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CONTENTS OF VOLUME XI.

ASHMEAD, WILLIAM H.,	
Classification of the Pointed-tailed Wasps or the Superfamily Proctotrypoidea — I , II ,	28, 86
Two New Hymenopterous Parasites,	144
BANKS, NATHAN,	
Additions to the List of Pentatomidæ,	227
Some New Neuropteroid Insects,	236
BRUES, CHARLES T.,	
On the Sleeping Habits of Some Aculeate Hymenoptera,	228
BUENO, J. R. DE LA TORRE,	
A Preliminary List of the Pentatomidæ Within Fifty Miles of New York,	128
Brief Notes Toward the Life-History of Pelocoris femorata, with a Few Remarks on Habits,	166
Note on Pentatomidæ,	228
BUSCK, AUGUST,	
Notes on the Cerostoma Group of Yponomeutidæ, with Descriptions of New North American Species,	45
On the Generic Name of the Codling Moth,	106
COLEMAN, GEORGE A.,	
Coccidæ of the Coniferæ, with the Descriptions of Ten New Species,	61
DAECKE, E.,	
The Larva of Phiprosopus callitrichoides,	105
DYAR, HARRISON G.,	
Illustrations of the Larvæ of North American Culicidæ, III,	23
A Review of the North American Species of Pronuba and Prodoxus,	102
The Real Larvæ of Xanthopastis timais,	104
HORN, WALTHER,	
List of the Cicindelidæ of Mexico, and their Relationship with the Species of the United States,	213

KEARFOTT, W. D.	
Descriptions of New Tineoidea,	145
LENG, CHARLES W.,	
Notes on Coccinellidæ — I, II,	35, 193
LETCHER, BEVERLY,	
Phryganidia californica,	117
LUDLOW, C. S.,	
Some Philippine Mosquitoes,	137
MACGILLIVRAY, ALEX. D.,	
Winding Elbow-Pins,	99
NEEDHAM, JAMES G., and ANTHONY, MAUDE H.,	
The Skewness of the Thorax in the Odonata,	117
PACKARD, A. S.,	
Color Preference in Insects,	132
New Generic Types of Bombycine Moths,	244
SCHAUS, WILLIAM,	
New Noctuidæ from Tropical America,	230
SMITH, JOHN B.,	
New Noctuids for 1903, No. 2, with Notes on Mames-	
tra and Scotogramma,	1
New Noctuids for 1903. No. 5,	188
SNODGRASS, ROBERT E.,	
The Terminal Abdominal Segments of Female Tipu-	
lidæ,	177
Notes on the Internal Anatomy of Peranabrus scabri-	
collis,	183
SWENK, MYRON H.,	
A Synopsis of the North American Species of Japyx,	129
WEBSTER, F. M.,	
The Price of Dairy Products as Influencing the Abun-	
dance of Some Insects,	59
WEEKS, ARCHIBALD C.,	
Theory as to Evolution of Secondaries of Moths of the	
Genus Catocala,	221
Proceedings of the New York Entomological Society, 111, 173, 249	

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Vol. XI.

MARCH, 1903.

No. 1.

NEW NOCTUIDS FOR 1903, No. 2, WITH NOTES ON MAMESTRA AND SCOTOGRAMMA.

By JOHN B. SMITH, Sc.D.

The first paper of this series is in the Canadian Entomologist, Vol. XXXV, January, 1903, p. 9, and six species are there described. The present paper contains descriptions of species and notes on a number of others — chiefly *Mamestra* and *Scotogramma*. It happens not infrequently that, after a genus has been monographed, material accumulates that makes studies possible that were not so when the original work was done; so in the two genera mentioned I have accumulated material that enables me to give figures of genitalic structures of species not in my possession when I first wrote on them; some corrections in the synonymy may also be made on the same occasion for these genera.

***Moma geminata*, sp. nov.**

Ground color of head, thorax and primaries a clear bluish-green, the maculation black and contrasting. Head with a black line across the front. Collar with a black central spot. Patagia and disc with scattered black scales. The scale tuft on the basal segment of abdomen black-tipped; segments blackish, edged with white. Primaries with all the usual markings present, broken, black, contrasting. Basal line geminate, outer portion powdery and marked over the costal area only; inner portion more prominent, curved inward to a basal black dot. A black spot on inner margin near base. An irregular black spur extends from base through the submedian interspace to the angle of t. a. line. T. a. line geminate, broken, inner line best marked by an angulate portion in the middle of the wing; outer line best marked on costa and internal margin, else powdery. T. p. line geminate, broken; the inner portion composed of two main portions, one opposite the cell, the other opposite the inner angle where it is broad, lunate and has an inward tooth; the outer portion is most promi-

ment on the costa and is then broken into somewhat triangular spots. A series of unequal terminal black spots beyond which the fringes are cut with black. Claviform indicated by black scales. Orbicular moderate, upright, oval, concolorous, incompletely outlined. Reniform large, almost lunate, outlined by black scales, the center a black diffuse lunule. A black median shade is marked on the costa, forms a black square between the ordinary spots and is traceable, though powdery, to the inner margin. Secondaries smoky over a white base, with a series of black terminal lunules and a reflection from the outer line and discal spot of the under side. Beneath, white, more or less powdery, with an outer blackish line, a discal spot and a broken black terminal line; primaries with the costal region and disc darker. Expands 1.48 inches = 37 mm.

Habitat: Cartwright, Manitoba, May 7.

One female, in good condition from Mr. E. F. Heath. This is a beautiful species, larger than the eastern form and obviously distinct by the geminate median lines and better defined ordinary spots.

Epidemas obscurus, sp. nov.

Ground color dull smoky gray, with a brownish tinge in primaries. Head and thorax concolorous, tending to gray tipplings. Primaries with the maculation fairly defined, but in no wise contrasting or prominent. Basal line not obvious. A slender, slightly curved black basal streak, which does not extend more than half way to the t. a. line. T. a. line single, black, slender, outwardly angulate in the interspaces, as a whole a little oblique. T. p. line geminate, the outer part even, smoky and incomplete; inner portion brown, a little lunulate, included space a little paler and with some white scales: as a whole abruptly bent over the cell, then evenly and not greatly incurved below. S. t. line a little paler, broken, indicated by a few whitish scales and by a darker preceding shade on costa and darker terminal space below the apex: a small W-mark is obvious on veins 3 and 4, and in the submedian interspace the line is emphasized by a brown shading on both sides. Fringes long, gray, cut with smoky, with a blackish interline and a blackish line at base. There is an obscure median dusky line, defined only below the median vein. Claviform concolorous, broad, extending half way across median space, incompletely outlined, connected by a blackish double shade with the t. p. line. Orbicular narrow, oblong, oblique, of the palest ground color, outlined in black or smoky. Reniform large, kidney-shaped, gray, inner portion outlined by black or gray scales, outer obscure, diffuse. Secondaries soiled whitish, with a smoky line at base of fringes, an extramedian smoky line and a dark discal lunule: the tendency is to a darkening between the extramedian line and the outer margin. Beneath powdery, with a blackish extra-median line and discal spot on all wings: primaries smoky gray; secondaries whitish. Expands 1.08-1.36 inches = 27-34 mm.

Habitat: Pullman, Washington, October 14 and 26.

Three males and one female received from Prof. C. V. Piper, none of them in good condition and the smallest example—the female—probably undersized. The species is congeneric with *cinerea* which I have from the same locality, but it lacks all contrasts and is altogether

more obscure and sordid as well as smaller in size. There is also a difference in the details of maculation which can be better brought out by comparing the descriptions. The tendency in this species is to an obsolescence of the maculation and in one example it is traceable with difficulty only.

Rhynchagrotis niger, sp. nov.

Ground color dull blackish with a purplish tinge, all the maculation obscure except for the velvety black filling in cell before and between the ordinary spots. Head and thorax concolorous, collar with a more or less obvious transverse line or shade of yellowish scales, centrally. Thoracic anterior and posterior divided tufting prominent, the scales a little gray-tipped. Primaries almost even in color, the costal region scarcely paler. Basal line geminate, velvety black. T. a. line geminate, included space a little paler, inner line obscure; outer line black, narrow, outcurved in the interspaces, as a whole a little outwardly oblique. T. p. line geminate, both lines even, obscure, feebly sinuate, the included space a little paler. S. t. line vaguely indicated at costa, else practically not traceable. No terminal spots. Claviform vaguely indicated on one example. Orbicular V-shaped, concolorous, open to the costa, elsewhere bordered by black. Reniform moderate, kidney-shaped, concolorous, incompletely defined by pale scales except anteriorly where it touches the black filling of the cell. Secondaries smoky fuscous, hardly paler at base, fringes yellowish with a smoky interline; a vague discal lunule. Beneath blackish or smoky, paler and more powdery along the costa, both wings with a blackish outer line, secondaries with a discal lunule. Expands 1.28-1.40 inches = 32-35 mm.

Habitat: Pullman, Washington, May 27; Moscow, Idaho, May 14, Prof. C. V. Piper.

Three female specimens in fair condition. The species resembles a small black *formalis*, or an *emarginata*, in which the pale outlines to the ordinary spots had disappeared and the black filling of the cell had been added. The course of the lines is different, however; there is no basal black mark or streak and the costal region is not in the least discolored. The specimens came with a series of *formalis* and *emarginata* and were at once easily recognizable as different.

Rhynchagrotis meta, sp. nov.

Ground color of head and thorax a somewhat rusty red, collar with or without transverse black scale lines. Primaries leaden gray with a vinous red suffusion, which predominates through the center of the median space, over the course of the s. t. line and on the fringes. Basal space to t. a. line mostly gray except along internal margin. Basal line geminate, black or brown, inner line complete, outer broken. T. a. line geminate, inner line not contrasting, outer line black or brown, as a whole outwardly complete, quite even and only a little outcurved in the interspaces. T. p. line geminate, rather evenly outcurved over the cell, very feebly incurved below; outer line obscure, inner line even or nearly so, brown or smoky. S. t. line a series of yellowish scale dots over which is a somewhat diffuse red shade

band. There is a series of vinous red terminal lunules at the base of the fringes which are of the same color. No claviform is obvious in any specimen before me. Orbicular V-shaped, open to the costa, concolorous with the gray shading of the wing and defined only by the slight contrast between this and the vinous red shading below it. Reniform moderate in size, kidney-shaped, gray, defined in part only by the reddish shade which borders it more or less. Secondaries smoky, with a yellowish tinge toward base, fringes whitish, with a smoky interline. Beneath reddish-gray, powdery; primaries with disc smoky and with a more or less complete outer line; secondaries with a wavy extramedian line and a small discal spot. Expands 1.20-1.36 inches = 30-34 mm.

Habitat: San Francisco County, California; Pullman, Washington, June 10, Experiment Station No. 295.

Three females in good condition. The California example has been in my collection for a long time and was looked upon as a suffused form until the specimens received from Prof. C. V. Piper made it certain that there is a good species. It has the wing form of *placida* and a casual resemblance to that variable species; but the open orbicular separates the new form at once and, among its associates in this character, I know of none with which it can be readily confused.

As between the specimens, that from California is the largest and has the least contrasts; not a black scale is on the primaries and the gray has a reddish tinge throughout.

Abagrotis ornatus, sp. nov.

Ground color creamy gray, varying to darker more smoky gray, the markings clearly written, ordinary spots contrasting, discolored. Head and thorax concolorous; palpi deep chestnut brown on the sides. Primaries with all the markings present. Basal line geminate, blackish, powdery, its parts widely separated. T. a. line geminate, the inner portion vague and broken, the outer distinct, black, not sharply defined; as a whole outwardly oblique, a little outcurved in the interspaces, a longer inward tooth on the submedian vein. T. p. line geminate on the costa, the outer line narrow, powdery, even over the subcostal, thence reduced to dark venular points. Inner line blackish, powdery, narrow, crenulate: as a whole little outcurved over the cell and then a very little incurved to the inner margin. S. t. line pale, slightly sinuate, preceded and emphasized by a narrow, blackish shade, the terminal space a little paler. A broken black terminal line, which may be reduced to a series of venular dots. Fringes with a slightly paler line at base and narrowly cut with the same shade. Claviform wanting. Orbicular oval, oblique, narrowly black ringed, defining a pale annulus, within which the spot is solidly and evenly filled with rusty brown. Reniform upright, rather narrow, only a little kidney-shaped, incompletely outlined by black scales which border a pale annulus: within this the center is brown-filled and a black powdering around the margins emphasize the distinctness of the spot. Secondaries smoky, paler basally, fringes pale with a reddish tinge; a blackish discal lunule apparent. Beneath reddish, powdery, with an incomplete exterior line;

primaries with a darker disc and a diffuse discal blotch; secondaries with a small, rather well-defined discal lunule. Expands 1.32-1.44 inches = 33-36 mm.

Habitat: Kaslo, British Columbia, J. W. Cockle; Idaho, C. V. Piper.

Three female specimens, one of them in excellent condition, the others somewhat rubbed and broken. The Idaho specimen is darker throughout, but does not differ otherwise from the Kaslo examples.

In the absence of the male the reference to *Abagrotis* is somewhat uncertain. I am assuming that the ♂ will be found to have serrated and bristle-tufted antennæ because the species resembles *erratica* in general appearance and type of maculation more than it does any species of *Rhynchagrotis*. To the latter genus the species must be referred should the ♂ antennæ prove to be simple.

Eueretagrotis inattenta, sp. nov.

Ground color an even, smoky, purplish-brown. Head and lower half of collar deep mahogany brown, velvety. Thorax else concolorous. Primaries very smooth and even, the maculation poorly defined, no contrasts except the quadrate velvety black patch between the ordinary spots and the small, triangular spot before the orbicular. Basal line geminate, marked across the costal region only. A diffuse blackish streak from base, below the median vein, almost to the t. a. line. T. a. line geminate, obscurely marked, outcurved in the interspaces and a little outcurved as a whole. T. p. line geminate, included space a little lighter than the ground, inner line feebly lunulated, outer line even, best marked by the slightly deeper s. t. space; as a whole nearly parallel with the outer margin. S. t. line pale, more or less broken, a little irregular, on the whole very nearly parallel with the t. p. line. Claviform small, concolorous, incompletely outlined. Orbicular large, concolorous or a little paler, slightly ovate, open above and elsewhere defined only by the black shading. Reniform large, kidney-shaped, concolorous or a little paler, usually outlined by somewhat darker scales, sometimes also by a few of yellowish tinge. A series of very small, blackish terminal lunules. Secondaries smoky gray, almost even, with a faint yellowish tinge basally and on fringes, and a darker terminal line. Beneath, primaries smoky, more or less powdery, with an incomplete outer line and a vague discal spot. Secondaries paler, more grayish, powdery on the costal region, with an outer smoky line and a smoky discal lunule. Expands 1.32-1.52 inches = 33-38 mm.

Habitat: Calgary, Alberta, Head of Pine Creek, July 10-14, F. H. Wolley Dod; Pullman, Washington, June 9, Exper. Station No. 320, C. V. Piper.

Four males in good condition are now at hand. ! Heretofore I have considered this as a form of the eastern *perattenta* and have so named specimens for Mr. Dod. *Perattenta* occurs at Cartwright, Manitoba, and as it is there somewhat less mottled than the normal Atlantic coast type I considered the Calgary specimens as larger, more

even examples. The receipt of an example from Professor Piper which was yet larger, darker and more even in color, induced me to reëxamine the series and to dissect out the genitalia. The new species is uniformly larger, darker and even in color, without mottling and with the terminal space not lighter than the ground, though in one case somewhat lighter than the s. t. spaces.

Carneades masculinus, sp. nov.

Ground color a dull leather brown, lighter or darker, with smoky or blackish shadings. Head ranges from brown to purplish-gray, with a darker line across the front. Collar light brown or gray inferiorly, to a transverse black line which is more or less obviously bordered on both sides by white scales: upper part of collar concolorous with thorax, sometimes tipped with brown. Thoracic disc ranges from brown to purplish-black, the edges of the patagiæ sometimes relieved by white scales. Primaries with costal region, to the t. p. line yellowish, grayish or whitish, always contrasting with the rest of the wing; median vein white to the end of the cell. Basal line barely indicated by geminate dots on costa. T. a. line indicated in the same way, and, in some examples, by a slightly paler line in the submedian interspace. T. p. line defined only by the difference in shade between the darker median space, and the lighter s. t. space; as a whole evenly outcurved over the cell and almost evenly oblique below. S. t. line very irregular, defined only by the contrasting darker terminal space and by a series of 3 or 4 preceding, more or less sagittate marks: the terminal space completely cut by pale rays on veins 3 and 4. A blackish terminal line and a pale line at the base of the fringes, which are of the darkest wing color. A black shade line from base through submedian interspace carries the narrow, black-filled claviform. Orbicular round, small or moderate in size, black-ringed, annulate within this ring by whitish scales, the center brown; occasionally the upper margin of the spot is cut by the pale costal area. Reniform moderate, kidney-shaped, margined by black scales within which is a whitish annulus: center brown. The cell before and between the spots is black or blackish. The internal margin is of the brown or lighter ground and, above this, the median space is dark to the median vein, cut only by the paler shade accompanying vein 2; but the amount of contrast between the shades varies. Secondaries of the male white or whitish; the veins, a discal lunule, a terminal line and the apical area a little smoky. Beneath, primaries gray, powdery, with a poorly marked incomplete extra-median line and discal spot: secondaries whitish, powdery along the costa, with a dark terminal line and discal spot. Expands 1.20-1.44 inches = 30-36 mm.

Habitat: Silverbow Co., Montana, 5,800 feet, August 28, R. A. Cooley; Yakima, Washington, C. V. Piper; southern Utah, April 1-15, Poling.

Seven examples, all males, and four of them decidedly ragged. The species is stout, comparatively short-winged, with proportionately very heavy thorax, and belongs in a general way with *furtivus*

or *idahoensis*; differing from these in the pale rays crossing the s. t. line, and from the other species in the strong costal contrast accompanied by the obscuring of the transverse maculation. There is quite a variation in color, but the specific habitus is so well marked that this is not confusing.

Carneades focinus, sp. nov.

Ground color ashen gray, varying somewhat in tint, but never very dark. Head concolorous or paler, sometimes rusty brown, with or without a black line below the antenna. Collar with a blackish transverse line across the middle, above which follow a pale gray and a paler band at tip; and below which the color is usually more or less rusty, often forming a pale spot at the base of the primaries. Thoracic tuftings often gray-tipped, and sometimes the center of disc may be gray. Primaries with all the maculation present, well defined, the ordinary spots large and a little contrasting. At base and through lower half of wing generally, the gray shade predominates: through the cell and in the upper half of wing a brown shade obtains which may change to blackish between the ordinary spots. The terminal space is the darkest portion of the wing. Basal line geminate, black, a little bent on the subcostal, sometimes a little shaded outwardly so as to give the appearance of a basal dash. T. a. line geminate, blackish, a little outcurved in the interspaces, as a whole somewhat oblique outwardly. T. p. line geminate, smoky, the outer portion equal, the inner lunulate or even crenulate, as a whole well removed from the base, broadly outcurved and rather even below that. S. t. line pale, irregular, preceded by sagittate black spots and else marked by the dark terminal space. A median shade runs obliquely between the ordinary spots, darkening the reniform and then running close to t. p. line. There is a series of black terminal lunules, and the fringes are interlined with smoky. The claviform is small, concolorous, smoky ringed. Orbicular large, oval, oblique, margined in blackish, gray-filled, sometimes not closed superiorly. Reniform large, kidney shaped, gray, the lateral margins marked with yellowish scales, the upper and lower margins sometimes obscured. Secondaries pale yellowish, becoming smoky outwardly to the whitish fringes: darker in the female. Beneath whitish, powdery, disk of primaries tending to smoky and in the female, more or less completely smoky. On both wings an outer dark line, and on secondaries a small, dark, discal spot. Expands 1.24-1.48 inches = 31-37 mm.

Habitat: Calgary, Canada; Pullman, Washington; Glenwood Springs, Colorado; Truckee and Sierra Nevada, California: June, July and August.

This is a common species represented in my collection by good series of both sexes. It is the species that I have mistaken for *friabilis* in collections and have so named for correspondents. A re-examination of the type of *friabilis* in the British Museum made it clear that this form would have to receive a new name. It is an ally of *tessellata* but grayer and narrower winged, with larger ordinary spots.

Hadena (Xylophasia) albiserrata, sp. nov.

Head, thorax and primaries blackish over smoky, with sparse gray powderings, giving the insect a rough appearance. Head with a black line across the front; collar with a black line across the middle. Thoracic tuftings distinct, tipped with gray. Abdominal tuftings prominent. Primaries with all the maculation obscured, no contrasts save in the large, white powdered reniform and in the sharply defined white dentate s. t. line, in which an obvious W is marked on veins 3 and 4. Basal line marked by black scales and a gray included space. T. a. line practically lost in one example; traceable in the other; upright or nearly so, a little irregular, black, preceded by white scales. T. p. line strongly outcurved over the cell, obliquely incurved below grayish with a scarcely defined preceding line to the middle of the wing below the reniform, then better marked, with a vague grayish cloud in the submedian interspace. S. t. line as described, margined by black interspaceal dashes. A series of black terminal lunules. A very narrow whitish line at the base of the fringes, which are narrowly cut with white on the veins. Claviform indicated by black scales and a gray shade, followed by a blackish shade to the t. p. line, connecting the median lines in the submedian interspace. Orbicular oval, oblique, gray, with smoky center, not sharply outlined. Reniform large, kidney-shaped, gray-powdered, with a smoky filling in which is a white lunule. Secondaries whitish, powdery in the male; smoky, powdery in the female; with a black terminal line, a darker outer shade and a discal lunule in each case. Beneath, ashen gray, powdery, with an extra-median and sub-terminal whitish shading and a dark discal spot. Expands 1.64-1.76 inches = 41-44 mm.

Habitat: Pullman, Washington, Sept. 19; Exper. Sta. No. 639; C. V. Piper.

One, somewhat ragged male, and one good female, from Professor Piper. The male is the smaller, a little the better marked and has whitish secondaries. The female is very obscure and looks powdery, blackish, the white s. t. line only standing out in bold relief. The relation is to *H. versuta* and the series in which there is a small W in the s. t. line.

Hadena (Xylophasia) alberta, sp. nov.

Ground color dark, smoky red brown, varying in tint and appearing like a smoky suffusion over a red-brown base. All the maculation is obscure, not contrasting, a variable bluish-gray powdering on the veins and along the course of the median lines. Basal line traceable, geminate, broken, extending to a short, slender, black basal streak. T. a. line geminate, broken, irregular, as a whole outcurved, rarely traceable for its entire course. T. p. line geminate, outer line obscure and even, inner line narrow, black, lunulate, broadly outcurved over the cell and rather evenly oblique to inner margin. In one example the included space is continuously bluish, in one there is no blue at all and the other three are intermediates. S. t. line broken, consisting of vague paler spots accompanied by darker shadings and forming in most examples a traceable W; it may be almost entirely wanting. A series of small black terminal lunules at the base of the slightly scalloped fringes. Claviform traceable,

concolorous, outlined in black, extending half way or more across the median space ; very obscure in dark examples. Orbicular small, oblong, oblique, slightly paler than ground, completely outlined in dark smoky. Reniform moderate, upright, kidney-shaped, obscurely defined, a little paler outwardly at and above the middle, somewhat darker inferiorly. Secondaries smoky fuscous, fringe and base a little paler ; a dusky discal lunule traceable. Beneath smoky, powdery and with a reddish tinge along the costa ; both wings with a smoky extra-median line and secondaries with a blackish discal spot. Expands 1.44-1.64 inches = 36-41 mm.

Habitat : Calgary, Alberta, June 24 to July 7.

Three male and two female examples, of which two male and one female were received from Mr. F. H. Wolley Dod under the number 33 (head of Fish Creek) and one male and one female are from Dr. Wm. Barnes.

The species is allied to *cinifecta*, but is very dark and the maculation is not easily made out in some specimens. The abdominal tuftings are obvious, though not prominent, the male antennæ are thickened and obviously ciliated.

***Hadena*(*Xylophasia*) *parcata*, sp. nov.**

Ground color dull luteous with a smoky suffusion, the maculation obscure. Median lines marked by smoky, geminate dots on costa, then continued as bluish, powdery lines, hardly defined by localized darker scales. Basal line traceable. A very fine blackish basal streak. T. a. line as a whole outwardly oblique to the submedian vein, then rather abruptly bent inward. T. p. line evenly outcurved over reniform and evenly oblique below it. S. t. line marked by a more leaden gray tint in the terminal space, broken to relieve a W-mark which, though vague, is yet the most obvious feature of the line. Fringes a little scalloped, cut with pale on the veins. A rather broad, diffuse median shade is traceable between the ordinary spots, darkening the lower half of the reniform and inwardly bent below it. Orbicular barely traceable, oblong, oblique. Reniform moderate, kidney-shaped, undefined, a little paler outwardly. Claviform vaguely indicated. Secondaries pale smoky, lighter at base, fringes whitish, a vague, dusky discal spot. Beneath powdery gray, disc of primaries a little darker, a common extra-median line and discal spot : the spot and line much more obscure on the primaries. Expands 1.44-1.52 inches = 36-38 mm.

Habitat : Yellowstone Park, Wyoming.

One male and one female from Dr. William Barnes. Despite the apparent differences it is not impossible that this may be a race of *alberta*. I placed it as such, at first ; but the differences were so well defined and the total impression was so distinctive that I concluded to separate the two. The scheme of maculation is similar ; but this species is much lighter in color, with narrower primaries, better defined and more characteristic W-mark, and an obvious median shade.

Oncocnemis aurea Grt.

This was described as a *Pseudanarta* by Mr. Grote and was unknown to me when I wrote my revision of *Pseudanarta* in 1889. I saw the type in the British Museum in 1891, and in my Catalogue (1893) I note that the species has armed anterior tibiæ; but I considered it rather Heliothid than otherwise from the examination then made. A more careful study of the type was made in 1900 and, on my return, I identified the species in my box of *Oncocnemis* — where it belongs. Six examples are before me at present, five of them from various Texan localities, one from Hot Springs, New Mexico, 7,000 feet alt., and there is on the whole a close resemblance between them. One specimen from Shovel Mountain, Texas, is larger than the others and the outer half of the wing is gray, quite sharply defined from the basal dark portion; but a tendency to this is noticed in a form from San Antonio, and is probably within the range of variation.

Oncocnemis nigerrima, sp. nov.

Head, thorax and primaries black or smoky over a gray base. On the head and thorax gray scales intermingle with the black, and the collar is narrowly gray-tipped over a blackish line. There is a black line between the antennæ and a paler line across the middle of the collar. Basal line of primaries indicated by black scales on the subcostal vein. T. a. line single, black, outcurved, a little irregular, preceded by a shading of gray scales. T. p. line single, evenly curved over the cell and as deeply incurved below it; a shading of gray scales on both sides giving a slight relief. S. t. line gray, broad, linear in the costal region, else diffuse, irregular, preceded by black lines in the interspaces. A black terminal line. Fringes long, grayish at base, interlined with smoky and cut with smoky beyond the interline. Claviform concolorous, outlined by separate black scales; short and broad. Orbicular small, round, gray with a smoky center, outlined by black scales. Reniform large, broadly oval, oblique, defined by a white ring, the center smoky brown. Secondaries deep orange, with a broad black border which extends also along the costa. Beneath, primaries black, with the reniform white. Secondaries as above. Expands .75 inch = 19 mm.

Habitat: Yuma County, Arizona, in July.

One good male from Mr. Geo. S. Hutson, taken in the desert area. The resemblance is to *aurea* Grt., than which the new form is smaller, blacker, with better defined markings, orbicular, clearly defined and the secondaries more deeply colored. The well-defined s. t. line which is lacking in *aurea* and the well-defined white-ringed reniform are the most striking characters of this species. *Corrusca*, which belongs to this same little group, is larger than either *aurea* or *nigerrima* and does not have the costal area of secondaries black.

***Oncocnemis euta*, sp. nov.**

Ground color of head, thorax and primaries a pale chocolate brown. Head and thorax concolorous, the vestiture scaly and in the specimens disarranged. Primaries with all the maculation obscure, an oblique indefinite paler shading through the outer third of the wing relieving it from absolute uniformity. The basal and median lines and the median shade are marked on the costa by spots or darker shades and occasional black scales on the veins; but no course can be made out. S. t. line vaguely traceable as a zigzag pale line, emphasized here and there by obscure blackish marks. A narrow blackish line at the base of the long fringes, which are cut on the outer edge with darker brown. There is a very narrow, broken line from base, at the end of which a claviform is indicated by black scales. Orbicular small, round, concolorous, outlined by black scales which incompletely define a slightly paler ring. Reniform small, lunate, outlined and annulate in the same way. Secondaries yellow, with a broad black margin taking up the outer third of the wing. Fringes yellowish or brown. Beneath, both wings yellow with a broad marginal band, brown on the primaries, black on the secondaries. Expands .88-1.00 inch 22-25 mm.

Habitat: Utah.

Two female specimens in good condition save that the thoracic vestiture is disarranged and partly lost. The resemblance is to *mirificalis*, but this is a smaller species, with lighter primaries on which the maculation is barely traceable. Unfortunately I have no better data as to locality than above given, and none as to date or the collector of the specimens.

***Oncocnemis chorda* Grt.**

This was described as an *Homohadena* and, when I revised that genus in 1890, I had, apparently, a specimen from the Edwards collection before me. Whether that specimen was imperfect or whether I simply accepted the generic reference as correct, I cannot say now; but in 1900 the type in the British Museum seemed familiar, and on examination I recognized it as my *Oncocnemis refecta*. The type shows the generic characters clearly and my examples came from the type locality; resembling the original specimen much more nearly than does the Edwards specimen, which is from Sierra Nevada.

***Oncocnemis rosea*, sp. nov.**

Ground color yellowish-gray. Head and thorax with a rosy red suffusion which fades out in old specimens and leaves the pale luteous ground with an odd discoloration that is recognizable when a fresh specimen comes to hand. Head with a dusky line across the front. Primaries with a rosy tinge in the basal space which changes beyond the t. a. line to a gray which, in the s. t. space becomes blackish or smoky and darkens the outer portion of the wing. Basal line single, blackish-brown, narrow, well-marked. T. a. line single, broad, a little diffuse, velvety blackish-brown, a little outcurved. T. p. line lunulate, single, blackish on costa, else smoky, slender,

followed by a narrow pale shading, rather abruptly bent over the cell, then evenly oblique to the inner margin. S. t. line pale, irregular, broken, almost punctiform. Median shade marked by a black spot on the costa, thence oblique between the ordinary spots almost to the t. p. line; then parallel with this line and close to it to the inner margin; nowhere well-marked except on the costa. The outer margin is slightly scalloped and emphasized by a narrow, dark, terminal line, followed by a narrow pale line at the base of the fringes. The latter have a dusky interline and are incompletely cut opposite the interspaces. Claviform wanting. Orbicular round, rather large in size, paler than the ground, not defined. Reniform moderate in size, broad, upright, paler than the ground, not outlined and incompletely defined. Secondaries whitish, somewhat translucent, with a broad smoky outer border. A pale yellow, followed by a smoky line at the base of the fringes. Beneath whitish, smoky toward the outer margin, the maculation of the upper side faintly reproduced. Breast and base of legs with a pinkish tinge, the tarsi pale ringed. Expands 1.20 inches = 30 mm.

Habitat: Colorado desert, Hy. Edwards; southern Arizona, April 1-15, Poling.

Two males: one is an old specimen given me many years ago by the late Henry Edwards. I recognized it as distinct from the described species, but realized also that it must be a discolored example; so I held it until I received recently from Dr. Barnes a fresh male which belongs obviously to the same species. The rosy flush over the thorax and basal space, and the broad, velvety, somewhat diffuse t. a. line serve to differentiate the species at once. It is allied to *refecta* in the simplicity of the basal line.

***Oncocnemis simplicia*, sp. nov.**

Primaries dull luteous gray, powdery and obscurely strigate so as to give a sordid confused appearance. Head deep chestnut brown. Basal line single, black, oblique, connected with the t. a. line by a narrow blackish streak. T. a. line single, black, broad, oblique. T. p. line marked by a smoky costal spot over the reniform, then almost lost as it bends over the cell; reappearing below vein two as a single black line, a little incurved and forming a slight outward dent on vein 1. S. t. line a vague, irregular paler shading, and there is a series of black venular dots on the slightly scalloped outer margin. Orbicular concolorous, oval, decumbent, narrowly pale ringed. Reniform narrow, almost lunate, pale ringed, the annulus edged with somewhat darker scales; center a little darker than ground. Secondaries translucent, white with a slight yellowish tinge, tending to smoky at the margin. Beneath yellowish-white, powdery along the costa and apically, both wings with a broken outer line; primaries with a small discal spot. Expands 1.28 inches = 32 mm.

Habitat: Colorado desert.

One male in fair condition. This is another of those specimens that has rested, undescribed, in my collection for many years, awaiting a companion of the other sex. I suspected a possible connection

between this form and the one just described as *rosea*; but the occurrence of another example of the latter makes it safe to separate this as a good species. The very simple maculation should make it a recognizable form; but there is a possibility that the ground is somewhat discolored and more yellowish than a fresh specimen would be.

GENERAL NOTES ON MAMESTRA.

In my revision of the species of *Mamestra*, Proc. U. S. Nat. Mus., XIV, 197-276, I listed 89 species, of which 76 were autotypically known to me. Of those that were then unknown I have since recognized *sutrina*, *vittula* and *dimmockii*. *Conditia* has been referred to the Agrotid series. *Strigicollis* has been referred as a synonym to *laudabilis*. *Expulsa* Wlk. is a synonym of *Carneades insulsa*; *septentrionalis* Wlk. is *Carneades messoria*; *punctigera* Wlk. is an earlier name for *Carneades pastoralis* Grt.; *vetusta* Wlk. is also a *Carneades*; *obliviosa* Wlk. is *Xylophasia lateritia* or something closely allied; and *associans* Wlk. is the *Noctua lubricans* of Guenée. *Ferrealis* Grt. and *impolita* Morr. yet remain unknown to me. I have again compared all my material carefully and find nothing to fit to either description.

On a renewed examination of the species in the British Museum, made in 1900, I again looked over the type of *Mamestra cristifera* Wlk., and concluded that Mr. Grote was right in declining to accept the reference of his *lubens* as a synonym to Walker's species. The lack of the brighter colorings which I had believed to be due to fading or to local variation now seems normal, with larger material, and the species is really nearer to my *invalida* than to *lubens*. I do not care to make this reference positively, however, because I have no material from the Hudson Bay faunal region and, with my present information concerning this fauna, I do not consider a good species at all improbable. At all events *lubens* Grt. is not *cristifera* Wlk.

In the *Biologia Centrali Americana Mamestra configurata* Wlk. is figured on Pl. XXVI of the *Heterocera*, Fig. 20. I noted that this was a very close ally of *Barathra occidentata* Grt., but delayed making the reference until I could examine the type. This was done later and I have no doubt that the two names refer to the same species. Walker's species was described from Doubleday's Mexican material in 1856, Cat. Brit. Mus. Het., IX, 234, and the generic characters are obvious. Mr. Grote's material came from New Mexico, not so far removed in faunal character.

Of the other species referred by me as varieties, *juncimacula* is a good species and so is *comis*, which I referred to as a synonym of *olivacea*. This latter correction I made in the Trans. Am. Ent. Soc., XXVII, 230, and would not think it necessary to repeat it here except for the fact that in Dr. Dyar's catalogue the species is again referred as a form of *olivacea*; and practically every form separated in my recent review of the species allied to *olivacea* appears as a synonym without explanation or comment. It goes without saying that I do not accept this reference, and prefer to regard the species as listed in the paper above referred to.

Aside from the forms allied to *olivacea* I have described since the revision 27 species, Mr. Strecker has described four, and one additional species is presented here. This gives altogether a series of 116 species, and the end is not yet.

Mamestra purpurissata, *M. juncimacula* and *M. nugatis* form a little group of allied yet perfectly distinct species, the male genitalia of which are shown at Pl. I, Figs. 1, 2 and 3. The figure representing *purpurissata* is redrawn from an eastern specimen, because Fig. 6 in my revision of *Mamestra*, Proc. U. S. Nat. Mus., XIV, Pl. VIII, really represents *juncimacula* and not *purpurissata* as stated. The fact is that both species may have the ordinary spots either fused or separated, though the fusing is rare in *purpurissata*, while it is not uncommon in *juncimacula*. Of the five examples of the latter species now before me two have fused spots, while of the eight examples of the former only one shows any appearance of a union. Comparing the two series, *purpurissata* has dark secondaries in both sexes, the primaries broad, with the median lines fairly obvious. In *juncimacula* the secondaries are whitish in both sexes, with smoky outer bordering: the primaries are narrower, have a more pointed apex, the outer margin is much more oblique, the hind angle distinctly retracted and the median lines are practically lost. It is altogether a brighter species and the s. t. line has the W-mark sharply cut to the outer margin.

Nugatis is smaller than either of the others and has entirely white secondaries. The primaries are more like *juncimacula*, but strigate in appearance with the transverse maculation practically all lost. The tendency here is also to a union of the ordinary spots; but whereas, in the larger forms the line of connection extends inferiorly on the median vein, in *nugatis* it is central and through the cell itself.

Another series of allies is *Mamestra discalis*, *nimbosa*, *imbrifera*,

rogenhoferi and *mystica*; the latter being the only one not figured in my revision of 1891. The genitalia are shown here at Pl. I, Fig. 4, and while they show a distinct agreement in type, also prove themselves different from any other species. Though the superficial resemblance to *nimbosa* is close, the genitalic resemblance is nearer to *imbrifera*, while from both the new form differs in lacking the small accessory clasper with spoon-shaped tip.

Mamestra gussata, *M. segregata* and *M. plicata* prove to be more nearly related than I had supposed, judging from superficial characters only. A comparison of Figs. 6, 7 and 8 will show that all three have genitalia of the same general type; the differences, such as appear, being in part due to the difference in the arrangement of the double claspers on the slide. But, curiously enough, while *gussata* and *segregata* are most nearly alike superficially, the genitalia are most dissimilar, while *plicata*, which looks obviously different from either, has a close genitalic resemblance to *segregata*. All the species have the antennæ serrated and bristle-tufted in the male, and agree in general type of maculation. *Plicata* is the largest species, very even in color, the markings neatly defined, no obvious median shade and no black about or between the ordinary spots. *Gussata* is smaller, broader-winged, with a grayish powdering over the brown base. There is a more or less obvious dusky median shade, the maculation is more broken and irregularly defined, a darker, brown shade tends to connect the claviform to the t. p. line and the cell becomes darker about the obscurely defined ordinary spots. In *segregata* we have a more boldly defined form, the median lines well marked, connected by a black bar over the claviform, a variably defined though not prominent W in the s. t. line, and the cell before and between the ordinary spots black. All things considered, the species are fairly well separated though closely allied and obviously descendants from the same stock.

Another member of this series is *negussa* in which the maculation consists of narrow gray lines in a grayish-brown base. The genitalia are practically like those of *gussata*, and with a sufficient series at hand, it is probable that the two will be found to be forms of one species. For the present this may be held as a hoary-gray type without obvious contrasts.

In its superficial characters and in the general type of maculation, *Mamestra navia* resembles *gussata* and belongs to the same general

series; but the genitalic structures of the male are totally different. They are shown on Pl. I, Fig. 12, and a comparison with Fig. 6 will at once show the differences between the two.

Mamestra mutilata was referred by me on superficial characters to *cuneata* and *strutina*: unfortunately, while the example was a good one I failed to get out the genitalia in good shape. What I obtained is shown at Pl. I, Fig. 11, and while it is not much, it is sufficient to show that it is not of the *cuneata* type at all. The latter is shown at Pl. X, Fig. 59, of Proc. U. S. Nat. Mus., XIV. *Strutina*, which is so nearly like *cuneata* that it might be readily confused with it, has male characters entirely different. Those of *cuneata* have been already referred to; those of *strutina* are figured in Pl. I, Fig. 9.

The male genitalia of *Mamestra intentata* are shown at Pl. I, Fig. 10, and they are almost identically like those pictured for *M. incurva* in Proc. U. S. Nat. Mus., XIV, Pl. XI, Fig. 54. Yet, superficially there is little resemblance between the two. *Incurva* is a clean-cut ashen gray species with smooth vestiture and well-defined maculation, the primaries rather narrow and short. *Intentata*, on the contrary, is a powdery fuscous gray, the maculation all diffuse, hoary, the vestiture rough. It is also decidedly larger and the primaries are broader, more trigonate, the apices much better marked. A closer relative superficially is found in *M. leucogramma*, which has similar harpes, but altogether different claspers (Proc. U. S. Nat. Mus., XIV, Pl. VIII, Fig. 7).

Mamestra ingravis has no close allies in superficial appearance, and this is indicated also in the genital characters. Pl. I, Fig. 5, illustrates a very distinctive structure which has no close parallel to any other species figured by me.

Mamestra cervina resembles a small *lustralis* and the genitalia bear out the relationship so indicated. *Cervina* is here figured on Pl. I, Fig. 13 and *lustralis* was pictured in the Proc. U. S. Nat. Mus., XIV, Pl. VIII, Fig. 11. The resemblance in type is obvious; but the difference in detail is equally great. Perhaps the greatest exists in the presence of the small accessory clasper in *cervina*, no appearance of which was seen in *lustralis*.

Mamestra neoterica looks like a small *detracta* with some minor differences in type of maculation. When the genitalia of the males are compared, these differences are enormously increased, though there is no change in type. The shape of the harpes differs, not only

in general but in the termination, which is long drawn out in *detracta* and rather short and abruptly terminated in *neoterica*. In the latter the clasper is a simple, curved, corneous hook, while in the former it is a peculiar spatulate process with a slender, acute tip. *Detracta* is figured in Proc. U. S. Nat. Mus., XIV, Pl. IX, Fig. 12, and the corresponding parts of *neoterica* are shown Pl. I, Fig. 14.

Mamestra lunolacta, sp. nov.

Ground color of head, thorax and primaries smoky fuscous, black powdered, and with an admixture of whitish or greenish scales that may, at times, give the insect a mossy appearance. Head with an admixture of gray scales. Collar with a feebly marked light median line and a blackish line below the gray tip. Thoracic vestiture defective in my specimens. Primaries with all the markings present, not contrasting except that the reniform is prominently white-ringed, and there is a large, lunate creamy white patch in the s. t. space just above vein 1. Basal line geminate, black, included space marked by creamy or mossy scales. T. a. line geminate, complete, blackish, included space a little mossy, as a whole obliquely outcurved. T. p. line geminate, inner line blackish, best marked in the submedian interspace, outer line smoky, lost over the cell: as a whole, the line is rather evenly curved over the reniform and then runs evenly oblique to the inner margin. S. t. line white or whitish, a little irregular, continuous, edged here and there by blackish scales or spots. Fringes long, a series of whitish lunules at their base, a line of brownish intermediate lunules, tips yellowish. Claviform small, incompletely outlined by black scales, with mossy yellowish scales that extend inward toward base. Orbicular small, narrow, oblique, outlined by black scales within which is a narrow paler line, else concolorous. Reniform narrow, upright, oblong or feebly lunate, outlined by black scales within which is a rather prominent white ring. Center concolorous. Secondaries smoky, a little paler at base, fringes whitish with a broad smoky interline. Beneath, primaries blackish smoky, with pale costal dots and pale lunules at the base of the fringes: secondaries gray, powdery, with a smoky outer line, marginal shade and small discal spot. Expands 1.08 inches = 27 mm.

Habitat: Idaho; Pullman, Washington, C. V. Piper.

Two females, both somewhat rubbed and with defective thoracic vestiture. This is a somewhat obscure, powdery form that gives the impression as though it might vary to mossy green at times. It is not unlike *alboguttata* in type of maculation, without the contrasts that inspired Mr. Grote's name, while it is characteristic in the large lunate pale patch in the s. t. space, extending to the hind margin only by an enlargement of the s. t. line. The s. t. space is a little paler, more grayish powdered than the rest of the wing; but not contrasting. The species should be readily recognized as a member of the smaller, stumpy-winged groups — *olivacea* or *laudabilis*; but its nearest allies cannot be determined until the male is at hand.

GENERAL NOTES ON SCOTOGRAMMA.

In my revision of some Tæniocampid genera (Proc. U. S. Nat. Mus., 1889, XII, pp. 445-496) I recognized six species as belonging to this genus. The group to which the generic term is applied is not a very satisfactory one, including as it does forms in which the vestiture is thin, hairy and divergent, and others in which it is scaly and close. Yet the species have a habitual resemblance, and the line between the two kinds of vestiture is not sharply defined. All of them are obscurely marked and while in some respects the relationship seems close, the resemblances are usually more apparent than real. Since 1889 eight species have been described by myself and one, described in this paper, brings the total number up to fifteen. In 1889 the male of *submarina* only was known and that was figured on Pl. XXII, Fig. 17, of the paper cited. The males of seven additional species are now at hand and figures of the genitalic characters are presented on Pl. I, Figs. 15 to 21. It will be noted that there are two rather obvious types, one of which is composed of *densa* and *megæra* only. Comparisons are best made from the figures, and while the forms are very similar, the differences are sufficient to hold the species. The superficial differences are even greater and, in the series before me, comprising both sexes of both species, there is not a trace of any intergradation. *Megæra* is uniformly larger, with proportionately more ample wings and the color is altogether different. That they can be varieties of one species does not seem credible to me. Very much the same type of genitalic structure is found in *Mamestra variolata* as figured on Pl. IX, Fig. 35, Proc. U. S. Nat. Mus., XIV, 1891, though there is no resemblance between the insects themselves. In *submarina*, on the other hand, which is superficially a close ally to *densa* and *megæra*, the genitalic characters are totally different: indeed they are unlike those of any other species of the genus. The other five species here referred to agree in a general way, the harpes being oblong, a little bent toward tip, the rounded lappet set with a series of spinules. The corneous claspers are double, and in this character they are Tæniocampid rather than Mamestrid. *S. luteola* and *uniformis* are most nearly allied, but in the former the harpes are not only relatively but absolutely smaller and broader, while the claspers differ in proportion to each other and to the same structures in the other species. *Phoca*, *discolor* and *infuscata* differ sufficiently to make a reference to the genitalic characters unnecessary, though in each form

these are distinctive. I have other, yet undescribed species of this genus, but prefer to hold them for better, more abundant material.

Scotogramma albinuda, sp. nov.

Ground color dark ashen gray, tending to smoky. Head and thorax concolorous, vestiture thin, loose, hairy, divergent. Primaries with the ordinary lines single, smoky, diffuse, not contrasting. Basal line very close to the root of the wing, inwardly bent on the subcostal. T. a. line upright as a whole, irregular, strongly outcurved in the submedian interspace. T. p. line lunulate, almost crenulate, broadly outcurved over the cell, rather deeply incurved in the submedian interspace. S. t. line is indicated by a dark preceding shade which is obvious on the costa, but gradually lost toward the hind margin: a few paler scales may or may not emphasize this line. A series of terminal dark lunules resembling a broken terminal line. Fringes with a pale interline, very narrowly cut with white on the veins. A smoky median shade is obvious on the costa, extending over and darkening the reniform, and it may or may not be faintly traceable to the inner margin. Orbicular concolorous, barely traceable, round, moderate in size. Reniform rather small, dark, broadly lunate rather than kidney-shaped. Secondaries deep smoky brown, with an obvious dark median shade, followed by a vague yellowish band, and a large blackish discal spot; fringes pale. Beneath whitish or smoky, powdery, with a common extra-median shade band and a large discal spot; primaries with an obvious s. t. shade band. Expands 1.28-1.32 inches = 32-33 mm.

Habitat: Rama, Labrador, 1900, A. Stecker, J. D. Sornborger.

Three females in fair condition from the Museum of Comparative Zoölogy, through the courtesy of Mr. Henshaw. The species is allied to *uniformis* Sm., but is somewhat better marked throughout, the color being also more ashen gray. The dusky shade band across the secondaries, followed by a diffuse pale shade is characteristic and readily identifies the species.

Nephelodes tertialis, sp. nov.

Ground color rusty red-brown varying to purplish or toward a somewhat luteous shading. Head and thorax concolorous, the former usually a little lighter than the thorax. Antennæ of ♂ well pectinated; of ♀ entirely simple. Primaries with fairly distinct maculation, the median space darker than the rest of the wing and thus defining the median lines which are not otherwise contrasting. Basal line wanting or marked only by costal dots. T. a. line geminate, the inner line vague, included space a little paler; as a whole a little outwardly oblique and a very little outcurved in the interspaces. T. p. line geminate, the outer line even, very little relieved, inner line forming the sharp border of the dark median space, included space a little paler. S. t. line very narrow, irregular, a little paler than ground, sometimes emphasized by a somewhat darker preceding shade, sometimes almost obsolete. A narrow darker line at the base of the fringes. Orbicular large, round, of the pale ground, without defining line. Reniform large, somewhat kidney-shaped, of the pale ground, the outer portion sometimes relieved by a few yellowish scales. Claviform very small and only feebly defined. Secondaries smoky, yellowish at base, variable in tint, the

fringes whitish with a rosy tinge. Beneath smoky with a rosy flush, powdery, disc of primaries darker, with a more or less complete outer line and on secondaries a small dusky lunule which may be altogether wanting. Expands 1.32-1.48 inches = 33-37 mm.

Habitat: Winnipeg, Manitoba, August 16-24, A. W. Hanham.

Eight examples, most of them in at least fair condition and only one of them a female. The species resembles the eastern form in general appearance and type of maculation; but is decidedly smaller throughout. The fringes are more even, with hardly a trace of scalloping, and there is no obvious median shade on the primaries. Add to this a distinct difference in the genitalia of the male and the specific separation proves inevitable. I have heretofore considered this as a small form of the eastern species and have so named it for the north-western collectors who have sent me material.

Anarta laerta, sp. nov.

Head and thorax black, clothed with smoky brown divergent hair and scales forming, in good examples, a distinct collar and obvious patagia. Collar and patagia paler tipped. Abdomen black. Primaries smoky brown, a little powdery, somewhat paler in the discal cell. Median lines single, black, obvious but not prominent. Basal line dentate on the veins, accompanied by a narrow, preceding paler shade. T. a. line rather evenly outcurved and scarcely oblique. T. p. line denticulate on the veins, hardly lunate, outwardly bent over the cell and not much incurved below the reniform. S. t. line pale, continuous or broken, preceded by obscure spots and shadings, the terminal space darkening to a blackish broken terminal line. Fringes paler tipped. A dark median shade crosses the reniform and then runs parallel with and close to the t. p. line. Claviform moderate or small, outlined in blackish and sometimes black filled. Orbicular round, variable in size, sometimes black-ringed only, and sometimes a rather undefined round spot. Reniform large, blackish-brown, varying from a rounded oblong to kidney-shaped, sometimes centrally constricted from both sides. Secondaries black along the inner and outer margins, the band broad, inwardly diffuse from the inner margin, sharply limited from the outer margin to a dirty white disc, which extends along the costal margin to base and is interrupted by a large, black, lunate spot which leaves only a little of the white visible. Beneath, the disc of both wings is whitish with a large, black, somewhat lunate spot. Toward base the wings become blackish. The secondaries have a broad black outer border through which there may or may not be a whitish shade line: the fringes whitish as on the upper side. Primaries with a smaller black spot corresponding to the orbicular and a black band corresponding in course to the t. p. line: beyond this the wing is more smoky to the blackish fringes which are based by a broken black line. Expands .88-1.08 inches = 22-27 mm.

Habitat: Silver Lake, Utah, July 13, Dr. Henry Skinner; Mt. Rainier, Washington Exper. Sta. No. 633, Professor C. V. Piper.

Three male and two female examples in good condition. Two of

these came from Mr. S. T. Kemp and are marked Utah, July 15; but I believe they are from the same lot as those which I owe to Dr. Skinner. The species seems to have been taken in some numbers and examples are in several collections. The general resemblance is to *melanopa*, but the new form is much darker and the secondaries have the pale area almost completely obscured. In the material before me the female is more obscurely marked than the male.

***Cosmia venosa*, sp. nov.**

Ground color a rusty luteous, varying toward the reddish. Head and thorax concolorous. Primaries powdery, all the veins more or less obviously blackish, the result being a peculiarly sordid appearance. The upper half of the median space is the darkest part of the wing and from this the otherwise undefined ordinary spots stand out as paler than any other part of the wing. Basal line geminate on the costa, but usually not traceable beyond it. T. a. line single, brown or smoky, more or less outcurved in the interspaces, as a whole a little oblique outwardly. T. p. line single, brown, more or less crenulated, rather widely bent over the cell, and either evenly oblique or a little incurved below that point. S. t. line vague, irregular, concolorous, marked only by a broken and very irregular preceding dusky shade. A narrow brown line at the base of the fringes. Median shade broad, diffuse, smoky, variably distinct, outwardly oblique from costa to lower margin of reniform, thence rather evenly oblique to the inner margin. Orbicular large, varying from round to oblong or oval, not sharply defined. Reniform large, kidney-shaped, not well defined. No obvious claviform. Secondaries pale, smoky yellowish. Beneath somewhat paler, only a little powdery, both wings with a smoky outer line and a small, hardly contrasting discal lunule. Expands 1.48-1.68 inches = 37-42 mm.

Habitat: Corvallis, Oregon, June 4-29, at light, A. B. Cordley; Olympic Mts., Washington, C. V. Piper; Victoria, British Columbia, July 7, through Dr. Fletcher.

Two male and four female examples are before us. The species differs obviously in appearance from the two forms previously described, in the crenulate t. p. line and the generally sordid, roughened appearance. The vestiture is also looser and more divergent; but this may be due in part to the fact that none of the specimens are perfect and all seem to have been caught at light.

***Scopelosoma colorado*, sp. nov.**

Ground color varies from reddish clay to pale rusty reddish. Head and thorax immaculate, concolorous with primaries. Primaries very slightly powdery, the ordinary maculation feebly defined. Basal line may or may not be visible; if it is, there is a narrow pale line with a scarcely darker defining edge. T. a. line faint, yet obvious, whitish, with a narrow smoky edging, a little irregular, but as a whole only a little oblique, nearly rigid. T. p. line geminate, with concolorous center, outer defining line even, hardly darker or altogether wanting; inner defining line crenulate,

slender, blackish in pale specimens, hardly darker than ground in deeply colored examples; as a whole it is a little and very evenly outcurved. S. t. line irregular, either a slightly paler line on an even ground, a mere contrast caused by a dusky terminal shading or by a preceding cloud. A darker terminal line at base of fringes. There is an obscure median shade, hardly traceable from costa obliquely to the inferior portion of reniform, there a little angled and then, more obvious to the inner margin. Claviform and orbicular wanting. Reniform rather narrowly kidney-shaped, somewhat rusty red outwardly, a little darkened inferiorly and with or without white dots at the extremities. Secondaries smoky, a little paler at base, fringes luteous to reddish. Beneath reddish, powdery, all wings with an extra-median line, primaries with the disk smoky, secondaries with a small discal spot. Expands 1.40-1.60 inches = 35-40 mm.

Habitat: Glenwood Springs, Colorado, April and October.

Three examples, all males, from Dr. Barnes, who has others. The specimens were captured in 1893, 1894 and 1895, and I have kept them associated with *walkeri* and *sidus* as a color variation. To determine which species I really had the genitalia were examined and proved it distinct from either of those described and figured by me. The maculation is as in the two species mentioned, but more obscure than in either, and the ground color is intermediate. It is also more even in appearance and the median shade is not nearly so well marked as in *walkeri*. The genitalic structure is most like that in *walkeri*, but lacks the accessory basal clasper and the tip of the harpe is entirely different in shape, unlike any other in the genus.

EXPLANATION OF PLATE I.

- ✓ Fig. 1. *Mamestra purpurissata*, ♂, harpe and clasper.
- ✓ Fig. 2. " *juncimacula*, ♂, harpe and clasper.
- ✓ Fig. 3. " *nugatis*, ♂, harpe and clasper.
- ✓ Fig. 4. " *mystica*, ♂, harpe and clasper.
- ✓ Fig. 5. " *ingravis*, ♂, harpe and clasper.
- ✓ Fig. 6. " *gussata*, ♂, harpe and clasper.
- ✓ Fig. 7. " *plicata*, ♂, harpe and clasper.
- ✓ Fig. 8. " *segregata*, ♂, harpe and clasper.
- ✓ Fig. 9. " *utrina*, ♂, harpe and clasper.
- ✓ Fig. 10. " *intentata*, ♂, harpe and clasper.
- ✓ Fig. 11. " *mutilata*, ♂, harpe and clasper.
- ✓ Fig. 12. " *navia*, ♂, harpe and clasper.
- ✓ Fig. 13. " *cervina*, ♂, harpe and clasper.
- ✓ Fig. 14. " *neoterica*, ♂, harpe and clasper.
- ✓ Fig. 15. *Scotogramma densa*, ♂, harpe and clasper.
- ✓ Fig. 16. " *megera*, ♂, harpe and clasper.
- ✓ Fig. 17. " *luteola*, ♂, harpe and clasper.
- ✓ Fig. 18. " *uniformis*, ♂, harpe and clasper.

- Fig. 19. *Scotogramma infuscata*, ♂, harpe and clasper.
 — Fig. 20. “ *discolor*, ♂, harpe and clasper.
 — Fig. 21. “ *phoca*, ♂, harpe and clasper.

ILLUSTRATIONS OF THE LARVÆ OF NORTH AMERICAN CULICIDÆ. — III.

BY HARRISON G. DYAR, PH.D.

The species figured herewith are largely the result of Professor John B. Smith's investigations on mosquitoes in New Jersey, of which he has given a preliminary account (Ent. News, XIII, 299-303, 1902). Professor Smith has handed me certain species obtained by his correspondents which I had not seen, and he requested two of them, Mr. H. Brehme and Mr. J. Turner Brakeley, to send living material. Mr. Brakeley especially responded most cordially and not only sent interesting material, but in collecting it, found a species new to New Jersey and previously unknown to Professor Smith, namely *Culex melanurus*. The jar sent by Mr. Brehme from the salt marshes of the Elizabeth River contained a mixture of *Culex sollicitans*, *C. tæniorhynchus*, *C. sylvestris* and *C. nigrutilus*. The latter larva was a surprise, coming close to *territans* which has hitherto stood alone.

Culex tæniorhynchus *Wiedemann.*

Larvæ bred by Professor Smith with *sollicitans* “from eggs in the same piece of sod” (Ent. News, XIII, 300), sent by Mr. Brehme as noted above and given me by Mr. Kotinsky from a culture at the Insectary of the Department of Agriculture which had been obtained at St. Georges Island, Md., by Mr. B. Eftyhithes. The larva differs from *sollicitans* by the shorter tube and differently shaped teeth of the lateral comb (Pl. II, Fig. 1, *B*), and comes nearest to *Stegomyia fasciata*, from which it differs in the comb (Pl. II, Fig. 2, comb of *fasciata*).

Larva.—(Pl. II, Fig. 1.) Head rounded pentagonal, flattened, normal, brown; antennæ moderate, uniform, slender, infuscated outwardly, paler at base, the tuft reduced to one hair, short, before the middle; mouth brush normal, well developed; dentate labial triangle low and broad, regularly and evenly toothed. Body normal, hairs moderate, diminishing posteriorly; air tube very short, not much

longer than broad, tapered on its outer half, with double row of pecten, the teeth two-spined, followed by a small tuft; dark brown. Lateral comb of eighth segment small, the spines irregularly shaped and digitately spined (Pl. II, Fig. 1, *B*) in an irregular double row. Anal segment short, ringed by the plate, tuft and brush normal, the brush without hairs before the barred area from which it arises. Anal processes four, moderate.

Culex nigrutilus Zetterstedt.

Received only from the salt marshes as noted above.

Larva.—(Pl. II, Fig. 3.) Head rather large, broad through the eyes, narrow before, pale, brown-blotched on the vertex; eyes black, transverse; antennæ large, long, the outer third narrower, the tuft at the point of narrowing; black at base and tip, broadly white banded centrally. Body normal, hairs moderate, diminishing posteriorly. Air tube long and slender, as long or longer than in *territans*, but straight, regularly tapered, not concave; brown, the tip darker; double row of pecten of 3-spined teeth and scattered hairs beyond. Comb of eighth segment a patch of about 40 small spines in three rows. Anal segment about as long as wide, ringed by the plate, tuft and brush normal, the latter confined to the barred area. Anal processes four, moderate.

There seems a possibility of question whether this is the true *nigrutilus* of Europe. Theobald's statement that he had taken the adults about old water butts scarcely suggests the habits of our salt marsh species.

Culex consobrinus Desvoidy.

Messrs. J. W. Dupree and H. A. Morgan have very kindly communicated to me specimens of this species, identified by them in Baton Rouge, La. The mature larva sent seems inseparable from that which I at first supposed to be *C. incidens* Thomson (Proc. Ent. Soc. Wash., V, 160, 1903). The antennal tuft is at the middle, the air tube about three times as long as wide, slightly inflated and with the peculiar prolongation of the pecten teeth into setæ, while the other characters agree. Several young larvæ also were sent in the bottle. They differ greatly. The antennal tuft is well at the outer third of the long, completely infuscated joint; the tube is nearly four times as long as wide, tapered outwardly and with a small row of spinous teeth at base followed by several hair tufts; the anal segment has a dorsal plate, the

ventral brush without tufts before the barred area; the comb is as in the mature larva, of many small teeth, finely divided at tip. A first-stage larva was also sent. It has the antennal tuft at the middle of the joint, eyes round, head slightly smoky blackish; air tube infuscated outwardly, ventral brush absent, comb a row of large, thorn-shaped, undivided spines. Disregarding the very generalized condition of the first stage, this larva presents a remarkable change at the last stage. It would almost suggest a mixture of species, though I have no reason to doubt the accuracy of Messrs. Dupree and Morgan's excellent work. The eggs are said to be laid in boat-shaped masses (*Science*, n. s., XVI, 1036, 1902), and this at once suggests the *picipens* type of larva with long tube and antennal tuft at outer third of joint. The young larvæ before me bear out this expectation, but the mature larva is strangely transformed. It must be a reversion to a primitive condition, somewhat like the first stage form of these larvæ of the *picipens* group. The peculiar modification of the air tube pecten is even more surprising.

Larva.—(Pl. II, Fig. 4.) Head rounded, narrowed somewhat before, brown, darker on the vertex; eyes black, transverse; antennæ rather long, slender, uniform, with a small tuft at the middle, not before the middle; pale brown. Body normal, thorax enlarged, flattened, abdomen submoniliform, the hairs moderate, diminishing posteriorly. Lateral comb of eighth segment a diffuse patch of about 50 small spines with digitately divided tips in four irregular rows (Pl. II, Fig. 4, *B*). Air tube about three times as long as wide, tapering outwardly, the usual pecten teeth modified into a row of rather long hairs, the outer ones longest. Anal segment about as long as wide, ringed by the plate, brown infuscated like the tube, tuft and brush normal, the latter continued before the barred area by little tufts to the base of the segment. Anal processes normal.

***Culex triseriatus* Say.**

Eggs obtained at Center Harbor, N. H., from captive females; alcoholic larvæ handed me by Professor Smith from Mr. J. Turner Brakeley's cultures at Lahaway, N. J. The eggs are laid at the edge of the water, just below the surface, in rows, patches or singly, adherent to the edge. The winter is passed in this state (*Science*, n. s., XVI, 672, 1902).

Eggs.—Elliptical, nearly cylindrical, uniform, no visible flattening; both ends rounded, the micropylar one more abruptly and with a

small, clear, annular cushion at the tip, the other end more obliquely narrowed, but rounded at tip. Sculpturing in the form of a heavy, rounded reticulation, at the margin showing clear projecting granules especially at the ends; centrally the clear covering layer is smoother. Also more or less smeared with mucilage. Length, .8 mm., diameter, .2 mm.

Larva.—(Pl. III, Fig. 1.) Head well rounded, flattened, normal, brown, darker on vertex, eyes black, transverse; antennæ long, but very slender, uniform, a single-haired tuft at the middle, brown. Body normal, hairs moderate, diminishing posteriorly. Air tube short, about three times as long as broad, tapering outwardly, brown, its pecten teeth considerably elongate, but with spines basally, not produced into hairs (Pl. III, Fig. 1, *A*). Lateral comb of the eighth segment a small patch of about twelve spines, stout and much elongated, with finely digitately divided tips, in an irregular double row. Anal segment about as long as wide, dorsally plated, the plate reaching below the middle of the sides; tuft and brush normal, the latter continued slightly before the barred area. Anal processes four, moderate.

***Culex signifer* Coquillett.**

This abnormal larva was given me by Professor Smith. The peculiar dorsal platings at the end of the body occur also in *Corethra brakeleyi*, but not in any other Culicid that I have yet seen. The antennæ are usually short and the head is elongate suggesting *Urano-tonia* and *Anopheles*. It is surprising to find these characters in a *Culex*.

Larva.—(Pl. III, Fig. 2.) Head rounded, elliptical, slightly flattened, black; antennæ very short, not exceeding the mouth brush, with a small tuft before the middle; eyes black, transverse. Body of normal shape, thorax enlarged into a thick disk, abdomen submoniliform: hairs moderate, those of the first two abdominal segments more strongly tufted than the succeeding ones. Seventh abdominal segment with a round dorsal plate, incised anteriorly; an angulated, transverse plate on the eighth segment anteriorly, reaching below the middle of the sides, with the comb at its posterior border but not united with it. Comb of long spines in a transverse row and a shorter second row (Pl. III, Fig. 2, *B*), finely divided on the side next the body. Air tube about three times as long as wide, slender and rather small, without pecten, but a hair tuft beyond the middle. A small, linear, transverse, lateral plate on the last segment anteriorly. Segment tri-

gonate, ringed by its plate, tuft and brush normal, the latter confined to the barred area. No anal processes visible in any of the specimens before me.

Culex bimaculatus *Coquillett*.

Larva.—(Pl. III, Fig. 3.) Head nearly straight behind, widest just behind the eyes, narrowed before, flattened; antennæ slender, rather small, uniform, colorless, with small tuft a little before the middle of the joint. Eyes large, black, transverse; mouth brush rather short, normal; head pale brown, darker on posterior edge, the neck black. Thorax roundedly enlarged, abdomen submoniliform, moderate, normal. Meso- and metathoracic hair tufts short, copious, brush-like, the upper mesothoracic tubercle bearing a long hair. Abdominal hairs rather slight, becoming single and diminishing posteriorly. Air tube two and a half times as long as wide, slightly tapered, conic; a double row of stout, pointed teeth, two- or three-branched at base, the outer tooth distant; a fan-shaped hair tuft within the row at about its middle. Lateral comb a patch of about thirty small spines with digitately divided tips, three rows deep. Anal segment ringed by the plate, brush and tuft of rather short hairs, but unusually thick, the separate pencils being thickened at base and apparently the hairs of the pencil basally consolidated; no tufts before the barred area. Anal finger-shaped processes very long, narrowly pointed, four, normal.

Sent me by Messrs. Dupree and Morgan from Baton Rouge, La.

EXPLANATION OF PLATES.

PLATE II.

Fig. 1. *Culex teniorhynchus* WIED. *A*, Pecten tooth of air tube, enlarged. *B*, Comb teeth of eighth abdominal segment, enlarged.

Fig. 2. *Stegomyia fasciata* FAB. Comb teeth of eighth abdominal segment, for comparison with Fig. 1, *B*.

Fig. 3. *Culex nigritulus* ZETT. *A* and *B*, as in Fig. 1.

Fig. 4. *Culex consobrinus* DESV. *A* and *B*, as in Fig. 1.

PLATE III.

Fig. 1. *Culex triseriatus* SAY. *A*, Pecten tooth of air tube. *B*, Comb of eighth abdominal segment.

Fig. 2. *Culex signifer* COQ. *B*, Comb of eighth abdominal segment.

Fig. 3. *Culex bimaculatus* COQ. *A* and *B*, as in Fig. 1.

CLASSIFICATION OF THE POINTED-TAILED
WASPS, OR THE SUPERFAMILY PROC-
TOTRYPOIDEA.—II.

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Family LIV. DIAPRIIDÆ.

This family comes very close to the *Belytidae*, the two having been treated as a single family by A. H. Haliday in 1839, but is readily separated by the absence of a basal cell in the hind wings and by the two-jointed labial palpi.

The genus *Loboscelidia* Westwood, described from Sulu Island, was placed in this group, but I think incorrectly; it is apparently a Cynipoid and not a Proctotrypoid.

In habits the Diapriids agree with the Belytids, being parasites upon Dipterous larvæ.

The family may be divided into two subfamilies, as follows :

TABLE OF SUBFAMILIES.

Submarginal vein reaching the costa at about half the length of the wing or a little before; if it does not reach the costa it attains nearly half the length of the wing and ends in a stigma; costal cell most frequently closed.

Subfamily I. SPILOMICRINÆ.

Submarginal vein shorter, never reaching the costa beyond one third the length of the wing; costal cell most frequently open.....Subfamily II. DIAPRIINÆ.

Subfamily I. SPILOMICRINÆ.

The species falling in this group are as a rule considerably larger than those in the *Diapriinæ*, and are easily recognized by the much longer submarginal vein, which reaches the costa at about half the length of the wing, and the usually closed costal cell. In two genera, however, *Anewhynchus* and *Labolips*, the submarginal vein does not reach the costa but ends in a stigma.

Table of Genera.

Females.....	1
Males.....	13
1. Antennæ less than 14-jointed	2
Antennæ 14-jointed; mesonotum with two furrows.	
Polypeza Förster (type unknown).	
2. Antennæ 13-jointed	3
Antennæ 12-jointed	8
3. Mesonotum without furrows or at most only slightly indicated posteriorly.....	7
Mesonotum with two distinct furrows.	
Metathorax unarmed	4

- Metathorax at base armed with a curved spine or thorn ; front wings with the basal nervure present **Hoploproia** *Ashmead**
 (type *H. pulchripennis* ASHM.).
4. Front wings with a distinct basal nervure 5
 Front wings without a distinct basal nervure..... 6
5. Abdomen conically pointed, the second segment without sulci at base, overlapping the apex of the petiole ; marginal vein distinct.
Spilomicrus *Westwood* (type *S. stigmatalis* WESTW.).
 Abdomen rounded or truncate at apex, the second segment with sulci at base ; marginal vein very short.....**Hemilexis** *Förster* (partim).
6. Abdomen rounded or truncate at apex ; front wings with the costal cell open ; stigmal vein often with a backward directed branch.....**Hemilexis** *Förster*
 (type *Diapria platyptera* HAL.)
 Abdomen conically pointed ; costal cell closed ; stigmal vein simple.
Paramesius *Westwood* (type *P. rufipes* WESTW.).
7. Front wings without a basal nervure ; stigmal vein longer than the marginal.
Hemilexodes *Ashmead* (type *H. floridanus* ASHM.).
8. Submarginal vein attaining the costa..... 9
 Submarginal vein not attaining the costa, ending in a stigma or knob..... 12
9. Front wings with a basal nervure 10
 Front wings without a basal nervure..... 11
10. Mesonotum with two furrows ; antennæ ending in a 5-jointed club.
Idiotypa *Förster* (type *Psilus maritimus* HAL.).
 Mesonotum without furrows ; antennæ ending in a 3-jointed club ; face keeled at the sides.....**Tropidopsis** *Ashmead*
 (type *T. clavata* ASHM.).
11. Mesonotum with two furrows.
 Antennæ ending in a 5-jointed club.....**Synacra** *Förster*
 (type *Diapria brachialis* NEES).
 Antennæ ending in a 4-jointed club..**Glyptonota** *Förster* (type unknown).
12. Mesonotum with two furrows.
 Stigma with a stigmal vein ; abdomen with three sulca at base.
Aneurhynchus *Westw.* (type *A. galesiformis* WESTW.).
 Stigma without a stigmal vein ; abdomen with only one sulcus at base.
Labolips *Holiday* (type *L. innupta* HAL.).
13. Antennæ less than 15-jointed 14
 Antennæ 15-jointed.
 Mesonotum with two furrows.....**Polypeza** *Förster*
14. Antennæ 13-jointed 15
 Antennæ 14-jointed 19
15. Mesonotum without furrows.
 Mesonotum with two furrows.
 Metathorax not armed at base with a curved spine..... 16
 Metathorax armed at base with a curved spine or thorn ; flagellar joints very long, cylindrical **Hoploproia** *Ashmead*

* To this genus belong the species described by Mr. P. Cameron, in Biol. Centr.-Amer., I, 1888, under the genus *Paramesius* Westw.

16. Front wings with a basal nerve 17
 Front wings without a basal nerve..... 18
17. Mesonotum longer than wide; first flagellar joint as long or longer than the second; costal cell closed.
 Abdomen without sulci at base **Spilomicrus** *Westwood*
 Abdomen with sulci at base..... **Idiotypa** *Förster*
 Mesonotum not longer than wide; first flagellar joint hardly as long as the second: costal cell open.
 Stigmal vein much longer than the marginal..... **Hemilexis** *Förster*
18. First flagellar joint not half as long as the second..... **Paramesius** *Westwood*
19. Submarginal vein not reaching the costa, ending in a stigma or knob..... 21
 Submarginal vein reaching the costa.
 Mesonotum with two furrows..... 20
 Mesonotum without furrows.
 Flagellar joints elliptic-oval **Tropidopsis** *Ashmead*
20. Front wings without a basal nerve.
 Eyes hairy..... **Synacra** *Förster*
21. Stigma with a stigmal vein..... **Aneurhynchus** *Westwood*

Subfamily II. DIAPRIINÆ.

This group is distinguished by the brevity of the submarginal vein which reaches the costa at about one third the length of the wing; to it belong also some wingless forms.

Table of Genera.

- Females..... 1
 Males..... 20
1. Antennæ less than 14-jointed..... 3
 Antennæ 14-jointed.
 Pronotum normal..... 2
 Pronotum abnormal, produced anteriorly into a long horn that extends forward over the head..... **Notoxoides** *Ashm. g. nov.*
 (type *N. brasiliensis* ASHM.).
2. Mesonotum without furrows; front wings without a basal nerve.
Myrmecopria *Ashmead* (type *Loxotropa mellea* ASHM.).
3. Antennæ 13-jointed..... 4
 Antennæ 12-jointed or less..... 5
4. Mesonotum without furrows or only slightly indicated posteriorly.
 Scutellum foveated at base; club of antennæ 1-jointed; basal nerve present.
Basalys *Westwood* (type *B. fumipennis* WESTW.).
 Scutellum not foveated at base; club of antennæ consisting of one enlarged joint. **Monelata** *Förster* (type *Diapria parvula* NEES)
5. Antennæ 12-jointed 6
 Antennæ 11-jointed 19
6. Face normal or not greatly lengthened.... 7
 Face abnormal, greatly lengthened; mandibles rostriform.
 Mesonotum with two furrows..... **Galesus** *Curtis*
 (type *Psilus cornutus* PANZER).

