (*Stenopelmatus* sp.) are also regular articles of diet.

During the spring months cutworms and caterpillars form a large percentage of the food. Wireworms (*Drasterius* sp.) and other beetle larvæ are taken to a less extent.

Among the Hemiptera the stink bugs (Pentatomidæ) are the ones most commonly found in the stomachs, also the cicada (*Platypedia* sp.). Species of *Podisus* and *Euschistus* have been identified. The leaf hopper *Stictocephala franciscana* has been found in several instances. *Corimaclina* sp. and *Anasa* sp. are also taken as food.

Ants form the largest percentage of the hymenopterous insects taken. *Messor andrei*, *Pogonomyrmex californicus*, *Formica* sp., and *Camponotus* sp., are naturally most often found in the stomachs. Ichneumon flies and certain black wasps have also been found. The common honey bee is occasionally taken.

Among the Diptera, the drone fly (*Eristalis* sp.) and pupæ of flower flies (*Syrphus* sp.) are the only representatives which have been identified.

Certain of the common centipedes (*Scolopendra* sp.) are often found in the stomachs of the western meadowlark. Still more remarkable is the fact that some of the millipedes (*Julus* sp.) are even more often found in their stomachs. Millipedes are usually considered to be well protected from attack by certain secretions which produce a pungent odor.

In the stomachs of two western meadowlarks taken in the vicinity of San Diego, two adult scorpions were found, they having been well beaten to pieces before being swallowed.

Almost the only crustacean found in the stomachs has been the common sow-bug (*Porcellio scaber*). Only one meadowlark so far has contained the remains of snails. These appeared to be the common small variety.

Spiders and their egg cases form a rather constant percentage of the food of the western meadowlark. The egg cases appear to be taken more often than the spiders themselves. The grass spiders (Agalenidæ), form the largest per cent. Daddy-long-legs are also taken.

Among the insects which are usually considered protected from attacks of birds are the cow killers (Mutillidæ). Stomachs of at least six of the meadowlarks examined have contained cow killers (*Sphaerophthalma* sp.). These insects were but slightly crushed, and it seems strange that the birds were able to swallow them without being stung. Several wasps have been found in the stomachs. In one case a couple of birds had eaten over a hundred white ants (*Termopsis* sp.?).

There has been considerable discussion of late as to whether butterflies are eaten by birds. The U. S. Biological Survey in the examination of more than 40,000 stomachs have found but four records of birds eating butterflies,

"and one of these probably relates to the capture of a very recently emerged specimen, or to one torn from the pupa before emergence, as it was accompanied by a pupa of the same species." Whether butterflies are too active to be caught, whether they are too dry, or whether they have a disagreeable taste, are questions still awaiting solution. In the investigation of an outbreak of buttertlies (*Eugonia californica*) in northern California during the summer of 1911, it was found that Brewer blackbirds were feeding on this buttertly to a considerable extent, and that the western meadowlark, western kingbird, blue-fronted jay, and Say phoebe occasionally took one of the insects.

The following dependable observation made by Mr. John G. Tyler of Fresno, California, also furnishes evidence of the fact that butterflies are occasionally, at least, destroyed by birds: "While strolling along the road east of this city the writer noticed a field of alfalfa that was infested with yellow butterflies. A nearer approach revealed the presence of several meadowlarks, and I was so fortunate as to see one of these birds seize a butterfly and make away with it. I am not prepared to say that the victim was actually swallowed, but it was certainly captured and killed." During the past summer the writer saw English sparrows trying to catch cabbage butterflies (*Pontia* sp.) which were abundant in a garden near Los Banos, Merced County. One bird was actually seen to capture a butterfly.

Another interesting find was the larva of the morning cloak butterfly (*Euvanessa antiopa*). This larva is one of the most hairy of our caterpillars. Other small hairy caterpillars have also been found in the stomachs. Both the larva and the pupa of the sphinx moth have been found.

Thus we see that birds although having a preference for certain articles of diet, do occasionally pick up certain other forms of life which we have often considered to be entirely protected by stings, hairs, or noxious secretions. We have still much to learn of the food habits of birds. The actual part which they play in the interaction of organisms is a problem of importance. The economic value of the western meadowlark does not depend so largely on the fact that it destroys only *injurious* insects, as that it destroys insects. The various proportions taken probably represent availability rather than preference.

SENSORY SETÆ OF TARANTULA AND SOME OF ITS RELATIVES

WILLIAM A. HILTON

The general sensory terminations of insects are found in hairs. These setæ are of about the same type throughout the group and consist of hollow extensions of chitin which may be microscopic or much larger. The base of the hair is usually movably, articulated in a chitinous ring. Below the cuticle and level with the hypodermal cells, there is at the base of each hair a larger "trichogen" or hair-producing cell. Sensory structures similar to setæ in insects have been described and figured in the Crustacea and some of these have been found with the bases of the hairs solid so that nerve fibres cannot penetrate very far into the hairs. Judging from methylene blue preparations

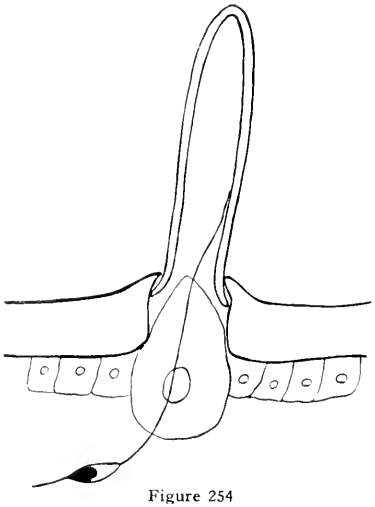

Figure 254

Sketch of a section through a body sense hair of an insect, showing the penetration of a nerve fibre into the base of the hair.

studied in section (Hilton '02), the nerve fibres of insects go only to the basal portions of the hairs and there terminate on one side (Figure 254).

In a study of the hairs of insects, spiders and other arthropods, it becomes necessary to distinguish between the hollow sensory setæ and the solid elevations of the cuticle which are either very much smaller or very much larger and heavier. These minute hair-like elevations and the larger spines or projections seem to be largely for protection. They are undoubtedly also for

sensation, although probably serving a very different purpose and stimulating a different part of the nervous system, perhaps part of the sub-hypodermal nerve plexus known to occur in many arthropods. These minute hairs will be considered at this time only in so far as they may represent parts of hollow sensory setæ.

One of the most noticeable features of tarantula is the great abundance of long hairs. These are especially numerous on the legs and abdomen but may be found on all parts. Two general types may be recognized at once, long rather large setæ often brown or of a red color and short dark ones often massed together and giving the appearance of black velvet. Both of these are hollow and seem to be simply greatly modified hairs of the insect type. The long brown or red hairs of tarantula are the most conspicuous. Some of these are as long as six mm. They are strongly chitinized, rather slender, with a large cavity which is usually somewhat larger at the base. Especially towards the tip, along the shaft, a fine pubescence is evident. In Figure 255, 1, there is shown a hair of this type. Near the joints of the leg there are fewer shorter, heavier hairs, almost spines, such as shown in Figure 255, 2. Between the long and heavier hairs of the legs and body there are numerous fine setæ which are quite plume-like because of the numerous fine chitinous branches extending off from the shafts of the hairs. Such a one is shown in Figure 255, 3, while Figure 255, 4, is a smaller one from a leg. It is these setæ or hairs similar to them, that cause the legs and body to appear dark. Modifications of this same type are found densely massed on the feet or other extremities where the dark velvet appearance is most marked. These hairs are often enlarged or flattened at the tip. Figure 255, 5, 6 and 7, are of this sort.

Near the mouth there are a number of long and short rather red hairs with very little pubescence upon them. A small one of these is shown in Figure 255, 8. Some of these red hairs about the mouth are much like the usual type, but many are long, slender and in some cases flattened somewhat.

Comparison was made between the setæ of tarantula and other spiders from a number of different families. In all, the usual type of seta was found, and the plume-like hairs, although less abundant, were found in almost every representative. Figure 256, 1 and 2, are from one of the Lycosidæ. The first figure was taken from the back of the abdomen and was much like some of those of tarantula, but was not so abundant. The second was a large hair of the simple type from a leg.

Figure 255, 3, 4 and 5, are from the Epeiridæ, *Epeira gemma;* 4 from the caudal end of the abdomen is a simple hair with a high base.

Figure 255, 6, 7 and 8, are from the Thomisidæ (*Thanatus* sp.), where, in addition to the usual type of simple hair there are at least these three sorts of setæ with side projections; 6, from the abdomen, is a short plumed hair with thicker projections also; 7 is a short plumed hair; 8 is a seta with secondary projections on one side. This last sort is very abundant on the legs.

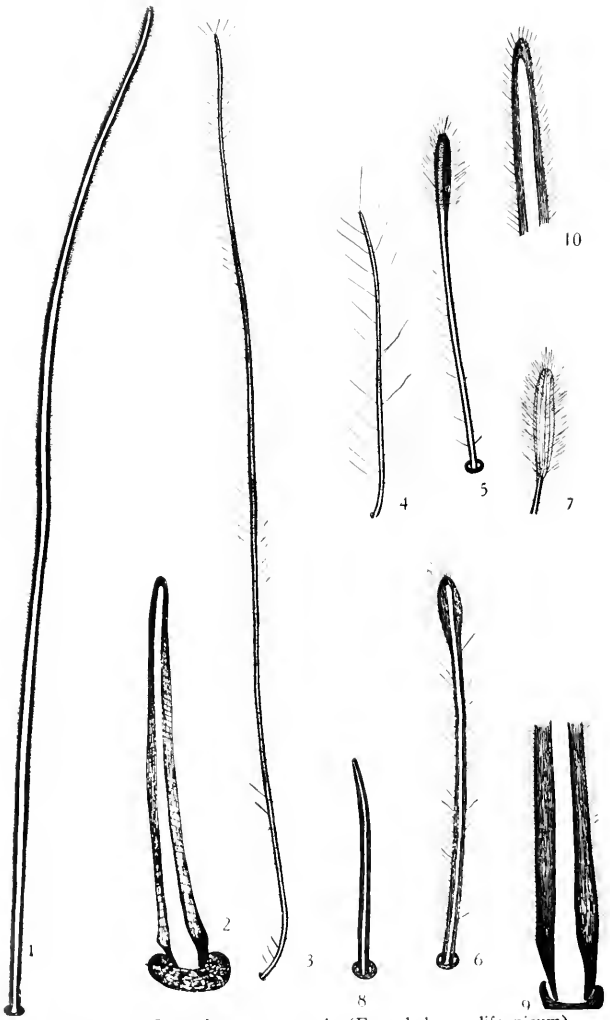

Figure 255. Setae from a tarantula (Euryphelma californicum)

One and two are enlarged 75 times, all the rest 325 times. 1, long, slender hair from a leg; 2, short, heavy hair from the under side of a leg near a joint; 3, hair from the thorax; 4, one of the smaller hairs from the back of the abdomen; 5 and 6, setae from a foot pad; 7, tip of hair from a foot pad; 8, one of the smallest red hairs from about the mouth; 9 and 10, base and tip of a hair similar to 1 and 2, only more highly magnified.

In a number of other families of spiders examined there were no hairs of unusual types. In a few there were only a very few plume like setae as in the Agelenidae (*Agelena naevia*), where there were only a very few hairs like Figure 255, 9.

Setae were also studied in examples of more distantly related groups of arthropods. Figure 256, 10, 11 and 12, are from a young *Limulus*. A rather usual type of hair is shown in 10. The tips of some of the setae have lateral projections such as shown in 11. A simple type with its communication through the chitin is shown in 12.

Among the Pedipalpida, there are many hairs of the usual type such as Figure 256, 1, but 2 shows a rather different structure where the hair projects from a little mound, and 3 shows simple elevations from which there are no hairs projecting.

Members of the Phalangida examined show rather usual types of hairs, similar to 4 and 5, which were found on various parts of the body of *Leiobunum* sp.

Among the Solpugida no new types were encountered.

The hairs of Acarina are both of the usual sort and also plume like. Berlese ('12) recently described many types of plume-like hairs in various species. These setae were chiefly from the body.

The hairs of the pseudoscorpions are of the usual type and so far as studied no other kinds are present.

Coming now to more distantly related groups we have Figure 256, 8 and 9, from a large diplopod. The first of these shows a hair of usual type with its canal through the thick cuticle. The second of these figures shows a larger, heavier hair located on a little mound with the base hollowed out but the cavity very slight beyond this point.

Figure 256, 10-14, shows simple hairs from a chilopod, *Scolopendra* sp. Some of the smallest of these are just simple projections from a slight elevation, one is a minute hollow elevation. Some of these simple hairs show stages in their development.

Passing now to another group of arthropods we find in a member of the Onychophora, *Peripatus*, very few hairs but numerous mound-like elevations over the surfaces of the body. Some of these little mounds are grouped together and from some of these true simple setae project; as is shown in Figure 256, 16. Some of the larger elevations have several setae, but most of the mound-like elevations have none, and probably represent a very primitive sensitive structure.

Conclusions

The hairs of tarantula are of two chief kinds, the usual simple sort and the plume-like structure. They are of many sizes from large and thick to short and slender. All of these hollow hairs are undoubtedly sensory, but the great variations in form and structure are probably not altogether due to special sensory functions and may be more for protection. Spiders with

abundance of hair are found to some degree living in similar situations, but plume-like setæ are found in many different groups of Arthropods, and in certain families such as the Therophosidæ and Thrombidiidæ, they are very marked.

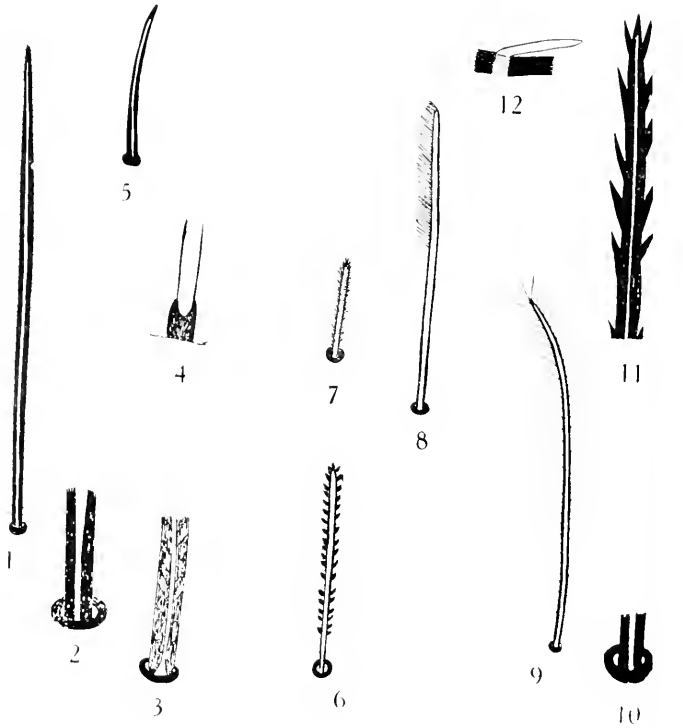

Figure 256. Setae from spiders and Limulus

All are enlarged 325 times. 1 and 2, hairs from the leg of one of the **Lycosidae**, the base of 2 is shown; 3, 4 and 5, setæ from one of the Epeiridae, the bases of 3 and 4 are shown; 6, 7 and 8, hairs from one of the Thonididae; 9, one of the very few plume-like hairs from one of the Agalaendae; 10, 11 and 12, setæ and parts of setæ from Limulus.