- 7. Apterous forms 8
 - Winged 12
- 8. Head large and flat, more or less quadrate; ocelli wanting..... 9
 - Head sometimes large, but quite differently shaped; ocelli sometimes present.. 11
- 9. Legs normal, not short and stout; scape of antennæ not dilated..... 10
 - Legs short and stout; scape of antennæ dilated, flat ...**Platymischus** *Westwood*
(type *P. dilatatus* WESTW.).
- 10. Head oblong, full behind the eyes, scutellum indistinctly separated; antennæ long, the flagellum subclavate, the first three or four joints not short.
 - Platymischoides** *Ashmead* (type *P. molokaiensis* ASHM.).
- 11. Thorax elongate and much narrowed, compressed; head of an abnormal shape, and compressed, seen from above it is longer than wide but hardly wider than the thorax, seen from the side it is much shorter than high, the small eyes being placed low down near the anterior margin**Zacranium** *Ashmead*
(type *Z. oluensis* ASHM.).
- 12. Front wings without a basal nervure..... 13
 - Front wings with a basal nervure
 - Mesonotum without furrows; club of antennæ 3- or 4-jointed.
 - Loxotropa** *Förster* (type *L. acoluta* FÖRST.).
- 13. Mesonotum without furrows.
 - Scutellum normal, not ending in a spine 14
 - Scutellum ending in a distinct spine.....**Acanthopria** *Ashmead*
(type *A. crassicornis* ASHM.).
- 14. Head transverse or subglobose..... 15
 - Head large, viewed from above pentagonal, the ocelli present; mesonotum without furrows; antennæ ending in a 5-jointed club, the funicle joints slender, subcylindrical, at least twice longer than thick.....**Tetramopria** *Wasmann*
(type *T. aurocincta* WASM.).
- 15. Scutellum not foveate at base..... 18
 - Scutellum foveate at base.
 - Tip of scutellum rounded or truncate, not compressed from the sides, ecarinate..... 16
 - Tip of scutellum compressed from the sides the sides, the disk or apex with a median carina; abdomen usually conically pointed.
 - Tropidopria** *Ashmead* (type *Diapria conica* FABR.).
- 16. Last joint of antennæ quite differently formed..... 17
 - Last joint of antennæ enormously enlarged, oblong-oval.
 - Megaplastopria** *Ashm. g. nov.* (type *M. brasiliensis* ASHM.).
- 17. Abdominal petiole much longer than thick; metathorax always with a distinct ridge or conic prominence at base.
 - Diapria** *Latreille* (type *Diapria verticillata* LATR.).
 - Abdominal petiole not longer than thick, densely woolly; metathorax most frequently without a conic prominence at base, usually areolated.
 - Antennal club 3-jointed..**Ceratopria** *Ashmead* (type *C. longicornis* ASHM.).
 - Antennal club 4- or 5-jointed**Trichopria** *Ashmead*
(type *T. pentaplasta* ASHM.).

18. Axillæ not separated.
 Front wings at apex entire.....**Phænopria** *Ashmead*
 (type *P. minutissima* ASHM.).
 Front wings at apex subemarginate.....**Adeliopria** *Ashmead*
 (type *A. longii* ASHM.).
19. Head globose; mesonotum without furrows; abdomen with the second segment occupying most of the entire surface; flagellum subclavate, the joints 2-7 transverse, the eighth quadrate, the club large, cone-shaped, unjointed.
Solenopsia *Wasmann* (type *S. imitatrix* WASM.).
20. Antennæ 14-jointed..... 21
 Antennæ 13-jointed or less..... 33
21. Scape not especially developed..... 22
 Scape abnormally developed, broad and flat.
 Apterous; mesonotum without furrows.....**Platymischus** *Westw.*
22. Face not lengthened; mandibles not rostriform..... 23
 Face lengthened; mandibles rostriform.
 Mesonotum with two furrows; antennæ filiform, the third joint small, rounded, the following long, cylindrical.....**Galesus** *Curtis*
23. Apterous forms..... 32
 Winged forms.
 Front wings with a basal nervure..... 24
 Front wings without a basal nervure..... 27
24. First joint of the flagellum not shorter than the second..... 25
 First joint of the flagellum much shorter than the second.....**Basalys** *Westwood*
25. Mesonotum without furrows.... **Loxotropa** *Förster*
26. Scutellum unarmed..... 27
 Scutellum ending in a distinct spine.....**Acanthopria** *Ashmead*
27. Scutellum not foveated at base..... 31
 Scutellum foveated at base.
 Scutellum at apex not compressed from the sides, rounded or truncate, without a carina..... 28
 Scutellum at apex compressed from the sides, the disk or apex with a median carina.....**Tropidopria** *Ashmead*
28. Stigma more or less developed; head not pentagonal..... 29
 Stigma not at all developed, head pentagonal; first joint of flagellum elongate, nearly twice longer than the pedicel, the second shorter than the first, curved and thickened at apex, the third small, quadrate, 5-12 globose.
Tetramopria *Wasmann*
29. Antennæ filiform or moniliform, the joints of flagellum not nodose-verticillate... 30
 Antennæ with the joints of the flagellum pedunculated, nodose-verticillate.
Diapria *Latreille*
30. Second flagellar joint longer and thicker than the first, usually curved or angulated towards one side, the joints beyond rounded, with long bristles.
Ceratopria *Ashmead*
 Second flagellar joint shorter than the first, the first four or five joints twice longer than thick, the joints beyond long-oval or moniliform, with short hairs, or the joints, after the second, moniliform, pilose.....**Trichopria** *Ashmead*

- 31. Second flagellar joint about as long as the first, the joints beyond long-oval or moniliform.....**Phænopria** *Ashmead*
- 32. Mesonotum without furrows.....**Loxotropa** *Förster*
- 33. Scutellum not foveated at base 34
 Scutellum foveated at base.
 Mesonotum with two furrows or at least well defined posteriorly.
 First joint of flagellum as long as the second and third united.
Basalys *Westw.*
- 34. Mesonotum without furrows.
 First joint of flagellum not half as long as the second.....**Monelata** *Förster*

Family LV. CERAPHRONIDÆ.

Mr. A. H. Haliday, as early as 1839, was the first to correctly indicate this family as distinct from other Proctotrypids. It is a most interesting family, quite distinct in many particulars and exhibits very little affinity with any of the other families defined here.

The family is an extensive one, widely distributed over the entire world and is well represented by both genera and species, but still imperfectly known or studied.

The species attack plant-lice, *Aphididæ*, and Dipterous larvæ, belonging principally to the family *Cecidomyiidæ*. A few, however, have been recorded from Lepidoptera and Coleoptera, but I think incorrectly.

TABLE OF SUBFAMILIES.

- Marginal vein stigmated; antennæ 11-jointed, the same number of joints in both sexesSubfamily I. MEGASPILINÆ.
- Marginal vein linear, never stigmated; antennæ with a less number of joints in the females than in the males; males with 10- or 11-jointed antennæ, females 9- or 10-jointed.....Subfamily II. CERAPHRONINÆ.

Subfamily I. MEGASPILINÆ.

This subfamily is easily distinguished by the large, stigmated marginal vein, which thus resembles the stigma of the more specialized families in the Apoidea, Sphecoidea, etc. The wingless forms, which are rare, are only separated from those in the *Ceraphroninæ*, by the difference in the antennæ.

Table of Genera.

- Females I
- Males..... 9
- 1. Mesonotum with three impressed lines..... 2
 Mesonotum without impressed lines, or with only one or two lines..... 6
- 2. Metathorax not spined at base..... 3
 Metathorax with a forked spine at base..... **Habropelte** *Thomson*
(type *Ceraphron scutellaris* DALB.).

3. Apterous..... 5
 Winged.
 Wings pubescent with cilia..... 4
 Wings bare, without cilia, glabrous..... **Trichosteresis** Förster
 (type *Ceraphron glabra* BOHEM.).
4. Eyes usually bare; mesonotum not narrowed anteriorly..... **Lygocerus** Förster
 (type *Ceraphron ramicornis* BOHEM.).
 Eyes pubescent; mesonotum narrowed anteriorly..... **Megaspilus** Westwood
 (type *Ceraphron abdominalis* BOHEM.).
5. Thorax not much narrowed; maxillary palpi 5-jointed, labials 3-jointed.
 Megaspilus Westw.
 Thorax much narrowed; maxillary palpi 4-jointed, labials 2-jointed.
 Eumegaspilus Ashmead (type *E. erythrothorax* ASHM.).
6. Mesonotum without impressed lines 8
 Mesonotum with one or two impressed lines.
 Mesonotum with one impressed line down the center..... 7
 Mesonotum with two impressed lines..... **Dichognus** Thomson
 (type *D. dimidiatus* THOMS.).
7. Eyes small; ocelli wanting. Apterous..... **Lagynodes** Förster
 (type *Ceraphron pallidus* BOHEM.).
 Eyes large; ocelli present. Winged..... **Atritomus** Förster
 (type *A. cocophagus* FÖRST.).
8. Eyes large, bare; ocelli distinct..... **Atritomus** Förster
 Unknown?..... **Dendrocercus** Ratzeburg
9. Mesonotum with three impressed lines. 10
 Mesonotum without impressed lines or with one or two impressed lines 13
10. Metathorax normal without a forked spine at base..... 11
 Metathorax with a forked spine at base **Habropelte** Thomson
11. Wings pubescent, with cilia... .. 12
 Wings bare, glabrous, without cilia **Trichosteresis** Förster
 Apterous. Antennæ filiform..... **Eumegaspilus** Ashmead
12. Antennæ dentate or ramose..... **Lygocerus** Förster
 Antennæ filiform, simple, not dentate..... **Megaspilus** Westwood
13. Mesonotum without an impressed line 14
 Mesonotum with one or two impressed lines..... **Dichognus** Thomson
 Mesonotum with one impressed line **Atritomus** Förster
14. Antennæ toothed or serrate..... **Atritomus** Förster
 Antennæ with five long branches, a branch on each of the first five flagellar joints.
 Dendrocercus Ratzeburg (type *D. lichtensteini* RATZEB.).

Subfamily II. CERAPHRONINÆ.

The species falling in this subfamily are distinguished by antennal characters, the males having more joints in the antennæ than the females, and by the *linear*, never stigmated, marginal vein.

Table of Genera.

Females.....	1
Males.....	8
1. Antennæ 10-jointed.....	2
Antennæ 9-jointed.	7
2. Apterous.....	5
Winged,	
Mesonotum without a furrow.....	4
Mesonotum with a median impressed line.....	3
3. Scutellum flat or subconvex, with a marginal frenum.....	Ceraphron <i>Jurine</i>
(type <i>C. sulcatus</i> JURINE).	
Scutellum convex, acuminate, without a frenum.....	Aphanogmus <i>Thomson</i>
(type <i>A. fumipennis</i> THOM.).	
4. Antennæ subclavate.....	6
5. Mesonotum with a median impressed line.	
Scutellum flat or subconvex, with a frenum.....	Ceraphron <i>Jurine</i>
Scutellum convex, without a frenum.....	Aphanogmus <i>Thomson</i>
6. Scutellum distinct.....	Aphanogmus <i>Thomson</i>
Scutellum not at all differentiated.....	Ecitonetes <i>Brues</i>
(type <i>E. subapterus</i> BRUES).	
7. Mesonotum with a median impressed line.....	Neoceraphron <i>Ashmead</i>
(type <i>Ceraphron macroneurus</i> ASHM.).	
8. Antennæ 11-jointed.....	9
Antennæ 10-jointed.....	12
9. Mesonotum with a median impressed line.....	10
Mesonotum without a median impressed line.	
10. Scutellum depressed or flat, without a frenum; antennæ simple, not serrate.	
Ceraphron <i>Jurine</i>	
Scutellum convex, acuminate, without a frenum; antennæ serrate.	
Aphanogmus <i>Thomson</i>	
11. Scutellum convex, acuminate, without a frenum.	
Antennæ serrate.....	Aphanogmus <i>Thomson</i>
12. Mesonotum with a median impressed line.	
Antennæ filiform.....	Neoceraphron <i>Ashmead</i>

NOTES ON COCCINELLIDÆ.

BY CHARLES W. LENG, B.S.

Major Thomas L. Casey's "Revision" of this family, printed in this Journal (Vol. VII, pp. 71-169), describes several new species: and the following notes result mainly from a study of his work and of the material in the collections of Messrs. Schaeffer, Roberts, Love, O'Conner, Luetgens, Marshall, Ouellet, Knaus, Wickham and Davis,

as well as my own. I have also been allowed to study the material in the American Museum of Natural History, through the kindness of Mr. William Beutenmüller.

The preceding papers by American authors are by LeConte, Proc. Acad., 1852, Vol. VI, p. 129; Trans. Am. Ent. Soc., 1880, Vol. VIII, p. 186; Crotch, Trans. Am. Ent. Soc., 1873, Vol. IV, p. 363; Horn, Trans. Am. Ent. Soc., 1895, Vol. XXII, p. 81. Since the publication of Major Casey's "Revision," Mr. F. C. Bowditch has published (Ent. News, Sept., 1902) some critical notes.

Some of these authors have been apparently handicapped by insufficient material; and it is to be regretted that, while the larger species are represented in most collections, the smaller species are usually represented by few specimens.

Collectors should not fail to take large series of the species of *Hyperaspis* and *Scymnus* on account of the interest they possess from the variety of their markings and their economic importance.

With few exceptions the Coccinellidæ are beneficial insects, feeding in the larval stage and as imagines on plant lice and scale insects. The reports of the various State Entomologists contain numerous references to their predaceous habits, the summary of which is that while they doubtless eat some vegetable matter, pollen for example, their food consists largely of injurious insects. There is room for original investigation in this direction.

The standpoint of Major Casey in regard to the relation between American species and the related foreign forms is quite different to that of previous authors. He apparently regards each geographic race as entitled to a specific name, though in some cases he uses the word subspecies; while his predecessors have sometimes sought to emphasize the relationship by the suppression of varietal names.

Tribe 1. *Hippodamiini*.

The body is more elongate and loosely formed; the upper surface is glabrous; the legs are longer and less retractile than in the following tribes.

The genera may be separated as follows:

Claws simple.....	Anisosticta.
Claws with a large quadrate basal tooth.....	Megilla.
Claws toothed near base.	
Antennæ simple.....	Paranæmia.
Antennæ with third jointed dilated.....	Ceratomegilla.
Claws bifid.....	Hippodamia.

Næmia is included with *Anisosticta*; *Adonia* is included with *Hippodamia*; *Eriopsis* is omitted for reasons stated below; *Macronæmia* is included with *Anisosticta*.

Anisosticta *Dufouchel.*

3033. **A. strigata** *Thunb.*, 1794. Northern States and Canada.

Ovate, black; head yellow, black at base; legs, antennæ, sides of abdomen and last segment yellow; thorax and elytra yellow, evidently punctate; thorax with two obtriangular spots (the external corner often isolated as a dot); elytra each with eight spots and a common bilobed scutellar spot black (the two pairs near the suture are often confluent, and then the external row forms a sinuous band). Length, 3.25 mm. = .13 inch.

The name *bitriangularis* Say is preferred by Major Casey, who states the American form is distinct from the European. The black markings of the elytra and thorax are heavier in eastern than in western specimens and two names may be necessary if we distinguish geographic races. A specimen from Manitoba (figured in plate) in Professor Wickham's collection is conspicuously pale. For the present I believe it will be preferred to use the original name of the species for all its forms.

3034. **A. seriata** *Mels.*, 1846. Maritime regions of Atlantic States and southern California.

Ovate, black; tibiæ, antennæ, sides of abdomen reddish-yellow; thorax and elytra reddish-yellow, punctulate; thorax with two large obtriangular spots connected at median line; elytra each with five spots and a common scutellar spot black. Resembles *Megilla maculata* but may easily be known by the entirely black head and the confluence of the spots. Specimens from southern California are redder and have the elytral spots barely connected. Length, 4.5 to 6.5 mm. = .18 to .26 inch.

This species was made the type of *Næmia* by Mulsant and in this he is followed by Major Casey but in view of the feeble characters used I prefer to retain the arrangement of the check list. The name *litigiosa* Muls., might be revived for the southern California form if it were desired to distinguish the geographic races of this species.

3035. **A. episcopalis** *Kirby*, 1837. Canada, Kansas, Wyoming, Colorado (April to June in sweepings, Wickham), Lake Tahoe, California (Fall).

Elongate, parallel, bright yellow, body black; head black behind and with two black vittæ; thorax rounded behind, sinuate before the posterior angles, rather finely punctate with a large three-lobed mark on either side the median line; elytra more strongly punctate, suture narrowly black and a discoidal vitta more broadly black (neither of them reaching the apex). Length, 3.75 mm. = .15 inch.

This species has not the characters by which Mulsant sought to separate *Næmia*; if it is to be separated from *Anisosticta* it should be

under Casey's name *Macronæmia*. I prefer to simplify the list by restoring it to *Anisosticta*.

Megilla Muls.

3036. **M. maculata** *DeG.*, 1775. Canada, United States and southward, except Pacific coast.

Ovate, black, alutaceous, thorax and elytra reddish, spotted with black, punctulate; head black with a triangular frontal red spot; thorax with an obtriangular black spot on either side the median line; scutellum black, elytra with two common spots (one scutellar, one at three fourths) and four arranged longitudinally, one on the callus, one medial larger, one at three fourths and one subapical. The spots become reduced in the variety *floridana*. Length, 4 to 7 mm. = .20 to .28 inch. This species hibernates gregariously.

This species may be divided into geographic races and if this be done our common form will be known as *fuscilabris*. Major Casey has described a large form from Brownsville, Tex., under the name *strenua* and there is still a third form occurring in Florida and Louisiana which is separated already in many collections and may be called *floridana*. These varieties may be separated as follows:

Larger form with fully developed markings.

Prothorax less than twice as wide as long; 4.7 to 6.2 mm..... **fuscilabris.**

Prothorax twice as wide as long; 5.2 to 7.2 mm..... **strenua.**

Small form with feebly developed markings; 4.5 to 5 mm..... **floridana.**

Megilla floridana, var. nov.

Head black, with a triangular red mark; thorax red, with two small basal black marks; elytra red, with a common scutellar black spot and each with humeral, antemedian, two postmedian and apical black spots. The spots are small and separated by more than their own diameter. The inner of the two postmedian spots is not sutural nor is it usually coalescent with the corresponding spot of the other elytron as in the variety *fuscilabris*. Length 4.5-5 mm.

Habitat: Florida and Louisiana (Vowell's Mill).

I regard this as a well-marked race of *maculata*.

Paranæmia Casey.

This genus differs from the preceding by the forms of the tarsal claws, as shown in figure, and by the pattern of maculation. I think it should be recognized.

3037. **P. vittigera** *Mann.*, 1843. Col., N. Mex., Ariz., Cal., on herbage in swampy places.

Ovate, black, alutaceous; thorax as in the preceding; pale spot of the head small or lacking in female; elytra with suture and a dorsal vitta black, both are attenuate towards the apex, which they do not reach. Length, 5 to 5.5 mm. = .20 to .22 inch.

Major Casey has separated under the name *similis* specimens from Colorado and Arizona in which the form is more elongate, the thorax especially so and more rounded at base. I can trace the differences described in the large series I have examined, but do not believe they indicate more than a feebly defined race.

Ceratomegilla Crotch.

3038. **C. Ulkei** Cr., 1873. Hudson's Bay.

"Oval, sub-opaque, antennæ, tarsi and palpi ochreous; head with a white spot in front of each eye, thorax with the sides bordered with ochreous, anterior angles broadly ochreous, and a very minute line in the middle of the anterior margin also ochreous; elytra rather closely punctate, a triangular spot on the base, the external margin irregularly, and an elongate common sutural spot near the apex fulvous. L. 22 inch (5.5 mm.)."

The claws are dentate at base and the antennæ have the third joint longer than the second, broadly dilated at apex, with the inner angle ciliate.

Unknown to Major Casey and not represented in any of the collections I have seen. I repeat the description of Crotch (Trans. Am. Ent. Soc., IV, 365).

Adonia Muls.

3039. **A. constellata** Laih., 1781. Nova Scotia.

"Black, tibiæ, antennæ and entire front of the head pale; thorax with a narrow border, an abbreviated medial line connected with the anterior margin and a round dot on either side white; elytra clearly and rather coarsely punctate, with a scutellar spot and six others (as in *Hippodamia*) variously united or absent. L. 19 inch = 4.7 mm."

This is a European insect and the name is cited as a synonym of *variegata* Goeze in the Gemminger & Harold Catalogue, and in the later Henshaw list. It is not represented in any of the collections I have seen. I quote Crotch's description.

I think this species should be omitted from our list.

Eriopsis Muls.

3040. **E. connexa** Germ., Texas, California, Vancouver.

Oblong, black, extremely finely and obsoletely, head more visibly, punctate; thorax with the sides, and a spot on the front and hind margins yellow; elytra with the margin, base and two dorsal spots yellow; the marginal line is dilated in five places, one basal, one subhumeral, one medial, one at three fourths and one sub-apical. L. 122 inch = 5.5 mm.

This is a South American insect, which has very seldom been found in the United States, even if the records are authentic.

I think this species should be omitted from our list.

This genus and the preceding are very close to *Hippodamia*.

Hippodamia *Muls.*

The synopsis by Crotch includes only part of the now known species; the later synopsis by Casey omits several of the previously described species; I am therefore compelled to offer a new synopsis. Our species fall into three groups distinguished by the character of the sternal plates or more readily by the markings of the thorax, viz :

- Thorax with broad white lateral margins within each of which is a black dot. The black dot is sometimes connected with the interior black portion, the latter being without the discal divergent lines.....Group 1
 Thorax with a white quadrate spot at the middle of the base and white lateral and anterior margins variously interrupted.....Group 2
 Thorax with a white lateral margin often interrupted at middle or reduced to an anterior marginal spot. In this group occur all the species with discal divergent lines on the thorax, but some species are without them.....Group 3

Group 1 consists of one species, *13-punctata*. Group 2 consists of one species *parenthesis*. Group 3 consists of several species separable as follows :

- Anterior half of elytra without markings or with only a humeral black dot...**glacialis**
 Elytra with a black subbasal band often reaching the humeri, with or without other marks.....**5-signata**
 Elytra with a common black scutellar spot in the form of a trilobed star, with or without other marks.....**Lecontei**
 Elytra black with a subapical red spot.....**mcesta**
 Elytra immaculate.....**ambigua**
 Elytra with six small spots, seldom even partly confluent..... **convergens**
 Elytra with sutural margin wholly or partly black and each with four spots distinct or united or with a sinuous vitta formed by the union of the spots.....**sinuata**
 Elytra with a broad subbasal band and a large medial spot.....**dispar**

3041. **H. 5-signata** *Kirby*, 1837.

Extends from New York (Adirondacks) to California, following a northern range but descending also to Colorado, Utah and New Mexico in the mountains.

In the most heavily marked form the thorax is all black except the anterior angles, and the elytra have three black bands, one subbasal, very broad, disconnected at suture; one post-median also broad but abbreviated, the third subapical and scarcely more than a good-sized spot. In the palest form the thorax has a white margin and discal lines, the elytra bear no marks behind the subbasal band which is

much reduced. This form is confined to the Pacific coast and is *extensa* Muls. Between these two extremes occur very many intermediate forms, some of which have been named by Major Casey, but in view of the variability of the large series before me collected at various points in the Rocky Mts. by Mr. E. J. Oslar, I am not sure that these names represent even established geographic races. For cabinet arrangement these forms may be arranged as follows if desired :

Three elytral bands	5-signata
Subapical band or spot lacking	leporina Muls. (<i>vernix</i> Csy.)
Subapical band lacking, middle band represented by two spots	unnamed.
Subbasal band narrower, others represented by small dots (united in <i>Csy.</i>).....	puncticollis
Middle and apical band lacking,.....	extensa Muls.

The last occurs as far as I know only west of the Sierra Nevada, is certainly a good variety and should be added to our list as

3041a. **H. extensa** Muls., 1851. California.

3042. **H. ambigua** Lec., 1852. California and Oregon.

With this species, itself closely related to the preceding I include as geographic races *obliqua* and *politissima* of Casey. All the forms have immaculate elytra rarely a few small spots but may be separated as follows :

Thorax without discal divergent lines.....	ambigua.
Thorax with discal divergent lines.	
Elytra feebly alutaceous	obliqua.
Elytra highly polished	politissima.

The discal divergent lines of the thorax when present may be represented by two short dashes at middle of thorax, or they may be so extended as to leave only a narrow black design on a white ground. In the series collected for me by Miss Dennis at Dilley, Oregon, every intergrade can be found.

3043. **H. Lecontei** Muls., 1851. Colorado to California.

In this species the trilobed scutellar spot is accompanied by humeral spot, post-median spots or band and subapical spot and its pattern of maculation closely resembles that of *5-signata*.

3043a. **H. mæsta** Lec., 1854. British Columbia, Oregon.

Very distinct from all others and I know of no reason for regarding it as a variety of the preceding.

3044. **H. glacialis** Fab., 1775. Northeastern America.

No division of this species has been proposed. Major Casey is in

error in saying "anterior spots always wanting." About half the specimens I have seen have a small black humeral dot as well as the post-median band and subapical spot.

3045. **H. 15-maculata** Muls., 1851. Kansas and Arkansas.

I regard as a variety of *convergens*.

3046. **H. convergens** Guer., 1846. North America.

The pattern of maculation in this widely distributed species is six spots on each elytron and a scutellar spot. The discal divergent lines are usually well developed. The variations are :

Elytra immaculate.....	obsoleta Lec.
Anterior and scutellar spots coalescent.....	unnamed.
Postmedian spots coalescent.....	juncta Csy.
All the spots enlarged and partly coalescent.....	15-maculata Muls.

3047. **H. spuria** Lec., 1861. Oregon, Vancouver.

"This species has the form and size of our common *H. parentthesis*, but the thorax of *H. convergens*. The elytra are more elongate oval in form than in either, and more obtusely rounded at tip; the apical angle is also not at all acute, but on the contrary, quite rounded. The spots of the elytra vary greatly; the scutellar elongate spot is sometimes prolonged on the sutural margin for two thirds the length; the first and second, or the second and third of the posterior spots are connected sometimes as in varieties of *H. parentthesis*, and specimens will undoubtedly be found in which all three are united to form an arcuated spot. It is also probable that *H. sinuata* Muls. is an extreme form of this species. Long. .20. Oregon."

I consider this a variety of *sinuata* to be separated as noted below.

It seems as if Major Casey had somehow been misled in regard to this species as his description does not coincide with that of Dr. Leconte and the locality (Colorado) cited is, in my belief, far from the region inhabited by Leconte's species. Leconte's description is here quoted.

3048. **H. oregonensis** Cr., 1873. Oregon.

Differs from the preceding by the absence of the discal divergent lines on the thorax. I believe that this is a form of *sinuata* var. *spuria*, but in the absence of sufficient specimens I am obliged to leave the name in doubt.

3049. **H. sinuata** Muls., 1851.

var. **spuria** Lec., 1861. Oregon, Vancouver, Washington.

var. **trivittata** Casey, 1899. California.

true **sinuata** Muls., New Mexico.

var. **spuria** Casey., Utah, Col., N. Mex., Nev.

In this species the basis of the markings may be regarded as four spots, one subhumeral, one subsutural near the middle, one submarginal behind the middle and one subapical. There is also a sutural stripe, more or less developed.

In the true *sinuata* the spots unite to form a vitta arcuately sinuate posteriorly. Sometimes the union is incomplete, the apical spot being separated (*americana* Cr.). The sutural stripe is narrow and reaches nearly to the apex. The color is quite reddish. All the specimens I have seen are from New Mexico.

In the variety *spuria* Lec., the subhumeral spot is usually separate and the three posterior spots are wholly or partly united, forming an arcuate spot as in *parenthesis*. The subhumeral spot, however, may also be united, in which case we have the form called *complex* by Casey. I include under *spuria* Lec., also *oregonensis*, differing only by the absence of discal thoracic lines, a character instable in a preceding species. In *spuria* Lec., the sutural stripe is a short broad mark surrounding the scutellum as in *parenthesis*. The color is paler than in *sinuata*. The home of this variety is in Vancouver, Oregon, and Washington, but I have a specimen collected by Mr. Warren Knaus in Kansas, which could be placed here.

In the variety *trivittata* the vitta of *sinuata* is almost reproduced, but I have seen no specimens in which the vitta is broken by the separation of the apical spot and the situation in the vitta is less marked, so that, as Major Casey says, the design is very much like that of *Paranæmia vittigera*. The sutural stripe is usually very long, but it is sometimes a short scutellar blotch as in the preceding variety which makes the form called *crotchi* by Casey. The color is comparatively pale in this variety. Its home is in California. It is probable that *falcigera* Cr., differing only by the absence of discal thoracic lines, is to be included here in which cases Crotch's name must be used; but I have seen no specimens from the locality named by him (Slave Lake, Hudson's Bay) and I prefer to leave this name in doubt for the present.

In the variety called *spuria* in Major Casey's paper (but which is really nameless for, as I read the descriptions, *spuria* is preoccupied) the four spots are entirely separated, or the two middle spots may be united, or some of the spots may be lacking. The sutural stripe is usually short and narrow. The color is yellow, or reddish-yellow in specimens from New Mexico. I have specimens from Utah, Colorado, Kansas, New Mexico, Nevada, Dakota, Idaho and Wyoming

and a specimen from Vancouver in Professor Wickham's collection has the markings so reduced as to be placed here.

It seems to me as if all these forms constituted one species which may have originally had the four spots; with a tendency to establish the varieties *sinuata*, *trivittata* and *spuria* Lec., in each of which, however, there is a tendency to revert to the ancestral type.

3050. **H. 13-punctata** Linn., 1735. Europe, Siberia and the United States.

No division of this species has been proposed.

3051. **H. parenthesis** Say, 1824. British America and the northern part of the United States, extending to Colorado in the mountains and from New England to California.

There is a great variation in the elytral markings, as will be noted by the figures. The quadrate white spot at the base of the thorax seems to be constant. Major Casey has proposed the name *apicalis* for that form in which the subapical spot attains the suture and apical angles, but I doubt very much if this indicates an established race. If so, it should be cited as

3051a. Var. **apicalis** Casey, 1899. Nevada and California.

3052. **H. falcigera** Crotch, 1873. Slave Lake, Hudson's Bay.

"Black, clearly and finely punctulate; head with a small frontal spot, yellow; thorax with a narrow uniform border yellow, no discal spots; elytra yellow with the suture black (narrowing out before the apex) and each with a black equally broad vitta suddenly incurved before the apex; meta-epimera black. L. .22 inch."

This I have not seen, but as stated above, I believe it to be the variety of *sinuata* called *trivittata* by Major Casey. The above is a copy of the original description.

3053. **H. americana** Crotch, 1873. Kansas, Hudson's Bay.

Under this name Crotch described *sinuata* with the apical spot detached and I do not think that the name can be anything but a synonym unless it be regarded as the first description of a departure from the true *sinuata* form and hence including all other departures in the same direction. In this view the name could be used for the fourth variety of *sinuata*, called *spuria* by Major Casey.

3054. **H. variegata** Goese, 1777.

Should be dropped. See under *Adonia constellata* above.

H. dispar Casey, 1899. Colorado.

Oval, black; antennae, epimera, frontal spot, anterior and lateral margins of thorax and elytra pale; elytra with subbasal band equally broad throughout and a broad post-median spot, black; surface of elytra strongly alutaceous and rugulose;

thorax closely punctate; body smaller and more depressed than usual in this genus. Length, 4.5 mm. = .18 inch.

I have not seen the type and the figure is drawn from a specimen in my own collection from the same locality and seemingly identical with the insect described by Major Casey. Mr. Blanchard has specimens from New Mexico, collected by Prof. F. H. Snow in which the subbasal band and median spot are connected. The elytra in one specimen bear also a disconnected subapical spot. I regard these as a form of *dispar*.

NOTES ON THE CEROSTOMA GROUP OF YPONOMEUTIDÆ, WITH DESCRIPTIONS OF NEW NORTH AMERICAN SPECIES.

BY AUGUST BUSCK.

While endeavoring to arrange some American moths of the *Cerostoma* group and for that purpose examining critically the European species placed in that genus by modern European authors, I was surprised by the diversity of forms included under that generic name. Meyrick, in his Handbook of British Lepidoptera, includes in *Cerostoma* all English Yponomeutidæ which have veins 6 and 7 in the hindwings stalked. This is at least more consistent than the course pursued by Rebel in the Catalogue of European Lepidoptera, where he places one of them, *mucromella* Scopoli, under a separate genus *Theristis*, leaving the rest, which readily separate into four just as distinct genera, in *Cerostoma*. The natural way seems to be to divide the group into the five genera defined by Wallengren (Ent. Tidskrift, I, p. 53, 1880), but some of his generic names will fall in favor of Hübner's earlier terms.

The genus *Cerostoma* was founded by Latreille (Hist. Nat. des Crust. et Ins., Vol. III, p. 416, 1802) and was characterized as follows: "Ailes tres-alongées, étroites, moulés sur le corps. Quatre palpes distinctes; les superieurs droits, les inferieurs long et recourbés; leur second article penicilliforme, le dernière conique, alongé, presque nu."

The type of this genus is *Ypsolophus (Alucita) dorsatus* Fabricius, that being the only species mentioned by Latreille both in this volume and in Vol. XIII, p. 247, 1805.

Latreille's redescription of this species and his subsequent figure (Genera Crust. et Insectorum, Vol. I, Plate 16, Fig. 6, 1806) agree well with Fabricius' original description of *Alucita dorsella* (Ent. Syst., 3, 2, p. 336, 1793), which is as follows: "Alis anticis cinereis fusco irroratis; dorso communi albedo; maculis duabus nigris. Magnitudo A. sylvellæ, caput albo hirtum; alæ anticæ cineræ atomis plurimis fuscis dorsoque communi albidore maculis majoribus atomisque plurimis nigris; posticæ fuscæ. Pedes albi, tarsi nigro annulatis."

Stephens (Cat. Brit. Lep., p. 223, 1829) made this species a synonym of *Tinea vittella* Linn. (Syst. Nat., edit. X, p. 538, 1758), and inasmuch as Linné's description does not disagree with this contention and as no disproof of the synonymy can be forthcoming, it is imperative that Stephens' synonymy should be accepted. Treitschke's contention (Schmett. Europe, Vol. IX, Part II, p. 39, 1832) that *dorsella* Fabricius is synonymous with *Tinea falcella* Hübner (D. & Sch.) (Syst. Verz. Schmett. Wien. Gegend, p. 112, 1775) cannot be sustained, owing to the priority of Stephens' determination, even if there was as much reason for Treitschke's belief as for Stephens', which, however, is not the case. Neither does Curtis' statement (Brit. Ent., Vol. IX, p. 420, 1832) that *xylostella* Linn. is the type of *Cerostoma* have any weight. Duponchel (Cat. Lep. Europe, p. 350, 1844), Herrich-Schäffer (Europe. Schmett., V, p. 41, 1853) and other subsequent writers followed Treitschke in placing *dorsella* Fabricius as synonym of *falcella* Hübner, but without giving the necessary evidence.

In any classification of the species comprised at present under the genus *Cerostoma*, the name *Cerostoma* must thus be retained for the group in which *vittella* Linné is found.

Hübner's genus *Harpipteryx* (Verz. bek. Schmett., p. 407, 1816) contained originally four species, of which Zeller made the one, *porficella*, type of a new genus *Holoscolia* (Isis, p. 190, 1839).

The other three are congeneric and the name *Harpipteryx* must therefore stand for the genus of which these three species: *hamella* Hübner = *nemorella* Linné, *harpella* Schiff. = *xylostella* Linné, and *falcella* Schiff., are to this day the principal best known species. *Xylostella* may, as suggested by Lord Walsingham (Proc. Zool. Soc. Lond., 1881, p. 309), be regarded as the type of this genus, of which *Periclymenobius* Wallengren (Ent. Tidskrift, I, p. 61, 1880) is an unquestionable synonym, as it contained the same three species and no more. Hübner's generic name *Theristis* has inconsistently been

retained by nearly all subsequent writers. It should stand for the genus at present represented by the single species *mucronella* Scopoli.

Wallengren also correctly divided the remaining European species in two genera under the names *Credemnon* and *Trachoma*, of which *sytaella* Linné and *asperella* Linné relatively may be regarded as types.

The first of these names should be dropped for Hübner's name *Abebea* (Verz. bek. Schmett., p. 408, 1816), which may appropriately be restricted to this group.

The *Cerostoma* group as here treated may briefly be defined as including all Plutellidæ with veins 6 and 7 in hindwing stalked. The genera have the following characters in common. Labial palpi with more or less developed porrected tuft on the underside of second joint ; terminal joint pointed. Maxillary palpi present, moderately developed, appressed or porrected.*

Forewings more or less elongate, apex often produced or falcate ; 12 veins, 7 to termen, 1 *b* furcate at base ; veins 7 and 8 stalked or separate, this character does not seem to have generic value in this group, while the relative position of veins 2 and 3 in the forewing on the contrary is found to furnish a good character.

Hindwings about as broad or somewhat broader than forewings ; costal edge nearly straight, dorsal edge evenly and but slightly rounded, without sinuation below the apex, which is more or less pointed ; veins 6 and 7 long-stalked, all other veins separate. Tibia of hind legs smooth.

The genera may be separated by the following table :

Forewings with erect scales.....	1
Forewings smooth.....	2
1. Veins 2 and 3 in forewings separate.....	Trachoma Wallengren ✓
Veins 2 and 3 in forewings stalked.....	Therestis Hübner ✓
2. Brush on second joint of labial palpi at most as long as terminal joint.	Cerostoma Latreille ✓
Brush on second joint longer than terminal joint.....	3
3. Forewing sickle-shaped ; veins 2 and 3 connate.....	Harpipteryx Hübner ✓
Forewings not sickle-shaped ; veins 2 and 3 distant.....	Abebea Hübner ✓

* Herrich-Schaeffer, Heinemann and other European writers state that the maxillary palpi are absent in the genus *Therestis* and this belief has probably been the principal reason why this genus alone has been retained separate ; but the maxillary palpi are merely obscured from view by the strongly developed labial palpi and can be found by removing them. They are about as well developed as in any of the other genera of the group.

Cerostoma Latreille.

Forewings narrow elongate, more than $3\frac{1}{2}$ times longer than broad, smooth, 12 veins, 7 and 8 stalked or separate, 7 to termen, 2 and 3 separate. Tuft on second joint of labial palpi broad and blunt, shorter than terminal joint. Ocelli present.

Type: *vittella* LINN.

Hereto belong presumably all of the European species listed by Rebel (Staudinger and Rebel, Cat. Lep. Eur., II, p. 138, 1901), between *vittella* Linné and *leuconotella* Snellen, inclusive. A few of these species are unknown to me except from description.

The American species, known at present, may be separated thus:

Forewings with distinct blackish second discal dot.....	1
Forewings without such dot.....	2
1. With blackish streak above the fold.....	<i>aleutianella</i> <i>Beut.</i>
Without such streak.....	<i>unicipunctella</i> , sp. nov.
2. With longitudinal black streaks.....	3
Without longitudinal black streaks.....	6
3. With continuous broad black streak from base to apex.....	<i>schwarziella</i> , sp. nov.
Without such streak.....	4
4. Ground color pure white.....	<i>striatella</i> , sp. nov.
Ground color not white.....	5
5. Head ochreous.....	<i>manella</i> , sp. nov.
Head black and white.....	<i>barberella</i> , sp. nov.
6. Head pure white.....	<i>angelicella</i> , sp. nov.
Head not white.....	7
7. Alar expanse less than 19 mm.....	8
Alar expanse more than 21 mm.....	9
8. Membrane between veins 11 and 12 in forewing thickened.....	<i>radiatella</i> <i>Don.</i>
Membrane not thickened.....	<i>rubrella</i> <i>Dyar</i>
9. Forewings light olive brown.....	<i>olivella</i> , sp. nov.
Forewings dark purplish-brown.....	<i>arizonella</i> , sp. nov.

Cerostoma unicipunctella, sp. nov.

Antennæ white, dotted with dark brown. Labial palpi on the outside dark fuscous, striated transversely with white, underside and inside of second joint silvery white; brush small; terminal joint thickened in front with rough scales. Maxillary palpi small, porrected, dark fuscous. Face, head, thorax and anterior wings unicolorous, pale olive buff with golden reflections; at the end of the cell is a conspicuous black round dot and a few scattered black scales are found especially in the apical part of the wing. Cilia concolorous with wing except the extreme dorsal part, which is white. Hindwings light silvery gray, deepening toward the edges; cilia whitish fuscous. Legs fuscous, tarsi blackish. Alar expanse, 23 mm.

Habitat: Williams, Arizona (Schwarz and Barber).

U. S. National Museum, type No. 6751.

***Cerostoma aleutianella* Beutenmüller.**

Cerostoma aleutianella BEUTENMÜLLER, Can. Ent., XXI, p. 27, 1889.

Cerostoma aleutianella RILEY, Smith's List Lep. Bor. Am., No. 5197, 1891.

Cerostoma aleutianella DYAR, Can. Ent., XXXII, p. 41, 1900; Bull. U. S. Nat. Museum, 52, No. 5498, 1903.

The unique type of the species is in U. S. National Museum, type No. 428.

Habitat: Aleutian Islands, Alaska.

***Cerostoma angelicella*, sp. nov.**

Antennæ white with sharp black annulations. Palpi, head and thorax white; shoulders yellowish. Forewings white with striking fawn-brown ornamentation. Extreme costal base brown; at basal third of costa begins a broad brown band curved downwards and outwards, which reaches the costal edge again at the middle of the wing and encloses a small semicircular white costal spot. At its lowest point this band approaches and sometimes joins a dorsal brown spot, which begins at the base of the wing and curves upwards at basal third. On the middle of the dorsal edge begins an outwardly oblique brown streak ending on the end of the cell in an inwardly curved hook. This streak sometimes connects with a large more or less y-shaped brown costal marking at apical third, which encloses a small triangular white costal spot and which nearly reaches across the wing to a small brown spot at the anal angle. Apex and a marginal spot below apex brown. The markings are sharply defined and edged with slightly darker scales of brown.

Six specimens, from which I have described this species, show some variation in the shade as well as in the form of the brown markings. In one specimen they are quite dark brown; in the others, which seem as well preserved, though they may be faded, the markings are light golden brown. Cilia white with brown pencils in the apical part. Hindwings shining ochreous white; cilia yellowish. Legs and under-side of body white, tarsi slightly dusted with dark scales. Alar expanse, 19-22 mm.

Habitat: Los Angeles, California (Coquillett).

U. S. National Museum, type No. 6765.

***Cerostoma oliviella*, sp. nov.**

Antennæ silvery white with narrow dark brown annulations. Labial palpi yellowish-brown, mottled on the outside with dark brown scales; tuft small, terminal joint roughened in front. Head and thorax light brown. Forewings olive-brown, closely and uniformly sprinkled with dark purplish-brown or blackish atoms, which give the wings a purplish sheen. On the fold is a small deep black spot and at the end of the cell is a small aggregation of black scales, hardly forming a defined spot. Cilia yellowish. Hind wings light silvery fuscous; cilia yellowish. Legs light brown mottled with black. Alar expanse, 21.5 mm.

Habitat: Williams, Arizona (Schwarz and Barber).

U. S. National Museum, type No. 6752.

Cerostoma arizonella, sp. nov.

Antennæ dark brown. Labial palpi on the inside light brown, on the outside strongly mottled with blackish scales; tuft on second joint small, terminal joint thickened with rough scales anteriorly. Head and thorax light ochreous brown. Ground color of forewings rather light brown, but thickly overlaid on the costal three fourths with deep brown and dark purple scales so as to obscure the ground color except along the dorsal edge. The fold is indicated by being rather more profusely overlaid with dark purple scales and at the end of the cell is a small aggregation of closely placed dark purple scales, hardly forming a defined dot. Irregularly scattered over the wing both in the dark portion and in the light dorsal part are a few single black scales and still fewer single white scales. Cilia light brown. Hindwing silvery fuscous; cilia a shade darker than the edge of the wing. Legs dark purplish fuscous, tarsi with a narrow white annulation at the end of each joint. Alar expanse, 22 mm.

Habitat: Williams; Arizona (Schwarz and Barber).

U. S. National Museum, type No. 6753.

Cerostoma radiatella *Donovan*.

Sinea radiatella DONOVAN, Nat. Hist. Brit. Ins., III, p. 14, pl. 77, figs. 3 and 4, 1794.

Cerostoma radiatella REBEL, Staudinger and Rebel, Cat. Lep. Eur., II, No. 2466, 1901.

Pluteoptera ochrella CHAMBERS, Journ. Cinn. Soc. Nat. Hist., II, p. 181, 1880.

Cerostoma radiatella WALSINGHAM, Proc. Zool. Soc. Lond., p. 303, 1881.

Cerostoma radiatella WALSINGHAM, Ins. Life, I, p. 287, 1889.

Cerostoma radiatella RILEY, Smith's List Lep. Bor. Am., No. 5193, 1891.

Cerostoma radiatella DYAR, Can. Ent., XXXII, p. 41, 1900.

Cerostoma radiatella DYAR, U. S. Nat. Mus., Bull. 52, No. 5500, 1903.

Lord Walsingham recorded this exceedingly variable species from California and established the synonymy of Chambers' *Pluteoptera ochrella*.

In U. S. National Museum are specimens from Williams, Arizona (Schwarz and Barber), which I cannot distinguish from some varieties of this species, a good European series of which is also in the Museum.

They have the peculiarity, mentioned by Meyrick, of the thickened area between veins 11 and 12 in the forewings.

Cerostoma rubrella *Dyar*.

Cerostoma rubrella DYAR, Proc. U. S. Nat. Mus., XXV, p. 404, 1902.

Cerostoma rubrella DYAR, Bull. U. S. Nat. Mus., 52, No. 5501, 1903.

The type (U. S. Nat. Museum, No. 6763) and a good bred series of this species is in the National Museum.

The species is certainly quite distinct from *radiatella* which is clearly proven by the absence of any thickened costal membrane in the forewing.

Habitat: Colorado.

Food-plant: *Berberis repens*.

Cerostoma barberella, sp. nov.

Antennæ dark fuscous with a few scattered white scales especially toward apex. Labial palpi black, mottled with light ochreous and white scales; brush on second joint well developed but shorter than terminal joint which is strongly roughened in front. Head and thorax dark pepper and salt colored, black, white and light ochreous fuscous scales being about evenly mixed. Forewings with light whitish steel-gray ground color, strongly overlaid with black and dark fuscous scales; extreme base of costa black; an interrupted deep black streak begins at basal third, and runs in the middle of the wing to apex; other short longitudinal black dashes especially towards the edges give a streaked appearance to the wing when looked at with the naked eye. Cilia ochreous fuscous. Hindwings shining dark fuscous, nearly black towards the edges; cilia light fuscous. Abdomen dark purplish fuscous. Legs nearly black with strong purple reflection; tarsi with a narrow white annulation at the end of each joint. Alar expanse, 24 mm.

Habitat: Williams, Arizona (Schwarz and Barber), U. S. National Museum, type No. 6756.

Cerostoma schwarziella, sp. nov.

Antennæ dark fuscous. Labial palpi on the outside clothed with blackish-brown light tipped scales, on the inside with light ochreous scales; tuft short; terminal joint thickened with rough scales in front. Head and thorax light brown, shoulders slightly darker, purplish-brown. Forewings light brown, sparsely sprinkled with dark fuscous scales; from the base of costa to apex of the wing is a straight deep purplish-black streak, broadest at about basal third and slightly attenuated toward the tip of the wing; along and just inside the dorsal edge is another much less prominent, narrower deep black longitudinal streak from base to tornus, sprinkled in its entire length but especially toward tornus with single white scales. Cilia whitish ochreous. Hindwing silvery fuscous, blackish toward apex; cilia light ochreous fuscous. Legs ochreous, mottled with black. Abdomen ochreous, sprinkled with black; ovipositor protruded, horny, with sparse long hairs. Alar expanse, 23 mm.

Habitat: Williams, Arizona (Schwarz and Barber). Also a specimen from Argus Mts., Arizona (Koebele). U. S. National Museum, type No. 6754.

Cerastoma manella, sp. nov.

Antennæ light fuscous. Labial palpi blackish fuscous on the outside, on the inside light ochreous; tuft on second joint small; terminal joint thickened with rough scales anteriorly.

Face, head and thorax light ochreous fuscous, with single blackish scales interspersed; shoulders darker, purplish. Forewings whitish fuscous with a violet or silvery sheen and sprinkled with light brown, dark fuscous and black scales.

The brown scaling is confined to the costal and apical half of the wing; the dark scales are arranged in poorly defined short longitudinal streaks especially towards the costal edge and towards apex, which produce a veined effect; fold and area around tornus nearly free from dark scales. Cilia whitish ochreous. Hind wings light silvery fuscous; cilia ochreous fuscous. Abdomen silvery fuscous, sprinkled with black. Legs whitish fuscous. Alar expanse, 22 mm.

Habitat: Williams, Arizona (Schwarz and Barber). U. S. National Museum, type No. 6755.

***Cerostoma striatella*, sp. nov.**

Antennæ white towards the apex with dark brown annulations. Labial palpi, especially second joint, unusually short for the genus; brush very short; terminal joint thickened with rough scales; white with a few dark scales on third joint. Head and thorax white, a narrow black streak on the shoulders. Forewings dull chalky white with narrow more or less interrupted purplish-black longitudinal streaks, best defined in apical half of the wing and radiating somewhat from the end of the cell towards costal and dorsal edge. Dorsal edge below the fold only sparsely sprinkled with dark scales. Cilia white, tipped with black. Hindwings whitish towards the edges, light ochreous fuscous; cilia white; abdomen white, mottled above with dark fuscous; ovipositor protruded, horny, stout. Legs whitish, slightly mottled with fuscous. Alar expanse, 23 mm.

Habitat: Los Angeles, California (Koebele). U. S. National Museum, type No. 6757.

Abebæa Hübner.

Forewing shorter and broader than in the foregoing genus, less than three and a half times longer than broad; smooth; 12 veins, 7 and 8 separate or stalked, 7 to termen, 2 and 3 separate. Tuft on second joint of labial palpi well developed, compressed, pointed, longer than terminal joint. Wallengren, Heinemann and other European writers have stated that the ocelli are absent in this group; this is at least not always correct, and even the European species have ocelli. Thus one of Wallengren's distinguishing characters for this genus (his genus *Credemnon*) is spoiled and I admit that I should hardly have given this group generic value if it had not been done by others before me. However the long-pointed brush on second joint of labial palpi, the broader wings and a certain undefinable general habitus prove that it is a natural division at least of the foregoing genus and afford sufficient help to distinguish it from the other natural division to which the name *Cerostoma* is restricted.

Type: *sylvella* Linné. Of European species, only *sylvella* Linné, *lucella* Fabricius and *alpella* Schiffermüller belong to this genus.

The American species may be separated by the following table:

- | | |
|--|---------------------------------|
| Forewings with broad white longitudinal streak from base to apex..... | 1 |
| Forewings without such streak..... | 3 |
| 1. Apical part of the forewings with black marking..... | 2 |
| Apical part of forewings pure white..... | cockerella , sp. nov. |
| 2. Forewings of same color above and below white streak..... | gerdanella , sp. nov. |
| Forewings differently colored above and below white streak..... | delicatella , sp. nov. |
| 3. Forewings with narrow white longitudinal lines..... | nella , sp. nov. |
| Forewings without such lines..... | 4 |
| 4. Forewings without any dark markings, head and top of thorax white..... | sublucella <i>Wals.</i> |
| Forewings with more or less dark ornamentation, head and thorax not white..... | 5 |
| 5. Forewings with subobsolete blackish longitudinal streak towards apex..... | cervella <i>Wals.</i> |
| Forewings without such streak..... | 6 |
| 6. Forewings with two faint oblique parallel dark dorsal streaks and one perpendicular to these..... | querciella , sp. nov. |
| Forewings without such streaks..... | subsylvella <i>Wals.</i> |

Abebæa gerdanella, sp. nov.

Antennæ white, dotted with black scales above. Labial palpi white, sprinkled with sparse black scales on the outside; tuft on second joint longer than terminal joint. Face, head and thorax white; shoulders yellowish. Forewings light golden brown with white and black markings. In the middle of the wing from base to apex is a broad white streak, slightly edged with black on both sides from base to end of cell; there it broadens out gradually and covers entire apical part of the wing, but is obscured by longitudinal black streaks covering the intervals between the apical veins and leaving the veins indicated by narrow white lines. Extreme costal edge is slightly touched with black; basal part of dorsal edge whitish. Cilia white with four narrow black transverse lines in apical part. Hindwings light silky ochreous; cilia whitish; legs and underside of body white, sparsely mottled with single black scales. Alar expanse, 18 mm.

Habitat: Mesilla Park, New Mexico, at light, May (Cockerell).

U. S. National Museum, type No. 6758.

Abebæa delicatella, sp. nov.

Labial palpi white, second joint sprinkled with a few black scales on the outside, terminal joint with a small black spot at base; tuft on second joint compressed, pointed, longer than the terminal joint. Head and thorax white. The dorsal half of the forewings from base to tornus dark reddish-brown, with strong purple reflections, lighter, more yellowish on the dorsal edge, gradually becoming darker and more purple towards the middle of the wing. Bordering this dorsal part, the

edge of which is sharply defined as a straight central line, is a longitudinal pure white streak. Above this the costal part of the wing is bright golden yellow. The costal yellow part is produced somewhat farther out in the apical part of the wing than is the darker dorsal color, which stops abruptly at tornus. The apical part of the wing is white, delicately mottled with black, each scale having a thin curved black edge. Cilia white, each scale with a straight black edge. Hindwings light silvery ochreous, slightly darker, fuscous towards apex; cilia whitish. Legs white, the anterior two pairs mottled with black. Alar expanse, 16 mm.

Habitat: Yuma County, Arizona. U. S. National Museum, type No. 6759.

I am indebted to my friend, Mr. Wm. D. Kearfott for the type of this species. Cotype is in his collection.

Abebæa cockerella, sp. nov.

Antennæ white, each joint with dark fuscous spot in front. Labial palpi white; tuft on second joint longer than the short terminal joint. Face, head and thorax white with a slight yellowish tint; shoulders very light golden brown. Forewings shining silvery white; from base to tornus along and crossing fold is a broad very light golden brown streak and just below the costal edge is another similar narrower golden streak. Apical edge touched with brown; cilia white. Hindwing light silvery fuscous; cilia white. Legs and underside of body white. Alar expanse, 21 mm.

Habitat: Mesilla Park, New Mexico, at light, April (T. D. A. Cockerell). U. S. National Museum, type No. 6760.

Abebæa nella, sp. nov.

Antennæ white with narrow sharp black annulations. Labial palpi dark canary yellow with the short terminal joint light yellow. Face and head whitish-yellow. Thorax fawn brown. Forewings fawn brown with a faint central streak from base to middle of cell, canary yellow and with apical part of costal edge touched with yellow. At the base just above the yellow streak start three narrow longitudinal lines of bluish-white scales, each of which has the central part black; at the end of the cell the lower of these lines divides into several, following the apical veins; on the fold is a similar but not so well defined line of white black-spotted scales. The entire wing has strong violet reflections. Cilia light fawn-colored. Hindwings rather dark purplish fuscous; cilia yellowish. Legs and underside of body golden white, sprinkled with black; anterior tarsi blackish. Alar expanse, 21 mm.

Habitat: Williams, Arizona, July (Schwarz and Barber). U. S. National Museum, type No. 6761.

Abebæa sublucella *Walsingham*.

Cerostoma sublucella WALSINGHAM, Proc. Zool. Soc. Lond., p. 308, pl. XXXV, fig. 9, 1881.

Cerostoma sublucella RILEY, Smith's List Lep. Bor. Am., No. 519, 1891.

Cerostoma sublucella DYAR, Can. Ent., XXXII, p. 41, 1900.

Cerostoma sublucella DYAR, Bull. U. S. Nat. Museum, 52, No. 5495, 1903.

One cotype ♂ of this species received from Lord Walsingham is in U. S. National Museum.

Habitat: California.

***Abebæa cervella* Walsingham.**

Cerostoma cervella WALSINGHAM, Proc. Zool. Soc. Lond., p. 307, pl. XXXV, fig. 8, 1881.

Cerostoma cervella WALSINGHAM, Insect Life, I, p. 287, 1889.

Cerostoma cervella RILEY, Smith's List Lep. Bor. Am., No. 5195, 1891.

Cerostoma cervella DYAR, Can. Ent., XXXII, p. 41, 1900.

Cerostoma cervella DYAR, Bull. U. S. Nat. Mus., 52, No. 5496, 1903.

Cotype ♂ of this species from California received from Lord Walsingham is in U. S. National Museum.

Also a large series collected by Messrs. Schwarz at Barber at Williams, Arizona.

***Abebæa subsylvella* Walsingham.**

Cerostoma subsylvella WALSINGHAM, Insect Life, I, p. 287, 1889.

Cerostoma subsylvella RILEY, Smith's List Lep. Bor. Am., No. 5196, 1891.

Cerostoma subsylvella DYAR, Can. Ent., XXXII, p. 41, 1900.

Cerostoma subsylvella DYAR, Bull. U. S. Nat. Mus., 52, No. 5497, 1903.

A cotype received from Lord Walsingham is in U. S. National Museum.

Habitat: Vancouver Island, B. C.

In the Museum under this species is also a fine series bred from *Quercus agrifolia* in Alameda Co., California, by Mr. A. Koebele, which differs from Walsingham's type and description in being mottled more strongly and with blacker scales. I leave these specimens under this species with some hesitation, considering these differences and the different locality, since they exhibit some variations and possess the general markings of the type.

***Abebæa querciella*, sp. nov.**

Antennæ white with black annulations. Labial palpi on the outside light brown, on the inside whitish; tuft longer than terminal joint, which is white. Face and head canary yellow. Thorax light reddish-brown. Forewings light golden brown, lightest, more yellowish along the costal edge and with strong silvery and greenish reflections. On the dorsal edge are two faint parallel outwardly oblique darker brown streaks one at basal third and one at the middle of the wing, reaching beyond the fold and two other subobsolete streaks perpendicular to these, all together forming a faint inverted open W. Cilia yellowish-brown. Hindwings light ochreous fuscous; cilia whitish. Legs and underside of body golden white. Alar expanse, 16 mm.

Habitat: Williams, Arizona (Schwarz and Barber).

Food-plant: *Quercus*.

U. S. National Museum, type No. 6762.

Described from a bred specimen. A series of less perfect, evidently somewhat rubbed specimens collected by the same gentlemen at the same locality are before me. They are much lighter, more violaceous and white, suffused with light canary yellow; but they have the same peculiar "W" marking and are probably at most a variety of this species.

Harpipteryx *Hübner*.

Forewings rather broad with apex greatly produced and bent backwards, sickle-shaped; no erect scales; 12 veins, 7 and 8 stalked, 7 to termen, 2 and 3 connate or stalked. Labial palpi with strongly developed porrected tuft which is more than twice as long as terminal joint. Maxillary palpi moderate. Ocelli probably present in all the species though obscured by the scales and difficult to discern in some. Heinemann and Wallengren state that they are absent.

Type: *xylostella* Linné. The European species belonging to this genus are *nemorella* Linné, *blandella* Christoph, *falcella* Hübner, *xylostella* Linné and *affinitella* Staudinger.

The known American species may be separated thus:

- | | |
|--|-----------------------------------|
| Apical half of costal edge of forewings dark purplish-brown..... | 1 |
| Entire costal edge canary yellow..... | canariella <i>Wals.</i> |
| 1. Light dorsal area of forewings with strong upward projection into dark part of forewing | dentiferella <i>W. ls.</i> |
| Light dorsal area without such projection..... | frustella <i>Wals.</i> |

Harpipteryx canariella *Walsingham*.

Cerostoma canariella WALSINGHAM, Proc. Zool. Soc. London, p. 309, pl. XXXV, fig. 11, 1881.

Periclymenobius canariellus RILEY, Smith's List Bor. Am., No. 5240, 1891.

Periclymenobius canariellus DYAR, Bull. U. S. Nat. Mus., 52, No. 5488, 1903.

Cotype received from Lord Walsingham is in the U. S. National Museum; also other specimens from California.

Harpipteryx dentiferella *Walsingham*.

Cerostoma dentiferella WALSINGHAM, Proc. Zool. Soc. London, p. 308, pl. XXXV, fig. 10, 1881.

Periclymenobius dentiferellus RILEY, Smith's List Lep. Bor. Am., No. 5205, 1891.

Periclymenobius dentiferellus DYAR, Bull. U. S. Nat. Mus., 52, No. 5489, 1903.

Cotype of this species received from Lord Walsingham is in the U. S. National Museum.

Habitat: California.

Harpipteryx frustella *Walsingham.*

Cerostoma frustella WALSINGHAM, Proc. Zoöl. Soc. London, p. 309, pl. XXXV, 12, 1881.

Periclymenobius frustellus RILEY, Smith's List Lep. Bor. Am., No. 5203, 1891.

Periclymenobius frustellus DYAR, Bull. U. S. Nat. Mus., 52, No. 5487, 1903.

Cotypes received from Lord Walsingham are in U. S. National Museum.

Habitat: California.

Trachoma Wallengren.

Forewings elongate, apex slightly produced, termen more or less sinuated, tornus rounded; with erect scale tufts; 12 veins, 7 and 8 stalked or separate, 2 and 3 separate. Labial palpi with large dense projecting tuft, longer than terminal joint. Maxillary palpi moderate. Ocelli present.

Type: *asperella*, Linné. To this genus belong the following European species: *persicella* Fabricius, *asperella* Linné, *falcullella* Erschoff, *scabrella* Linné and *horridella* Treitschke.

The American species at present known may be separated thus:

- | | |
|---|-----------------------------------|
| Forewings with short oblique white streak at the end of the cell..... | senex <i>Wals.</i> |
| Forewings without such streak..... | I |
| 1. General color of forewings brownish..... | falciferella <i>Wals.</i> |
| General color of forewings grayish..... | walsinghamiella , sp. nov. |

Trachoma falciferella *Walsingham.*

Cerostoma falciferella WALSINGHAM, Proc. Zoöl. Soc. London, p. 307, pl. XXXV, fig. 7, 1881.

Trachoma falciferella RILEY, Smith's List Lep. Bor. Am., No. 5201, 1891.

Trachoma falciferella DYAR, Bull. U. S. Nat. Mus., 52, No. 5491, 1903.

Cotypes of the species from California, received from Lord Walsingham are in the U. S. National Museum. Lord Walsingham also recorded this species from Oregon.

Trachoma walsinghamiella, sp. nov.

Cerostoma instabilella WALSINGHAM (nec Mann), Proc. Zoöl. Soc. London, p. 306, 1882.

Trachoma instabilella RILEY, Smith's List Lep. Bor. Am., No. 5200, 1891.

Trachoma instabilella DYAR, Bull. U. S. Nat. Mus., 52, No. 5490, 1903.

Antennæ whitish, sharply annulated with black. Labial palpi with tuft on second joint very long, more than twice as long as terminal joint, porrected, whitish, thickly mottled with black. Face and head whitish-gray with a few black scales; thorax light iron gray with a central longitudinal darker, blackish line. Forewings light bluish-gray, overlaid with white, light ochreous, dark gray and black scales. The dark and light scales are so arranged in narrow longitudinal undefined

lines as to give the wing an indistinct striated appearance. The extreme dorsal edge is darker than the rest of the wing, blackish fuscous, and is limited above by a thin wavy more or less interrupted white line. Above this line in the dorsal part of the wing are several small tufts of erect black scales. Cilia dark fuscous. Termen of forewing is hardly sinuate, but the cilia is cut out just below apex and is abruptly longer at the anal angle, giving the wing a falcate appearance. Hindwings rather dark shining fuscous; cilia a shade lighter. Legs and underside of body whitish-gray, mottled with black scales; tarsi blackish. Alar expanse, 20-25 mm.

Habitat: Williams, Arizona (Schwarz and Barber), Mt. Shasta, California (Walsingham). U. S. National Museum, type No. 6764.

Part of the original series determined by Lord Walsingham as *Cerostoma instabilella* Mann is in U. S. National Museum, besides specimens determined at later dates by him as *Trachoma instabilella*. There are also two perfect, authentic European specimens of *Cerostoma instabilella* Mann. I am unable to agree with Lord Walsingham in his determination. His material consisted evidently of flown specimens with most of the erect scales and the details of the ornamentation obliterated, which has affected a superficial resemblance to *instabilella* Mann and the record of this southeast European species from America, a priori highly improbable, is thus not well founded.

It gives me pleasure to name the species in honor of Lord Walsingham.

Trachoma senex *Walsingham*.

Trachoma senex WALSINGHAM, Insect Life, I, p. 288, 1889.

Trachoma senex RILEY, Smith's List Lep. Bor. Am., No. 5202, 1891.

Trachoma senex DYAR, Bull. U. S. Nat. Mus., 52, No. 5492, 1903.

Cerostoma koebelella DYAR, Can. Ent., XXXII, p. 40, 1900.

Cerostoma koebelella DYAR, Bull. U. S. Nat. Mus., 52, No. 5499, 1903.

Dr. Dyar's unique type of *koebelella* (type No. 4422) is a *Trachoma* and, though I have no specimens of *senex* determined by Lord Walsingham, there is no doubt but that Dr. Dyar's species is identical with it. It agrees with Lord Walsingham's description, and bears the same locality label as his type, which he received from the late Dr. Riley. On the reverse of Dr. Dyar's label is written "*Cerostoma*, unnamed. Wlsm., 1886," which shows that Dr. Riley sent a specimen to Lord Walsingham, who subsequently described the species.

Habitat: California.

Theristis *Hübner*.

Forewings very long and narrow; apex strongly produced, with erect scale tufts, 12 veins, 7 and 8 stalked, 7 to ternum, 2 and 3 connate. Tuft on second joint of

labial palpi very long, porrected; terminal joint short. Maxillary palpi present, moderately developed, appressed and obscured from view by the labial palpi. Ocelli absent?

No American species has as yet been discovered and the genus is represented at present by the single European species *mucronella* Scopoli, a good series of which is in the U. S. National Museum.

THE PRICE OF DAIRY PRODUCTS AS INFLUENCING THE ABUNDANCE OF SOME INSECTS.

BY F. M. WEBSTER.

The economic entomologist sometimes meets with curious and far-reaching relationships in the matter of influences of certain factors that it would at first seem preposterous to associate with insects at all. The threadbare story involving the maiden of uncertain age, cats, mice, bumble-bees and red clover seed, however, sometimes finds a parallel.

That the price of dairy products could have any influence on chinch bugs, *Blissus leucopterus*, or any other species not an animal parasite, at first seems improbable, yet such appears to be the case, so closely are insects connected with some of our industries; and as a seeming accentuation of this fact, we have a similar combination of interests in a different part of the country, involving another insect in precisely the same manner and with the same result.

The dairyman cultivates comparatively little land; prefers permanent pastures and meadows to crop rotation, for the reason that the additional labor required to change his crop from grass to grain and back to grass again increases the expense of his business, without materially adding to his profits. In the northern portion of the country, timothy is the favorite, and, in fact, almost universal meadow grass. In previous numbers of this Journal, I have called attention to the two forms or races of chinch bugs, and pointed out the partiality of the eastern or short-winged form for the roots of timothy as a food plant, while the western or long-winged race seldom attacks this grass, and never if it can procure other food.

The short-winged or brachypterous race, once it becomes established in a timothy meadow, does not leave it, but continues to increase and lives by extracting the juices from the bulbous root, with the result that the plant discolors and dies. Timothy meadows, within the

areas inhabited by this short-winged race of chinch bugs, if left for a long series of years without rotation with cultivated crops, got overpopulated with chinch bugs and the whole meadow is destroyed, whereas a rotation not only destroys a large number of the bugs but serves to keep them reduced over large areas of country. In Jefferson and Essex counties, New York, there is at present a serious outbreak of these chinch bugs in timothy meadows, and this has occurred in Ohio in other years. It has been demonstrated that if a crop rotation is generally carried out in a community, this trouble will be prevented.

In Illinois and some portions of Ohio, the long-winged or macrop-terous race of chinch bug is the only one present and the timothy meadows, even of long standing, do not suffer from their ravages. But over such areas, the long standing meadows of the dairyman are attacked by other insects, and, though these are in no manner related to the chinch bug, the results are precisely the same. After a couple of years the insects become so abundant as to kill out the timothy entirely, and not only this, but where corn is planted on these grounds, if plowed in spring, the young corn plants are frequently entirely destroyed by the pests that have developed in the field the previous summer. In this case the insect causing the destruction is *Sphenophorus parvulus*, which deposits its eggs in the bulbous roots of the timothy and the larvæ hatching from these eat out the interior of the roots, killing the grass. In some parts of Ohio I have found this insect very destructive to timothy meadows of several years' standing, besides frequently destroying the young corn the following spring, if this was planted. There are some indications that the insect is becoming more numerous and menacing the corn crop over considerable areas. Dr. Forbes has found that in some sections of Illinois, in meadows of two years' standing, from ten to twenty per cent. of the roots were affected and in those that have stood three or four years, from fifty to seventy-five per cent. are affected, but in any case, if the land be fall plowed, the beetles will leave the field and not attack the crop that follows the next year.

Thus, lucrative prices for dairy products stimulates dairying; this increases the area of timothy meadows and tends to their continuance for a series of consecutive years. This increases the abundance of these insects and consequently the magnitude of their ravages.

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COCCIDÆ OF THE CONIFERÆ, WITH THE DESCRIPTIONS OF TEN NEW SPECIES FROM CALIFORNIA.

BY GEORGE A. COLEMAN.

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This paper includes the descriptions of ten new species of Coccidæ and a list of additional species, all found on conifers in California, a host list showing the distribution of these various coniferous species in the state with the Coccidæ found on each, some brief notes on the economic status of these conifer-infesting Coccidæ, and a complete list of all other records of Coccidæ on coniferous hosts in the world. The collections of, and notes on, the Coccidæ of the California conifers were mostly made in the summer of 1901, during a special trip for the purpose, extending for about one thousand miles through the forests of the northern California coast region. The journey was made on foot with the camp equipment borne on pack animals, so that trails through the heart of the forests and back and forth over the mountain crests could be made. The trip extended through the most important timber region of the state, including parts, or all, of the range of twenty-five species of conifers.

I wish to express my thanks to Professors W. R. Dudley and V. L. Kellogg, of Stanford University, for placing funds at my disposal for the expenses of the trip; to Mr. T. H. Pergande, for comparison of some of my specimens with those in the collection of the Division of Entomology, U. S. Dept. of Agric.; to Mr. Edw. M. Ehrhorn

for material collected by him and for helpful suggestions, and to Mr. T. D. A. Cockerell for kindly reviewing my MS. and specimens, as well as for valuable notes included, with their source indicated, in this paper.

This paper was prepared in the Entomological Laboratory of Stanford University, under the direction of Professor V. L. Kellogg.

Phenacoccus kuwanæ, sp. nov.

Female and Ovisac.—Length about 2.5 mm.; ovisac yellowish-white, short oblong, smooth.

Adult Female.—Length 1.6 mm., width .9 mm.; color yellowish-white; body sparsely covered with a yellowish-white powder; slightly hairy; a great many minute short spines scattered evenly over each segment; a single gland orifice on the lateral margin of each segment; last segment with lateral, marginal groups of several rather long, slender spines, near the base of which are grouped several large gland orifices; just beneath this group there arises a very long hair, with a shorter one on either side near its base. Anal ring with six long, stout hairs. Legs (Plate V, Fig. 1) rather long and slender; tarsus (65μ) about one half as long as tibia (30μ), well armed with long slender hairs; claw long (7μ), slightly curved, with a distinct notch; two stout digitules on ventral side of claw; I have been able to see but one digitule on the tarsus, but presume they are both there. Antennæ (Plate V, Fig. 2), length .7 mm.; nine-segmented, formula, 9, (2, 3), 5, 8, (1, 6, 7), 4; measurements, 1 (12), 2 (22), 3 (20), 4 (10), 5 (13), 6 (12), 7 (12), 8 (13), 9 (25). Each segment with several long, slender hairs as indicated in the figure.

Eggs.—Very light yellow.

Habitat.—Discovered by the author on a species of lichen growing on the weeping spruce, *Picea breweriana*, on the east side, near the summit of the Salmon Mountains, about ten miles west of Salmon Forks, Siskiyou Co., California, August 3, 1901. Only a few specimens were found.

Named for Mr. S. I. Kuwana, of Stanford University.

Type specimen in the entomological collection of Stanford University.

Dactylopius andersoni, sp. nov.

Female with Ovisac.—Length about 6 mm.; ovisac white, oblong, very convex, transversely convoluted and longitudinally bisected by a dorso-median groove.

Adult Female.—Length 3.3 mm., width 1.6 mm.; color lead-gray, covered with heavy white powder; marginal appendages short; caudal filaments short and stout. Body sparingly covered with rather long and stout hairs; a few minute gland openings scattered over the surface, with one larger one on each lateral margin, of each segment; last two abdominal segments armed with marginal groups of two stout spines; last segment with a long stout hair arising just laterad of each group of spines. Anal ring with six long, stout hairs. Legs (Plate V, Fig. 3) short and

stout, not reaching beyond the margin of the body; tarsus one third as long as the tibia; claw stout; the four digitules present, ventral pair very stout; tibia and tarsus armed with numerous long hairs; a single short spine on the inner margin of tibia near the distal end. Antennæ (Plate V. Fig. 4), about .5 mm. in length, eight-segmented, formula, 8, 3, 2, 1, 5, 4 (6, 7); each segment with numerous hairs.

Habitat. — Discovered by the author on *Cupressus goveniana*, in the southern part of Lake Co., California, June 21, 1901. Found by Mr. M. P. Anderson and the author, on *Libocedrus decurrens*, in Scott Valley, Siskiyou Co., Cal., in August, 1901.

In both localities mentioned the trees on which the specimens were found were in well-protected, warm little nooks, in the first instance in a little ravine about half way down the mountain side, in the second, just at the edge of the valley and at the foot of a dry hill.

Note. — Mr. Edward M. Ehrhorn and the author made a careful comparison of specimens of this species with specimens of *D. ryani* in his collection. While we find some resemblance, there are also many marked differences, viz., the ovisac of *D. ryani* is a rather shapeless fluffy mass, while that of *D. andersoni* is perfectly symmetrical and of a very solid construction. There is much difference in the size of the two species and in the antennæ, as will be seen by the following table:

D. andersoni, antennæ, 1 (22), 2 (26), 3 (27), 4 (16), 5 (20), 6 (15), 7 (15), 8 (35).

D. ryani, antennæ, 1 (15), 2 (17), 3 (22), 4 (17), 5 (12), 6 (13), 7 (12), 8 (30).

Type specimens in the entomological collection of Stanford University.

Dactylopius dudleyi, sp. nov.

Adult Female and Ovisac. — The adult female is usually entirely enclosed in a very light, fluffy, white ovisac, in which the eggs are embedded at the upper anterior part, some of the sacs being so loosely constructed that both eggs and female are visible from above. As they are of a very irregular shape, it is very hard to give any exact measurement, but they are on an average, about 2.5 mm. in length.

Adult Female (Plate V, Fig. 5). — The adult female is about 1.6 mm. in length and .6 mm. in width; color grayish-white; body covered with fine whitish powder; marginal appendages not conspicuous, caudal filaments short. Body covered with many fine hairs, which are scattered evenly over each segment, each segment densely pitted with the openings of fine spinning glands, one or two larger ones near the margin; all segments with marginal groups of two or three small spines, eighth abdominal segment with one long hair and several shorter ones on each lateral margin, arising from near the groups of spines, ninth segment armed with marginal groups of

two stout spines; anal ring with six long hairs; legs (Plate V, Fig. 6) very stout, tarsus less than half as long as the tibia, well armed with spines and hairs as indicated in the figure; claw stout, strongly curved, the four digitules present. Antennæ (Plate V, Fig. 7) eight-segmented (some specimens show a tendency of the eighth segment to divide, see Fig. 7), length .36 mm.; formula, 8 (32), 1 (20), 2 (18), 3 (16), 5 (13), 7 (12), 4 (11), 6 (10).

Larva (Plate V, Fig. 8).—The newly hatched larvæ are of a transparent whitish color and about .9 mm. in length; antennæ seven-segmented, formula, 7, 3, 1, 2 (4, 6), 5. Legs about the same as in the adult female, except more slender; body hairs, spinning glands, spines, etc., as in the adult.

The Egg.—The eggs are rounded oval, dark yellow and about .3 mm. in length.

Male.—Not known as yet.

Habitat.—In April, 1901, a few specimens of this species were discovered by the author, on some herbarium specimens of *Cupressus macnabiana*, which were collected by Professor W. R. Dudley, of Stanford University, near Clear Creek, four and one half miles west of Shasta P. O., Shasta Co., Cal., July 19, 1899. As *Cupressus macnabiana* is a very rare cypress, being known but from three or four localities in the state, I paid a visit to the locality above mentioned, Aug. 29, 1901, and found the adult, with young insects very abundant.

The trees on which this coccid are found are situated at an elevation of about one thousand feet in a little flat, in a dry, sandy, chalky soil, and consists of about a dozen small trees, not more than ten feet in height. Several of these trees were literally covered with the insects and none was free from them. This is the only locality from which they have been obtained.

Named for Professor W. R. Dudley, of Stanford University.

NOTE.—*D. ryani* Coq., also found on cypress in California is not the same, it having the last antennal joint 99 μ ; penultimate joint 47 μ . It is also larger and differently colored. (Ckll.)

Type specimens in the entomological collection of Stanford University.

***Aspidiotus californicus*, sp. nov.**

Scale of Female.—Length about 2 mm., width about 1 mm.; oblong-oval and rather conical in form; color blackish with pale edges; exuviae central, reddish-brown. (An examination of hundreds of specimens shows a great variation in form and size; where crowded together on the tree they are small and more nearly circular in outline, but where only a few are on the tree they are larger and more oblong in shape.)

Adult Female.—Length about .9 mm., width about .65 mm.; egg-shaped; color light greenish-yellow; eyes rather large; antennæ reduced to a single large, flat, circu-

lar, basal segment bearing a single long heavy spine; body bearing several rows of long slender hairs. Characters of abdominal margin as follows (Plate V, Fig. 9): there are four pairs of lobes; the median pair are well developed, of medium size, rounded, with a slight lateral notch; second pair not so long as the median, rounded, but with outer corner truncate; third pair inconspicuous, broad, triangular and with terminal margin serrate; fourth pair of the same general shape as the third pair but broader and less conspicuous, terminal margin also serrate; a single broad plate between median lobes, with four or five points; two rather broad plates, with deeply incised margins, between median and second lobes; three broad plates, with deeply incised margins, between second and third lobes; a broad plate with slightly serrated margin, followed by two rather narrow plates with deeply incised margins, between third and fourth lobes; a large dorsal and ventral spine at the base of each lobe. There are five groups of spinnerets; the anterior group consisting of three to five, cephalo-laterals of about eight, caudo-laterals of two to five. (I have examined over a hundred specimens from different localities and on different hosts, and find a considerable variation in the number and grouping of the spinnerets, but the above arrangement seems to obtain in the majority of cases; however, where the anterior laterals consist of three or less, the caudo-laterals correspond.)

Scale of Male. — Smaller, darker colored and with exuvæ nearer one end than in the female.

Adult Male. — I have found the adult male in mounting dried specimens but they were not good enough for description.

Larva. — The newly born larvæ are about .3 mm. in length and about .2 mm. in width; suboval in shape, narrowing anteriorly; color bright yellow; eyes inconspicuous; antennæ very long, five-segmented, formula, 5, 2, 1, 3, 4, segment five much longer than all the others together, ringed and with several stout hairs; legs rather long and stout, femur stout, tibia less than half the length of the tarsus, claw long and slender and slightly curved, digitules of tarsus and claw, long and slender; on the last abdominal segment there is a median pair of lobes which are quite conspicuous; between these lobes there are two large tubercles bearing terminal hairs; other lobes, plates and hairs are not well defined.

Habitat and Distribution. — Discovered by the author on *Pinus sabiniana*, San Felipe Hills, Mt. Hamilton range, alt. 2,700 feet. June 4, 1901. Cobb Mt., Lake Co. June 22, 1901. Supply Creek, Hoopa Valley Indian Reservation, July, 1901 and Scott Valley, Mt. Shasta, and the upper Sacramento region on *Pinus ponderosa*. On *Pinus lambertiana* (herbarium specimens), Santa Lucia Peak, and Sugar Pine Flat, Sierra Nevada Mts. Elevation 7,000 ft.

On *Pinus attenuata*, mts. west of Scott Valley, Siskiyou Co., and S. E. side of Mt. Shasta, Aug., 1901. On *P. ponderosa* (herbarium specimens), Zyanta Creek, Santa Cruz Co.

Type specimen in the entomological collection of Stanford University.

Aspidiotus florenciæ, sp. nov.

Scale of Female.—Length about 3 mm., width 1 mm., of rectangular shape with rounded corners, nearly semi-cylindrical; color light slaty blue, paler at the ends; exuvie bright red, usually situated near one end, but sometimes in the middle.

Adult Female.—Length about 1.4 mm., width about .9 mm.; a remarkably large and elongated body; antenna reduced to a large conical tubercle, with a long heavy spine at the base on the inside and a short tubercle on the outside; body with several long hairs on and near the lateral margin of each segment, a group of several on the cephalic margin between the antennæ, a few short hairs scattered over the body. Characters of the abdominal margin as follows (Plate V, Fig. 10): two pairs of lobes; median pair large rounded, without notches (compare with *A. californicus* in the figure); second pair small, of about the same shape as the median; a pair of gland openings between the median lobes, and a number of others as indicated in the figure; a pair of long serrated plates between first and second lobes; a large, broad, serrated plate laterad of second lobes; a dorsal and ventral spine arising at the outer base of the second lobes, and three more pairs on the lateral margins as indicated in the figure. Four groups of spinnerets, right hand cephalo-laterals composed of about seven, left hand cephalo-laterals of three; right hand caudo-laterals of three, left hand caudo-laterals of about six or seven (I have examined a number of specimens and this rather queer arrangement is the same in all of them).

Larva.—The newly born larvæ are about .2 mm. long and .1 mm. wide; antennæ five-segmented, formula, 5, 2, 1, 3, 4, segment five much longer than all the others together, transversely ringed, with two long lateral hairs; legs rather long and stout, claw slender, slightly curved, digitules present; last abdominal segment with two large lobes between which are two short spines and two very long hairs.

Habitat.—Discovered by the author on herbarium specimens of *Pinus ponderosa*, Pine Ridge, California.

Named for my wife.

NOTE.—“These two species (*A. californicus* and *A. florenciæ*), are very close to one another and to *A. abietes* (Schr.) (Syns. *pini* Comst., and *abietes* Comst.). They are extremely variable as to the lobes (*californicus* I see may have two or three pairs) and glands, and it strikes me as possible that the two species are extreme variations of the one, and that is *abietes*. However, I can hardly believe this, especially as the dorsal glands are less numerous in *californicus* than in *florenciæ*. It is *californicus* which is nearest to *abietes*; it probably is a ‘representative species,’ taking the place of *abietes* in California.

“*A. florenciæ* has some resemblance to *A. cupressi* Ckll. but *cupressi* has only one pair of lobes and the anal orifice is much nearer the hind end than in *florenciæ*. (*Cupressi* lives in Mexico, see Biol. Cent. America.)” (Cockerell.)

Type specimen in the entomological collection of Stanford University.

Aspidiotus coniferarum *Ckll.* var. **shastæ**, var. nov.

Scale of Female. — The outer scale is a thin, transparent, brownish-white cone, about 1 mm. in diameter, with a minute yellowish exuvia at the apex; beneath this shell there is a thick, opaque, reddish-brown skin, enclosing the insect; there is a very thin white ventral scale. The outer scale bears such a close resemblance to the little drops of exuded gum with which the host trees, *Cupressus Macnabiana*, are covered, that it is a very hard matter to distinguish them in the live state, but they fall from the dried branches by the hundred.

Adult Female (Plate VI, Fig. 11). — Length .5 mm., width .4 mm.; body nearly circular in outline; color light brown; a very few minute hairs visible; spines on the margin as indicated in the figure; spiracles with club-shaped protuberances; antennæ reduced to stout spines with tubercular base. Characters of abdominal margin as follows (Plate VI, Fig. 12): a single pair of lobes, which are inconspicuous, broadly rounded, often apparently fused; there is a gland opening between these lobes, with a serrated plate surrounding it, often protruding beyond the lobes (see Fig. 12); a gland opens also, just at the lateral margin of either lobe, where a slight conical plate is sometimes visible; a second and third slight incision, into which glands also open, are situated above the lobes; spines as follows: a very small pair between the median lobes; five pairs of stouter ones are situated at intervals along the margin. No groups of spinnerets.

Larva (Plate VI, Fig. 13). — The young, which are developed in the body of the female, are, at birth, about .2 mm. in length, oblong-oval in form, and of a light lemon-yellow color; margins of thoracic segments marked by pairs of spines; lobes and spines of abdominal segment showing very distinctly; legs rather long and slender; tarsus about three times as long as tibia; with two very long digitules on the dorsal side and a stout spine on the ventral side near the distal end; claw long and slender, slightly curved, with digitules slightly knobbed. Antennæ five-jointed, formula, 5, 1, 2 (3, 4), the fifth is slightly longer than all of the other segments together, with numerous transverse folds and several long hairs; the first segment bears one long hair.

Scale of Male. — I have found small, dark-colored scales along with the female, which I believe to be the male, but not having found the adult insect or the pupa I cannot describe it as such.

Habitat. — Discovered by the author, on *Cupressus macnabiana*, at Clear Creek, near Shasta P. O., Shasta Co., Cal., Aug. 29, 1901, on the same trees with *Dactylopius dudleyi*, where it was also very abundant.

In going over my material in the laboratory, I find specimens which have the same general characters as the above species except that they average much larger, from *Cupressus goveniana*, collected in the southern part of Lake Co., Cal., June 21, 1901. I believe them to be the same species and will so record them until further investigation.

NOTE. — Prof. T. D. A. Cockerell has kindly compared this species with his *A. coniferarum* and also sent me a slide of his species. After carefully comparing them, and reading his description in *Psyche*, I find the following marked differences: my species is much smaller and the single pair of lobes are narrower and shorter than in *A. coniferarum*. I am unable to find in my specimens the second and third pair of lobes which are described for the above species, and as they are also from different hosts, I propose it as a variety.

Type specimens in the entomological collection of Stanford University.

Aspidiotus (subg. **Diaspidiotus**) **ehrhorni**, sp. nov.

Scale of Female. — Nearly circular, very slightly convex; dark gray, with light yellow exuviae at apex; diameter about 2 mm.; covered with minute granules and resembling the lichens under which it is found. Underneath this outer scale is a dark reddish-brown skin enclosing the insect; ventral scale very thin, transparent and white.

Adult Female. — Length .9 mm., width .7 mm.; color light yellow; outline of body subovate. Characters of abdominal margin as follows (Plate VI, Fig. 14): there are five groups of spinnerets, anterior group of two, anterior-laterals of five to nine, posterior-laterals of three to seven; a single pair of large lobes, each rounded, with slight lateral notch on the outer side; between the lobes there is a gland orifice, with a slightly serrated margin; just laterad of each lobe there is a large incision into which a gland opens, and around the margin of which are two or three conical and sometimes serrated plates; a second large incision and gland orifice, with one or two small conical plates, a short distance from the first incision; a third very slight incision, about an equal distance laterad of this second one; spines as follows: a dorsal and ventral pair of short, stout ones just laterad of each lobe, a pair of longer ones between the first and second incision, a pair of about the same size, between second and third incision, a pair of smaller ones at some distance above these.

Scale of Male. — The scale of the male is oblong, about 1 mm. in length; dark gray, with bright red exuviae at one end.

Very near to *A. ancylus* Putnam, but smaller and with a smaller number of spines on the abdominal margin, also with an additional incision.

Habitat. — Discovered by Mr. Edward M. Ehrhorn, concealed among and underneath the lichens on the bark of *Abies concolor*, near Sissons, Mt. Shasta, Siskiyou Co., Cal., Sept. 4, 1901. Also on the bark of *Libocedrus decurrens* at the same locality.

Type specimen in the entomological collection of Stanford University.

Leucaspis kelloggi, sp. nov.

Scale of Female (Plate VI, Fig. 15). — Length 3 mm (larval skin .4 mm., second skin .6 mm., scale 2 mm.); width 1 mm., straight, very convex about the

middle, gradually flattening out posteriorly; color of larval skin lemon yellow, first and second skins light brown with translucent edges; ventral scale formed by a turning in of the lateral edges of the 2d scale, sometimes completely enclosing the insect.

Adult Female (Plate VI, Fig. 16).—The color of the female is transparent, yellowish-white, abdominal segments yellowish; length about 1 mm., width .4 mm.; elongate oval, head flattened anteriorly, thorax cylindrical, with flattened and very conspicuous marginal lobes. Abdominal margin flattened, and with the following characters (Plate VI, Fig. 16, *a*). There are no groups of spinnerets, but a large spinning gland opens into each incision and there are several near each lateral margin of the caudal segment, as there are also several on the lateral margin of each body segment; the median lobes are well developed, rounded, with a slight lateral notch, the second pair are double, about equally developed, of about the same shape as the median, but smaller, the third pair are also double, but the outer ones are smaller than the inner ones, of the same shape and appearance as the second pair, but smaller; the first pair of plates are situated near the inner margins of the median lobes, are rather conspicuous, and have about five points, the second pair are between the median lobes and the first incision, are somewhat less conspicuous than the first and have about four points, the third pair are between the second pair of lobes and the second incisions, are of about the same size as the second pair, and also have four points; there are five deep incisions on either lateral margin, situated as follows: Between first and second pairs of lobes, between second and third pairs of lobes, a double one just laterad of the third pair of lobes and a single one a considerable distance above these. The spines are inconspicuous except the median pairs; they are situated as follows: on both dorsal and ventral margins, between median lobes, laterad of median lobes, laterad of each of the second pair of lobes, laterad of each of the third pair of lobes.

After impregnation the body of the female becomes much swollen and of a dark brown color. It also becomes much elongated and the lateral lobes of each segment are almost obliterated as the young develop (Plate VI, Fig. 17).

The Young Larva (Plate VII, Fig. 18).—The young larvæ, which are developed in the body of the female, are at birth about .4 mm. in length, about .2 mm. in width, of truncate-oval form and milk-white color. Antennæ (Plate VII, Fig. 18, *a*) .08 mm. long, 6-segmented, formula, 6, 5 (3, 1) (4, 2); several long hairs on the sixth segment, a few shorter ones on each of the outer segments. The legs (Plate VII, Fig. 18, *b*) are rather short and stout, femur very stout, tibia and tarsus slender, claw long and slightly curved, with a pair of knobbed hairs dorsally and a pair of digitules ventrally.

Female Larva, First Moul.—After the first moult the larva takes the form of the adult female and begins the construction of its scale, to the anterior part of which the larval skin is attached. The scale when complete, is of the same general appearance and color as that of the adult and about one third as long.

Female Larva, Second Moul.—At the second moult the larva does not change in form, but is considerably larger. It begins a new scale, which when completed, serves as its permanent home as described for the adult female.

Scale of the Male (Plate VII, Fig. 19).—The scale of the male consists of the first larval skin and one scale, which is of the same light brown color as that of the female. Length about 2 mm. (larval skin .4 mm.), width about .8 mm.; straight,

semi-cylindrical about the middle and ending posteriorly rather abruptly; larval skin of the same size, shape and color as that of the female.

Adult Male (Plate VII, Fig. 20). — The adult male is about 1.2 mm. in length and colored as follows: Head white, with purplish tinge; eyes dark purplish; thorax brownish; abdomen purplish; wings smoky, iridescent; legs light brown; antennæ very light, about .65 mm. in length and ten-segmented, formula, 3 (4, 5, 6) (7, 8) 9, 10, 2, 1. The wings are about as long as the entire body, very light colored and minutely haired. The legs are long and slender, slightly hairy as indicated in the figure; claw long and slender, slightly curved, with a pair of long knobbed hairs dorsally, and a pair of shorter digitules ventrally.

The Young Male Larva. — The young male larva is similar to that of the female, hence needs no description.

Male Larva, First Moults. — At the first moult the male larva still has the same form as that of the female, but during this stage it grows considerably larger than that of the female of the corresponding stage.

Pupa of Male. — After completing its external scale, the larva changes to the pupa state, remaining in the larval skin until antennæ, legs and wings show quite plainly in their development, when the larval skin is shed together with the mouthparts, and the pupa is complete.

Finally the adult male is formed and after lying quietly in place under the scale, which has served as a case for all of the above transformations, for some time, it emerges from the anterior part of the scale, pushing off the larval skin in its exit.

Habits. — The females are usually found singly on the under side near one margin of the needles of the red fir (*Pseudotsuga taxifolia*), although I have found several on one needle and have also found them thickly massed about the base of the needles of *Abies magnifica*, from high altitudes. The males are usually found singly on a needle, though more often than with the female, several are found on the same needle. Occasionally males and females are found together.

I have found the adult female throughout the entire year, but specimens in the gravid state were found in the Stanford arboretum in January, February, March and December, 1901; near Usal, Mendocino Co., July, 1901; at Shasta Camp, Mt. Shasta, August 19, 1901, and at Dunsmuir, Siskiyou Co., August 25, 1901.

Males in the young stages were found in Mendocino Co., throughout July, 1901; at Shasta Camp, Mt. Shasta, August 19, 1901; at Dunsmuir, Siskiyou Co., August 25, 1901. A few empty scales were found at each of these places. I found the young males on trees in the Stanford arboretum in Oct. and Nov., 1901, and dissected out several perfect males Nov. 15, 1901. They were very numerous about Dec. 1, but by Dec. 24 were very scarce.

Newly born larvæ were found on the white fir (*Abies concolor*), at Shasta Camp, Aug. 19, and on the red fir (*Pseudotsuga taxifolia*), in the Stanford arboretum, Dec. 15, 1901.

At nearly all stations where studied the young we found in all stages of development. It would seem from this that there is no well-defined breeding season and that breeding goes on throughout the year, the abundant season varying with the elevation and climate.

Distribution.—The first specimens were found by the author, on the red fir (*Pseudotsuga taxifolia*), near Saratoga Summit, Sierra Moreno Range, about twenty-five miles south of Stanford University, July 6, 1900. These specimens were sent to the Division of Entomology, U. S. Dept. of Agriculture, where Mr. Pergande identified them as a *Leucaspis*, sp. Since this first date I have found them on the red fir as follows: Mountains West of Napa City, Napa Co., June 17, 1901; Cobb Mt. and hills about it, Lake Co., June 21, 1901; mts. near Blue Lakes, Lake Co., June 25, 1901; from the head of Big River, Mendocino Co., all through the Coast Range to near Mendocino City, thence northward and throughout a forest of this species about thirty miles in width, in the northeast part of Humboldt Co., in June, 1901, and near Dunsmuir, Siskiyou Co., August 25, 1901.

I have also found this scale on *Abies grandis*, near Casper and Rockport, Mendocino Co.; on *Abies concolor* near Salmon Forks, Siskiyou Co., and at Shasta Camp, Mt. Shasta; in Stanford arboretum and on some herbarium specimens of *Abies magnifica* from La Porte, Pulmas Co., and from "Trail to Sentinel Dome," Yosemite: on the Shasta fir (*Abies shastensis*), near the east side of the summit of range, west of Salmon Forks, Siskiyou Co., California.

Evidently the scale is not confined to *Pseudotsuga taxifolia* although it seems to be most abundant on that species.

Type specimens of the entomological collection of Stanford University.

Leucaspis cupressi, sp. nov.

Scale of Female (Plate VII, Fig. 21).—Length 1 mm.; larval skin very minute, light yellow; second skin light, brownish-white, nearly circular; scale transparent white, oblong; the whole forming a very convex and irregularly curved scale.

Adult Female (Plate VII, Fig. 22).—Length .8 mm., width .4 mm., egg-shaped; color transparent white; segments of body very obscure. Characters of abdominal margin as follows: a single pair of lobes, rounded, with a slight lateral notch, plainly visible, but not conspicuous; a slight incision caudo-laterad of each

lobe and a slightly larger one considerably removed cephalo-lateral from each lobe; spines, four between the lobes, one between the lobes and second incision, and two cephalo-laterad of each second incision; dorsal spinning glands grouped on each lateral margin of each one of the body segments, anterior lateral groups of last segment of twenty to thirty, posterior laterals about ten.

Young Larva (Plate VII, Fig. 23). — The young larvæ, which are developed in the body of the female, are at birth about .23 mm. long, .13 mm. wide, of a broadly oval form and light yellow color; antennæ six-segmented, formula, 6, 1, 3, 2 (4, 5), a single terminal hair, one long hair near the base, a shorter one near the end and one near the middle of the sixth segment, a long hair on the first segment, and very minute hairs on each of the other segments, as indicated in the figure (Plate VII, Fig. 23, *a*); legs very stout (Plate VII, Fig. 23, *b*), tarsus stout and curved, with a pair of very long knobbed hairs about the middle, dorsally, and a long hair just below these; claws very long, stout, and slightly curved, with a pair of knobbed digitules at base. Abdominal margin plain with two very long hairs.

Male not known.

Habitat. — Discovered by the author on *Cupressus goveniana*, about six miles north of the southern line of Lake Co., on the Toll road between Calistoga and Lakeport, California, June 21, 1901. This is the only locality from which it has been obtained as yet.

Type specimens in the entomological collection of Stanford University.

Physokermes taxifoliæ, sp. nov.

In June, 1900, Mr. Edw. M. Ehrhorn and the author found on the red fir (*Pseudotsuga taxifolia*) at Stevens Creek, Santa Clara Co., California, numerous specimens of the adult and young of a *Physokermes*, which after a careful comparison with *P. insignicola* Craw., we find to be very near to that species except for the following differences, viz.: The color is uniform light, mahogany brown, while that of *insignicola* is very dark or almost black; measurements of antennæ, in microns:

P. taxifoliæ, 90, 180, 150, 60, 80, 130, formula, 2, 3, 6, 1, 5, 4.

P. insignicola, 100, 280, 150, 110, 80, 150, formula, 2, (3, 6) 4, 1, 5.

The young are essentially the same in both species.

In the summer of 1901 I found this *Physokermes* on *Pseudotsuga taxifolia*, all through the coast counties of northern California, and wherever found they were of the same color. As this color is so constant and the scale insect seems to be confined to *Pseudotsuga taxifolia*, we propose it as a new species.

Type specimens in entomological collection of Stanford University.

Physokermes concolor, sp. nov.

July 31, 1901, the author found on the white fir (*Abies concolor*), near the summit of the Salmon Mts., west of Salmon Forks, Siskiyou Co., California, three specimens of the female of a *Physokermes* and later the young were obtained from these specimens.

While the young of this species is essentially the same as that of *P. taxifoliæ* and *P. insignicola*, the adults are very much lighter in color, being very light brown or fulvous and in the live state marked with a dark line along the dorso-median groove. Antennæ in microns, 120, 150, 150, 80, 70, 200, formula, 6 (2, 3), 1, 5, 4.

NOTE.—The differences in these two species and in comparison with *P. insignicola* are very hard to describe and yet with the three species before me I feel that they should be separated.

Type specimens in the entomological collection of Stanford University.

SPECIES OF COCCIDÆ FOUND ON CONIFEROUS HOSTS IN CALIFORNIA,
WITH LOCALITY.

Eriococcus araucariæ Mask. On *Araucaria excelsior*, Hopkins Place, Menlo Park. (Introduced.)

Phenacoccus kuwanæ, sp. nov. On *Picea breweriana*, Salmon Mts., near Salmon Forks, Siskiyou Co.

Dactylopius sequoiæ Coleman. On *Sequoia sempervirens*, Sierra Moreno Mts. and Coast Range as far north as Humboldt Co.

Dactylopius andersoni, sp. nov. On *Cupressus goveniana*, Lake Co. and on *Libocedrus decurrens*, Scott Valley, Siskiyou Co., and upper Sacramento region.

Dactylopius dudleyi, sp. nov. On *Cupressus macnabiana*, Clear Creek, Shasta P. O., Shasta Co.

Physokermes insignicola Craw. On *Pinus insignis*, Stanford grounds.

Physokermes taxifoliæ, sp. nov. On *Pseudotsuga taxifolia*, Stevens Creek, Sierra Moreno Mts., and all the Coast Range as far north as the Salmon Mts.

Physokermes concolor, sp. nov. On *Abies concolor*, Salmon Mts., west of Salmon Forks, Siskiyou Co.

Lecanium hesperidum L. On *Abies concolor*, Stanford arboretum.

- Lecanium oleæ** Bern. On *Tumion californicum*, Stanford arboretum.
- Aspidiotus hederæ** Vall. On *Sequoia sempervirens*, Sierra Moreno Mts., near Stanford University.
- Aspidiotus rapax**. On *Sequoia gigantea*, Stanford arboretum.
- Aspidiotus abietes** Comst. On *Pseudotsuga taxifolia*, Stanford arboretum and all through the Coast Range.
- Aspidiotus californicus**, sp. nov. On *Pinus lambertiana*, Sugar Pine Flat, el. 7,000 ft., Sierra Nevada Mts.; *Pinus ponderosa*, Pine Ridge, Zyanta Creek, Santa Cruz Co., Cobb Mt., Lake Co., Hoopa Ind. Res., all through the mountains in Siskiyou Co., on Mt. Shasta and in northern Shasta Co.; *Pinus sabiniana*, San Felipe Hills, Mt. Hamilton Range, el. 2,700 ft., near Cobb Mt. and Lake Port, Lake Co., Hoopa Valley, upper Sacramento R. region, Shasta Co.; *Pinus coulteri*, east side of Mt. Hamilton, el. 3,700 ft., Mt. Lewis, el. 3,600 ft.; *Pinus attenuata*, mts. west of Scott Valley, Siskiyou Co., Mt. Shasta.
- Aspidiotus florenciæ**, sp. nov. On *Pinus ponderosa*, Pine Ridge.
- Aspidiotus coniferarum**, var. **shastæ**. On *Cupressus macnabiana*, Clear Creek, Shasta Co., and on *Cupressus goveniana*, southern Lake Co.
- Aspidiotus ehrhorni**, sp. nov. On *Abies concolor* and *Libocedrus decurrens*, Shasta Camp, Mt. Shasta (collected by Edw. M. Ehrhorn).
- Chionaspis ceruela** Targ. On *Cupressus goveniana*, Stanford arboretum.
- Mytilaspis newsteadi** Sulc. On *Sciadopitys verticellata*, Campbell Place, near Stanford University. (Determined by Mr. T. H. Pergande and said to be the first record of this species in this country.) Probably introduced from Japan.
- Chionaspis pinifolia** Fitch. On *Pinus monticola*, near Clouds Rest Peak, Yosemite; near Salmon Forks, Siskiyou Co.; *Pinus lambertiana*, Santa Lucia Peak; Hoopa Valley Indian Reservation; Sugar Pine Flat, Sierra Nevada, 7,000 ft.; *Pinus albicaulis*, Black Butte, Siskiyou Co., above 6,000 ft.; *Pinus torreyana*, Soledad Creek; *Pinus ponderosa*, Pine Ridge; mts. in Lake Co.; Hoopa Valley Ind. Res.; all through the mountains in Siskiyou Co.; Mt. Shasta; northern Shasta Co.; *Pinus ponderosa* var. *jeffreyi*, Glacial

Point, Yosemite; *Pinus murrayana*, dry foothills, Del Norte Mts., Del Norte Co.; *Pinus sabulata*, San Felipe Hills, Mt. Hamilton Range, el. 2,700 ft., mts. in Lake Co.; Hoopa Valley Ind. Res.; Sacramento River region, in northern Shasta Co.; *Pinus coulteri*, east side of Mt. Hamilton; near Indria; *Pinus radiata*, Stanford arboretum; *Pinus attenuata*, mts. west of Napa City, Napa Co.; mts. west of Scott Valley, Siskiyou Co.; *Pinus muricata*, near Mendocino City, Mendocino Co.; *Pseudotsuga taxifolia*, Stanford arboretum; *Abies concolor*, Stanford arboretum; *Libocedrus decurrens*, Lake Co.; Hoopa Valley Ind. Res., Scott Valley, Siskiyou Co.; upper Sacramento region; *Tumion californicum*, Stevens Creek; Blue Lakes, Lake Co.

Leucaspis kelloggi, sp. nov. On *Pseudotsuga taxifolia*, Sierra Moreno Mts.; Stanford arboretum; mts. west of Napa City, Napa Co.; near head of Big River, and Usal, Mendocino Co.; Dunsmuir, Siskiyou Co.; *Abies grandis*, hills between Mendocino and Fort Bragg, and near Rockport, Mendocino Co.; *Abies concolor*, Sentinel Dome, Yosemite; Salmon Mts., west of Salmon Forks, Siskiyou Co.; Shasta Camp, Mt. Shasta, el. 3,700 ft.; Stanford arboretum: *Abies magnifica*, by trail to Sentinel Dome, Yosemite; La Porte, Plumas Co.; *Abies shastensis*, Salmon Mts., near summit of range west of Salmon Forks, Siskiyou Co.

Leucaspis cupressi, sp. nov. On *Cupressus goveniana*, southern Lake Co., about six miles north of the county line near toll road, Calistoga to Lakeport.

HOST LIST, SHOWING DISTRIBUTION OF THE CONIFERS AND THE SPECIES OF COCCIDÆ FOUND ON EACH.

Pinus monticola DOUGL. Silver Pine.—*Chionaspis pinifolia*, Just below Clouds Rest Peak, Yosemite; near forks of Salmon River, Siskiyou Co.

Pinus lambertiana DOUGL. Sugar Pine.—*Chionaspis pinifolia*, Santa Lucia Peak; southern Lake Co.; Hoopa Valley Ind. Res.; *Aspidiotus californicus*, Sugar Pine Flat, 7,000 ft., Sierra Nevada.

Pinus albicaulis ENGELM. White-bark Pine.—*Chionaspis pinifolia*, Black Butte, above 6,000 ft., Siskiyou Co.

Pinus torreyana PARRY. Torrey Pine.—*Chionaspis pinifolia*, Soledad Creek.

- Pinus ponderosa* LAWS. Bull Pine.—*Chionaspis pinifolia*, Pine Ridge; near summit of mts., southern Lake Co.; line and Cobb Mt., Lake Co.; Hoopa Valley Ind. Res.; near Salmon Forks and all along through the mountains in southern Siskiyou Co., Mt. Shasta, northern Shasta Co.; *Aspidiotus florenciæ*, Pine Ridge; *Aspidiotus californicus*, Pine Ridge; Zyanta Creek, Santa Cruz Co.; Cobb Mt., Lake Co.; near head of Supply Creek, Hoopa Valley, Ind. Res.; Salmon Forks, all through the mountains of southern Siskiyou Co., including Mt. Shasta and in northern Shasta Co.
- Pinus jeffreyi* "Oreg. Com." Jeffrey Pine.—*Chionaspis pinifolia*, Glacial Point Yosemite; near Salmon Forks, Siskiyou Co.
- Pinus murrayana* "Oreg. Com." Lodgepole Pine.—*Chionaspis pinifolia*, dry foothills, Del Norte Mts., Del Norte Co.
- Pinus sabiniana* DOUGL. Gray Pine.—*Chionaspis pinifolia*, San Felipe Hills, Mt. Hamilton Range, alt. 2,700 ft.; near Cobb Mt., and Lakeport, Lake Co.; Hoopa Valley; Upper Sacramento region, Shasta Co.; *Aspidiotus californicus*. Same localities as above.
- Pinus coulteri* LAMB. Coulter Pine.—*Chionaspis pinifolia*, east side of Mt. Hamilton; near Indria; *Aspidiotus californicus*, east side of Mt. Hamilton, alt. 3,700 ft.; Mt. Lewis, alt. 3,600 ft.
- Pinus radiata* DON. Monterey Pine. *Pinus insignis* DOUGL.—*Chionaspis pinifolia*, Stanford University arboretum; *Physokermes insignicola*, Stanford University arboretum; *Lecanium hesperidum*, Stanford University arboretum; *Aspidiotus hederæ*, Stanford arboretum.
- Pinus attenuata* LEMMON. Knobcone Pine.—*Chionaspis pinifolia*, high mts. west of Napa, Napa Co.; mts. west of Scott Valley, Siskiyou Co.; *Aspidiotus californicus*, Mt. Shasta; mts., west of Scott Valley, Siskiyou Co.
- Pinus muricata* DON. California Swamp Pine.—*Chionaspis pinifolia*, three miles east of Mendocino City, and thence northward all along the coast, to near Rockport.
- Picea breweriana* WATS. Weeping Spruce.—*Phenacoccus kurwanæ*, Salmon Mts., west of Salmon Forks (near summit of range on east side), Siskiyou Co.

- Pseudotsuga taxifolia* (LAM.) BRITTON. Douglas Spruce.—*Chionaspis pinifolia*, Stanford arboretum; *Aspidiotus abietes*, Stanford arboretum; mts. west of Napa, Napa Co.; near head of Big River and near Usal, Mendocino Co.; near Dunsmuir, Siskiyou Co.; *Physokermes taxifolia* (Douglas Spruce or Red Fir), Stevens Creek, Santa Clara Co.; mts. west of Napa, Napa Co.; near head of Big River, Mendocino Co.; near Dunsmuir, Siskiyou Co.
- Abies grandis* LINDL.—Lowland Fir. *Leucaspis kelloggi*, hills between Mendocino City and Fort Bragg, and near Rockport, Mendocino Co.
- Abies concolor* (GORD.) Parry White Fir.—*Leucaspis kelloggi*, Sentinel Dome, Yosemite; Salmon Mts., west of Salmon Forks (near summit of range on east side), Siskiyou Co.; Shasta Camp, Sissons, alt. 3,700 ft.; Stanford arboretum; *Physokermes concolor*, Salmon Mts. (near summit of range on east side), west of Salmon Forks, Siskiyou Co.: *Chionaspis pinifolia*, Stanford arboretum; *Lecanium hesperidium*, Stanford arboretum.
- Abies sastensis* LEMMON. Shasta Fir.—*Leucaspis kelloggi*, Salmon Mts. (near summit of range on east side), west of Salmon Forks, Siskiyou Co.
- Abies magnifica* MURR. Red Fir.—*Leucaspis kelloggi*, by trail to Sentinel Dome, Yosemite (herb. specimens).
- Sequoia sempervirens* (LAMB.) ENDL. Redwood.—*Dactylopius sequoie*, Sierra Moreno Mts.; mts. west of Napa City, Napa Co.; all through the redwood belt, as far north as Humboldt Bay; *Aspidiotus hederæ*, Sierra Moreno Mts.
- Sequoia washingtoniana* (WINSL.) SUDWORTH. Bigtree. On some cultivated trees of this species in Stanford arboretum, I find *Aspidiotus rapax* very abundant. As this scale is quite common on other trees in the arboretum, they have probably migrated to this host.
- Libocedrus decurrens* TORR. Incense Cedar.—*Chionaspis pinifolia*, Lake Co.; near head of Supply Creek, Hoopa Valley Ind. Res.; Scott Valley, Siskiyou Co.; upper Sacramento.
- Cupressus macrocarpa* HARTW. Monterey Cypress.—*Dactylopius ryani*, Monterey Co. (Coquillett).
- Cupressus goveniana* GORD. Gowen Cypress.—*Dactylopius andersoni*, southern Lake Co.; *Leucaspis cupressi*, Lake Co.; *Aspidiotus coni-*

ferarum var. *shastæ*, Lake Co.; *Diaspis carueli*, Stanford arboretum.

Cupressus macnabiana MURR. Macnab Cypress.—*Dactylopius dudleyi*, near Clear Creek (four and one half miles west of Shasta P. O.), Shasta Co.; *Aspidiotus coniferarum* var. *shastæ*, same locality as above.

Tumion californicum (TORR.) GREENE. California Torreya.—*Chionaspis pinifolia*, Stevens Creek and Blue Lake, Lake Co.; *Phenacoccus*, sp., Stevens Creek (Ehrhorn); *Lecanium oleæ*, Stanford arboretum.

CULTIVATED EXOTIC SPECIES.

Pinus strobus LINN. White Pine.—*Chionaspis pinifolia*, Stanford arboretum; *Aspidiotus californicus*, Stanford arboretum.

Picea abies. Norway Spruce.—*Chionaspis pinifolia*, Cedro Place, Stanford University; *Lecanium hesperidum*, same locality as above.

Thuja orientalis.—*Diaspis carueli*, Stanford arboretum.

Juniperus communis LINN. Dwarf Juniper.—*Diaspis carueli*, Stanford arboretum.

Sciadopitys verticellata. Parasol Fir.—*Mytilaspis newsteadi*, Campbell Place, near Stanford University.

Araucaria excelsior. Norfolk Island Pine.—*Eriococcus araucariæ*, Hopkins Place, near Menlo Park.

NOTES ON ECONOMIC STATUS.

The following brief notes on the distribution, abundance and injurious effects of the coniferous Coccidæ may be of interest:

It is evident from a study of the records that *Chionaspis pinifolia* is the most cosmopolitan species, *i. e.*, is found on a greater number of species of conifers, is more generally distributed and is found at a greater range of altitude (sea level to 7,000 feet) than any other species. It occurs in such numbers, along with *Physokermes insignicola*, on the Monterey pine (*Pinus insignis*), on the Stanford Ranch, as to be very injurious to the trees; indeed these trees are slowly dying, the needles first turning yellow, finally dying and dropping off. It is very abundant on almost all species of conifers infested by them, especially where the trees are on a dry hillside or in a hot interior valley, and in several instances I thought them to be very injurious.

On Cobb, Mt. Lake Co., I found a group of yellow pines (*Pinus ponderosa*), which was evidently being killed by *Aspidiotus californicus*. A group of half a dozen trees, about 6 to 8 inches in diameter and 60 to 70 feet high, were literally covered from bottom to top with these Coccidæ; though the trees were still alive, the needles were so pale and discolored as to give the trees a very sick appearance. A few rods from these trees stood another group of three, which had evidently succumbed the year previous, as the dead needles were still hanging to the limbs. A careful inspection of the trees showed them to be covered with the same species of scale as the neighboring trees and that the injury had not been caused by other insects. A fire had gone through the forest the year before, and although it had destroyed many trees, this group had not been touched, as they stood by the roadside, thus being isolated from the main forest. Hence I think it fair to conclude that the trees were killed by the scale insects. This species, *A. californicus*, is a close second in its abundance and range of distribution in this state to *Chionaspis pinifolia*.

Macnab's cypress (*Cupressus macnabiana*) is very limited in its distribution and in number of individuals. The group at Clear Creek, Shasta Co., consists of about a dozen small trees, all of which are very badly infested with *Dactylopius dudleyi* and *Aspidiotus coniferarum* var. *shasta*, so much so that it seems to me this small grove of a very rare species is doomed to speedy extinction.

Leucaspis kelloggi is found on all the species of firs with which I am acquainted and is widely distributed over the state. While no serious injury from this species is apparent, it is sufficiently abundant in most localities to become injurious should the conditions favor its increase.

The conifer-infesting Coccidæ are most numerous, in both numbers of individuals and species, in the hot interior valleys and on dry hillsides, at about 1,000 to 3,000 feet elevation, or what corresponds in most cases to the upper Sonoran zone, and usually on the young growth which has been left after lumbering the region, or has come up after a fire has gone through the forest. In the fog belt or the great lumber belt of the coast range there are very few species or individuals in the virgin forests, but where the region has been lumbered or a fire has gone through a few years before they are more numerous. Near the coast they are scarce, except in dry plateaus or hillsides, where somewhat protected from the cold ocean breeze.

Remedies. — The question of the destruction of these insects is one which will require much further study, and is, I believe, of sufficient importance to warrant further investigation.

In the present state of our forestry operations in California it is of course impractical to spray or fumigate the forest trees, except by individual owners in limited areas, or where it is desired to preserve some cultivated species. However, a number of species of these coccidæ harbor from one to several species of parasites, which in most cases, except where the conditions are extremely favorable for the increase of the scale insects, are very effective in keeping them in check.

The proper solution of this problem will only come with the development of a proper forestry system for our extensive forest areas in California, as well as in other states. When we have competent foresters and forest entomologists we can look to them to see that badly infested trees are destroyed and that proper parasites are introduced.

PREVIOUS RECORDS OF COCCIDÆ FOUND ON CONIFEROUS HOSTS, WITH
REFERENCE BIBLIOGRAPHY.

- Monophlebus hellenicus** *Gennadius*. On *Pinus halepensis*. (Cockerell, Food-Plants of Scale Insects, p. 773, Proc. U. S. Nat. Mus. XIX.)
- Monophlebus burmeisteri** *Westw.* On *Pinus*, sp., Yokohama, Japan, and on *Ficus*, sp., China. Also on *Gardenia florida*, Hongkong, China. (Maskell, Trans. N. Z. Inst., Vol. XXIX, p. 328.) Also on *Pinus*, sp., Yokohama, Japan. (Kuwana, Coccidæ of Japan, Proc. Calif. Acad. Sci., Vol. III, No. 2, p. 46.)
- Icerya purchasi** *Mask.* On pines and firs. (Maskell, Scale Insects of New Zealand, p. 113.) On cypress (*ibid.*, p. 112.)
- Eriococcus gilletti** *Tinsley*. On *Juniperus virginianus*, Salida, Colorado. (Can. Ent., Vol. XXXI, 1889, p. 46.)
- Eriococcus araucaria** *Mask.* On Norfolk Island pine (*Araucaria*). (Maskell, Scale Insects of New Zealand, p. 113; Comstock, 2d, Cornell Report, p. 137) (as *Rhizococcus*).
- Eriococcus phyllocladi** *Mask.* On *Phyllocladus trichomanoides*, D. Don., New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIV, p. 25.)

- Puto attenuata** *Sign.* On *Pinus cembra*. (Signoret, Essai sur les Coch., p. 375.)
- Rhizococcus totaræ** *Mask.* On *Podocarpus totaræ* and on *Fagus menziesii*, near Reefton, N. Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXII, p. 142.)
- Dactylopius ryani** *Cog.* On *Thuja orientalis*, California. (Coquillet, West American Scientist, 1889, p. 122.) Also on *Cupressus macrocarpa* and *Araucaria excelsa*, California. (*Ibid.*)
- Dactylopius aurilentus** *Mask.* On *Araucaria bidwilli* Hooker and *Araucaria excelsa*, Auckland, N. Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXII, p. 152.)
- Dactylopius pini** *Kuwana.* On *Pinus*, sp., Kiushu, Japan, and on *Pinus pentaphylla*, Tokyo, Japan. (Kuwana, Coccidæ of Japan, Proc. Calif. Aca. Sci., Vol. III, p. 54.)
- Phenacoccus minimus** *Tinsley.* On *Picea pungens*, Fort Collins, Colo. (Can. Ent., Vol. XXX, p. 223.)
- Ceroplastes rubens minor** *Mask.* On *Pinus sinensis* and on *Pinus thunbergii*, China. (Maskell, Trans. N. Z. Inst., Vol. XXIX, p. 309.)
- Pulvinaria maskelli** *Oliff* var. **spinosior** *Mask.* On *Frenela* or *Callistris robusta*, South Australia. (Maskell, Trans. N. Z. Inst., Vol. XXVI, p. 78.)
- Ctenochiton dacrydii** *Mask.* On *Dacrydium cupressinum*, New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIV, p. 18.)
- Physokermes insignicola** *Craw.* On *Pinus insignis*, Golden Gate Park, San Francisco, Calif. (Cockerell, Can. Ent., 1895, p. 258.)
- Physokermes abietes** *Modeer* (*Lecanium piceæ*). (Signoret, Essai sur les Coch., p. 273.) Newstead cites it only from *Abies* (Ent. Month. Mag., 1893, p. 209). On *Abies excelsa* in Europe. (Cockerell, Food-Plants of Coccidæ, Proc. U. S. Nat. Mus., Vol. XIX, p. 773.)
- Physokermes coloradensis** *Ckll.* On spruce, Manatou, Colorado. (Gillette and Baker, Hemiptera of Colorado, p. 126.)
- Lecanium parvicorne** *Ckll.* On *Pinus*, Florida, U. S. (Psyche, July, 1897, p. 90.)

- Lecanium pini** *King*. On *Pinus austriaca*, London, Ontario. (Can. Ent., 1901, p. 334.)
- Lecanium oleæ** *Bern*. On Irish juniper, cedar of Lebanon and Indian cedar, Los Angeles Co., California. (Coquillett, Bull. 26, Div. of Ent. U. S. Dept. of Agric., pp. 28-29.)
- Lecanium fletcheri** *Ckll*. On juniper, N. Y. (Pettit, Bull. 7, Cornell Univ. Exp. St., p. 341.)
- Lecanium pallidior** *Ckll* and *King*. On *Chamaecyparis thyoides* Methuen, Mass. (Cockerell and King, Psyche, Vol. VIII, p. 349.)
- Lecanium minimum pinicola**. On *Pinus insignis* Dougl., Cape of Good Hope, S. Africa. (Maskell, Trans. N. Z. Inst., Vol. XXIX, p. 310.) See also Ent. Mo. Mag., 1896, p. 225.
- Aspidiotus abietes** *Schränk*. On pitch pine, Ithaca, N. Y. (Comstock, Agric. Report, 1880, p. 306.) (Syn. *Asp. pini*.) On under surface of hemlock leaves (*Abies canadensis*), Ithaca, N. Y. (Comstock, 2d, Cornell Rep., 57.) On pitch pine, Karner, N. Y. (Bull. N. Y. State Museum, Vol. IX, No. 46.) On *Pinus sylvestris*, Prague, Bohemia. (Cockerell, Can. Ent., 1894, p. 190.)
- Aspidiotus nerii** *Bouche*. On cones of arbor vitæ (*Thuja occidentalis*), California. (Coquillett, Bull. 26, Div. Ent. U. S. Dept. Agric., p. 20.)
- Aspidiotus (Diaspidiotus) glanduliferus** *Ckll*. On branches of *Pinus sylvestris*, Columbus, Ohio. (Cockerell, Ohio Nat., Vol. II, No. 8.)
- Aspidiotus cupressi** *Ckll*. On *Cupressus* (Koeble), Toluca, Mexico. (Biol. Cent. America, p. 23.)
- Aspidiotus aurantii** *Mask*. On *Podocarpus*, Honolulu (on trees from Japan). (Maskell, Trans. N. Z. Inst., Vol. XXVII, p. 41.) On *Podocarpus chinensis*, Yokohama, Tokyo, and Wakayamaken. (Kuwana, Coccidæ of Japan, Proc. Calif. Acad. of Sci., Vol. III, No. 2, p. 70.)
- Aspidiotus hederæ** *Val*. On leaves of *Pinus*, Oaxaca, Mexico, Aug. 20, 1897. (Koeble, 1897, pars.) (Ckll.) On *Pinus*, Mexico. (Cockerell, Mag. Nat. Hist., Feb. 1899, p. 167.)
- Aspidiotus lataniæ** *Sign*. On *Abies firma*. Nishigahara, Agric. Exp. Station, Tokyo. (Kuwana, Coccidæ of Japan, Proc. Cal. Acad. of Sci., Vol. III, No. 2, p. 68.)

- Aspidiotus cryptomeria** *Kuwana*. On *Cryptomeria japonica*, Gifu-ken, Japan. (Kuwana, Coccidæ of Japan, Proc. Cal. Acad. of Sci., Vol. III, p. 69.)
- Chrysomphalus dictyospermi** *Morgan*. On leaves of *Pinus*, Oaxaca, Mexico, Aug. 20, 1897. (Koeble, 1897 pars.) (Ckl.)
- Poliaspis pini** *Mask*. On *Pinus densiflora*. (Maskell, Trans. N. Z. Inst., Vol. XXX, p. 231.)
- Mytilaspis newsteadi** *Sulc*. On *Pinus sylvestris*, Bohemia. (Cockerell, Food-Plants of Coccidæ, Proc. U. S. Nat. Museum, Vol. XIX, p. 773.)
- Mytilaspis abietes** *Sign*. On *Abies excelsa*, Europe. (Signoret, Essai sur les Coch., p. 135; Comstock, 2d, Cornell Rep., 1880, p. 121.)
- Mytilaspis pallida** *Green* (var.). On *Podocarpus*, sp., Honolulu, H. I. (on trees from Japan). (Maskell, Trans. N. Z. Inst., Vol. XXII, p. 46.)
- Mytilaspis citricola** *Pack*. On *Taxus cuspidata*, Japan. (Kuwana, Coccidæ of Japan, Proc. Cal. Acad. Sci., Vol. III, p. 81.)
- Diaspis carueli** *Targ*. On *Thuja occidentalis*, Washington, D. C. Also on *Juniperus communis* and *J. chinensis*, *J. oxycedens* and *J. japonica* (syn. of *chinensis*), *ibid*. Collected by Targ. Tozzetti, at Orbitello near Florence, Italy. (Signoret, Essai sur les Coch., p. 436.)
- Diaspis minima** *Targ*. On *Thuja occidentalis* and *Cupressus*, Europe. (Comstock, 2d, Cornell Rep., p. 96; Signoret, Essai sur les Coch., p. 438.)
- Diaspis juniperi** *Bouche*.—On *Juniperus communis*. (Signoret, Essai sur les Coch., p. 437.)
- Chionaspis pinifolia** *Comstock*. (*Aspidiotus pinifolia* Fitch). “Recorded on *Pinus strobus*, *Pinus resinosa*, *Pinus mitis*, *Pinus cembra*, *Pinus pyreniaca*, *Pinus laricis*, *Pinus sylvestris*, *Pinus austriaca* and *Pinus pumella*. The Department of Agriculture contains examples from *Pseudotsuga taxifolia* and *Abies excelsa* and I have received specimens on *Abies nigra* from Canada, and *Abies alba*, Mass.”
- “Received from Maine, New York, New Jersey, District of Columbia, Michigan, Iowa, Illinois, Missouri, New Mexico, Florida,

Colorado and California." (R. A. Cooley, The Coccid Genera *Chionaspis* and *Hemichionaspis*, Bull. Hatch, Exp. Station, Aug., 1899.) On pines and spruces and *Pinus monophylla*. (Comstock, 2d, Cornell Rep., 1880, p. 319.)

On firs and spruces, Colorado. (Gillette and Baker, Hemiptera of Colorado, p. 129; Signoret, Essai sur les Coch., p. —, as *Mytilaspis pinifolia*.)

Prof. Cockerell sends me specimens which he collected March 27, 1902, at Prescott, Ariz., on *Pinus*.

Chionaspis pinifolia heterophylla Cooley. On *Pinus heterophylla*, Florida. (R. A. Cooley, Bull. Hatch, Exp. Station, Aug., 1899.)

Leucaspis signoretii Targ. On *Pinus sylvestris*, France. (Signoret, Essai sur les Coch., p. 100 (144).)

Leucaspis pini Hartig. On *Pinus laricis*, Poir, France. (Signoret, Essai sur les Coch., p. 146.)

Leucaspis leonardii Ckll. sp. nov. On *Pinus picea*, Portici, Italy. (Cherm. Ital., Fasc. I, No. 19 as *L. pini*.)

Fiorinia sulcii Newst. (See Ent. Mo. Mag., 1894, p. 232.) "According to Mr. Sulc, the *Fiorinia sulcii* Newst., formerly confounded with *Leucaspis pini*, is a distinct species, but nevertheless a *Leucaspis* Ckll. On *Pinus*, Dordogne, France, 1901, P. Marchal (through Prof. T. D. A. Cockerell). Also on *Pinus sylvestris*, Brandenburg, Germany, Reh. (through King and Cockerell).

Leachea zealandica Mask. On *Podocarpus totara* and *Cupressus dacrydiodes*, New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIII, p. 27.)

Fiorinia camelliæ. On *Pinus chinensis*, Hongkong, China and on *Juniperis*, Formosa. (Maskell, Trans. N. Z. Inst., Vol. XXX, p. 232.)

Fiorinia fiorinia var. **japonica** Kuwana. On *Pinus chinensis*, Tokyo and on *Pinus*, sp., Shiga-ken, Japan. (Kuwana, Coccidæ of Japan, Proc. Calif. Acad. Sci., Vol. III, No. 2, p. 79.)

Poliaspis pini Mask. On *Pinus densiflora*, Mayanoshita, on *Pinus austriaca*, Tokyo, on *Podocarpus chinensis*, Wakayama-ken, on *Abies firma*, Tokyo, on *Torreya mucefera*, Tokyo, on *Pinus thunbergii*, Tokyo, and on *Pinus*, sp., Kiushiu, Japan. (Kuwana, Coccidæ of Japan, Proc. Cal. Acad. Sci., Vol. III, No. 2, p. 82.)

- Cœlostoma pilosum** Mask. On *Podocarpus totaræ*, New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIII, p. 30.)
- Cœlostoma compressum** Mask. On *Podocarpus totaræ*, New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIV, p. 46.)
- Coccus hystrix** Baer. (Signoret, Essai sur les Coch., p. 455.)
Syngenaspis parlatoria Sulc. On *Abies*, Bohemia (Sulc). (Cockerell, Food-Plants of Coccidæ, Proc. U. S. Nat. Mus., Vol. XIX, p. 774.)
- Parlatoria proteus** Mask. On *Pinus insignis* Dougl., Botanical Gardens, Sydney, Australia. (Maskell, Trans. N. Z. Inst., Vol. XXIX, p. 300.)
- Pseudophillippia quaintancei** Ckll. On pine, Florida. (Psyche, 1897, p. 90.)

EXPLANATION OF PLATES.

PLATES V.

- Fig. 1. *Phenacoccus kuwanae*, leg of adult female.
Fig. 2. " " antenna of adult female.
Fig. 3. *Dactylopius andersoni*, leg of adult female.
Fig. 4. " " antenna of adult female.
Fig. 5. *Dactylopius dudleyi*, adult female.
Fig. 6. " " leg of adult female.
Fig. 7. " " antenna of adult female.
Fig. 8. " " larva; *a*, leg; *b*, antenna.
Fig. 9. *Aspidiotus californicus*, abdominal margin of adult female.
Fig. 10. *Aspidiotus florenciæ*, abdominal margin of adult female.

PLATE VI.

- Fig. 11. *Aspidiotus coniferarum* var. *shastæ*, adult female.
Fig. 12. " " " " abdominal margin of adult female.
Fig. 13. " " " " larva.
Fig. 14. *Aspidiotus* (subgen. *Diaspidiotus*) *ehrhorni*, abdominal margin of adult female.
Fig. 15. *Leucaspis kelloggi*, scale of female.
Fig. 16. " " adult female; *a*, abdominal margin of same.
Fig. 17. " " adult female (pregnant).

PLATE VII.

- Fig. 18. *Leucaspis kelloggi*, young larva; *a*, leg; *b*, antenna.
Fig. 19. " " scale of male.
Fig. 20. " " adult male insect; *a*, leg of same.
Fig. 21. *Leucaspis cupressi*, scale of female.
Fig. 22. " " adult female.
Fig. 23. " " young larva; *a*, antenna; *b*, leg.

**CLASSIFICATION OF THE POINTED-TAILED
WASPS, OR THE SUPERFAMILY
PROCTOTRYPOIDEA.—III.**

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Family LVI. SCELIONIDÆ.

The position of the antennæ, which are inserted low down on the face or close to the clypeus, and the shape of the abdomen, which is always acute or margined along the sides, the tergites and sternites where they unite usually forming a fold or carina, will at once distinguish the wasps belonging to this family, from those which follow. The family comes quite close to the family Platygasteridæ, the two having been classified together as a single family by Haliday, but it may be easily separated from that family by abdominal peculiarities, by the differences in the antennæ, and by the totally different venation of the front wings.

The family Scelionidæ is one of the most extensive, being widely distributed over the entire world, with many genera and species but imperfectly studied. All of the species, without a single exception are egg-parasites of other insects, the Lepidoptera, Hemiptera, Orthoptera and Neuroptera especially being the ones most frequently attacked by them; other orders, however, are not exempted from their attacks, and one little group, the Bæinæ, destroy the eggs of various spiders (Arachnida).

TABLE OF SUBFAMILIES.

- | | |
|---|---|
| 1. Abdomen always with a distinct lateral carina..... | 2 |
| Abdomen without a distinct lateral carina, although more or less acute, in shape most frequently broadly oval, rarely pointed ovate, but depressed, the second segment always the largest and longest; front wings with the post-marginal and stigmal veins long; ♀ with 11-jointed antennæ, rarely 12-jointed, clavate or subclavate; ♂ antennæ 12-jointed..... | |
| Subfamily I. TELENOMINÆ. | |
| 2. Abdomen sessile, most frequently long, fusiform or linear, extending beyond the tip of the wings when folded, rarely broadly oval, the segments more nearly equal, or the third segment is the longest, although rarely much longer than some one of the others; post-marginal vein usually present, rarely wanting, if wanting the submarginal vein ends in a stigma..... | 3 |

Abdomen broadly oval or long oval, the third segment much the longest; post-marginal vein never developed.

Marginal vein very short, punctiform or thickened, not or hardly as long as the stigmal vein; stigmal vein short, thickened at base and ending in a rounded stigma; antennæ in ♀ 7-jointed, the club being unjointed, in ♂ 12-jointed, filiform-moniliform; lateral ocelli usually close to the eye margin; females usually apterousSubfamily II. BÆINÆ.

Marginal vein very long, usually 5 or 6 times as long as the exceedingly short stigmal vein; stigmal vein not thickened at base; antennæ in ♀ 12-jointed, clavate, the club 5- or 6-jointed, in ♂ 12-jointed but filiform, the funicle joints long; lateral ocelli not close to the eye margin; females rarely apterous..... Subfamily III. TELEASINÆ.

3. Marginal vein seldom twice as long as the stigma vein; stigmal vein not especially short, oblique, rarely entirely absent; if the post-marginal vein is wanting, the submarginal vein ends in a stigma; antennæ in ♀ 12-jointed, clavate, in ♂ 12-jointed, usually filiform, in a single genus 10-jointed.

Subfamily IV. SCELIONINÆ.

Subfamily I. TELENOMINÆ.

This is a most interesting group first recognized by C. G. Thomson, the eminent Swedish entomologist. Many species have been described, the majority living parasitically in the eggs of Lepidoptera and Hemiptera.

Hemisius Westwood, may be an older name for *Telenomus* Haliday.

Aleria Marshall, described in 1874, also belongs here, I think, but it is too insufficiently characterized to be incorporated in my table.

Table of Genera.

1. Females	2
Males	7
2. Antennæ 12-jointed.....	6
Antennæ 11-jointed, clavate.	
Lateral ocelli touching the margin of the eye.....	3
Lateral ocelli not touching the margin of the eye.....(?)	Hemisius Westw.
3. Mesonotum without parapsidal furrows ..	4
Mesonotum with parapsidal furrows.	
Post-scutellum spined.....	Trimorus Förster (type <i>Gryon nanus</i> WALKER).
4. Head quadrate; abdomen pointed-ovate, the ovipositor usually exerted.	
Head transverse, often very broad; abdomen broadly oval, usually truncate at apex.....	Telenomus Haliday (type <i>T. brachialis</i> HALIDAY).
5. Mesonotum with three furrows abbreviated anteriorly; frons very broad, a short but distinct groove extends from the eye back of the lateral ocellus to the occiput	Trissolcus Ashmead (type <i>T. brachymenc</i> ASHM.).
Mesonotum with two furrows abbreviated anteriorly; frons not very broad; no groove back of the lateral ocellus.....	Dissolcus Ashmead.
	(type <i>D. nigricornis</i> ASHM.).

6. Head transverse, convex in front, the ocelli arranged in a triangle, the lateral close to the eye margin; wings not banded; club of antennæ 4-jointed.
Tiphodytes *Bradley* = **Limnodytes** *Marchal*.
 (type *L. gerriphagus* *MARCHAL*).
 Head large, flat, the ocelli in a triangle, the lateral nearer to the front ocellus than to the eye margin; wings banded.....**Aradophagus** *Ashmead*.
 (type *A. fasciatus* *ASHM.*).
7. Lateral ocelli not touching the eye margin.....(?) **Hemisius** *Westw.*
 Lateral ocelli touching the eye margin.
 Mesonotum without parapsidal furrows..... 8
 Mesonotum with parapsidal furrows.
 Postscutellum spined.....**Trimorus** *Förster*.
8. Head transverse, often very broad; abdomen oblong-oval or broadly oval..... 9.
 Head quadrate**Phanurus** *Thomson*
9. Pedicel clavate; first joint of the flagellum longer than the second, the latter longer than the third.....**Telenomus** *Haliday*.
 Pedicel oblong; first joint of the flagellum the longest joint, the second shorter than the third..**Tiphodytes** *Bradley* = **Limnodytes** *Marchal*.

Subfamily II. BÆINÆ.

This group was first recognized by the author as a tribe, but is now elevated to subfamily rank. To it belong some of the smallest Hymenoptera, the majority rarely attaining a millimeter in length, and all of them seem to be parasitic only in the eggs of various spiders (Arachnida).

Table of Genera.

1. Females 2
 Males 9
2. Apterous forms..... 3
 Winged..... 6
3. Scutellum distinct..... 4
 Scutellum wanting.....**Bæus** *Haliday* (type *B. seminulum* *HALIDAY*).
4. Mesonotum without furrows; lateral ocelli close the eye margin.
 Basal segment of abdomen normal, without a horn..... 5
 Basal segment of abdomen with horn.....**Ceratobæus** *Ashmead*.
 (type *C. cornutus* *ASHM.*).
5. First abdominal segment as broad as the metathorax and only visible as a transverse line; face with an antennal furrow, the occiput concave, the superior margin sharp; mandibles bidentate..... **Acolus** *Förster*
 (type *A. opacus* *THOMS.*).
 First abdominal segment subpetiolate, much narrower than the metathorax; face not or only slightly impressed, the superior margin of the occiput rounded; mandibles tridentate**Acoloides** *Howard* (type *A. saitiidis* *HOW.*).
6. Basal segment of abdomen normal, without a horn..... 7
 Basal segment of abdomen with a horn.
 Mesonotum without furrows**Ceratobæus** *Ashmead*.

5. Metascutellum with three spines.....**Trissacantha** *Ashmead.*
(type *T. americana* ASHM.).
Metascutellum with one spine.....**Xenomerus** *Walker.*
(type *X. ergonina* WALK.).
6. Postscutellum with a single large spine ; mandibles bifid, the outer tooth the larger.
Posterior femora, tibiæ and tarsi slender, the tibial spurs weak.
Prosacantha *Nees* (type *P. longicornis* NEES).
Posterior femora swollen, tibiæ dilated at apex, the basal joint of tarsi short,
stout, the tibial spurs not weak.**Teleas** *Latreille.*
(type *T. clavicornis* LATR.).
7. Apterous forms..... 8
Winged.
Metascutellum with a spine or tuberculate.....**Hoplogryon** *Ashmead.*
(type *H. minutissimus* ASHM.).
Metascutellum simple, unarmed...**Gryon** *Haliday* (type *G. misellus* HAL.).
8. Metascutellum with a small spine or tubercle**Hoplogryon** *Ashmead.*
Metascutellum simple without a spine or tubercle**Gryon** *Haliday.*
9. Abdomen long-oval, the first segment petioliform ; marginal vein very long... 10
Abdomen broadly oval, the first segment usually wider than long..... 13
10. Mesonotum with parapsidal furrows..... 11
Mesonotum without parapsidal furrows..... 12
11. Postscutellum with three spines ; antennæ very long, filiform, pubescent.
Trissacantha *Ashmead.*
Postscutellum with one spine ; antennæ with whorls of long hairs.
Xenomerus *Walker.*
12. Hind femora not swollen, the tibial spurs not developed, the basal joint of tarsi
long, slender ; antennæ long, filiform, the flagellar joints at least four times as
long as thick, the third joint excised at base.....**Prosacantha** *Nees.*
Hind femora swollen, the tibial spurs developed, the basal joint of tarsi short,
stout ; antennæ filiform, the flagellar joints usually less than thrice as long as
thick..... **Teleas** *Latreille.*
13. Postscutellum with a small spine or tubercle ; antennæ filiform, the flagellar
joints elongate.....**Hoplogryon** *Ashmead.*
Postscutellum without a small spine or tubercle ; antennæ filiform, the joints
scarcely longer than thick..... **Gryon** *Haliday.*

Subfamily IV. SCELIONINÆ.

In having the abdomen always distinctly carinated at the sides this subfamily comes closest to the Teleasinae, but here the resemblance ceases, the abdomen, except in a few cases, being much more elongated and pointed, or fusiform, and extends beyond the tips of the wings when folded. With a little knowledge of the forms the student may at a glance recognize a species falling in this group, but when in doubt the venation may always be depended upon to distinguish the group, being quite characteristic. The postmarginal vein,

except in a few cases, is always fully developed and longer than the marginal, while the stigmal vein is never very short. The few forms without a postmarginal vein have the submarginal vein ending in a stigma (*Bæoneura* and *Seelio*).

The species falling in the groups confine their attacks principally to the eggs of orthopterous and hemipterous insects.

Table of Genera.

1. Females	2
Males	31
2. Postmarginal vein always greatly lengthened, the submarginal vein complete, never ending in a stigma.....	3
Postmarginal vein wanting or poorly developed, always shorter than the stigmal vein, the submarginal vein often abbreviated and ending in a large stigma ; abdomen long, fusiform	26
3. Basal nervure present, distinct.....	4
Basal nervure wanting.....	15
4. Basal abdominal segment without a horn	5
Basal abdominal segment with a horn.	
Marginal vein short ; abdomen long, pointed-fusiform, the first segment narrow, petioliform, the second and third segments nearly equal.	
Caloteleia <i>Westwood</i> (type <i>C.</i>).	
Marginal vein long ; abdomen long, linear or subfusiform, the first segment quadrate or nearly	Baryconus <i>Förster</i> (type unknown).
5. Abdomen long, pointed-fusiform or linear, with segments 2, 3 and 4 nearly equal	6
Abdomen not so long, oblong-oval or fusiform.....	9
6. Mesonotum with parapsidal furrows.....	7
Mesonotum without parapsidal furrows.....	12
7. Metanotum with a large semicircular enclosed space at base.....	8
Metanotum without an enclosed space at base.	
Mandibles 3-dentate.....	Macroteleia <i>Westwood</i> . (type <i>M. cleonymoides</i> WESTW.).
Mandibles 2-dentate.....	Calliscelio <i>Ashmead</i> (type <i>C. laticincta</i> ASHM.).
8. Marginal vein punctiform.....	Chromoteleia <i>Ashmead</i> . (type <i>C. semicyanea</i> ASHM.).
9. Postscutellum spined	10
Postscutellum not spined, simple.....	13
10. Mesonotum with parapsidal furrows.....	11
Mesonotum without furrows.....	12
11. Mandibles 2-dentate.....	Opisthacantha <i>Ashmead</i> (type <i>O. mellipes</i> ASHM.).
12. Mandibles 2-dentate.	
Abdominal segments 1 and 2 of an equal length, the third long.	
? Opisthacantha <i>Ashmead</i> .	
Mandibles 3-dentate.	

Abdominal segments 2 and 3 of an equal length, the first short.

Lapitha Ashmead (type *L. spumosa* ASHM.)

13. Marginal vein short, or not more than half the length of the stigmal vein, most frequently postmarginal.
 Mesonotum with parapsidal furrows..... 14
 Mesonotum without parapsidal furrows.
 Head quadrate; mandibles 3-dentate.
Cacellus Ashmead = *Camea* Fåhræ proo.
 (type *C. crassipes* ASHM.)
14. Club of antennæ 5- or 6-jointed..... **Anteris Förster**
 (type *A. ruficornis* ASHM.)
 Club not differentiated, the flagellum filiform..... **Apegus Förster**
 (type *A. leucocoma* FÖRSTER.)
15. Mesonotum with parapsidal furrows..... 16
 Mesonotum without parapsidal furrows..... 21
16. Mesonotum with two furrows..... 17
 Mesonotum with three furrows.....
 Postscutellum 1-dentate..... **Hoploteleia Ashmead**
 (type *H. floridana* ASHM. ♀ = *Formilus* Walker.)
17. Abdomen not very long, ovate or oblong-oval..... 20
 Abdomen very long, fusiform.
 Metathorax unarmed..... 19
 Metathorax with two teeth..... 18
18. Mandibles 3-dentate..... **Cacellus Ashmead**.
19. Mandibles 3-dentate..... **Macroteleia Westwood**.
 Mandibles 2-dentate..... **Caloteleia Westwood**.
20. Mandibles 2-dentate; metathorax unarmed..... **Auteris Förster**.
21. Postscutellum simple, unarmed..... 22
 Postscutellum armed with a spine..... **Opisthacantha Ashmead**.
22. Abdomen without a horn at base..... 23
 Abdomen with a horn at base.
 Marginal vein short..... **Caloteleia Westwood**.
 Marginal vein long..... **Baryconus Förster**.
23. Abdomen broadly oval, sessile, the second segment usually a little the largest..... 25
 Abdomen not broadly oval, long-fusiform.
 Club of antennæ 4- or 5-jointed..... 24
 Club of antennæ 6-jointed; abdominal segments normal, **Cacellus Ashmead**.
24. Club of antennæ oval, 5-jointed; abdominal segments strongly constricted.
Cremastobæus Ashmead (type *C. basilar* ASHM.).
 Club of antennæ 4-jointed, the funiculi joints very minute, transverse, the pedicel
 as long as the first three or four joints united; abdominal segments not con-
 stricted, the third segment the longest..... **Embidobia Ashmead**.
 (type *E. urichi* ASHM.)
25. Club of antennæ 6-jointed..... **Hadronotus Förster** (type *H. caliceps* FÖRSTER.).
26. Submarginal vein reaching the costa often by a thickened stigma..... 27
 Submarginal vein ending in a knob or stigma, but not reaching the costa.
 Wings narrow, fringed; abdomen much depressed, long and pointed.
Bæoneura Förster (type unknown).

27. Submarginal vein ending in a thickened stigma..... 28
 Submarginal vein not ending in a thickened stigma.
 Mesonotum with parapsidal furrows; marginal vein very short, the post-
 marginal vein hardly developed or shorter than the stigma.
 Idris Förster (type *I. flavicornis* FÖRSTER).
28. Head normal, without a frontal lamina or ledge; postmarginal vein not devel-
 oped..... 29
 Head abnormal, with a frontal lamina or ledge; scutellum quadrate, the posterior
 angles acute; postscutellum with a large erect spine.
 Acanthoscelio Ashmead (type *A. americanus* ASHM.).
 Scutellum and postscutellum normal, the latter not spined.
 Sparasion Jurine (type *S. frontale* LATR.).
29. Mesonotum with parapsidal furrows..... 30
 Mesonotum without furrows or very rarely distinct.
 Maxillary palpi short, 3-jointed, **Scelio** Latreille (type *S. rugulosa* LATR.).
30. Maxillary palpi short, 3-jointed..... **Scelio** Latreille.
 Maxillary palpi long, 5-jointed..... **Sceliomorpha** Ashmead.
 (type *S. longicornis* ASHM.).
31. Postmarginal vein always greatly lengthened, the submarginal vein complete,
 never ending in a stigma..... 32
 Postmarginal vein wanting or poorly developed, always shorter than the stigmal
 vein, the submarginal vein often abbreviated and ending in a large stigma;
 abdomen usually long..... 49
32. Basal nervure present, distinct..... 33
 Basal nervure wanting 42
33. Mesonotum with parapsidal furrows 34
 Mesonotum without furrows..... 38
34. Metathorax with a large semicircular enclosed space 37
 Metathorax without an enclosed space.
 Postscutellum not spined..... 35
 Postscutellum spined 41
35. Marginal vein longer than the stigmal vein..... 36
 Marginal vein punctiform or not longer than the stigmal vein.
 Mandibles 3-dentate **Caloteleia** Westwood.
 Mandibles 2-dentate..... **Anteris** Förster.
36. Mandibles 3-dentate.
 First joint of the flagellum scarcely longer than the third, the latter excised.
 Macroteleia Westw.
 First joint of the flagellum much longer than the third... **Baryconus** Förster.
37. Mandibles 3-dentate; marginal vein punctiform..... **Chromoteleia** Ashmead.
38. Postscutellum not spined 39
 Postscutellum spined 44
39. Marginal vein long, always longer than the stigmal vein..... 40
 Marginal vein punctiform, or shorter than the stigmal vein.
 Mandibles 3-dentate.
 First joint of the flagellum very long..... **Caloteleia** Westwood.
 First joint of flagellum shorter than the second..... **Cacellus** Ashm.