Among arthropods there has been, in the past, evidence from the Golgi and methylene blue methods that nerve fibres from bipolar sense cells penetrate setæ; some of the evidence by Bethe ('96), Duboscq, Holmgren ('98), Schreiber ('98) and many others. Some Golgi preparations gave impregnation results which seemed to show that the whole hollow of the hair was filled

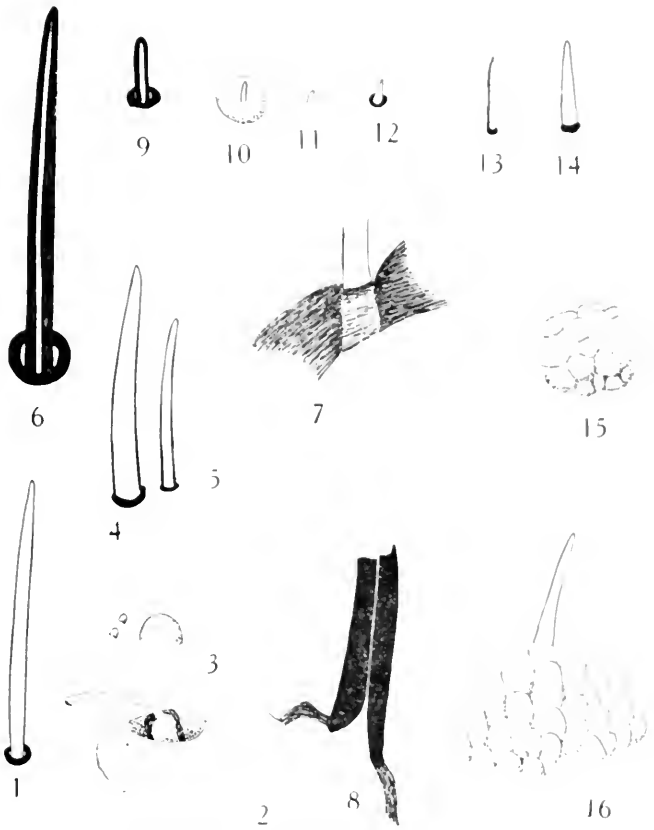

Figure 257. Setae from various groups of Arthropods

All enlarged 325 times. 1, hair from antenna of one of the Pedipalpida; 2, mound with sunken hair from the thorax of one of the Pedipalpida; 3, small elevations on the thorax of one of the Pedipalpida; 4 and 5, hairs from one of the Solpugida; 6 and 9, hairs from a scorpion; 7 and 8, bases of hairs from a diplopod; 10 to 14, hairs of Scolopendra; 15, complex mound of Peripatus; 16, complex mound of Peripatus with a simple hair.

with the nerve fibre. This result was criticised and the nerve termination was found to be exaggerated in these cases. In some Crustacea it was found that the base of the hair was shut off from the shaft so that no nerve strand could penetrate very far into it. In insects most of the hairs seem to be hollow from base to tip or nearly to the tip, with often some granular substance in the cavity. In work done with methylene blue and sections of material stained by this method nerve fibres were traced into the hairs but only a short distance into the shaft, Hilton (1902). As yet the few injections which have been tried with tarantula have not shown much, but a study of the hairs seems to show no barrier to the penetration of the nerve fibre. It seems doubtful, however, whether the very long hairs of tarantula contain nerve fibres in very much of their length.

In tarantula many hairs which at first sight seem to be of the simple type and without pubescence are found under higher powers of the microscope to show delicate projections. It is probable that hairs of this sort are of wide occurrence. It is interesting to note in this connection that the hair shown in Figure 3, Plate III, in Villane's ('81) early paper on the histology of insects is of this type.

Among the setæ of other arthropods exclusive of Crustacea, spiders and insects, we find the simple hair of medium size the most usual type. In some of the hairs of diplopods we find thick hairs with a very small central cavity beyond the base. In Pedipalpida there is a simple type in the sort of hair which projects from a mound. Very simple types of hairs were found in *Scolopendra* where the hairs were minute projections only. These simple types show something of how setæ may have developed, as little knobs on the surface which became sensitive by means of a more or less definite nerve termination and later came to grow out longer and form a hollow projection and develop a collar from the little mound at the base. We have all stages shown in the figures: the little mounds, the little projections with mounds and without them.

The generalized *Peripatus* is interesting to examine in this connection. Here we find the predominating sensory projections are little elevations; some of these become farther specialized by secondary knobs and now and then from these last, little hair-like hollow projections have been formed.

It is hoped at a later date to make a study of the sensory structures of spiders with some experiments on the functions of the setæ.

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1892 Rath, O. Vom. Ueber die von C. Claus beschriebene Nervenendigungen in den Sinneshaaren der Crustaceen. *Zool. Anz*

1894 Rath, O. Vom. Ueber die Nervenendigungen der Hautsinnesorgane der Arthropoden nach Behandlung mit der Methylenblau und Cromsilbermethode. *Berichte der natur. Gesellsch. zu Freiburg.*

1896 Rath, O. Vom. Zur Kenntniss der Hautsinnesorgane des sensiblen Nervensystems der Arthropoden. *Zeitschr. f. wiss. Zool.*

1890 Retzius, G. Zur Kenntniss des Nervensystems der Crustaceen. *Biol. Unt.* N.F.

1895 Retzius, G. Das sensible Nervensystem der Crustaceen. *Biol. Unt.* N.F.

1898 Schreiber, W. Noch ein Wort über das peripherische sensible Nervensystem bei den Crustaceen. *Anat. Anz.*

1881 Villanes. Sur les terminations nerveuses sensitives dans la peau de quelques insects. *C. R. Acad. Sc.*

1883 Villanes. Recherches sur l'histologie des insects et sur les phénomènes histologiques qui accompagnent le développement postembryonnaire de ces animaux. *Th. Pairs.*

BUTTERFLY HUNTING IN MANY LANDS

C. B. LONGSTAFF
LONGMANS & CO.

This book, as the title indicates, is the work of a field naturalist. The material, which fills about seven hundred pages, covers the collecting trips made by the author in practically all parts of the world. There are five colored plates showing some of the most interesting and beautiful insects from widely separated regions. While there are numerous accounts of insects seen and captured, the collection of Lepidoptera is chiefly described. Mention is made of the chief species captured on the various trips and accounts are given of the conditions under which they are found. In addition to this there are most interesting sketches of travel from place to place, with descriptions of lands and peoples.

Although there is much to interest the general reader besides entomological material, no one is at any time far from the description of the occurrence or the capture of insect forms. The book is indeed as the author states in the preface: "An attempt to put into readable form the technical diaries of a wandering entomologist."

Naturally to the field entomologist this book chiefly appeals, but to all interested in collecting or in biological work out of doors, it is a very interesting volume. To the entomologist as to the general reader the pleasing accounts of trips taken and specimens obtained cannot fail to awaken interest. The book is also more than an account of field trips and of travel, for it is in a sense an autobiography giving so much of the causes which led to the author's interest in entomology.

There are first notes of early field trips in England and then follow the accounts of longer expeditions as follows: India and Ceylon 1903-4, Algeria in 1905, South Africa in 1905, West Indies and South America 1906-7, Ceylon 1908, Egypt and Sudan 1909, and finally New Zealand and Australia in 1910.

At the end of the book is a chapter on bionomics, in which a number of interesting observations are brought together, especially on mutilation by foes, the results from experiments on palatibility, mimicry, list and shadow, inverted attitude and so on. Not much of this is really new, but it is all interesting. In the appendix are four plates with translations of papers by Muller on hair tufts, scent glands, scent organs, etc., of Lepidoptera.

This book is in its way an important contribution to our literature of field naturalists, and many parts of it, as the descriptions of early collecting in England, will rank well with our best accounts of such work.

WILLIAM A. HILTON.

WEST COAST NEWS NOTES

FORDYCE GRINNELL, JR.
PASADENA, CALIFORNIA

"It is only needful that one shall read and think, and the work of others which may have been published half a century ago, will suggest something to you which it never suggested to anyone before, and which may occupy your attention for years."—*Francis E. Nipher.*

Prof. Vernon L. Kellogg, of Stanford University, attended the Second International Congress of Entomology, at Oxford, England, last August, he contributed a paper on the distribution of the Mallophaga, and acted as chairman of one of the sections.

Dr. Charles Lincoln Edwards has been appointed Naturalist of the Park Department of Los Angeles, in charge of the proposed Zoological Gardens in Griffith Park. Entomology will be represented, as outlined in the first publication of the Los Angeles Zoological Society, issued in August.

Dr. Albert J. Cook, State Horticultural Commissioner, has been delivering lectures in various parts of California, during the past summer, on the work of the Commission.

Messrs. Newcomb, Haskin and Coolidge, of Los Angeles, have recently taken a considerable series of the very interesting butterfly, *Lycaena neurona*, on Mt. Wilson, the first part of September, which was described in 1902 by Dr. Skinner, from one female.

Mr. J. R. Haskin, on his recent trip to Northern Arizona, took a nice series of *Thecla halesus*.

Mr. J. C. Bridwell, Instructor in Entomology, University of California, was in Southern California during the past summer, collecting especially in the San Jacinto Mountains, and Los Angeles County, and getting many interesting Hymenoptera. He spoke to a meeting of the Entomological Club in August on his San Jacinto trip.

Mr. Wilhelm Schrader is constructing an elaborate and specially planned building for his experimental work with the Lepidoptera, near Los Angeles.

Mr. H. C. Fall, of Pasadena, spent his summer, as usual, in Boston, studying part of the time at the Museum of Comparative Zoology.

In the October number of The Auk, an ornithological magazine, there is an article by Francis H. Allen, entitled "Remarks on the Case of Roosevelt vs. Thayer, With a Few Independent Suggestions on the Concealing Coloration Question." The paper is of interest to all naturalists interested in animal bionomics.

Recherches Experimentales sur les Mecanismes du Melanisme et l'Albinisme ches les Lepidopteres, par Dr. Arnold Pictet. Memores de al Societe

de Physique et d'Histoire Naturelle de Geneve, Vol. XXXVII, pp. 111-278, 5 plates. 1912. This paper is reviewed in "Nature" by F. Merrifield, for October 3, 1912, in an article entitled: "Experimental Researches on Variation in the Coloring of Lepidoptera." The following quotations from this review might be suggestive and instructive:

"Melanism is a sign of vigor and health; albinism, on the contrary, of the enfeebling of the organism."

"The cause of variation may be generally stated thus: An individual which in the course of its ontogeny makes less pigment than its congeners, albinises; inversely, it melanises if it makes more pigment than is normal; the quantity of pigment is much more important than chemical modification of it."

"Lepidoptera, Dr. Pictet tells us, with very few exceptions, vary in only two directions, melanism and albinism."

"Dr. Pictet's valuable researches certainly cannot be considered to exhaust the subject of the cause of variation in the coloring of Lepidoptera."

Mr. Frank Walter Weymouth, who recently received the degree of Master of Arts from Stanford University, in the Department of Zoology, for a thesis on a group of crabs of Monterey Bay, spent the summer at Woods Hall Marine Laboratory, and is now at Johns Hopkins University, where he is candidate for the degree of Ph. D. He read the Phi Beta Kappa poem at Stanford, last May; the title was "Earth."

Dr. A. Fenyes, of Pasadena, is monographing the *Aleocharinae* (Staphylinidae) for the Genera Insectorum, published in Brussels, Belgium, by P. Wytsman.

Journal of Economic Biology

Edited by Walter E. Collinge, M. Sc., F. Z. S., F. E. S.

With the co-operation of

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All editorial communications should be addressed to Walter E. Collinge, 59 Newhall Street, Birmingham, and all subscriptions to

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VOLUME FOUR NUMBER FOUR

Pomona College Journal of Entomology

DECEMBER 1912

Contents

1 WEINLAND, H. A. — The Cosmopolitan Habits of the Fruit Fly
2 ESSIG, E. O. — Host Index to California Plant Lice II
3 ALEXANDER, CHARLES P. — The American Species of Adelphomyia Bergroth
4 HILTON, W. A. — A Preliminary Study of the Central Nervous System of Spiders
5 COLE, F. R. — Notes on the Diptera of Laguna Beach
6 BACON, GERTRUDE — Some Collembola of Laguna Beach
7 — Shorter Articles and Important Literature of the Past Year
8 GRINNELL, FORDYCE — News Notes

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Pomona College Journal of Entomology

Volume IV DECEMBER 1912 Number 1

THE COSMOPOLITAN HABITS OF THE FRUIT FLY (Ceratitis Capitata, *Wied*)

H. A. WEINLAND

Of all the pests we have or know of attacking fruit crops such as those grown in California perhaps the Mediterranean Fruit Fly is the worst. Should it be necessary to make a choice of pests, taking the world at large, from which we should likely receive the most damage in this state should it be imported, the Mediterranean Fruit Fly would without doubt be the one chosen.

The reasons for this are several. One is the fact that the attack of a single insect upon a certain fruit absolutely ruins that fruit for any purpose. The worst scale or root pests we have may kill the tree in time, may smut the fruit or cause it to be small or of an interior grade, but none of them make at once each and every fruit attacked absolutely worthless as does this pest. Another reason is that it is one of the most cosmopolitan insects in its habits of which the world knows.

A list of all the fruits of all countries from which it has been bred would be alarmingly long and would not present the facts I wish to bring forth. The nature of these fruits, the approximate number of flies per fruit, and the adaptability of each as a host is rather the topic of this discussion.

I base these statements on the conditions prevailing in the Hawaiian Islands for the reason that the conditions are such there that the fly has ample choice of host fruits and a very suitable climate, giving valuable basis for such a discussion.

First, let me say that one phase of Nature's plan seems to be to destroy by decay the fruits her trees produce, in order to hasten the cycle time of those elements of which the fruits are composed, getting them back into the soil to be used in future crops. The whole family of fruit flies seems to have been created for this purpose even to the tiny Drosophilids or vinegar flies which we have all over the world and which are so common wherever there is decaying fruit. The only difference between this family and other fruit flies, particularly the Mediterranean Fruit Fly is that the Drosophilids do not begin their work till natural decay sets in or until some bruise or abrasion is made in the skin, while this fly begins earlier in the game, often before the fruit begins to ripen. Thus the Drosophilids are a valuable asset to horticulture, while some of the higher forms are an extreme pest.

Let me also state in the beginning that well known fact that when the eggs of female flies are developed after copulation, they must soon be laid be there favorite host fruit present or not. Thus the spread of such a pest has more to do with the food content of the fruits and adaptability to the growth of the maggots than to the fact whether or not eggs are placed therein. I have found cysts of undeveloped and dried-up eggs under the skin of lemons, very green guavas and papaias, showing that when sufficient favorable fruit was not available, the eggs were laid upon the fruits nearest to the right conditions. I also have noticed upon the star apple, a fruit containing a quantity of quick hardening lacteal fluid in the skin, numerous female fruit flies held solid by the hardening of this fluid on the ovipositor before oviposition was completed. Tests showed however that only a small percent of eggs thus laid developed.

I do not mean to say that the fly will deposit eggs in any and all fruits promiscuously, but the many different kinds of fruits which breed the fly show that it is able to adapt itself to many conditions. The limit of its powers of adaptability to different kinds of host fruits is impossible to determine, yet observation of its relation to certain styles of host fruits gives basis for certain conclusions.

The thickness or hardness of the skin of fruits is apparently not a serious detriment to the development of this fly. In Australia it has been bred from the passion fruit, which has a very hard skin, much resembling an eggshell, though not brittle. Flies closely related, (*Dacus cucurbitae*), and of very similar habits have been bred from the water lemon in Hawaii which is very similar. The thickness of the skin then cannot be considered a safeguard.

The presence of certain acids in the fruits in small quantities does not prevent development either if we can judge from the fact that the fly thrives in oranges, grapefruit, and certain varieties of limes. As for lemons, we have no record of its being bred from them though we have evidence that the eggs had been placed therein.

As for juicy fruits, such as the peach, mango, etc., it is interesting to note that the number of flies produced in proportion to the size of the fruit is lower than in certain pulpy fruits. I have found that it is easy to drown the maggots in the juice of decaying fruits in laboratory jars if too many fruits were put in a single jar. The growth of the maggot rapidly causes a putrid juice to form which, should the whole fruit be full of maggots, would furnish enough juice to drown probably the smallest ones, if not some more mature. The instinct of the fly seems to regulate this so that not too many eggs are laid in a fruit. Consequently, though the orange, for instance, is comparatively a large fruit, the number of flies bred per fruit is usually about 15 to 25. It is interesting to note that in addition to this fact with regard to the peach, the fly stings this fruit when it is still small and very green.

Three pulpy fruits, however, give us some interesting data, namely, the Coffee berry, the Mock orange (*Murraya exotica*), and the Kamani nut or

Mexican almond. The coffee berry and the mock orange are both about the size of the end of a little finger, yet each of them will breed from six to twelve flies per fruit, though they will be much smaller than those bred from a fruit such as the fig, in which, it seems, they find better nourishment. The Kamani nut, which is about the size of the California almond, breeds a startling number for its size, from twenty five to fifty flies per nut.

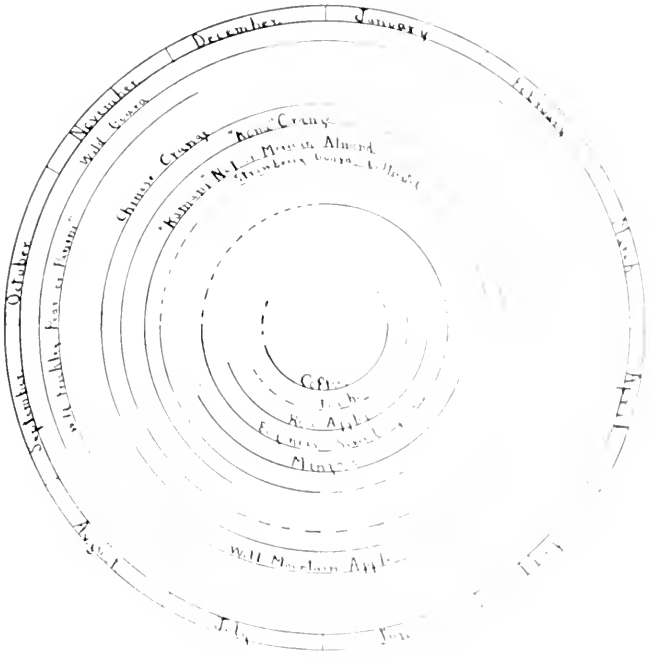

Figure 258

In these pulpy fruits, the hull instead of the berry or nut is the part affected, while the berry, though brought to the ground perhaps a little earlier than otherwise is not materially injured. Coffee growers on the island of Hawaii state that they are unable to see any damage to their coffee due to the work of the fly, although it breeds literally by the millions therein. In portions of South Africa, this fly is commonly known as the coffee fly since it is most often found where there is coffee. The fact of the similarity of this kamani nut to our almonds and walnuts leads to the possibility that unless containing too much tannic acid, the hull of these might add to the food supply in California at a time when little else was available.

Figure 258 is a diagram showing some of the most important host fruits in Hawaii and the seasons when they are in bearing. The circles and portions of circles represent periods during the year when the host fruits are to be found. It will be noticed that the wild guava and Chinese orange have a continual cycle while the eugenias, strawberry guavas and Kona oranges have certain main seasons with intermittent fruiting between. It is difficult to

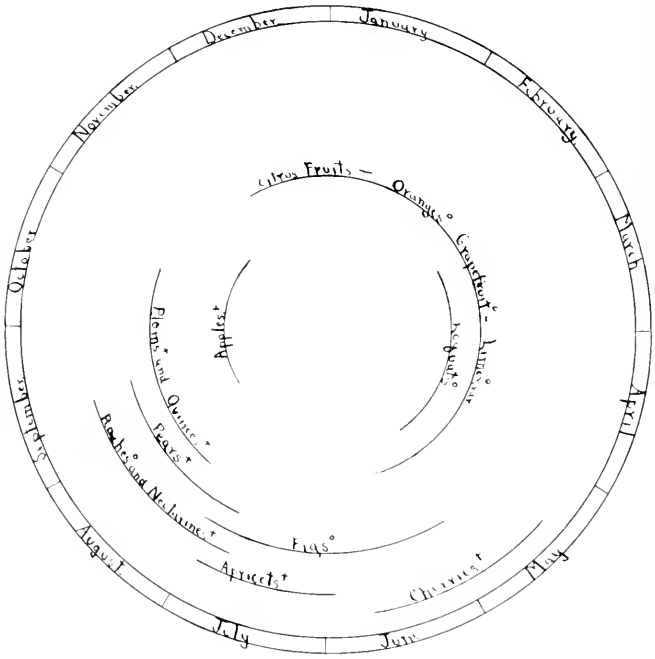

Figure 259

establish seasons for many of these fruits as they fruit at different times in different localities, and with some it is not an uncommon sight to see flowers, green and ripe fruit on the trees all at once. However, it can be seen that at any time of year there are at least six host fruits in bearing, one or two of which are wild. Is it any wonder that the fly has continued to increase in numbers in Hawaii, defying all methods of control?

Figure 259 shows a corresponding diagram made with Southern California conditions in mind. The fly has been bred from all the fruits shown in the diagram, those marked with □ in Hawaii, and those marked with ×

reported by W. T. Kirk of New Zealand. This means that the probable cycle for Southern California would be:

December—Early citrus fruits.
January and February—Oranges and grapefruit.
March—Oranges, grapefruit and early loquats.
April—Oranges, grapefruit and loquats.
May—Oranges, grapefruit, some loquats and early cherries.
June—Scattering citrus fruits, cherries and early figs.
July—Apricots and figs.
August—Peaches, nectarines and pears.
September—Peaches, nectarines, pears and plums.
October—Plums, quinces, apples.
November—Doubtfully any.

Considering the similarity of prunes to plums and the similarity of the almond to the Kamani nut, these two might also serve as hosts and lengthen the list.

This discussion, it will be noticed, is totally without reference to climatic conditions, the relation of which to the fruit fly is very hard to accurately determine. However, from the history of its work in similar latitudes in Australia and South Africa, we have ample reason to think that should it by any means gain entrance to California, it could thrive in winter in some stage in the southern part of the state at least, and prove to this state and country the most serious pest of its history.

HOST INDEX TO CALIFORNIA PLANT LICE, II (APHIDIDÆ)

E. O. ESSIG
SECRETARY STATE COMMISSION OF HORTICULTURE
SACRAMENTO, CALIFORNIA

The first and original index was a compilation of all that could be found in literature of California Aphididæ, as well as all of the notes made from the observations of the writer, and was published in Pomona College Journal of Entomology, Vol. III, No. 2, pp. 457-464, May, 1911.

The following includes some which were overlooked in the last article and new species, all of which have not been reported heretofore:

Alnus rhombifolia Nutt. (Alder)
Myzocallis alni (Fab.) Pass. Santa Paula, Cal., August 16, 1911.

Artemisia californica Less. (California Sage)
Macrosiphum frigidae Oestl. P. C. Jr. Ent., III, 548, 1911.

Ash see **Fraxinus dipetala** H. & A.

Aster sp.
Macrosiphum rudbeckiae (Fitch). Santa Paula, Cal., August 15, 1911.

Astragalus leucopis Torr. (Loco Weed)
Aphis medicaginis Koch. P. C. Jr. Ent., 529, 1911.

Atriplex canescens tetraptera
Aphis tetrapteralis Ckll. Bull. S. Cal. Acad. Sci., I, No. 4, April 1, 1902

Boston Fern see **Nephrolepis exaltata**

Buttercup see **Ranunculus californicus** Benth.

California Sage see **Artemisia californica** Less.

Ceanothus hirsutus Nutt.
Aphis ceanothi-hirsuti Essig. P. C. Jr. Ent., III, 527, 1911.

Chrysanthemum indicum L.
Macrosiphum rudbeckiae (Fitch). Santa Paula, Cal., September 16, 1911.

Citrus aurantium L. (Orange)
Aphis cooki Essig. Pomona, Cal., April 4, 1909.
Aphis gossypii Glover. Santa Paula, Cal., May 17, 1911.
Macrosiphum citrifolii (Ashm.). Santa Paula, Cal., April 7, 1911.
Myzus persicae (Sulz.). Santa Paula, Cal., April 14, 1911.
Toxoptera aurantiae Koch. Santa Paula, Cal., April 3, 1911.

Citrus limonum L. (Lemon)
Myzus persicae (Sulz.) Santa Paula, Cal., April 14, 1911.
Toxoptera aurantiae Koch. Santa Paula, Cal., April 3, 1911.

Cottonwood see **Populus trichocarpa** T. & G.

Fern, Boston, see **Nephrolepis exaltata**

Fraxinus dipetala H. & A. (Mountain Ash)
Pemphigus fraxini-dipetalae Essig. P. C. Jr. Ent., III, 556, 1911.

Juglans californica Wats. (Southern California Wild Walnut)
Callipterus californicus Essig. Mts. near Santa Paula, Cal., July 1, 1911

Lemon see **Citrus limonum** L.

Loco Weed see **Astragalus leucopis** Torr

Lupinus albifrons (Lupine)
Macrosiphum albifrons Essig. P. C. Jr. Ent., III, 541, 1911.

Lycopersicum esculentum Mill. (Tomato)
Myzus persicae (Sulz.). Santa Paula, Cal., April 14, 1911.

Nephrolepis exalta (Boston Fern)
Idiopterus nephrolepidis Davis. P. C. Jr. Ent., III, 546, 1911.

Orange see **Citrus aurantium** L.

Potato see **Solanum Tuberosum** L.

Populus trichocarpa T. & G. (Cottonwood)
Eikochaitophorus populifolii Essig. Santa Paula, Cal., August 1, 1911.
Melanoxantherium rufulus (Davidson). Santa Paula, Cal., August 5, 1911.
Thomasia salicicola Essig. P. C. Jr. Ent. III, 534, 1911.

Ranunculus californicus Benth. (Buttercup)
Pemphigus californicus Davidson. Nordhoff, Cal., April 29, 1911.

Sage, California, see **Artemisia californica** Less

Salix lævigata Bebb. (Willow)
Davidsonia saliciradicis Essig. Santa Paula, Cal., August 16, 1911.
Hyadaphis pastinacae (Linn.) Schout. P. C. Jr. Ent., III, 537, 1911.
Macrosiphum lacvigatae Essig. P. C. Jr. Ent., III, 550, 1911.
Micra monella Essig. Santa Paula, Cal., July 20, 1911.
Symdobius salicicorticis Essig. Santa Paula, Cal., August 16, 1911.
Thomasia salicicola Essig. P. C. Jr. Ent., III, 534, 1911.
Tuberolachnus viminalis (Fonsc.) Mord. Santa Paula, Cal., August 11, 1911.

Salix lasiolepis Benth.
Micra monella Essig. Santa Paula, Cal., September 15, 1911.

Salix macrostachya Nutt.
Symdobius macrostachyae Essig. Santa Paula, Cal., August 25, 1911.
Thomasia crucis Essig. Santa Paula, Cal., August 25, 1911.
Tuberolachnus viminalis (Fonsc.) Mord. Santa Paula, Cal., August 5, 1911.

Solanum tuberosum L. (Potato)

Myzus persicae (Sulz.). Santa Paula, Cal., April 14, 1911.

Trifidaphis radicicola (Essig.) Del Guercio. Santa Paula, Cal., June 10, 1911.

Thuya occidentalis

Lachnus juniperi De Geer. P. C. Jr. Ent., III, 543, 1911.

Tomato see **Lycopersicum esculentum** Mill.

Tule see **Typha latifolia** L.

Typho latifolia L. (Tule)

Rhopalosaphum nymphaeae (Linn.) Koch. Santa Paula, Cal., August 28, 1911.

Viola sp. (Violet)

Idiopterus nephrelepidis Davis. P. C. Jr. Ent., III, 541, 1911.

Walnut, Wild, see **Juglans californica** Wats.

Willow see **Salix**

THE AMERICAN SPECIES OF ADELPHOMYIA BERGROTH (TIPULIDÆ DIPT.)

CHARLES P. ALEXANDER
ITHACA, NEW YORK*

The small size of the crane flies constituting the genus *Adelphomyia* Bergr.[1] entitles them to the name of Mycetobiophilum, the majority of the described forms being much smaller than members of allied genera.

Some confusion has arisen recently, regarding the identity of the most common of the three known American species and the purpose of the present article is to straighten out this imbroglio. The first mention of an American representative was in an article by the author in which a new species (*minuta*) was described and a second species referred, provisionally, to the widely-distributed European form, *senilis* Hal. This latter species was again mentioned, and its venation figured in a second article and here, also, was referred to *senilis*. There has always been a question in my mind regarding the specific identity of the American and European forms and I have taken the opportunity to send specimens to Mr. F. W. Edwards, who kindly compared the American species with European specimens of *senilis* in the British Museum collection and reports that the two forms are distinct. I give a key to the known American species and describe two new forms.