40. Mandibles 3-dentate.....**Baryconus** Förster.
41. Marginal vein longer than the stigmal vein; mandibles 3-dentate.
Lapitha Ashmead.
 Marginal vein shorter than the stigmal vein; mandibles 2-dentate.
Opisthacantha Ashmead.
42. Mesonotum with parapsidal furrows..... 43
 Mesonotum without parapsidal furrows..... 45
43. Mesonotum with two furrows..... 44
 Mesonotum with three furrows.
 Postscutellum bidentate; tip of abdomen ending in two short prongs.
Hoploteleia Ashmead.
44. Metathorax unarmed: mandibles 3-dentate.....**Macroteleia** Westwood.
 Metathorax bidentate; mandibles 2-dentate.....? **Cacellus** Ashm.
45. Postscutellum simple, not spined..... 46
 Postscutellum spined.....**Opisthacantha** Ashmead.
46. Metathorax unarmed, simple.. 47
 Metathorax with two small teeth at apex; mandibles 2-dentate.**Cacellus** Ashm.
47. Abdominal segments not strongly constricted..... 48
 Abdominal segments strongly constricted; antennæ subclavate.
Cremastobæus Ashmead.
48. Antennæ subfiliform, slightly and gradually thickened towards apex, the flagellar joints after the first not or not much longer than thick...**Hadronotus** Förster.
49. Submarginal vein usually reaching the costa, usually but not always stigmated at apex..... 50
 Submarginal vein not reaching the costa, ending in a knob...**Bæoneura** Förster.
50. Submarginal vein ending in a stigma 51
 Submarginal vein not ending in a stigma.
 Mesonotum with two furrows; marginal vein very short, the postmarginal vein hardly developed or shorter than the stigma.....**Idris** Förster.
51. Head without a frontal ledge or lamina..... 52
 Head with a frontal ledge or lamina.
 Scutellum quadrate, the hind angles acute; postscutellum spined.
Acanthoscelio Ashmead.
 Scutellum and postscutellum normal.....**Sparasion** Jurine.
52. Mesonotum without furrows or rarely distinct... 53
 Mesonotum with two furrows.
 Antennæ 12-jointed, long; maxillary palpi long, 5-jointed.
Sceliomorpha Ashmead.
 Antennæ 10-jointed, not long; maxillary palpi short, 3-jointed.
53. Antennæ 10-jointed; maxillary palpi short, 3-jointed.....**Scelio** Latreille.

Family LVII. PLATYGASTERIDÆ.

This is probably one of the largest families in the superfamily Proctotrypoidea, the most widely distributed and of great economic importance, the species all being parasitic in dipterous larvæ, belong-

ing principally to the families Cecidomyiidae and the Tipulidae. The gall-inhabiting and fungus-inhabiting species are especially subject to their attacks.

Species belonging to the genus *Amitus* Haldeman are, however, reared from species belonging to the homopterous family Aleurodidae, but since these insects also have dipterous parasites or dipterous insects associated with them, it is quite probable that the *Amiti* come from the Diptera and not from the aleurodids.

The family is quite closely allied to the Scelionidae, where Haliday placed it, but from that family it may be easily separated by the different antennæ which are never more than 10-jointed, by the 2-jointed maxillary palpi, by the 1-jointed labial palpi, and by the mandibles which are always bidentate.

TABLE OF SUBFAMILIES.

- Submarginal vein in front wings clavate or ending in a stigma or knob.
 Subfamily I. INOSTEMMINÆ.
 Submarginal vein in front wings entirely absent or only indicated at the base, never clavate or knobbed at apex. Subfamily II. PLATYGASTERINÆ.

Subfamily I. INOSTEMMINÆ.

Table of Genera.

1. Females	2
Males	8
2. Tarsi 5-jointed.....	3
Tarsi 4-jointed.	
Antennæ 8-jointed, the flagellar joints nodose-pedicellate, with whorls of hairs; submarginal vein ending in a small knob.	
	Iphetrachelus Haliday (type <i>I. lar</i> HAL.).
3. Antennæ 10-jointed.....	4
Antennæ 9-jointed	Allotropia Förster (type <i>A. mecrida</i> FÖRST.).
4. Front wings with a basal nervure	5
Front wings without a basal nervure.....	6
5. Mesonotum with the furrows distinct or faint.	
Club of antennæ 3-jointed	Metaclisis Förster.
	(type <i>Platygaster carcolatus</i> HAL.).
Club of antennæ 4-jointed.....	Monocrita Förster (type <i>M. atinas</i> FÖRST.).
6. Lateral ocelli nearer the inner margin of the eye than to the front ocellus.....	7
Lateral ocelli nearer the front ocellus than to the inner margin of the eye.	
Club of antennæ 4-jointed.....	Isostasius Förster.
	(type <i>Platygaster punctiger</i> NEES).
7. Basal segment of the abdomen with a horn that extends forwards over the thorax; mesonotum with faint furrows.....	Inostemma Haliday.
	(type <i>Platygaster boscii</i>).

- Basal segment of the abdomen normal, without a horn; mesonotum with distinct furrows; club of antennæ 4-jointed, the funicle joints slender, cylindrical.
- Acerota Förster.**
8. Tarsi 5-jointed..... 9
Tarsi 4-jointed.
Antennæ 10-jointed, with whorled hairs.....**Iphetrachelus Haliday.**
9. Antennæ 10-jointed..... 10
Antennæ 9-jointed, with whorled hairs.....**Allotropa Förster.**
10. Front wings with a basal nervure..... 11
Front wings without a basal nervure of the submarginal vein ending in a knob. 12
11. Mesonotum with two faint furrows or with distinct furrows. Antennæ subclavate, moniliform, the first joint of the funicle very minute, the second somewhat larger, the following to the tenth large, gradually enlarged; the last the largest, conical.....**Metaclisis Förster.**
Antennæ filiform submoniliform, the first joint of the funicle very minute, the second larger, thickened, curved, the third small, triangular, the following, except the last, transverse-moniliform, the last conical....**Monocrita Förster.**
12. Lateral ocelli nearer the inner margin of the eye than to the front ocellus..... 13
Lateral ocelli nearer the front ocellus than to the inner margin of the eye; pedicel obconical, rather long; club of antennæ 4-jointed.....**Isostasius Förster.**
13. Mesonotum with faint furrows; antennæ moniliform, pubescent, the first two funicular joints nearly equal, the second somewhat curved, the third small, triangular, the four following moniliform, the last conical.
Inostemma Haliday.
Mesonotum with two distinct furrows; antennæ filiform, pubescent, the second funicular joint long, cylindrical, longer than the first, the third shorter than the first, the following oval, the last about thrice as long as thick.
Acerota Förster.

Subfamily II. PLATYGASTERINÆ.

To this subfamily belong all species with veinless wings, all the veins being wholly gone or obliterated, except sometimes the submarginal vein basally; if present it is, however, never knobbed, as in the *Inostemminæ*.

The genera recognized in this group are much more numerous and more difficult to separate than those in the previous subfamily, but it is believed that the characters made use of in the table below will be sufficient for their recognition.

Table of Genera.

1. Females ..	2
Males.....	18
2. Scutellum lengthened, spined, or when shortened, compressed at the sides and furnished with an awl-shaped thorn, spine or tubercle.....	3
Scutellum not lengthened semicircular, either flat or convex, cushion-shaped, or cupuliform, and always unarmed.....	9

- Lateral ocelli not close to the eye margin ; club of antennæ 5-jointed.
- Trichacis** Förster (type *Platygaster pesis* WALKER).
13. Abdomen not much lengthened..... 14
 Abdomen very much lengthened.
 Club of antennæ 5-jointed ; mesonotal lines distinct.
Polymecus Förster (partim).
14. Lateral margins of the abdomen normal..... 15
 Lateral margins of the abdomen broadly deflexed.
 Mesonotal furrows distinct.....**Hypocampsis** Förster.
 (type *H. hyalinata* THOMSON).
15. Thorax short, the scutellum pillow-shaped, separated from the mesonotum by a deep furrow.. 16
 Thorax more elongate, the scutellum not separated from the mesonotum by a deep furrow ; mesonotal furrows distinct..... 17
16. Face with a distinct keel between the antennæ.....**Erित्रissomerus** Ashmead.
 (type *E. cecidomyiæ* ASHM.).
 Face without a keel between the antennæ**Polygnotus** Förster.
 (type *Platygaster striolata* NEES).
17. Lateral ocelli nearer the eye margin than to the front ocellus.
Platygaster Latreille (type *P. rufipes* LATR.)
 Lateral ocelli nearer the front ocellus than to the eye margin.
Isocybus Förster (type *Platygaster grandis* NEES).
18. Scutellum lengthened, never semicircular ; if shortened it is compressed at the sides and furnished with an awl-shaped thorn or tubercle.....19
 Scutellum not lengthened, semicircular, or either flat, convex or cushion-shaped.....25
19. Scutellum lengthened, triangular, often produced into a long, acute spine.....20
 Scutellum not lengthened, with an awl-shaped thorn, short thorn or tubercle. 22
20. Thorax not strongly compressed from the sides..... 21
 Thorax strongly compressed from the sides.
 Head large, rounded or quadrate.....**Piestopleura** Förster.
21. Mesonotal furrows deep, parallel posteriorly.....**Xestonotus** Förster.
 Mesonotal furrows at most feebly impressed or wanting....**Amblyaspis** Förster.
22. Scutellum with a short thorn or tubercle at apex.....23
 Scutellum with a strong awl-shaped thorn at apex.
 Lateral ocelli nearer the eye margin than to the front ocellus.
Laptacis Förster.
 Lateral ocelli nearer the front ocellus than to the eye margin or not nearer to the eye margin than to the front ocellus.....**Isorhombus** Förster.
23. Abdomen not much lengthened.....24
 Abdomen much lengthened, longer than the head and thorax united, the second segment very large.
 First joint of flagellum minute, rounded, the second large, dilated.
Polygmeus Förster.
24. Ocelli their width from the eye margin**Sactogaster** Förster.
 Ocelli close to the eye margin**Synopeas** Förster.
25. Scutellum not cupuliform, convex or flattened.... 26

- Scutellum cupuliform as in the Figitid genus *Eucolia*; mesonotum without furrows.
Cœlopelta *Ashmead*.
26. Scutellum convex or cushion-shaped..... 27
 Scutellum quite flat or almost subconvex.
 Mesonotal furrows distinct; antennæ verticellate..... **Amitus** *Haldeman*.
 Mesonotal furrows wanting or distinct; antennæ 10-jointed, not verticellate
 subclavate **Anopedias** *Förster*.
27. Scutellum without a tuft of hairs at apex..... 28
 Scutellum with a tuft of hairs at apex.
 Lateral ocelli away from the left margin; club of antennæ 6-jointed, the first
 funicle joint small, the second large, much longer than thick, the third
 shorter; parapsidal furrows complete..... **Trichacis** *Förster*.
28. Lateral margins of abdomen normal 29
 Lateral margins of abdomen broadly deflexed.
 Lateral ocelli nearer to the eye margin than to the front ocellus; club of
 antennæ 4- or 5-jointed, the first joint smallest; parapsidal furrows want-
 ing or incomplete..... **Hypocampsis** *Förster*.
29. Thorax not short, more elongate; scutellum not separated from the mesonotum
 by a deep furrow; mesonotal furrows distinct, rarely incomplete..... 30
 Thorax short; scutellum pillow-shaped or highly convex, separated from the
 mesonotum by a deep furrow; mesonotal furrows variable, more rarely dis-
 tinct or complete, sometimes wanting.
 Face with a sharp keel between the antennæ; third joint of antennæ strongly
 dilated **Eritrissomerus** *Ashmead*.
 Face without a sharp keel between the antennæ..... **Polygnotus** *Förster*.
30. Lateral ocelli nearer the eye margin than to the front ocellus.
Platygaster *Latreille*.
 Lateral ocelli nearer the front ocellus than to the eye margin... **Isocybus** *Förster*.

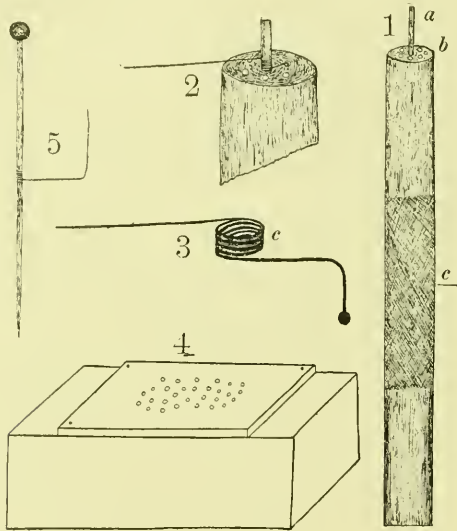
WINDING ELBOW-PINS.

ALEX. D. MACGILLIVRAY.

Elbow-pins are useful for mounting minute insects of many kinds, as Diptera, Hemiptera, Homoptera and Hymenoptera. They are much firmer and neater appearing mounts than those made with blotting-paper, bristol-board, cork or pith. Elbow-pins are not listed by dealers in entomological supplies, and any tools that will simplify the making of them are worthy of being noticed.

The apparatus described below was devised by Mr. J. O. Martin while a student in the entomological laboratory of Cornell University. It consists of two separate pieces, one for winding the coils 3c, and the other for placing the coils on the pins.

The tool used in winding the coils (Fig. 1) consists of a piece of brass wire one fourth of an inch in diameter and three inches in length and roughened in the middle so as not to tire the fingers, 1*c*. One end is planed off square and has from two to six holes bored in this end, 1*b*, one hole being placed in the center and the others being arranged around the periphery. In the central hole there is placed a steel needle or pin, 1*a*, that fits the hole so snug that it will not turn.



The pin should project a half inch or more beyond the end of the tool and should be slightly smaller in caliber than the insect pin on which it is intended to place the coils. The holes around the periphery are for holding the head of the pin while the coil is being wound, and should be not less than one half an inch in depth and of different sizes, so as to fit the heads of the various sized pins that may be used for elbows.

The winding of the the coils is accomplished as follows: The head of the pin to be wound is inserted in one of the peripheral holes and bent out at right angles to the tool, being careful while doing this to see that the head of the pin is held firmly at the bottom of the hole. The free end of the pin is now turned against the side of the central steel pin, 1*a*, and held there by the left thumb while the tool is rotated between the thumb and forefinger of the right hand until several

turns are made around the central steel pin, two, three or more as the operator may desire, care being taken to see that the coils of the pin are close together and fit tight to the central steel pin, Fig. 2. If the pin is not kept at the bottom of the peripheral hole when it is bent out at right angles, it is quite likely to draw out of the hole while the winding is being done. When the coil is completed, Fig. 3, it is removed from the central steel pin and the head and the portion of the pin between it and the coil is cut off close up to the coil with a pair of shears or with a pair of wire side cutters. The coils are now placed on the pins and shoved through one of the holes in the steel plate, Fig. 4, which places them on the pin firmly and raises them all to the same height. Now all that needs to be done is to turn the apical third of the pin up at right angles and the operation is completed, Fig. 5.

The tool used in placing the coils on the pins is a steel plate with a number of holes bored through it and fastened over a hole in a wooden block, the thickness of the block depending on the height at which it is desired to place the coils. The size of the holes should be slightly larger than the diameter of a No. 5 Kläger insect pin.

In my own experience I have found that the black Schlüter pins, No. 00, make the best elbows. The points are very fine and the pins are springy, causing them to hold firmly to the upright pin. If Schlüter pins one and five eighth inches in length are used, the peripheral holes should be deeper, otherwise the elbows will be too long. The ideal calibered pin to carry the elbows would be one of the size of a No. 3 Kläger, but I have found it impossible to find anything strong enough of this size to serve as the central steel pin and so have adopted the No. 5 Kläger as the size on which to place the elbows.

Where it is desired to make the elbows in quantity it will be found a great saving of time to do one thing at a time, that is, wind a number of the coils, then cut off the heads, shove them on the carrying pins, and finally bend them. If the tool is properly constructed, but little mechanical skill is required. I have frequently taught students in ten minutes so that they could make as perfect elbows and coils as one who had had considerable experience.

A REVIEW OF THE NORTH AMERICAN SPECIES OF PRONUBA AND PRODOXUS.

BY HARRISON G. DYAR.

The late Dr. C. V. Riley was especially interested in these genera and has published much valuable and detailed matter on their structure and habits. His specific descriptions are, however, more or less incomplete or scattered, except in his paper in the third report of the Missouri Botanical Garden (pp. 99-158, pls. 34-43, 1892). As this is a botanical journal, not usually accessible to entomologists, and as Riley gives no synoptic tables, I have thought it advisable to treat the forms from the standpoint of species in a brief synoptic form. It will only be necessary to refer to Dr. Riley's account of the relations of these insects to their host plants.

Genus *Pronuba* Riley.

SYNOPSIS OF SPECIES.

- Fore wings white.
- Fore wings unspotted.....**yuccasella.**
 - Fore wings spotted.
 - Marginal spots distinct, separate**maculata.**
 - Marginal spots clouded, confluent.....var. **apicella.**
 - Fore wings not white.
 - Fore wings dead black.....**aterrima.**
 - Fore wings obscure, dull gray.....**paradoxa.**

Pronuba yuccasella Riley.

This well-known species is easily recognized by its pure white fore wings and gray hind wings with white fringe, but it is so similar to *Prodoxus quinquepunctellus* that it is very difficult to distinguish set specimens. The pupæ are entirely unlike.

Pronuba maculata Riley.

The type specimens are from Caliente, Kern Co., Cal. The variety *apicella* is from Los Angeles Co., Cal., from seeds of *Yucca whipplei*. The black subapical spot of typical *maculata* is here produced into a blotch and a black clouding confuses and joins the marginal spots.

Pronuba aterrима Trelease.

Described as a variety of *maculata* (4th Rept. Mo. Bot. Gard., 216 note, 1893), but represents a distinct species, I should think. The description reads:

"*Pronuba maculata*, var. *aterrima*, n. var. Characters of the species, but the chitinized parts smoky brown, and the scales of a dead black color throughout or a few pale ones near the tips of the primaries. Living as a larva in the forming seeds of *Hesperoyucca whipplei* var. *graminifolia*, the flowers of which are pollinated by the female imago. In the foothills immediately north of San Bernardino, Cal."

Pronuba paradoxa Riley.

This was mentioned by Riley as *paradoxa* (1889) but described by him later as *synthetica* (1892). There is no description accompanying the first name, yet enough is given to determine the species, since there can hardly be a doubt of the identity of the species of *Pronuba* which fertilizes *Yucca brevifolia* in the Mojave desert, and these points are mentioned. The first name will hold therefore.

Genus Prodoxus Riley.

SYNOPSIS OF SPECIES.

Wings with ground color white.

Fore wing white, rarely with a few black dots.

Medium-sized species, hind wings gray with white fringe.

Smaller, expanse 15-22 mm..... **quinquepunctellus**. +

Larger, 25 mm..... **intermedius**. +

Small species, hind wings white with gray costal border..... **sordidus**. +

Fore wing with conspicuous dark markings, rarely obsolete.

Wings without transverse median bands.

A marginal black border before fringe..... **marginatus**. +

Outer half of wing powdered with black..... **pulverulentus**. +

Wings with transverse median bands.

Bands forming two Y-shaped marks on costa..... **reticulatus**. +

Bands forming one Y-shaped mark on costa.

Markings distinct.

The two basal bands separate..... **coloradensis**. +

These bands joined, forming a Y-shaped mark on internal margin..... var. **confluens**. +

Markings faint, obsolete..... var. **lautus**. +

Bands not forming a Y-shaped mark on costa.

A V-shaped mark resting on anal angle..... **y-inversa**. +

Wings gray or brown.

Fore wing shining gray, rather light; hind wing blackish..... **cinereus**. +

Fore wing dark gray; hind wing pellucid..... **ænescens**. +

The above synopsis will serve to distinguish the forms. *P. intermedius* seems rather poorly separated from *quinquepunctellus*, the only obvious difference being the size; but Dr. Riley figures apparently marked differences in the shape of the ovipositor. The other species

are obviously distinct. References to the literature will be found in Bulletin 52, U. S. N. M., except to the paper in the Report of the Missouri Botanical Garden, referred to above.

THE REAL LARVA OF XANTHOPASTIS TIMAIS CRAMER.

BY HARRISON G. DYAR.

A little while ago I described in this JOURNAL (Vol. X, p. 125) a larva from Florida under the name of *timais*. Since then Mr. E. A. Schwarz has found larvæ in Cuba which he has bred, and he brings me a specimen in alcohol which he assures me is the true larva of the species. It is not like the larva described by me, except in a superficial way, and I therefore publish the following in correction. What the larva is that I described has not yet been ascertained.

Larva.—Head rounded, slightly wider than high, scarcely bilobed; setæ coarse, black; light red, a round black spot on seta ii and one over eye, jaws black-lined. Body cylindrical, subequal, joint 12 scarcely enlarged, feet normal, equal. Cervical shield, bases of thoracic feet, abdominal feet and bases, posterior half of joint 12 and all the ground color of 13, light red. Venter pale; rest of body black, spotted with white. Cervical shield with black spots on the tubercles; setæ large and coarse; tubercles large, somewhat elevated, black. The white spots consist of three transverse rows per segment, the two anterior rows of small spots, the posterior row of larger spots, in the positions of the usual lines, dorsal, subdorsal, suprastigmatal, substigmatal and one at tubercle vi. Tubercle iv at the center of the spiracle. Three black spots on the leg base at the setæ; claspers black; joints 12 and 13 heavily black-spotted at the tubercles. Spiracles black, that of joint 2 with white posterior border. Width of head 3.2 mm.

The larva described by me differs in the tubercles being obscure and reduced, the setæ fine and short; the head is higher and the black spot on it is in a different place, the cervical shield is uncornified and is black with some red in the neck only; the distribution of the whitish marks on the body is very different and the red color at the anal end is less extensive and not spotted by black tubercles.

THE LARVA OF PHIPROSOPUS CALLITRICHOIDES.

By E. DAECKE.

Bright mahogany red; sparsely pubescent, apparently naked; about the second and last abdominal segments of a somewhat lighter shade. A fine ochraceous dorsal line on the first thoracic segment extending over the head and widening at the mouth parts. From the fourth, fifth and sixth abdominal segments, laterally, a light salmon-colored band, each converging toward the dorsum into a patch. A gray band indistinctly defined from the fourth segment, terminating V-shaped, of dark brown color between the seventh and eighth segments. This V being bordered by a fine silvery line on the seventh segment, inside of which is a dark mahogany spot. A similar silvery line and mahogany-colored spot on the fourth segment. First segment with a slight dorsal elevation. Second segment with a 7-8 mm. long process inclined forward and curled at the tip, rarely straight. A pale flesh colored band before the dark-brown apex. Third segment with a 3 mm. long, bright mahogany process curling backward. First pair of abdominal legs wanting. Length, about 26 mm.

Food-plant.—*Smilax rotundifolium*.

When at rest the larva is S-shaped. The head and thoracic segments are held at right angles upward, and the three last segments are also uplifted. It very much resembles in color and shape a ragged and withered edge of a fresh leaf. The caterpillar spins a cocoon on the stems of the plant near the base or on the ground near by. The cocoon is usually covered with long pieces of small twigs, giving the appearance of the sac of a caddis-fly larva. The moth when at rest resembles a small dried leaf, the pale oblique line of the brown fore wings resembling the vein of the leaf. The larvæ were found August 25; pupated August 30 and the moth emerged the following June.

ON THE GENERIC NAME OF THE CODLING
MOTH.*

By AUGUST BUSCK.

When I lately (Proc. Wash. Ent. Soc., II, p. 235, 1903) described a striking western variety of the codling moth as *Cydia pomonella* var. *simpsonii*, I used the generic name *Cydia* on the strength of Lord Walsingham's conclusion (Proc. Zoöl. Soc. Lond., 1897, p. 130) that *Cydia* was the proper name for the genus, and I employed the name without investigation the more confidently because it had been adopted by our American authority on the Tortricidæ, Professor C. H. Fernald in his recent list (U. S. Nat. Museum Bull. 52, p. 471, 1903).

Since then however Professor T. D. A. Cockerell has kindly called my attention to a footnote in his bulletin on the codling moth (N. Mex. Coll. Agr. Sta. Bull. 25, p. 47, 1898) in which he, through a dexterous and logical manipulation of Lord Walsingham's own arguments comes to a different result in favor of the long and generally used name *Carpocapsa*, and being asked for my opinion about the proper name to be used in a forthcoming departmental bulletin I was led to go over the ground independently.

As I come to the same result as Professor Cockerell in favor of the time-honored *Carpocapsa* though on different grounds, I venture to give these in the hope that it may lead to a much needed generally adopted scientific name for this insect.

I wish to acknowledge my indebtedness to Mr. Nathan Banks, whose intimate knowledge of the old literature—so willingly imparted—has helped me greatly in this study.

I also wish to thank Professor C. H. Fernald who most generously came to my assistance in the last moment, when he realized that I had committed an excusable but griveous error, which he was able to correct.

Up to the year 1818 *pomonella* Linnè was placed in one or another of the roomy genera *Tinea* and *Tortrix*.

In that year Hübner erected his genus *Cydia* (Verz. bekannt. Schmett., p. 375) including three species, *pomonella*, Linn., *aspidiscana* Hübn. and *monetulana* Hübn. (= *hohenwarthiana*, Schiffermüller and

* Read before Washington Entomological Society, May 14, 1903.

Denis = *cana* Haworth). All three species are generically distinct and Hübner did not indicate which was the type; this consequently must be determined by elimination.

In 1829 Treitschke erected the genus *Carpocapsa* (Treitschke Schmett. Eur., VII, p. 231) and on the next page of the same work his genus *Grapholita* appeared; the first of these genera contained *pomonella* Linn. and four other species, the latter contained *hohenwarthiana*, Schiff. and Den., *aspidiscana*. Hübn. and eight others. No type was indicated for either genus.

From these facts Lord Walsingham concluded (Proc. Zool. Soc. Lond., 1897, p. 130) that one or another of Treitschke's two genera must fall as synonyms with *Cydia* of Hübner and making use of a subsequent work by Stephens (Ill. Brit. Ent., Haust., IV, p. 119, 1834) he determined that *Carpocapsa* should fall, while if his premises—that one of the two genera must fall—had been right, *Grapholita* should logically fall as pointed out by Prof. Cockerell and *Carpocapsa* be retained as the first restriction of *Cydia* on account of its page precedence.

As, however, a genus is not fixed before its type is determined and as both *Carpocapsa* and *Grapholita* of Treitschke contained several other species besides the three in Hübner's *Cydia* none of them is necessarily synonymous with this genus; in fact none of them could rightfully be made such according to the rules of nomenclature unless all the species contained in them were truly congeneric, which is not the case.

But the type of *Carpocapsa* had already been fixed as *pomonella* before the above-mentioned work of Stephens, by Curtis (Brit. Entom., VIII, p. 352, 1831), and that species could therefore not rightfully subsequently be fixed as the type of *Cydia*, which must be one of the remaining species of that genus.

Besides Curtis' work another earlier reference bearing on the subject is found, namely Kirby's and Spence's Introduction to Entomology in which in Vol. III, p. 123, 1826, *pomonella* Linn. is given the generic name *Erminea*.

This being the earliest elimination from *Cydia* it would have held good for *pomonella*, which as the only species mentioned must be regarded as the type of the genus, if the name *Erminea* had not previously been used in another sense by Haworth.*

* That such is the case I did not realize before Professor Fernald called my attention to it.

To put it in more schematic form and in chronological order :

I. Hübner, Verz., p. 375, 1818.

Cydia Hübner.

pomonella Linn.

aspidiscana Hübn.

monetulana Hübn. (= *cana* Haw. = *hohenwarthiana* Schiff.).

All three species belong to different genera ; no type indicated.

II. Kirby & Spence, Intr. Ent., III, p. 123, 1826.

Erminea Kirby & Spence.

pomonella Linn.

This being the first restriction of *Cydia* and *pomonella* being the only species mentioned in the genus it must be the type of that genus, but as the name *Erminea* was preoccupied in another sense by Haworth [Lep. Brit., III, p. 512, 1812] this name cannot be employed for *pomonella*.

The date of *Erminea* Haworth is given by C. O. Waterhouse in his Index Zoölogicus, 1902, as 1828, the correct date of Volume IV of Haworth's Lep. Brit., on the first page of which (p. 512) the genus appears. This would make *Erminea* Haworth subsequent to *Erminea* of Kirby and Spence, whose name thus would stand, but Professor Fernald informs me that part of that particular page (512) was published already in Haworth's Volume III, 1811, and subsequently republished as the first page of Vol. IV.

Professor Fernald writes (letter of May 26, 1903): "*Erminea* was first established, so far as I know, by Haworth on the last page of his Lepidoptera Britannica, which was published in 1811. The genus was described and the species *evonymella* was given with its synonymy and description and then *irrorea* was given with the Latin diagnosis, which was all there was room for on this page."

"Part IV of the Lepidoptera Britannica was published in 1828, as shown on the outside cover of my copy, and also the date is given on the last page in this part. Page 512 was reprinted as the first in Part IV. The author in the postscript at the end of the work gives his reason for doing this. Waterhouse evidently found *Erminea* on the first page in Part IV, but overlooked the fact that it had already been printed in Part III. Tutt in his British Lepidoptera has made the same error. My copy is in the original parts, a condition in which the work is now rarely found."

I should have been able to find this state of affairs out through a more careful perusal of Stainton's Cat. Brit. Lep., III, 1851, on which work, together with those of the modern authorities, I depended for the date of *Erminea* Haworth. As however the only reference to *Erminea* in the index of Stainton's work is to page 34 and there is given the year 1829 as the date for the identical page 512 on which *Erminea* is erected it did not occur to me to look further, before aroused by Professor Fernald's letter. On page 36 Stainton gives the date for page 512 as 1812 and 1829 and on page 37 the single date 1812.

III. Treitschke, Schmett. Europe, VIII, p. 231, 1829.

Carpocapsa *Treitschke*.

- pomonana* Linn.
splendana Hübn.
woeberiana Schiff.
arcuana Linn.
aurana Hübn.

No type indicated.

IV. Treitschke, Schmett, Europe, VIII, p. 232, 1829.

Grapholita *Treitschke*.

Fam. A. *hohenwarthiana* Schiff. (= *monetulana* Hübn.).

- hypericana* Hübn.
aspidiscana Hübn.
zachana Hübn.

Fam. B. *lunulana* Schiff.

- dorsana* Hübn.
montana Schiff.
ephippiana Hübn.
trauriana Hübn.
gundiana Hübn.

No type indicated.

V. Stephens, Cat. Brit. Ins., II, p. 179, 1829 (1830?)

Semasia *Stephens*.

- pomonella* Linn.
splendana Hübn.
grossana Haw.
woeberiana Schiff.
rheediella Linn.
lanccolana Hübn.
hypericana Hübn.
perlepidana Haw.
pupillana Linn.
putvana Steph.
cana Haw. (= *monetulana* Hübn.).
scopoliana Haw.
rufana Steph.

No type indicated.

VI. Curtis, Brit. Entom., VIII, p. 352, 1831.

Curtis designated *Tinea pomonella* Linn. as the type of *Carpocapsa* Treitschke. This definite assignment of *pomonella* as type of *Carpocapsa* was perfectly legitimate when *Ermenia*, Kirby and Spence is invalid and effectually settles the question as far as *pomonella* is concerned. That species must from that date rightfully be known as *Carpocapsa pomonella*. Lord Walsingham evidently overlooked this reference in 1897.

VII. Stephens, Ill. Brit. Entom., IV, p. 119, 1834.

Stephens makes *Cydia* a subdivision of his enlarged conception of *Carpocapsa* including in it *pomonella* Linn., *splendana* Hübn., *grossana* Haw., *aspidiscana* Hübn., thereby making the latter the type of *Cydia*, *pomonella* being already constituted types of *Carpocapsa* and *grossana* and *splendana* not being found in the original *Cydia* of Hübner.

Thus *Carpocapsa* should stand for the genus of which *pomonella* Linn. is the type, the *Carpocapsa* of Meyrick (Handbook Brit. Lep., p. 515, 1895) and Rebel (Staudinger and Rebel, Cat. Lep. Europe, II, p. 125, 1901) and the *Cydia* of Walsingham (Proc. Zoöl. Soc. Lond., p. 130, 1897) and of Fernald (U. S. Nat. Mus. Bull. 52, p. 471, 1903).

Cydia Hübner should be used for the genus of which *aspidiscana* Hübn. is the type as rightly employed by Meyrick instead of *Semasia* of Rebel's Catalogue and instead of *Thiodia* of Walsingham and Professor Fernald.

As a well-known entomologist, whose oral parts are developed on more romantic curves than mine expressed it:

“Fair Lady Pomonella was the heiress to all the apple orchards of the Pacific Northwest. Count *Cydia* and Baron *Carpocapsa* were two adventurous Austrian noblemen with a long black history. For many years Lady Pomonella, under the care of her guardian Sir John Curtis, had been keeping company with Baron *Carpocapsa* and it seemed that their marriage was assured. But her godfather Lord Walsingham who had heard of her early affection for Count *Cydia* discovered that nobleman in retirement at Stephen's hermitage. He reintroduced Count *Cydia*, who soon won Lady Pomonella's affection and their announcements were even published by Father Fernald in Dyar's Blue-book of the best Society in spite of hermit Cockerell's earnest protestations. At this moment, an alleged English Knight Earl *Erminia* of Kirbyshire, who had crossed foreign seas to fight the haughty Saracen,

returned and induced Busck's Detective Agency under promise of fame and fortune to introduce him to Lady Pomonella, whom he had not seen since his boyhood.

"He then attacked Baron Carpopapsa with three years' priority, stabbed Count Cydia with a monotype and eloped with the blushing Lady Pomonella. But alas! It was a short-lived bliss, as they were confronted at the very altar by Father Fernald who had looked up Earl Erminea's credentials and soon discovered that he was a preposterous pretender, travelling under the assumed name of the long-deceased Prince Erminea of Haworthia, and he was consequently at once ignominiously dumped into the sheol of homonymy.

"And Baron Carpopapsa regained consciousness in the nick of time and was brought to the altar to the anxious bride Pomonella, who was trembling lest the ceremony should again be nolle prossed.

"May they now live in peace!"

PROCEEDINGS OF THE NEW YORK ENTO- MOLOGICAL SOCIETY.

MEETING OF TUESDAY, JANUARY 6, 1903.

The annual meeting of the Society was held at the American Museum of Natural History. President Groth in the chair. Sixteen members present.

The report of the treasurer was presented and referred to the Auditing Committee.

Mr. Leng reported that a room had been reserved at the Hotel Endicott for the evening, January 24, when the annual dinner of the Society would take place.

A canvass of the members present was taken to determine the number who would attend the dinner. Seventeen signified their intention to be present.

On motion the dinner committee were instructed to invite the members of the Brooklyn Entomological Society.

Nominations for the elections of officers for the year 1903 were then called for, and the following names were presented:

For President, C. F. Groth and Wm. Beutenmüller; * Vice-President, Charles W. Leng; Recording and Corresponding Secretary, H. G. Barber; Treasurer, L. H. Joutel and E. G. Love; Librarian, C. Schaeffer; Executive Committee, W. D. Kearfott, W. T. Davis, E. B. Southwick, C. Roberts, Wm. Beutenmüller, Charles Palm, H. F. Kudlich, G. Beyer, Charles W. Leng and C. F. Groth; Publication Committee, E. G. Love, C. Schaeffer, L. H. Joutel, H. Hug, W. D. Kearfott, Henry Bird and Wm. Beutenmüller. The following were elected:

* Name withdrawn at request of candidate.

President, C. F. Groth; Vice-President, Charles W. Leng; Recording and Corresponding Secretary, H. G. Barber; Treasurer, L. H. Joutel; Librarian, C. Schaeffer; Executive Committee, W. T. Davis, C. W. Leng, Wm. Beutenmüller, Charles Palm and E. G. Love; Publication Committee, Wm. Beutenmüller, W. D. Kearfott, H. Hug and Henry Bird.

The following committees were appointed by the president:

Field Committee: W. T. Davis and J. R. de la Torre-Bueno; Auditing Committee: E. B. Southwick, H. G. Barber and C. Schaeffer; Delegates to Scientific Alliance: E. G. Love and T. D. O'Connor.

The treasurer presented a bill for \$18.79 in payment for boxes used in storing away the Journals, also, a bill for expressing Journals from Mr. Palm's residence to the Museum for \$2.50. On motion these bills were allowed.

Mr. Love moved that \$25.00 be transferred from the Society's account to the Journal fund. Carried.

Ellison A. Smyth, Jr. and C. T. Brues were elected active members of the Society.

Dr. Walther Horn and Mr. Charles Dury were elected corresponding members.

Adjournment.

MEETING OF JANUARY 20, 1903.

Held at the American Museum of Natural History. President Groth in chair. Fifteen members and three visitors present.

The Librarian reported that he has made a complete list of the books belonging to the Society, and that he assorted, counted and stored away in boxes the back volumes of the Journal.

Mr. Leng reported that the annual dinner would be held at the Hotel Endicott on the evening of January 24.

The Secretary read the resignation of Henry Bird from the Publication Committee, which was accepted with regrets.

Mr. Meyer proposed the following amendment to the Constitution and By-Laws:

Article IV, shall be amended to read "Officers shall be elected at the annual meeting of the Society by a majority vote of the members present in person and voting at that meeting. Proxies shall not be accepted."

Mr. Davis stated that seven specimens of *Homoglua carnosa* Grote were found at Lakehurst, New Jersey, resting on huckleberry bushes at twilight, on October 18 and 19, 1902. A specimen was given to the American Museum of Natural History, was identified by W. Beutenmüller to be this species. Another specimen was sent to Prof. John B. Smith, who stated that the identification was correct and that the specimen was the first he had been able to add to his collection. It seems to be a rare moth in this vicinity. Another moth new to the New Jersey list is *Catocala herodias* Streck. Two specimens were captured on pine trees at Lakehurst, New Jersey, on the 12th and 13th of July.

Mr. Joutel exhibited a box of twelve *yama-mai* moths, the specimens ranging in color from uniformly dark lemon yellow, through various shades of red and combinations of red and yellow, to some that were extremely dark reddish-brown, nearly black. These were connected by intermediate forms with other examples which were of a pale clay color. He stated that all of the individuals were raised from the same

parents. He pointed out that some specimens had entirely lost the clear space in both sets of wings, which made them look quite distinct. There was no variation in the larvæ or in the conditions in which they were bred.

Mr. Barber said that he wished to put on record what seemed to him a very peculiar breeding place for a bot-fly. Mr. E. H. Emerton had noticed one day at Cold Spring Harbor, Long Island, a common box turtle that had a peculiar swelling under the edge of the shell near the head. They discovered that the swelling was open in front and within, by means of forceps, they found several grubs of a bot-fly. These were removed and placed in a proper jar for maturing. In a recent communication Mr. Emerton stated that he had obtained the fly and had determined it as a species of the genus *Sarcophaga*. Mr. Beutenmüller and Mr. Brues both stated that they had seen a record of the occurrence of the bot-fly on the turtle.

Mr. Schaeffer spoke concerning some of the genera of Cerambycidae. He said that by the addition of new species the definition of some of the genera of Cerambycidae becomes very vague. Among others he mentioned the genera belonging to the tribe *Ibidionæ* of Lecordaire, to which the genus *Ididion* with three species has to be added to our list and which seem to differ only from *Compsa* by the carinate hind tibiae, a character which, if he remembered correctly, is not so very pronounced in some of the Central American species. The distinguishing characters were explained by him and the following table presented :

Front coxal cavities closed behind ; joint 3-6 of antennæ carinate.	
Tibiae carinate	<i>Ibidion.</i>
Tibiae not carinate	<i>Compsa.</i>
Front coxal open behind ; antennal joints and tibiae not carinate.....	<i>Heterachthes.</i>

He mentioned further that Bates, in Biol. Centr. Amer., referred all of the Central American species to *Ibidion*, of which some evidently would fall either in *Compsa* or *Heterachthes*. All of the species known to occur in our fauna were exhibited by him with the exception of *I. nobilis*. The three species of *Ibidion* are *I. exclamatoris*, *townsendi* and *textile* var. *alacre*, all three from Brownsville, Texas.

He also exhibited a specimen of the true ♀ of the white ant, *Termis flavipes*, the capture of which he had recorded in one of the previous meetings; also the piece of wood out of which the queen was taken.

His collection of Cassidini were then shown by him with a series of the newly-discovered *Cassida viridis** from Canada, concerning which he remarked, that from what he was able to gather from the references within his reach, he takes to be the European *Cassida viridis* contrary to the views of Messrs. Wickham and Liebeck, who identified it as *C. thoracica* as one of his correspondents had informed him, and that Rev. Dr. Fyles who first took the species and recorded it in the Canadian Entomologist as *C. viridis*, was right in his identification.

Adjourned.

* Specimens of this species were exhibited by me at a previous meeting, and were pronounced, by Mr. Schaeffer, not to be *C. viridis*. The identification, however, seems to have been correct. — W. B.

MEETING OF FEBRUARY 3, 1903.

A regular meeting of the New York Entomological Society was held at the American Museum of Natural History, Tuesday evening, at eight o'clock. President Groth in the chair. Twenty-three members present.

A communication was read from Mr. Joutel requesting the Society to endorse his application for a grant from the Herman fund to enable him to study the white-ant (*Termes flavipes*).

Mr. Watson proposed for active membership Dr. R. E. Call, and Mr. Barber proposed Mr. George A. Billings.

Mr. Love moved that a member of the Publication Committee be elected to take the place of Mr. Bird, resigned.

Mr. Kearfott nominated Dr. H. G. Dyar as a member of the Publication Committee and he was duly elected.

The amendment to Article IV of the Constitution and By-laws (as proposed at the last meeting) was read and on motion was carried.

A vote of thanks was extended to Professor John B. Smith for his interesting lecture on mosquitoes, delivered January 24.

Dr. R. E. Call then delivered a lecture on insect life and insect collecting underground, illustrated by slides, which showed the more interesting types obtained by the lecturer during a period of six years in which the Mammoth Cave was explored and surveyed. Dr. Call made running comments upon the different forms as they were thrown upon the screen, dwelling particularly upon the peculiar adaptations of the cave-inhabiting forms. He showed also a map of the cave and explained where the best collecting was to be found.

The President expressed the thanks of the Society to Dr. Call for his lecture.

Mr. Watson then gave "Some Notes on Three of our Local Butterflies," and exhibited specimens to illustrate his remarks. Two specimens of *Pamphila attalus* Edw., were taken at Lakewood, N. J., July 12, 1902, by Mr. Comstock and himself. Two male specimens of *Pamphila bimacula* G. and R., were captured at Greenwood Lake Glens, N. J., on June 22, 1902. Also one male and three female specimens of *Pamphila dion* Edw., were taken at Jamesburg, N. J., the latter part of August, 1902.

Mr. Davis stated that he had found *P. dion* at Lakehurst, N. J., July 27, and at Brookeville, N. J.

Mr. Schaeffer exhibited two new Scarabæidæ from Florida, on which he made the following remarks:

One of the localities given for *Strategus julianus* is Florida, but all the specimens he had seen in collections from that locality are undoubtedly distinct from *Strategus julianus*. The side margins of the prothorax meet the base in a continuous curve, the horn on each side of the middle of the prothorax is more slender and somewhat tapering to tip, not broad or laminiform as in *julianus*; the guleæ of mandibles are also different; the tibial ridges next to the apex in *julianus* are broadly rounded, while in the Florida specimens they are angulate with a strong tooth on the outside; the thorax is entirely smooth and not transversely wrinkled as in *julianus*. All of these characters make it as unquestionably distinct from *julianus*, and it seems to be nearly allied if not identical with one of the forms

included by Burmeister in his Handbuch under *Strategus alans* Fabr. He also remarked that the new *Trigonopeltastes* (*Trichius*) which he said he owes to the kindness of Mr. Leng, is very distinct from *T. delta* by the different form of the clypeus and different color markings.

He then exhibited a specimen of *Lachnosterna postrema* Horn, taken at Point Pleasant, N. J., by Mr. Green, remarking that it is quite a rare species, and the only recorded locality for it is Florida. It resembles some of the forms of *L. fusca* very closely but is distinct from them by having the apex of the hind tibiae sinuate before the fixed spur in the male and the straight ridge of the penultimate abdominal segment; the genitalia differ also somewhat.

Society adjourned.

MEETING OF FEBRUARY 17, 1903.

A regular meeting of the New York Entomological Society was held at the American Museum of Natural History. President Groth in the chair with ten members present.

On motion of Mr. Joutel, Dr. R. E. Call and Mr. Geo. A. Billings were elected active members of the Society.

The Society then listened to a lecture by Professor E. B. Southwick on the subject of "A Botanical Study of the Plant Families as Insect Food," illustrated by stereopticon slides.

Mr. Wm. T. Davis exhibited a large fly resembling a bumble-bee in general appearance and stated that it had been received from Mr. C. H. Sunderland, who collected it at Rutherford, N. J. From the figures and description contained in "Insects Affecting Domestic Animals," Bulletin No. 5, new series, U. S. Dept. of Agriculture, it appeared to be the rabbit bot-fly, *Cuterebra cunicula*. The insect has not before been reported from this vicinity.

Mr. Joutel stated that he had found a larva beneath the skin of a rabbit, and Mr. Chubb added that he had found several larvæ in tumors filled with pus in a rabbit skinned by him. There is another species of rabbit bot-fly, the cotton-tail bot, *Cuterebra fontinella*, that might be found in this vicinity.

MEETING OF MARCH 3, 1903.

Held at the residence of Dr. Rodrigues Ottolengui, 522 W. 140th St. Mr. Groth in the chair, with fourteen members and three visitors present.

The President reported that the Executive Committee had decided to endorse Mr. Joutel's application for a grant from the Herman fund in order to investigate the white-ant.

Dr. Ottolengui then gave an interesting account of his collecting on Mt. Katahdin and in the Adirondacks.

Adjournment.

MEETING OF MARCH 17, 1903.

A regular meeting of the Society was held at the American Museum of Natural History, Tuesday evening. President C. F. Groth in the chair with ten members and eleven visitors present.

Mr. Davis, of the Field Committee, reported that the first outing would take place on April 19, to Ft. Lee, N. Y.

Professor W. G. Johnson then delivered an interesting and instructive lecture on the subject of "Some Entomological Problems in America's Largest Orchards."

Professor Johnson confined his remarks mainly to a discussion of the peach-raising industry in different parts of the United States. He stated the total number of peach-bearing trees in the United States and then took up in turn, the peach belt of Georgia, Michigan, Lake Ontario and the western New York region, Chesapeake Peninsula, Blue Mountain belt. He exhibited characteristic lantern slides showing different phases of the industry in these various sections.

He explained some of the methods used in combating the diseases and insect enemies of the peach trees, paying particular attention to the San José scale and the hydrocyanic gas treatment of these insects.

Adjournment.

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THE SKEWNESS OF THE THORAX IN THE ODONATA.

BY JAMES G. NEEDHAM AND MAUDE H. ANTHONY.

(PLATE VIII.)

Any one looking carefully at a dragonfly sees that the legs are attached far forward and the wings far back upon the thorax, and that the side plates of the latter are decidedly aslant. This arrangement of parts is an adaptation to perching on the sides of vertical stems without much alteration of the position maintained in flight. It makes for celerity in stopping and starting again. The legs are thrown forward where they readily reach and grasp the vertical stem, and the wings are shifted backward and tilted so that their cutting edges are directed obliquely upward, in which position a simple sculling action lifts the body instantly from its support.

In the jumping Orthoptera exactly the reverse inclination of the lateral thoracic sclerites has taken place: the legs have been shifted backward — especially the large hind ones used in jumping — and the side pieces are aslant with the opposite inclination. Doubtless these lateral sclerites (episternum and epimeron) were primitively placed at right angles to the axis of the body, so that the sutures between them were vertical, as they still are when first developed in dragonfly and grasshopper alike.

Among the orders the Odonata are extremely isolated, and, in their own way, undoubtedly highly specialized. As marks of their isolation the accessory genitalia of the males developed in an isolated position on the ventral side of the second abdominal segment, the

type of venation, and the remarkable structure of the labium — especially, of the nymphal labium — have been frequently noted. But this skewness of the thorax, hitherto almost unstudied, is the external evidence of the most profound alterations of the whole bodily organization. As for the skeleton, the legs have moved forward and the wings backward, greatly increasing the areas between the sternum of the metathorax and the abdomen, and between the tergum of the mesothorax and the prothorax respectively, and these areas have been overgrown by neighboring lateral sclerites (mesepisternum in front and metepimeron behind). The unusual proportions and the new (dorsal and ventral) positions thus attained by these sclerites were long a puzzle to many eminent entomologists. The question of their homologies was finally set at rest by a study of the segmental muscles and sutures made by Dr. Calvert for his well-known catalogue, published in 1893. He showed that the muscles have retained fully their segmental arrangement, the wing muscles becoming enormously enlarged and taking on the general inclination of the thorax. The mid-lateral suture is completely and the others are almost obliterated.

This fusion of sclerites is doubtless an accompaniment of the increasing power of the wing muscles. The skeleton is further strengthened by the development of a unique system of carinæ, the strongest of which is the mid-dorsal thoracic carina, formed at the junction of the mesepisterna along the dorsal line, forking above and ending in an antealar crest, ending below in a transverse collar-like ridge abutting against the prothorax. There are also carinæ along the upper ends of the lateral sclerites about the wing bases, and others trussing the floor of the metathorax between the bases of the hind legs and the abdomen. Doubtless these all contribute to the strength of the thoracic skeleton, and enable it to withstand the pull of the enormously large and powerful wing muscles. If in a dragonfly that has newly emerged from the nymphal skin and that has not yet had time for the hardening of the skeleton, the muscles be stimulated artificially to contract (as by putting in alcohol or cyanide bottle) they draw the thorax into a crumpled and contorted condition. Doubtless a careful study of this system of carinæ, and of the external topography of the thoracic skeleton in general would yield good results: but it is a less ambitious undertaking that this paper records.

Impressed by the differences in degree of skewness in the thorax of a number of dragonflies that were lying before him one day, the

senior author bethought himself that this skewness might be measured, and devised as an instrument for the purpose the goniometer shown in Pl. VIII, Fig. 1. This was constructed with little trouble out of a discarded box top, about 100 mm. square, a small brass protractor scale, a bicycle spoke, and a piece of brass about 25 mm. square. The brass was first drilled through the center and reamed out so that the head of the bicycle spoke would fit it neatly and rotate in it smoothly. Then the corners of the brass were drilled to receive screws. Then, with the spoke in place, its head flush with the surface of the brass, the latter was screwed fast to the under side of the wooden base, nearer the hinge edge of the cover, from which the side strip that was underneath had been removed. Thus the spoke was securely held by its head while free to rotate in the brass. Then the spoke was bent twice at right angles in an elongate **U** with unequal arms, the first bend perpendicular to, the second parallel to the surface of the board, the two arms being strictly parallel and far enough apart to allow the placing of the body of the largest dragonfly between the upper arm and the wooden base (Pl. VIII, Fig. 1). Then the protractor scale was glued to the wooden base in such position that its center of curvature was exactly over the center of the pivot below the base. The longer upper arm of the **U** then crossed the center in any position of rotation, and its end crossing the scale served as an indicator.

To use this goniometer a dragonfly with wings folded back to back was laid on a broad glass slip (this merely for convenience in moving the specimen) and brought to rest with its predetermined base line of angle measurement coinciding with the base line of the protractor scale. Then the index arm above was moved parallel with the suture forming the other limb of the angle to be measured. Then the angle was read by sighting along the edge of the indicator, keeping the exact center and the degree to be read in alignment. Thus the three successive operations — the placing of the specimen, the adjustment of the indicator and the reading of the scale — were done independently and in the order stated. This made for accuracy, but there were both mechanical and anatomical reasons why great accuracy was unattainable.

1. *Mechanical.* — The base line was too short. It was impossible to go beyond the confines of the combined meso- and metathorax and have fixed points, owing to the flexibility of the articulations with prothorax and with abdomen. To settle upon two points that should

determine a longitudinal line in comparison with which the angle of inclination of the sclerites should be measured was not easy. After canvassing the external topography of the thorax carefully, we settled upon the pleural articulation of the middle coxa for the anterior point (Pl. VIII, Fig. 2, *b*) and the infero-lateral articulation of the thorax and abdomen for the posterior, the two determining the base line *bd* of Fig. 2. By comparing Fig. 1* it will be seen that the two points are so close together as to occasion difficulty in bringing them into exact coincidence with the base line of the scale.

2. *Anatomical.*—The anatomical sources of error were several. (*a*) The articulations used to determine the base line are something more than points in breadth. (*b*) They are sometimes obscured by hairs. (*c*) The sutures with which the indicator must be made parallel are sometimes sinuous, and their general direction has to be estimated.

At first the skewness of the three lateral sutures and of the dorsal carina were measured, but as the differences discovered were rather less than the rather wide limits of probable error, only the first lateral (humeral) suture was measured to the end, and that and the tilt of the wing bases in the opposite direction are reported upon below.

The diagrammatized photograph (Fig. 2) shows these angles: *abc* is the angle made by the humeral suture *cb* with the perpendicular *ab* to the base line *db*, assumed to be parallel with the axis of the body. This angle measured upon the arc *x* represents the degree of skewness or inclination of that suture.

cdb is the angle made by a line *cd* drawn through the wing bases with the base line *bd*, and is measured upon the arc *z*. The wing bases are assumed to have rested primitively upon the line *cc* parallel to *db*. The specimen shown in Fig. 1 is nearly in position for measuring this angle.

The actual measurements were all made by the junior author upon miscellaneous papered specimens. Each specimen selected was measured first upon one side and then upon the other, and after intervening measurement of other species, was measured again, and then the average of all the measurements was taken. But one specimen was used for each species and the sex was disregarded. Some of the first meas-

* The specimen is off the base line in Fig. 1, having slipped out of place just before this photograph was taken.

urements made showed considerable discrepancies and were discarded altogether; but, with practice, they came into much closer agreement. It is not claimed, however, that the figures herein given are to be relied upon absolutely within the limits of two or three degrees.

Suborder Anisoptera.

Fam. ÆSCHNIDÆ.

ÆSCHNINÆ.

	<i>x</i>	<i>z</i>		<i>x</i>	<i>z</i>
<i>Boyeria irene</i>	21	19*	<i>Staurophlebia magnifica</i> ...	36	25
<i>Anax junius</i>	27	21	<i>Epiæschna heros</i>	37	23
<i>Æschna californica</i> ..	34	22	<i>Gomphæschna furcillata</i> ...	37	24
<i>Coryphæschna ingens</i>	34	25	<i>Gynacantha trifida</i>	39	27
<i>Æschnophlebia anisoptera</i> ...	35	34†	<i>Basiaeschna janata</i>	42	27
<i>Æschna verticalis</i>	36	23	<i>Planæschna multipunctata</i>	42	28

GOMPHINÆ.

<i>Dromogomphus spinosus</i>	31	25	<i>Lanthus albistylus</i>	42	28
<i>Gomphus simillimus</i> ..	32	22	<i>Herpetogomphus designatus</i>	41	28
<i>Gomphus villosipes</i>	33	26	<i>Ophiogomphus serpentinus</i> ..	44	27
<i>Gomphoides stigmatus</i>	36	26	<i>Progomphus obscurus</i>	44	27
<i>Gomphiidia confluens</i>	37	26	<i>Onychogomphus uncatatus</i> ...	47	27
<i>Aphylla producta</i>	39	27	<i>Epigomphus paludosus</i>	47	29
<i>Hagenius brevistylus</i>	40	22*	<i>Hemigomphus ochraceus</i>	50	29†
<i>Gomphus dilatatus</i> ..	41	22			

PETALURINÆ.

<i>Tachopteryx thoreyi</i>	40	28
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CORDULEGASTERINÆ.

<i>Cordulegaster diastatops</i>	37	35
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Fam. LIBELLULIDÆ.

MACROMIINÆ.

<i>Didymops transversa</i>	29	20	<i>Epopthalmia elegans</i>	33	18*
<i>Macromia magnifica</i>	32	22	<i>Synthemis brevistyla</i>	39	33†

* Minima: second column.

† Maxima: second column.

CORDULINÆ.

<i>Helocordulia uhleri</i>	30	25	<i>Tetragoneuria canis</i>	36	29†
<i>Epicordulia princeps</i> ..	33	24	<i>Cordulia shurtleffi</i>	37	24
<i>Hemicordulia tau</i>	34	23*	<i>Somatochlora elongata</i>	38	24

LIBELLULINÆ.

<i>Perithemis domitia</i>	28	21	<i>Mesothemis simplicicollis</i>	43	34
<i>Acisoma panorpoides</i>	28	24	<i>Trithemis minuscula</i>	43	38*
<i>Rhyothemis splendida</i>	33	25	<i>Brachythemis contaminata</i> ..	44	26
<i>Onychothemis abnormis</i>	31	22	<i>Tramea carolina</i>	44	27
<i>Brechmorhoga mendax</i>	34	24	<i>Pachydiplax longipennis</i>	44	27
<i>Lepthemis vesiculosa</i>	34	27	<i>Crocothemis erythræa</i>	44	30
<i>Belonia herculea</i>	35	19*	<i>Anatya anomala</i>	45	29
<i>Diastatops tincta</i>	36	27	<i>Neurothemis equestris</i>	45	31
<i>Zygonyx iris</i>	36	28	<i>Micrathyria didyma</i>	47	27
<i>Dythemis velox</i>	37	29	<i>Potamothemis americana</i> ...	46	29
<i>Orthetrum albistylum</i>	38	25	<i>Sympetrum rubicundulum</i> ...	46	31
<i>Miathyria marcella</i>	39	24	<i>Pantala flavescens</i>	47	25
<i>Plathemis lydia</i>	40	22	<i>Celithemis elisa</i>	48	30
<i>Ladona julia</i>	40	28	<i>Palpopleura vestita</i>	49	24
<i>Libellula pulchella</i>	41	23	<i>Melanarptis minckii</i>	49	31
<i>Orthemis ferruginea</i>	41	27	<i>Leucorhinia glacialis</i>	51	23
<i>Nannothemis bella</i>	42	32	<i>Macrothemis</i> sp. †.....	52	30
<i>Pseudophlebia minima</i>	43	28			

Suborder **Zygoptera**.

Fam. CALOPTERYGIDÆ.

EPIOPHLEBINÆ. †

<i>Epiophlebia superstes</i>	43	45
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EPALLAGINÆ.

<i>Euphæa decorata</i>	51	45*	<i>Anisopleura lestoides</i>	64	54
<i>Rhinocypha</i>	63	61†	<i>Bayadera indica</i>	67	57
<i>Diphlebia lestoides</i>	64	53			

* Minima : second column.

† Maxima : second column.

‡ An undetermined species from Brazil, selected for the extreme reduction of its venation.

§ The preoccupied Selysian name *Paleophlebia* being now replaced by *Epiophlebia* (Calvert, Ent. News, vol. XIV, p. 208, 1903), the subfamily name is here modified to correspond.

VESTALINÆ.

<i>Neurobasis chinensis</i>	46	39	<i>Calopteryx maculata</i>	54	43
<i>Mnais strigata</i>	50	40	<i>Heterina americana</i>	58	40
<i>Calopteryx angustipennis</i>	51	35*	<i>Lais pudica</i>	59	49†

THORINÆ.

<i>Thore picta</i>	52	48	<i>Cora inca</i>	59	50
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Fam. AGRIONIDÆ.

LESTINÆ.

<i>Archilestes grandis</i>	59	38	<i>Lestes rectangularis</i>	66	48
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AGRIONINÆ.

<i>Calicnemis atkinsoni</i>	57	51	<i>Disparoneura vittata</i>	64	55
<i>Hyponeura lugens</i>	58	53	<i>Oxyagrion terminale</i>	64	58
<i>Platycnemis pennipes</i>	61	42	<i>Nehalennia irene</i>	64	61
<i>Hemicnemis bilineata</i>	61	51	<i>Leptagrion macrurum</i>	65	47
<i>Amphiagrion saucium</i>	62	42*	<i>Enallagma doubledayi</i>	65	48
<i>Xanthagrion erythroneurum</i>	62	47	<i>Protoneura capillaris</i>	65	53
<i>Ischnura grallsii</i>	62	48	<i>Telebasis allaudi</i>	65	53
<i>Argia violacea</i>	63	59	<i>Ceriagrion glabrum</i>	65	53
<i>Ceratura capreola</i>	64	48	<i>Acanthagrion gracile</i>	65	54
<i>Mecistogaster</i> sp?.....	64	49	<i>Acanthagrion cheliferum</i>	65	57
<i>Anomalagrion hastatum</i>	64	51	<i>Erythragrion saluum</i>	67	45
<i>Agriocnemis pulverulans</i>	64	55	<i>Aciagrion pallidum</i>	72	62*

The maxima, minima and averages for both angles are given for the subfamilies, of which representatives were studied, in the following table :

Anisoptera	ÆSCHNIDINÆ	Angle of humeral suture.			Angle of tilt of wing bases.		
		Mi.	Ma.	Av.	Mi.	Ma.	Av.
		ÆSCHNINÆ.....	21	42	35	19	34
GOMPHINÆ.....	31	50	40	22	29	26	
PETALURINÆ.....	40	—	—	35	—	—	
CORDULEGASTERINÆ.....	37	—	—	35	—	—	
MACROMIINÆ.....	29	39	33	18	33	24	
CORDULINÆ.....	30	38	35	23	29	25	
LIBELLULINÆ.....	28	52	41	19	38	30	

* Minima : second column.

† Maxima : second column.

		Angle of humeral suture.			Angle of tilt of wing bases.			
		Mi.	Ma.	Av.	Mi.	Ma.	Av.	
Zygoptera	CALOPTERYGIDÆ	EPIOPHLEBIINÆ.....	43	—	—	45	—	—
		EPALLAGINÆ.....	51	67	62	45	61	54
		VESTALINÆ.....	46	59	54	35	49	41
		THORINÆ.....	52	59	55	48	50	49
		LESTINÆ.....	59	66	62	28	48	43
	AGRIONIDÆ	AGRIONINÆ.....	54	72	62	42	62	49

The above listed material was the best selection that could be made from the material that happened to be at hand in the collection of the senior author. Only papered specimens could be used readily. Whole subfamilies are unrepresented, and the material used is insufficient to furnish a basis for true averages for any of the subfamilies. Yet notwithstanding this, and with all due allowance for error in the making of difficult measurements of angles, some general results are sufficiently evidenced by the figures obtained.

In the first place it is evident that the skewness of the thorax is much greater in the Zygoptera than in the Anisoptera, the average of the former being above the maximum of the latter. The minimum for both angles measured is found in the *Æschmīnæ*, and the maximum in the *Agrioninæ*. The widest range is shown by the *Libellulinæ*, and it is probable that this is due only in part to the selection of a wider range of representatives of this subfamily.

There was found less correlation between the two angles measured than might have been expected. It will be observed throughout that the maxima and minima rarely fall in the same places in the two columns. The angle that measures the inclination of the humeral suture is with a single exception greater than that measuring the tilt of the wing bases, *Epiophlebia* alone furnishing the reverse condition.

There is little correlation between the size of the insect and the inclination of the humeral suture: just how much, will be seen by glancing down the first column, which in each subfamily is arranged in accordance with the increasing angulation here. There appears to be much more correlation between mere size and the tilt of the wing bases: for it will be noticed in each group that the minimum falls upon one of the largest and the maximum on one of the smallest species.

It must not be forgotten for a moment that these measurements take no account of possible parallelisms within the subfamilies, nor of di-

vergent lines of development, but give merely the degree of progress in two particular lines of specialization arbitrarily selected. The figures, however, are interesting to one who knows these species by sight — even surprising — especially in the Libellulinae, where they seem to support no one's theory of the interrelationships of the genera.

PHRYGANIDIA CALIFORNICA, *PACKARD*.

BY BEVERLY LETCHER.

Had the general excellence of the account of the life history of this moth as set forth by Vernon L. Kellogg and F. J. Jack (Proceedings of the California Academy of Sciences, second series, Vol. V, 1895, page 562) been maintained throughout their article, there would hardly have been occasion for the present but with them critical observation seems to have ceased with the pupal stage. Other differences are slight but as they are of some interest, may be noted.

To afford a ready comparison of the head measurements, they have been tabulated, those of Kellogg and Jack appearing in the first column and those of the writer in the third. Little value can be attached to the several durations of stages in the fourth column as they were made on larvæ subject to the artificial surroundings of the study: they are from observations of the summer brood while those of Messrs. Kellogg and Jack were made on wintering larvæ.

Stage.	Kellogg and Jack.		Letcher.	
	Mm.	Days.	Mm.	Days.
Egg		10		10
1st	.68	14	.53, .67	8
“ supplementary			.73	8
2d	1.14	13	1.15	6, 8
3d	1.45	17	1.32, 1.47	7
4th	1.88	25	1.82	8
5th	2.21	21	2.20	5
6th	2.57	12	2.31	9
Pupa		10		9

A practical agreement is to be noted for the 1st, 2d, 3d, 4th and 5th stages. My observations show a stage supplemental to the 1st and

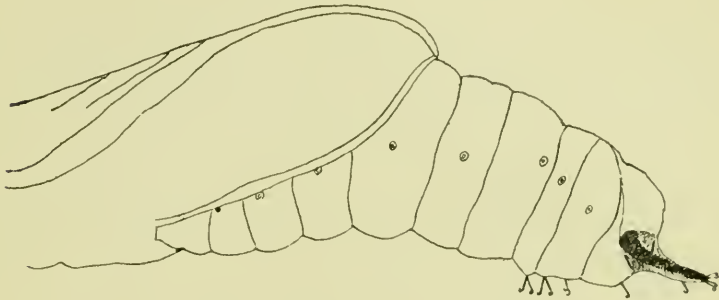
what was at the time of disturbing, a measurement of one larva in the first stage of .53 mm. and of one in the third of 1.32 mm. The 2.31 of the sixth stage as against 2.57 mm. was also suspicious, but as it had been carefully taken and was the average of a number but slightly varying, there can be no question as to its correctness. The calculated series for the second set of observations would be (ratio .80) .74, .94, 1.16, 1.48, 1.85 and 2.31 which contains most of the observed stages: and for the first .54, .68, .85, 1.06, 1.32, 1.65, 2.06 and 2.57. In neither of these does the observed fifth stage (2.20) find a place: but all of the others, including the abnormal measurements, appear in one or the other of the series.

Markings.—The development of the markings also shows a close correspondence, although through the absence of the divided first stage their derivation was not as clear to the first investigators.

The .53 mm. stage shows no markings whatever: the first stage (.68 mm.) a faint, claret-colored transverse shade on the 1st, 3d, 5th, 7th, 8th and 9th abdominal segments extending across the dorsum to tubercle iii on each side. In the supplementary stage the subdorsal line (sometimes interrupted) appears widening on each segment to reach tubercle iii and on the 2d thoracic, to surround tubercle i. The transverse dorsal shades have now on abdominal segments 1, 3, 5, 8 and 9 become distinct and broad and extend ventrally on segments 1, 7 and 8 (7, however, has become clear dorsally) to beyond the as yet undeveloped tubercle vi. In the second stage, the dorsal line appears indicated by spots, always on the thoracic segments and interruptedly on the abdominal. Traces of the infraspicular line are also apparent. In the third stage, the infraspicular line is more clearly marked and a supraspicular line is developed by the restriction and breaking up of the transverse bands. The fourth stage shows all lines well marked—dorsal, addorsal, subdorsal, supraspicular, infraspicular and subventral. In later stages, there is a gradual broadening and fusion of the lines so that in some individuals the markings appear yellowish green on a dark ground instead of the reverse. The greenish-yellow ground color appears to exist in the fat body: the claret-colored markings are cuticular.

Wart Formation.—Is that of the typical noctuina pattern, large in first stage, later much reduced; setæ are simple. Tubercle vi wanting through the .73 mm. stage. Secondary setæ appear in the second stage, one above and one below tubercle iii and caudad to it.

Pupa. — In addition to the hooks of the cremaster (by which alone the article above cited says it is attached) the pupa has a series proceeding from the dorsum, one pair on 9th abdominal, two on 8th and one on 7th. The attachment is therefore quite rigid and is at first



sight peculiar in that the pupa faces out, its dorsum being applied to the supporting surface. No recorded observation is familiar to me, but such pupæ of the micros as have come to my notice face out and among the macros, pupæ of *Ctenucha ochroscapus* assume the same position; to what extent it may be characteristic of the Heterocera I cannot say.

The wing-cases are well developed and full and with a shortening dorsally of the 7th abdominal segment cause the dorsal surface to be more or less concave. The 5th and 6th segments are free. The 9th segment disappears ventrally and the 10th dorsally, the large 10th sternite assisting materially in producing the concave dorsum. The wart formation and setæ appear in the pupa in a very much reduced state.

There is a great deal of variability in the extent of the pupal markings, but where they do not occur the pupal case after emergence of the wings is transparent and readily lends itself to a study of the interior. In tracing the extent and location of the mouth and head parts it was noted that the clypeus showed internally the structure of the cocoon breaker which occurs in other forms, although there is no suggestion externally of its existence.

A PRELIMINARY LIST OF THE PENTATOMIDÆ WITHIN FIFTY MILES OF NEW YORK.

BY J. R. DE LA TORRE BUENO.

Due to the great courtesy of Mr. E. P. Van Duzee, of Buffalo, who very kindly examined and named the material collected by me in this locality and others near by in 1902 and the spring of 1903, I am enabled to present this very incomplete Preliminary List of the Pentatomidæ within fifty miles of New York. In extenuation for presenting such a fragment, I may say that it is, I trust, a beginning, a foundation on which myself or another better fitted for it than I, may erect a superstructure comparable to Professor Smith's invaluable list of the insects of New Jersey.

Of the Pentatomidæ in my collection, one genus, *Pentatoma*, and one species, *Mineus strigipes* H.-S., are additions to Smith's list for this vicinity. The specimen of *Pentatoma senilis* Say, was taken by that indefatigable collector, Mr. W. T. Davis, who generously presented it to me. He has several specimens from Staten Island, and it cannot therefore be rare hereabout.

Family PENTATOMIDÆ.

Perillus Stål.

P. exaptus Say. Mosholu, N. Y., June 22.

Mineus Stål.

M. strigipes H.-S. Mosholu, N. Y., July 12, 1902. Not rare.

Podisus H.-S.

P. maculiventris Say (= *spinus* Dall.). Mosholu, N. Y., July 19, August 23, September 4, October 6. Forest Park, L. I., June 8 and 14. Van Cortlandt Park, N. Y., September 13.

Brochymena Am. et Serv.

B. annulata Fab. Lakehurst, N. J., May 27.

Cosmopepla Stål.

C. carnifex. Fab. Mosholu, N. Y., August 9. Forest Park, L. I., June 8. Not rare.

Mormidea Am. et Serv.

M. lugens Fab. Mosholu, N. Y., May 31, June 22, July 4, 12, 19 and 26. Forest Park, L. I., June 14. Palisades, N. J., July 4.

Euschistus *Dallas.*

E. fissilis *Uhl.* Mosholu, N. Y., May 31, July 19 and 26, August 23. Forest Park, June 14.

E. tristigmus *Say.* Mosholu, N. Y., July 26, August 23, September 4. Staten Island, August 16.

E. variolarius *Pal. B.* Mosholu, N. Y., June 22 and 28, July 12 and 19, August 7 and 30, September 9. Forest Park, L. I., June 14. Van Cortlandt Park, New York, September 13.

Cænus *Dall.*

C. delius *Say.* Mosholu, N. Y., July 19 and 26, August 12, 23 and 30, October 18. Very abundant in clover patches in meadow.

Pentatoma *Oliv.*

P. senilis *Say.* Staten Island.

Hymenarcys *Am. et Serv.*

H. nervosa *Say.* Staten Island, N. Y., August 22.

Trichopepla *Stål.*

T. semivittata *Say.* Mosholu, N. Y., July 19 and 26, August 7, September 9. Very abundant in low grasses.

Peribalus *Muls.*

P. limbolarius *Stål.* Mosholu, August 9.

Thyanta *Stål.*

T. custator *Fab.* Mosholu, N. Y., June 28, July 19 and 26, August 23, September 4.

Nezara *Am. et Serv.*

N. pennsylvanica *DeG.* Lakehurst, N. J., May 27.

N. hilaris *Say.* Dunellen, N. J.

A SYNOPSIS OF THE NORTH AMERICAN
SPECIES OF JAPYX.

BY MYRON H. SWENK.

Since Haliday in 1864 characterized the genus *Japyx* from specimens of *J. solifugus*, over thirty additional species have been described from different parts of the world. Several of these are in all probability synonyms. Up to the present time six well-marked species have been described from the United States and Mexico, and these, together with an undescribed species from Nebraska, may be

separated by the following table based on characters of forceps dentation.

Right arm of forceps with about twenty small, blunt teeth, all of practically the same size and in a single continuous row; left arm with numerous small, blunt teeth, and a single large tooth midway between the center and the base of the arm.

Japyx hubbardi *Cook* (Chiricahua Mts., Arizona).