American Species of Adelphomyia

1. Wings with cell M1 absent. *cayuga* sp. n.
   Wings with cell M1 present. 2
2. Pubescence in cells of wings lacking or sparse; cross-vein *r* not evident; cross-vein *m* short or obliterated; general color of body pale yellow. *minuta* Alex.
   Pubescence in cells of wings conspicuous; cross-veins *r* and *m* distinct; body color more brownish. *americana* sp. n.

Adelphomyia americana sp. n.

1911 *Adelphomyia senilis* Alexander. Can. Ent.

1911 *Adelphomyia senilis* Alexander. Ent. News.

Small species (length, ♀, 3.8-4 mm.); radial cross-vein present; cell M1 present; plumae almost unicolorous, dull yellow.

♂ Length, 3.2-3.5 mm.; wing, 4.3-4.6 mm.

Foreleg, femur, 3.7 mm.; tibia, 4.1 mm.; tarsus, 3.8 mm.

Middle leg, femur, 3.9 mm.

♀ Length, 3.8-4 mm.; wing, 5-5.3 mm.

---

* Contribution from the Entomological Laboratory, Cornell University.

1 Bergroth; Mittheil. Naturf. Gesell. Bern, p. 134, 1891.

2 Alexander; Canad. Entom., Aug. 1911.

3 Alexander; Entomol. News; Oct. 1911.

Rostrum and palpi light brownish-yellow; antennæ light brown. Front vertex and occiput light brownish-yellow, with a sparse greyish bloom.

Thoracic præscutum dull yellow, rather shining, without apparent stripes, scutum, scutellum and postnatum similarly colored. Pleuræ uniform dull yellow. Halteres pale, uniform throughout. Legs—Coxæ and trochanters dull brownish-yellow; femora similar, slightly darkened apically; tibiæ and tarsi uniform brownish-yellow. Wings almost hyaline, veins light brown. Venation (Figure 260, A, or Ent. News, l. c.)—Sc^1 very long, Sc^2 far removed from its tip; cross-vein *r* present, inserted on R2 about its own length beyond the form of R2+3; M1 much shorter than M1+2 beyond cross-vein *m*. Short hairs in most of the distal cells of the wing.

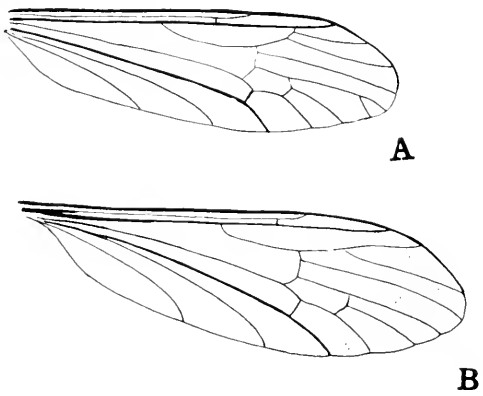

Figure 260

Abdominal tergum brown with a narrow, darker, median line and a narrow pleural band of the same color; sternum pale yellow, almost concolorous with the thoracic pleuræ.

Holotype, ♂. Woodworth's Lake, Fulton Co., N. Y.; alt. 1650 ft.; Aug. 22, 1910. (Alexander, coll.)

Allotype, ♀, with the type.

Paratypes, 30, ♂ ♀. Sport Is., Sacandaga R., June 28, 1911; Woodworth's Lake, Gloversville and Johnstown, Fulton Co., N. Y.; Ithaca, Tompkins Co., N. Y.; September, 1911.

Types in Author's Collection

Paratypes in British Museum of Natural History, U. S. Nat. Mus., Cornell University and in author's collection.

I am indebted to Mr. Edwards for the following comparison of *americana* with the European *scurilis*:

"1. The pleurae in *A. americana* are unicolorous ochreous, in *A. scudis* they are reddish-brown above and below, more ochreous in the middle.
2. The marginal cross vein is present in *A. americana*, absent in *A. scudis*
3. The genitalia are different in the two species but as we have only one male, I do not want to dissect it, without which I cannot properly make out the structure."

Adelphomyia cayuga sp. n

Large species (length, ♀, 5 mm.); radial cross vein indistinct, cell M1 absent.

♀, length 5 mm.; wing 5.1 mm.

Rostrum, palpi and antennae light brown. Front, vertex and occiput brown.

Thoracic praescutum uniform light brown without apparent dorsal stripes; scutum, scutellum and postnatum lighter-colored yellow. Pleurae light brownish-yellow, brighter colored on the metapleurae and on the posterior portions of the mesopleurae. Legs rather uniform light brown throughout. Wings rather uniformly suffused with dark, membrane distinctly darker colored than in *americana* or *minuta*; veins light brown. Venation (Figure 260, B)—Sc1 rather long, about five times as long as Sc2, R2+3 in a line with R2; cross-vein *r* not evident; basal deflection of R4+5 in a line with cross-vein *r-m*; cell M1 absent, i. e., M1 and M2 fused to the wing margin. A short pubescence in the apical portions of the wing, tips of cells R1, R2, R3, R5, M2 and M3 being included.

Abdominal tergum and sternum uniformly brown.

Holotype ♀ (balsam slide), Vanishing Brook, Ithaca, N. Y. Aug. 16, 1912. (Alexander, coll.)

Type in author's collection.

A PRELIMINARY STUDY OF THE CENTRAL NERVOUS SYSTEM OF SPIDERS

WILLIAM A. HILTON

It is surprising how little work has been done on the central nervous system of spiders. Most that we know of this organ in arachnids is due to earlier investigators. There are the papers of Trevianus in 1832, Brandt in 1840, Grube in 1842. Then there is the work of Schimkewitsch in 1884. The first extensive account of the central nervous system studied by modern methods is by St. Remy in 1890, where a number of brains or supræsophageal ganglia are considered. There are also the numerous papers by Patten on Limulus and his recent book on the origin of vertebrates.

The following preliminary study has been made from dissections and serial sections from the nervous systems of members of the family Aviculariodea. Figure 261 and Figure 262 are drawn from tarantula *Eurypholma californicum*. Two chief masses of the central nervous system are easily recognized in the cephalothorax. The part corresponding to the subesophageal, thoracic and abdominal ganglia is larger and as shown in the figures has five pairs of large nerves given off from it and one unpaired nerve in the caudal region which goes to the abdomen and branches a number of times. The lower four pairs of nerves are slightly larger than the abdominal and these go to the legs. Just in front of the first pair of leg nerves is the slightly smaller one on each side of the ganglion; this runs into the palpus. Fibers from all of these nerves penetrate more or less deeply into the ganglion and each one is intimately associated with numerous large and smaller nerve cells. The cells are for the most part ventral in position and fibers from them and from other parts form an intricate network in the central portion of the ganglion, all indications of special areas of cells and fibers being lost at such points.

The five pairs of nerves and the caudal unpaired one have to some degree the appearance of being made up of several portions as seen in the gross structure. The distribution of these nerves so far as could be determined without special stains, was such as to indicate that they were made up of afferent and efferent components.

Figure 262, A, shows some of the main branches of a nerve as it passes down a leg. Petrunkevitch, '09, has described the muscles in the legs of Pholcus, but a general examination of the appendages of tarantula has shown more complex conditions. The muscles will not be considered especially at this time. In the first four joints of the front leg shown in the diagram, the muscles are more distinct and when the nerve is exposed from above, branches may be seen as shown in the figure. The nerve in this part of its course runs nearer the upper side of the leg so that most of the muscles shown are extensors. In the last three joints, the main nerve trunk

runs in to the lower surface of the leg. Probably the more proximal part of the nerve furnishes more muscular branches while its more distal parts from their position seem to contain a larger proportion of sensory fibers.

The nerve trunk going to a palpus has a somewhat similar course as the large nerve in the leg, but the muscles are not so distinct. Here also the main trunk is more deeply situated in the distal segments and runs next to or very near the chitin in the last joints of the appendage. Figure 262, B.

Aside from these eleven large trunks which supply the abdomen and larger appendages, there are numerous small nerves between the others as

Figure 261. Nervous System of Tarantula, ×5

A, from above; B, from the side, enlarged five times. O, ocular branches; C, chelicral branches; P, palpal trunk. In A the darkest portion of the drawing indicates the position of a part of the digestive tract. In B dark portion of the figure in the supræsophageal portion, is a part of the digestive tract, a light area above the ocular lobe is also a part of the digestive system.

shown in the diagram, some of these at least seem to be confined to the cephalothorax.

Extending up from the great cephalothoracic ganglion is the supræsophageal mass which partly surrounds a portion of the digestive tract. Its center is fibrous, nerve cells are above and on its sides. (Figures 261 and 263). The most conspicuous nerves from this portion are those of the chelicerae and the ocular branches. The first of these pairs is the larger. Each of this pair divides into three branches, two of which are distributed to the head region and the base of the chelicera, the other enters the chelicera and divides into three, the lower of these goes in deeply and reaches nearly to the chitin and seems to be largely a sensory branch. The upper is probably a muscular branch and the middle one was traced up to near the tip of the appendage.

In dissections and sections there was some evidence of visceral nerves coming off from the supræsophageal ganglion. Other small nerves were also found but from surface views and sections there was little indication of more

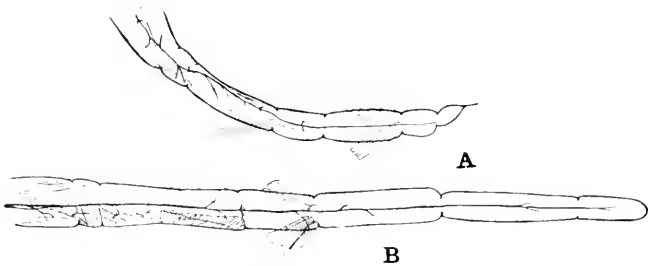

Figure 262

A, palpus; B, leg with the cephalic side up from the right of a tarantula. B is the first leg and it and the palpus is shown as opened up from above. Some of the muscles and chief nerves are shown, ×2.

than seven distinct parts of the nervous system; one for each pair of nerves. The fusion of all parts was so complete in the adult as to almost obliterate all subdivisions. However, there is some indication of segments in the adult beyond the last leg division.

In a general study of the structure of the nervous system intricate connections were noted between all parts of the ganglionic mass, by means of fibers connecting the seven easily recognized regions. Adjoining segments were found fused by many fibers, more distant segments had possibly fewer communicating strands with the exception of the supræsophageal, which seems to have very extensive connections with all lower portions. The larger nerve trunks are probably all mixed except the optic.

The nerve cells of the cephalo-thoracic-abdominal ganglion are mostly ventral in position. Those of the supræsophageal mass dorsal and lateral. As compared with insects there seem to be fewer very dense masses of fibers in the central portions of the nervous system.

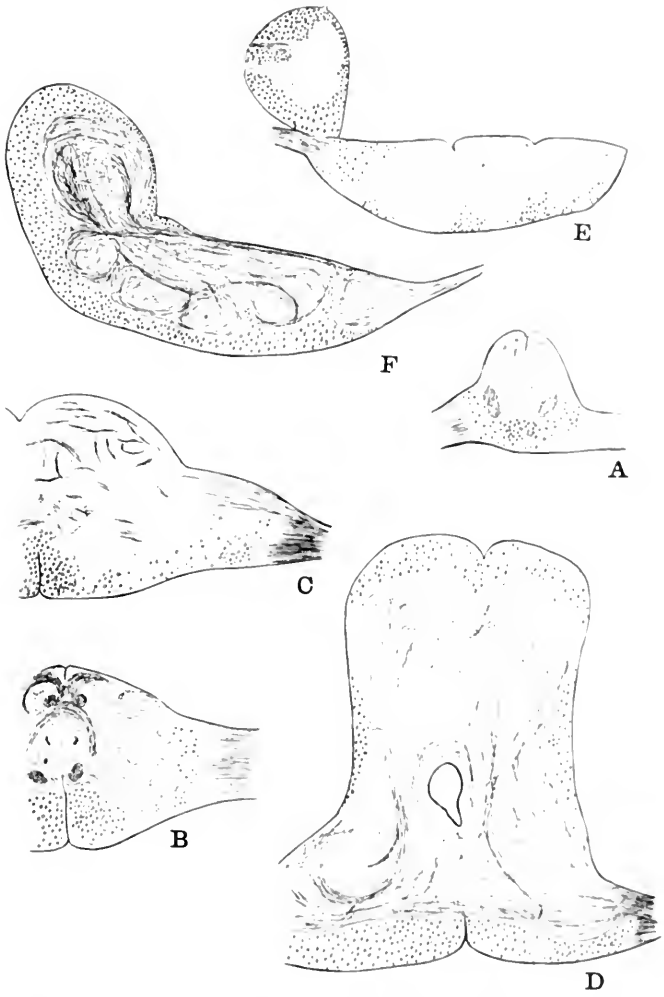

Figure 263. Sections Through the Nervous Systems of Brachybothrium sp

The positions of cells and fibers is shown at various levels. A, cross section near the caudal end; B, higher up, showing dense masses of substance among the fibers; C, more cephalad; D, section through sub- and supra-esophageal masses, with the intestinal opening in the center. E, longitudinal section near edge. F, same as E, only farther in

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NOTES ON THE DIPTERA OF LAGUNA BEACH

J. R. COLE

There were many flies obtained from the vegetation back from the beach and from the great swarms of them about the kelp which was strewn along the shore. The sand is also a good collecting place for some species, and some are found in wet places and even in the spray of the waves as they dash over the rocks. There were countless thousands of the large and small Fucellia. The larger species is often on the wet rocks, flying upwards as the waves come rolling in, and settling back as the water subsides again.

Figure 264. Neopogon sp.

In the last report of the Laguna Marine Laboratory only a surface study was made of the Diptera and only a part of the collection was reported on. Since that time a number of forms have been added to the list of Diptera from Laguna. There were two mistakes in the last report. According to Aldrich, Prof. Hine made a mistake in determining the asilid sent him as *Stichopogon trifasciatus* Say. Figure 264.

This fly according to his classification is of the genus *Neopogon* and an undescribed species. Back, in his monograph, attributed *trifasciatus* to Southern California; Williston did the same. This new species has upward directed white pile around the margin of the scutellum. Bezzi has published

a paper on the Dasypogoninae since the work of Back, and has made several new genera. All of the American species are put in the new genus Neopogon. (His paper is in the Annales of the Hungarian National Museum). Aldrich believes that both Back and Williston were wrong in identifying *trifasciatus* from Southern California.

The other mistake was due to Aldrich. The small fly determined by him as *Allotrichoma* n. sp. (Figure 265) and published in the Laguna Report as *Allotrichoma littoralis* is *Atissa pygmaea* Haliday. Aldrich somehow traced it wrong in Becker's and kindly rectified the mistake. The specimen was determined by Becker, who is the author of the current monograph of the European species. This is an European species described many years ago.

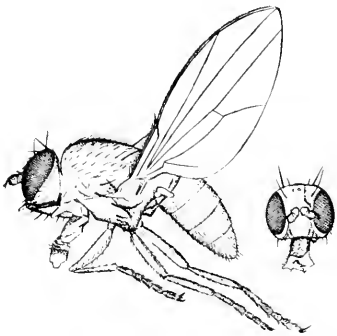

Figure 265. Atissa pygmæa Hal.

Lipochaeta slossonae, which was figured in the Laguna Report, was discovered first on the Florida Coast, then on the west side of the Gulf of Mexico, then on the California coast. It is, according to Aldrich, a southern species, and is found in large numbers at some of the Southern California beaches. It was quite rare at Laguna. It differs greatly from most ephyrids. Williston thought it an Ascinid at first.

There was another slight mistake in the last Laguna Report. The *Scatopse* was named *californiana* in the figure and *californica* in the text. It should be *californica*.

There are a number of flies that were collected and not reported on last year. The collection has not been fully classified as yet, but considerable additions can be made to last year's list, thanks to the determinations made by Aldrich.

STRATIOMYIDAE

Euparyphus apicalis Coq.

New to Aldrich. Described by Coquillet from Siskiyou County, Cal.

SCENOPINIDAE

Scenopinus fenestralis Linne

Two specimens were collected at Laguna.

EMPIDIDAE

Paracthallasius aldrichi Melander

Parathallasius sp

This is an undetermined specimen and is larger than *aldrichi*, but resembles it much.

DOLICHOPODIDAE

Hercostomus occidentalis n. sp.

This gray dolichopodid has a laterally compressed conical abdomen. The eyes are red and the thorax iridescent with metallic greens and blues. The occiput is concave and the head slightly wider than the thorax. The antennae are short and thick with a long bare dorsal arista. At the end of the second joint is a circlet of short spines. The third joint is rounded on the end. The head is flat and the eyes quite large and not contiguous. The antennae are yellowish in color. The front is gray and pilose, and the legs light yellow, thickly covered with short spines.

The spines are most all reclinate. There is one large supra-alar bristle, two pairs of long intra-alar, and two large bristles on the back end of the scutellum. There are two large ocellar bristles, one large bristle over the eye, two pair of notapleural, and a long bristle just under the propleura. There are three heavy spines on the front of the fore femora, one large bristle on the humeral callosity, two on the middle femora, and one on the back of the hind femora. There are two small ocellar bristles and the acrostichal and dorsocentral bristles are small. The wings are hyaline. Length 3.25 mm., wing the same.

There was only one specimen collected at Laguna.

Dolichopus bakeri

This species was determined by Aldrich from a female. The thorax is a beautiful bronze and green color. The hind tarsi are yellow at the base. The third joint of the antennae is large and round. (See Figure 266). The antennae are black with gray pile on the third joint. The front is purple. The arista is dorsal, long, slender, and bare. The sides of the abdomen are a red bronze color and the rest of the body a metallic green. The face is white pilose, the eyes quite large with a black center and a reddish margin (See Figure 266). The spines are heavy and black and reclinate. The spines on the tarsi are long and quite heavy. There are two long ocellar and two very long supra orbital bristles. The empodia are small and white. The head is slightly wider than the thorax. Wings hyaline. Length of fly 4.50. Length of wing 4 mm.

Dolichopus afflictus o. s.

Quite a number of these were collected.

SYRPHIDAE

Paragus tibialus

Quite common at Laguna.

Of the family Borboridae there were several species collected, all of the genus Limosina. These species were undetermined, Melander having most of the material on the family. They were found with the ephydrids in large numbers.

AGROMYZIDAE

Leucopis bella

A small gray fly. The larvae are cylindrical, thicker posteriorly and creep like geometrids.

Leucopis nigricornis

Agromyza puella Mg.

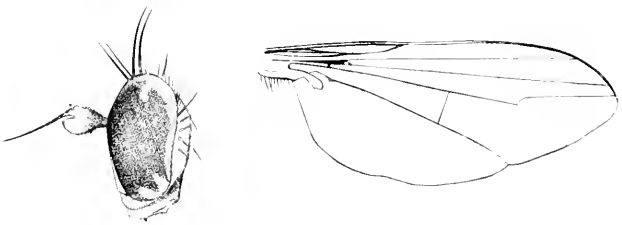

Figure 266. Head and Wing of Dolichopus bakeri

OSCINIDAE

Chlorops assimilis common

Another species of *Chlorops* was quite common. Aldrich only worked it out to the genus. It is a reddish yellow fly with eyes and top of abdomen black. They were found with a species of *Meromyza*, a small slender yellow fly with gray markings and dark spots on the abdomen.

ANTHOMYIDAE

There were four genera of this family collected. Anthomyia, Pegomyia, Cenosia and Hydrotaea. All of these flies were found along the beach about the piles of kelp and sea weeds.

SARCOPHAGIDAE

Two species of Sarcophaga were found in the decaying kelp. They probably breed in the rotting piles of sea weed and moss thrown upon the beach.

SOME COLLEMBOLA OF LAGUNA BEACH

GERTRUDE BACON

This paper is the first of a series to be written upon the Collembola. It is the result of work upon specimens collected at Laguna Beach, California, during the summer months of July and August, 1912.

The coast at Laguna is very rocky and is a most favorable place for shore collecting at low tide, for at that time the rocks covered with seaweed are exposed for considerable distance oceanward. Along some parts of the beach the rocks can be overturned and it was on the underside of these that the Collembola were found. When the stones were overturned the Collembola did not appear at once, but after most of the water had drained off. They were caught by a camel's hair brush that had been dipped in alcohol. These insects were not found on all rocks but were most numerous on large ones, the upper sides of which were thickly covered with algæ, and the under sides with a great number of worm cases, small holes and cavities. They were

Figure 267. *Isotoma bidenticula* Guth
From the side

never found on the upper side or on the under side of small, smooth stones.

At high tide the rocks were too far under water to overturn. At low tide it was found that there were no Collembola at the high tide mark. Rocks at the very edge of the water contained a few and they became gradually more abundant farther out. At the lowest minus tide, they were found as far out in the water as it was possible to turn over the stones, although they did not occur in as great numbers as a little nearer shore. This means that these insects must remain in these rocks under water for weeks and even months at a time. C. B. Davenport has described some Collembola from Cold Spring Beach but entirely in relation to the sand. None were found at Laguna on the beach in the sand; they were confined entirely to the rocks. However, one of the species, *Isotoma besselsi*, that Davenport found in the sand was found at Laguna. It has a different relation at Laguna, probably it remains in air cavities under the rocks on this coast.

The Collembola were not widely distributed along the shore for they were found only on the rocks of one cove. Farther up the coast the majority of the rocks were immovable, and on those that could be overturned, practically no specimens were found. Nowhere did they appear in any very great abundance. They were all very small, less in size than those found on land. As far as the specimens have been determined, the representatives of only the one family Entomobryidæ were found, and only two genera of these, *Entomobrya* and *Isotoma*. This paper is concerned only with the last of which there were fewer in number.

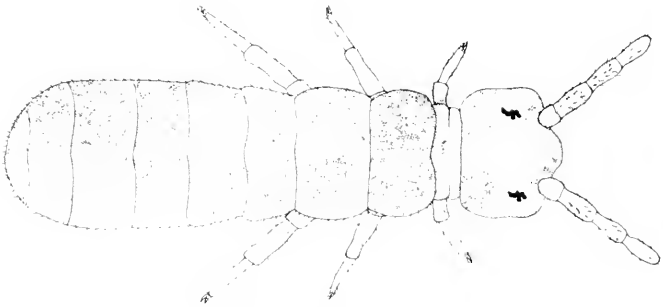

Figure 268. Isotoma bidenticula Guth.
Dorsal view.

Isotoma bidenticula (Guthrie)

(Figures 267, 268 and 269)

Found under the largest rocks below the mean tide mark at low tide. Length 1 mm. *Color*—Dark, dull brown, mottled. Ventral side dark; light at the junction of body segments; furcula and legs light. *Body*—Long, subcylindrical; sparsely haired. *Head*—Slightly elongate. Antennæ (Figure 269, C) short, little longer than head; segments four, stout and rounded. I shortest, II longer than III, and IV longest. Guthrie in his description of this species states that III is longer than II, but this is not so with those that I found. Ocelli, sixteen. In each eye spot (Figure 269, D) there are two which are smaller than the other six, probably showing degeneration. These are different in this respect than those described by Guthrie. The ocelli of his are all the same size. Post-antennal organ (Figure 269, E) is present. *Thorax*—The three segments not fused, each bear a pair of legs that have five joints; short coxa and trochanter; femur much longer; tibia still longer; tarsus very small and has two claws (Figure 269, A) without teeth; legs short. Ventral tube on first segment; tenaculum on second. *Abdomen*—Segments III and IV about equal in length; IV, V and VI fused so as to almost appear as one. Furcula (Figure 269, F) on penultimate segment; short,

not reaching ventral tube; not slender and tapering. Manubrium slightly longer than dentes and mucrones together, fine serrations on dorsal edge of dentes; sparsely haired. Mucrones (Figure 269, B) bidenticulate, first tooth horizontal, long, slender, curving but slightly, second tooth vertical and curves slightly cephalad.

Habitat—Nova Zembla, Northern Siberia, and Greenland.

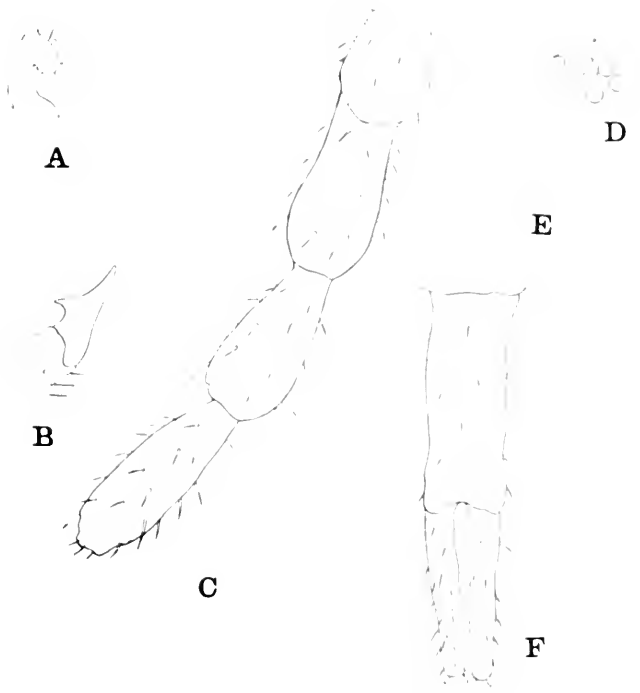

Figure 269. Isotoma bidenticula Guth.
A, tarsus with two claws, B, mucrones, C, antenna, D, eyes of one side, E, post antennal organ, F, furcula.

Isotoma besselsii (Packard)

(Figure 270)

Very few of these specimens were found. In general appearance they look almost exactly like the *I. bidenticula*, although slightly smaller. These were hard to identify as they resembled both the *Isotoma minima* (Guthrie)

and the *I. besselsii* (Packard) but with apparent differences. They resemble the *I. minima* perfectly except for the position of the teeth on the mucrones. Because of this important difference I have provisionally classified mine as *I. besselsii*.

Length .75-1 mm. *Color*—Brown, yellow at junction of segments, furcula and legs light; ventral side dark. *Body*—Subcylindrical, sparsely haired. *Head*—Elongate. Antennae (A) about as long as head, segments four; I shortest, IV longest, II and III subequal; different from those described by Macgillivray. "First and second segments dilated, as broad as long and twice as broad as the third or fourth." In my specimens, I is as

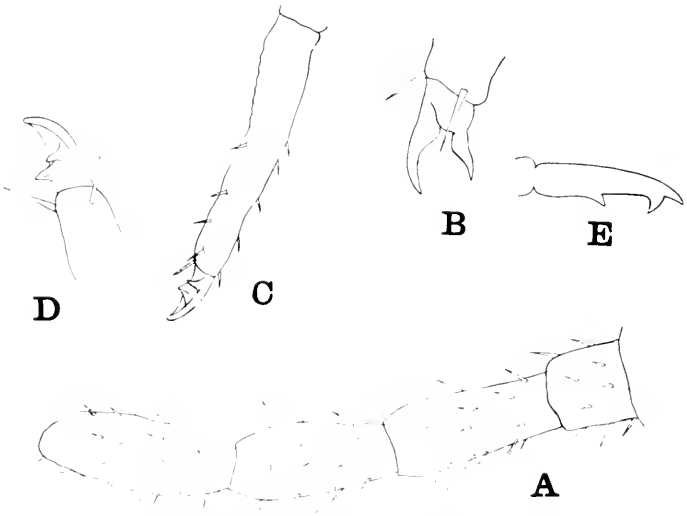

Figure 270. **Isotoma besselsii** Packard. A to D. A, antenna; B, claws; C, dentes and mucrones; D, mucrones; E, mucrones of **I. minima**, after Guthrie.

broad as long, but this is not true of II. Also I and II are not as broad as III and IV. Ocelli, sixteen. *Thorax*—Segments not fused. Joints of legs same as *I. bidenticulata*; tenant hairs on tibia; claws (B) uncurved; superior claw wide at the base but narrow at the apex; inferior claw with inner margin dilated at base. *Abdomen*—Segments subequal; IV, V and VI appear to be fused. Furcula short, stout, not reaching ventral tube; manubrium slightly longer than dentes; mucrones (D) tridenticulate; distal tooth long and but little curved; second and third teeth of about the same length, vertical, on opposite sides of the mucrones and nearly opposite each other.

Mucrones of *I. minima* (Guthrie — E. have "the distal tooth almost straight, the antedistal tooth close to, and at right angles to it, proximal tooth smaller and set about the middle of the mucrone pointing slightly distalwards." The mucrone resembles those of *I. minor* Schaff., the distal tooth is the same, the second and third are in the same position but only one of them is vertical, the other is almost horizontal.

Habitat—Polaris Bay in the Arctic regions, Spitzbergen, Massachusetts Bay, and Cold Spring Beach.

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SHORTER ARTICLES AND SOME IMPORTANT LITERATURE OF THE PAST YEAR

THE PEPPER TREE CATERPILLAR

For several years the pepper trees at Klerksdorp, Transvaal, says William Moore in the Agricultural Journal of the Union of South Africa, have been regularly stripped of their leaves by the pepper tree caterpillar.