Right arm of forceps with one or two teeth decidedly larger than the others (1)

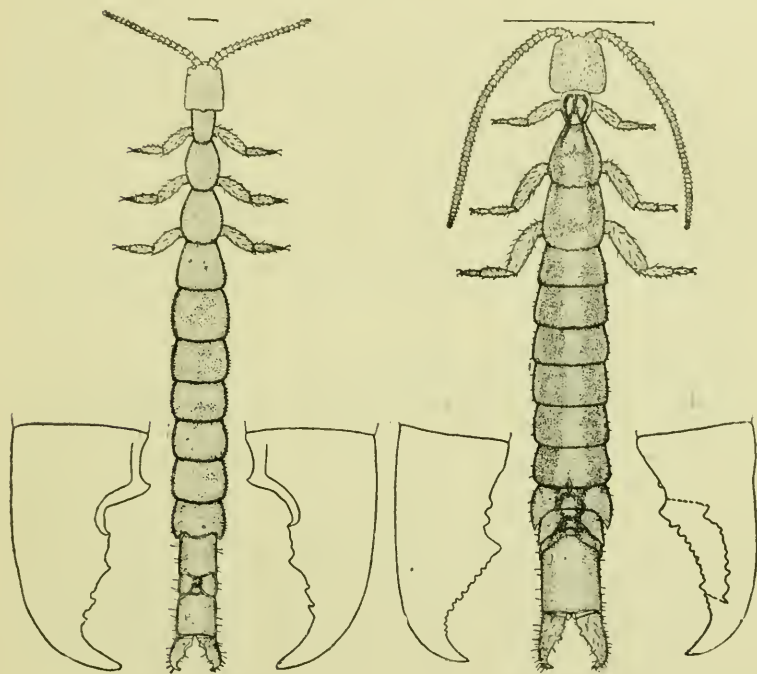
1. Center of inner margin of right arm with a single tooth larger than any of the other teeth (2).
 1. Largest tooth or teeth of right arm not in the center of the margin, but placed either proximally or distally from the center (5).
2. Right arm with a smooth, even sinus proximally from the broad central tooth, as broad as the base of the tooth itself, and abruptly interrupted by another tooth, smaller but also broad based and blunt; a row of six subequal denticles distally from the central tooth, and a superior row of one or two small denticles proximally from it; left arm with its largest tooth placed distally from the center, and proximally from it a superior and an inferior row, each containing about six blunt denticles **Japyx bidens** *Cook* (Alabama).
2. Right arm without a conspicuous sinus proximally from the central tooth; this in no case as broad as the base of the tooth itself, and not abruptly interrupted by another blunt tooth (3).
 3. Right arm with the proximal margin from the large central tooth having but one or two rounded denticles, the distal margin with about a dozen blunt denticles; left arm with a large tooth one-third the length of the arm from the base, midway between this tooth and the apex another smaller tooth, and between these teeth a double row of variously sized denticles, each row containing about eight. **Japyx saussurii** *Humbert* (Orizaba and Cordova, Mexico).
 3. Right arm with four or more denticles on the proximal margin from the central tooth (4).
4. Left arm very slender with about twenty distinct denticles arranged in two subequal rows proximally from the largest tooth, which is distad from the center; distally from this tooth the margin is concave and nearly smooth; right arm without a superior row, but with a straight, inferior row of four or five rather large, subequal denticles proximally from the large central tooth, and distally from it a concave, finely denticulate margin. **Japyx multidens** *Cook* (Alabama).
4. Left arm moderately stout with only seven or eight small denticles proximally from the largest tooth, which is distad from the center; distally from this tooth the margin is ^{concave}convex and minutely denticulate; right arm with the proximal margin from the central tooth convex with four small denticles, the distal margin concave with numerous denticles. **Japyx subterraneus** *Packard* (Kentucky; District of Columbia).
5. Right arm with two large teeth, one just before the other just after the center of the margin; proximally from the first tooth the margin is convex with five denticles, between the two teeth straight with six, and distally from

the second tooth concave with many ; left arm with a large tooth one third its length from the base, proximally from which are three smaller denticles and distally from it nine feebly marked denticles.

Japyx americanus *MacGillivray* (West-central Washington).

5. Right arm with a single broad based, sharp tooth about one fourth the length of the arm from the base, distally from which is a large abruptly inwardly deflexed sinus, interrupted by four smaller, widely separated denticles ; left arm similar to right.....

Japyx minimus, sp. nov.
(Southeastern Nebraska).



Japyx minimus.

Japyx saussurii

With enlarged dorsal view of their forceps.

Japyx minimus, sp. nov.

Head quadrangular, transverse, about one fourth longer than broad ; antennæ short, eighteen-jointed, the segments subcylindrical, and gradually decreasing in size apically. Prothorax about two thirds as broad as the head, longer than broad, and truncate in front. Abdomen with first seven segments rounded at the sides, the second slightly larger than the others, of which the seventh is slightly the smallest. All are without emargination. The last three segments have straight, almost parallel sides, the eighth with the anterior end concave, the posterior end convex and articulating with the concave anterior end of the ninth segment ; this one in turn articulates

with the tenth which has the anterior end convex with a rather abrupt central protuberance, and the posterior end subtruncate. Forceps shorter than the last or tenth segment, which is nearly as large as the eighth and ninth together, the ninth being about one half the size of the eighth. Forceps and last segment of the abdomen light brown, the rest of the insect whitish. The whole insect covered sparsely with hair-like bristles, these densest on the forceps. Abdominal appendages present, but minute.

Right arm of forceps with a large, broad based, sharply pointed and slightly backward inclining tooth, placed on the lower inner margin and distant from the base about one fourth the length of the arm. From this tooth to the base the arm is slightly concave, but about equal in thickness throughout; distally from the tooth the margin is very abruptly deflexed inwardly (sometimes almost at a right angle), for about one third the width of the arm; at the end of this smooth sinus is a denticule, generally broad and blunt, and some distance from this another similar one and between these two are often traces of two very blunt tubercles; then the margin is again deflexed, somewhat sharply and obliquely, this interrupted by two equal, saw-tooth-like denticules, always distinct and about equidistant from each other and the second denticule. No superior row of teeth. The left arm is very similar to the right and presents no constant difference either in size, strength or dentation.

Length without antennæ 3.85 mm.; length of antennæ .73 mm.; length of abdomen 2.55 mm.; length of last abdominal segment and forceps .43 mm.; length of forceps .17 mm.

Habitat: Southeastern Nebraska.

Four specimens of this little *Japyx* are in the collection of the University of Nebraska taken as follows: Malcolm, Nebr., May 4, 1901, one specimen; Crab Orchard, Nebr., May 7, 1901, one specimen; Adams, Nebr., May 11, 1901, two specimens. In all cases they were taken from among the roots of wheat growing in damp soil, and are probably quite common when carefully looked for. It is very different from any described species and may easily be distinguished by the combination of very small size, few joints in the antennæ, the head longer than broad, and the shape of the last three abdominal segments, as well as by the similarity of the two arms and the peculiar dentation of the forceps.

COLOR-PREFERENCE IN INSECTS.

BY A. S. PACKARD.

In my "Text Book of Entomology" I have briefly stated from what sources I had access to, the little that was known up to 1898 as to the color-preferences of insects. It appears that few observations

had been made, the most careful being those of Lubbock who showed that the honey bee prefers blue, and ants violet. The following observations are published with the view of calling attention to this interesting matter, which in the case of flies and mosquitoes is a subject of no little importance.

Preference of Locusts (Acrydiidæ) for White.—My attention was first called to the preference of locusts for white by a letter to St. Nicholas in 1900 from Boothbay Harbor, Maine, written by Dorothy C. Baldwin to the following effect: "I would like to inquire why grasshoppers are attracted more by white than any other color? I have noticed that when I wear a white dress I find several grasshoppers on it, but when I wear any other colored dress they do not jump upon me at all." Upon inquiring as to others' experience, my daughter tells me that she always observed that white or light-colored clothes attracted grasshoppers, and when walking scarcely more than a hundred feet she has noticed five or six grasshoppers on her white dress, but none when the dress was dark in color. Another lady has also noticed that a white dress will attract "grasshoppers," or more properly, locusts.

Color-preference in Moths.—The late S. Lowell Elliot once told me of a case observed by him where white moths (*Spilosoma*, *Hyphantria* and *Acronycta obliquata*) would alight upon the white trimmings of a red and white barn, while on the darker, red portions, sat *Catocalæ*, and other dark or reddish moths. They were thus protected from observation.

An English writer states that *Bryophila perla* will frequently alight upon stone walls or those composed of grayish colored bricks, but in the case of a red brick wall, it will only alight upon the mortar between them, thus trying to harmonize its color with its surroundings.

M. Rocquigny-Adanson while walking with his insect-net saw *Adela degeerella* alight on the green gauze. In walking a distance of two hundred meters it did this twice (Bulletin Soc. Ent. France, 1903, No. 12, p. 207). His note was called out by that of M. Poujade, but he cited it as an instance of familiarity rather than of color-preference.

Color-preference in Butterflies.—I once observed at Amherst, Mass., that white butterflies (*Pieris*) would alight upon the flowers of a white aster, while *Colias philodice* would by preference alight upon the yellow flowers of the golden rod, but these observations need repetition before they can be accepted as a normal or regular occurrence.

It has also been stated by Lubbock or some other English entomologist that butterflies will descend from a position high in the air and fly down to bits of white paper, apparently mistaking them for white flowers.

On April 28 I saw in my yard a *Pieris rapæ* flying across a bed of violets, many in flower, and then after crossing the bed without pausing in its flight it rather suddenly turned down and alighted on a single white flower of the bloodroot, remaining at rest on it for one or two minutes. It was evidently attracted by the white color, passing by the violets to visit the bloodroot. April 30 I saw two *Pieris* fly towards bits of white paper which I had thrown down; they did not alight upon them, but evidently were attracted to them, as they would turn toward them in their flight; but after this they took no further notice of the papers.

M. Poujade (Bulletin Soc. Ent. France, No. 9, 1903) mentions seeing *Thecla rubi* flying without fear around a green net and rest upon it if held still, but this familiarity ceased when the green was replaced by blue gauze. We should cite this as a case of color-preference.

Mr. Beverly Letcher writes me from San Francisco, June 5, 1902, regarding a case observed by him, which will illustrate both the range of butterfly vision and the preference for colors of the same hue as themselves, as a means of unconscious protection.

"I have for some years intended to communicate to you an observation on insect vision. I collect with a green cheese-cloth net which by July has faded to a yellow, closely approximating that of the female *Meganostoma evydice*. I, as well as G. T. O. Mueller, with whom I sometimes collect, had noticed that the males flew directly into my net, but the particular instance to which I desire to call your attention is that of a male flying rapidly by in the open bushes at least 25 feet from the road on which I was collecting, and which suddenly turned at right angles to its course, flying directly at me and into the net."

Color Preference of Diptera. — Gross has observed that house flies would frequent a bluish-green circle on the ceiling of his chamber; but if it were covered by white paper, the flies would leave the spot, though they would return as soon as the paper circle was removed (Kolbe).

We have observed that house flies prefer green paper to the yellowish wall of a kitchen, but were not attracted to sheets of a Prussian blue paper, attached to the same wall and ceiling.

At Sugar Hill, N. H., while sitting on the hotel piazza, September 14, 1901, I noticed that the numerous house flies present alighted by dozens on my daughter's dress, which was of homespun dyed red and black, though the prevailing color was a madder or dark Indian red. Nearly fifty flies would come and alight within one or two minutes. On drawing a steamer rug, which was of a light faun color, over the dress, very few flies alighted on it, only one or two dozen. Also many alighted on my dark blue striped flannel trousers. On another occasion from fifteen to twenty flies alighted on a brown woolen dress, but none on a light gray waist. On still another occasion I noticed house flies gathering on a lady's black dress, while but one or two settled on the white towel next to it. A number rested on a dark lavender-colored shawl she was knitting, showing that they decidedly preferred lavender color to white.

I am told by a lady that the ribbon on her hat which was butter-yellow, and also of another shade of yellow, became so badly speckled that it had to be taken off, while white ribbon was not spotted. Her pale bright green dress, as she was sitting on the piazza, was literally covered with flies; indeed she took the flies away from all the other people sitting near by. The flies did not rest on a lavender-colored dress.

Mr. J. F. Collins, of Brown University, tells me that he noticed that a lady wearing a black silk gown was attended by "swarms of house flies." He also states that a number of black flies (*Simulium*) and mosquitoes alighted on his own person dressed in a black suit, while they did not alight on a man standing by who was wearing a white sweater.

In his notes on flower-haunting Diptera, read before the Entomological Society of London, Mr. Scott-Elliot shows that some of the higher types of flies appeared to prefer red and blue flowers.

Color-preference in the Mosquito. — In continuation of their researches on the structure and biology of *Anopheles maculipennis*, the commonest British mosquito and one known to convey malaria, Dr. Nuttall and Mr. A. E. Shipley observed some interesting facts on the preference this species exhibits for different colors and for different shades of color. The experiments were conducted as follows: In a spacious photographic studio a large muslin tent was set up with one end against the glass window through which the sunlight poured. At the bottom of the tent were some large pans for the *Anopheles* to breed in, and these were from time to time renewed. The mosquitoes were fed on bananas, which, it may be noted, must be kept fairly fresh, otherwise dates or figs are preferable. On one side of the tent seventeen boxes

without lids were piled one upon the other, the order being changed each day so as to eliminate any preference due to position or exposure to light. Each box was lined with a cloth having a slightly rough surface — not a shiny or smooth one — to which a mosquito could easily cling. The experiment consisted in counting the number of mosquitoes found in each box on seventeen different days. The results obtained are striking. During the seventeen days on which the count was made, 108 mosquitoes were found in the navy-blue box, 90 in the dark-red box, 81 in a reddish-brown box, 59 in the scarlet box, and 49 in the black box. There was at this point a sharp drop to 31 in a slate-gray box and 24 in an olive-green box. Violet, leaf-green, and full-blue boxes had respectively 18, 17 and 14. Pearl-gray had 9, pale green 4, light-blue 2, ochre and white 2 each, orange 1, and pale yellow about the color of khaki none at all.

It is thus evident that color has a marked power of attracting this species of mosquito, and that the color which is by far the most attractive is navy-blue. In both services and equally amongst civilians this is a very common, perhaps the commonest, color for male attire. The experiments just quoted show that it is at least equally popular with malaria-carrying mosquitoes. Light colors were avoided, especially those with a tinge of yellow. Khaki-colored garments would seem to have other advantages besides that of invisibility on a light soil.

The results of these observations, conducted on one species and in the midst of an English university town, must not too rashly be thought to hold good of other species living in the open; but there is a certain amount of evidence that points in the same way. It has been noticed in Indian hospitals that *Anopheles* hides on black coats and avoids white ones, so that the men who catch them take care to hang up a dark coat or two in the wards when they wish to collect the insects. The Frenchman Joly noticed in Madagascar that the mosquitoes were attracted by a black soil more than by a red or light one, and that persons wearing black shoes and socks were more often bitten than those who wore white or light coverings for their feet. Whilst a black dog was severely bitten, its companion, who was yellow, almost entirely escaped; thus the "yaller dog" of Western fiction has some advantages in this world.

Other observations not only point to a modification of dress in malarious districts, but they indicate that much may be done to render dwelling-houses and temporary shelters less habitable to the insects. Mr. J. Cropper has put on record how attractive the dark blue lining of the tent he used in Palestine was to *Anopheles* and to other Culicidæ, and Austen has noted that if the walls of a room be whitewashed with a dark dado the insects are invariably found on the dado and not on the light surface. This points to doing away with dadoes and using only whitewash.

The gist of these experiments, which seem to have a very practical bearing on life in malarious districts, was published in the *British Medical Journal* last September. They seem to have attracted little attention in this country; but the practical minds at the head of the United States army, without waiting for the fuller report, which appears in the current number of the *Journal of Hygiene*, have already decided to take action on the lines that the experiments indicate. We learn from the Surgeon-General's Office in Washington that the regulation army shirt of navy blue is to be withdrawn from all malarious districts, and a light one issued in its stead. (*English Mechanic*, January 24, 1902.)

From these few observations it appears that dark moths and butterflies prefer blue, red, black or green-colored objects on which to rest ; that white butterflies are most generally attracted by white flowers ; yellow butterflies by yellow flowers, while locusts decidedly prefer to rest on a white surface.

In the case of house-flies, and perhaps *Simulia* and Culicidæ, I have thought that as flies evidently love heat, being thermotropic, that as dark cloths absorb and retain the heat of the sun's rays better than white or pale materials, they "feel better," *i. e.*, they respond to the stimulus of the warmth of a dark surface, respire more rapidly and are more active ; the cause being a physical one.

It is also evident that all these insects have good eyesight, distinguishing at a considerable distance the different colors of small objects, or of more extended surfaces.

SOME PHILIPPINE MOSQUITOES.

By C. S. LUDLOW.

The study of the mosquitoes in the Philippine Islands is carried on by the authority of the Surgeon-General, U. S. A., and with the cooperation of the Medical Department to ascertain at what places and times those proven or likely to be proven disease carriers are prevalent. The work has been in progress now for about three years, the collections having come in from all parts of the Islands, from Appari in Luzon to Jolo in the Sulu Archipelago, and the records show that besides the information gained for the medical phase of the study there has also been gathered some of value only from the entomological standpoint.

Among the mosquitoes listed below are some recently described by Theobald (British Museum) as found in adjacent countries, a couple of *Anopheles* previously published in the Journal of the New York Entomological Society, and some new species, one of which Theobald publishes with my permission, from my MS. in the new volume of his Monograph.

Mr. Theobald has lately created from the *Anopheles* the new genus *Myzomyia*, but as I do not know the distinctive characteristics on

which the new genus is based I have retained the old nomenclature, putting the new name in parentheses in the species of which he has written me.

ANOPHELETES.

Anopheles philippinensis *Ludlow*.

A. sinensis *Wiedemann*.

A. " var. **annularis** *van der Wulp*.

A. pseudobarbistrois *Ludlow*.

A. (Myzomyia) rossii *Giles*.

A. (Myzomyia) ludlowii *Theobald*.

A. kochii *Donitz*.

A. funestus *Giles*.

A. ludlowii was referred to in my article "Two Philippine Mosquitoes" (Jour. N. Y. Ento. Soc., Sept., 1902) as *A. rossii* Giles having "curiously mottled legs not described for the type" and later specimens were sent to Mr. Theobald who found the variations considerable enough to be specific. It is, so far as the collections to date show, the most widely distributed of the *Anopheles* in the Islands, being sent in from many parts of Luzon, and some of the southern islands.

STEGOMYLÆ.

Stegomyia fasciata *Fabricius*.

S. " var. **mosquito** *Desvoidy*.

S. " var. **luciensis** *Theobald*.

S. scutellaris *Walker*.

S. " var. — equivalent to *luciensis*, *i. e.*, a black tip on the last hind tarsal joint.

S. scutellaris subspecies **samarensis** *Ludlow*.

The specimens of *scutellaris* taken on Samar, differ from the type as follows:

I. Has two white lateral bands on the head.

II. The silvery median line on the thorax extends the whole length of the mesonotum, tapering from the cephalic end to just in front of the scutellum, and there is a narrow white line on each side extending cephalad from the scutellum about one third of the length of the mesonotum, and dividing its width almost exactly into quarters.

III. Femora of hind legs are white at the base with a white line reaching almost to the knee: on fore and mid legs this line is not so distinct nor is it so long: the metatarsi of the hind legs have a basal white band, and those of the fore and mid legs a basal white spot.

IV. The first submarginal cell is longer than its stem, and about the same width as second posterior.

While these variations are perhaps not specific they are certainly enough to create a subspecies. It is perhaps as close to *grantii* as to *scutellaris* Theob.

***Stegomyia nivea*, sp. nov.**

♀. Head covered with dark brown scales, which in some lights giving bronze iridescence, dark brown forked scales on the occiput, narrow white rim around the eyes; proboscis with dark brown scales also showing iridescence; palpi dark brown; antennæ dark brown, verticils brown, pubescence pale, eyes brown.

Thorax: the mesonotum densely covered with long curved white (silvery) scales from the neck about two thirds of the way, with three very narrow dark lines, one median and two submedian. The rest of the mesonotum with dark brown curved scales; scutellum covered with dark brown scales, also showing iridescence; metanotum nude; pleuræ dark brown, with silvery spots.

Abdomen covered dorsally with dark brown scales, the first three segments entirely brown, the fourth showing a small basal median white spot, the following segments basally white-banded, the bands heavier on the last two segments; brown and light hairs on the apex of each segment; ventrally the abdomen is basally white-banded throughout, the bands widened laterally so as to form heavy white basal lateral spots.

Legs: coxæ and trochanters light and ventral side of all the femora light, but the rest of the legs very dark brown (almost black) except the femora of the legs, which are white dorsally, as well as ventrally two thirds of the distance from the trochanters to the tibiæ; the tarsal joints, including the metatarsus of the hind legs, are a slightly lighter brown, and show iridescence. Ungues simple and equal.

All the flat brown scales, on whatever part of the body, show bronze iridescence, but the curved and forked ones seem to lack it. This, of course, does not apply to wing scales.

The wings show the typical *Stegomyia* scales, brown; the first submarginal cell is slightly narrower and longer than the second posterior, the bases being nearly on a line; the mid- and supernumerary cross-veins meet the latter a little shorter than the mid-vein, and the posterior distant from the mid-vein about twice the latter's length.

Length 5.6 mm. (including proboscis).

Habitat: Oras, Samar, P. I. Caught. May-June, 1902.

This is an easily recognized species, the snowy thorax and white femora being distinctive.

***Stegomyia amesii*, sp. nov.**

♀. Head covered with dark brown scales, giving dark iridescence, a minute pale spot on the sides, forked scales dark brown, brown hairs between the eyes: antennæ dark brown, verticils brown, pubescence brown, first joint testaceous: palpi dark brown: proboscis very dark scaled, dark iridescence in some light: clypeus brown: eyes brown.

Thorax dark brown and rather closely covered with small slender dark brown curved scales : scutellum dark brown : metanotum dark brown ; pleuræ brown with three bunches of white scales.

Abdomen brown, heavily covered with dark brown scales giving dark green and blue iridescence, small white lateral spots on most of the segments : venter dark.

Legs dark brown, the femora light on ventral side, otherwise the whole of the leg is dark, but the scales are so iridescent, those of the femora and tibiæ reflecting green and blue lights, and those on metatarsi and tarsal joints giving bronze lights that the latter often appear much lighter. Ungues equal and simple.

Wings heavily brown scaled with typical *Stegomyia* scales : first submarginal cell a little longer and about the same width as the second posterior, its base slightly inferior to the latter's. The supernumerary cross-vein meets the mid at an obtuse angle and is about the same length as the mid, as is also the posterior cross-vein, which is distant from the mid about three times its own length. Halteres heavily light scaled on the stem, knob dark.

Length 3-3.5 mm.

Habitat : Oras, Samar. Tacloban, Leyte. Twin Peaks, Banquet. Luzon.

Caught. June-December.

This is a very small dark species near *S. minuta* Theob. and was sent me by Dr. Roger P. Ames, Major, Surgeon U. S. V., who did the clinical work in the investigation by Major Reed, Surgeon U. S. A., concerning mosquitoes and "yellow fever."

The *Stegomyia* are wide-spread throughout the Islands, *S. fasciata* Fabr. being apparently present in every locality, and very numerous. The others are not so frequently met, and *S. nivea* has been taken only at Oras, Samar.

DESVOIDEÆ. (ARMIGERES.)

Desvoidea fusca *Theob.*

Taken, so far, only in the southern islands.

In the last few months a new genus near *Stegomyia* has been created, the distinctive differences lying mostly in the head and wing scales, by which, as well as by the lack of the continuation of the third longitudinal vein, it is also separated from *Desvoidea*.

Finlaya *Theobald.*

Finlaya poicilia *Theobald.*

This mosquito is also confined to the southern islands.

Another species has come in in the last few days which is apparently undescribed, but there has not been sufficient time to make the

necessary comparisons to determine it a new species and the description is withheld. It is a very beautiful species, the very heavy silvery median line on head, mesonotum, and scutellum resembling those of *Culex serratus* Theobald, while the scale positions remove it from that genus.

The genus is named for Dr. Finlay, who was probably the first to suggest the connection between mosquitoes and "yellow fever."

CULICES.

Culex microannulatus Theob.

Culex annulifera, sp. nov.

♀. Head covered with dark brown and light scales, two bands of white flat scales on the sides, curved creamy, and dark forked scales on the occiput, a narrow white rim around the eyes, and a few brown hairs between the eyes: antennæ brown, verticels and pubescence brown, but giving pale reflections, first joint testaceous: palpi brown with small white apex: proboscis dark brown at base and apex, with a very broad cream-colored band, equal to one half or more the length of the proboscis, between: eyes brown.

Thorax dark brown, covered with dark brown curved scales with curved white and creamy scales in irregular and indefinite lines and spots: scutellum dark brown with cream-colored curved scales, hairs brown: metanotum dark brown: pleure dark, with numerous patches of white scales.

Abdomen covered with very dark (almost black) scales and basal white bands, sometimes extending as small lateral spots: ventrally largely white scaled with apical white spots on many of the segments. The abdominal markings vary in definiteness in the individuals, but the dorsal basal bands and the ventrolateral apical spots seem persistent, while the very small dorso-lateral spots are not.

Legs: coxæ and trochanters all more or less white scaled: femora all dorsally dark brown heavily sprinkled with white scales, white or creamy knee-spot, sometimes involving both sides of the joint, ventrally much lighter: tibiæ all dark, slightly sprinkled with white, and sometimes, on the fore and mid legs, a narrow white ring at the apex: all the metatarsi dark with narrow basal light bands, and that on the hind leg somewhat heavier and sometimes a few light scales scattered through the dark ones: first and second tarsal joints on fore and mid legs have narrow light basal bands third and fourth joints dark, sometimes a very small basal spot on the third: all the tarsal joints on the hind legs have heavy basal white bands. Fore and mid ungues equal and uniserrate, hind simple.

Wings heavily brown-scaled; cells small: first submarginal narrower than and the same length as second posterior, the base of the latter well interior; the stems of both nearly equal to the length of the cells: supernumerary cross-vein is two thirds the length of the mid-vein which it meets, posterior cross-vein is as long as the mid-vein and distant from it a little more than its own length. Halteres light, the knob white-scaled.

Length 6 mm., with proboscis 9 mm.

♂. Head much as in female except that the second pale band on the sides is not so defined and is perhaps lacking (males not in good condition): antennæ are really brown, but the reflections make them look ochraceous: palpi dark with a white spot at the bases of the ultimate and penultimate joints, and a cream-colored band dividing the remainder in halves, the plumes are rather heavy and dark, but like those of the antennæ, often look mostly light: proboscis very dark with quite a narrow cream-colored band somewhat caudad of the middle (on a line with the interior band on the palpi).

Thorax much as in female, the lines and spots less definite.

Abdomen as in female, but very hairy. Claspers large.

Legs practically as in female. Fore and mid ungues very unequal, the larger having a large tooth about midway and a short, apparently spinous, one at the base; hind ungues small and simple.

Wing not so heavily scaled, and the first submarginal is a little longer than the second posterior, their bases nearly on a line: the posterior cross-vein is a little shorter than the mid, and not quite its length distant.

Habitat. — Philippine Islands. Caught, February (Mangarin), March, April (Dagupan).

The female was described from a lot (28), all females, sent by Dr. Frank Suggs from Mangarin, Mindoro: the males from a lot (234) sent by Dr. M. A. DeLaney, First Lieutenant and Assistant Surgeon U. S. A. from Dagupan, Pangasinan, Luzon, but the insects had many of them been wet and were not in good condition. It is nearly related to *C. microannulatus* Theob. and *C. vishnui* Theob.

Culex sitiens *Wiedemann.*

C. annulioris *Theobald.*

C. hirsutum *Theobald.*

C. cæcus *Theobald.*

C. gelidus *Theobald.*

C. gelidus var. **cuneatus** *Theobald.*

C. fatigans *Wiedemann.*

Culex fragilis, sp. nov.

Female. Head dark, covered with light ochraceous, almost cream-colored, curved, and light fawn-colored forked scales on the occiput, with white flat opalescent ones on the sides and a rim around the eyes; antennæ light brown, pubescence and verticils the same; palpi light brown; proboscis light brown; eyes dark blue.

Thorax very light with two rather broad light brown submedian lines and a light greenish-brown tinge, covered with a frosty bloom much like that found on *Anopheles*, sparsely covered with very small hair-like golden scales. Scutellum light brown with similar scales; metanotum almost white; pleuræ testaceous, a soft blue-green. The whole thorax has a greenish tinge and a general translucent appearance. Abdomen dark green sparsely covered with very thin white opalescent flat scales and light brown hairs; ventrally much the same.

Legs : coxæ and trochanters colored like pleuræ, femora light fawn-colored dorsally, white ventrally ; tibiæ much the same ; metatarsi and tarsi rather darker — a light brown — the scales are all small and on these joints give golden reflections. Ungues small, simple and equal.

Wings covered with small fawn-colored scales : first submarginal a little longer and nearly the same width as second posterior, the stems of both about two thirds the length of the cells ; supernumerary cross-vein same length as mid which it meets : posterior cross-vein same length as mid and about two and a half times its length distant. Halteres, light stem, fawn-colored knob. The third long vein is extended into the base cells by an incrossation nearly as heavy as that found in *Desvoidie*.

Length 3-3.5 mm.

Male differs very slightly from the female. Antennæ a soft light brown, and the tufts of the palpi are small and of the same general fawn-color ; the thorax frequently lacks the two light brown submedian lines and is perhaps lighter. Ungues of fore and mid legs slightly uneven, the larger bearing a long tooth about midway.

A very delicate looking insect, the general translucent appearance of the thorax and small opalescent scales giving an appearance of great fragility.

Habitat. — Oras, Samar. Caught, August 6.

The culices are mostly wide-spread, *gelidus*, *cæcus* and *fragilis* being apparently the most restricted as to localities ; *fatigans* is of course universal.

GRABHAMIÆ *Theobald.*

Grabhamia spencerii *Theobald.*

This specimen was taken at Hagonoy Bulacan, Luzon, P. I., and as *G. spencerii* was reported only from Manitoba and there were some slight variations I hesitated to place it under this species, but I have since taken it at San Francisco, Cal., and Mr. Theobald has written that it is almost surely this species, which is quite variable.

MANSONIÆ.

Mansonia annulifera *Theobald.*

Masonia africana vel **uniformis** *Theobald.*

Mr. Theobald writes me that *africana* and *uniformis* are identical, some badly preserved specimens from a different locality being responsible for the second species. *M. africana* occurs in many parts of the Islands.

ÆDOMYIÆ.

Ædeomyia squammipenna *Arribalzaga.*

This is rarely taken, only two specimens having been sent in during the three years.

There are, of course, many insects closely related to the Culicidæ, and at times some not even belonging to the dipteræ, sent in, but no effort is made to determine these, as they have no place in the problem on hand, though they are, many of them, of interest to the entomologist and may prove to be of interest to the pathologist.

Much of the country is still unexplored, so far as this research is concerned, the southern islands particularly having few collecting stations, and with the exception of the collections sent in by Major R. P. Ames, such as have been sent in have, partly owing to the change of surgeons, either been irregular or have not covered many consecutive months, so that other new species are to be expected and will undoubtedly be added to the list.

TWO NEW HYMENOPTEROUS PARASITES.

BY WILLIAM H. ASHMEAD, M.A., D.Sc.

Orgilus kearfotti, sp. nov.

♂. Length 3 mm. Honey-yellow, the head in front paler; disk of metathorax, the eyes and the stemmaticum black; flagellum dusky or brownish; a spot at apex of hind femora, the hind tibiæ, except a white annulus at base, and their tarsi, fuscous. Wings hyaline, the stigma and the veins brown.

Caldwell, N. J. One specimen, bred by Mr. W. D. Kearfott, July 2d, from *Recurvaria juniperella* Kearfott.

Type.—Cat. No. 6960, U. S. N. M.

Protapanteles recurvariæ, sp. nov.

♀. Length 1.65 mm. Head and thorax black and shining, but sparsely punctate; the clypeus, the mandibles, scape of antennæ, the abdomen at sides and beneath, the second dorsal segment, and the legs, except a spot at apex of the hind femora, the apex of hind tibiæ and the hind tarsi except basally which are fuscous, honey-yellow. Wings hyaline, the stigma brown. The ovipositor is prominent clavate, black; the plate of the first segment is trapezoidal, sculptured, the rest of the abdomen smooth, impunctured.

Montclair, N. J. Two specimens, bred by Mr. W. D. Kearfott, June 2d and 7th from *Recurvaria piccaella* Kearfott. Another specimen was bred from *R. thujaella* Kearfott.

Type. Cat. No. 6961, U. S. N. M.

DESCRIPTIONS OF NEW TINEOIDEA.

By W. D. KEARFOTT.

The majority of the following species are the result of breeding from larvæ found on various food plants in New Jersey.

I am indebted to Mr. August Busck for very kindly working up the genera of most of the species, in fact more than half of the species are described on his authority that they were unknown. I have also to acknowledge my obligation to Mr. C. L. Pollard for all the botanical determinations, excepting the conifera, also to Dr. W. H. Ashmead for all identifications of the hymenopterous parasites, and my thanks are especially due to Mrs. William Beutenmüller, for the very artistic and perfectly drawn figures for the plate that accompanies this paper; and it is with much pleasure that I can add my small testimony to the generally conceded opinion, that Mrs. Beutenmüller is the first in the ranks of the entomological artists of this country.

Symphysa adelalis, sp. nov. Plate IX, Figs. 11 and 20.

79, 80
Head and thorax pure white, eyes black. Tongue short, yellow. Palpi short, perfect, second joint with long loose projecting scales beneath, apical joint short, not pointed; color white, shaded with pale golden-brown. Antennæ one third length of forewing, ciliated; basal joint white, enlarged, outer joints white, with annular rings of pale brown on each, darker on the inside. Forewing pure white, a few pale brown scales on median line at base, an interrupted band of the same from costa to inner margin, before middle, the scales within this band on the inner margin are very long and tipped with dark brown. An ovate discal spot of dark brown raised scales. A sub-outer marginal band of very pale brown from costa before apex to inner angle, broadening below and extending up to discal spot and below cell almost to and sometimes coalescing with inner band. A few raised yellowish scales, tipped with brown on costa just before apex, in some specimens this is a well-defined spot, in strongly marked specimens there are three small brown dots on outer margin, just below apex. Cilia a pale brown inner band, then a nearly white band, scales tipped with dark brown at apex, becoming paler below. The markings are repeated on the underside, but intensified, and concentrated into two patches of dark brown, one before the discal spot and one subapical. Hindwing pure white, with two shades or patches of light brown on the inner margin, the inner about middle of margin extends upward to cell, the outer beginning at anal angle reaches to within a quarter or a third of apex, nearly parallel to outer margin, in the darkest specimens these shades almost or quite coalesce at their upper parts. There are two tufts of very long raised white scales, tipped with brown, one on median line beginning at base and ending over inner brown shade where the brown tips form a distinctly darker spot, the lower one extends from inner angle to about inner third of dorsum, and the brown tips form another spot at

that point. In repose, especially when the wings are below the abdomen, so that the dorsum is in profile these two tufts and the long thoracic scales form a dentate outline of three prominent groups of scales. (The thoracic tuft white, the two dorsal tufts dark brown.) Cilia: white shaded with light brown lines, darkest opposite the dorsal patch. Underside: the pattern of the upperside is more or less faintly repeated, some specimens have three small dark brown dots, one about middle of cell, one on same line half way between end of cell and outer margin and the third close to the anal angle. Abdomen: first abdominal segment pure white, second shaded with brown, others to apex dark brown, with white scales at incisions. Underside white, slightly shaded with brown. Legs white, outer joints lightly shaded with brown. Alar expanse 12 to 16 mm.

Described from 46 specimens, issued from July to 20 August 15. Types U. S. Nat. Mus., no. 6970. Cotypes, Am. Mus. Nat. His., Acad. Nat. Science, British Museum and collection Kearfott.

Larva. — Full grown, 8 mm., extended 10.5 mm., flattened, annulated. Width segments 4 to 11, 1.9 mm.; width head 1.1 mm. broad, flattened, triangular, retractile into 2 and 3; head very dark brown, almost black, shining, mouth parts paler, almost square deeply cleft on top forming two well rounded lobes, shagrened; clypeus triangular, curving out slightly just above base, suture light brown. Antennæ long, pale at base, two outer segments black, joints paler, ocelli brown on darker brown field. Segments 2, contracted, smoky brown. Prothoracic shield divided from head by pale cream color collar, narrow, but extending down almost to spiracles, color brown clouded with paler shades and edged posteriorly and laterally with black. Anal shield small, concolorous, roughened but not chitinous. Thoracic feet unusually long, claws dark brown, upper segments pale brown. Four pairs abdominal feet but slightly developed, the crochets brown, small, circle slightly flattened or oval and not open, color brown. Anal feet the same. Spiracles concolorous. Dorsal setæ very short and minute, lateral setæ moderate, head setæ long, nearly equal to width of head. Tubercular plates large and polished, giving larva a shining appearance, the dorsal tubercles on 3 and 4 are like prothoracic shield, chitinous, smoky brown.

Pupa. — Very small for size of moth; 6 mm. long, 1.6 mm. diameter at thorax, rounded and tapering gradually to anal end which terminates in two very short knobs on the cremaster, each armed with a single short recurved hair. Eye caps prominent, oblong, reaching to vertex of head, clypeal space between eyes rather narrow and nearly closed just above labrum; labial palpi narrow, tapering to a point at their posterior end which is two thirds distance from vertex of head to end of wing cases; latter and thoracic feet cover sixth abdominal segment; antennal cases terminate half way between tips of wing cases and end of labial palpi. No spines or hooks on dorsal region. Setæ minute. Dehiscence: upper half of labial palpi separates on both sides thoracic feet cases, and remains attached to labrum, clypeus and eye caps. Another long separation occurs on each side between antennal cases and wing covers, also a split along dorsal line which extends to posterior edge of thorax.

About the latter part of June, 1901, when examining the tree trunks at Anglesea, N. J., for small moths, I found a very interesting larval case a little more than an eighth of an inch long roughly shaped like a flat-

tened figure 8 but rounded out instead of indented in the waist and which was made of very small particles of a nearly pure white lichen (Plate IX, Fig. 20, enlarged); this lichen occurring in patches on several species of trees in this sea- and wind-swept district, including oak, holly and juniper. I felt very certain I had discovered the habitat of one of our North American species of *Adela*, as the case very closely resembles the cases of that genus as figured in Stainton's Natural History of the Tineina, Vol. XIII.

Notwithstanding that an ample supply of the lichen was brought home with it, the larva failed to get beyond the stage in which I found it, although constantly watched until the spring of the following year. When, in 1902 I visited Anglesea again, at nearly the end of June, and began almost immediately on arrival a hunt to secure other cases of my supposed *Adela*, sp. The trees were there and the patches of lichen were common and for over two hours I scrutinized minutely and as I thought exhaustively, with never a case to reward my search; almost on the point of giving up the hunt I threw myself down on the soft white sand at the root of a large oak, and from force of habit kept my eyes on the white lichen although it was seemingly barren of insect life; after a few moments steadily gazing at one spot I fancied I witnessed a slight movement, still closer examination and the secret was out — a full-grown case this time, with the larva busily eating, and occasionally as he browsed, shifting his case a short distance and then securing it again with a few threads of silk. In five minutes on this same patch I had found eight more cases and in an hour or two ten times as many.

The home of this larva is a very beautiful illustration of natural mimicry, as it is composed of the pabulum of the insect, without change of color and almost without change of form, flattened and with edges pressed tightly to the lichenous bark, it is as nearly invisible as anything in perfectly plain sight can be, and I am afraid had not my first larva taken the notion, at the moment I was looking towards him, to move his house, he would be undiscovered to this day. A fresh supply of food was brought back to the city with the cases, and placed in a very large battery jar with the pieces of bark secured to short thin boards and all stood on end in the jar, to imitate the natural position of the bark; an occasional sprinkling with a fine hot-house syringe and the cover left off of jar to ensure plenty of fresh air seemed to agree with the larvæ as the increasing quantity of dry

powdery frass at the bottom testified. A month later several very delicate little pearly white moths made their appearance, and destroyed my hope of an *Adela*, but as the habitat of this larva so closely resembles that of an *Adela* larva, I have called it *Adelalis*, although to be properly scientific I suppose it should be called in Latin the "Lichen-feeding-*Adela*-like-case-bearing-almost-invisible-pyralid."

It is placed tentatively in the genus *Symphysa*, as its structure more nearly resembles the species of this genus than any other with which I am familiar, but there are certain differences in the moth as well as entirely different habits of the larvæ which will probably warrant the erection of a new genus if nothing more closely allied than *Symphysa* can be found to accommodate it. The case is from 14 to 16 mm. long, 6 to 7 mm. wide, 2.5 mm. thick in the middle. It is composed of small particles of nearly white lichen, held together with silk, the outside appearance is rough very much resembling the lichen on a fairly smooth piece of bark; the inside is neatly lined with a thin layer of white silk.

The case is bivalvular, the under valve is only two thirds the length of the upper, hence, at each end the latter overlaps the former, giving a space for the larva to stretch head and two or three segments from the closed case and feed in safety, entirely invisible, under the protection afforded by the projecting ends of the upper valve; this item of safety is further enhanced by the way the silk is spun into these ends, causing them to lay with edges flat and pressed to the bark.

The case is begun with a hinge on one side, exactly like a pair of clam shells, and is enlarged by adding to the outer edges and ends. On the under side the concentric rings of slightly different shades of lichen clearly indicate this. In shape the main or protected part of case is roughly oval, but with the extension pieces of the upper valve broadening out equal to its greatest width. Fig. 20 on Plate IX was drawn from an imperfect case, in perfect specimens the outer ends are smoothly and evenly rounded.

The larvæ spend from eight to ten days in pupa. On June 26 about a dozen moths had emerged, while a considerable number of larvæ had not pupated. Only one brood, the moths, no doubt, lay their eggs shortly after emergence, and I believe the eggs hatch and small cases are begun in the fall, the insects wintering in this stage.

Crambus vachellellus, sp. nov. Plate IX, Fig. 6.

Head, palpi and thorax lead color with a slight metallic luster. Fore wing dull lead color, inner two thirds, with a number of nearly black lines; one, beginning at base extends parallel to costa to inner third where it divides for a short distance (about one eighth), then joining again and ending before subterminal band. A second line begins at costa on inner third, runs obliquely outward to band number one but does not touch it, beyond this on costa a third oblique dash. Below band number one beginning at base a fourth band descends obliquely towards anal angle, but stopping before subterminal band, below this band number five runs parallel to number four, number six, somewhat less distinctly defined parallels the last two. In the space beyond and below cell and between bands one and four are three short dashes of same dark color. Between these dashes and also between bands four and five the ground color is replaced by creamy white. The ground color of outer third of wing is bright ochreous, crossed from costa to anal angle by subterminal band of metallic lead color. This is angulated in center same as *hortellus*. An apical dash of metallic and metallic scales on cilia forming a terminal metallic band is also like *hortellus*. The three black dots on lower half of outer margin are also repeated. Hind wings and under side of both wings are dull lead color, cilia shining but not metallic. Abdomen lead color, legs fuscous. Alar expanse 15 to 20 mm.

Size and markings same as *Crambus hortellus* Hbn. but ground color very dark lead grey, instead of pale cinereous as in our eastern specimens of *hortellus*, and while it may prove to be the same species, the constancy of coloration in the long series before me will certainly entitle it to a varietal name.

My species much more closely resembles Meyrick's description of *hortellus* in his Handbook of British Lepidoptera than Fernald's description of this species in his Crambidae of North America.

Described from forty specimens collected by Arthur H. Vachell, Verdi, Nevada, June 1 to 10, 1903, and I take pleasure in naming it after him. Mr. Vachell advises me that the specimens were all caught in long grass.

Type U. S. Nat. Mus., No. 6969. Cotypes, Am. Mus. Nat. Hist., Acad. Nat. Sciences, British Museum and collection Kearfott.

Thaumatopsis daeckeellus, sp. nov. Plate IX, Fig. 14.

Eyes large, hemispherical, reddish-brown mottled with black, scales between eyes, long, erect, light and dark brown mottled, same coloration extending over thorax, base of antennæ circled by a ring of cream-colored scales. Palpi long as head and thorax, pointed; long scales mottled ochreous fuscous and dark brown. Antennæ half as long as front wing, pectinated, dark fuscous. Front wing ochreous fuscous, almost uniformly distributed over wing, except above median line ground color is a shade or two darker. Conspicuously marked with a narrow white band on median line beginning at base, clearly defined and distinct to end of cell, then gradually turn-

ing to light brown (approximating ground color of wing) and continuing to outer margin. No other lines or dashes. Cilia short, uniform with ground color. Hind wing dark fuscous. Underside both wings dark fuscous. Abdomen dark fuscous, terminal tuft shade lighter. Legs dark fuscous. Alar expanse 20 to 23 mm.

Described from five males, Lucaston, N. J., October 10, 1902. Collected by E. Daecke in whose honor I take pleasure in naming this very distinctive species. Mr. Daecke states that on October 10 the grass was fairly alive with specimens of this species, and as it seemed so common he thought the few he caught would be sufficient for all of his needs.

Zelleria celastrusella, sp. nov. Plate IX, Fig. 1.

Head: frontal tuft of long, overhanging, light gray scales, finely speckled with brown, and over the eyes forming rounded tufts, out of which the antennæ arise. Palpi porrect, one and a half length of head, second and apical joint about equal in length, both tufted, the apical joint ending in a large rounded tuft, scales same color as on head. Eyes black. Antennæ: basal joint slightly thickened beneath, color fuscous, more whitish on upper side of basal joints, and at incisions, length three quarters of forewing. Thorax: rather closely appressed scales, whitish with fuscous spots caused by tips of scales being so marked. Patagia long, appressed scales, same color as thorax. Forewing: fuscous, with loosely appressed scales, about twenty single long, black scales form as many black dots, four on costa before the middle, two just below costa beyond the middle and two on costa before the apex, others are about evenly distributed over the dorsal half of wing, a lighter shade crosses wing at inner fourth bordered outwardly by a much darker patch, which is broadest just below costa, and curves inwardly to a narrow band on dorsum. A distinct patch of white scales form a spot on costa before apex, just at the beginning of the cilia, another patch of white scales on outer margin between apex and outer angle, between these white patches is a median shade of yellowish fuscous, beyond this shade and the white spots the cilia is inwardly margined with black, cilia before apex ferruginous, a shade of pearly white scales on cilia below lower white spot. A streak of lighter ground color from base to angle between median and dorsal. Underside dark fuscous, nearly black at apex. A costal white line on the outer half, ending in a white costal spot beneath the subapical spot on upper side. Cilia paler. A long pencil of dark fuscous hairs arise at base and lay along costa. Hind wing: upper and under side uniformly dark fuscous, cilia paler. Abdomen fuscous, speckled with lighter scales. Legs same as head and palpi. Alar expanse 13 to 16 mm.

Described from about 200 bred specimens, Essex County, New Jersey, larvæ on *Celastrus scandens* Linn. (climbing bittersweet). Type U. S. Nat. Mus., no. 6817. Cotypes, Am. Mus. Nat. Hist., Acad. Nat. Sciences, British Museum and collection Kearfott.

Larva.—Mature, 9-10 mm. long, slender, tapering evenly to each end, slightly annulate, width widest part middle segments 1.5 mm.; width head .45 mm. Head olive greenish-brown, mouth parts light brown, ocelli black; slightly flattened, in-

dented at top, lobes full and rounded. Clypeus triangular, reaching only half way to vertex. Thoracic legs yellowish-green; abdominal legs normal, complete crochets of brown hooks. Skin vivid leaf green, slightly darker dorsal line and ventral surface paler. Anal prolegs long, projecting back beyond anus. No lines or marks on skin. Thoracic shield concolorous, but shining, tubercular plates concolorous and inconspicuous. Spiracles minute, concolorous. Tubercle i at same height as ii, iii directly dorsad to spiracle, iv caudad and ventrad to spiracle. Thorax ia + ib, iia + iib. Setæ short and very slender, tubercles minute.

Pupa.—From empty pupal skin; very thin and flimsy. Length 5.5 mm. Wing and antennal cases extend down to extreme end of anal segment, the latter a trifle beyond as two blunt points. Cremaster small, very slightly indented, armed with two short hairs, each terminating in a small recurved hook. Labial palpi about half length of wing cases and swelling out to twice its average width, at about one third below labrum. Just below eye cap, on each side between labial palpi and prothoracic feet cases, is a slightly indented oblique suture forming a small triangular space that perhaps indicates the position of the maxillary palpi. Dehiscence, the ventral edge of antennal cases on one side separate from prothoracic foot, and on the other side the lateral edge of antennal case separated from wing case for about half their length. Part of vertex of head, clypeus, labrum and about half of eye-caps remain cemented to labial palpi.

Early in May the terminal twigs and almost every leaf of this vine is crumpled and spun together by these slender green larvæ, each living separately. Pupated from May 15 to 20 and moths began emerging May 27, continuing until middle of June. I have not found any trace of a second brood. The larvæ pupate within the crumpled leaf, spinning a dense spider-web mass of white, silk, pupa remains in cocoon when moth emerges. The moths have a distinctive resting habit; the legs are drawn up close to thorax and latter is pressed down so that the ventral side touches the twig, the wings are pressed tightly against abdomen and tilted up, at an angle of fifteen to twenty degrees from the level of the surface on which they are resting. In this position they can readily be mistaken for a well-developed bud, as their general color is not unlike the bark of the vine.

Recurvaria.

During the early spring of 1902 and 1903 I succeeded in breeding moths of this genus from four different species of conifera, and after having done so found I was able to clear up a case of wrong identification with regard to one of the species.

In the Fifth Report of the U. S. Entomological Commission, page 850, Fig. 284 is labelled *Gelechia obliquistrigella* Cham. The type of *obliquistrigella* which Mr. Busck has examined at Cambridge and the

U. S. National Museum is an entirely different species. Therefore, Fig. 284 represents a species until now undescribed and which I propose to call *piceaella* after its food plant, red spruce in New England and black spruce in Northern New Jersey.

Very closely allied to this species, and difficult to separate in the perfect state, except for its average smaller size is a species that feeds on *Thuja occidentalis* Linn. (arbor-vitæ or white cedar), this species I have named *thujaella*.

On *Juniperus virginiana* Linn. (red cedar) I have bred what I believe to be the true *obliquistrigella* of Chambers.

On *Juniperus communis* Linn. (common juniper) is a fourth species closely allied to the last, which I have named *juniperella*.

Two additional species were also bred on conifera which, having similar larval habits, may be included in the following brief synopses.

On *Pinus rigida* Mill. (common pitch pine) the larvæ of *Paralechia pinifoliella* Cham. are common throughout northern New Jersey.

On account of its larval habits I am inclined to place this species under the genus *Recurvaria*, but refrain owing to a strong protest from my friend Busck whose opinion on the general subject and especially generic distinctions I have much respect for; although I am not convinced that he is entirely right in placing *pinifoliella*—a miner of pine needles and our old friend *inscripta* Wlsm. (but hereafter to be known as *crisifasciella* Cham.), whose larva lives on oak, between two leaves fastened together with silk, both together in his new genus *Paralechia*; and while the venation of these two species may be identical, their appearance, in outline, coloration and general superficial characters, as well as their habits, are very different.

On *Tsuga canadensis* Linn. (common hemlock), *Recurvaria apicitripunctella* Clem. (*abietisella* Pack.) are common as larvæ in March and April in North Jersey.

The five first-named species are distinctly miners, excavating and living within the leaflets or needles; I was somewhat doubtful about this being the case with the two juniper species, as juniper leaflets are very much contracted at the joints, but careful examination with a lens proved that narrowed as they are they are hollowed out in exactly the same fashion as by the feeders on the long leaf pine and shorter leaf spruce.

The leaf of the hemlock is so very flat it is very doubtful if the larvæ excavate, at least in their later stages.

I have observed one habit common to all six species. Their eggs are laid within a reasonable time after the moths' emergence (June and July), in due course the young larvæ hatch and begin a very minute mine (the hemlock species I have not observed in its earliest stage), which is slowly enlarged until cold weather causes torpidity, and the larvæ remain in these original mines until the earliest sunny and warm spring days, when they desert the old mines and begin new ones (in previous season's leaves) usually farther out or nearer the end of the twig. One pitch pine needle is sufficient to complete the larva's growth; on spruce several are required and the holes in the bases of these are connected together with slender tubes of silk, the larva passing from one to another at will, and it may often be seen in the tube, between two needles, seemingly enjoying the warmth of a sunny day.

The above-named moths can be separated by the following synopsis.

SYNOPSIS OF SPECIES.

1. Forewing with whitish band from base to outer margin, parallel to costa..... 2
Forewings without this band..... 3
2. Subcostal band on forewing continuous..... **juniperella.**
This band interrupted about one third from apex **obliquistrigella.**
3. Forewing with three oblique costal dashes..... 4
Forewing without these dashes..... 5
4. Forewing grayish fuscous..... **thujaella.**
Forewing ochreous fuscous..... **piceaella.**
5. Forewing with three white vertical bands from costa to dorsum..... **pinifoliella.**
Forewings amber color, an oblique white streak from middle of costa.
apictripunctella.

The following synopsis will indicate the principal differences in the larvæ; the most similar pair of moths *thujaella* and *piceaella* are very distinct in the larvæ. All comparisons are from mature larvæ.

SYNOPSIS OF LARVÆ.

1. Head and prothoracic shield very dark brown, almost black..... 2
Head and shield light brown..... 3
2. Skin green..... **apictripunctella.**
Skin brown..... **pinifoliella.**
Skin red..... **thujaella.**
3. An open red square on abdominal segments confined to dorsal region
obliquistrigella.
These squares extending to below spiracles..... **juniperella.**
Red predominating on dorsal and lateral regions..... **piceaella.**

Recurvaria thujaella, sp. nov. Plate IX, Figs. 8 and 21.

Head cream white, closely appressed scales. Palpi long, twice length of head, descending, curved; cream white, basal joint black, and a black streak on under side of middle joint from base to half its length; a narrow ring of black on terminal joint near base and another just before apex. Antennæ: length two thirds of forewing; basal joint dark brown, without pecten, balance grayish-white with black annulations at incisions. Thorax and patagia cream white. Forewing cream white; three outwardly oblique, roughly triangular, black costal patches, all edged outwardly with whitish scales; the inner begins at base and extends nearly to dorsum, the middle patch at inner third and the outer at outer third are both smaller and reach only to median line; with a denser cluster of black raised scales at lower apex of each forming a distinct black dot; below each, close to dorsum is a small black dot; close to costa between basal and middle patch is a sixth black dot, these six dots are in three vertical pairs, almost evenly spaced and are all formed of black raised scales bordered by one or two pure white scales. The outer patch is bordered by a white line from costa, curving obliquely outward to middle of wing and then obliquely inward to dorsum. Beyond this white line on costa is a patch of ground color more or less evenly overlaid with dark brown scales, beyond this on outer margin is a wide band of blackish-brown and a paler streak at extreme outer edge. On costa before apex are three small black dots, also one at apex, one on outer margin close to apex and one close to outer angle, these six spots are of black raised scales with one or two white scales bordering each; the apical spot is narrowly ringed with ground color, this ring is bordered by darker scales, these scales being condensed into a fine semicircular line on extreme apical margin, the whole forming a clearly defined apical ocellus. Cilia above apex, short, ground color heavily overlaid with black, below apex longer and less overlaid with black, on inner margin light gray and as long as width of wing. Cilia indented at inner angle. Under side smoky gray, a pale whitish narrow shade along costa at outer third and several lighter shades on costa before apex. Cilia much paler, especially along outer margin where it sharply contrasts with dark gray of wing; this lighter shade turns the corner of the apex. Hind wing light gray; cilia same, about one and a quarter as long as width of wing. Under side same, but slightly darker. Abdomen creamy white, under side shaded with brown at anterior and middle segments. Legs creamy white, each joint ringed or shaded with dark brown. Alar expanse 8.5 to 10 mm.

Described from forty-two specimens, bred from *Thuja occidentalis*, Linn., the common arbor-vitæ used extensively for hedges, and also known as white cedar when allowed to grow into trees.

Type U. S. Nat. Mus., No. 6964. Cotypes, Am. Mus. Nat. Hist., Acad. Nat. Sci., British Museum and collection Kearfott.

Larva. — Slender cylindrical, tapering only close to ends, slightly annulate, length 7.5 mm. Width central segments, 1 mm. Width head .5 mm. Head jet black, narrow pointed, scarcely indented at apex, lobes rounded, clypeus narrow, triangular, reaching to within one third of vertex. Prothoracic shield dark brown nearly black bisected by a faint green line and separated from head by a narrow green collar. Anal shield small, black. Thoracic feet black-brown; abdominal feet

normal, hooks brown in small complete crochets. Skin dull red, slightly tinged with purple, greenish in incisions between segments pink on ventral surface.

Pupa.—From empty pupal shell. Length 4.5 mm., slender, cylindrical, tapering evenly to anal end, which is rounded, not pointed, and armed with two short recurved hairs. Wings and antennæ extend down to posterior edge of fifth abdominal segment. Labial palpi slender, tapering evenly to almost a point and half as long as wings. Vertex of head rounded and smooth, eyes rounded, moderate, prominent. Dehiscence accomplished by labial palpi, to which is attached labrum, clypeus, and eye caps, separating from prothoracic feet covers, on one side the split extends down to lower end of palpi. On dorsal line the split extends length of thorax. Pupa remains in cocoon when moth emerges.

The eggs are deposited in the summer, and young larvæ begin mining in the preceding year's leaves, avoiding the tender and resinous young leaves of the present year; they are probably more than half grown by fall and hibernate in this stage. In the very early spring, late February and early March, on warm sunny days the larvæ can be seen travelling a few inches farther out the twig and starting a fresh mine, this time in the growth that was new their first year.

The interior of the peculiar close-jointed leaves, is completely excavated, causing the empty leaves to turn yellow, and these small patches are easily seen as contrasted with the natural dark green foliage (Plate IX, Fig. 21, enlarged). When ready to pupate the larva lines one of the leaflets with white silk, making a roomy little cell and begins pupating latter part of May, first moths emerged June 7, and continue during June.

A few hymenopterous parasites were bred, issuing about the same time as the moths, which Dr. Ashmead describes as new in this number of the Journal (p. 144) under the name of *Protapanteles recurvaria* Ashm.

Recurvaria piceaella, sp. nov. Plate IX, Figs. 10 and 19.

Markings same as *thujaella*, except the light shades have an ochreous tone rather than fuscous as in *thujaella*. The average size of *piceaella* is about 1 mm. greater than of *piceaella*. Otherwise, the two species are very difficult to separate in the imago state, and my only justification in making two species is in the considerable difference in the larvæ and their food plants. Alar expanse, 9.5 to 11.5 mm.

Described from fourteen specimens bred from black spruce, *Picea mariana* Mill., Montclair, N. J. Issued May 30 to June 18, 1903. Type, U. S. Nat. Mus., No. 6962. Cotypes Am. Mus. Nat. Hist., and collection Kearfott.

Larva.—Same shape as larva of *thujaella*, but instead of black the head is pale brown, prothoracic shield same but lighter. Skin red on dorsal, lateral and ventral

regions, a dark green patch on each abdominal segment, on central dorsal area. On ventral surface of thoracic segments, between each pair of legs is a deep purplish red spot; on segments 5 and 6 there is one such spot on each segment on center line.

This species is so well represented by Fig. 284, page 850 of the Fifth Report of the United States Entomological Commission, that a detailed description is hardly necessary. Dr. Packard states that the alar expanse of the specimens before him was 13 mm. I have not bred or seen any specimens exceeding 11.5 mm.

Parasites: *Protapanteles recurvaria* Ashm., same as above.

From the same batch of larvæ from which the above issued were bred three almost black specimens which, below, I have given the varietal name of *nigra*.

***Recurvaria piceaella* var *nigra*, var. nov.** Plate IX, Fig. 9.

Face cream white, slightly irrorated with smoky brown, scales closely appressed, vertex same but smoky brown predominates. Palpi long, curved upwards, outer end of second joint enlarged, apical joint about half as long as second, obtusely pointed. Color inside and top of second joint cream white, underside fuscous, irrorated with black, outside dark brown, nearly black, with two small spots of creamy white on inner end and a large white spot at outer end. Outer joint a white annulation at base, center and apex, between these are two rings of blackish-brown. Antennæ: basal joint black, slightly enlarged, about three fifths length of front wing, annulated with cream white and fuscous. Thorax shiny fuscous, irrorated with brown scales. Fore wing: color dark brown, nearly black on costa, evenly shading to a few degrees lighter on dorsum. Marked by three conspicuous oblique white costal spots, evenly spaced, first at inner fourth, second about center and outer at apical third. A black spot close to costa beyond first white spot and two black spots below it, one on median line and one close to dorsum, both outwardly edged with white. Below middle white costal spot is a smaller white spot on median line, below this but slightly towards base is another black spot edged outwardly with white. A larger black spot close to dorsum at outer two thirds, edged with white costad, and a smaller black spot just above it, this latter has a white scale on each side dorsad. The outer white costal spot extends obliquely to median line, then proceeds at right angles inwardly to dorsum, forming a >, beyond this the ground color is dark fuscous, heavily overlaid with black scales, and with three small median spots of white in a line parallel to costa before apex, and one just above anal angle on outer margin. Cilia dark fuscous, inside light fuscous. Hind wing very dark fuscous, cilia paler, underside of both wings same. Abdomen dark fuscous, anal tuft dark cream. Legs fuscous, annulated with cream color. Alar expanse 10 mm.

Three specimens bred from *picea mariana* Mill. Type U. S. Nat. Mus., No. 6963. Cotypes Am. Mus. Nat. Hist. and collection Kearfott.

Recurvaria juniperella, sp. nov. Plate IX, Figs. 3 and 17.

Head creamy ochreous white, closely appressed scales. Palpi long, second joint thickened with appressed scales, third joint nearly as long as second, slender, bluntly pointed, slightly drooping, curved outward and upward; color cream white, with dark brown or blackish scales on basal joint, on under side and extending upwards in two patches on outer side of middle joint, forming basal ring and a short streak on under side of terminal joint, this last streak joining a subapical ring. Antennæ: basal joint without pecten, whitish clouded with brown, other joints with annulations of white and brown, about two thirds length of forewing. Thorax creamy white, less ochreous than head, irrorated with light brown. Forewing: creamy white, a sharply defined narrow band of black raised scales slightly and evenly curved from base along median line to apex of wing, at base this black band extends to costa to one eighth; above this band the ground color is more of a pearly white, and forms a distinct whitish streak; on costa at inner third is a short line of black and at outer third a longer line of black, the latter broadening at outer end into a triangular patch almost reaching median band. Four almost evenly spaced dots of black raised scales parallel to and about midway between median bands and inner margin, a fifth dot vertically above the outer on the costal edge of the median band. Three other dots in a line along outer margin; all of the dots are of black raised scales bordered by one or two white scales. Cilia at apex and outer margin mottled with dark brown, at inner margin pale gray. Under side brownish-gray, darker along costa and at apex. Hindwing: upper and under sides pale gray. Abdomen creamy white, darker beneath. Legs creamy white, streaked and spotted with reddish-black, the latter color predominating on first pair, only the incisions are white. Alar expanse 9.5 mm.

Thirteen bred specimens on *Juniperus communis* Linn., Essex Co., N. J.

Type U. S. Nat. Mus., No. 6965. Cotypes, Am. Mus. Nat. Hist., and collection Kearfott.

Larva.—Slender, cylindrical, slightly and evenly tapering to each end, 5–6 mm. long, 9 mm. extended. Width widest part 1.3 mm. Width head .55 mm. Head high or long, slightly flattened on face, slightly bilobed at top, lobes small and rather acutely rounded. Clypeus triangular, to within one third of vertex, narrow. Color, head light brown, mouth parts darker, ocelli black, antennæ very short. Prothoracic shield concolorous with head, size moderate, to subdorsal line. Thoracic legs light greenish-brown, abdominal legs normal, hooks yellow in complete crochets. Skin pale dull green, tinged with dull pink laterally on dorsum and on posterior edges each segment, and a double pink line across the anterior edge of each abdominal segment. The pink shading is concentrated into oblique dashes behind and below the spiracles. Ventral surface paler green. Tubercular plates inconspicuous, setæ weak and short.

Pupa.—From empty pupal skins. Length 3.8 mm. Slender, slightly flattened tapering evenly to end of anal segment, which is rounded smoothly with no trace of a cremaster, armed with a dozen or more very short fine hairs, with small recurved hooks on their tip ends, on dorsal and ventral surfaces, principally on former; later-

ally on each abdominal segment is a minute spur and minute stiff hair, to assist pupa to make its way to hole prepared for emergence of moth. Wing cases half way overlap sixth abdominal segment, labial palpi, half length of wing covers, are slender, very slightly enlarged at one third. I do not recognize any indentation or marks indicating maxillary palpi. Dehiscence: labial palpi separated on both sides for its entire length except lower end, from the prothoracic feet, the antennal cases are laid between the metathoracic feet and wing covers. To the labial palpi are attached the labrum, clypeus, a small part of the vertex of head and inner half of eye cap. Apparently segments six and seven are free.

A new hymenopterous parasite was bred from this species, described in this number of the Journal (p. 144) as *Orgilus kearfotti* Ashm.

Gnorimoschema busckiella, sp. nov. Plate IX, Figs. 7 and 8.

Head: cream white, loosely appressed scales, irrorated with bronze-brown. Palpi: long, drooping, curved, twice length of head, upper, inner surface of second joint and basal half of third joint same as head, outer and under side the brown predominates, with a few specks of white; apical half of third joint, brown predominates, same as under side. Second joint tufted on under side, outer edge dentate, apical joint half length second, slender, slightly rough beneath, pointed. Antennæ two thirds length of forewing, basal joint slightly larger than next, bronze-brown speckled with white, outer joints alternate rings of bronze-brown and white. Thorax and fore wings bronze-brown, irrorated with white, the basal half of each scale is white, outer and overlapping half bronze-brown, the white irrorations are caused by the brown not entirely covering the basal white. This arrangement of scales is uniformly distributed over the wing, except on the costal margin outer quarter and outer margin, where on account of the greater length of the scales, more white is exposed and the colors are almost equal. On the outer margin the same coloration extends half way out on the cilia. Underside dull brown, with a very faint wave-like whitish irroration, more distinct at apex. Hind-wing: both upper- and underside and cilia fuscous. Abdomen: bronze-brown, irrorated with whitish-brown at incisions on upper side, and over entire under surface, tufts of whitish-brown scales along each side. Legs: same ground color, with small specks of whitish-brown, with an almost white annulation at each incision. Average alar expanse 16 to 19 mm., one specimen only 11 mm.

Fifty-five specimens bred from larvæ forming a peculiar gall on the lateral shoots of *Aster patens* Ait., from Caldwell, N. J., issued during October. Type U. S. Nat. Mus., No. 6818, and Cotypes Am. Mus. Nat. Hist., Acad. Nat. Sci., British Museum and collection Kearfott.

Larva. — Cylindrical, robust, tapering only at extreme ends, length 10 mm., width abdominal segments 2 mm., width head .8 mm. Head small, rounded, bilobed, color dark brown, paler on front of lobes, clypeus narrow, evenly triangular, reaching to apex; paraclypeal pieces dark brown; ocelli black, antennæ moderate, basal segment whitish. Prothoracic shield a darker shade of yellow than skin, triangular, bisected by paler dorsal line, anal shield same, very narrow and small, neither chit-

inous. Thoracic feet concolorous, a small triangular brown spot cephalad and ventrad to each. Abdominal feet normal, small crochets of hooks complete, in minute circles. Skin uniformly pale yellow, dorsal line and anal segments smoky yellow, from food visible through clear skin. Spiracles minute, concolorous. Tubercular plates obsolete, tubercles very minute, setæ short and very minute, pale yellow.

Pupa.—From empty pupal skin: length 7 to 8 mm., width 1.8 mm. to 2 mm. Shape cylindrical, gradually tapering from thorax to anal segment, emergence affected by a split on dorsal line to and through mesothorax, on ventral surface the separation occurs on outside edge of one eye piece, and almost an even line to base of labial palpi, the latter is separated from adjoining tissue but remains attached at base. Wing cases, antennæ, and metathoracic feet extend down to posterior edge of seventh abdominal segment. Labial palpi to posterior edge of third abdominal segment. Eye-covers very small, clypeus small, narrow triangular at lower edge where it joins labrum. I cannot make out a distinct suture defining maxillary palpi. Anal segment terminates in an obtuse point, no defined cremaster or hooks, both dorsal and ventral surfaces are evenly smooth, free from deep sutures or hooks and setæ are so short as to be invisible under a lens of moderate power.

Late in August, last year, I noticed in a swampy meadow near Caldwell, N. J., a large proportion of the common late purple aster (*Aster patens* Ait.) with their lateral twigs or branches dwarfed in a peculiar manner (Plate IX, Fig. 18, enlarged), and on investigation found each of these twigs to contain a lepidopterous pupa.

This year, I have made almost weekly examinations of the plants, and not until late in July were the larvæ found, apparently nearly full grown as they began pupating the first week in August.

A moth was caught on a warm day late in November, having been beaten up from its resting place close to or almost on the ground.

Another peculiarity in connection with the life-history of this species is that it seems to be partially dependent upon the habits of another insect to prepare its habitat. Each of the Aster plants on which *busckiella* larvæ or pupæ were found in the lateral stems, were tenanted in the main or central stem by a single larva of *Thiodia radiatana* Wlsm., a large Tortricid. This larva makes a long burrow or excavation, three or four inches long, open at the top, destroying the central bud; thus the plant, pruned at the top, immediately starts a vigorous growth of laterals. On some plants as many as a dozen were found, each tenanted by *busckiella*. The Tortricid larva remains in the stem throughout the winter, deserting it late in March or early April and pupates on the ground, in a closely spun brown cocoon among the dried grass, leaves, etc.

The life cycle of *busckiella* then appears to be: Hibernation in the perfect state, eggs laid during June, after *radiatana* has dwarfed the

plant and thereby started many tender lateral twigs, larvæ full grown and pupated early in August and moths emerging during September and early October.

The effect produced by the larva of this species on the aster twig, is to hinder its growth at its outer ends, causing the leaves to be closely crowded together, and closely massed somewhat like a wide-open cone of hemlock or spruce. The stem, for about two inches of its outer length is also swelled to about twice the diameter of the portion of the stem below the gall. There is no opening at all in this cell, during the larval period, but just before pupation a hole large enough for moth to crawl out is cut in the upper portion, but not entirely through. The thin outer skin is left intact to be broken by the moth. So the frass cannot be ejected, and as but a thin dark layer is found in the lower end of the cell, I am inclined to think that the greater part of the excretion is absorbed in the live and growing tissue of the plant.

I have observed the same state of affairs in the large plum-like galls on goldenrod of *Gnorimoschema gallæsolidaginis* Riley. The query arises: Are not the galls produced by the absorption into the cells of the plant, of this unaccustomed liquid rather than by any mechanical action caused by the larva eating? It would not be difficult to learn something more about this, by the use of a hypodermic syringe, to inject the liquid squeezed from a few pellets of frass into the soft tissues of various perennial or other plants.

The moth emerges from pupa within the cell, leaving the empty pupal shell within.

***Gnorimoschema artemisiella*, sp. nov.** Plate IX, Fig. 5.

Head, thorax and palpi grayish-white, irrorated with darker scales, face white. Second joint palpi thickened, outer joint two thirds length of second with a basal and subapical band of brown scales, patagia terra-cotta. Antennæ two thirds length forewing, basal joint mottled, outer joints annulated light gray and black. Forewing ochreous, pink, or terra-cotta, heavily overlaid with streaks and bands of mottled gray and black, running parallel to costa. The costa is narrowly edged with this secondary color, a streak from base along median line curving into costa at one half; this color also predominates along inner margin. On apical third the black and gray dots are formed into narrow streaks or dashes radiating to outer edge and extending over cilia. There are three small black dots of raised scales, one on costa at inner fourth, one in cell just before outer end and one on median line beyond cell. There is a considerable degree in variation in different specimens, some are so heavily overlaid with the secondary color that the ground color is reduced to three narrow streaks, one just below costa, one along median line and the lower one in fold, these only extending to end of cell with just a bare indication of

the ground color on the outer half between the nearly parallel radiating lines of the secondary color. In other specimens the ground color occupies more than half of the inner half and extending down to inner margin. Underside fuscous with secondary color on apical cilia. Hindwings light gray, cilia fuscous, under side same. Abdomen: upper side terra-cotta, but more ochreous than on forewing; anal segment grayish-white, underside pearly white, a double row of black dashes on either side of segments 6 to 9. Legs same color as underside of abdomen, tinged and mottled with brownish black. Alar expanse 9 to 11 mm.

Described from twenty-four specimens bred from *Artemisia Canadensis* Michx., received in June, 1902 and 1903, from my friend Mr. Jos. H. Reading, of Chicago. I also have one specimen of what is no doubt this same species, collected by Dr. R. E. Kunze, July, 1900, Pinal Mountains, Arizona; Mr. Busck advises me that in the U. S. National Museum are specimens of this same species, unnamed, bred by Miss Murtfeldt on *Astemisia*, from St. Louis; indicating a rather extensive range. Type U. S. Nat. Mus., No. 6816. Cotypes Am. Mus. Nat. Hist., Acad. Nat. Sci., British Museum and collection Kearfott.

Larva.—Cylindrical, slender, tapering evenly from 7 to anal segment, annulate. Length 8 mm. Width 1 mm. Head .6 mm. Head small, rounded, slightly bilobed, clypeus evenly triangular, extending nearly to apex. Ocelli black, antennæ minute. Head yellowish-brown, retractile under 2. Prothoracic shield moderate, triangular, mottled brown, bisected by paler dorsal line, and an almost black spot each side of dorsal line on posterior edge. Anal shield pale yellowish-green, small, shining but not chitinous. Thoracic feet clear yellowish-green, tipped with brown; abdominal feet normal, small, circles complete. Skin dull sordid green, not shining. Tubercular plates not developed, tubercles small black raised points, no other marks except discoloration from food showing through dorsal area. Setæ very weak and minute.

Pupa.—Length 5 mm., width across thorax 1.5 mm., very slightly flattened. Surface generally smooth, tapering gradually to blunt point end of anal segment, which is armed with a radiating zone of very minute stiff hairs before the apex. Vertex of head and upper part of clypeus full, rounded, and extending up above the eye cases, latter small, round, prominent and well defined. Beneath the eyes, on each side of labrum, is a small raised process consisting of a parallel pair of narrow short elevations, which may indicate the maxillary palpi. Labial palpi broadened out about the middle of its length and terminates just before the prothoracic feet, about one half length of wing cases. Latter with antennæ cover fifth abdominal segment. Dehiscence: Pupal skin is very flimsy and fragile and difficult to rescue without fracture from its cocoon, but there appears to be one long break on each side of labial palpi, this organ remains attached at posterior end, and remains united to labrum and clypeus. The cap on vertex of head and eye covers are entirely separated; antennal cases remain attached to wing covers.