The moth is pure white in color, the female being about three-quarters of an inch in length and one and one-half inches across the expanded wings; the male is somewhat smaller. The caterpillar when full grown measures about one and one-quarter to one and one-half inches in length. The body is black; has two narrow pale yellow lines on each side and is clothed with burnt orange colored hairs which give it a yellowish appearance. The legs are dark brown; the forelegs are red in color. The young caterpillars have hairs much shorter, so that they appear blacker.

The moth lays her eggs at about the beginning of October, in a cluster which forms a band about one inch in length around the petiole of the leaf or young twig. They hatch in about twenty to twenty-five days, and the young caterpillars immediately begin feeding upon the leaf nearest to them. The progeny of one moth seem to live in a cluster unless forced to scatter because of lack of food. The feeding is done at night. By the middle of December the caterpillar has reached full size. It pupates in an oval cocoon, and these may be found most abundantly on the ground under an infested tree. The moths of the second brood appear in the last of February or the first of March. These lay their eggs, and the caterpillars are found on the trees in April. They reach full growth by the end of May and pupate, passing the winter in this condition.

The parasite of the caterpillar, the tachnid fly, which resembles the house fly, but is somewhat larger, is comparatively ineffective because of its appearance the second time, i. e., from maggots in the December caterpillars, about three months before the second brood of caterpillars appear, and have no place to lay their eggs except as they may find another kind of caterpillar. Thus all the flies may die leaving no progeny.

If the pepper trees are sprayed during April and May with a solution of two pounds of lead arsenate in one hundred gallons of water, the injury from the caterpillar will be slight, the tachnid fly being able to destroy most of the caterpillars which appear.

Roy E. St. Clair.

AN ATTEMPT TO CONTROL AN OUTBREAK OF A WELL KNOWN PEST*

GEORGE W. ATWOOD
ALBANY, NEW YORK

Attention was called to the presence of a few caterpillars of the gipsy moth late this season, just at the time when they were crawling and before pupating. An examination of the premises was immediately made in the residence section where the outbreak occurred. The area involved was about 200 by 300 feet. Caterpillars were found on the trunks of old apple trees, on fences and in sheds and chicken coops to the number of about 1,000. The back yard fences, chicken coops, brush and all litter were gathered and burned. The infested trees were allowed to stand until pupation ceased. Then they were cut to the ground, sawed into short lengths saturated with kerosene and burned. Many of the trees were hollow and within were found moths and pupæ of last year and quite large numbers of fresh pupæ. The location was in the back yard section of residences in the midst of much disorder. The apple trees were old ones, some of them five to seven feet in circumference. Egg masses were found in every conceivable place—under old pieces of carpet, under boards lying on the ground, in the cornices of some of the residences and elsewhere. At the first discovery, all trees, including the street trees within a radius of 600 to 800 feet, were burlapped with burlap about eight to ten inches wide, folded and tied tightly about the trunks. These were examined carefully during the period that the caterpillars were moving, and daily some caterpillars were found, but only close to the center of infestation. About forty large trees were burned, as were also twenty-five cords of stove wood in which the insect had taken refuge. Gardens, fences and lawns, in addition to kindling wood, were destroyed and the loss to the owners of the property from the shade of the large trees was considerable; the intention was to completely eradicate the colony. Indications are that perhaps not more than a single mass of eggs started the infestation about three summers previous. Close attention was given to every conceivable detail and it may be interesting to know that some of the residents in the houses had recently moved to other parts. Property taken from the yards of the infested area was locked up and in one case a boy's sled was found under which were two or three egg masses.

This outbreak will be kept very closely under the care of competent inspectors and as soon as the frost destroys vegetation thorough scouting will be resorted to in the search for egg masses of the gipsy moth. It would seem almost too much to hope that the last insect has been found and destroyed but it is believed that the work was done so thoroughly that success has attended the efforts.

*In spite of the enormous sums which have been expended and are being provided to keep it in check, the gipsy moth goes on extending its territory

ALFALFA WEEVIL

In the Monthly Bulletin of Horticulture, G. E. Merrill presents an interesting paper on the Alfalfa Weevil (*phytonomus posticus*).

He says: "It passes through four complete metamorphoses. The eggs are small, oval in shape and when first laid are lemon yellow in color. The eggs average ten in number, are usually laid in the spring. The hatching season varies considerably. When first hatched, the larva feeds on the inner part of the stem in which it hatches, and in a few days works its way out and finds a leaf bud, upon which it feeds and grows.

"In cold weather the weevil seeks to hide under all kinds of trash that might be found in the field. In warm weather they become active, mate, and begin their work.

"They spread by means of crawling, flying, wind, freight cars, wagons, etc. Most of the state of Utah is infested with this weevil, and they are making different experiments to do away with the pest. The best method so far is to cultivate the field after each cutting with a spring tooth harrow with a wire brush attachment.

"California is protected from the pest to some extent by the high mountains and the quarantine law, but to make sure of the protection it is up to every grower to keep a keen outlook for the pest and when he discovers something that is destroying his alfalfa he should notify someone whose business it is to look into the case."

C. A. PERRIN.

THE ACTIVITY OF *PROSPALTELLA* BERLESEI HOWARD AGAINST *DIASPIS PENTAGONA TARG.* IN ITALY

(Translated into English by L. O. Howard in the August, 1912, Journal of Economic Entomology)

In Italy the white scale of the mulberry (*Diaspis pentagona* Targ.) has spread very rapidly and done great damage since its apparent introduction from Japan prior to May 10, 1886. In 1891 the government, by law, enforced the scraping and pruning of trunks and branches of the trees, as well as spraying with insecticides, but the treatment, with extended use, proved vain.

Prof. Berlese in 1906 introduced *Prospaltella berlesei* How., parasitic in America on *Diaspis amygdali*, into the region about Milan. The same parasite was subsequently brought in small numbers from Japan. With the spread of *Prospaltella* in these localities and the consequent reduction of *Diaspis*, branches from parasitized trees were distributed throughout the mulberry regions of the country.

The effectiveness of *Prospaltella* is attributed to the facts that it is migratory through flight, that it sedulously searches out and oviposits in the parthenogenetic female of *Diaspis*, and that it is itself parthenogenetic and very prolific, hatching four or five generations a year. Because of these characteristics it is waging so effective a warfare on the white mulberry scale that Prof. Berlese predicts the early extermination of the latter from Italy.

WM. BREWSTER.

THE POSSIBLE ETIOLOGICAL RELATION OF CERTAIN BITING INSECTS TO THE SPREAD OF INFANTILE PARALYSIS

By Brues and Sheppard, in August Journal of Economic Entomology

Of late a good deal of attention has been attracted towards infantile paralysis (*acute epidemic poliomyelitis*) owing to a slight epidemic in Southern California, but very little is really known concerning the channels of infection of this disease.

Considerable field work during the summer of 1912 has been carried on in various cities of Massachusetts, and the results of this work, together with a consideration of the epidemiology of the disease so far as known, points very strongly toward biting flies as carriers of the virus, particularly the common stable fly (*Stomoxys calcitrans* L. possibly aided by another biting fly (*Tabanus lineola*. So far this hypothesis has proven correct, no facts to the contrary having been discovered.

Some of the domestic animals are strongly suspected of being afflicted with acute epidemic poliomyelitis, and if so, another channel of infection may be open, namely, ticks.

At present the relation between animal and human paralysis is but imperfectly understood, and it is probable that studies along this line may bring out some very interesting facts concerning the spread of acute epidemic poliomyelitis in man.

More recent investigation seems to confirm the earlier work mentioned above.

N. W. Daniels.

UNCONSIDERED FACTORS IN DISEASE TRANSMISSION BY BLOOD-SUCKING INSECTS

(Written by Frederick Knab in April, 1912, Journal of Economic Entomology)

Since it has become recognized that certain blood-sucking insects are secondary hosts of pathogenic parasites, all insects feeding in this way have come under suspicion.

In order to transmit these diseases, it is necessary that the insect be closely associated for some time with man. As example of this class there are *Aedes calopus*, the host of the yellow fever parasite, and *Culex quinquefasciatus*, host of filariasis and dengue fevers. With these, individuals are always present with man to act as intermediaries. Another example of this class of insect is the large hemipter *Triatoma*. *Conorhinus megistus* in Brazil, transmitter through biting of a dangerous trypanosome. This bug does not occur except in close association with human beings, as to food, habitation, etc. *Anopheles* in transmitting malaria will be found, when closely studied, to be thus intimately connected with man also.

There are no specimens of *Anopheles* on the upper Chagres river, which is uninhabited. Suitable breeding places for the species are there, yet because of the absence of human beings for food, the mosquitoes do not exist.

W. B.

SOME INSECT PESTS OF THE CALIFORNIA LIVE OAK

R. W. DOANE

Journal Economic Entomology, August, 1912

The following were mentioned: The oak tree moth, the tussock moth, at least three species of leaf miners, carpenter worm, oak tree Cerococcus.

W. A. HILTON.

THE YELLOW CURRANT FLY OR GOOSEBERRY FRUIT FLY (*EPOCHRA CANADENSIS* LOEW.)

J. H. PAINE

Psyche, October, 1912.

Observations were taken in the vicinity of Stanford University.

The adult females go about the fruit at the time of laying with a constant fluttering of the wings. As a rule the fly prefers a berry that has not been stung before, but most of the fruit under observation had been stung twice or oftener. After puncturing the skin the hole formed remains small, but later the area about the egg turns brown and makes a very conspicuous spot. In the vicinity of Stanford, egg laying is continued through April to the middle of May. When the presence of the larvæ causes the berry to ripen and drop prematurely, it turns red with black blotches. The larvæ penetrate the ground to a depth of an inch or so and change to pupæ. There appears to be but one brood, the insects remaining inactive in the ground for ten months.

Several remedies have been suggested:

1. Frequent burning of fallen currants.
2. Removal of top soil underneath the bushes to a depth of two or three inches.
3. A mulch of coarse straw or hay well packed about the bushes to prevent the flies from emerging.
4. Allowing young chickens to run under the bushes at the time of the ripening of the fruit.
5. Pick and destroy the entire crop while green.
6. A method tried with success by the author was to cover the entire bush with mosquito netting to keep the flies away from the fruit.

W. H.

WHITE ANTS IN NATAL

In the October number of the South African Agricultural Journal, Mr. Claude Fuller, the Government entomologist in Natal, gives a detailed account of the white ants in that province. The most common as well as the most harmful species is the *Termes natalensis*, which has been taken destroying live

wattles and feeding upon the outer bark of old peach trees and eucalypti. It is this kind that commonly attacks buildings. The marching termite *Hodotermes mossambicus* is well known for the spoliation of crops of growing grain, while the insidious termite *Termes badius* is frequently guilty of injury in cane-fields newly set out, although no harm is done to grown fields. Other species which are more or less harmful are *Calotermes durbanensis, C. latericius, T. vulgaris T. incertus, T. parvus, T. bilobatus, Eutermes transvaalensis.*

Within the last twelve years there has arisen upon the town lands of Pietermaritzburg, a small suburb, and the whole of the area built over has been inhabited by termites, presumably from time immemorial. It is estimated that there are ninety-three nests per acre on this ground. The villas which spread over this area are all of brick; many are especially constructed with a view to circumventing white ant attack, and in most at least some measures have been taken in that direction, but all suffer more or less. Amongst them is a building upon raised Jarrah posts, and built of wood and iron; beneath is a clear space of about two feet, and light and air penetrate freely under it. This house has never been attacked, although on wooden posts, and it is thought to be due to the fact that the ground underneath is dry, well ventilated and exposed to light, making an environment wholly unsuited to the tastes of the white ants. Mr. Fuller cites eight other cases where the termites had found their way into buildings through defects so slight as to entirely escape the notice of the builders. That such loopholes are found by termites even where expensive precautions are taken is not altogether due to their happening upon them in the course of their indeterminable "voyages of discovery," but they are attracted along the directions which they take. Man's ingenuity fails before those stimuli which impel the insect unerringly towards a food supply almost as a moth is driven to the light, not consciously nor out of curiosity, but because it cannot help itself.

The attack of the insects upon fruit trees and in wattle and other plantations is a common complaint. It is a curious fact that peach trees are not eaten by Natal termites, and advantage has been taken of this to graft plums upon peach roots. Plum, apricot, apple, and pear trees are very susceptible to attack, while citrus trees and the more tropical fruits are taken only under exceptional circumstances.

In preparing ground either for building purposes or for agriculture it has been found that the termites can be eradicated by forcing arsenic and sulphur fumes into the nests. This must be done, however, before the ground is disturbed. The same method is used but with less success in orchards and plantations where the termites become troublesome. When found in buildings, carbon bisulfide repeatedly poured into nests which may be found beneath houses or in the walls, has usually been successful in driving away the pests.

Roy E. St. Clair.

LES ZOOCECIDIES DU NORD DE L'AFRIQUE

C. HOWARD

Ann. de la Soc. Ent. de France. Vol. LXXXI, 1912.

This is a paper of 128 pages. It takes up the galls on the various groups of plants beginning with the Algæ and including conifers and many of the other groups of plants where galls are better known. There are two plates and over two hundred small text figures.

TROMBIDIIDÆ

ANTONIO BERLESE

Redia, Vol. VIII, 1912.

Practically all of this number is taken up with the 290 pages of this paper. There are a number of line cuts and one double colored plate.

FEEDING HABITS OF SCORPION FLIES

In the Entomologist, for November, 1912, F. W. and H. Campion consider the feeding habits of scorpion flies. Their observations show that these insects are carnivorous, they feed on dead animal matter, they do not catch and devour living prey.

DIE SEHORGANE DER LARVA UND IMAGO VON *DYTISCUS MARGINALIS*

KARL GUNTHER

Zeit. f. Wiss. Zool. C. Bd. III, 1912.

The stemmata show two sorts of receptive cells, horizontal rods with small sense cells and vertical ones with large visual cells. The rods are, in general, hollow structures bound together by the distal ends of sense cells. Near the six stemmata on either side of the larval head are the so-called eye-spots, "Augenfleck," described for the first time. These are considered to be visual organs. They have vitreous bodies, true rods, and are connected by a nerve with the optic ganglion. The stemmata last through metamorphosis, so that in the imago they are without lens and vitreous body. With the development of the retinula the central cell of the eight moves basalwards, from the seven radial retinula cells in the proximal row. It does not form a part of the rhabdom, which is the product of seven cells.

Iris and retinal pigment were distinguished, they have their origin from different cell elements, the pigment cells and the retinal cells.

W. H.

DIE HALTEREN DER DIPTEREN

HUGO PELGSTALDT

Zeit. f. Wiss. Zool. Bd. C., H. 1, 1912.