The terminal leaves of this plant resemble a long silvery green

tassel, composed of a thick mass of velvety needle-like leaves. This tassel is webbed together by a small green larva, that partially excavates the tip of the twig and feeds close to the bases of the leaves.

The majority had pupated by the first of July in a tough compact little cocoon well hidden in the mass; the first moth issued July 3 and continued until July 17.

Three different species of hymenopterous parasites were bred from this species, namely, *Iseropus inquisitor* Say, *Temelucha nartii* Ashm., *Protapanteles cacacie* Riley.

Anacampsis coverdalella, sp. nov. Plate IX, Fig. 13.

Head: closely appressed scales, thorax dark purplish-brown. Palpi same color, slender, long pointed. Antennæ: basal two fifths same color, outer three fifths canary yellow, length four fifths of wing. Front wing: base from costa to inner margin dark purplish-brown, from base to outer fourth canary yellow, outer fourth same as base and thorax—both division lines vertical from costa to inner margin, slightly serrate. The yellow color along costa a shade paler than below median line. Cilia very short, unicolorous with adjacent portion of wing. Underside brownish fuscous shading into darker gray fuscous beyond outer third; a small basal costal patch of nearly black purple brown. Hind wing fuscous, cilia slightly paler and as long as breadth of wing; underside the same. Abdomen: first two abdominal segments canary yellow, others purplish-brown, same as thorax. Underside fuscous. Legs fuscous, tarsi and spurs purplish-brown, nearly black. Alar expanse 11.5 mm.

Specimens collected by George Coverdale, Natchitoches Parish, La., after whom I take pleasure in naming this distinctively marked species. Type U. S. Nat. Mus., No. 6967. Cotype collection Kearfott.

Epimения cicutella, sp. nov. Plate IX, Figs. 12, 15 and 16.

Head: closely appressed scales, fuscous, each scale tipped with a minute dot of brown—making a finely speckled appearance. Thorax and patagia the same, but the latter a darker fuscous. Labial palpi long, recurved, apical joint about half second, thickened with loose scales, rather obtuse; yellowish fuscous inside, lower edge tipped with dark brown; outside same but much darker, apical joint dark brown, with minute yellowish specks. A narrow ring of yellow on middle joint at outer end. Antennæ about three quarter length forewing, basal joints slightly enlarged, dark brown, outer joints ringed with brown and pale gray. Forewing creamy white, irrorated with brown and black dots. The brown color is massed into a smoky brown shade on and parallel to costa beginning just before half and extending to outer two thirds, the shade is darkest brown along median line, its inner edge extends obliquely to inner margin and is there accentuated by largest dentate pencil of scales referred to below; the lower edge of shade is sharply defined by paler ground color, just below median line, somewhat reniform, with inner lobe twice length of outer. Beyond this in apical third along median line is another smoky brown shade longer than wide, and a very small one just beyond base on median line. At base of wing is

a short median dash of black. The costa is also marked with about eight small clusters of black scales irregularly spaced. The inner margin is strongly dentate by four clusters of long scales, whitish at base and tipped with black; the largest cluster at inner third, the outer three evenly spaced within the middle third; a small black spot between two brown shades, on median line at outer two thirds and another black spot on outer margin just below apex. Cilia pale fuscous, more than the width of wing, on outer margin long wing scales project into cilia forming a smoky line bounded inwardly by ground color and outwardly by pale fuscous and extreme edge beyond that smoky fuscous, at apex the cilia is uniformly dark, forming a hook-like termination to wing. Underside dull fuscous. Hindwing, upper- and underside bright silvery fuscous. Cilia very long, three to four times wings' width. Abdomen and legs fuscous, latter banded with very dark brown. Alar expanse 13 to 14.5 mm.

Forty specimens bred from larvæ on flower heads of *Cicuta maculata* Linn., water hemlock, Essex County, N. J. Type U. S. Nat. Mus., No. 6815. Cotypes Am. Mus. Nat. Hist., Acad. Nat. Sci., British Museum and collection Kearfott.

Larva.—Mature 6.5 mm., robust, cylindrical, slightly tapering, width 1 mm. Width head .6 mm. Head very pale brown, clypeus evenly triangular, reaching nearly to vertex; slightly bilobed, lobes full and rounded. Mouth parts dark brown, antennæ moderate, pale green, except outer joint brown. Ocelli on black field. Prothoracic shield, all of dorsal region, bisected by a narrow yellowish line, same color as tubercular plates. Anal shield small, narrow, not chitinous. Thoracic feet black, greenish-yellow at articulations. Abdominal feet normal, hooks very dark brown in complete circles, not open. Skin creamy white, broad subdorsal band of a smoky brown or pale grayish-brown from segment 3 to anal segment, involving tubercles i and ii. These bands are continuous from 5, and on 3 and 4 are interrupted between tubercular plates. The latter on thorax and abdomen are large and same color as subdorsal bands, but a shade darker. Tubercles i and ii normal, iii dorsad and cephalad to spiracle iv + v. On thorax ia + ib, iia + iib, iv + v. Setæ moderate, very dark nearly black. Spiracles small, round, very dark brown.

Pupa.—Nearly cylindrical to ends of wing cases, then evenly tapering to apex. Length 5 to 6 mm.; diameter 1 mm. Cremaster long, narrow, armed with about a dozen short hairs, each terminating in a strong recurved hook, all pointing backwards. Vertex of head full, rounded, smooth, and much paler in color than balance of pupa, eye cases small, rounded, labrum small, labial palpi widens to double width of labrum at one third below it, and extends down two thirds length of wing-covers. Antennæ and wing cases cover seventh abdominal segment, organs on frontal piece well defined, sutures deep. A lateral spine on abdominal segments 4 to 7. Color of pupa, except vertex of head, very dark brown, nearly black on dorsum. Debiscence: A long separation between antennal cases and labial palpi, on each side of latter and extending two thirds their length; labrum and clypeal piece remain attached to labial palpi; half of eye cap attached to wing cover. Antennæ remain cemented to wing covers on lateral edges.

Miss Murtfeldt* described an *Epimения* which she bred from

* Can. Ent., XXXII, 162, 1900.

Pimpinella integerrima Linn., a plant closely allied to *Cicuta*; I have compared my species with specimens of *Pimpinella* Murf., in the U. S. National Museum and there is no doubt they are distinct.

The food-habits are also different. My species lives on the flower heads of *Cicuta maculata* Linn., and when the seeds are formed it excavates their contents (Plate IX, Fig. 16, enlarged). In fact the majority of larvæ found are more than half buried in a seed. Although carefully examined a number of times before the seeds formed, I was unable to find any indication on the leaves that the larvæ had at any time mined them. When ready to pupate the larva makes brown silk open-mesh cocoon, invariably spun either on the upper or under side of the seed heads, between the radiating stems on which the seeds are borne.

My species is very similar to but quite distinct from the European *E. chærophyllella* Gz.*

Larvæ mature and begin pupating first week of August. Moths emerge August 18 to 27.

The discovery of this species was rather an accident. An unusual looking insect on the flower head of *Cicuta* caught my eye whilst looking carelessly at the plant; close examination showed it to be a moth just out of the pupa, with wings as tiny pads; it was bottled and allowed to develop and dry and a careful search made for other specimens, which were soon found in considerable numbers, but all on that date, August 20, as pupæ. The larvæ were not turned up until nearly a year later.

One parasite was bred from this species, *Iseropus inquistor* Say.

***Epimenia ramapoella*, sp. nov.** Plate IX, Fig. 4.

Head, palpi, thorax, patagia, abdomen and front wings pale creamy brown faintly tinged with red, and irrorated with very minute dots of fuscous. Front wings: Three small black dots along median line, one at inner third, one at half and one at outer third; two small dots of black on costa just before apex. Irregularly dentate along middle third of inner margin, defined by two clusters of longer scales, all tipped with black. At base of wing and along inner margin before anal angle ground color is less creamy brown and more whitish-gray, while on apical third the brown scales are closer together, becoming intensely brown at apex. Cilia shining brown, shading into dark fuscous at apex, length not quite width of wing. Hind wing gray, cilia same as front wing and about twice width of wing. Underside both wings and cilia shining brown. Underside abdomen dark brown, except outer edges each segment light brown. Legs same as general ground color, a shade paler at joints. Alar expanse 14 to 16 mm.

* Meyrich, Handbook Br. Lep., p. 691.

Described from five specimens, all taken at Ramapo, N. Y., May 27, 1900, on a steep mountain side, in dense woods. The moths seemed fairly abundant flying up from the shrubbery as it was disturbed, or from one tree trunk to another. A much larger series could easily have been taken, but on this particular date the woods were almost uninhabitable from the myriads of very small hymenopterous? insects, which gathered in clouds about one's head and required constant slapping of neck, face and hands.

Type U. S. Nat. Mus., No. 6966. Cotypes Am. Mus. Nat. Hist., and collection Kearfott.

MONTCLAIR, N. J.,

August, 1903.

EXPLANATION OF PLATE IX.

- Fig. 1. *Zelleria celastrusella* Kearfott.
 Fig. 2. *Recurvaria obliquistrigella* Chambers.
 Fig. 3. *Recurvaria juniperella* Kearfott.
 Fig. 4. *Epimения ramapoella* Kearfott.
 Fig. 5. *Gnorimoschema artemisiella* Kearfott.
 Fig. 6. *Crambus vachellellus* Kearfott.
 Fig. 7. *Gnorimoschema busckiella* Kearfott.
 Fig. 8. *Recurvaria thujaella* Kearfott.
 Fig. 9. *Recurvaria piceaella*, var. *nigra* Kearfott.
 Fig. 10. *Recurvaria piceaella* Kearfott.
 Fig. 11. *Symphysa adelalis* Kearfott.
 Fig. 12. *Epimения cicutaella* Kearfott.
 Fig. 13. *Anacamptis coverdalella* Kearfott.
 Fig. 14. *Thaumatopsis doeckellus* Kearfott.
 Fig. 15. *Epimения cicutaella* Kearfott, dorsal view.
 Fig. 16. Seed of *Cicuta maculata* Linn., excavated by larva of *Epimения cicutaella* (enlarged).
 Fig. 17. Mine of *Recurvaria juniperella* (enlarged) on *Juniperus communis* Linn.
 Fig. 18. Section of gall on *Aster patens* Ait., caused by larva of *Gnorimoschema busckiella* (enlarged).
 Fig. 19. Mines of *Recurvaria piceaella*, in needles of *Picea mariana* Mill. (enlarged).
 Fig. 20. Case of *Symphysa adelalis* on lichen (enlarged).
 Fig. 21. Mine of *Recurvaria thujaella* on *Thuja occidentalis* Linn. (enlarged.)

BRIEF NOTES TOWARD THE LIFE HISTORY OF
PELOCORIS FEMORATA Pal. B. WITH A
FEW REMARKS ON HABITS.

BY J. R. DE LA TORRE BUENO.

The aquatic Rhynchota present an attractive and fallow field to the entomologist, and afford him an opportunity to tread in ways never before explored. Of all the faunas, that of Europe is comparatively best known and most studied; yet even in that, although classification, the skeleton of the science, is more advanced than with us in the United States, but little is known of the life-histories of even the commonest species, beyond, perhaps, a description of the ovum; or a surmise as to the number of instars, deduced from analogy; or, again, a description of one or two nymphal stages. The greater part of this work, as I have noted elsewhere, refers principally to *Notonecta* and *Corixa*. To this scanty store of information it is now my privilege to add these notes on *Pelocoris* in the hope that they will fill up a gap in our knowledge of American insects.

Pelocoris femorata Pal. B. is to be found, according to Professor Uhler's "Check List," in the United States. However, no mention is made of the insect in the local lists of Osborn, Gillette and Baker, or Van Duzee. Professor Smith, on the other hand, mentions it in his New Jersey List and Lugger in his "Bugs of Minnesota," while Uhler gives it as found in California in his paper on "The Hemiptera of Lower California." In this vicinity, I have found it abundant, and my collection contains one specimen each from Rhode Island, Pennsylvania and Maryland. Uhler, in the second paper mentioned, states that it is widely distributed in the United States.

Wherever I have found it I have taken it in large numbers. *Pelocoris* is a vigorous swimmer. In the spring of the year the bugs may be seen freely swimming among the growing aquatic vegetation. When alarmed, they hide in the soft ooze at the bottom or among the weeds, getting close in to the axils of the leaves. Occasionally, they may be seen in the hollows of lily-pads, apparently sleeping in the sun. I have taken the bug in this condition, quite dry and seemingly torpid. At times they come to the surface, where they hang abdomen or dorsum up, indifferently, the tip of the abdomen breaking the surface

film. This is done, as is usual with the aquatic Hemiptera, for the purpose of renewing the air coating the abdomen and stored under the hemelytra. In renewing its supply of air, *Pelocoris* sometimes appears to protrude the terminal abdominal segments to break through the surface. It also separates the tip of the abdomen and the hemelytra in such a manner that a comparatively large aperture is formed at the surface. While under water the insect may be seen to pass its swimming legs through the abdominal air-coating a few times every now and then, somewhat as does *Corixa* and possibly for the same purpose of renewing the oxygen. Some of the individuals from which I have made these notes, when taken, had a fungoid growth on the hemelytra and thorax. This, however, does not seem to be in any way injurious. I have one individual in this condition in my aquarium, where it has been for the last four months. When in captivity, I have fed them on flies, one apiece every day, which appears to have been enough. Sometimes three or four will fasten on one insect, feeding together very amicably. *Pelocoris* is fiercely predaceous, and its salivary secretion must be highly toxic. In a thoughtless moment, I put a *Belostoma* (*Zaitha*) nymph in the aquarium with these insects. It was no sooner in the water than it was seized, and although I forcibly rescued it immediately, it died in about a minute.

According to De Geer, the European *Ilyocoris* (*Naucoris*) *cimicoides* Linné, flies by night, and it may safely be assumed that our *Pelocoris* does the same, although I have never seen it. At any rate, its wings are well developed and apparently powerful.

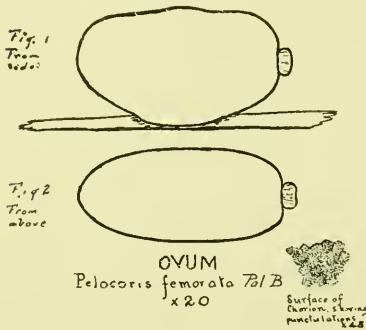
In common with Belostomidæ, Nepidæ and Corixidæ, *Pelocoris* is at times found with water mites fastened to it, especially under the hemelytra, or at the suture dividing the thorax and prothorax. *

Pelocoris femorata overwinters in the adult form, and survives till the following autumn. Oviposition begins in the spring, just how early I am unable to say, and continues at least till the middle of summer, when the insect begins to come to maturity. I have taken

* I have very rarely found this to be the case with *Notonecta*, although I have taken *Notonecta irrorata* Uhl. with mites under the wings. In general, the water-bugs are attacked in about this order: Nepidæ, Belostomidæ, Corixidæ, Naucoridæ and Notonectidæ, the last named being the least susceptible. From the facts that this is also the order of their activity; that *Ronatra*, a most sluggish insect, is the most heavily parasitized; and that *Notonecta*, which is constantly on the move, the least, it seems fair to infer that the water mite selects for its attacks those insects that disturb it least.

ova as early as May 16, and found the recently transformed adults on August 16, giving a period of development of over 12 weeks. However, as the ova and adults were found in different localities, this may explain the discrepancy, as the period in question has not been borne out by aquarium experiments, which gave about 77 days for development from the ovum to the adult. There are five nymphal instars which, with the embryonic stage and the adult, gives seven stages of growth altogether, as shown by aquarium breeding. The number of instars also holds good in nature. On the same day and at the same place, I have taken *Pelocoris* in all stages, except the ovum and the first nymphal instar.

The following life-history has been worked out by me in my aquaria, and is subject to revision, because of the small number of individuals observed. The young *Pelocoris* were fed on flies, on which they thrive.



On June 6 of this year (1903), I took a number of overwintering *Pelocoris*, which I put in an aquarium on the following day. On looking at them a day or two later, I noticed that the water-

plant in the aquarium had some ova on it. I removed these on the 8th, and did the same on the 9th, setting apart the two lots, 73 ova in all, for observation.

Color. — Translucent pearly white when deposited, growing darker as development progresses. *Markings:* Surface minutely punctulated in lines, punctures set close together, giving the appearance of meandering striations. As the time for emergence approaches the character of the markings changes. The chorion is still punctulated, but at the same time engraved in distinct hexagons produced by the punctulations. *Shape:* From above, imperfectly oval; from side, somewhat flattened above, with a gradual rise toward the middle. The cephalic end is more rounded than the caudal, descending to the line of attachment with a shorter curve. This curve is somewhat depressed at the extremity of the ovum, from which depression arises the micropylar boss. (See Figs. 1 and 2.) The form changes during incubation and just previous to emergence the ovum is larger and rounder than when first deposited. *Size:* Longitude, 1.4 mm.; latitude, .6 mm.; altitude, .7 mm.

While I have not been so fortunate as to witness oviposition by this insect, M. Régimbart, in his classic paper on "Observations sur la

Ponte du *Dytiscus marginalis* et quelques autres Insectes aquatiques," read December 9, 1874, before the Société Entomologique de France, describes the act in *Ilyocoris cimicoides*, in connection with the same function in *Notonecta glauca*. His description follows :

"These insects (*Ilyocoris cimicoides* and *Notonecta glauca*) attach themselves firmly by means of their anterior and intermediate pedes to the stems of plants, holding the head high in the same way as *Dytiscus*, making peculiar motions with the swimming legs; the rostrum is sunk deeply into the plant for support, and an incision is made with the ovipositor. The motion of this apparatus, which is more complicated than that of *Dytiscus*, can scarcely be properly examined, as little can be gathered from the outside; it can be guessed at from the abdominal movements from front to back and from back to front. The incision calls for about one minute's labor on the part of these insects; it is not very deep, only about 2 or 3 mm. long, and the ovum is only about three fourths of its length enclosed by it, being set obliquely, so that one of its ends is nearly quite out. It should be noted that the free portion corresponds to the cephalic extremity of the embryo."

It may be assumed, in default of direct observation on *Pelocoris*, that the mechanism of oviposition is substantially as described, and it is to be hoped that some observer may be so fortunate as to be able to describe the process in detail. However, as regards the attachment of the ovum, *Pelocoris femorata* seems to differ from *Ilyocoris cimicoides*, as far as my observation has gone. Out of about 100 ova examined by me, some found in natural conditions, others deposited in aquaria, none has been met buried in the plant tissue to any extent. The majority have been found attached axially to the stems or leaves of *Ceratophyllum*, and secured to them by a glue in which the ovum is set and which surrounds the slender stem or leaf to a variable extent. The adhesion is not very firm, however, and the ova are readily detached.

As development advances, the eyes begin to show at the micropylar extremity of the ovum as two little red lines which grow plainer day by day. The embryonic stage lasts from 22 to 27 days, the greater number (over two thirds of the ova I bred) emerging on the twenty-fourth day.

FIRST NYMPHAL INSTAR.

Immediately after emerging from the ovum, the nymph is transparent, white and colorless, except that each abdominal segment has a broad dark luteous band at the connexivum. Also, the eyes are red and well-marked. The tarsal claws of the second and third pairs of pedes are dark and noticeable. The single claws of the first pair are colorless and transparent. The short rostrum is transparent pale lute-

ous, darker at the tip. A seta issues from the posterior angle of each abdominal segment, at the connexivum, on the dorsal surface. About eight hours after emergence the insect is much darker in color.

In shape the young *Pelocoris* resembles nothing so much as the suctorial midnight prowler, at a superficial glance. Carefully examined, however, it is seen to resemble closely the adult in shape, allowing for the difference in size and absence of wings.

When recently hatched its abdominal air coating is absent, and the young insect finds it difficult to reach the surface, which it succeeds in doing only by vigorous swimming. If it relaxes its efforts, it immediately sinks to the bottom. *Pelocoris* swims back down when in this condition.

When still uncolored, the dorsal vessel can be plainly seen pulsating and the oily globules of the unabsorbed yolk moving in the abdominal cavity. Size: Longitude, 2.5 mm.; latitude, 1.5 mm.

Out of a large number of individuals obtained from ova, only five reached the second instar, one in ten days after emergence, three in eight days and one in seven. This would give an average period of eight days for the first instar.

SECOND NYMPHAL INSTAR.

The appearance after the molt is practically the same as after emergence from the ovum, except that there is a dark, somewhat triangular shaped blotch extending from the caudad margin of the thorax to the fourth abdominal segment, apparently produced by the abdominal contents. The pulsations of the dorsal vessel can also be seen in this instar under the same conditions as before, save that the yolk is, of course, totally gone. Size: Longitude, 3.25 mm.; latitude, 2 mm.

Three alone survived till the second moult, two making the ecdysis in nine days and one in six. It may safely be assumed that the longer period is nearer the average, since the more rapid molt occurred in very hot weather.

THIRD NYMPHAL INSTAR.

The preceding description applies to this equally well. Size: Longitude, 4.8 mm.; latitude, 3 mm.

The succeeding observations have been made on the two survivors, which I safely carried through to maturity. However, I did not examine these at all closely for fear of losing them, so my notes on the

remaining instars are rather scanty. These two individuals molted for the third time eight days after the second ecdysis.

FOURTH NYMPHAL INSTAR.

Coloration and other peculiarities slightly more accentuated than in the preceding instars. Size: Longitude 6.5 mm.; latitude 4.2 mm.

I may here state that just previous to a molt, the insect is very thick through, especially so in this and the succeeding instars, and looks fit to burst out of its skin, as it does.

These two individuals were brought without accident to the fourth molt, one in ten and the other in twelve days. I am inclined to the belief that the former is more likely to be the average period.

FIFTH NYMPHAL INSTAR.

In this instar *Pelocoris* is much more opaque, though still whitish, immediately after the ecdysis. The wing pads appear in this instar. Size: Longitude, 8.3 mm.; latitude, 5.5 mm. The difference in size between this and the preceding instar is so great that, unless bred, one might be led to the belief that there was still another stage between the two.

The two insects arrived at the fifth and last moult in sixteen days, which taken in conjunction with the fact that an individual caught in this stage did not reach the adult condition till eleven days after capture, would seem to denote that it is practically the normal period.

I was fortunate enough to have the opportunity of observing the last moult in *Pelocoris*, which I will now describe from my notes taken during the process of the ecdysis.

The bug hangs from the surface, back up. The outer skin then splits along the thorax, and the scutellum of the emerging insect is seen. The opening enlarges as the insect gives rhythmical convulsive heaves. First the entire thorax comes out; then, with a jerk, the head. It now rests a moment and in a short space again takes up its motion, withdrawing the body little by little from the cast-off skin. The dorsum, as yet uncovered by the still unexpanded alæ and hemelytra, has a coat of air. The wings and hemelytra expand as the insect emerges, so that by the time it is entirely out they are fully developed, completely concealing the dorsum abdominis. It takes the insect about ten minutes to go through this final transformation. When it is entirely free, it turns quickly and hangs back down from the air-

filled and buoyant cast skin for a moment, until the wings are perfectly expanded. Then it begins to swim about quite rapidly, coming to rest once more, seemingly requiring something to 'hang to. There appears to be an undue amount of air under the insect's wings while it is in this condition, and it remains back up while swimming. The tracheal lining may be seen as *Pelocoris* emerges, connecting the sternum with the cast skin.

Pelocoris, immediately after the last ecdysis, is entirely of a beautiful light green like aquamarine, including the hemelytra and the limbs excepting the tibiæ, which are dark from the swimming hairs. The eyes are a dark ruby-red. The insect gradually grows darker, and about four hours after the change it is a mottled dark green. The full mature coloration is reached in about 12 hours.

Pelocoris femorata, therefore, as has been shown, has seven instars, namely: one embryonic, five nymphal and one adult. The embryonic stage lasts about 24 days; the first nymphal instar, about eight; the second, about nine; the third, about eight, the fourth, about twelve; and the fifth and last about 16 days. The adult overwinters and begins to breed in the spring, oviposition taking place earlier or later in the season, according to the temperature; and the life-cycle is completed about the beginning of July or later, governed by circumstances. The adult may, under favorable conditions, live for over a year, and oviposition seems to be continuous during the summer, giving a number of overlapping broods from overwintering adults.

The last conclusion is borne out by the fact that on the same day and at the same place, as previously stated, I have taken *Pelocoris* in the second to the fifth nymphal instars. The measurements of these in conjunction with those taken from my bred specimens, give ranges in size as follows, for the instars observed. All measurements are from the living or freshly killed insect.

2d Instar,	Long.,	3.25	mm.	(bred)	3.6	mm.	(wild).
	Lat.,	2	mm.	"	2.3	mm.	"
3d Instar,	Long.,	4.8	mm.	"	5	mm.	(wild).
	Lat.,	3	mm.	"	3.1	mm.	"
4th Instar,	Long.,	6.4	mm.	(wild)	6.5	mm.	(bred and wild).
	Lat.,	4	mm.	"	4.3	mm.	(wild).
5th Instar,	Long.,	7.9	mm.	"	9.2	mm.	" (8.3 mm. bred).
	Lat.,	5.1	mm.	"	6	mm.	" (5 mm. "
Adult,	Long.,	8.6-10	mm.	"			
	Lat.,	6-7	mm.	"			

In conclusion, I wish to say in extenuation of the many shortcomings and omissions in my endeavor to cast some light in obscure places, that in this work there are no guides. None have blazed a way which one may follow. And if I have erred, it is the school where the explorer learns, that later he or another may avoid the same pitfall.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF APRIL 7.

Held at the American Museum of Natural History, Tuesday evening, April 7, at 8 o'clock. The President and Secretary being absent the Vice-President, Mr. Leng, presided and Mr. Charles Myers was elected Secretary pro tem.

The following members were present: Messrs. Billings, Brues, Davis, Joutel, Leng, Myers, O'Connor, Palm, Southwick, Bueno, Watson, Weeks and two visitors, Miss Billings and Mr. Raymond Osborn. Reading of the minutes of the previous meeting was necessarily omitted.

Mr. Davis of the Field Committee reported that cards had been mailed to members calling for an outing to Fort Lee, Sunday, April 19.

Mr. O'Connor proposed Mr. Morgan Hebard, of Chestnut Hill, Philadelphia, as an active member of the Society.

A communication from the New Era Printing Company regarding the entry of the Journal as second class mail matter was referred to the Publication Committee. Also a communication was read from Mr. Schaeffer, referring to the fact that he would be out of the city for some time and Mr. Joutel was elected to fill the position of Librarian during Mr. Schaeffer's absence.

Mr. Davis then presented a few remarks on the subject of "A New Cricket (*Apithes agitator* Uhler) from the vicinity of New York."

He stated that this cricket was described in 1864 by Uhler who wrote of it as follows: "It inhabits grape vines and dense shrubbery near Baltimore and is found fully developed about the middle of September."

In the "Insects of New Jersey" it is recorded from Anglesea and Bay Side, both in Cape May County. In these localities it was found in September. In Scudder's Catalogue of the Orthoptera of the United States its habitat is given as "Southern U. S. east of the Great Plains." On the 21st of last September a single female of this species was found at Ward's Point, Tottenville, Staten Island, which is the most northern locality so far reported.

Mr. Joutel gave some notes on the "Food Habits of *Goes pulverulenta*." He stated that his experience in breeding this species showed the small value of negative evidence in that although he had always looked for the insect in beech, its recorded food plant, he had only found it in iron-wood (blue beech) and so thought there might have been an error in the determination of the food plant; since then, however, he has been informed by Mr. Laurent, of Philadelphia, that he had bred it from

beece and showed him some examples of the work and also the insects. Also Mr. Blanchard had informed him that he had found it in Elm at Tyngsboro, Mass. Mr. Joutel stated also that he had found it last season in the scrub-oaks at Lakehurst, New Jersey, in stems from one inch to one and a half inches in diameter and that the work of the larvæ was quite distinct in the several food plants. In the beech it generally started at the crotch of the branches, in iron-wood in the trunk of trees ranging from three inches to six or seven inches in diameter, and in the dwarf-oak as stated above.

The Vice-President asked Mr. Raymond Osborn of Columbia University to address a few words to the members.

In response Mr. Osborn gave quite an interesting account of his collection of Serpent Flies, particularly about the distribution of forms found on Vancouver Island and stated also that some were found on glaciers in British Columbia. He had found a number of new species. He also spoke of the dragonflies of British Columbia, of which he has a large collection. In that region he found them particularly abundant, sometimes sitting on a telegraph wire all in a row like so many sparrows.

Mr. Bueno made some remarks on the hibernating position of *Vespa maculata* found at Fort Lee, N. J., which he exhibited to the members.

Mr. Leng showed specimens of the genera *Adalia* and *Coccinella* of the family Coccinellidae and spoke of the variations in the markings in connection with the geographical distribution of the species. Some of the species are remarkably constant in the maculation while other species are equally inconstant.

Mr. Leng also called attention to the recently published "Briefe eines reisenden Entomologen," by Dr. Walther Horn (Deutsche Entomologische Zeitschrift, 1902, Heft 2), containing descriptions of American Cicindelidae and complimentary allusions to the New York Entomological Society. A review of the "Briefe" will be published in JOURNAL.

On account of Mr. Barber's absence his paper on a rare beetle from Mt. Katahdin was postponed.

Society adjourned.

MEETING OF APRIL 21.

Held at the American Museum of Natural History, Tuesday evening, April 21, at 8 o'clock.

President C. F. Groth presided with the following members in attendance: Messrs. Barber, Brues, Davis, Holmes, Joutel, Leng, Love, Myers, Bueno, Watson and Zabriskie.

The minutes of the two previous meetings were read and approved.

A communication from Mr. Beutenmüller was read in reference to the entry of the JOURNAL as second class mail matter.

The secretary was instructed to call the attention of the publication committee to the fact that the number of JOURNAL published should be limited to 325, according to a former action of the Society; also that occasional reports of the actions of the publication committee should be transmitted to the Society.

Moved by Mr. Bueno and seconded that the several letters received by Mr. Joutel from the New Era Printing Company in reference to the entry of the JOURNAL to be transcribed and sent to the publication committee. Carried.

Mr. Davis, of the field committee, announced that the next field meeting would be held Sunday, May 3, near Patterson, N. J., with Mr. Herman Erb as guide.

Also the third outing of the season would take place at Mosholu, Sunday, May 17.

Mr. Morgan Hebard, of Philadelphia, Pa., was elected an active member of the Society.

Mr. Joutel stated that he had been requested by the Brooklyn Entomological Society to determine whether or not the New York Entomological Society would be willing to print its proceedings in our JOURNAL.

On motion of Mr. Leng the society voted to allow two pages of each issue of the Journal for printing the proceedings of the Brooklyn society. Mr. C. T. Brues then gave a talk on "Ant and Termite-guests," illustrated by lantern slides. The examples mentioned were drawn, some from previous accounts of other authors, and others from the speaker's personal experience in collecting these insects in Texas. He said that at the present time there had been described over 2,000 species of Arthropods which live occasionally or regularly in ant and termite nests.

Of these Coleoptera and especially Staphylinidæ are the most numerous, although insects of all orders are represented. In all of them there is a tendency to produce strange and remarkable forms and to develop structures suited to their rather precarious existence. This could be well seen in the Dipterous family Phoridae, which contains some of the most peculiar of all myrmecophiles. He spoke of the habits of a large number of the insects thrown upon the screen, roughly classifying them into welcome, indifferent and dangerous guests, although such a classification is useful only as a convenience. In regard to termitophiles he spoke of the physogastric or swollen condition of the abdomen which is characteristic of all true termite-guests and attributed it to the way in which they were stuffed with food by the white ants. In conclusion the speaker showed a picture of *Termitoxenia* Wasm., which he regarded as one of the most remarkably specialized insects ever described.

Mr. Leng inquired if *Cremastochilus* was milked by the ants. Mr. Brues replied that it was.

Mr. Joutel asked if the habits of the Staphylinidæ which lived with the queen termite had been worked out. Mr. Brues stated that he thought their habits were not known.

Mr. Leng also inquired if it was thought that these myrmecophilous beetles acted as scavengers. Mr. Brues replied that generally the ants were very particular to keep their nests clean themselves although some of the staphylinids were very fond of any grease which they could find on the walls of the nests.

Mr. Barber then spoke concerning the rare beetle *Miscodera arctica* Payk., which he had collected last summer near the base of Mt. Katahdin in Maine at an elevation of 3,000 feet. One specimen was taken under a stone. Mr. C. Schaeffer had determined the specimen for him. Mr. Samuel Henshaw wrote him in reference to this species that he had record of its capture in northern Michigan, Alaska and Newfoundland. He also mentioned that he had collected 58 specimens of a probably new species of Coccinellid at Lakehurst, N. J., on April 9, pronounced by Mr. Leng to be *Brachyacantha*, n. sp., or a European species.

Society adjourned.

MEETING OF MAY 5.

Held at the American Museum of Natural History, Tuesday evening, May 5, at 8 o'clock. President C. F. Groth occupied the chair with the following members present: Messrs. Barber, Billings, Brues, Call, Davis, Franck, Joutel, Love, Leng, Myers, Snyder, Southwick, Bueno, Watson, Weeks and Zabriskie. Ten visitors also present. The minutes of the previous meeting were read and approved.

Mr. Joutel reported that he had sent out the last issue of the JOURNAL to subscribers.* Dr. Call proposed Mr. George P. Engelhardt, 185 Brooklyn Ave., Brooklyn, as an active member.

The society then had the pleasure of listening to an illustrated lecture by Dr. E. P. Felt, on the subject of "Wood-Borers (Scolytids) and Their Ways." Dr. Felt spoke first about the relative size and economical importance of the Scolytidae compared with other important families of Coleoptera. He then threw upon the screen illustrations of the work of various species of Scolytids, commenting upon the peculiar difference in each case. He also showed a number of pictures to illustrate how rapidly these insects can destroy apparently healthy trees. He also exhibited a case showing specimens and workings of most of the important species of Scolytids.

On motion of Dr. Love the society accorded to Dr. Felt a hearty vote of thanks for the lecture.

* This must be an error, the March number of the Journal was sent out by The New Era Printing Company at Lancaster, Pa.

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THE TERMINAL ABDOMINAL SEGMENTS OF FEMALE TIPULIDÆ.

BY ROBERT E. SNODGRASS.

(PLATES X AND XI.)

In a paper not yet published * the writer has described and figured the terminal parts of the male abdomen for a large number of Tipulid species. The present paper is complementary to this one for the same species have been used in studying the female abdomen. The specimens were identified by Mr. R. W. Doane and belong to the zoölogical department of the Washington Agricultural College.

Tipula angustipennis Loew. (Pl. X, Figs. 2, 5, 7, 8, 9 and 10.)

This species will be described first as an example of the entire family.

The abdomen (Fig. 10) is long and slender, slightly swollen at the fourth and fifth segments. Posteriorly it terminates in a slender tapering point when the apical parts are appressed. There are ten abdominal segments. The first seven have the ordinary cylindrical shape. The eighth, ninth and tenth are the ones that present the genital modifications.

The eighth tergum (Figs. 5, 7, 9 and 10, *VIII t*) is only about a third of the length of the seventh tergum. It is otherwise unmodified. The eighth sternum (*VIII s*) on the other hand, is greatly elongate, reaching far beyond its tergum. It is strongly convex ventrally and projects posteriorly beneath the ninth and tenth segments. On the posterior half it presents a long median triangular membra-

* The Hypopygium of the Tipulidæ (MS.), Proc. Davenport Acad. Sci.

nous area. Two long, slender, blade-like processes (Figs. 5, 7, 9 and 10, *a*) arise from its posterior end and project backwards. They are almost as long as the sternum itself and are set on edge side by side. The space between the dorsal surface of the eighth sternum and the ventral surfaces of the ninth and tenth segments is the genital chamber. Arising from the floor of this chamber, *i. e.*, from the dorsal surface of the projecting part of the eighth sternum, is a small darkly chitinized plate (Fig. 8) ending posteriorly in two free diverging prongs. This plate may be the fused and rudimentary anterior gonapophyses.

The ninth segment (Figs. 5, 7, 9 and 10, IX) is very small. Its tergum consists of a narrow transverse band of chitin back of the eighth tergum. The ventral part of the ninth segment is entirely hidden above the eighth sternum. It is membranous and is continuous with the membranous ventral surface of the tenth segment. The two together form the roof of the genital chamber. In this membrane are two chitinous rods that arise close to the lower ends of the ninth tergum (Fig. 2) and converge posteriorly where they unite in a chitinous plate ending in two free prongs on the under side of the tenth segment. The two free processes are apparently the rudimentary second gonapophyses. The plate and converging arms may be regarded as the ninth sternum.

The tenth segment (Figs. 5, 7, 9 and 10, X) is relatively large. Its dorsum is convex and presents a number of transverse wrinkle-like grooves. Its basal part is widest, the median part somewhat contracted, and the terminal part is slightly expanded again into a triangular suranal plate. The membranous ventral part is slightly concave. It terminates in two rounded podical plates. On each side a long, rigid, tapering, chitinous cercus (Figs. 5, 7, 9 and 10, *cer.*) arises between the suranal and podical plates.

***Tipula bella* Loew.** (Pl. X, Fig. 6.)

Externally this species scarcely differs from *T. angustipennis*. The lower ends of the ninth tergum are wider (Fig. 6, *IX t.*). The ninth sternum consists of two triangular plates, each with a long tapering angle projecting posteriorly and inwardly (Fig. 6, *gon. 2*). The first gonapophyses are slenderer than in the last species, and the podical plates are shorter.

Tipula retusa Doane. (Pl. X, Fig. 3.)

This species differs from *T. angustipennis* chiefly in the shape of the cerci (*cer.*). Instead of being long and tapering they are shorter and expanded terminally where they bear four small points. At the base of each is a sharp point on the tenth tergum. The appendages (*a*) of the eighth sternum are slightly curved upward. The ninth sternum is a slender V-shaped bar with the apex drawn out posteriorly into a sharp point. The first gonapophyses are represented by two small triangular plates on the floor of the genital chamber with a slender rod between them. Neither the plates nor the rod project from the chamber wall.

Tipula uncinata Doane. (Pl. X, Fig. 4.)

Externally the abdomen of this species is almost identically the same as that of *T. bella*. The ninth sternum is considerably different, however, as is shown in Fig. 4. It consists of two lateral, curved bars with a slender, tapering plate between their tips.

Tipula acuta Doane. (Pl. XI, Fig. 13.)

Externally very similar to *T. angustipennis*, differing only in the slightly longer tenth segment and shorter cerci. The ninth sternum (Fig. 13) is a very slender V-shaped rod with the apex drawn out posteriorly into a long parallel-sided point. On the floor of the genital chamber is imbedded a small chitinous rod.

Tipula carinata Doane. (Pl. XI, Fig. 11.)

Eighth sternum rather large and swollen, making the end of the abdomen subterminally enlarged. Tenth segment shorter than in the other species described. Cerci long, blade-like, slightly constricted at the middle, tapering distally. Ninth sternum similar to that of *T. uncinata* but the median semi-chitinous point much larger.

Tipula sulphurea Doane.

Externally very similar to *T. angustipennis*, the principal difference being in the shorter eighth segment and in the wider ninth tergum. The eighth tergum is even a little shorter than the ninth. Tenth tergum lacks the transverse wrinkles. Ninth sternum a simple narrow U-shaped bar with the closed end posterior and produced into a short slender bar.

Tipula dorsolineata Doane.

Externally almost identical with *T. angustipennis*. The tenth tergum, however, has no transverse wrinkles, and the ninth sternum is

U-shaped with a Y-shaped bar between the arrow, having the forked part posterior.

These forms described are typical of the genus *Tipula*. The following species are all very similar to *T. angustipennis*: *T. bisetosa* Doane, *T. æqualis* Doane, *T. caloptera* Loew, *T. lamellata* Doane, *T. flavicollis* Fab., *T. tephrocephala* Loew, *T. cinerea* Coq., *T. trivitta* Doane, *T. fallax* Loew, *T. brevicollis*, *T. incisa* Doane, *T. impudica* Doane, *T. truncorum* Meig., *T. cognata* Doane, *T. spernax* O. S., *T. cuspidata*, *T. inermis* Doane.

Tipula bicornis. (Pl. X, Fig. 1, and Pl. XI, Fig. 16.)

This species and the next described depart from the general form for the genus more than do any others examined. In *T. bicornis* the eighth sternum is unusually large and prolonged posteriorly as far as the lips of the very short cerci. It bears at the end two very short, vertical, apical lobes (Fig. 1 a). The tenth segment is very short, the cerci (*cer.*) are small and spatulate. The ninth sternum consists of a bilobed plate having the form shown in Fig. 16.

Tipula streptocera Doane. (Pl. XI, Fig. 19.)

Of the same type as the last, but the ninth tergum is shorter and is deeply notched above on the posterior margin. Both eighth tergum and sternum large, apical appendages of the latter small. Ninth sternum (Fig. 19) consists of two leaf-shaped plates, each produced posteriorly and inward as a long stem-like process, the two stems fusing into a median point. Tenth segment consists of a narrow transverse band expanded triangularly on dorsum. Cerci are short, vertical, semicircular plates.

No other species in the collection were found of the *bicornis* and *streptocera* type. The males of these species present the same type of structure in the form of the hypopygium but they differ greatly in degree of development of certain parts. For example, in each a process projects backward from the "pleural" plates, but in *T. bicornis* they are short and inconspicuous, while in *T. streptocera* they form a pair of long rod-like arms projecting posteriorly and upward.

All the lower genera show the same plan of structure as does *Tipula*. Their species differ in various minor ways from the species of this genus, but there are no generic and super-generic variations in the female genitalia as there are in the male hypopygia.

Dicranomyia venusta Berg. (Pl. XI, Figs. 12 and 14.)

Very similar to *Tipula*. The eighth tergum is narrow above, widened on the sides (Fig. 14, VIII t). The eighth sternum is prolonged posteriorly beneath the ninth and tenth, and terminates in two blade-like appendages (*a*). The ninth tergum is a narrow band back of the eighth. The ninth sternum (Fig. 12) is a curved transverse bar of chitin bearing a median bar projecting caudally. This supports a free membranous flap on the dorsal wall of the genital chamber. The tenth segment is comparatively long and supports two curved, tapering cerci.

Dicranomyia longipennis Schum.

In this species the appendages of the eighth sternum are longer than in the last, and the ninth sternum is a simple transverse bar of chitin. Otherwise the two species are alike.

Symplecta punctipennis O. S. (Pl. XI, Fig. 15.)

Very similar to *Dicranomyia*, differing in the proportionally larger and strongly up-curved cerci of the tenth segment.

Limnophila sciophila O. S. (Pl. XI, Fig. 17.)

Very similar to *Dicranomyia* and *Symplecta*. The eighth sternum short but its appendages (*a*) large. Cerci long, slender and curved. Ninth sternum is a sinuous transverse bar of chitin bearing a median rod projecting posteriorly as in *Dicranomyia venusta* and supporting a long triangular membranous flap (Fig. 17, gon. 2).

Antocha opalizans O. S.

Does not differ from the last.

Dicranoptycha scabrina.

Tenth segment rather elongate and the cerci spatulate in form.

Erioptera caloptera Say and **E. septentrionis** O. S.

Differ in no way from the foregoing genera. The cerci are curved upward.

Epiphragma forcipennis Say (Pl. XI, Fig. 18) and **Trimicra anomala** O. S.

In both of these forms the cerci are rather large and strongly bent upward.

Amalopis constans Doane and **A. inconstans** O. S.

Very similar to *Epiphragma* and *Trimicra*.

Ptychoptera lenis O. S. (Pl. XI, Fig. 20.)

Considerably different from any others examined. The abdomen is club-shaped, enlarging posteriorly to the seventh segment. The eighth, ninth and tenth terga are consolidated and covered by the posterior margin of the seventh. The eighth sternum is short and thick and its appendages (*a*) are rudimentary. The cerci (*cer*), on the other hand, are extremely large plates widest near the middle, tapering to a point distally.

Ctenophora bimaculata, **C. flaviolata**, **C. angustipennis**.

Parts all of ordinary form. In *C. atrata* the tip of the abdomen and the cerci are greatly prolonged and tapering.

Pachyrrhina, spp.

Eight species were examined and none were found to depart from the ordinary type.

This study of the female abdomen shows that there is but one type of structure throughout the entire family, and that the generic and specific modifications of this type are but slight. The contrast between the males and the females in this respect is very striking. The modifications of the female parts are insignificant when compared with the enormous variety of hypopygial structure in the males. It is utterly impossible to point out any correlation between the variations of the corresponding parts in the two sexes. There consequently arises the interesting problem of explaining the modifications of the male genital parts by some other theory than that of adaptation to the female organs.

EXPLANATION OF THE PLATES.

a, appendages of eighth sternum; *cer*, cercus; *gon. 2*, second gonapophyses; *VIII t*, eighth tergum; *VIII s*, eighth sternum; *IX, X*, ninth and tenth terga.

PLATE X.

- FIG. 1. *Tipula bicornis*, lateral view of end of abdomen.
 FIG. 2. *Tipula angustipennis*, second gonapophyses (*gon. 2*) and lower ends of ninth tergum (*IX t*).
 FIG. 3. *Tipula retusa*, lateral view of end of abdomen.
 FIG. 4. *Tipula uncinata*, ninth sternum.
 FIG. 5. *Tipula angustipennis*, lateral view of end of abdomen.
 FIG. 6. *Tipula bella*, ninth sternum and lower ends of tergum.
 FIG. 7. *Tipula angustipennis*, ventral view of end of abdomen.
 FIG. 8. *Tipula angustipennis*, fused first gonapophyses.
 FIG. 9. *Tipula angustipennis*, dorsal view of end of abdomen.
 FIG. 10. *Tipula angustipennis*, lateral view of entire abdomen.

PLATE XI.

- FIG. 11. *Tipula carinata*, lateral view of end of abdomen.
 FIG. 12. *Dicranomyia venusta*, ninth sternum and appendage.
 FIG. 13. *Tipula acuta*, ninth sternum.
 FIG. 14. *Dicranomyia venusta*, lateral view of end of abdomen.
 FIG. 15. *Symplecta punctipennis*, lateral view of end of abdomen.
 FIG. 16. *Tipula bicornis*, ninth sternum.
 FIG. 17. *Linnophila sciophilila*, lateral view of end of abdomen.
 FIG. 18. *Epiphragma forcipennis*, lateral view of end of abdomen.
 FIG. 19. *Tipula streptocera*, ninth sternum.
 FIG. 20. *Ptychoptera lenis*, lateral view of end of abdomen.

NOTES ON THE INTERNAL ANATOMY OF PERANABRUS SCABRICOLLIS (THOM.).

BY ROBERT E. SNODGRASS.

(PLATES XII AND XIII.)

Peranabrus scabricollis (Thom.) is a large, thick-bodied, short-legged locustid inhabiting the central part of the State of Washington. The writer has already prepared an account of its interesting life-history to be published as a bulletin of the Washington Experiment Station under the name of the "Coulee Cricket."

The Alimentary Canal (Fig. 13) has the ordinary *Anabrus* form. The crop is large, extending back to the posterior edge of the thorax. The ventriculus and small intestine form a complete dorsal loop. The numerous, thread-like Malpighian tubules are grouped in six bunches. The gastric cæca (*gas. c.*) are two wide pouches embracing the posterior end of the crop.

The Salivary Glands (Fig. 4) are composed of groups of racemose glands in the ventral part of the thorax. The scattered groups (*s. gts.*) on each side are connected by ducts which finally form one main tube (*s. d.*). Into this opens the duct from the large sac-like reservoir (*s. r.*) of the same side. The final right and left ducts then unite in a median duct that opens at the base of the hypopharynx.

The Respiratory System is highly developed and all of the main tracheæ are large. The dorsal longitudinal trunks (Fig. 12, *d. l. tr.*) lie just at the edges of the diaphragm. Each is connected with the spiracle trunks of same side by two transverse tubes (Fig. 12, *t. tr.*). The anterior one of each pair is larger than the other.

The Nervous System (Figs. 1 and 3) consists of six abdominal ganglia, three thoracic, and the usual two head ganglia.

The brain (Fig. 1) is not composed of distinct lobes as it is in Acrididæ (*Dissosteira*). The procerebral, dentocerebral and tritocerebral parts on each side form one continuous mass thick above (*op. l.*) but gradually tapering downward into the circumœsophageal commissure (*cæ. c.*). The optic lobe regions (*op. l.*) are broadly united mesially and from their outer upper aspects give off the optic nerves or optic ganglia (*op. gl.*). Each of the latter is thickened basally, constricted beyond the middle, and swollen terminally where it abuts against the eye. The optic ganglia are much smaller than in the much larger-eyed Acrididæ. The ocellar nerves (*oc.*) are short and slender. The antennal nerves (*ant. n.*) arise from the upper part of the dentocerebral regions. The labral nerve (*l. n.*) and frontal commissure (*f. c.*) have a common basal trunk on each side, but the labral nerve soon separates, and goes downward to the labrum. From the frontal ganglion (*f. g.*) there goes ventrally upon the front of the œsophagus a slender œsophageal nerve (*æ. n.*), and posteriorly upon the dorsal surface of the crop a thicker stomatogastric nerve (*sg. n.*). The œsophageal commissure (*æ. c.*) arises on each side just before the bases of the circumœsophageal trunks (*cæ. c.*).

The subœsophageal ganglion (Fig. 3) is of ordinary form and gives off the mouth-part nerves as shown in the figure.

The three thoracic ganglia are situated one in each segment.

Of the six abdominal ganglia the first two are in the first and second segments respectively, the third is in the fourth segment, the fourth in the fifth, the fifth in the seventh, and the sixth in the eighth.

The Circulatory System (Figs. 9, 10 and 12) is rather easily studied on account of the large size of the specimens. The heart consists of a tube reaching from the posterior end of the abdomen forward into the head. In each abdominal segment it presents a fusiform enlargement or chamber (Fig. 12, *ht.* and *av.*).

The diaphragm extends throughout the entire length of the dorsal part of the body, *i. e.*, from the anterior edge of the prothorax to the tip of the suranal plate (Fig. 12, *dφ.*). In the thorax it is a wide sheet with slightly concave margins. It is widest in the prothorax, tapering posteriorly in the meso- and metathorax. In the anterior half of the abdomen it is a little wider than in the mesothorax, but back of this it gradually tapers posteriorly, ending in a point beneath the suranal plate.

The two dorsal longitudinal tracheal trunks lie just above the edges of the diaphragm (Fig. 12, *d. l. tr.*). The paired transverse commissures (*t. tr.*) join the longitudinal trunks at the middle of each segment from the first to the ninth. In the tenth segment there is only one transverse trachea on each side.

The diaphragm muscles (Fig. 12, *dp. m.*) are fan-shaped bundles of fibers that diverge upon the diaphragm from the anterior edges of the terga between each two pairs of transverse tracheæ. After entering upon the diaphragm the muscles break up into minute fibrillæ (Fig. 9) that cross and are interwoven in all directions, so that one individual fiber cannot be followed. In many cases the muscle appears to end after breaking up into fine hair-like bunches of spreading fibrillæ (Fig. 10).

The diaphragm is an almost invisible membrane but its presence is indicated by its numerous nuclei (Figs. 9 and 10, *d. n.*). The membrane itself, however, can be seen between the muscle fibers or the fan-shaped bundles. Mesially the diaphragm is imperforate, but laterally it is fenestrated by numerous large and small oval holes (Fig. 9). In *Dissosteira* it is everywhere imperforate and is, in this form, much more plainly visible than in *Peranabrus* because the muscle fibers on it are not so numerous and do not break up into a felt-work of fibrillæ. Fig. 10 is a detailed copy of a small piece of the perforated part of the diaphragm. Several fenestræ are shown with the muscle bundles splitting and going around them as diverging groups of fibrillæ. The latter are seen in several places disappearing by becoming lost in a felt-work of fibers. The diaphragm nuclei (*d. n.*) are seen irregularly scattered about. In *Dissosteira* the muscle fibers extend continuously across the diaphragm from one side to the other, or branch and unite mesially in only a very simple plexus. They are further in *Dissosteira*, not distributed upon the diaphragm in fan-shaped bundles but arise serially or in small groups along the edge of the diaphragm and extend mostly straight across its surface.

In *Peranabrus* the muscle fibers appear to be unstriated. In *Dissosteira* they are distinctly striated. In the crayfish (*Astacus*) the floor of the pericardium is composed of an upper and a lower nucleated membrane inclosing a layer of transverse striated muscle fibers. Mesially the fibers break up into unstriated fibrillæ but these can be traced across directly into the fibers of the opposite side.

The upper surface of the diaphragm is covered by a layer of small,

granular pericardial cells. The pericardial space above is filled by a loose mass of pericardial fat cells.

The *Reproductive Organs* occupy the usual positions above and below the alimentary canal.

In the male (Figs. 2 and 8) the testes (Fig. 8, *tes.*) are flat, oval and set on edge against the side wall of the body cavity, reaching from the front part of the fourth into the seventh abdominal segment. Four large tracheal trunks, from the spiracles of the third, fourth, fifth and sixth abdominal segments ramify in finger-like bunches upon the inner surface of each. Each testis is a racemose gland, not composed of tubes as in *Dissosteira*, and the vas deferens issues from its lower end. The latter, just below the testis, is tightly coiled into a solid, epididymis-like mass (Figs. 2 and 8, *epd.* The epididymis is uncoiled on the right side of Fig. 2).

Below the epididymis the vas deferens turns inward and is lost in the mass of accessory glands (Fig. 8, *ac. gls.*). When the posterior smaller ones of these are removed (as in Fig. 2) it is seen that the vasa deferentia enlarge greatly before uniting to form the ejaculatory duct (*ej. d.*). There are two sets of accessory glands. One set consists of two anterior lateral masses (*ac. gls.*) of long coiled tubes, those of each mass uniting posteriorly in a short tube (Fig. 2) which opens into the enlarged part of the vas deferens. The other set consists of a great number of smaller tubes (*ac. gls.*) opening directly into the enlarged parts of the vasa deferentia. These glands must secrete the large mass of albuminous matter injected by the male into the bursa copulatrix of the female at the completion of copulation.

The spermatozoa are filiform with an anterior enlargement showing a constriction near the front end (Fig. 5). They occur in fan-shaped or conical bunches in the testes. In the spermatophores they form long feather-like bundles (Fig. 6), the shafts of which are formed by the united heads of the spermatozoa.

The penis (Fig. 11, *pen.*) consists of an irregularly lobed evagination from the anterior end of the genital chamber (*g. c.*). On its dorsal surface is an invagination, the spermatheca (*s. p.*), into which opens the ejaculatory duct. Above the base of the penis there arises from the anterior wall of the genital chamber two slender serrated, chitinous rods (*r.*).

In the female organs (Fig. 7) the ovaries (*ov.*) consist of two large oval masses of egg tubes, about fifteen tubes in each, lying in the

upper lateral parts of the abdominal cavity from the first to the seventh segments. The tubes converge posteriorly and open together into the upper ends of the oviducts (*od.*), not serially along the sides of the oviducts as in *Dissosteira*. The vagina is very short and opens into the genital chamber above the anterior end of the eighth sternum.

The spermatheca (*spt.*) is an oval sac opening by a narrow neck into the dorsal wall of the genital chamber just back of the opening of the oviduct. A long coiled tubular gland (*gl.*) lies on the right side of the rectum and opens posteriorly between the bases of the gonapophyses.

The spermatophores are large, globular, chitinous capsules, about 2.25 mm. in diameter, of a yellowish color, and having a long slender, tapering, curved neck. Each is filled with a mass of the feather-like bundles of spermatozoa (Fig. 6) already described. The spermatheca contains only a few spermatophores — five in the specimens examined, and these are imbedded in an albuminous mass within it.

EXPLANATION OF THE PLATES.

PLATE XII.

Fig. 1. Anterior view of the brain. *ant. n.*, antennal nerve; *ca. c.*, circumoesophageal commissure; *f. c.*, frontal commissure; *f. g.*, frontal ganglion; *l. n.*, labral nerve; *oc.* ocellar nerves; *a. c.*, oesophageal commissure; *a. n.*, oesophageal nerve; *op. gl.*, optic ganglion; *op. l.*, optic lobe; *sg. n.*, stomatogastric nerve.

Fig. 2. A part of the male reproductive organs, the testes and the smaller accessory glands (*ac. gls.* of Fig. 8) removed, also the right epididymis partially unwound. *ac. gls.*, larger accessory glands; *ej. d.*, ejaculatory duct; *epid.*, epididymis; *vd.*, vas deferens.

Fig. 3. Suboesophageal ganglion, left side. *ca. c.*, circumoesophageal commissure; *lab. n.*, labial nerve; *md. n.*, maxillary nerve; *mx. n.*, maxillary nerve; *p. c.*, posterior commissure.

Fig. 4. Salivary glands and reservoir of one side. *s. d.*, salivary duct of one side; *s. gls.*, salivary glands; *s. r.*, salivary reservoir.

Fig. 5. A mature spermatozoön from the testis.

Fig. 6. A feather-like bundle of spermatozoa from a spermatophore.

Fig. 7. Female reproductive organs, dorsal view. *gl.*, a tubular gland opening into the bursa copulatrix back of the spermathecal orifice; *od.*, oviduct; *ov.*, ovaries; *spt.*, spermatheca.

Fig. 8. Male reproductive organs, dorsal view. *ac. gls.*, larger accessory glands; *ac. gls'*, smaller accessory glands; *ej. d.*, ejaculatory duct; *epid.*, epididymis; *tes.*, testis; *v. d.*, vas deferens.

PLATE XIII.

Fig. 9. A part of the pericardial diaphragm and one "alary" bundle of muscles. The unperforated part of diaphragm is median.

Fig. 10. A small piece of lateral perforated part of diaphragm highly magnified.

Fig. 11. Median vertical section of posterior part of male abdomen. *ac. gls.*, accessory glands; *an.*, anus; *cer.*, cercus; *ej. d.*, ejaculatory duct; *g. c.*, genital chamber; *pen.*, penis; *pod. pl.*, podical plate; *r.*, serrated rod above penis; *rect.*, rectum; *sa. pl.*, suranal plate; *s. p.*, spermatic pouch; *X t.*, tenth tergum; *IX s.*, ninth sternum.

Fig. 12. Ventral view of dorsal body-wall with diaphragm and tracheæ attached. *ao.*, aorta; *dp.*, diaphragm; *dp. m.*, fan-shaped muscle bundles ("alary" muscles) of diaphragm; *d. l. tr.*, dorsal longitudinal trachea; *ht.*, heart; *t. tr.*, transverse tracheæ.

Fig. 13. Alimentary canal, left side. *cr.*, crop; *gas. c.*, gastric cæca; *mal. t.*, Malpighian tubules; *a.*, œsophagus; *rect.*, rectum; *vent.*, ventriculus.

NEW NOCTUIDS FOR 1903. NO. 5.*

By JOHN B. SMITH, Sc.D.

Luperina migrata, sp. nov.

Ground color fuscous brown, shaded with smoky and marked with black. Head darker in front, immaculate, collar with a median, black transverse line below which it is paler. Disc of thorax palest, the sides of the patagia smoky; tufting small and neatly marked. Two or three small dorsal tufts of the abdomen evident. The primaries are strigate in appearance, and the transverse maculation is all lengthily dentate. There is a black basal streak and a black streak along the inner margin near base, extending to the t. a. line. The t. a. line is marked by a pair of oblique smoky streaks on the costa, and by a black dent on vein 1; in the submedian interspace it merges into a claviform that is black-edged and extends to the t. p. line. T. p. line geminate, smoky, the included space paler, even and evenly curved to opposite the cell, then inwardly oblique, strongly dentate, the inner portion becoming black as it approaches its lower termination; a blackish shading extends over the junction with the claviform. S. t. line slender, pale, dentate, broken, with difficulty traceable through a series of black or blackish interspaceal streaks. A pale ray extends from the t. p. line to outer margin over veins 3 and 6. There is a narrow black terminal line at the base of the slightly scalloped fringes, which are brown, marked with a conspicuous yellowish dot at the end of each vein. There is a diffuse smoky or blackish median shade, oblique from costa between the ordinary spots, then inwardly oblique, less marked, parallel to the t. p. line. The orbicular is elongate, narrow, oblique, black bordered and narrowly pale ringed. Reniform large, upright, kidney-shaped, pale ringed, partly edged with black scales. Secondaries soiled white at the base, the veins smoky, with a moderate deep smoky outer border: a blackish lunate terminal line at the base of the whitish fringes. Beneath, primaries gray, blackish powdered, with a distinct discal spot, an extramedian line and a series of dark terminal lunules. Secondaries whitish with a gray powdery border along the costa and outer margin, a small discal lunule and a distinct extramedian line. Expands 1.70-1.80 inches = 42-45 mm.

* The fourth paper of this series, containing references to those preceding is in the Trans. Am. Ent. Soc., XXIX, 191-224.

Habitat: Stockton, Utah: New Jersey (!)

Two female examples in good condition. One of these examples has been in my collection over ten years, bearing a "N. J." locality label; but from whom I received it is not recorded. I felt certain that this could not be correct and, as I could not identify it with any exotic form accessible to me, I simply waited until I received the example from Utah through Mr. George Franck. This matches my specimen exactly, save that it is fresher and more intense in its maculation. The species is a large one, allied to *burgessi*, but with the strigate maculation that is not familiar to me in any other form.

***Chytonix parvimacula*, sp. nov.**

Ground color dull smoky brown, basal and lower portion of the median space much darker than the other parts of the primaries. Head and thorax mottled with lighter and darker scales, but forming no obvious ornamentation. Primaries with all the markings well defined, but not contrasting. Basal line extending almost across the wing, geminate, inner portion blackish, included space paler. T. a. line black, preceded by a narrow whitish line, outwardly oblique, almost even to the submedian vein, below which it bends inwardly to the margin. T. p. line black, followed by a very narrow paler line, abruptly bent outward on the costa, then with a rather even curve to the inner margin. S. t. line pale, diffuse, irregular, forming a small W centrally; a slight mossy greenish tinge extending on each side of the line. A broken blackish terminal line and the fringe with a smoky interline. The upper margin of a claviform spot is indicated, surmounted by a few greenish scales, and a narrow white bar extends from the end of this indicated spot to the t. p. line. Orbicular of good size, irregularly oval, oblique, narrowly outlined, annulate with gray, center concolorous. Reniform moderate, a little constricted centrally, lower part somewhat dilated, incompletely outlined and annulate. Secondaries rather dark smoky brown, fringes paler. Beneath whitish, mottled with smoky, both wings with a darker extra-median line; primaries with a paler terminal area, secondaries with a discal lunule. Expands 1.12 inches = 28 mm.

Habitat: "Middle California."

One male example in fair condition, the label giving no indication of its source or the exact locality where collected. The species has the wing-form of *sensilis* rather than *palliatricula*; but is more nearly like the latter in maculation and in general appearance.

***Chytonix laticlava*, sp. nov.**

Ground color dull smoky gray; primaries paler, with a brown tinge in the median space above the submedian transverse bar. Head and thorax mottled, collar with an obscure darker median line; patagia marked with gray—though this is probably a variable character. Abdomen with the usual tufts. Primaries with the maculation well defined. A short black basal dash which broadens and forks at the outer end; a short black streak along the inner margin. Basal line marked by geminate dots on the costa. T. a. line well removed from base, single, somewhat diffuse, black, out-

wardly oblique to the submedian interspace, then forming an almost right angle, inwardly oblique to the inner margin. T. p. line unusually near outer margin; geminate, even, dark smoky, the inner part becoming black inferiorly; included space whitish powdered; evenly outcurved over the cell and evenly oblique below it. S. t. line very irregular, defined only by contrasts in color between the shadings in the terminal and s. t. spaces; a trigonate dusky shade in the terminal space above the middle and another above the hind angle are most conspicuous and between these two or three preceding black marks indicate an obscure W, the teeth of which reach the outer margin. A black, somewhat lunate terminal line. Fringes with a smoky interline. Claviform concolorous, short, very broad, black margined; from its lower edge a broad black bar extends to the t. p. line, beyond which the s. t. space is whitish. Orbicular large, oval, oblique, pale, not well margined. Reniform large, broadly ovate, outlined by darker scales and obscurely darker in center. A black costal spot indicates a median line of underside faintly reproduced above. Beneath gray, powdery, with a discal spot and an extramedian line on all wings. Expands 1.16 inches = 29 mm.

Habitat: Pullman, Washington, August 14 and 30, 1897.

One pair taken at light and somewhat defective, from Professor C. V. Piper. The species has been in my collection for some time, associated with *palliatricula*, of which I have now a nice series which excludes the present form. *Laticlava* is paler, more ashen in tint, the secondaries much paler; there is no trace of the white dot at the end of the transverse dark bar, while on the other hand the s. t. space within hind angle becomes whitish. Other differences of details appear in the description.

***Cerma fascia*, sp. nov.**

Ground color pale creamy yellow, overlaid and mottled by brown, rusty and black scales. Head and palpi pale creamy yellow, immaculate; collar a little mottled with silvery gray scales; disc gray and brown centered, the basal tuft being nearly white. The little abdominal tuft at base is dark gray. Primaries powdery gray, more or less overlaid or mixed with yellow and rusty brown scales, the space between the basal and t. a. lines and the s. t. space paler or even whitish, giving the appearance of a pale subbasal fascia and a more irregular, mottled terminal pale area. Basal line black, narrow, irregular, not well defined. T. a. line nearly upright, irregular, marked chiefly by the difference in color between the subbasal and median spaces. T. p. line white, irregularly denticulate, preceded by black and followed by rusty scales; abruptly bent below costa, squarely and broadly exerted over the cell. There is no obvious s. t. line, the terminal area being irregularly mottled, yet leaving a better marked blotch on the margin above the hind angle and another above the middle. A distinct, black, broken terminal line. The long fringes are brown, mottled, cut with white opposite the veins. Orbicular round or nearly so, white ringed, narrowly edged with black. Reniform of good size, oblong, oval, a little constricted centrally, incompletely white ringed and not completely defined. Secondaries very pale smoky, the veins a little darker. Beneath, primaries quite smoky, the ter-

minal area paler; secondaries whitish with a smoky discal lunule and extramedian line. Expands, 1.08-1.16 inches = 27-29 mm.

Habitat: Doble, California, in early August.

Two good females, collected by Mr. George S. Hutson in the Colorado desert. The species resembles *olivacea* in general appearance, but has the maculation much more diffuse. The paler area just before the t. a. line also seems to be characteristic, none of the five examples of *olivacea* now before me showing any tendency that way. It is likely to be found in other of the desert localities.

Fishia vinela, sp. nov.

Ground color ashen gray, marked and dusted with black and brown. Head with a black frontal line. Collar with a black median transverse line; patagia with a black line through the center; disc gray and brown powdered. Primaries apparently have the lower third of the wing darker, the maculation over the costal area obscure and not well defined. An irregular, narrow black basal streak, which does not reach the t. a. line. A black streak along the internal margin, reaching to the t. a. line but not quite to the base. T. a. line geminate, incomplete, marked as a pair of oblique dusky streaks on the costa, nearly lost in the middle of the wing and again marked by a long outcurve below the submedian vein. T. p. line obscure, dentate, geminate, the outer part lost over the cell, the inner portion slender, very faint from the costa to vein 3, below which it is black, the lunule in the submedian interspace best marked and followed by a whitish shading. S. t. line is a line of pale dots in a series of black or blackish interspaceal streaks which are most obvious over the hind angle and above the middle. There is a narrow blackish terminal line, beyond which the smoky fringes are based by a narrow yellow line. The outer margin is obviously though not deeply scalloped and the hind angle a little retreating. Orbicular outlined in blackish, a black line bordering it below and extending across the median space to the t. p. line. Orbicular oval, a little oblique, moderate in size, obscurely defined. Reniform large, upright, broad kidney-shaped, obscurely and incompletely pale ringed, not otherwise defined. Secondaries white, semi-transparent, with a blackish terminal line; veins smoky; a reddish flush along inner margin. Beneath whitish, powdery, most so along costal area and toward apices; a dusky median line and a small discal spot. Expands 1.60-1.80 inches = 40-45 mm.

Habitat: Denver, Colorado, October 3 (Oslar); Glenwood Springs, Colorado, September and October (Barnes).

Three male examples in good condition are before me at present. Dr. Barnes has others and it is probable that specimens are in collections mingled with *Hadena evelina* French. With the latter species this new form agrees in general type of maculation and wing-form; but the primaries are a little narrower, the ornamentation is more confused, powdery and paler, while the secondaries are almost white. As a whole the species is smaller and less robust than its Californian ally.

Hadena evelina, by the bye, must also be placed as a *Fishia* though the spinulation of the middle and hind tibiæ is so obscure as to be readily overlooked except on the closest examination. In fact it was not until I had seen the spines in *vinela* that I discovered them sparsely hidden also in the vestiture of *evelina*, this difference in armature affording another point of distinction between them.

***Anytus tenuilinea*, sp. nov.**

Ground color very pale ashen gray, giving the appearance of an *Acronycta*. Head rusty brown below a dusky, transverse frontal line, somewhat smoky on the vertex. Collar with a black transverse line; disc of thorax smoky, patagia with a powdery blackish submargin. Primaries with the marking neatly and clearly written. A line of black scales indicates a narrow basal streak. T. a. line single, black, outwardly oblique, outcurved between the veins, that in the submedian interspace drawn into a tooth from which a slender black streak extends to the t. p. line. T. p. line geminate, the outer part a mere smoky shade line, the inner slender, black, lunulate, forming a long outcurve under the cell and a deep incurve in the submedian interspace to meet the streak from the t. a. line. The s. t. line is vague and indicated by differences in shade between the s. t. and terminal spaces and by a series of darker elongate spots in the interspaces. A series of black terminal lunules, beyond which the fringes are cut with brown. All the veins are marked with black scales. Orbicular large, oval, oblique, inferiorly a little drawn out, paler than the surroundings, not otherwise defined. Reniform of moderate size, kidney-shaped, defined by black scales within which there is an incomplete whitish ring. Secondaries smoky, paler at base within a vague median shade line; the fringes whitish beyond a dark, broken terminal line. Beneath, primaries smoky, with a vague discal lunule and median line; secondaries paler, more ashen, median shade and discal dot better marked. Expands 1.50 inches — 37 mm.

Habitat: Stockton, Utah.

One good female from Mr. George Franck. The species appears to be somewhat narrower-winged than the others and differs from all those previously described by the slender clean-cut markings on a pale ground, which give it a deceptive *Acronycta*-like appearance.

***Euxoa* * *nesilens*, sp. nov.**

Ground color a pale yellowish-gray, maculation of a deeper, luteous or smoky gray. Head a little smoky on the vertex, palpi smoky at the sides. Collar with a transverse, smoky median shading, which tends to become a line. Thorax concolorous. Primaries without conspicuous contrasts or shadings; yet all the markings evident, just enough darker than the ground to make them readily recognizable. Costal area a little paler. No basal streak. Basal line geminate, marked on costa and median vein only. T. a. line geminate, nearly upright, a little outcurved in the interspaces, tending to become broken and to the loss of the inner portion. T. p. line crenulate, single or with the outer portion obscurely marked, rather abruptly bent

* An older term for *Carneades*.

on the costa, nearly parallel thence with the outer margin. S. t. line pale, a little irregular, marked by a dusky preceding shade. There is a series of interspaceal terminal lunules. Fringes concolorous. The claviform is vaguely traceable in some examples, wanting in others. Orbicular large, irregularly ovate, oblique, paler than the ground, the margins edged with darker scales. Reniform large, kidney-shaped, paler than the ground, incompletely defined by a yellowish annulus and brown marginal scales. Secondaries smoky whitish, paler at the base, the veins and a discal lunule darker. Beneath yellowish-white. The disc of primaries smoky; both wings with an incomplete, diffuse median shade line and a smoky discal spot. Expands 1.48-1.68 inches = 37-42 mm.

Habitat: Brandon, Manitoba; Calgary, Canada, July 5-12 (F. H. Wolley Dod).

Two males and three females are before me at present; others are in the collection of Mr. Dod, who called my attention to the species. In general appearance it resembles *silens*, but does not have the black basal streak nor the blackish suffusion between the ordinary spots. On the other hand it does have more complete, better marked median lines. Attention once drawn to the species, its distinctness is clear and its association is with *basalis*, from which, however, it differs obviously in color.

NOTES ON COCCINELLIDÆ. — II.

BY CHARLES W. LENG, B.S.

(PLATES XIV AND XV.)

Tribe II. *Coccinellini*.

Front coxal cavities closed; base of antennæ exposed; metasternal and ventral coxal lines distinct; body loosely articulated, not very contractile; usually rounded in outline, sometimes oblong, never pubescent above.

The technical definition of this tribe is given above; it includes those lady-bugs most commonly met with, as the two-spotted lady-bug (*Adalia bipunctata*) often found in houses, and the nine-spotted lady-bug (*Coccinella 9-notata*) which is abundant in gardens; most of the species are about the size of these common representatives of the group, round and convex. They feed on plant lice and are useful insects.

The genera are by no means strongly separated. The following table is based upon that printed by Major Casey in this Journal (Vol. VII, No. 2, June, 1899), simplified by the omission of the foreign

forms and by the suppression of some genera that seem unnecessary. The Psylloborini are included to avoid the division into so many groups. The term "metacoxal plate" is used for that portion of the first ventral segment included above the ventral lines visible on that segment in this and following groups (see sketch of under side on plate XIV).

Body larger, antennæ shorter with last joint truncate.

First ventral lines arcuate, continuous, not quite entire, the metacoxal plates shorter than the segment; body oval **Adalia.**

First ventral lines curving outward to the sides of the body along the first suture, the included area (or metacoxal plate) frequently divided by an oblique line; body usually rounded.

Tarsal claws with a large subquadrate tooth at base..... *Coccinella.*

Tarsal claws cleft within **Neomysia.**

Body smaller; antennæ slender with last joint elongate..... **Psyllobora.**

Division of Coccinella.

Metacoxal plates divided by an oblique line joining the bounding arc at about its middle point, forming an angulate inner plate..... **1**

Metacoxal plates not or only partially divided, the oblique line obsolete or feeble... **2**

1. Oblique line meeting the bounding curve at middle of segment; elytra blue.

Agrabia.

Oblique line meeting the bounding curve at hind margin of segment... **Coccinella.**

2. Mesosternum truncate with a minute notch at middle..... **Harmonia.**

Mesosternum broadly and deeply sinuate.

Prosternal process narrow, strongly bicarinate **Anisocalvia.**

Prosternal process broad, strongly convex in a transverse direction and prominent at the apical margin **Anatis.**

To a large extent the markings of the thorax are uniform throughout each genus and reference to the figures will save minute study of the under surface which, as specimens are ordinarily mounted, is not easy.

Of the genera tabulated by Major Casey, *Neoharmonia*, *Cycloneda* and *Olla* are included above with *Coccinella*—*Neomysia* replaces *Mysia* of the check list. *Cleis* is included with *Harmonia*.

Adalia *Muls.*

Thorax with a broad M-shaped median black design, the broad pale margins immaculate..... **bipunctata.**

Thorax with M-shaped design and a black point at the center of the broad yellow margin..... **frigida.**

Thorax with M-shaped design and a submarginal black spot; elytra with transverse series of spots or transverse bands..... **annectans.**

Thorax black with narrow pale apical and lateral margins..... **humeralis.**

3067. **A. bipunctata** *Linn.*, *Syst. Nat.*, 1758, p. 364. [*bioculata* Say.]

Oval, black; tarsi and sides of abdomen rufescent; head with two yellow frontal marks; thorax yellowish-white with an M-shaped median black design, the broad pale margins immaculate; elytra red with a tolerably large rounded discoidal black spot; thorax obsolete punctulate, elytra punctate; the first ventral line is semicircular and nearly complete. Length, 3.8-5.2 mm. = .15-.21 inch.

Distributed by commerce widely over the world.

3066. **A. frigida** *Schneider*, 1792, *Neu. Mag. Ent.*, p. 172.

Oval, black; tarsi rufescent; head with two yellow frontal spots; thorax yellowish white with an M-shaped black design and a black spot at the center of the broad yellow margin (or black with the front, sides and basal bilobed spot yellowish); elytra red, either immaculate or with two spots black or with two black bands; thorax absolutely punctulate, elytra punctate; metacoxal plates extending to apical third or fourth of first ventral segment. Length, 3.2-4.8 mm. = .14-.19 inch.

Occurs in Europe and Siberia and across the northern part of this continent, extending as far south as Ohio, Kansas, Missouri and Nebraska.

The following varieties are based on the differences in elytral ornamentation:

Elytra immaculate, Mass., Maine.....unnamed.

Elytra immaculate or with two faint spots, Vancouver and California (Ohio?)

melanopleura *Lec.*

Elytra with two distinct spots or with one of them faint, Canada and Mass., Mo.

ophthalmica *Muls.*

Elytra with two bands, Wis. and Mass.....**disjuncta** *Rand.*

Elytra with a median band broken and a subapical transverse spot, Colorado.

ornatella *Csy.*

The localities stated for these varieties are taken from my own collection only and are therefore incomplete. I have not placed *hyperborea* Payk.; it is cited by Crotch as a synonym of *frigida*. Crotch uses *barda* Lec. for the first variety erroneously, this being a synonym of *C. juliana*.

3063. **A. annectans** *Crotch*, *Trans. Am. Ent. Soc.*, 1873, p. 371.

Oval, black; tibiae, antennæ and mouth pale reddish; head with two white spots bordering the eyes; thorax short, yellowish-white, with a lateral dot and a discoidal M-shaped mark black (this design is variable); elytra reddish-yellow with a common scutellar spot (sometimes bilobed) and each with seven others black; two small near the base (the outer one largest), three across the middle (the outer smallest), two before the apex; elytral pattern very variable, the spots sometimes connected, forming irregular bands; elytra punctate; metacoxal plates somewhat angular postero-externally. Length, 4-4.5 mm. = .16-.18 inch.

Occurs in Colorado, New Mexico and California and is closely allied with the preceding.

The following varieties have been described :

- Submarginal spot of thorax isolated or nearly so ;
 Elytral spots entirely disconnected, Cal. **ovipennis** *Cty.*
 Submarginal spot of thorax broadly amalgamated with the central black design ;
 Elytral spots connected to form bands, N. Mex. **transversalis** *Cty.*

It seems to me probable that still other variations in the elytral markings may be found so as to form a complete series connecting this and the preceding species ; but with the material before me they appear sufficiently distinct to remain as species for the present.

— . **A. humeralis** *Say*, Jour. Ac. Nat. Sc. Phil., IV, p. 95.

Oval, black ; head with two reddish spots ; thorax with narrow apical and lateral margins reddish-yellow ; elytra with subquadrate humeral blotch red and a round spot behind the middle also red (sometimes lacking). The elytra have also a very fine yellow side margin not always evident ; metacoxal plates parabolic, extending nearly to apical third. Length, 4-5 mm. = .16-.20 inch.

Widely distributed but rare in collections : Canada, Nova Scotia, Massachusetts, New York, Middle and Western States, Nebraska, New Mexico, Arizona, Utah, California.

3068. **A. ludovicæ** *Muls.*, Mon., p. 36.

“ Head and thorax whitish, that black posteriorly, this with five black spots ; elytra red, disk with a large black dot ; ventral segments and legs orange, those black on the middle. Length, 3 mm. = 1.25 inch.

“ North American (Felix).”

This description, quoted by Crotch, has not been identified by Major Casey ; it is possibly a mistake to include the name longer in our lists.

Agrabia *Casey.*

3070. **A. cyanoptera** *Muls.*, 1851, Spec., p. 82.

Oval, moderately convex, pale rufo-testaceous above and beneath, except the elytra which are bright blue, sometimes with a feeble greenish tinge, the side margins very narrowly testaceous from the humeral angles to apical four fifths, where the pale margin is inwardly dilated, forming an elongate, internally arcuate spot, which narrows and disappears completely very near the sutural angles ; punctures strong and rather close-set, somewhat unequal. Length, 5.5 mm. = .22 inch.

Occurs in Mexico, New Mexico, Arizona. Rare in collections.

Coccinella *Linn.*

May be divided into subgenera as follows :

- Thorax with subquadrate pale spots at apical angles, sometimes also with apical margin pale **Coccinella.**
 Thorax black, variegated with pale markings or yellow with black spots.

- Body somewhat depressed.....**Neoharmonia**.
 Body convex ;
 Mesosternum truncate anteriorly.....**Cycloneda**.
 Mesosternum broadly and rather feebly sinuate.....**Olla**.

These subgenera are supported by other characters for which the reader is referred to Major Caséy's "Revision." They are used here as a convenient division of the genus *Coccinella*.

Subgenus **Coccinella**.

All the species are similarly marked on the prothorax, viz.: a quadrate white spot in each apical angle. The apical margin is more or less white, varying according to the species. The head is also more or less white. By the variation in the elytral markings the species may be separated as follows :

- A. Body larger, 5-7 mm. ;
 Elytra normally nine-spotted.....**9-notata**.
 Elytra normally with five large marks, the median being an oblique band.
monticola.
 Elytra normally with subbasal band and four spots**transversoguttata**.
 Elytra normally immaculate.....**californica**.
 B. Body smaller, 4-5 mm. ;
 Elytra normally with three bands.....**trifasciata**.
 Elytra with subbasal band, tricuspid in front and two spots.....**tricuspis**.

Arranging the species by the markings of the head and thorax the same result follows :

- Head white in front ; thorax with pale apical margin ; suture of elytra narrowly black ; elytral markings usually consisting of nine spots but variable ; meso and meta-epimera white.....**9-notata**.
 Head with two white spots in front ; thorax without pale apical margin ; suture of elytra never black ; meso-epimera white.
 Elytral markings tending to form transverse bands.**transversoguttata**.
 Elytral markings heavy, oblique.....**monticola**.
 Elytra immaculate.....**californica**.
 Body smaller ; head with two spots or entirely pale ; thorax with pale apical margin usually broad ; suture of elytra never black ; meso and meta-epimera white.
 Elytral markings, when complete, three bands, varying to immaculate.
trifasciata.
 Elytra with subbasal band tricuspid in front and two spots.....**tricuspis**.

The differences that separate *monticola* and *californica* from *transversoguttata* are no greater than those existing between the varieties of *trifasciata*, but they are a little more constant and are supported by geographical distribution indicating former geographic races that have now become permanent species. I believe that ultimately *subversa*

Lec., now regarded as a variety of *trifasciata*, may become equally established as a definite species.

The expression "normally" is used because great variation in marking is liable to occur, as will be explained in dealing with each species.

3058. **C. 9-notata** *Herbst*, Käfer, V, 1793, p. 269.

Hemispherical, black, alutaceous, very obsoletely punctulate; meso- and meta-epimera white; elytra orange with a common sutural spot, one on the callus, one small near the margin (sometimes connected with the preceding), one large discoidal and one subapical, black; suture of elytra very narrowly black; head pale, posteriorly margined with black; apical margin of thorax white. Length, 5.5-7.0 mm. = .22-.28 inch.

Occurs in the Atlantic region, and west to Oregon. Four specimens taken at Dilley, Ore., by Miss Dennis. The following varieties have been described:

3058a. Var. **franciscana** *Muls.*, 1853, Opus. Ent., III, p. 19.

Elytra spotless. — Occurs in Mexico and should be dropped from our list. Major Casey places this name as a synonym of *californica* which view would also drop the name from our list.

— Var. **degener** *Casey*, l. c., 1899, p. 88.

"Elytral spots very small and feebly developed, the subhumeral and posthumeral reduced to small points, the juxta-sutural transversely linear and much smaller than the transverse subapical, which is the largest; coloration as in *9-notata*, the body smaller." Length, 4.7-6.3 mm. = .18-.25 inch.

Occurs in New Mexico, Arizona, Colorado.

One specimen from Nebraska in which the posterior spots are obliterated is included under this name.

3060. **C. monticola** *Muls.*, 1851, Spec., p. 115. [*lacustris* Lec.]

Hemispherical, black, alutaceous, very obsoletely punctulate; meso-epimera only white; elytra orange with a large scutellar spot, and each with a broad oblique medial fascia, and a shorter subapical one, black; suture of the elytra never black; apical margin of thorax not white; head with two pale spots. Length, 6-7 mm. = .24-.28 inch.

Occurs in Lake Superior, Oregon, Vancouver, Colorado and California (Tallac and Kern Co.).

The following variety has been described.

— Var. **suturalis** *Casey*, 1899, l. c., p. 89.

"Body more narrowly oval than usual in this group and very much less convex, the pronotum finely but strongly and closely punctured, with the pale spot at the apical angles small and subquadrate; elytra with an even oblique band just before the middle, terminating at equal distances from the suture and margin, and also with a

short transverse spot at apical fourth or fifth; subhumeral spot completely obsolete the punctures rather strong and close set.

"*Elytral suture broadly black* from the rhomboidal scutellar spot to the apex, toward which the vitta is noticeably broader. Length, 5.7 mm. = .23 inch."

Occurs in Colorado.

I have not seen this variety — Italics in the description quoted above are mine.

3059. **C. transversoguttata** *Fald.*, 1835, *Mém. Ac. Petr.*, II, p. 454. [*5-notata* Kirby.]

Hemispherical, black, alutaceous, very obsolete punctulate; meso-epinera only white; elytra orange with a subbasal common fascia, a transverse medial spot near the suture and another towards the apex near the margin, black; suture of the elytra never black; apical margin of thorax not white; head with two pale spots. The elytral markings subject to much variation. Length, 6-7.5 mm. = .24-.30 inch.

Occurs over a wide range, Massachusetts, Ontario, Colorado, Utah, Wyoming, Idaho, Kansas, Hudson's Bay Territory, California, Oregon and Siberia.

The following varieties have been described:

3059a. Var. **nugatoria** *Muls.*, 1851, *Spec.*, p. 1021.

Basal band reduced to scutellar spots and two subhumeral spots.

The name *transversalis* used in the check list is preoccupied.

Occurs in Utah and Colorado.

3061. Var. **prolongata** *Cr.*, 1873, l. c., p. 371.

"Very like *C. 5-notata* (= *transversoguttata*), and intermediate between it and *C. monticola*, punctuation more obsolete (much as in *C. 9-notata*); elytra as in the variety *transversalis* (= *nugatoria*), the humeral spot never present, but often with a small submarginal spot beyond the medial one (one even with a medial fascia). Length, .27-.29 inch. Utah, Kansas, California.

"This differs from the others by the anterior angles of the thorax, the white spot is prolonged acutely on the disc, and the margin is often narrowly white."

Basal band reduced to scutellar spot; medial spot extending nearly across the elytra, complete or broken, suture not black.

— Var. **impressa** *Casey*, 1899, l. c., p. 89.

"Scutellar spot large, transversely suboval or elliptical, the subhumeral always wanting; suture never black; pronotum polished, the minute punctures well separated, the pale spot at the apical angles moderate in size and subquadrate; elytra each with a long oblique spot just before the middle and another shorter near the apex; submedian oblique fascia tending to disintegrate into an outer, smaller and inner and larger spot; body more broadly oval, polished, strongly punctured toward the sides of the elytra, the impression along the side margin of the pronotum extending arcuately inward just before the middle, disappearing at some distance from the edge; inner part of the abdominal plates acutely angulate behind. Length, 6.4 mm.; width, 5.0 mm. California."

— . Var. **alutacea** Casey, 1899, l. c., p. 89.

“Scutellar spot large, transversely suboval or elliptical, the subhumeral always wanting; suture never black; pronotum strongly alutaceous, the minute punctures deep and close-set, the pale spot at the apical angles large, extending to basal third; body oval, very strongly convex, the elytra dull, finely and feebly punctate, each with a transverse spot at the middle as in *g-nolata* (*transversoguttata*), and a small rounded spot near the margin and somewhat more anterior, the two sometimes sub-united, the subapical transverse spot nearer the margin than the suture. Length, 6.7 mm.; width, 5.2 mm. New Mexico.”

3059b. Var. **californica** Mann., 1843, Bull. Mosc., II, p. 312.

Closely resembles the preceding and differs by the immaculate elytra. Major Casey mentions a rare spotted form, but all that I have seen are readily assigned to *g-nolata*. Length, 6–7.5 mm. = .24–.30 inch.

Occurs in California, Oregon and Washington.

3056. Var. **trifasciata** Linn., 1758, Syst. Nat., ed. X, p. 365. [*perplexa* Muls.]

Hemispherical, black, punctulate; thorax at the anterior angles with a quadrate white spot above and below and the anterior margin white; elytra orange with three fasciæ black, one subbasal, common, the others medial and subapical, abbreviated at both ends; head ♂ entirely white in front; ♀ with two white spots; meso- and meta-pimera white. Length, 4.5–5 mm. = .22–.25 inch.

Occurs throughout the northern United States and Canada. The following varieties occur:

3056a. Var. **juliana** Muls., 1856, Opusc. Ent., VII, p. 135.

Elytra with the basal band only.

Occurs in Oregon and California (northern and middle coast regions) [*barda* Lec.].

3056b. Var. **subversa** Lec., 1854, Proc. Ac. Nat. Sc. Phil., p. 19.

Elytra usually immaculate but indications of all the normal markings of the species are liable to rarely occur. I am indebted to Miss Florence Dennis, of Dilley, Ore., for a large number of this variety.

3057. **C. difficilis** Cr., 1873, Trans. Am. Ent. Soc., p. 370.

Elytral markings reduced to scutellar spot, one or two medial spots, small and a large subapical spot.

Occur in Utah and Colorado.

— . Var. **eugenii** Muls., 1866, Mon., p. 95.

Basal band divided, other bands entire.

Occurs in California (Tallac and Siskiyou.)

Besides the described varieties of *trifasciata*, many other variations in the elytral markings will be found on the Pacific coast where the greatest instability seems to exist. Doubtful forms should be called *subversa*, that being the earliest described variety.

— Var. **nevadica** Casey, 1899, l. c., p. 88.

"Scutellar spot small and oblong or rhomboidal; pronotum without a pale apical margin; elytral suture not at all darker in color; body broadly oval, strongly convex, the pronotum black with a subquadrate pale spot at each apical angle, the punctures fine and unusually close-set, giving a feebly alutaceous luster; elytra immaculate, except a small black scutellar spot flanked at each side by a pale spot at the basal margin, the punctures fine and rather close-set, becoming quite strong laterally; abdominal plates strongly defined, broadly ogival in form internally. Length, 5.8 mm.; width, 4.5 mm. Nevada (Reno)."

Major Casey places this variety near *g-notata*, but on account of the absence of sutural darkening and pale apical margin of pronotum it seems to belong with *3-fasciata*.

3062. **C. tricuspis** Kirby, 1837, Faun. Bor. Am., IV, p. 231.

Elytra strongly punctulate, shining; black, ovate, less convex, thorax with the anterior angles triangularly whitish; elytra orange with a common black subbasal fascia, tridentate in front, and each with a triangular subapical spot black. Length, 4 mm. = .20 inch.

Occurs in Hudson's Bay Territory, Canada, Lake Superior, Kansas, Siberia, Michigan. Rare in collections.

C. menetriesi Muls., 1851, Spec., p. 104.

This species, *vide* Crotch, is not rare in parts of Siberia, Mongolia, Persia and Egypt, but though described from California, there is no other record of its occurrence in our territory. The name should be dropped. I add the description however to aid in identification in case it should be found.

Oval; prothorax black, sides bordered with yellowish-white more broadly in front; elytra orange, paler at the sides of the scutellum, sometimes immaculate, usually with a common scutellar black obcordiform spot and five others on each, arranged as follows: one on the callus, small, one at two sevenths submarginal large, oval and transverse, one subsutural at three sevenths also large, one submarginal at two thirds, one subsutural at three fourths; the four spots forming two oblique pairs, the outer spots being nearer the base than the inner; epimera white. Length, 4.5-5.6 mm. = .18-.22 inch.

Occurs in Russian Asia (and California?).

Cited by Gemminger and Harold as a variety of *undecimpunctata* L.

Subgenus **Neoharmonia** Casey.

Separated from *Coccinella* by the form and ornamentation of the body, more broadly reflexed side margins, more depressed surface and emarginate mesosternum. The punctuation also is distinct.

Includes *Coccinella affinis* Rand., and its variety *venusta* Muls. (3055 and 3055a of check list) and the Mexican species *ampla*. The

name *affinis* was cited in error by Crotch, being a synonym of *Hyperaspis binotata* and disappears entirely. Major Casey regards the variety as a valid species so that we have three species :

— . **N. venusta** *Melsh.*, 1846, Proc. Ac. Nat. Sc. Phil., III, p. 178.

Broadly rounded, feebly convex ; head black, yellow along the eyes ; pronotum pale, with a large oblique black fascia at each side and two approximate median spots, sometimes united with basal fasciæ ; elytra pale yellow or reddish, each with two large subbasal black spots, another near the margin before the middle, also a large spot near the margin at apical fourth united with a common sutural vitta, also with a rounded spot before the middle and near the suture, prolonged obliquely forward ; under surface and legs blackish. Length, 6 mm. = .24 inch.

Occurs in Indiana, Arkansas, Kansas and Louisiana.

— . **N. notulata** *Muls.*, 1851, Spec., p. 83.

Similar to the preceding, but black above and beneath ; pronotum with wide oblique pale border narrower toward the base ; elytra each with a transverse pale or reddish fascia of irregular design. Length, 5-6 mm. = .20-.24 inch.

Occurs in Louisiana.

The relation between these two species remains doubtful from lack of sufficient material.

— . **N. ampla** *Muls.*, 1851, Spec., p. 82.

Similar to *venusta* ; pronotum with two black longitudinal vittæ each side of the middle ; elytra with two black spots near the base, three spots at two fifths and two blotches at four fifths ; the marks on pronotum sometimes confluent. Length, 5-6 mm. = .20-.24 inch.

Occurs at Brownsville, Texas (Mr. Charles Schaeffer), and in Mexico. It will be figured in a subsequent number.

Subgenus **Cycloneda** *Crotch.*

3064. **C. sanguinea** *Linm.*, 1763, Amœn. Acad., VI, p. 393.

Black, alutaceous, finely punctulate, thorax with the front, sides and hind angles bordered with white, the front margin gives off three white branches, the lateral ones sometimes reaching the base ; elytra bright red, spotless ; ♂, head white in front ; prosternum and meso-epimera white ; ♀, head with two white spots, body black ; tibial spurs short and weak, metasternum margined, form convex ; thorax rather broadly reflexed, metacoxal line following the apical margin of the ventral segment but distinct from it, epipleure of elytra concave. Length, 4-6 mm. = .16-.24 inch.

Occurs in North and South America, abundant.

The following varieties have been described :

Sublateral pale spot of thorax isolated.

Elytra generally luteo-flavate.....**immaculata.**
Elytra deep and bright scarlet.....**rubripennis.**

Sublateral pale spot of thorax united to the pale apex ; body smaller.

Elytra luteo-flavate **munda**.

Elytra generally bright scarlet **polita**.

— . Var. **immaculata** *Fab.*, 1792, Ent. Syst., I, 1, p. 267.

Pronotum black, with a narrow pale side margin extending with equal width posteriorly and internally along the base, terminating abruptly at about lateral sixth and sometimes extending more narrowly along the median parts of the apex, also with an isolated small pale spot at the middle of the length and lateral fourth ; body broadly oval but distinctly longer than wide, the marginal bead of the elytra not or only slightly darker ; metacoxal plates devoid of any trace of an oblique line ; elytra generally luteo-flavate, without distinct paler spaces at the sides of the scutellum ; pronotum of the female generally with the apical margin narrowly pale, usually subinterrupted at the middle and not posteriorly spurred. Length, 5.7-6.0 mm. = .23-.24 inch.

Occurs in Florida, Georgia and Louisiana.

This is a well-marked race and probably exists in all collections possessing southern specimens.

— . Var. **rubripennis** *Casey*, 1899, l. c., p. 92.

Elytra deep and bright scarlet, with a short transverse paler spot at each side of the scutellum which is black as usual ; pronotum relatively narrower than in *immaculata* and rather more strongly rounded at base, the median length relatively greater when compared with the sides, having a narrow apical margin with narrow parallel posterior prolongation pale in the male, the female interruptedly margined with paler and without a medial spur. Otherwise as in preceding. Length, 4.4-5.8 mm. = .18-.23 inch.

Occurs at Brownsville, Texas, in Colorado, and in southern California. This is also a well-marked race. The original description of *rubripennis* is copied from Major Casey's paper, as well as his description of *immaculata*, so that the reader may follow his exact words.

— . Var. **munda** *Say*, Journ. Bost. Soc. Nat. Hist., I, p. 202.

Pronotum as in preceding, except that the apical margin is broadly pale, with a posterior medial spur short and triangular, and the sublateral pale spot is united to the pale apex, but does not join the basal pale area ; body more elongate-oval, the elytra luteo-flavate, with more narrowly reflexed margins, which are always paler. Length, 4-5 mm. = .16-.20 inch.

Occurs in the Atlantic and Middle States.

This is the common form of *sanguinea* with us in the East.

— . Var. **polita** *Casey*, 1899, l. c., p. 93.

Pronotum as in preceding except that the sublateral spur is longer, frequently joining the basal pale border so as to leave a black spot isolated ; medial spur long and narrow, gradually acuminate and extending to or beyond the middle of the disk ; body smaller and rather more rounded, the elytra generally bright scarlet and with almost completely obsolete punctures, occasionally yellow and in a northern example, with more distinct punctuation. Length, 3.8-4.7 mm. = .15-.19 inch.

Occurs in California, Washington, British Columbia, Idaho, Oregon, Vancouver.

This is the extreme northwestern form of the species.

The species *hondurasica*, *limbiter* and *ater* described in Major Casey's paper should not be included in our lists, two being from outside our limits and one, *ater*, from an unrecorded locality. The description of the last is as follows :

"Pronotum completely black; body broadly rounded and rather less convex, shining deep black throughout above and beneath, the sides of the prothorax rather less arcuate, and the basal angles more narrowly rounded; elytral punctures much larger and more distinct than usual, but sparse. Length, 4.3 mm.; width, 3.5 mm."

Unique type found in Levette Cabinet but had no label attached.

Subgenus **Olla** Casey.

3065. **O. oculata** Fab., 1792, Ent. Syst., I, p. 287.

Black, alutaceous, very obsoletely and finely punctulate; abdomen red, epimera white; elytra each with an irregular red discoidal spot before the middle; thorax with the apical margin and sides white; head white in front in male.

Length, 4-5.5 mm. = .16-.22 inch.

The original description of Fabricius is incorrect, in describing a larger round white spot on each side the thorax, as pointed out by Major Casey but clearly refers to this insect.

Occurs in Southern States and Mexico, North Carolina to California.

Major Casey discards the name *oculata* for this species and divides it into three varieties which seem in my series too inconstant to consider well defined. They differ as follows :

— Var. **plagiata** Casey.

Apical margin of thorax not white; elytral spot irregularly transverse, emarginate internally at apex and externally at base.

Type Locality: Texas, Arizona and California.

Many Texan specimens however have the pale apical thoracic margin.

— Var. **sobrina** Casey.

Apical margin of thorax pale and with a median spur pale; elytral spot triangular externally truncate, inner angle rounded.

Type Locality: Florida.

— Var. **fenestralis** Casey.

Apical margin of thorax not pale, pale lateral margin incomplete; elytral spot semicircular, base straight.

Type Locality: Las Vegas, New Mexico.

I have not seen this form, which may be an individual variation of *plagiata*.

3665a. **O. abdominalis** Say, 1824, Journ. Ac. Nat. Sc. Phil., IV, p. 95.

Entirely pale ochreous, thorax with seven black dots, five discoidal (forming an M-like mark), two lateral; elytra each with eight black dots, four subbasal, three medial, one submarginal before the apex; broadly oval and strongly convex, very finely and obsoletely punctulate, side margins of elytra quite broadly reflexed; under surface and legs pale. Length, 4.25-5.25 mm. = .17-.21 inch.

Occurs from Indiana to Texas, Arizona and California.

There is little variation in this species; Crotch describes a form with a large black triangular mark in the posterior half of the elytra which I have not seen; several specimens in my collection lack part of the elytral spots.

There is no apparent reason for classing this as a variety of the preceding. The name *sayi* Crotch, List Coccinellidæ, 1871, p. 6, is synonymous.

Harmonia *Mulsant.*

Metacoxal plates only partially divided, the oblique line feeble or lacking.

3669. **H. picta** Randall, 1838, Journ. Bost. Soc. Nat. Hist., II, p. 51.

Oval, rather depressed; black, legs orange; head yellow with two interrupted frontal vittæ black; thorax punctulate, very short, spotted with yellow and very variable, two approximate spots at middle of base always present, sometimes united; elytra variable, closely and distinctly punctate; underside black, prosternum and epipleuræ yellow, episternum black; mesosternum and three side pieces yellow; metasternum black, episternum and epimera yellow.

The elytra are yellow, without spots in the male, more or less variegated with black in the female which sex is apparently the more abundant. Length, 3.5-5.0 mm. = .15-.20 inch.

The name *contexta* Muls. applies to the female in which the black color forms two transverse bands sublaterally connected; the name *concinmata* Muls. applies to those females in which the elytra are almost wholly black.

Occurs throughout the northern part of our territory and probably wherever pine is found. It attacks aphids living on that tree.

The following varieties have been described:

— . Var. **minor** Casey, 1899, l. c., p. 95.

Sublateral spot of pronotum feebler and usually disintegrated; body smaller, slightly feebler punctures, dark design of elytra paler in color and less developed, ex-

ternal spot near the posterior extremity of the vitta frequently prolonged irregularly to the side margin. Length, 3.7-3.9 mm. = .15-.16 inch.

Occurs in California and Vancouver.

— Var. **hudsonica** Casey, 1899, l. c., p. 95.

Pronotum relatively smaller and with the black design more irregular, with a few black points at the middle of each side of the apex in addition; elytral design less developed, consisting of a fine straight vitta from the callus to the middle at apical fourth, where it is slightly dilated internally, each also with a small elongate dark spot near the vitta internally at two fifths, and another at three fifths from the base at the lateral margin and remote from the vitta. Length, 4 mm. = .16 inch.

Occurs in Hudson's Bay Territory and White Mountains of New Hampshire.

Anisocalvia Crotch.

Metacoxal plate not divided, ventral line continued along the posterior margin of first segment; thorax black, front and side margin usually pale, also a median line more or less complete.

Elytra dark with or without pale spots.....14-**guttata**.

Elytra pale with eleven large rounded or oval black spots.....12-**maculata**.

3071. **A. quatuordecimguttata** Linn., 1758, Syst. Nat., ed. X, p. 367.

♂. Black, legs and sides of ventral segments broadly orange; head orange; thorax black, front margin, side margin, medial line, spot near posterior angle orange, distinctly punctate; elytra dark, brown or nearly black, each with seven pale rounded spots, one near the scutellum, three across before the middle, two across behind the middle and one before the apex, reflexed margin pale throughout. Length, 5-5.3 mm. = .20-.22 inch.

Occurs throughout our northern states to British Columbia, White Mts., Adirondacks, Massachusetts, Wisconsin and Minnesota.

The female differs remarkably from the male and varies, the variations having led to the following names being proposed for its forms.

— Var. **cardisce** Rand., 1838, Journ. Bost. Soc. Nat. Hist., II, p. 32.

Thorax black with narrow apical and lateral margin and median line pale; elytra black with reflexed side margin pale.

3071a. Var. **similis** Rand., 1832, Journ. Bost. Soc. Nat. Hist., II, p. 58.

Thorax as in preceding, the median line abbreviated or lacking, the apical and lateral margins abbreviated; elytra black with an irregular triangular red blotch.

— Var. **victoriana** Casey, 1899, l. c., p. 96.

Thorax with narrow apical and lateral pale margin and abbreviated medial pale line; elytra black with pale side margin toward apex only and a rounded discal pale spot near the suture behind the middle.

In addition to these variations I have seen females in which the pale spots of the males are partly reproduced in conjunction with the characteristic female blotch.

Major Casey does not consider our species identical with the European *I. guttata* (see this Journal, Vol. VII, p. 96); but the differences he names are not constant in the specimens before me and I prefer to adhere to the name used in the check list.

3071b. **S. hesperica** Cr.

This name must be dropped. The description is too imperfect for recognition.

3072. **A. 12-maculata** Gebl., 1832, Nouv. Mém. Mosc., II, p. 76. [*incarnata* Kirby.]

Convex, subhemispherical, black; head black, clypeus in front, labrum and the border of the eyes testaceous; thorax and elytra distinctly and closely punctate with their epipleura testaceous (or pinkish-white alive) and marked with black; tibiae, tarsi, sides of ventral and the whole of the anal segments testaceous; thorax with two large black discoidal marks, leaving only a thin marginal and medial line pale; elytra with two common (one subscutellar, one toward the apex) and five other spots black (one subbasal, two rounded almost contiguous medial, one on the apical third, one triangular apical). Length, 5-5.5 mm. = .20-.22 inch.

Occurs at Lake Superior, Hudson's Bay, Siberia, British Columbia.

The following variety has been described:

— Var. **elliptica** Casey, 1899, l. c., p. 97.

Smaller and more broadly oval, prothorax relatively smaller, sides much more strongly convergent, basal angles more broadly rounded, punctures finer and sparser; elytral spots much larger and narrowly separated, the two transversely placed at the middle, generally confluent. Length, 4 mm. = .20 inch.

Occurs at Hudson's Bay.

Anatis Mulsant.

Metacoxal plate not divided, ventral line effaced externally; prosternum compressed in front, process broad, prominent at apical margin; elytra (♀) with small sutural tomentose patch near apex; thorax with pale sides and usually two basal pale spots.

3075. **A. quindecimpunctata** Oliv., 1808, Ent., VI, p. 1027, t. 6, f. 83. [*labiculata* Say.]

Very broad, rather convex, black; head black, punctate, eyes emarginate by the yellow antenniferous tubercles and two triangular spots on the front yellow; thorax and apical half of epipleura yellowish-white, posterior angles obtuse, alutaceous, finely and closely punctulate, marked with a N-like discoidal spot and a lateral dot black; elytra yellow or reddish-brown alutaceous, closely and decidedly unequally punctulate; sides somewhat explanate, margin itself thickly reflexed, with a row of deeper punctures; legs, sides and apices of ventral segments orange; meso- and meta-epimera white; elytra each with eight black spots, one scutellar, one on the callus, three forming a medial fascia, and three a subapical fascia. Length, 6.5-9.0 mm. = .26-.36 inch.

Occurs throughout the Atlantic region.

The larva is black, variegated with yellow, of the same form as other Coccinellid larvæ, but much larger, measuring five eighths inch when full grown.

Major Casey recognizes the following, heretofore considered a synonym as a valid species. I would rather cite it as a variety.

— . Var. **mali** Say, 1824, Journ. Ac. Nat. Sc. Phil., IV, p. 93.

Elytral spots all surrounded by a broad pale border, the ground tint red brown; the submarginal spot at two fifths geminate; the apical margin of thorax pale throughout, not interrupted as in *15-punctata*. Length, 8-10 mm. = .32-.40 inch.

Occurs in Indiana, Wisconsin, Idaho.

3076. **A. rathvoni** Lec., 1852, Proc. Ac. Nat. Sc. Phil., VI, p. 132.

Elytra decidedly rhomboidal, scarcely as long as wide, strongly dilated at two fifths, where there is a small marginal spot; remainder immaculate or with a few of the spots of the preceding species, the punctures much smaller and nearly equal; basal spots of pronotum large, much extended antero-externally, sometimes even uniting with the lateral pale area and broadly united at base; pale apical margin transverse. Length, 8.3 mm. = .33 inch.

Occurs in California and Oregon.

The following variety has been described:

— . Var. **lecontei** Casey, 1899, l. c., p. 98.

Elytra very broadly rounded or subrhomboidal, slightly more dilated at two fifths, scarcely as long as wide, the punctures strong, bright brownish-red, immaculate entire limb deep black; pronotum black with a broad yellow vitta extending from base to apex, slightly distant from side margin which it joins at apical angle, also with two small pale spots at middle of base sometimes lacking; head black with a small yellow spot beside the eye; legs and beneath black, epipleuræ black in external and red in internal half their width from base to apex. Length, 8.7-10 mm. = .35-.40 inch.

Occurs in New Mexico and Colorado.

Probably more abundant in collections than the typical form.

Neomysia Casey.

Replaces *Mysia* from which it differs in the more narrowly reflexed margins, very fine punctuation and polished surface.

The species may be separated as follows:

Pronotum pale with trapezoidal black space; elytra interruptedly vittate.

subvittata.

Pronotum pale with trapezoidal dark or black space, also with sublateral black spot.

pullata.

Pronotum pale with nubilous brown spots.....**hornii.**

The elytra are feebly or irregularly vittate in some races of the last two species but often immaculate.

3077. **N. subvittata** *Muls.*, 1851, Spec., p. 138.

Oval; pronotum black, sides pale, trapezoidal black space sometimes divided by longitudinal pale line; elytra pale with three interrupted black vittæ, the external vitta narrow, abbreviated at both ends, the middle vitta sometimes complete, united with the interior at base and sometimes at middle, the last not reaching the apex; the union of the vittæ always leaves a small pale spot each side the scutellum and, when complete, leaves also a pale spot before the middle; head dark, sometimes partly pale; body beneath and legs pale in light-colored specimens, brownish in others. Length, 6 mm. = .24 inch.

Occurs in northern California to Vancouver.

The description of Mulsant was written from pale specimens.

N. montana Casey is a dark form of the same species occurring in Montana.

3073. **N. pullata** *Say*, 1825, Journ. Ac. Nat. Sc. Phil., V, p. 301.

Oval, convex, black; head with two frontal spots yellow; thorax (♂) with broad yellow side margins enclosing a black spot and with a yellow spot before the scutellum (sometimes extended into a median yellow space); thorax (♀) with dark area, pale brown with blackish lateral edges; elytra entirely pale or with irregular dorsal black ill-defined vittæ; legs generally black, meso-epimera white. [*notans* Rand.] Length, 6-7 mm. = .24-.28 inch.

Occurs in Canada, Middle and Southern States.

The following variety has been described:

— Var. **randalli** *Casey*, 1899, l. c., p. 99.

The elytral markings in this form are more completely developed and it leads toward the Oregon form *subvittata*. The markings are: subsutural vitta from base for three fifths, broadly united at base with a short median vitta, a narrow external vitta from one third to three fourths, and a broad median vitta from three fourths to seven eighths. A whitish basal spot each side of the scutellum. Length, 6.6 mm. = .26 inch.

Occurs at Lake Superior.

3074. **N. hornii** *Crotch*, 1873, Trans. Am. Ent. Soc., p. 375.

Pronotum pale yellowish-brown with a feeble trace of two basal browner spots; elytra with three feeble incomplete pale brown vittæ, the two inner uniting near the apex and broader, the outer narrow and almost completely obsolete; or entirely pale; thorax and elytra finely punctulate, alutaceous; meso-epimera white. Length, 6-7 mm. = .24-.28 inch.

Occurs in Oregon and California.

The following variety has been described:

— Var. **interrupta** *Casey*, 1899, l. c., p. 99.

Pronotum with two clouded basal spots and V-shaped spot before the middle; elytra yellow with three fine incomplete vittæ of pale brown. Length, 7 mm. = .28 inch.

Occurs in New Mexico, Colorado and Arizona.

Psyllobora Chev.

Body small, convex, pale in color, spotted with a darker tint above; mesosternum truncate, claws with a large quadrate tooth internally at apex.

Our species are closely related and may be separated as follows:

Elytra without sutural common spots, suture pale;

Each elytron with nine spots of uniform color some of which may be confluent.

20-maculata.

Each elytron with two basal spots and a large reniform discal spot.....**renifer.**

Each elytron with two or three basal spots and seven others variously confluent, sometimes differing in color.....**tædata.**

Elytra with two common sutural spots, the sutural margin narrowly black.....**nana.**

3078. **P. 20-maculata** Say, 1824, Journ. Ac. Nat. Sc. Phil., IV, p. 96.

Small, rounded, convex; pronotum finely but distinctly punctate, elytra strongly and very closely punctured; ochreous white, pronotum with five black spots, the ante-scutellar spot small; elytra with nine spots, two subbasal, two subsutural, three submarginal, two discal, the latter often connected and sometimes joining the others partly together; sternum and middle of ventral segments black, epimera and part of meta-episternum white. Length, 2.1-2.7 mm. = .08-.11 inch.

Occurs in Atlantic region.

The following varieties have been described:

— Var. **obsoleta** Casey, 1899, l. c., p. 101.

The elytral spots are brown instead of black. Length, 2.15 mm. = .086 inch.

Type Locality: Keokuk, Iowa.

With this I include all the specimens from the Middle West in which the color is pale and the spots begin to suggest the Texan and Californian forms. It seems to me at best a feebly differentiated race.

— Var. **parvinotata** Casey, 1899, l. c., p. 101.

Ante-scutellar spot of pronotum obsolete; elytral spots smaller and completely isolated. Length, 1.9 mm. = .08 inch.

Occurs in Florida.

This variety appears incorrectly in many collections under the name *nana*, which is described below.

— **P. renifer** Casey, 1899, l. c., p. 102.

"Body very small, rounded, with very minute sparse punctures; pronotum subimpunctate, the five spots present but pale brown in color; elytra very pale yellowish-white, with brown markings consisting, on each, of two subbasal spots, the outer the larger and with a lobe on the callus, a small faint subsutural cloud at one third, a large bilobed discal spot extending from basal third to apical fifth, prolonged and acuminate antero-externally and a large bilobed and less well-developed fine sub-apical spot." Length, 1.6 mm. = .065 inch.

Type locality, Brownsville, Texas.

In my series of this species, the outer basal spot of the elytra is in some cases nearly divided and there is also a lack of uniformity in the form of the discal spot as well as some inequality in the depth of color. Crotch mentioned this species as a variety but did not name it.

— *P. tædata* Lec., 1857, Rep. Pac. R. R. Exp., IX, p. 76.

Pronotum subimpunctate; elytra with impressed sparse punctures; pronotum with five spots more or less nubilata; elytral spots very irregular, the outer subbasal usually completely or partly divided, many of the spots frequently coalescent and pale brown. Length, 1.9–2.6 mm. = .08–.10 inch.

Occurs in Vancouver, Oregon, California.

The variability of the elytral markings has led to the description of several species, all of which seem to me merely forms of *tædata* and not actually geographical races or subspecies. In the series I have received from the Pacific coast all these forms came from the same locality at one time. For cabinet arrangement these names may be used if desired: *borealis* and *separata* for those with uniformly dark spots, the first when the outer subbasal spot is partly divided, the second when the division is complete; *tædata* and *deficiens* for those with black spots mingled with pale brown spots, the first when two distinct dark submarginal spots are present, the second when these are lacking.

P. nana Muls., 1851, Spec., p. 181.

More narrowly oval, ante-scutellar spot of pronotum very small; elytra very minutely sparsely punctulate, with two common sutural spots at one third and two thirds from base, the sutural margin narrowly black, also with eight other spots on each, two basal, one large triangular discal, two submarginal, two subapical, one small discal, variously united; elytra pearly white in color. Length, 2.5 mm. = .10 inch.

Occurs in Cuba, Jamaica and Florida; rare in collections.

Thalassa montezumæ Muls., 1851, Spec., p. 512.

Body bluntly oval, convex, finely punctured; dull metallic green above, head with a small yellow spot; antennæ yellowish, palpi green; pronotum with anterior angles narrowly yellow; elytra each with a reddish irregular spot before the middle; beneath dull greenish-black, abdomen reddish-yellow, paler at the side, tarsi yellowish-trochanters green. Length, 4.8 mm. = .19 inch.

Occurs in Arizona and Mexico.

This species is not rare in Mexico and has been found at Tucson and Williams in Arizona. It may therefore be included in our list.

EXPLANATION OF PLATES XIV AND XV.

Represents the tribe *Coccinellini*. *A*, underside of *Anatis 15-punctata*, showing metacoxal line on first ventral segment at *a*. *B*, various structures much enlarged:

a, tarsi (top view) showing form of second joint; *b*, tarsi (side view) second joint apparently divided; *c*, mandible; *d*, palpus; *e*, end view of last joint of palpus; *f*, antenna. *C*, half of first ventral segment showing form of metacoxal line (*a*) and claw (*b*) of each genus in tribe Coccinellini. For *Psyllobora* the tarsus (*c*) also is shown on account of the oblique termination of the first joint.

The remaining figures show crudely the markings of the species as follows, the size being indicated by the line beside each figure :

1. *Adalia bipunctata*.
2. " *frigida*.
3. " " var. *ophthalmica*.
4. " " " *melanopleura*.
5. " " " *disjuncta*.
6. " *annectans*.
7. " " var. *transversalis*.
8. " *humeralis*.
9. *Agrubia cyanoptera*.
10. *Coccinella 9-notata* (eastern form).
11. " " " " " "
12. " " (Oregon form).
13. " *monticola*.
14. " *transversoguttata*.
15. " " var. *nigatoria*.
16. " " " *prolongata*.
17. " " " *alutacea*.
18. " *californica*.
19. " *trifasciata*.
20. " " var. *juliana*.
21. " " " *subversa*.
- 22, 23, 24, 25, 26. " " all drawn from the series collected by Miss Dennis at Dilley, Oregon. The common form is that shown by Fig. 21.
27. *Coccinella trifasciata* var. *eugenii*.
28. " " " *difficilis*, ♀.
29. " *tricuspis*.
30. *Neoharmonia* (subgen.) *venusta*.
31. " *notulata*.
32. *Cycloneda* (subgen.) *sanguinea*.
33. *a.* var. *munda* ♂. *b.* var. *munda*, ♀, thorax and head. *c.* var. *immaculata*, thorax and head. *d.* var. *polita*, thorax and head.
34. *Olla* (subgen.) *oculata*.
- 35 and 36. *Olla* (subgen.) *abdominalis*.
37. *Harmonia picta* ♂.
38. " " ♀ form *contexta*.
39. " " ♀ " *concinmata*.
40. " " var. *minor*.
41. " " " *hudsonica*.
42. *Anisocalvia 14-guttata*, ♂.

43. *Anisocalvia 14-guttata*, ♀, form *similis*.
 44. " " *12-maculata*.
 Fig. 45 is not drawn from the type.
 45. *Anisocalvia 14-guttata*, ♀, form *victoriana*.
 46. *Anatis 15-punctata*.
 47. " " " dark form.
 48. " " " var. *mali*.
 49. " *rathvoni*.
 50. " " " var. *lecontei*.
 51. *Neomysia pullata*.
 52. " " " var. (Ontario).
 53. " *hornii*.
 54. " *subvittata*.
 55. *Psyllobora 20-maculata*.
 56. " " " var. *parvinotata*.
 57. " *renifer*.
 58. " *tædata*, form *separata*.
 59. " " " *bovealis*.
 60. " " " *tædata*.

The following were omitted from the Plate IV, Vol. XI.

61. *Hippodamia glacialis*, usual form.

62. " " " " "

63. " " " " unusually dark form taken by Mr. Davis on Staten Island, October 3.

Plate IV, Vol. XI, the right-hand figure of *parenthesis* represents an unusual variety from Tallac, Cal.

LIST OF THE CICINDELIDÆ OF MEXICO AND ON THEIR RELATIONSHIP WITH THE SPECIES OF THE UNITED STATES.

BY WALTHER HORN, M.D.,

BERLIN, GERMANY.

Cicindela schaefferi, sp. nov.

Cicindelæ sinaloæ Bat. similis, differt labro in medio ipso sat producto denteque longo ornato; oculis minus prominentibus; ante sulcum basalem pronoto constricto, angulis posticis minus prominentibus, margine antico in medio producto, basi evidentius (subtiliter) transversim striolata, elytris magis parallelis, superiore lunulæ apicalis parte non anticem versus inflexa sed rotundata, parte inferiore spinam versus incrassata, disco punctis 2 (altero ante medium in illa specie deficiente, altero pone medium ut in *P. sinaloa* Bat.) ornato, macula marginali media fere in puncta duo æqualia dissoluta, serie foveolarum juxta-suturalium (in tertia parte basali foveolis viridilibus!) minus conspicuis. Long., 9 mm.

One female — the only specimen I know — was kindly given to me by Mr. C. Schaeffer (Brooklyn), who had it in his collection labelled "California?" I believe, to be sure, it comes from north Mexico!

The pattern of the elytra resembles very much that of the European *Cicindela lunulata* F., a humeral and an apical lunula, two marginal spots (connected with each other) and two discoidal spots. The coloration of the body and the shape of the tip of the elytra is like that of *Cicindela sinaloa* Bat.

In 1897 I published, together with Mr. R. Becker and Mr. C. F. Höge (Deutsche Entomologische Zeitschr.), a paper on the Mexican Cicindelidæ and their relationship to the species of the United States and the tropical countries of Central America. I could not adopt Bates' opinion that the Mexican fauna should belong to the neotropical region, as 30 species (of the 80 Mexican Cicindelidæ) occur in the United States, but only 17 are to be found also south of Mexico. At the same time I already stated that in future this proportion would still change in favor of the North American species, as the extreme north of Mexico and the extreme south of the United States were not yet known sufficiently. Time has proved my opinion. One genus of the United States (*Amblychila*) was discovered lately in Sonora. I described *Cicindela wickhami* from southern Arizona and northern Mexico; *C. arizonensis*, generally considered to be a variety of *C. viridisticta* Bat., is a "good" species, and on the other hand, *C. hæmorrhagica* Lec., is but a subspecies of *C. carthagena* Dej.; *C. (pusilla* Say var.) *lunalonga* Schpp. occurs also in Lower California; *C. flavo-punctata* Chev. was found near Nogales (Arizona!); *Tetracha chevrolati* Chd. — considered always a variety of *T. infusata* Mann., belongs as a subspecies to *T. carolina* L.; *Cicindela melania* Bat., is the same as *C. viatica* Chev. (var.) and *C. ritteri* is the same as *hornii* Schpp. var., etc. As I am enabled now to correct some other notes in my former paper (1897) I give herewith a new list of the Cicindelidæ of Mexico.

A. CICINDELIDÆ ALOCOSTERNALLÆ W. Horn, Ent. Nachr.,
1900, p. 214.

Ctenostoma Klug, Nov. Act. Acad. Leop., X, 1821, p. 304.

Caris FISCH., Gen., 1821, p. 98.

1. **maculicorne** Chev., Rev. Mag. Zoöl., 1856, p. 352.

sigma BAT., Proc. Zoöl. Soc. Lond., 1878, p. 388.

B. CICINDELIDÆ PLATYSTERNALLÆ W. Horn, l. c.

I. CICINDELIDÆ Lac.

a. Euryodini W. HORN, Deutsch. Ent. Zeitschr., 1899, p. 37.

Hiresia Dej., Spec., V, 183, p. 206.

2. **boucardi** Chev., Rev. Mag. Zoöl., 1862, p. 485.

Beckerium W. Horn, Deutsch. Ent. Zeitschr., 1897, p. 164.

3. **leptale** Bat., Biol. Centr. Am., 1881, p. 15, pl. 1, f. 23.

b. Odontochilini W. HORN, Deutsch. Ent. Zeitschr., 1899, p. 37.

Odontochila Cast., Silb. Rev., 1834, p. 34.

4. **mexicana** Cast., Et. Entom., 1834-35, p. 38.

nictoi GUER., Rev. Zoöl., 1844, p. 254.

5. **quadrina** Chev., Col. Mex., 1835, II, p. 176.

princeps DUP., i. l., Dej., Cat., III, p. 2.

dejeani CHEV. (olim), Dej., Cat., III, p. 2.

c. Cicindelini W. HORN, Deutsch. Ent. Zeitschr., 1899, p. 37.

Cicindela Linn., Syst. Nat., II, 1735, p. 657.

Group I. *Malis nudis, fronte pilosa.*

6. **latesignata** Lec., Ann. Lyc. N. Y., V, 1851, p. 172.

7. **oregona** Lec., Trans. Am. Phil. Soc., XI, 1856, p. 41.

guttifera LEC., l. c., p. 42.

8. **hirticollis** Say var. **ponderosa** Thom., Arc. Nat., 1859, p. 89.

9. **scutellaris** Say* var. **unicolor** Dej., Spec., I, 1825, p. 52.

10. **pimeriana** Lec., Proc. Ac. Nat. Sc. Phil., 1866, p. 363.

viatica LEC., Tran. Am. Phil. Soc., XI, 1856, p. 62.

Group II. *Malis fronteque nudis, disco et marginibus antico posticoque prothoracis nudis (antennis numquam pilis longissimis ornatis).*

11. **chrysippe** Bat., Biol. Cent. Amer., I, Suppl., 1884, p. 257, pl. 13, f. 2.

12. **hoegei** Bat., l. c., I, p. 6, pl. 1, f. 5.

13. **smaragdina** Chev., Col. Mex., VIII, 1835, No. 179.

14. **ioessa** Bat., Biol. Cent. Amer., I, 1881, p. 5.

15. **beckeri** Hoeg., Deutsch. Ent. Zeitschr., 1897, p. 185; W. Horn, Deutsch. Ent. Zeitschr., 1902, p. 231.

16. **lugens** Klug, Jahrb., I, p. 34.

aberr. **aterrima** Klug., l. c.

carbonaria CHEV., Col. Mex., p. 128.

17. **nigrocerulea** Lec., Ann. Lyc. N. Y., IV, 1848, p. 181, pl. 14, f. 9.

18. **enthalis** Bat., Ann. Mag. Nat. Hist., 1882, p. 319.

19. **viatica** Chev., Col. Mex., No. 180.

melania BAT., Tran. Ent. Soc. Lond., 1890, p. 495; W. Horn, Deutsch. Ent. Zeitschr., 1898, p. 193.

aberr. **nigrilabris** BAT., l. c., p. 495.

aberr. **nigra** CHAUD., i. l. Cat. Coll., p. 35.

* Not yet undoubtedly proved, that it occurs in Mexico.

20. **hornii** Schpp., Bull. Brookl. Ent. Soc., VI, p. 88.
anthracina G. HORN, Tran. Am. Ent. Soc., 1880, VIII, p. 139.
 aberr. **ritteri** Bat., Tran. Ent. Soc. Lond., 1890, p. 496, pl. 16, f. 2; W.
 Horn, Ent. Nach., 1900, p. 116.
21. **scotina** Bat., l. c., p. 494.
 aberr. **chloris** Hoega, Deutsch. Ent. Zeitschr., 1897, p. 168.
22. **luteolineata** Chev., Rev. Mag. Zool., 1856, p. 351.
flammula THMS., Ann. Soc. Ent. Fr., 1856, p. 326, pl. 8, f. 5.
32. **craveri** Thms., Rev. Mag. Zool., 1856, p. 528.
24. **obsoleta** Say, et varietates.*
 I subsp. **latemaculata** Becker, Deutsch. Ent. Zeitschr., 1897, p. 169.
 II subsp. **juvenilis** W. Horn, l. c., p. 169.
 III subsp. **santaclaræ** Bat., Tran. Ent. Soc. Lond., 1890, p. 493.

The Mexican specimens of this race are beautifully green, or brownish or black. The specimens from the United States (New Mexico) are very seldom full-green (generally only greenish!), sometimes bluish and brownish, more often black. Notwithstanding this variability in color it is very easy to distinguish this subspecies from other forms of *C. obsoleta* Say, from the United States, as the pattern of the elytra almost always shows a constant feature: in the type it is "lineiformis," in subspecies *santaclaræ* Bat. "punctiformis."

IV subsp. **thalestris** Bat., Tran. Ent. Soc. Lond., 1890, p. 494.

25. **rufiventris** Dej., Spec., I, 1825, p. 102.

Var. *hentzii* Dej., Spec., V, 1831, p. 148 = *hemorrhoidalis* Hentz, Tran. Am. Phil. Soc., 1830, p. 254, pl. 2, f. 2, does not occur in Mexico; it was a mistake by G. Horn, who took a variety of *P. cartagena* Dej., to be this variety of *rufiventris* (confer. W. Horn, Deutsch. Ent. Zeitschr., 1902, p. 378).

I subsp. **flohri** Bat., Proc. Zool. Soc. Lond., 1878, p. 588.

II subsp. **beckeri** W. Horn, Deutsch. Ent. Zeitschr., 1897, p. 171.

III subsp. **reducta** W. Horn, l. c., p. 171.

aberr. **hoegeana** W. Horn, l. c., p. 171.

IV subsp. **sedecimpunctata** Klug, Jahrb., 1834, p. 32.

rubriventris CHEV., Col. Mex., No. 101.

ventanosa BAT., Tran. Ent. Soc. Lond., 1890, p. 503.

This variety occurs also in the United States; South Arizona (Rivers).

aberr. ? **parallela** (Fet., i. l., Cat. Cic., p. 70) Bat., l. c., p. 503.

aberr. **sallei** Chev., Col. Mex., No. 126.

aberr. **mellyi** Chid., Bull. Mosc., 1852, p. 19.

calochroides MOTSCH., Et. Ent., VI, 1857, p. 109.

26. **hydrophoba** Chev., Col. Mex., No. 125.

aberr. **tenuisignata** Fet., i. l. Cat. Cic., p. 69 (Bat., Biol. Cent. Am., I, p. 8).

*The typical *C. obsoleta* Say is not known from Mexico.

- I subsp. **quinquenotata** (*Sturm*, i. l.) *Bat.*, Biol. Cent. Am., I, p. 8.
signatodilatata *FET.* i. l. Cat. Cic., p. 69.
- II subsp. **taretana** *Bat.*, Biol. Cent. Am., I, Suppl., p. 259.
27. **dysenterica** (*Chaud.* i. l., Cat. Coll., p. 29) *Bat.*, Biol. Cent. Am., I, p. 7.
 I subsp. **dugesi** *Bat.*, Biol. Cent. Am., I, Suppl., p. 258.
 aberr. **calomicro** *Bat.*, Tran. Ent. Soc. Lond., 1890, p. 501.
 II subsp. **deliciola** *Bat.*, l. c., p. 502.
 III subsp. **clarina** *Bat.*,* Biol. Cent. Am., I, p. 6.
despecta *SRHM.*, i. l. (Mus. Berol.).
truquii *CHAUD.*, i. l. (Mus. Paris).
28. **rugatilis** *Bat.*, Tran. Ent. Soc. Lond., 1890, p. 497.
semicircularis *BAT.* (olim), Biol. Cent. Am., I, p. 6, t. I, f. 19.
29. **catharinæ** *Chev.*, Col. Mex., No. 178.
30. **punctulata** *Oliv.*, Ent., II, 1790, No. 33, p. 27, pl. 3, f. 37, a, b.
micans *FABR.*, Ent. Syst., 1798, p. 61.
obscura *MELSH.*, Cat. Ins. Pennsv., 1806, p. 46.
 aber. **jenisoni** *Gistl.*, Syst. Ins., I, p. 55.
 aber. **chihuahuae** *Bat.*, Tran. Ent. Soc. Lond., 1890, p. 500.
micans *SCHAUPP*, Bull. Brookl. Ent. Soc., 1884, p. 98.
31. **digueti** *W. Horn*, Deutsch. Ent. Zeitschr., 1897, p. 186.
32. **politula** *Lec.*, Tran. Am. Ent. Soc., 1875, p. 159.
33. **nebuligera** *Bat.*, Tran. Ent. Soc. Lond., 1890, p. 504, pl. 16, f. 8.
34. **phosphora** *Bat.*, Cist. Ent., 1878, p. 329.
35. **guerrerensis** *Bat.*, Tran. Ent. Soc. Lond., 1890, p. 499, pl. 16, f. 5.
36. **præcisâ** *Bat.*, † l. c., p. 498, tab. 16, f. 4.
37. **æneicollis** *Bat.*, Biol. Cent. Am., I, p. 13.
 aber. **viridis** *Becker*, Deutsch. Ent. Zeitschr., 1897, p. 176.
38. **papillosa** *Chaud.*, Bull. Mosc., 1854, p. 123.
39. **semicircularis** *Klug*, Jahrb. 1834, p. 33. (nec Bates!).
 aber. **plurigemmata** *Bat.*, Tran. Ent. Soc. Lond., 1890, p. 496, pl. 16, f. 3.
40. **cyaniventris** *Chev.*, Col. Mex., No. 27.
corvina *LEC.*, Tran. Am. Phil. Soc., 1856, p. 53, pl. 1, f. 47.
rugipennis *DUP.*, i. l., Dej. Cat., III, 1837, p. 6.
 aber. **chevrolati** *W. Horn*, Deutsch. Ent. Zeitschr., 1892, p. 371.
41. **radians** *Chev.*, Mag. Zoöl., 1841, p. 57.
42. **aurora** *Thms.*, Arc. Nat., 1859, p. 90.
43. **vasseleti** *Chev.*, Col. Mex., No. 33.
44. **flavopunctata** *Chev.*, l. c., No. 28.
 aber. **humeralis** *Chev.*, Mag. Zoöl., 1841, p. 59.
 aber. **ocellata** *Klug*, Jahrb., p. 33.
 aber. **incerta** *Chev.*, Col. Mex., p. 127.
 aber. **chiapana** *Bat.*, Tran. Ent. Soc. Lond., 1890, p. 505.
 I subsp. **rectilatera** *Chd.*, Bull. Mosc., 1843, p. 693.
decostigma *LEC.*, Tran. Am. Phil. Soc., 1856, p. 54, pl. 1, f. 48.
texana *LEC.*, i. l., List of Col.

* Aberrat colore fusco : La Venta (Fényes).

† Near Matamoras, collected by Dr. Fényes.

C. rectilatera Chaud., was considered until now as distinct species, but the differences distinguishing it from *C. flavopunctata* (form of the labrum, general shape of the body, coloration and pattern, tip of the elytra) are very small and show variations. I have seen specimens of the latter having only the extreme tip of the abdomen reddish-testaceous.

45. **roseiventris** Chev., Col. Mex., 1834, No. 29.
semicircularis CHEV., Col. Mex., 1835, index (nec Klug!).
 subsp. **mexicana** Klug, Jahrb., 1834, p. 31.
decostigma CHEV., Col. Mex., III, fasc. 1834-35.
belti BAT., Proc. Zool. Soc. Lond., 1878, p. 588.
46. **klugi** Dej., Spec., V, p. 263.
neglecta KLUG, i. l., Dej. Cat., III, p. 5.
 aberr. **douei** Chenu., Mag. Zool., 1840, p. 1 (Mexico!).
47. **carthagena** Dej., Spec., V, p. 229.
 I subsp. **hentzii** G. Horn, ex parte (nec Dej.!) Proc. Cal. Acad. Sc., 2d Ser., Vol. IV, 1894, p. 307; W. Horn, Deutsch. Ent. Zeitschr., 1902, p. 378.
 II subsp. **hæmorrhagica** Lec.,* Ann. Lyc. N. Y., V, 1851, p. 171.
48. **sommeri** Mann., Bull. Mosc., 1837, p. 12.
hoffneri DEJ., i. l., Cat., III, p. 3.
fuscognira HOPFN., i. l., Dej. Cat., III, p. 3.
ferrugata PUTZ., Mém. Liège, II, 1846, p. 366.
49. **tenuisignata** Lec., Ann. Lyc. N. Y., 1852, p. 171.
psilogramma BAT., Tran. Ent. Soc. Lond., 1890, p. 507, pl. 16, f. 10
50. **fera** Chev., Col. Mex., 1834, No. 30.
tenuilineata Brill., Arch. Mus., I, 1838, p. 128.
51. **sinaloæ** Bat., Tran. Ent. Soc. Lond., 1890, p. 505.
52. **schaefferi** *mihi* (spec. nov.), hoc loco p. prima.

Group III. *Malis fronteque nudis, thoracis marginibus omnibus et (interdum sparsissime) disco hirsutis, basi plerumque dilatata, pedibus posticis valde elongatis.*

53. **chlorocephala** Chev., Col. Mex., 1834, No. 32.
54. **leuconoe** Bat., Tran. Ent. Soc. Lond., 1890, p. 508, pl. 16, f. 11.
55. **macrocnema** Chd., Bull. Mosc., 1852, p. 15.
 subsp. **batesi** W. Horn, Deutsch. Ent. Zeitschr., 1894, p. 111.
 aberr. **albina** W. Horn, l. c., p. 240.
56. **curvata** Chev., Col. Mex., 1834, p. 31.
57. **dorsalis** Say (subsp. **media** Lec.) aberr. **castissima** Bat., Biol. Cent. Am., 1, Suppl., p. 260, pl. 13, f. 1.
 subsp. (**saucyi** Guér.) aberr. **venusta** Laf., Rev. Zool., 1841, pp. 37, 96.
saucyi GUÉR. var. A. Rev. Zool., 1840, p. 37.

* The variations of this subspecies with reduced pattern (var. *bisignata* Dokht.) and *pacifica* Schpp. are not yet known from Mexico.

Group IV. *Malis, fronte, thoracis disco nudis (antennis sparsissime sed longissime pilosis); antico thoracis margine fere toto piloso.*

58. **gabbii** *G. Horn*, Proc. Acad. Sc. Phil., 1866, p. 395.

Group V. *Malis fronteque nudis, thoracis marginibus late, lateralibus anticoque et disco* pilosis, pedibus posticis non elongatis.*

59. **trifasciata** *Fabr.*, Sp. Ins., I, 1781, p. 286.

tortuosa *DEJ.*, Spec., I, p. 87.

var. **tortuosa** *Lec.*, Tran. Am. Phil. Soc., 1856, p. 92.

60. **pusilla** *Say*, Journ. Ac. Sc. Phil., I, 1817, p. 21.

subsp. **lunalonga** *Schpp.*, Bull. Brookl. Ent. Soc., VI, 1884, p. 122. Lower California.

aberr. **tuolumnæ** *Leug*, Trans. Am. Ent. Soc., 1902. Lower California.

The specimens I know show all intermediate forms between this aberration and the subspecies *lunalonga* *Schpp.*

61. **speculans** *Bat.*, Tran. Ent. Soc. Lond., 1870, p. 500, pl. 16, f. 6.

62. **viridisticta** *Bat.*, Biol. Cent. Am., I, p. 14, pl. 1, f. 20; *Chaud.*, i. l., Cat. Coll., 1865, p. 23.

63. **arizonensis** *Bat.*, Biol. Cent. Am., I, Suppl., p. 260; *W. Horn*, Deutsch. Ent. Zeitschr., 1903, p. 182.

64. **wickhami** *W. Horn*, l. c., p. 182.

65. **hemichrysea** *Chev.*, Col. Mex., 1835, VI, No. 129.

aberr. **inspersa** *Chev.*, l. c., No. 130.

aberr. **cyanosparsa** *Chaud.*, Bull. Mosc., 1852, p. 23.

66. **nephelota** *Bat.*, Ann. Mag. Nat. Hist., Ser. 5, IX, p. 319.

67. **debilis** *Bat.*, Tran. Ent. Soc. Lond., 1890, p. 509, pl. 16, f. 12.

68. **schauppilii** *G. Horn*, Tran. Am. Ent. Soc., 1876, p. 240.

69. **severa** *Laf.* † var. **yucatanæ** *Chd.* i. l., Cat. Coll., p. 28; *W. Horn*, Deutsch. Ent. Zeitschr., 1896, p. 354.

Var. statura paullo minore. margine laterali elytrorum ab humeris usque ad spinam suturalem (ut in *C. circumpecta* *Laf.* intus undulato) albo. — Yucatan.

70. **californica** *Mén.*, Bull. Soc. Imp. Pétersb., 1844, p. 52.

aberr. signatura marginali elytrorum late confluenta.

subsp. **prætextata** *Lec.*, Proc. Acad. Sc. Phil., 1854, p. 220.

This variety differs from *C. californica* *Mén.*, not only in pattern. The body, especially the prothorax, is slender, the tip of the elytra not so much rounded (spine less retracted), etc. But after examining some more specimens, it seems to me to be a geographical race of *Ménétries'* species. The latter was confounded always with *C. circumpecta* *Laf.*, from which it may be separated by the constantly finer striation of the front between the eyes, etc.

* Interdum sparsissime.

† I am not absolutely sure about the pubescence on the disc of the pronotum, but I believe fresh specimens will show some bristles inside of the lateral ones.

Group VI. *Malis pilosis, fronte nuda.*

71. **euryscopa** *Bat.*, *Tran. Ent. Soc. Lond.*, 1890, p. 506.

Group VII. *Malis fronteque pilosis.*

72. **sperata** *Lec.*, *Tran. Am. Phil. Soc.*, 1856, p. 50.
 73. **hamata** *Brll.*, *Arch. Mus.*, I, 1838, p. 132, pl. 8, f. 9.
christofori *CHEV.*, *Mag. Zoöl.*, 1841, p. 15.
reichi *CHAUD.*, *Bull. Mosc.*, 1843, p. 689; 1854, p. 115.
 ♀ *apicalis* *CHAUD.*, *Bull. Mosc.*, 1843, p. 691.
 subsp. (**lacerata** *Chaud.*), aberr. **pallifera** *Chaud.*, *Bull. Mosc.*, 1852, I, p. 17.
canosa *G. HORN*, *Entom. News*, 1892, p. 26 (*Lec. i. l.*).

SUPPLEMENT.

74. **lemniscata** *Lec.*, *Tran. Ac. Sc. Phil.*, 1854, p. 220.

II. MEGACEPHALIDÆ *Lac.*

Tetracha * *HOPE*, *Man.*, II, p. 7.

75. **angustata** *Chev.*, *Mag. Zoöl.*, 1841, p. 55.
obscura *HÜPFEN.*, i. l., *Dej. Cat.*, III, p. 1.
 aberr. **fuliginosa** *Bat.*, *Ent. Month. Mag.*, 1874, p. 261.
 76. **affinis** *Dej.*, *Spec.*, I, 1825, p. 12.
impressa *CHEV.*, *Mag. Zool.*, 1841, p. 56.
 77. **sobrina** *Dej.*, *Spec.*, V, 1831, p. 202.
 aberr. **geniculata** *Chev.*, *Col. Mex.*, 1834, No. 26.
 78. **carolina** *L.*, *Syst. Nat.*, XII, ed. 1735, (?) p. 657.
carolinensis *LATR.*, *Gen. Crust. Ins.*, I, 1806, p. 175.
 aberr. **splendida** *Dokht.*, *Spec. Cic.*, I, 1882, p. 46.
 aberr. **boisduvali** *Gistl.*, *Syst. Ins.*, I, p. 7.
 aberr. **mexicana** *Gray*, *Anim. Kingd.*, I, 1832, p. 263, pl. 29, f. 1.
 aberr. **maculicornis** *Cast.*, *Rev. Silb.*, II, 1834, p. 28.
 aberr. **mexicana** *Chev.*, *Col. Mex.*, No. 25.
 I subsp. **chevrolati** *Chaud.*, *Bull. Mosc.*, 1860, IV, p. 334. This form belongs to *T. carolina* and not to *T. infuscata* *Mann.*
 II subsp. **cyanides** *Bat.*, *Biol. Cent. Am.*, I, p. 1.
 79. **virginica** *L.*, *Syst. Nat.*, II, 1735, p. 657.
virginata *L.*, *Syst. Nat. Gmel.*, I, 4, 1788, p. 1922.

III. NEOMANTICHORIDÆ *W. Horn*, *Deutsch. Ent. Zeitschr.*, 1898,

Suppl., p. 16.

Amblychilina *CSIKI*, *Math. Nat. Ber. Ungarn*, XVIII, 1900/2, p. 124.

Amblychila *Say*, *Journ. Ac. Sc. Phil.*, III, 1823, p. 139.

Chaleposomus *CHAUD.*, *Bull. Mos.*, 1860, II, p. 337.

80. **baroni** *Rivers*, *Ent. Am.*, VI, 1890, p. 111; *W. Horn*, *Deutsch. Ent. Zeitschr.*, 1902, pp. 179, 190, 196; 1903, p. 97. *Sonora* (*Arispe*).

In regard to localities, unnamed varieties and citations in literature I refer to my first paper: *Deutsch. Entom. Zeitschr.*, 1897, p. 161.

* *T. infuscata* *Mann.*, in all probability does not occur in Mexico.

Of the above noted eighty species of Cicindelidæ thirty* occur in the United States, four species (*Cicindela trifasciata* F., *flavopunctata* Chev., *carthagenæ* Dej. and *Tetracha carolina* L.) are known from the United States, Mexico and countries south of Mexico. The species with the widest geographical distribution is the last one, which runs down to the north of Chile. The four tropical genera (*Ctenostoma*, *Hiresia*, *Beckerium* and *Odontochila* represented all together only by five species!) belong all to the extreme south of Mexico (south of Vera Cruz).

THEORY AS TO EVOLUTION OF SECONDARIES OF MOTHS OF THE GENUS CATOCALA.†

ARCHIBALD C. WEEKS.

The conspicuous beauty of the secondaries of the members of this genus, the delight and admiration of every collector, is so wonderfully and handsomely differentiated from that of their plainer congeners of the noctuidæ as to entitle it to some speculation as to its origin. Although there is something to admire in the colorative arrangement of the subdued and modest hues of the species of allied genera, nevertheless, in both primaries and secondaries of the latter prevail shades ranging from black, brown, pale yellow, red, green and gray to white, all calculated to make their wearers invisible by reason of their more or less perfect blending with the color scheme of earth, rocks, and dead or living vegetation, and so escape observation of enemies and perpetuate their species. The *Catocala*, however, though provided with primaries similarly marked and obviously for the same purpose yet possess secondaries adorned with brilliant red, scarlet, magenta, pink, yellow, blue, black or white, as startling a contrast of vestiture as could possibly be imagined. Instead of a coloration developed along the lines of agreement or identification with environment we here find one which apparently scorns concealment and openly and

* 29, if *Cicindela sommeri* Mann. would not belong to the fauna of the United States.

† Read before the Entomological Department of the Brooklyn Institute of Arts and Sciences, February 26, 1903, and Brooklyn Entomological Society, April 2, 1903.

boldly declares its owner, inviting attention and daring and braving attack and capture. Such coloration by way of distinction may be termed "aggressive or hostile" as opposed to passive where the colors copy and blend with surrounding objects, the terms "aggressive" and "passive" being understood to be merely relative and to imply no special consciousness or instinct. It would seem a fair question to ask what environment or circumstance of natural selection could have produced a decoration so variant and which must necessarily have been acquired under substantially the same conditions as that of other noctuids. Although North America is virtually the home of the *Catocala*, species of this genus, or at least species having a similar scheme or plan of maculation occur almost universally, among which may be mentioned the *Ophiderides* of India and Java, while hosts of unrelated genera also possess lower wings far more attractive and conspicuous than the upper, and, therefore, whatever theory may be offered in explanation of this characteristic in the *Catocala* would apparently apply equally to the others. Since the problem of the origin of aggressive coloration does not appear at first glance to be directly demonstrable, a more satisfactory method of solution may be obtained indirectly by considering the circumstances under which certain forms of the secondaries have been developed and the uses to which they are applied, since, however remarkable the contrast of hues between the upper and lower wings, it is not more peculiar and surprising than the apparently abnormal secondaries of many other groups of lepidoptera to which tails are attached, moderately among the papilios, graptas, theclas, certain hesperians and many others, or extraordinarily, as in the case of *Actias luna* and allied species. The theory has been advanced and it seems quite a reasonable one that development by prolongation of the lower wings in the form of tails, abnormal and apparently unnecessary as it is, is really a factor of high value as a means of preservation of an insect from destruction by its enemies. Again and again may predatory bat or bird, in an effort to capture a moth or butterfly, successively tear away sections of the tails, of which a sacrifice can be readily afforded, without disabling it or retarding its flight.

The abnormal development of these appendages or tails seems to have originated from the fact that whenever, in the course of natural variation, certain individuals have been congenitally provided with secondaries unduly enlarged, these individuals by reason of being pos-

possessed of more wing to sacrifice had just so much more chance to escape, while those possessed of abbreviated wings would in the ordinary course of existence be first destroyed, and consequently those individuals inheriting a tendency to enlargement of the secondaries would be most likely to survive and transmit their structural peculiarities to their descendants until the character became fixed and permanent. Such development, of which the secondaries of the luna moth are an example, is directly opposed to the common understanding that wings should be as compact as possible without unnecessary appendages and thus facilitate escape by rapid flight. If, therefore, it be deemed reasonable and well proved that aggressive formation has developed through its protective qualities, why is it not quite as reasonable to assume that aggressive coloration has originated under similar circumstances and for a similar purpose, viz.: to divert the attention of a pursuer to the conspicuous, vividly-colored, attractive-appearing secondaries, whereby the plainer, uncolored and unattractive but vital parts escape injury. This result would undoubtedly be obtained along the lines of natural experimental variation and varietal production, those individuals having brighter, more striking, or more attractive-appearing secondaries being most likely to escape for the reason that the attention of an enemy would ordinarily be diverted to these showy but non-vital portions, and, as in the case of the luna moth and other species with tailed secondaries, the individuals thus escaping would be enabled to propagate and so bequeath their excess of coloration for fuller development. In the course of a long series of generations a constant elimination of the duller-hued individuals as being the first captured and an equal survival from capture of the brighter forms would inevitably tend to the abnormal development of highly colored secondaries such as we find in the members of the genus *Catocala* to-day, and will, I think, be accepted as a reasonable solution of the origin of the extraordinary and apparently inexplicable departure in coloration of the members of this genus from those of kindred genera. The fact that there are now so many species, all variant in color and maculation by bands or stripes, works no contradiction to this theory. Granted that in the far distant past there was a primitive ancestor in whose secondaries slight suggestions of bands might appear, it is easy along the lines of development to obtain more pronounced variations, and the several species are simply the variant forms which always arise under favorable or unfavorable environ-

ments, including supply, scarcity and variety of plant food, temperature, interbreeding, etc.