This is a careful anatomical study of the halteres of several species of flies; *Sarcophaga carnaria, Calliphora erythrocephala, Syrphus balteatus* and *Eristalis tenax.*

The nerves going to the halteres are from the third thoracic ganglion, or from that part of the fused thoracic central nervous system which would correspond to the third ganglion. The nerve is as large or larger than the other nerve which goes to the wings (Figure 271. Figure 271, A, is a copy from the author's drawing of this organ in *Eristalis*, from the dorsal side Figure 271, B, is from the ventral side. There are three main regions, the base, the stalk and the head. On the dorsal side of the base are two patches of sensory structures and one similar one on the ventral side. In the head is a furrow, and on it a few sensory hairs of the usual type.

The author recognizes three types of sensory organs (1) papillae, such as those at the base of the organ; (2) sense hairs, such as those on the head, (3) chordotonal organs. These last lie under the ventral chitinous plate on the basal part of the organ (Figure 271, B).

The nerves which enter the halteres are large and seem to be entirely sensory although coming off from the lower part of the thoracic ganglionic mass, they have a rather direct pathway through the ganglion to the connectives which run to the subesophageal ganglion, as is shown in the copy of the author's figure of a longitudinal section through the ganglion (Figure 271, C and D).

The nerve on each side divides into two upon entering the sensory structure and the smaller one on the ventral side supplies some sense organs on that side. The larger nerve is connected with sensory terminations on each side (Figure 271, E). There is a chitinous mass partly separating these two nerves.

Of the basal papillae, the author makes two types, one sort where the nerves end in slight elevations, and the kind where there are almost no elevations of the chitin.

The chordotonal organs are similar to those found in other locations among insects but seem to be not complete enough to be organs of hearing. As to the function of the papillae and other sense organs, the author is still in doubt. By some they have been considered to be olfactory organs, but the author does not favor this because he thinks their structure is not enough like those well known in other arthropods. He thinks it possible that the chordotonal organs may be for detecting strain and stress, perhaps something like a muscular sense. Similar sense organs as those found in the halteres occur in the wings of insects.

Some experiments were performed with living flies. When both halteres were removed the insects were unable to fly, and if thrown into the air fell

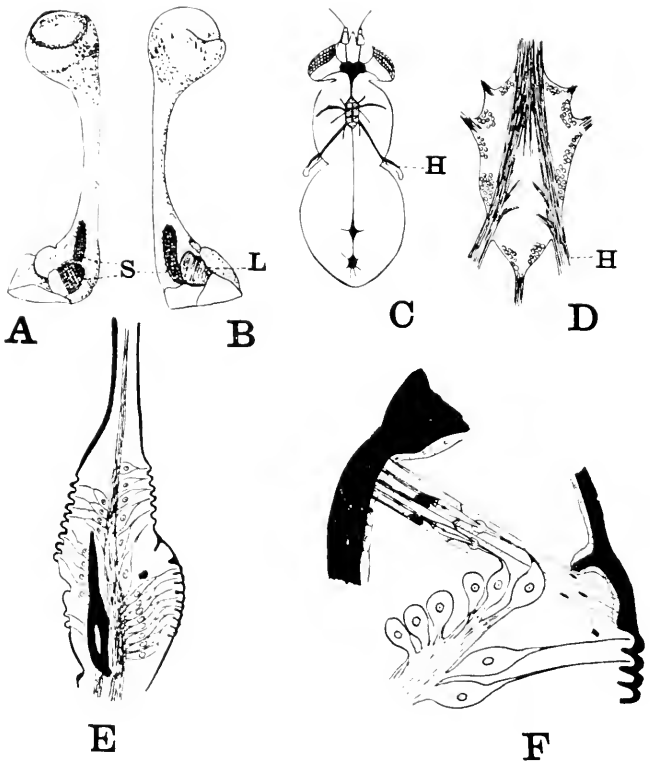

Figure 271

A, haltere of **Eristalis** from the dorsal side showing sensory areas, S, at the base; B, haltere from below showing sensory and chordotonal areas, the last indicated at L; C, nervous system of a fly, showing nerves to the halteres, H; D, longitudinal section of the thoracic nerve center, showing nerves connected with the halteres, passing by direct tracts into the subesophageal connectives, H; E, longitudinal section of the base of a haltere showing the two nerves and the two types of sensory structures found in the base; F, diagram much enlarged of the chordotonal organ of the fly.

straight to the ground. If placed on their backs they could only right themselves with difficulty. If only one organ was removed the insects flew back and forth but awkwardly and with hesitation and were easily brought to the ground. That the flies go in circles when one of these structures is removed was not observed.

Weinland considers the chordotonal organs are for the purpose of steering and the papillary organs are considered by him to be for the purpose of perceiving the strength and method of movement of the halteres. This may be true, the author thinks, but has found no way to test this by experiment. He tried experiments in making the halteres immovable by shellac, but this produced the same result as when they were removed.

W. H.

HISTOLOGISCHE STUDIEN UBER INSEKTEN II DAS SENSIBLE NERVENSYSTEM DER ESCHNALARVEN

ALEXIUS ZAWARZIN

Zeit. Wiss. Zool. C. Bd., 2H, 1912

The sensory nerve cell of the bipolar type is found in connection with the peripheral sensory structure, either a knob or a hair. In the labrum a group of cells enervate one organ. From the spindle-shaped cell there are two processes, one to the central nervous system—this may be varicose—and one to the sensory organ.

Besides cells of this type there are some of the author's type II, with characteristic tree-like peripheral processes. Cells of this type have their processes distributed to the membranes between segments and appendages. Cells of this sort have not always been considered to be a part of the sensory nervous system.

W. H.

STATISCHE SINNESORGANE BEI DEN NEPIDEN

WALTER BAUNACKE

Zool. Jahrb. Pd. XXXV, Heft. 2, 1912.

This extensive article covers a hundred and sixty-six pages and it is illustrated with twelve text figures and four double plates.

There is an account of the larva of *Nepa cinerea* L., with special reference to the abdominal sense organs. Then follows a study of ontogeny of the organs and then a discussion of them in the adult of this species. There is a very full account of the form and structure of these organs in this species and closely related ones, with some discussion of their functions.

The so-called sieve-formed stigma which are found in three pairs on the abdomen of members of this group, are breathing organs, organs of hearing or

rudimentary structures, as authors have called them. They are the organs which serve the orentation of these animals as they crawl under water.

These structures of the adult are preceded by eight sensory pits of the larva which serve a similar purpose. The pits are abundantly supplied with nerve fibers and trachea and may be surrounded and often covered with sensory hairs. At the regions of the depression there are numerous little pores leading down through the chitin.

W. H.

UBER DIE CHORDOTONALORGANE IN DER WURZEL DER SCHMETTERLINGSFUGEL

RICHARD VOGEL

Zeit. Wiss. Zool. C. Band, H. 2, 1912.

This article is concerned chiefly with the structure of these organs in the fore and hind wings of the Lepidoptera. In general the structure of these is much like that of similar organs in various parts of other insects, such as in the bases of wings, appendages of other sorts such as antennæ, mouth parts, legs and in the abdomen. The function of these structures with a tympanum such as the author describes in some Lepidoptera has been thought to be for hearing, those without this membrane are not so well understood. The hypothesis of Loeb and others which considers these simpler organs to be static, the author believes has much to support it.

As to the organ in Lepidoptera, there is no proof that it is for hearing, or indeed that these animals have such a sense. Especially in satyrs where there is a good tympanic membrane, it seems there is at least an organ for perceiving sound, whether it be noise or tone is, however, a harder question. As others have mentioned, the author considers the possibility of butterflies perceiving tones or sounds not audible to the human ear.

W. H.

DAS GESCHLECHTSLEBEN DES *DYTISCUS MARGINALIS* L. 1. TEIL DIE BEGATTUNG

HANS BLUNCK

Zeit. Wiss. C11 Bd., 2 Heft., 1912.

In this paper there is a consideration of the periodicity of the mating habits, a discussion of polygamy and polyandry. There are descriptions and figures of the male and female sexual organs and a consideration of the sexual habits and fertilization. Abnormal sexual parts are also considered.

W. H.

ÜBER DEN THORAX VON *GRYLLUS DOMESTICUS*

(Ein Beitrag zur Vergleichung der Anatomie und des Mechanismus des Insektenleibes, insbesondere des Flugels

FÜNFTER TEIL

Die nachembryonale metamorphose im ersten Stadium.

DR. FRIEDRICH VOSS

Zeit. f. Wiss. Zool. CI Bd. 4, 1912.

This is one of the most detailed and extensive pieces of work so far undertaken with a single species of insect as a basis. This part five alone covers over a hundred pages and is illustrated by means of five beautiful colored plates. Any further summary of this great work would be impossible in a few words. W. H.

BAU UND MECHANISMUS DES RECEPTULUM SEMINIS BEI DEN BIENEN, WESPEN UND AMEISEN

ALEXANDER ADAM

Zool. Jahrb. Bd. XXXV, Heft. 2, 1912.

There is a description of the receptaculum of *Apis mellifica*, *Bombus*, solitary wasps, *Vespa*, *Formica*, *Camponotus*. There are twenty-five figures in the text and three double plates in colors.

GLIEDERUNG UND EIGNE MUSKULATUR DER BEINE VON *ACERONTOMON* UND *EOSENTOMON*

HEINRICH PRELL

Zool. Anz. Bd. XL, N. 2 3, 1912.

The muscles of the legs of these animals are considered and their positions indicated in diagrams. In glancing over the figures of the muscles of these three legs it is interesting to notice that there is quite a little difference in the origins and insertions of the different muscles in each of the animals considered by themselves and compared with each other.

VERGLEICHEND-ANATOMISCHE UNTERSUCHUNGEN ÜBER DEN STECHAPPARAT DER AMEISEN

EMIL. FOERSTER

Zool. Jahrb. Bd. XXXIV, H. 3, 1912.

This is a detailed anatomical study of the anatomy of the stinging apparatus of ants. Representatives from several families were studied and besides a number of text figures showing the mechanism of the sting, there are two double plates in colors giving the various homologus chitinous parts in colors and the outlines of the various muscles connected with them.

W. H.

UBER DIE KOFFDRUSEN EINIGER NIEDEREN ORTHOPTEREN

SERGIUS SUSLOV

Zool. Jahrb. Bd. XXXV, H. 1, 1912.

This is not only a study of the glands in Orthoptera but a consideration as well of the comparative anatomy of these organs in both insects and myriapods. It is illustrated by three plates.

UBER DIE MORPHOLOGIE DER HETEROPTEREN UND HOMOPTERENSTIGMA

HEINO MAMMEN

Zool. Jahrb. Bd. XXXV, H. 1, 1912.

Diagrams are given showing the anatomy and mechanism of these openings, and the conditions in a large number of species as figured and described. Stigma were found with one, two and three muscles.

ZUR BIOLOGIE UND MORPHOLIGIE EINIGER PERLA-ARTEN

VON EDWARD SCHOENEMUND

Zool. Jahrb. Bd. XXXV, H. 1, 1912.

In this article is given first a short description of the life conditions of Perla and then a more extended account of the morphology of each of the three largest species, the *Perla marginata*, *Perla maxima*, and the *Perla cephalotes*. The tracheal system is of special significance. It appears in six brush-like appendages on the sides of the thorax and two on the inner side of the base of the cerci.

The writer believes Perla to be a very ancient insect group because of the simple structure of the body, the equal development of the abdominal segments and especially because of the long caudal appendages.

EDITH MCCONNELL.

THE LACINIA IN THE MAXILLA OF THE HYMENOPTERA

ALEX. D. MAC GILLEVRAY

Ann. Ent. Soc. of Am., September, 1912. Vol. V, No. 3.

The lacinia were found to be present in the maxillae of practically all the Hymenoptera examined. The only exception found was in the short tongued bee, Augochlora.

ANATOMY OF THE TOMATO-WORM LARVA, *PROTOPARCE CAROLINA*

ALVAH PETERSON

Ann. Ent. Soc. Am. Vol. V, No. 3, 1912.

This is a consideration of the external and internal structure. It includes three plates of line cuts illustrating: digestive, respiratory, muscular and nervous systems.

OBSERVATIONS ON THE ECOLOGY OF DRAGON FLY NYMPHS REACTIONS TO LIGHT AND CONTACT

C. F. RILEY

Ann. Ent. Soc. Am. Vol. V, No. 3, 1912.

In their natural habitat they respond strongly to contact. They respond negatively to strong light; this is a photic response and not a reaction to temperature. They also exhibit a "clasping response," seizing each other around the thorax and abdomen by means of their thoracic appendages. Sometimes as many as fifty individuals are clasped together in this way. The response of these nymphs to photic stimuli may be overcome by response contact. It seems to the writer that the behavior of the nymphs with respect to light and contact may not be entirely of a reflex mechanical nature. Such movements are not always precise and definite; sometimes they are considerably modified. May they not, as Holmes has shown with respect to Panatra, possess some of the concomitants of the pleasure pain-reaction? The two sorts of responses seem to be beneficial to the nymphs. Such responses not only aid in concealment from enemies, but also assist in obtaining food. Beneficial reactions are frequently "pleasureable," at least they are not usually "painful." On the other hand injurious responses are often "painful," certainly not "pleasant." The nymphs are guided fairly well by their "likes" and "dislikes," if such terms may be used.

THE NORTH AMERICAN DRAGONFLIES OF THE GENUS ÆSTHNA

University of Toronto Studies Biological Series

E. M. WALKER

The first part of this work is taken up with a detailed account of the genus Aesthna, being mainly a study of the general life history. Then follows a key to the North American species, for both males and females, as well as the known nymphs. Thorough descriptions of the sixteen species are given. There are twenty-eight plates, including six colored plates of the adults.

MABEL GUERNSEY.

UBER VERSONDRUSEN BEI LEPIDOPTEREN

DR. PAUL SCHULZE

Zoologischer Anzeiger. April 30, 1912.

The moulting fluid glands, which have never before been noticed in the adult, were discovered in an adult *Spilosoma lutcum*. These are apparently the source of a secretion—probably protective—which has been observed on the prothorax of certain Lepidoptera.

MABEL GUERNSEY.

THE FUNGUS GNATS OF NORTH AMERICA—PARTS I-V.

O. A. JOHANNSEN, PH. D.

Maine Agricultural Experiment Station. 1912.

On account of their small size and obscure habits these flies have received but little attention from entomologists, so this work with its 82 genera and 428 species is especially interesting. "It presents a synopsis of the fungus gnats or Mycetophilidæ, of North America, with descriptions and tables for all genera and species and life histories when known." The work is well illustrated, chiefly by means of half-tones.

NEUE TERMITEN AUS DER ZOOLOGISCHEN STAATSSAMMLUNG IN MÜNCHEN SOWIE EINEGEN ANDEREN SAMMLUNGEN

KURT VON ROSEN

Zool. Anz. Bd. XXXIX, n. 5/6, 1912.

Nine new species are described and very good figures are given of the heads of the soldier class of some of these.

W. H.

WEITERE BEITRAGE ZUR KENNTNIS DER BLINDKAFERFAUNA DER OSTALPEN UND DES KORSTES

PROF. D. V. JOSEF MULLER

There are five new species described, several subspecies and a new genus.

MYRIAPODA IN THE AUSTRALIAN MUSEUM

H. W. BROLEMANN

Rec. Aust. Mus., Vol. IX, No. 1.

This paper of about forty pages is illustrated by means of thirty-four text figures. As the author states, there are added to the observations furnished, full descriptions borrowed from more recent authors and as complete synonymical indications as possible. There are two new genera given and several new species and subspecies.

W. H.

NUOVI GENERI E NUOVE SPECIE DI CAMPODEIDÆ (THYSANURA)

F. SILVESTRI

Boll. Lab. Zool d. sc. Sup. in Portici, Vol. VI, 1912.

The new genus Metricampa is described with the species *packardi*, from Tacoma. The new genus *Holocampa* with the new species *wheeleri* from Shasta Springs, California. A new species, *Eutrychocampa wilsoni*, is described from Los Angeles (Mt. Lowe). Another new genus, *Hemicampa*, with

one species from Mexico and five new species of the genus *Campodea* are described; of these *C. kelloggi* is from Mt. Lowe. Specimens were also mentioned from San Francisco and Pacific Grove.

In another article in the same publication the same author publishes a paper on the Campodeidæ of Europe, in which twelve new species are described. There are also several other articles by the author in this number as well as a number of papers by other writers.

W. H.

DIE TERMITEN JAPANS

NILS HOLMGREN

Ann. Zool. Jap. Vol. VII, Pt. I, 1912.

The species of Japanese termites known to the entomologists of Europe and America are very meager. Twelve are described in this paper.

W. H.

DIE CICADINEN JAPANS—II

PROF. S. MATSUMURA

Ann. Zool. Jap. Vol. VII, Pt. I, 1912.

Of the family Membracidæ seventeen new species are described. Of the family Jassidæ there are twenty-six new species given. In this last group five new genera are described. W. H.

A REPORT ON SOME RECENT COLLECTIONS OF FOSSIL COLEOPTERA FROM THE MIOCENE SHALES OF FLORISSANT

H. F. WICKHAM

Bul. Univ. Ioa. Vol. VI, No. 3, 1912.

The remarkable preponderence of Rhynchophora noted earlier by Scudder seems well sustained. This group was undoubtedly a dominant one during Miocene times. The seed weevils had a strong representation during this time.

The author was not able to find the affinities with the Central American fauna suspected by Scudder. The species studied were more closely related to those in the United States. Bizarre structures of any description were conspicuously lacking. There seems to be no well marked difference in the average size of recent beetles of given genera when compared with their presumed relatives of Miocene rocks. No really large family or series of families seems to be entirely lacking. Small Coleoptera of all families are extremely few in collections.

There are seven plates of line cuts in the article.

W. H.

UNTERSUCHUNGEN UBER BAU UND DIE LEBENSWEISE DER LYMEXYLONIDEN, SPEGIELL DES HYLECOETUS DERMESTOIDES L.

F. GERMER

Zeit. Wiss. Zool. CI Bd. II. 4, 1912.

The male and female beetles have different maxillary palpi. In the male they are greatly modified and in them terminate large nerves of smell in olfactory terminal organs. These serve to find the female and are necessary organs for this purpose. The antennæ are also important sensory organs.

The imago takes no nourishment during its short life. The larva takes a little over a year in development. These larvæ burrow in wood but none of it passes through their alimentary tracts. A fungus is found in the burrows in which the larvæ live. It is *Endomyces hyocoeti;* it probably grows on the ground wood of the cavities. It is upon the spores of this fungus that the larvæ live.

In *H. flabellicornis,* the male antennæ are modified, the palpi normal. The female has simple mouth parts.

In *Lymexylon navale* the male palpi are modified.

In tropical forms of this group the palpi or antennæ are modified in the male. W. H.

THE EVOLUTION OF THE VERTEBRATES AND THEIR KIN

WILLIAM PATTEN

P. Blakiston's Son & Co., Phila., Pa., 1912.

Those who are familiar with Prof. Patten's previous work will not be surprised that he considers arthropods and especially arachnids as being the nearest to present day vertebrates. The chief basis of work is the king crab Limulus and there are numerous figures showing the anatomy and all stages of development of this animal, given in comparison with living and fossil vertebrates, arthropods, and other groups. The book is a rather large one, having nearly five hundred pages, and is illustrated by about three hundred figures, practically all of which are original. Many of the figures are simply line cuts, but are beautifully done. The whole book is well compiled and much interesting information is given the reader. The whole plan of the work, of course, is to support the author's theory and whether one accepts his conclusions or not, it is necessary to admit that the work itself appears to be one well worth careful consideration. W. H.

EVOLUTION OF THE WEBS OF SPIDERS

A concise and comprehensive abstract of an article on this subject by J. H. Comstock of Cornell University appeared in the Annals of the Entomological Society of America for March, 1912. The discussion begins with the statement that, since all spiders use silk in caring for their eggs, while

only a part of them use it in capturing their prey, the former must have been the primary utility, and this use varies in amount from the few threads of the Pholcus to the elaborate egg sac of the *Glyptocranium comptum*. Some of the more specialized ways of utilizing the silk, are by the burrow spider for strengthening the walls of the tunnel or by the trap door spider in its specialized lid, or the *Aranea* in its remarkably contrived tube. Nothing can be said definitely as to the way in which the web making habit arose, but it seems probable that the spinning of a drag line was one of the first steps, and the next is not difficult to imagine. Working in a limited space, the spider would cross and recross this line till something of a web was formed, and if perchance an insect were entangled in it, the process would be complete. The simpler webs, such as that of the *Pholcus*, are just those irregular nets made of the same kind of silk as the drag line. In advance of the *Pholcus* are the Linyphiidæ, the sheet web weavers, and the Agelenidæ with the addition of the funnel-shaped retreat. All of these webs, formed of one kind of silk, are simply to entangle the insects until the spider can reach them, but during the evolution of the web-making habit, many families have developed special organs for producing a viscid silk for holding the insect fast. The Theridiidæ have the simplest form, a viscid liquid thrown over the prey, but there is a specialized organ, the comb on the tarsus of the fourth legs, for flinging the silk. Other families use a thread or band of the viscid silk in making the web and in these webs of combined materials, two lines of specialization are recognized. The first is a simple foundation and a complex structure of the viscid which may be a simple or complex hackled band. The second, a perfected foundation and an unspecialized use of the viscid silk, finds its culmination in the orb-weaving spiders, the Uloboridæ and the Argiopidæ. The steps in the building of an orb web are very interesting. First the outer framework, the permanent part, is made, and then in the open space thus formed the radii are stretched. At their converging point the hub is erected and from this a spiral guy line is spun upon the radii, to hold them together for the next process. After all this has been formed of dry silk, beginning at the outer edge, the spider adds the loops and turns of viscid silk, destroying the spiral line in the process. The remainder of the article is devoted to examples of orb-weaving spiders of different kinds and closes with a tabular arrangement of the steps in the perfection of web-making.

Elizabeth Jacks.

THE SPIDER BOOK

J. H. Comstock

Doubleday, Page & Co.

To the general reader as well as to those more particularly interested in zoology, this book must be of interest. The subject matter covers over 705 pages and there are also over 700 illustrations. Much of the material included is new and all is clear and well presented. Among the interesting material

there are many photographs from spider webs. These were obtained only after patient experiment.

This work should go far towards making this rather neglected group of animals better known.

A PROBLEM IN THE FLIGHT OF INSECTS

HERBERT OSBORN

Ann. Ent. Soc. Am. Vol. V, 1912.

One of the prevalent flight movements among the slender winged species, is the backward motion taken by so many of them in flying. The hawkmoth in its approach and retreat to flowers, takes a most decided backward movement, the backward flight of a honey bee, in its initial flight from the hive, when it is fixing the location of the entrance of the hive, is also one of the best examples of this mode of flight. The explanation of this movement is accounted for on the basis of an adaptation in the wing for a forward and backward movement. The angle of the wing is so placed with reference to the axis of the body, that it represents different degrees ranging from a right angle to one of 35 to 45 degrees. "The direction of force of each wing would form an angle to the median axis of the body, and that at a point where these would neutralize each other, the effect would be to produce a stationary condition of the insect whereby it would hover at a fixed point, and that a slight further rotation forward would serve to push the insect in a backward direction."

M. MOLES.

MIMANOMMA SPECTRUM, EIN NEUER DORYLINENGAST DES EXTREMSTEN MIMIKRY TYPUS

E. WASSMAN

Zool. Anz. Bd. XXXIX, 1912.

Among the guests of the driver ant *Dorylus* (*anomma*) *nigricans* Ill. subsp. *spostedti*, there were found in two different migrations a most peculiar form. It appeared like an ant to some degree, but proved to be a beetle of the family Staphylinidæ. This remarkable form was given a new genus *Mimanomma*, with the specific name of *spectrum*.

W. H.

A PROTECTIVE ADAPTATION IN A BRAZILIAN MEMBRACID

WM. M. MANN

Psyche, Vol. XIX, Oct., 1912.

The author tells of *C. boski* Germ. which has a very large pronotum. The specimens he first attempted to capture flew away, leaving the large pronotum behind. He believes that this structure is distinctly an advantage to the animal, its use being comparable to the loosely jointed tails of certain lizards.

W. H.

BEITRAGE ZUR KENNTNIS DES GENERATIONSWECHSELS BEI EINIGEN APHIDIDÆ

I. Klodnitski

Zool. Jahrb. Bd. XXXIII. Heft. 5. 1912.

The species considered in particular are *Siphonophora rosae*, *Aphis hederae*, *A. salicti*, *Chaitophorus testudinatus* and *C. aceris*. There are numerous diagrams and tables. The general results are as follows

Every one of the investigated aphid races possesses a single particular cycle which consists of parthenogenetic and sexual generations. The occurrence of the sexual animals and also the other characters of the cycle, (occurrence of the winged forms, rest periods of eggs, etc.), are dependent upon inner causes. The outer factors can only lead to somatic changes, also to such which consist of the check of development and various different quantitative modifications, but they can call forth no generative changes, which modify the method of propagation in qualitative regard.

There are two particular types of cycles. In one group of individuals with one year there is a complete and closed cycle. Under this come the sexual animals for the most part, after a certain number of the parthenogenetic generation. The second group has an incomplete cycle whose genealogical stems can propagate themselves unbroken through a very long time by parthenogenesis. From these stems the branches separate gradually, which end with sexual animals.

WEST COAST NEWS NOTES

FORDYCE GRINNELL, JR.
PASADENA, CALIFORNIA

A chiel's amang you taking notes,
And faith! he'll prent it.—*Burns.*

"Il n'est aucun voyageur qui ne puisse faire bonne observation et apporter au moins une pierre digne d'entrer dans la construction de ce grand edifice." —*H. B. de Saussure.*

"Since the greater refinements and thoroughness of scientific methods and the enormous and ever-increasing mass of literature have inevitably led to extreme specialization, it is more than ever important to look beyond the immediate limits of one's own subject, and to note its points of contact with other lines of research." —*Seward.*

Mr. H. H. Newcomb and Mr. Karl R. Coolidge are planning a trip to San Diego.

Rev. George W. Taylor, a well-known student of Pacific Coast Entomology and other branches of natural history, died, at Nanaimo, British Columbia, last August.

"Within the next few weeks ground will be broken in Golden Gate Park opposite the Memorial Museum for the new Academy of Science building. Contracts already have been let for the first wing to cost $120,000. For six years experts have been working on exhibits and when completed the contents of the building will greatly surpass those of the old museum on Market Street, destroyed by the fire of 1906."—*The S. F. Argonaut*, August 31, 1912.

Mr. John Comstock, formerly secretary of the Entomological Section of the Chicago Academy of Sciences, is now living in Los Angeles.

William Greenwood Wright, a pioneer naturalist of California, died December 1, at San Bernardino. He was the author of "Butterflies of the West Coast," published in San Francisco in 1905, and of many short articles in various journals. He was also a well-known botanical collector and his name appears often in the "Botany of California." He was well known on the Pacific Coast and will always be remembered in connection with the pioneers of science on this Coast.

In the magazine section of the Los Angeles Times of December 1, there is an interesting account, with illustrations, of the work in breeding butterflies of Miss Ximena McGlashan of Truckee, Calif. She is the daughter of C. F. McGlashan, well known as a collector of Lepidoptera, and a pioneer who came to California in the early days with the ill-fated Donner party, of which he wrote a history.

Exchanges and Determinations

Thysanoptera and *Psyllidae* of the two Americas, including many cotypes to exchange for material in these groups from any part of the world. Prompt determinations of new collections made on request.

D. L. Crawford, Stanford University P. O., California

Wanted by purchase or exchange, pupae, cocoons or eggs of any *Catocalae* of the West and South, especially California and Mexico.

Joseph Sever, 335 E. 49th St., New York City

Named *Coccidae*, *Aphididae*, and *Coccinellidae* of California to exchange for named species of these groups from other regions.

E. O. Essig, Deputy Horticultural Commissioner, Sacramento, California

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Named Californian *Acarina* (Mites and Ticks), mounted on Slides, for similar material from other parts of the world.

H. V. M. Hall, Pomona College, Claremont, California

Aleocharinae (Staphylinidae) of the world. Will buy and exchange.

Dr. A. Fenyes, Box W, Pasadena, California

Wanted by exchange, *Moths*, from the Western States, especially *Noctuidae*. Will endeavor to determine species sent for names. Will name any North American *butterflies* for privilege of retaining a set.

F. Grinnell, Jr., 572 N. Marengo Ave., Pasadena, California

Fine named American *Cicadidae* to exchange for *Cicadidae* from any part of the world.

Named Californian and Mexican *Diptera* and *Orthoptera* (some new) to exchange for desiderata in these groups from other Western States or from Mexico, Central or South America.

Also named Californian and Mexican *Coleoptera* to exchange for named Southwestern or Mexican *Coccinellidae*, *Scarabacidae*, *Cerambycidae*, or *Rhynchophora*.

C. F. Baker, Pomona College, Claremont, California

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D. L. Crawford, Pomona College, Claremont, California.

Prosopidae of North America and *Colletes* of Mexico to exchange for species not in my collection. Prompt determinations of western and southwestern material made on request. Also named Californian *Noctuidae*—some new—to exchange for West Coast species not in my collection.

C. W. Metz, Pomona College, Claremont, California.

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E. O. Essig, Horticultural Commissioner, Santa Paula, California.

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