The above conclusion that the conspicuous colors of the secondaries are useful in diverting attention from the more vital parts seems to be confirmed by the habits and incidents in the life history of the *Catocala*. During the day these moths securely screen themselves from observation by selecting resting places more or less hidden on the bark of trees or other objects, the color of which is best adapted to harmonize and blend with the twilight shades of the upper wings, and with which they cover and conceal their prominently marked lower ones. At night, however, unless resting or sated with juices, this practice is almost always reversed, and the brilliantly hued lower wings are displayed to their utmost extent, rendering them in contrast with their surroundings visions of surpassing and impressive beauty. These colors could not have been developed in vain, and although except by artificial means we are denied the pleasure of beholding them, we must remember that in the lower world there are myriads of eyes whose powers are far superior to our own and it is not credible that the joyous colors of the day are forbidden them when the sunlight has vanished. A further confirmation of the theory is furnished by the fact that one of the most discouraging features in collecting these moths is the difficulty of obtaining specimens the secondaries of which are perfect. It is a common experience to find either one or both of these wings badly marred, mutilated, or partly missing, while the primaries are almost invariably intact. The freshest as well as the eldest specimens are equally thus injured, which certainly affords strong evidence that the secondaries are chiefly the objects of attack.

An exception to the concealment of the secondaries may be noted which still further confirms the above theory as to their origin and development. Should the insect be compelled, by reason of lack of suitable ground, trees, rocks or other similar objects whereon to rest and match the sober markings of the fore wings, to light among the grass, weeds and leaves where there are myriad streaks or bands of light and shade it will often, especially of the yellow-banded species, drop down with the wings partially opened as if by the exhibition of its own stripings to match its surroundings. Within a short time, however, it will crawl closer to the ground beneath the sheltering grass and other herbage and there fold its wings. A genus of small

moths closely allied to the *Catocala* is *Syneda*. Insects of this genus have pale yellow, transversely marked secondaries. Their habitat and methods of concealment also furnish suggestions as to the origin of this method of maculation by stripes as a protective character by coincidence with environment. These moths occur in sandy localities where there is practically, to the ordinary view, but little opportunity for concealment, the surface of the ground being principally bare and interspersed with patches of stunted and sparse vegetation not more than a few inches in height, and strewn around which in different directions lie masses or little heaps of dead grass, or other fragments of withered plants. The moth generally rests upon the ground in close proximity to small sticks, stones or where the darkened sand and earth correspond more nearly with the general coloration of the fore wings. Its most common attitude at the moment of alighting is with wings expanded so as to match their stripings and maculation with the mottled and banded appearance presented by small differently colored stones and grass. Shortly afterward the fore wings slowly close over the hind wings which still better match the surroundings and render the moth invisible to the ordinary eye. The stripings on all animals are a characteristic, generally admitted to be useful in concealment from observation, as the vertical stripes on the zebra, tiger, etc., which correspond with the alternate lights and shadows of closely standing tree trunks or small stems of canes and other tropical vegetation. In the same way many of the moths which frequent grassy fields as the arctians, for instance, have wings striped longitudinally with the evident intent of matching the light and dark hues caused by the appearance of the light spaces between the plant stalks. We may fairly infer therefore that the ancestor of the *Catocala* was an insect which originally acquired its protective stripings merely for the purpose of concealment by harmonizing and blending with its environment, and that aggressive coloration was a subsequent acquisition which was improved and encouraged in the same proportion as its value as a protective factor increased.

We have still another form in various other families where the secondary is provided with a large and prominent ocellus or eye-shaped figure. Whether this be for the purpose of counterfeiting the eyes of some predatory bird or animal and thus causing fear or whether these pronounced eye-like spots are useful in diverting the attention of an enemy, might afford a question for discussion, but according to

analogy I should prefer the latter, and for this form of protective development I would coin a third term "aggressive maculation."

We have then six terms to express protective development, viz., passive or negative formation, maculation and coloration, and active, aggressive or hostile formation, maculation and coloration. For practical application of these terms we may confine ourselves to the lepidoptera. Among the noctuids in general, omitting the genus *Catocala* the entire family depends for concealment upon the two last divisions of the first class, viz., passive or negative coloration and maculation, while certain of the graptas by folding their wings with deeply indented margins furnish examples of all three divisions. Moths like the *Actias*, as our native luna, furnish examples of both passive coloration (in that the wings are of a delicate green shaded with white resembling many large leaves) while the projection rearward of its secondaries furnishes an example of aggressive formation, being thus doubly protected whether at rest or in flight. The *Catocala* are also doubly protected, but in a different way, the fore wings furnishing examples of passive coloration and maculation while the hind wings are models of aggressive coloration except in cases where they are employed under circumstances above named to blend with the alternate shadings of grass stalks and other herbage. The aggressive formation of the *luna* is for protection during flight while the aggressive coloration of the *Catocala* is principally for protection while at rest. It would be an interesting as well as an instructive exercise to examine the wing structure, coloration and maculation of numerous species and endeavor, in connection with such knowledge as can be gained concerning their life-histories, to trace the causes which probably produced the variations of each, in accordance with the classification above prescribed, taking into consideration nevertheless that all deductions are necessarily limited to such meager inference and knowledge as we may chance to possess of the varying environments to which previous generations have been subjected through myriads of ages. It must also be conceded that no result has been without object, but that every form with its accompanying shades and patterns of color has been evolved for a definite purpose in the course of the pitiless struggle for existence since the beginning, and remains more or less permanent though the circumstance which promoted its origin may have long since passed away.

ADDITIONS TO THE LIST OF NEW YORK PENTATOMIDÆ.

BY NATHAN BANKS.

Mr. Torre Bueno's article on Pentatomidæ near New York induced me to look over my collection of these insects, many of which were taken at or near Sea Cliff, L. I., my former home. I see that I have taken there all the species Mr. Torre Bueno lists except *Mineus bioculatus*. In addition there are several forms, some of which are not common.

Stiretrus anchorago *Fabr.*

One specimen taken at Roslyn several years ago.

Dendrocoris humeralis *Uhler.*

One specimen from Bayville Beach, May. I might mention that in Dr. Smith's New Jersey list this species is under two names; once as above, and again as *Liotropis humeralis*. *Liotropis* Uhler was pre-occupied, so Bergroth in 1891 proposed to change it to *Dendrocoris*.

Perillus circumcinctus *Stål.*

One specimen, taken years ago at Roslyn. *P. exaptus* is much more common, and overwinters as adult.

Podisus serieventris *Uhl.*

From Sea Cliff, March, May and August.

Banasa calva *Say.*

Specimens from Harbor Hill, July; and Sea Cliff, March and July.

Lioderma (Pentatoma) saucia *Say.*

This species occurs at Sea Cliff and vicinity in salt-grass meadows, in company with *L. senilis*, which is the more common.

Lioderma (Pentatoma) ligata *Say.*

One specimen from Sea Cliff, in August. The insect is common a little farther north.

Murgantia histrionica *Hahn.*

I have not seen this from Long Island, but in the past few years it has been recorded several times from near Jamaica, L. I., on cabbages.

NOTE ON PENTATOMIDÆ.

BY J. R. DE LA TORRE BUENO.

In looking up authorities for a paper I have in preparation, I find that my unfamiliarity with the synonymy of the Pentatomidæ betrayed me into two errors in my paper on "The Pentatomidæ within Fifty Miles of New York," published in the September number of the JOURNAL. I made the statement in it that I had added a genus and a species to Prof. Smith's New Jersey List, viz., genus *Pentatoma* and species *Mineus strigipes* H.S. This, however, is erroneous, as *Pentatoma*, auctt. is the same as *Liederma* Uhl.; and *Mineus strigipes* H.S. is the same as *bioculatus* Fab. Will you kindly have this correction appear in the forthcoming JOURNAL, so that matters may be straightened out and the responsibility for this slip put with me, where it belongs?

ON THE SLEEPING HABITS OF SOME ACULEATE HYMENOPTERA.

BY CHARLES T. BRUES.

Recently, while looking over a series of papers by Mr. E. A. Schwarz, published some years ago, my attention was called especially to some interesting observations made by him (Proc. Ent. Soc. Wash., Vol. IV, 1, p. 24) on the sleeping habits of certain aculeate hymenoptera.* These recall very forcibly some similar observations which Mr. A. L. Melander and myself have made at scattered intervals in various parts of the country, and as ethological notes relating to the sleep of insects are rather rare in our literature, I think these are worthy of record.

The first instance relates to the common black digger wasp, *Priononyx atrata*, which is very abundant in the country about Chicago, Ill. One evening just at dusk, while collecting insects along the shore of Lake Michigan, I noticed a large sturdy specimen of the sweet clover (*Melilotus alba*) which had a considerable number of black objects clinging to the thicker portions of its branches. Just then a specimen of *Priononyx* flew wearily up to the bush, and after a second or two quietly settled down on one of the twigs among the other black objects which investigation showed to be also members of the same species. All were very loath to move and twenty-five or more wasps

* Banks (JOURNAL N. Y. ENT. SOC., X, 209) has also described the sleeping habits of some other species.

were easily picked off with the forceps before the others became aroused and gradually flew away to seek another resting place. Wasps of both sexes of this single species were represented among the captured individuals. This same species of sweet clover, which is very abundant in northern Illinois and is much sought for by various Aculeata during the day, was the center of the second observation which we had occasion to make in McHenry Co., Ill. This time several species were commingled upon the same plants. Among them were *Epeolus lunatus*, a parasitic bee; *Scolia bicincta*, *Mysson plagiatus*, a species of *Tachytes* and some other smaller wasps. In this case the *Epeolus* was the predominating form, at the hour when the plants were examined, which was just about at sundown.

It may, I think, be properly asked whether the strong scent given off at all times by the clover attracts the insects or whether they simply settle down upon the plants which they have frequented during the busier hours of the day. The fact that the *Priononyx* are not often seen on this plant in the daytime and the large numbers congregated on one bush at night would lead one to believe that they are attracted by the plant's odor as well as by the presence of their fellows which have already settled there.

Indeed each species usually has its own preference as to sleeping plant. In the case of the Texan *Scolia lecontei*, this is a species belonging to the Umbelliferae. On any warm spring evening shortly after sunset one can collect numbers of the male *Scolias* resting upon or below the older umbels whose inflorescence has passed away. In nearly all cases the wasps rest with the head down; in this position their bodies harmonize well with the plant and they are not at all conspicuous. Whether this is why the same plant is always chosen would be more difficult to say. As they leave the brilliant red and yellow flowers of *Lepachys columnaris* severely alone, although resting upon these the similarly colored *Scolias* would be much more neatly concealed, it seems that concealment cannot be the cause of the choice.

In the common *Myzine sexcincta*, another scoliid wasp, gregarious resting habits can be observed not only late in the evening but in the middle of the day. In southern Illinois one hot day in August I noticed upon a small dried plant of a species of wild pink a large number of the males of the *Myzine* resting so thickly upon its stem and branches that they gave it a brilliant color with their con-

spicuous black and yellow bodies. A single sweep with an insect net captured some sixty or more specimens while a cloud of others flew away on being disturbed. I have also noticed similar groups of *Myzine* resting in the daytime in Massachusetts, but never so large a number on a single plant. An explanation for the gregarious habits of the male *Myzine* can readily be made when it is recalled that as the males seem to be more numerous than the females, the greater proportion of the males probably never take any active part in the economy of the species.

NEW NOCTUIDÆ FROM TROPICAL AMERICA.

BY WILLIAM SCHAU.

Lycophotia microstigma, sp. nov.

Head and abdomen grayish-buff. Collar buff posteriorly and also thorax dark lilacine brown. Primaries lilacine buff, thinly irrorated with dark scales, basal half of subcostal broadly creamy white, posteriorly shaded by dark velvety brown, which is cut by a white line crossing to base of vein 3, the brown in cell is interrupted by the orbicular which is large, round, lilacine white; the reniform small, consisting of a dark brown point beyond a lilacine white lunule; an outer curved row of dark points; some brown, shading beyond cell, and on outer margin above angle, and above vein 4; terminal triangular black spots between the veins; fringe light brown at base, terminally buff. Secondaries white; a dark interrupted terminal line. Expanse 28 mm.

Habitat: Castro, Parana.

Mamestra viriditincta, sp. nov.

Head and thorax mottled fawn color and brown. Abdomen gray with brown subdorsal tufts and lateral fawn tufts. Primaries fawn color; base of inner margin dark brown; a dentate black basal line followed by a dark patch on costa; inner line black, angled below orbicular; median space dark olivaceous mottled with black; spots large, vague, partly outlined with black and containing olivaceous scales; outer line fine black, followed by some black points on veins; outer margin mottled with olivaceous and black; terminal black points; fringe fawn color spotted with black. Secondaries white; some brown on outer margin, and the ends of veins dark. Expanse 30 mm.

Habitat: Castro, Parana.

Mamestra flavidentula, sp. nov.

Head and thorax gray; black lines on tegulæ and patagiæ. Abdomen blackish-gray. Primaries gray, mottled with brown, in, beyond and below reniform; black geminate basal lines on costa, a black streak at base of median, and another near

base of inner margin; inner line irregularly curved, geminate, outwardly black, inwardly brown; beyond inner line the veins are finely streaked with black; spots finely circled with black; median shade thick, black on costal margin and above submedian where it suffuses with the outer line; otherwise median shade is brownish; below the orbicular a black dentate line from inner line to median shade; outer line strongly dentate, blackish, fine; a series of black dashes between the veins on outer margin, each dash interrupted by a yellowish-white spot; fringe gray spotted with black. Secondaries white suffused with gray, darkest along outer margin; a discal spot; fringe white, divided by a black line. Expanse 40 mm.

Habitat: Chili.

Mamestra goniophora, sp. nov.

Head and thorax olivaceous brown. Abdomen dark gray; a subdorsal white tuft at base. Primaries dark olivaceous, markings pure white; a broad line at base, not reaching inner margin; an inner row of spots large on costal and inner margins; orbicular small, round; reniform large, irregular, surmounted by a white spot on costa; an outer row of points, very irregular; three small spots on costa towards apex; three larger spots at apex; four spots on outer margin between veins 2 and 5; a small spot at inner angle. Secondaries dark brown; costa whitish. Expanse 25 mm.

Habitat: Castro, Parana.

Mamestra paranica, sp. nov.

Head and thorax gray; the patagiæ edged with brown dorsally. Body grayish-brown. Primaries: veins steel-gray; base olivaceous; basal line black, outwardly white; inner line black, irregular, inwardly shaded with white; orbicular whitish, also a spot below it, and a space above it on costa; median space olivaceous, partly edged with black; reniform large, indistinct, dark gray and olivaceous; a finely lunular black outer line, the lunules filled with gray; outer space mottled olivaceous and gray, with some black spots and followed by the subterminal, which is wavy, white; outer margin gray, mottled with olivaceous; black terminal spots; fringe white and olivaceous. Secondaries whitish at base, otherwise dull brown; fringe white. Expanse 36 mm.

Habitat: Castro, Parana.

Himella nigripars, sp. nov.

♂. Head, thorax and primaries light brown. Abdomen dorsally and secondaries darker brown. Abdomen ventrally and anal tuft light brown. Primaries thinly irrorated with black scales; lines fine, darker; basal and inner lines wavy; outer line crenulate, followed by a row of black points on veins. Reniform partly outlined with black; an oblique black median line from costa to reniform, then as a brown shade to middle of inner margin; a pale subterminal line; black terminal points. Secondaries with black terminal points; a small discal point.

The female is darker, the lines distinctly reddish-brown; the orbicular consists of a minute black circle; the reniform is whitish, finely outlined with black containing a gray point anteriorly and a larger gray spot posteriorly; the median shade is entirely reddish-brown; the black dots on veins are close to the subterminal shade which is

more wavy, and there are no black terminal points; a terminal pale line; fringe roseate, spotted with gray. Expanse, ♂, 34 mm., from Costa Rica. Expanse, ♀, 35 mm., from Jalapa, Mexico.

These two specimens have been identified by Sir George Hampson as belonging to the same species; personally I should consider them distinct.

Himella crocosticta, sp. nov.

Head, thorax, and primaries lilacine brown. Abdomen and secondaries dull brown. Primaries: lines fine, black, wavy; the outer line slightly curved; a median darker shade; reniform small, ochreous; a subterminal wavy dark shade; a pale terminal line; veins tipped with white; some white spots on costa at apex. Secondaries: a terminal dark line; base of fringe pale. Expanse 28 mm.

Habitat: Orizaba, Mexico.

Himella rubripuncta, sp. nov.

Head, thorax, abdomen below and anal tuft light reddish-brown. Abdomen above and secondaries blackish. Primaries dark reddish-brown; basal line darker, geminate on costa; inner line wavy, black; median shade darker, oblique from costa to reniform, then straight to inner margin; reniform small, red, posteriorly shaded with black; outer line black, wavy, followed by dark points; subterminal shade black; white points on costa near apex and at tips of veins; a terminal whitish line. Secondaries paler at base; a black discal spot; base of fringe whitish. Expanse 29 mm.

Habitat: Orizaba, Mexico.

Himella diplogramma, sp. nov.

Head, thorax and anal tuft buff; collar posteriorly shaded with light reddish-brown. Abdomen dull gray brown. Primaries buff; an inner and a median short brown streak on costa; six black spots beyond middle of costa; inner margin violaceous brown; a median violaceous brown shade angled at reniform, followed by some fine dark streaks; orbicular as a black point; reniform large, dark gray, widest posteriorly; an oblique dark band from vein 2 to outer margin below apex, partly divided by a pale line, and preceded by some black streaks; a few black irroration on outer margin; fringe buff spotted with brown. Secondaries thinly scaled with brown gray. Expanse 28 mm.

Habitat: Las Vegas, Mexico.

Himella ignescens, sp. nov.

Head, thorax and abdomen below lilacine brown. Abdomen above blackish; anal tuft light brown. Primaries dark violaceous red; the reniform brighter red; no lines visible, only a darker irregular subterminal shade; a terminal pale line; fringe dark gray. Secondaries dark grayish-brown; a dark discal point; fringe light gray, partly divided by a dark gray line. Expanse 24 mm.

Habitat: Orizaba, Mexico.

Himella goniostigma, sp. nov.

Palpi inwardly, head and collar buff. Palpi outwardly, vertex and thorax dark brown. Abdomen grayish-brown. Primaries brown shaded with buff near base, in cell, and before subterminal line; a dark space at base crossed by basal line; inner line dark, geminate, oblique from costa to median, then wavy to inner margin; median shade dark, visible on costa and inner margin; orbicular dark, oblique; reniform large, dark velvety brown, edged with pale buff, constricted and broader posteriorly; outer line from middle of costa sharply curved around reniform, pale, preceded by small velvety brown spots between veins 3 and 7, and followed by a geminate row of dark points on veins; subterminal pale, nearly straight, inwardly edged with reddish-brown; the outer margin dark grayish-brown; terminal black points between the veins; fringe light brown with two darker lines. Secondaries whitish along inner margin, otherwise dark gray; a dark discal point. Expanse 27 mm.

Habitat: Guadalajara, Mexico.

Himella ochrota, sp. nov.

Body grayish-brown. Primaries light brown, irrorated with gray scales, chiefly on costal and outer margins, the latter being quite dark; the subterminal heavy, velvety black from submedian to vein 7; orbicular round, circled with dark gray; reniform broad, inwardly and outwardly shaded with dark gray, also with white outwardly. Secondaries whitish, the veins dark; gray irrorations along costa; a black discal spot, and a terminal black line. Expanse 28 mm.

Habitat: San Andres, Chalchicomula, Mexico.

Himella marginalis, sp. nov.

♀. Head, thorax and primaries very dark brown. Abdomen and secondaries dull dark brown. Primaries: traces of geminate and inner irregular black lines filled in with lighter brown; reniform large, indistinct, faintly outlined with lighter brown, and marked by four paler points; outer line fine, black, lunular, the lunules filled in with lighter brown, and followed on veins 2, 3 and 4 by a pale point between two small black dashes; a subterminal dark velvety brown spot between 5 and 6; the outer margin broadly gray, inwardly marked by two large whitish spots; a terminal black line; terminal black spots between the veins; fringe light brown spotted with black. Secondaries: a dark discal point; fringe light reddish-brown. Expanse 36 mm.

Habitat: Sao Paulo, southeastern Brazil.

Himella gigantea, sp. nov.

Head and thorax lilacine brown. Abdomen dark gray above; lilacine brown laterally; anal tufts yellowish. Primaries pale buff, tinged with lilacine on costal and inner margins and thinly irrorated with black; cell and outer margin tinged with light brown; a minute black spot in cell near base; inner line very fine, black, indistinct; orbicular small, reniform large, formed by a darker shade; outer line very fine, indistinct, followed by black points on veins; a subterminal fine brownish line; terminal gray spots between the veins; fringe light brown. Secondaries white; the costal margin and fringe buff; some black terminal points. Expanse 57 mm.

Habitat: Petropolis, Brazil.

Himella mediorufa, sp. nov.

Palpi and thorax reddish-brown. Head and abdomen dorsally brownish-gray; anal tuft ochreous. Primaries violaceous brown, irrorated with lilacine scales; lines paler, edged on either side with darker brown; the basal line indistinct; the inner line slightly curved; the outer line nearly straight; a slightly curved reddish-brown median shade separating the spots; the orbicular consisting of a circle of lilacine scales; the reniform larger, reddish-brown edged with lilacine scales; a dark, wavy, subterminal line; a terminal black line. Secondaries whitish; a small gray discal spot; an outer gray line; the outer margin broadly gray. Expanse 32 mm.

Habitat: Castro, Parana.

Himella leucopera, sp. nov.

Head, thorax and primaries lilacine brown. Abdomen brownish-gray above. Primaries: the lines and spots outlined with lilacine gray scales; costal and inner margins tinged with gray; the inner line outwardly curved below orbicular, which is round; the outer line outwardly curved beyond cell, inwardly curved below reniform which is large and slightly constricted, and this line is followed by geminate black points on veins separated by a lilacine point; subterminal pale, shaded with reddish-brown, and parallel with outer margin; an apical grayish spot; a dentate terminal pale line. Secondaries whitish clouded with gray at apex. Expanse 29 mm.

Habitat: Sao Paulo, southeastern Brazil.

Himella violascens, sp. nov.

Head, thorax and primaries lilacine brown. Abdomen above dark gray. Primaries: the spots, inner band, space between median shade and outer line, also the outer margin violaceous brown; a dark spot near base of cell; the inner line geminate; orbicular small, round; median shade close to reniform, which is large and faintly outlined by pale scales; outer line indistinct, geminate, followed by dark streaks on veins; subterminal fine, pale, dentate from apex to inner angle; a terminal black line followed by a pale line on base of fringe. Secondaries whitish at base, outwardly grayish; the veins gray; fringe buff, tipped with white. Expanse 32 mm.

Habitat: Guadalajara, Mexico.

Himella secedens, sp. nov.

Head and thorax lilacine brown. Abdomen above and secondaries dark gray; anal tuft fawn color. Primaries lilacine brown, thinly irrorated with black; lines very fine, black; basal line forming a black spot in cell; inner and outer lines partly edged with lighter brown; median shade dark, thick, chiefly visible on inner margin; outer line followed by a row of black points; a pale subterminal line edged with darker brown, slightly curved below costa, then straight to inner margin; a terminal pale wavy line; the spots large, formed by a pale line. Secondaries: a dark discal point; fringe roseate fawn color. Expanse, ♂ 32 mm., ♀ 36 mm.

Habitat: Castro, Parana.

Himella pallescens, sp. nov.

Head, thorax and anal tuft fawn color. Abdomen dull black above. Primaries lilacine fawn color, irrorated with black scales; lines very fine, black, indistinct; a black point at base of cell, and a similar point at orbicular; reniform large, consisting of a pale line inwardly edged with reddish scales, and with a black spot anteriorly and another posteriorly; a subterminal pale line; terminal black points; fringe at apex tipped with black. Secondaries dark gray; a dark discal spot; fringe pale. Expanse 32 mm.

Habitat: Sao Paulo, southeastern Brazil.

Himella azucara, sp. nov.

Head and collar light brown. Thorax dark brown. Abdomen and secondaries dull brown. Primaries light brown thickly irrorated with dark brown, the markings very indistinct; traces of dark basal, inner and outer lines; spots dark faintly outlined with light brown; the reniform marked by white spots on either side posteriorly; a faint pale subterminal line; fringe black, spotted with light brown. Secondaries: an indistinct discal spot; fringe paler, divided by a dark line. Expanse 37 mm.

Habitat: Sao Paulo, southeastern Brazil.

Conservula furva, sp. nov.

Head, collar and primaries reddish-brown. Abdomen above violaceous brown, the thorax somewhat darker. Primaries shaded with violaceous at base, on costa and beyond outer line, also the spots which are outlined with grayish scales; the orbicular small, oblique; the reniform large; the outer line angled on subcostal, then oblique to middle of inner margin, gray inwardly shaded with dark reddish-brown; the veins darker on outer margin; a darker brown subterminal shade edged with gray at costal margin; fringe violaceous. Secondaries whitish, the veins brown; a dark terminal line. Expanse 25 mm.

Habitat: Orizaba, Mexico.

Hydræcia pexa, sp. nov.

Head and thorax lilacine brown. Abdomen grayish-brown above. Primaries light brown; the base, orbicular, a spot below it, and subterminal shades ochreous brown irrorated with dark scales; inner and outer lines fine, black; median shade thick, dull brown; reniform large, white, with an ochreous spot and two dark brown lines; costal margin finely dark gray; outer margin dull brown; a terminal dark line. Secondaries gray; the veins brown. Expanse 32 mm.

Habitat: Oaxaca, Mexico.

Hydræcia cauta, sp. nov.

♀. Head gray. Thorax dark reddish-brown. Primaries blackish-gray; four small yellow spots on costa beyond outer line; a streak below costa, one in cell, the space below cell and a spot on inner margin all dark red, crossed by a fine inner lunular black line; reniform large, white, mottled with red; outer line fine, dentate, black, beyond which the wing is more brownish-red, crossed by a blackish subterminal

shade; a black terminal line, and a pale line on base of fringe, interrupted by white points. Secondaries dull brown; a dark discal point; fringe gray; at apex roseate, divided by a black line. Expanse 28 mm.

Habitat: Costa Rica.

Perigrapha dukinfieldi, sp. nov.

Head, thorax and primaries lilacine brown. Abdomen darker with pale tufts at base. Primaries thinly irrorated with black scales; lines very fine, brown, geminate; basal line wavy, followed by a dark point outwardly shaded with white in cell; inner line oblique to cell, then straight; orbicular a dark point inwardly shaded with white; median shade thicker, strongly angled on reniform posteriorly; reniform large, circled with buff, then outwardly shaded with reddish-brown, and marked with black posteriorly; outer line curved below costa, the outer portion punctiform from vein 5 to inner margin; an interrupted reddish-brown subterminal line parallel to outer line; a terminal black line preceded by black points. Secondaries dull brown; fringe roseate. Expanse 45 mm.

Habitat: Sao Paulo, southeastern Brazil.

SOME NEW NEUROPTEROID INSECTS.

BY NATHAN BANKS.

PSOCIDÆ.

Psocus genualis, sp. nov.

Pale yellow; head with a median shining brown spot on ocelli, a patch of brown each side behind, and a median one on upper part of nasus. Lateral lobes of thorax shining black. Abdomen marked with black. Legs yellow; tarsi dark brown, tips of femur and base of tibia marked with shining black. Antennæ large, reaching beyond tips of wings: yellow on base, darker beyond, short pilose. Wings hyaline, venation brown, the radius pale till near angle of pterostigma, the forking of radial sector and the posterior cross-vein closing the discal cell white; the median white on base, and the cubitus and anal white to tip, where there is a brown spot; a smaller brown spot at base of the pterostigma. The discal cell is almost square. Length to tip of wings 6 mm.

One specimen from Austin, Texas, June (McClendon). Distinguished by markings of face, and the black knees. Similar in many respects to *P. nova-scotiæ*, but with different markings.

Psocus slossonæ, sp. nov.

Head pale yellowish, nasus with vertical dark lines, partly obsolete above; labrum black; palpi black; antennæ with basal joints brown, then pale till near middle, beyond which it is blackish. Vertex with about eight brown roundish spots

each side, and several grouped into a figure at center about ocelli; mesothorax pale, with a median brown spot behind; similar spots on front and hind margins of metathorax. Legs pale; femur I banded with brown at middle and before tip, other femora banded near tip only; tibiæ with bands near base and near tip, sometimes indistinct; tarsi dark. Abdomen pale, marked with brown in uncertain manner from dried specimens. Wings hyaline, heavily marked with dark brown as follows: an incomplete basal band, a median band starting from near middle of costal margin and extending obliquely backward, in its posterior part with a hyaline spot; the apical half of the pterostigma brown, and a band reaching from it across the wing; the apical part of wing clouded with brown, but leaving clear spaces between the terminations of the veins; just basad of this band is a crescent of six black spots, one in each cell, the posterior ones forming eye-spots. There is also a patch of small black spots near middle of wing, and a couple near middle of posterior margin. The venation is mostly whitish or pale, except where the wing is dark, where the veins are also dark. Hind wings hyaline. Venation of true *Psocus*, the discal cell about twice as long as wide, and nearly equally wide throughout. Pterostigma rounded behind. Length to tip of wings 4.4 mm.

Specimens come from Franconia, N. H.; Ithaca, N. Y., September 1; and Falls Church, Va., July 12. Separated from all our other species by the ocellate markings in apical part of fore wings. It is apparently allied to the European *P. sexpunctatus*, but the wings are more slender, more heavily marked, etc.

***Psocus tolteca*, sp. nov.**

Head entirely yellow; antennæ black; palpi black; thorax and abdomen black, the latter indistinctly banded with pale on base; legs dark or black, the femora sometimes paler than the other joints. Wings hyaline, with a large basal black mark, a black V-mark, and an apical black band reaching base of the V-mark. This marking is thus like that of *P. nigrofasciatus* Prov., but the apical mark extends to the margin on the veins, leaving a clear space between veins. The wings are more slender than in that species, and the head is wholly yellow. Length 6-7 mm.

Many specimens from Guadalajara, Mexico.

***Peripsocus fumosus*, sp. nov.**

Pale yellowish-brown without distinct markings; the ocellar spot shining black and two faint marks behind; the lobes of thorax darker in middle than on the sides. Antennæ dark, rather large, pilose. Legs pale brownish, the femora above, and the tarsi darker brown; abdomen dark brown. Wings uniformly dull blackish, with a minute white spot at tip of posterior branch of median vein. Venation blackish; hind wings not so heavily fumose. The radial sector forked just above the last fork of the median vein. Length to tip of wings, 3 mm.

Two specimens from southwestern Colorado (Osler).

***Peripsocus californicus*, sp. nov.**

Head pale, nasus brown, vertex with two brown spots; thorax and abdomen marked with brown; antennæ pale, basal joints reddish; legs pale. Wings hyaline,

with ten small brown spots, as follows: one at base and one at apex of pterostigma, one at connection of radial sector with median, and one at the termination of the each of the seven veins. Wings slender; pterostigma three times as long as wide, equally wide throughout, radial sector and median meeting at but one point which is fuscous; no posterior cell; fork of radial sector nearer base than last fork of the median; venation yellowish and brown in fore wings, brown in hind wings. Length to tip of wings 2 mm.

Several specimens from Berkeley, Cal. Easily known by the ten dots on wings.

Cæcilius pinicola, sp. nov.

Pale yellow throughout; a reddish spot each side of ocelli; antennæ rather heavy and brown. Wings pale yellowish, venation of same color. Wings slender, pterostigma long, rounded off behind; radial sector and median vein united for about the width of a cell; radial sector forked before the second fork of the median vein; posterior cell half-elliptical. Length to tip of wings 2.5 mm.

Several specimens from Falls Church, Va., October 10, in pine trees. Appears to be related to *C. aurantiacus*, but separated by lack of black posterior venation, and duller colored wings.

Ptilopsocus annulicornis, sp. nov.

Head yellowish, vertex blackish in the middle, nasus pale, clothed with many short white hairs; eyes prominent; antennæ very hairy, reaching tip of the body, each segment white on basal third, rest black; thorax rufous, darker on the sides; abdomen dark. Wings hyaline; pterostigma, posterior cell, and tip of wing, brown; tip of hind wings faintly brown; venation very hairy. Venation and shape of wings

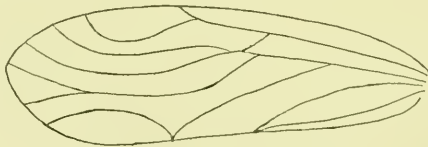


FIG. 1. *Ptilopsocus annulicornis*. Venation of wing.

very much like *P. griseolineatus* Enderlein. The pterostigma very long, and rounded behind; the radial sector forked close to base; the median vein with but one fork which is toward tip of wing, beyond end of pterostigma, the posterior cell is very large, elongate, larger than the pterostigma. The legs are pale, the hind femora dark at base. Length to tip of wings 4 mm.

One specimen from Falls Church, Va., June 8. The four species of this genus all come from Peru, and its discovery in the United States is of much interest.

CHRYSOPIDÆ.

Leucochrysa punctata, sp. nov.

Head pale yellowish; antennæ pale yellowish; pronotum pale, with a brown dot each side toward the margin, rest of thorax pale, dark at base of wings; legs pale;

abdomen pale, brown towards tip. Wings hyaline, pterostigma in both pairs very distinctly brown; venation mostly pale, many of the cross-veins dark at ends, both gradate series brown. Divisory veinlet of the third cubital cell starts near the lower end of the cross-vein; wings rather broad and rounded at tips. Length to tip of wings 15 mm.

Two specimens from Guatemala. A very distinct species because of the prominence of the pterostigma in all wings and the two brown dots on pronotum.

***Chrysopa aztecana*, sp. nov.**

Face yellowish, a black semicircle along base of clypeus; basal joints of antennæ pale, beyond deep black; palpi black, narrowly banded with pale, vertex pale, with a median line and a reddish spot each side; pronotum pale, brown on sides; rest of thorax pale; abdomen brown. Wings hyaline, pterostigma not marked; venation brown, except the subcosta, radius, and median veins, which are pale. Two series of gradate veins in both wings; divisory veinlet ending beyond the cross-vein. Wings rather narrow, and acute at tips in both pairs. Length to tip of wings 15 mm.

One specimen from Truxpan, Mexico, September 5 (McClendon).

SIALIDÆ.

***Corydalis texana*, sp. nov.**

General color luteous, blackish around ocelli, two punctate streaks behind scarcely paler, pronotum with the hastate and lateral scars hardly paler than general surface; antennæ blackish, basal joints yellowish; legs yellowish, darker on base of tibia and on tarsus. Wings with one white spot in each costal cell, the latter very regular in size, many white dots scattered through the other cells; forkings and cross-veins mostly black; costal cross-veins black at ends, longitudinal veins yellow, a few small indistinct clouds in some cells, the pterostigma scarcely infuscated. Head not very broad, in both sexes with a tooth behind eye; male mandibles but little longer than those of female, their greatest length hardly equal to length of head, without a free tooth at base of the apical part or fang. Superior male appendages not very long, incurved, and twisted toward tip; inferior appendages upturned and clavate. Length from tip of mandibles to tip of wing but 48 mm.; expanse of wings 76 mm.

One pair from Laredo, Texas, August 13 (McClendon). Separated from all others by small size, small mandibles, and especially from *C. cognata* by absence of a subapical tooth to male mandibles, and by the pale color of the scars on pronotum. Mr. Davis in his recent monograph of the Sialidæ has described a species from Ithaca, N. Y., as *Chauliodes concolor*; it differs, according to table, from *C. angusticollis* in having black instead of brown antennæ. No other differences are given in the description. I have specimens from Ithaca which have brown antennæ. This difference, I think in this family, is not worthy of the barest notice; certainly it is not of specific value, and *C. concolor* is equal to *C. angusticollis*. I also think that Mr.

Davis's *Sialis morrisoni* is only a specimen of *S. nevadensis* not fully colored. The two species were collected at same place on same date by same party.

MYRMELEONIDÆ.

Dendroleon pumilus *Burm.*

This species does not seem to have been noted for many years. Hagen in his "Stray Notes" does not treat of it. I have one specimen from Lake Worth, Florida, which may be described more fully than the early accounts, as follows:

Head black, a pale transverse line from eye to eye above antennæ; pronotum jet black, with a prominent white spot each side on the anterior margin; thorax black, sutures on pleura white; abdomen black, a prominent white spot near middle of each segment, and tips of third and fourth segments white on the sides; legs black, knees, middle of tibia and two bands on tarsus white, provided with erect white bristles. Wings hyaline, veins black, longitudinal ones mostly interrupted with white, each fore wing with about eleven prominent black spots, six along radius, between it and the subcosta, one half way out on cubitus, one at fork of cubitus, two on upper fork of cubitus, the last under last of radial series, and one at end of lower fork of cubitus, where it meets the anal vein; hind wings unmarked, venation brown. Prothorax slender, legs slender, tibial spurs as long as first two joints of tarsus; abdomen slender, reaching scarcely to tip of hind wings. Anterior wings rather broad before tip, scarcely falcate at tip; hind ones narrower, but as long as fore wings, and rather more falcate at tips. Anal vein ends as far out as origin of first fork of radial sector; and in hind wings, the anal vein does not go beyond fork of cubitus; in fore wings are three cross-veins basad of radial sector, in hind wings but two. Length 20 mm.

Readily known from *D. obsoletus* by smaller size, smaller spots on wings, absence of marks on hind wings, and color of head, thorax, and legs, as well as the presence of marks on the abdomen. It agrees with that species in all essential points of venation, but being smaller, has not as dense venation, especially in apical part.

Brachynemurus dorsalis, sp. nov.

Face yellowish, a dark brown interantennal mark, concave below, a pale transverse band from eye to eye above antennæ; vertex brown, with a small pale band on posterior margin not reaching the eyes. Antennæ brown, annulate with pale, basal joints pale. Pronotum brown on sides, with a broad, pale median stripe, rather broader in front than behind, continued back on thorax, but rather broken by median marks; lateral lobes brown, with a pale dot just above base of wings; mesoscutellum with a median brown stripe; legs pale, the femora dark brown near tips, especially on outer side, tibia with a narrow band near middle and one at tip, and tarsus with two dark bands. Abdomen dark brown, unmarked. Wings hyaline, veins brown interrupted with pale, a distinct brown dot at tip of upper fork of cubitus toward

outer margin of wings, and another at end of lower fork near end of anal vein. Wings rather narrow; but few costal cross-veins forked; venation on usual plan. Length 27 mm.

Laredo, Texas (McClendon). Similar in appearance to *B. longicaudus* but markings of head, pronotum and legs entirely different.

Myrmeleon mexicanum, sp. nov.

Head black, shining below antennæ and the scars on vertex; lower part of face pale yellowish as well as along eyes; pronotum brown, with a pale yellowish spot at each anterior corner, and sometimes two near the middle; rest of thorax gray-brown, abdomen same color, last segments partly pale; legs pale yellowish, marked with black, femora with a long black spot above near tip; tibia with a black spot before middle, and a band at tip; the tarsi tipped with brown. The pale parts of the legs are not dotted. The black spot on middle femora is larger than the others. Wings hyaline, the longitudinal veins (except anal) interruptedly yellow and black, other veins black; pterostigma small, white. Length 35 mm., expanse 74 mm.

Several specimens from Guadalajara, Mexico (McClendon).

It differs from *M. abdominalis* in not having black dots on the pale parts of the legs, and no pale spots on abdomen, except at tip. It differs from *M. occidentalis* in having the hind femora pale, with only a black patch above and more white on face.

TRICHOPTERA.

Glyphotælius bellus, sp. nov.

Face and vertex brownish, with short grayish hair, posterior margin with longer erect hair; antennæ yellowish, basal articles rather long, ocelli small, vertex flat; prothorax short, with long yellowish hair; meso- and metathorax yellowish, with a black stripe each side; abdomen brown; legs yellow-brown, spines small and black. Anterior wings yellow in anterior half, brown on posterior half, a long silvery streak in thyridial area nearly to base separates the two parts, this crosses the anastomosis and extends into fifth apical cell for one third its length; another silvery streak in fourth apical cell nearly to base; the outlines of these streaks are very clear near anastomosis; another hyaline streak in apical part of first subapical cell; a faint trace of a silvery streak along posterior edge of radius. Pterostigma rather darker than its environment; venation yellowish. Wing long; posterior apical margin plainly excised; pedicel of discal cell as long as cell; second and fourth apical cells broad at base; radius at pterostigma curved. Hind wings hyaline; the third, fourth and fifth apicals extend nearer base than others; a black dot in base of third. Length to tip of wings 26 mm.

One specimen from Nanaimo, British Columbia, September 3 (Taylor). This species differs much in appearance from *G. hostilis*; the incision of apex of wings is an even one, and the wings are much narrower; the basal joints of the antennæ are not as long, and the prothorax is shorter.

Homophylax nevadensis, sp. nov.

Pale yellowish, head and thorax unmarked, clothed with yellow hair; abdomen brown toward tip; legs with black spines and yellow spurs, latter 1-2-2; antennæ yellow; wings yellow, clothed with yellow or tawny hairs, with five dark brown, pointed stripes; one on the discal cell, one in fourth apical reaching nearly to tip, one in second subapical, one in the thyridial cell, and a long one near base in anal area. Hind wings yellowish; venation of both pairs yellowish. The posterior and anterior anastomoses are in the same line, making the apical cells very long. The wings are rather more slender than in *H. flavipennis* and the spur formula different. Length to tip of wings 20 mm.

One specimen from Ormsby County, Nev., July 6 (Baker).

Asynarchus pallidus, sp. nov.

Face yellowish, vertex brownish-yellow; antennæ brown, pale yellow toward tips. Head and thorax with yellow hair; ocelli of moderate size. Meso- and metathorax yellowish; abdomen pale brown; legs pale yellow, with black spines wings pale yellow, sparsely yellow-haired, with yellowish venation, except that the anastomosis is usually dark; a dark dot usually present in base of third apical cell in both wings, fifth apical cell in fore wings acute or even pedicellate, in hind wings first, third and fifth apicals are acute at base; anastomosis in hind wings often weak or lacking; radius in fore wings bent at pterostigma; discal cell as long as pedicel. Length to tip of wings 15 mm.

South Park, Colorado, August 23 (Osler). This species apparently approaches the genus *Parachiona* Thomson.

Neophylax fuscus, sp. nov.

Head black, with black hair; antennæ yellowish, basal joints long, brown; thorax black, with mostly black hair; abdomen brown, legs pale yellowish, with a few black spines. Spurs 1-2-2. Wings dark brown, indistinctly irrorate with pale; hind wings dusky; venation of both pairs brown. Shape of wings and venation much as in *N. concinnus*; the pterostigma prominent, and radius strongly bent at this point. In hind wings the apical cells are variable, as in *N. concinnus*. Length to tip of wings 9 mm.

Agricultural College, Michigan, September 25 (Pettit); and Franconia, N. Hamp. (Mrs. Slosson).

Leptocerus floridanus, sp. nov.

Head yellowish, clothed with long, white hair; pronotum with long white hair; rest of thorax yellowish, with shorter and more sparse white hair; antennæ white, narrowly annulate with dark brown; legs yellow, with short white hair, tarsi banded on tips with brown; wings pale brown, rather densely clothed with white hair, mostly in small patches, giving the wing a marmorate appearance; apical fringe alternately brown and white; hind wings with the apical part slightly infuscated. Length to tip of wings 10 mm.

One specimen from Biscayne Bay, Florida (Slosson).

Differs from all our other species in the covering of hoary hair.

Hydropsyche analis, sp. nov.

Head black, with sparse black hair. Antennæ brown, annulate with pale; thorax black, with some black and yellowish hair; legs pale yellowish, a dark mark on tips of tibiae, and the tarsi dark; abdomen brown. Wings a uniform brown, except a triangular white mark at end of anal vein, surface very sparsely clothed with short golden hairs; hind wings not so dark as fore pair; venation brown. Anterior wings rather narrow, hind pair with a rather long fringe on posterior margin. Length to tip of wings 7-8 mm.

Several specimens from Ithaca, N. Y., May till July; and River-ton, New Jersey, July 16. Easily known from our other species by the uniform brown wings, except the anal white mark.

Pellopsyche, gen. nov.

Venation like *Philopotamus* and *Dolophilus* except that the cross-vein which in those genera arises from the base of the thyridial cell in this genus arises beyond middle of that cell and continues across the cubitus to the anal vein; this probably being due to the wing being narrower than in those genera. Discal cell short and



FIG. 2. *Pellopsyche signata*. Venation of wing.

narrow; both branches of the radial sector forked beyond anastomosis; upper branch of medius forked beyond the anastomosis, lower branch at anastomosis. Spurs 2-4-4; ocelli present; palpi slender and long, antennæ as long as wings, first joint enlarged.

Pellopsyche signata, sp. nov.

Head yellow, with long white hair in front and above; antennæ pale, tips of joints are narrowly brown; palpi pale; legs pale; spurs yellowish; abdomen pale yellow. Wings pale yellowish; venation yellowish; anastomosis black and a blackish mark near pterostigma; beyond this is a broad white band, and beyond the wing is broadly brown. On the white part are white hairs, elsewhere the hair is golden. On fork of median vein is a prominent circular black dot, and a similar one is on fork of lower branch of radial sector. Hind wings hyaline; both pairs with long pale fringe. Length to tip of wings 5 mm.

Several specimens from Ft. Collins, Colorado (Titus).

NEW GENERIC TYPES OF BOMBYCINE MOTHS.

BY ALPHEUS S. PACKARD.

The following descriptions of new genera are published in advance of the monographic revision of the families to which they are here referred. All of the genera of Hemileucidæ are from the neogæic realm, or the tropical region of Mexico, and the South American continent.

Family HEMILEUCIDÆ.

Rhodormiscodes, gen. nov.

Imago. — Male. Front of the head a little broader than in *Ormiscodes*. Antennæ shorter and wider than in that genus; as usual pectinated to the tip, the extremity of which is subfiliform; antennal joints shorter than in *Ormiscodes*. Two pairs of pectinations, the distal pair larger than in *Ormiscodes*, those on the inner side only slightly shorter than those on the outer side. Palpi ascending and projecting beyond the front, much larger, longer and wider, with shorter closer squamation, than in *Ormiscodes*; third joint distinct, about one half as long as second joint is wide, while in *Ormiscodes* they are depressed, small, short and indistinct, and with irregular scales.

Thorax with scattered long flattened hairs, as in *Ormiscodes*.

Fore wings more falcate than in *Ormiscodes*, costa fuller, more convex toward apex; outer edge short; wings subfalcate, but not excavated behind the apex. Hind wings regularly rounded on the apex and inner angle, much more so than in *Ormiscodes*, and of quite different shape from that genus.

Venation: Vein II 1 arises near the outer end of the discal cell, *i. e.*, much nearer the origin of the anterior discal vein, and the two discal veins make a straight line, not an oblique one as in *Ormiscodes cinnamomea*, and they are situated inside of the middle of the wing. In the hind wing veins II 1, 2, 3 arise farther apart than in *O. cinnamomea*.

Markings: No white discal spot, but an irregular dark one. Purple tints with purple-brown markings, and roseate hind wings. The abdomen is banded with yellow and black.

This genus is based on *Ormiscodes rosea* Druce.

Geographical Distribution. — Vera Cruz, Mexico (Franck).

This genus differs from *Ormiscodes* not only in the venation, but in the larger palpi, the shorter, broader antennæ, subfalcate fore wings and more rounded hind wings. The thorax is equally shaggy and woolly and the legs thick and hairy. In the shape of the fore wings and absence of a discal spot it somewhat approaches *Hylesia*.

Hyperdirphia, gen. nov.

Imago. — Male. Head narrower in front than in *Dirphia* (*D. hægeri*). Antennæ of male the same as in *Dirphia* (*D. hægeri*), pointed at the end and pectinated to the tip; the distal pectinations being a little shorter, so that the tip is more prolonged, filiform, than in *Dirphia*. Eyes large, decidedly more prominent and globose than in *Dirphia*. Palpi very much larger and wider than in *Dirphia* and extending well beyond the front; third joint distinct.

Thorax normal, not shaggy, but with a soft, rather short fur-like coat, with no long thickened hairs, such as are characteristic of *Dirphia* (*D. hægeri*).

Fore wings very short and broad, costa regularly arched, apex squarish, outer edge much as in *D. hægeri*, though less oblique. Hind wings large and wide, outer edge full and rounded, extending a little beyond the abdomen.

Venation: The discal cell is broader and the two discal veins taken together are more oblique than in *Dirphia*; also vein II I arises nearer the origin of the anterior discal vein, *i. e.*, much nearer the outer end of the discal cell. In the hind wings the outer side of the discal cell is more oblique, and the posterior discal vein longer than in *Dirphia*.

Abdomen banded as in *Dirphia hægeri*.

Markings: The ground color of the fore wings a frosty, tawny hue, with a peculiar, very large brown discal spot one half as wide as the wing itself, and broken up by the discal veins and vein IV, which are snow-white. No basal or extradiscal lines in male, but they are present in female. Hind wings ochreous tawny, with a slight dusky discal streak; no discal spots beneath.

The type of this genus is Cramer's *Attacus tarquinia* (Papillons Exotiques, I, p. 6, Pl. IV, A, ♀, B, C, ♂, from Surinam; my example coming from French Cayenne).

This genus, represented by a single species, is interesting as being a connecting link between the *Dirphia* group and the *Automeris* group of genera. At first sight it would be mistaken for an *Automeris* or ally of that genus, but on closer examination it will be found to be more nearly allied structurally to *Dirphia*, especially the *hægeri* section. It is a mistake, however, to refer it to *Dirphia*, since it decidedly differs besides the extraordinary style of coloration, in the much larger and longer palpi, the narrower front of the head, and the more elongated tip of the male antennæ. It is an intermediate form very decidedly linking *Dirphia* with *Protautomeris* and the *Automeris* group of generic forms.

Protautomeris, gen. nov.

Imago. — Male. Head moderately broad, narrowing somewhat towards the labial region. Antennæ of male much as in *Dirphia* (*D. hægeri*), not very long but differing from *Dirphia* in the extreme tip being subfiliform; the distal pectinations about three quarters as long as the basal ones; the joints in the middle of the antennæ rather short.

Palpi stout, porrect, slightly exceeding the front, and with close scales; third joint distinct, but short and somewhat depressed.

Thorax stout, with a few fine slender but long hair-like scales, *i. e.*, flattened hairs, on each side of the patagia.

Fore wings much as in *Automeris*, the wings more falcate than in *Dirphia*; costa well curved before the apex which is subacute; outer edge much shorter than the inner and very slightly concave. Hind wings much rounded at the apex; outer edge full and convex, the inner angle extending as far as the tip of the abdomen. Venation: Differs from that of *Automeris io* in vein II (first subcostal) arising nearer the middle of the discal space, while the independent vein arises near the middle of the discal space, *i. e.*, the two discal veins are of nearly the same length, while in *A. io* the anterior discal is very much shorter than the posterior. In the hind wings the discal cell is narrower than in *A. io*.

Colors and markings: Very similar to those of some of the species of *Automeris*. A curved irregularly scalloped basal line; extradiscal line strongly marked, oblique, a little curved and ending as in *Automeris* at the apex. Ocellus faint, much as in *Automeris*. Hind wings with a well-marked very large ocellus of the *Automeris* type and partly surrounded by a heavy black extradiscal line.

Abdomen lake-red, but tawny yellowish at tip.

This genus is based on *Dirphia mæonia* of Druce, the only species yet known.

Geographical Distribution. — So far as yet known the single species of the genus is confined to Mexico, but may be found to extend into Central America.

This rather remarkable genus is a very interesting annectant form between the two principal subdivisions of the family Hemileucidæ represented by *Dirphia* and *Automeris*. It differs from *Dirphia* and *Hyperdirphia* in the much smaller palpi, which are much as in *Automeris*, being of about the same length, though the antennæ are of the same shape as in the two former genera. In the shape of the wings it approaches *Automeris*, and still more in the markings in which it is in advance of its structural features, having the oblique extradiscal line of the fore wings, and the very large and perfect ocellus of the hinder ones. The erect long thoracic hair-like thoracic scales may be an inheritance from *Dirphia*, while in the single known species the abdomen is not striped with dark and yellow, but is reddish carmine. It is most probable that the *Automeris* group originated from a form similar to this. Its larval history would be most interesting.

Eussyssaura, gen. nov.

Syssaura HUEBNER (in part), Verzeichniß, p. 150, 1816 (1822?).

Oxytenis WALKER, Cat. Lep. Het. Br. Mus., V, p. 1181, 1855. KIRBY, Syn. Cat. Lep. Het., 1, p. 770, 1892.

♂ Male. Front of the head rather short and unusually broad; it is not exactly square as in *Oxytenis*, but is a little narrower in front than on the vertex. Male antennæ well pectinated to the tip; the branches being long and ciliated, and drooping so as to be folded close together as in *Platypteryx*, etc., not spread wide open as usual in the Saturniidae; the antennal joints are short, bearing but a single pair of pectinations, but they are so close as to appear as if there were two pairs to a joint. Maxillary palpi well developed, united, quite long, much longer than usual in the group, reaching down to the base of the labial palpi. Maxillary palpi well developed, in my example distinct, slender, and as long as the two maxillæ measured across their base. Labial palpi unusually large and thick, blunt at the end, being considerably larger and thicker than in *Oxytenis* (*O. lamis*); the basal joint short; the second very long and large, thick, extending very far (for this family) beyond the front; third joint small, depressed, not so distinct as in *O. lamis*. Eyes moderately large.

Fore wings of almost exactly the shape of those of *Platypteryx*, the apex being much more produced than in *Oxytenis* and square at the tip; the costa is much curved towards the apex; outer edge deeply excavated towards the apex; inner angle rectangular. Venation: Very different from that of *Oxytenis* since *11 1* is very short arising not within the origin of the discal vein but far out near the end of *1*. *11 2* wanting. In both wings the forward discal vein much curved inward, the hinder vein oblique and not curved. Hind wings full, apex not so round as in *Oxytenis*, more angular; outer edge regularly convex and rounded; inner edge nearly straight and long; the end of the abdomen reaches a little beyond the middle of the hind wings. Venation: remarkable for the presence of a long vestige of vein VIII.

The markings are almost exactly of the pattern of those of *Platypteryx*. The general color is that of a dead leaf; on the fore wings is an extradiscal distinct oblique line, beginning on the middle of the inner edge and extending obliquely, but not wavy, to the apex. A zigzag line beyond; this oblique line extends to the hind wings, where it is also distinct, straight; beyond it is a zigzag line. Discal dots minute, black accompanied on the fore wings by a few white scales.

The type of this genus is *Attacus honesta* Stoll, IV, t. 302, C, D, 1781. Druce's *Oxytenis malacena* from Panama is a member of this genus, the species of which range from Nicaragua to the Amazons.

Mesoleuca, gen. nov.

Hemileuca WALKER, in part, Cat. Lep. Het. Br. Mus., VI, 1855, p. 1319.

Imago. — Male. Closely allied to *Hemileuca* but differing in the larger, longer palpi, the shorter wings, and in the venation.

Head as in *Hemileuca*, hairy and shaggy in front, of about the same width between the eyes, which are of the same size as in *Hemileuca*. The antennæ differ in the joints being longer, so the pectinations are farther apart, but in their length and hairiness the two genera are similar. Palpi much longer and more distinct than in *Hemileuca*, projecting well beyond the front, but the hairs on them are bushy or shaggy and irregular. The thorax and abdomen are as in *Hemileuca*.

Fore wings rather shorter and broader, and the hind wings broader and rather more rounded at apex. The hind wings extend as far as the end of the abdomen. The venation in general is as in *Hemileuca*, but with the notable difference from any

other genus of Hemileucidæ that vein II 5 arises rather far from the origin of III 1, far from the discal veins; the latter also are oblique, especially the posterior one. Hind wings with the discal veins very oblique, the other veins much as in *Hemileuca*.

Markings: wings all pale, tending to ochreous whitish, the veins being dark, distinct; no discal spot and no bars, only a submarginal brown line common to both wings.

There are no long flattened hairs on the thorax.

The type of this genus is *Hemileuca venosa* Walker.

The species is confined to northeastern South America, *M. venosa* occurring in Venezuela (Caraccas) and Colombia (Bogota). My example was compared with Walker's type in the British Museum, and the localities mentioned are from the labels in that museum.

Family CERATOCAMPIDÆ, subfamily BUNÆINÆ.

Leucopteryx, gen. nov.

Imago. — The head is partially concealed by the high overhanging thorax; it is not prominent; the front unusually wide between the eyes. The antennæ are wanting in my specimen. The vestiture of the front short, fine and wooly.

Palpi not visible, apparently 1-jointed, short, feeble and drooping. Body rather stout; the vestiture short, the hairs very fine and rather short.

Fore wings short and broad, not falcate; costa straight, a little curved towards the apex, which (though broken off) appears to be rather obtuse and subrectangular; outer edge shorter than the inner and slightly convex. Hind wings rather long, costa not very convex, apex rounded, outer edge full, well rounded, inner edge rather long, extending a little beyond the end of the abdomen.

Venation. Closely similar to that of *Heniocha terpsichore*; the first subcostal vein (II 1) arising in the same position and ending just before the apex of the fore wing; the origin of the semi-independent vein (III 3) is the same, and the discocellulars collectively made a slight inward angle; in the hind wing they make a straight line.

Markings: Ground-color white and pearl-ash gray; no definite lines on the wings of either pair. On the fore wings a moderately large round discal spot, solid in the center except a narrow, clear, linear chink. On the hind wings no complete ocellus, but a subtriangular, dark, opaque spot, with a slight linear chink or fissure.

The type of this genus is *Ceranthia? mollis* Butler, Trans. Ent. Soc. London, 1889, p. 391, Pl. 12, Fig. 5. I have had the opportunity through the kindness of Dr. H. G. Dyar of examining a female from Tana River, East Africa, north of Mombasa, collected by the Chandler Expedition for the U. S. National Museum.

Geographical Distribution. — Ethiopian realm, Eastern Africa, Mombasa and Tana River, north of Mombasa in British East Africa.

This genus by its venation closely approaches the African species referred to *Heniocha* (*H. terpsichore*), but differs from any of that

group in the shorter, wider fore wings, and the absence of any transverse lines. The type of Mr. Butler's description is in the British Museum.

MEETING OF MAY 19.

Held at the American Museum of Natural History, Tuesday evening, May 19 at 8 o'clock.

In absence of the President and Vice-President, Rev. J. L. Zabriskie was elected to preside at the meeting.

The following members were present: Messrs. Barber, Brues, Davis, Joutel, Love, O'Connor, Southwick, Bueno, Zabriskie and visitors Mr. Martin and daughter.

Mr. Davis of the Field Committee reported that the next field trip would be to Fort Montgomery, N. Y., May 29 to 31. Also on June 14 the committee had arranged a field trip to Huguenot, Staten Island.

Mr. Engelhardt was elected an active member of the society on motion of Dr. Love.

On motion of Mr. Joutel the society voted to discontinue its meetings during June.

The first paper of the evening was by Mr. Zabriskie on the subject of "The Microscopical Study of the Food of *Trox unistriatus*."

Mr. Zabriskie stated that he had subjected some specimens of this beetle to the action of a weakened solution of caustic soda in order to prepare them for dissection. They had been collected some nine years ago from the carcass of a horse. On opening the stomach of these beetles he had discovered a great number of little black rod-like objects. He mounted some on a slide and examined under a microscope and after some investigation he had decided that they were the snapped-off butt ends of horse hairs. He called attention to the fact that all of the hairs which he exhibited under the microscope were snapped off in the same oblique manner.

Mr. Zabriskie also exhibited under the microscope the stalked eggs of *Xiphydria maculata*, one of the wood-boring wasps. Mr. Joutel exhibited some of the stages as well as drawings of some of the Bombycine larvæ from Japan. He called attention particularly to the difference in the larvæ at different moults.

Mr. Brues mentioned that he had collected recently an interesting wingless hymenopteron, *Isobrachium rufiventre* Ashm., at Ft. Lee, N. J., which was new to the New Jersey List of Insects.

Mr. Brues then read a paper on the subject of "The Sleeping Habits of Some Aculeate Hymenoptera."

Mr. Bueno stated that he had noticed that the *Cicindela sexguttata* which he had taken at Fort Lee, N. J., had a peculiar odor similar to that of an enraged bee. He also exhibited a number of live *Plea striola* taken at Van Cortlandt Park.

Mr. Davis then made some remarks about the early collection of certain butterflies as evidence of the early spring of 1903. He had taken *Lycæna pseudargiolus* on Staten Island, March 28. On two previous years the butterfly has been observed

as early as April 2, but its first appearance is usually about the middle of April. The full-grown caterpillar of *Phyciodes tharos* was taken at Richmond, Staten Island, on March 29. It pupated quickly and the butterfly hatched on April 20.

Mr. Scudder says that in "Massachusetts these caterpillars are full fed by the middle of May."

Mr. Davis also related an interesting experience which he had with the large red and black ant (*Formica rufa*) at Paterson, N. J. The ants when disturbed had a peculiar way of standing erect on their second and third pair of legs, and then turning the abdomen forward and upwards they squirted a considerable spray of formic acid at their tormentors.*

Mr. Barber exhibited a number of specimens of Coleoptera to show the results of his spring collecting about the vicinity of New York.

Society adjourned.

THE MOTH BOOK.

A Popular Guide to a Knowledge of the Moths of North America.

By W. J. HOLLAND, D.D., Ph.D., Sc.D., LL.D. New York, Doubleday, Page & Company, 1903. Pp. xxiv + 479, pl. 48.

This fine and valuable book has appeared at last. We congratulate our friend, Dr. Holland, for his painstaking work, which without any question or doubt will gladden the hearts of all interested in the study of Lepidoptera. Although we do not quite agree with the nomenclature adopted by Dr. Holland and with the identification of some of the species, we express a hope that the edition will be exhausted soon and that the few shortcomings will be corrected in the second edition.

W. BEUTENMÜLLER.

* Prof. W. M. Wheeler informs us that this position in defending its nest is characteristic of *Formica rufa* and serves at once to distinguish it from other species of *Formica* which have similar coloration, size and nest architecture.—W. B.

Index to Volume XI.

- Abagrotis ornatus* Smith, n. sp., 4
Abebaea Hübner, table of species, 53
 cervella Wals., 55
 cockerella Busck, n. sp., 54
 delicatella Busck, n. sp., 53
 gerdanella Busck, n. sp., 53
 nella Busck, n. sp., 54
 quercicella Busck, n. sp., 55
 sublucella Wals., 55
 subsylvella Wals., 55
Adalia Muls., table of species, 194
 annectans Crotch, 195
 bipunctata Linn., 195
 frigida Schneid., 195
 humeralis Say, 196
 ludovicae Muls., 196
Adonia constellata Laich., 39
Ædomyia squammipenne Arrib., 143
Agrabia cyanoptera Muls., 196
Anacamptis coverdalella Kearf., n. sp., 162
Anarta laerta Smith, n. sp., 20
Anatis quinquedecimpunctata Oliv., 207
 rathvoni Lec., 208
Anisoclava duodecimmaculata Gebl., 207
 quatrodecimguttata Linn., 206
Anisosticta episcopalis Kirb., 37
 seriata Mels., 37
 strigata Thunb., 37
 Ant and Termite guests, talk on, 175
Anytus tenuilinea Smith, n. sp., 192
Aphites agitator Uhler, 173
 Ashmead, Wm. H., articles by, 28, 86, 144
Aspidiotus californicus Coleman, n. sp., 64
 ehrhorni Coleman, n. sp., 68
 florenciae Coleman, n. sp., 66
 shastae Coleman, n. var., 67
Asynarchus pallidus Banks, n. sp., 242
 Bæinae, table of genera, 88
 Banks, Nathan, articles by, 227, 236
 Beutenmuller, article by, 250
 Book notice, Holland's Moth book, 250
Brachynemurus dorsalis Banks, n. sp., 240
 Brues, Charles T., article by, 228
 Bueno, J. R. de la Torre, articles by, 128, 166, 228
 Busck, August, articles by, 45, 106
Cacellus Ashmead, n. n., 92
Cæcilius pinicola Banks, n. sp., 238
 Call, Dr. R. E., lecture by, 114
Carneades focius Smith, n. sp., 7
 masculus Smith, n. sp., 6
Cassida viridis, 113
 Cassidini, exhibition of, 113
Catocala herodias Streck, 112
 theory as to evolution of color in hind wings, 221
Cerambycidae, certain genera of, 113
Ceraphronidae, table of subfamilies, 33
Ceraphroninae, table of genera, 35
Ceratomegilla ulkei Cr., 39
Cerma fascia Smith, n. sp., 190
Cerostoma Latr., synopsis of species, 48
 aleutianella Beut., 49
 angelicella Busck, n. sp., 49
 arizonella Busck, n. sp., 50
 barberella Busck, n. sp., 51
 manella Busck, n. sp., 51
 olivella Busck., 49
 radiatella Don., 50
 rubrella Dyar, 50
 schwarziella Busck, n. sp., 51
 striatella Busck, n. sp., 52
 unicipunctella Busck, n. sp., 48
Chrysopa azteca Banks, n. sp., 239
Chytonix laticlava Smith, n. sp., 189
 parvimacla Smith, n. sp., 189
Cicindela schæfferi Horn, n. sp., 213
Cicindelidae of Mexico, list of, 214
Coccidae on Coniferous hosts in California, 73
 general references, 80
Coccinella Linn., synopsis of species, 196
 difficilis Cr., 200
 menetriesii Muls., 201
 monticola Muls., 198
 9-notata Herbst, 189
 transversoguttata Fald., 199
Coccinellidae, notes on, 35, 193
Coccinellini, table of genera, 194
 Codling moth, generic name of, 106
 Coleman, Geo. A., article by, 61
Conservula furva Schaus, n. sp., 235
Corydalis texana Banks, n. sp., 239
Cosmia venosa Smith, n. sp., 21

- Crambus vachellus* Kearfott, n. sp., 149
Culex annulifera Ludlow, n. sp., 141
 bimaculatus Coq., 27
 consobrinus Desv., 24
 fragilis Ludlow, n. sp., 142
 nigritulus Zett., 24
 signifer Coq., 26
 taniorhynchus Wied., 23
 triseriatus Say, 25
Cuterebra fontinella, 115
Cycloneda sanguinea Linn., 202
Dactylopius andersoni Coleman, n. sp., 62
 dudleyi Coleman, n. sp., 63
 Daecke, E., article by, 105
Dendroleon pumilus Burm., 240
Desvoidea fusca Theob., 140
 Diapriidae, table of subfamilies, 28
 Diapriinae, table of genera, 30
 Dyar, Harrison G., articles by, 23, 102, 104

Epidemas obscurus Smith, n. sp., 2
Epimения cicutella Kearf., n. sp., 162
 ramapoella Kearf., n. sp., 164
Eriopsis connexa Germ., 39
Eueretagrotis inattentus Smith, n. sp., 5
Eusyssaura Packard, n. gen., 246
Euxoa nesilens Smith, n. sp., 192

 Felt, Dr. E. P., lecture by, 176
Finlaya poicilia Theob., 140
Fishia vinela Smith, n. sp., 191
Formica rufa, defensive position of, 250

Glyptotaelius bellus Banks, n. sp., 241
Gnorimoschema artemisiella Kearf., n. sp., 160
 busckiella Kearf., n. sp., 158
Goes pulverulenta, 173
Grabhamia spencerii Theob., 143

Hadena alberta Smith, n. sp., 8
 albiserrata Smith, n. sp., 8
 evelina French, 192
 parcata Smith, n. sp., 9
Harmonia picta Rand, 205
Harpiteryx Hubn., table of species, 56
 canariella Wals., 56
 dentiferella Wals., 56
 frustrella Wals., 57
Himella azucara Schaus, n. sp., 235
 chocosticta, Schaus, n. sp., 232
 diplogramma Schaus, n. sp., 232
 gigantea Schaus, n. sp., 233
 gonostigma, Schaus, n. sp., 233
 ignescens Schaus, n. sp., 232
 leucoptera Schaus, n. sp., 234

Himella marginalis Schaus, n. sp., 233
 mediorufa Schaus, n. sp., 234
 nigripars Schaus, n. sp., 231
 ochrota Schaus, n. sp., 233
 pallescens Schaus, n. sp., 235
 rubripuncta Schaus, n. sp., 232
 secedens Schaus, n. sp., 234
 violascens Schaus, n. sp., 234
Hippodamia Muls., table of species, 40
 ambigua Lec., 41
 americana Crotch, 44
 convergens Guer., 42
 dispar Casey, 44
 extensa Muls., 41
 falcigera Crotch, 44
 glacialis Fab., 41
 lecontei Muls., 41
 moesta Lec., 41
 oregonensis Cr., 42
 parenthesis Say, 44
 15-maculata Muls., 42
 quinquesignata Kirb., 40
 sinuata Muls., 42
 spuria Lec., 42
 13-punctata Linn., 44
 variegata Goetze, 44
Hippodamiini, table of genera, 36
Homoglaea carnosa Grote, 112
Homophylax nevadensis Banks, n. sp., 242
 Horn, Walther, article by, 213
Hydracia cauta Schaus, n. sp., 235
 pexa Schaus, n. sp., 235.
Hydropsyche analis Banks, n. sp., 243
 Hymenoptera, sleeping habits of, 228.
Hyperdirphia Packard, n. gen., 245.

 Inostemnine, table of genera, 95
 Insects, color preference in, 132

Japyx Hal., synopsis of North American species of, 129
 minimus Swenk, n. sp., 131
 Johnson, W. G., lecture by, 116

 Kearfott, W. D., article by, 145

Lachnosterna postrema Horn, 115
 Leng, Chas. W., articles by, 35, 193
Leptocerus floridanus Banks, n. sp., 242
 Letcher, B., article by, 125
Leucaspis cupressi Coleman, n. sp., 71
 kelloggi Coleman, n. sp., 68
Leucochrysa punctata Banks, n. sp., 238
Leucopteryx Packard, n. gen., 248
 Ludlow, C. S., article by, 137
Luperina migrata Smith, n. sp., 188

- Lycophotia microstigma* Schaus, n. sp., 230
 MacGillivray, article by, 99
Mamestra, general notes on, 13
 flavidentula Schaus, n. sp., 230
 goniophora Schaus, n. sp., 231
 lunolacta Smith, n. sp., 17
 paranica Schaus, n. sp., 231
 viriditincta Schaus, n. sp., 230
Mansonia africana Theob., 143
Megaplastopria Ashmead, n. gen., 31
Megaspilinae, table of genera, 33
Megilla floridana Leng, n. sp., 38
 maculata DeG., 38
Mesoleuca Packard, n. gen., 247
Miscodera arctica Payk., 175
Moma geminata Smith, n. sp., 1
 Mosquitoes of Philippines, 137
Myrmeleon mexicanum Banks, n. sp., 241

 Needham, J. G. and Anthony, Maude H., article by, 118
Neoharmonia ampla Muls., 202
 nodulata Muls., 202
 venusta Melsh., 202
Neomysia Casey, synopsis of species, 208
 hornii Crotch, 209
 pullata Say, 209
 subvittata Muls., 209
Neophylax fuscus Banks, n. sp., 242
Nephelodes tertialis Smith, n. sp., 19
Notoxoides Ashmead, n. gen., 30

Odonata, skewness of thorax in, 117
Olla abdominalis Say, 205
 oculata Fab., 204
Oncocnemis aurea Grote, 10
 chorda Grote, 11
 euta Smith, n. sp., 11
 nigerrima Smith, n. sp., 10
 rosea Smith, n. sp., 11
 simplicia Smith, n. sp., 12
Orgilus kearfotti Ashmead, n. sp., 144

 Packard, A. S., articles by, 132, 244
Pamphila attalus Edw., 114
 bimaculata G. & R., 114
 dion Edw., 114
Paranemia vittigera Mann., 38
Pellopsyche Banks, n. gen., 243
 signata Banks, n. sp., 243
Pelocorsis femorata DeB., notes on life history of, 166
Pentatomidae, list of species near New York, 128, 227, 228
Peranabrus scabricollis Thom., internal anatomy of, 182

Perigrapha duckinfeldi Schaus, n. sp., 236
Peripsocus californicus Banks, n. sp., 237
 fumosus Banks, n. sp., 237
Phenacoccus kuwanae Coleman, n. sp., 62
Phipposopus callitrichoides Guen., larva of, 105
Phryganidia californica Pack., larva and pupa, 125
Physokermes concolor Coleman, n. sp., 73
 taxifoliae Coleman, n. sp., 72
 Pins, winding elbow, 99
Platigasteridae, table of subfamilies, 95
Platygasterinae, table of genera, 96
Proapanteles recurvariae Ashmead, n. sp., 144
 Proceedings of the New York entomological society, 111, 173, 249
Prodoxus Riley, synopsis of species, 103
Pronuba Riley, synopsis of species, 102
 aterrima Trelease, 102
 maculata Riley, 102
 paradoxa Riley, 103
 yuccasella Riley, 102
Protameris Packard, n. gen., 245
Psocus genualis Banks, n. sp., 236
 slossoniae Banks, n. sp., 236
 tolteca Banks, n. sp., 237
Psyllobora Chev., synopsis of species, 210
 20-maculata Say, 210
 nana Muls., 211
 renifer Casey, 210
 tadata Lec., 211
Ptilopsocus annulicornis Banks, n. sp., 238

Recurvaria, synopsis of species, 152
 juniperella Kearf., n. sp., 157
 nigra Kearf., n. var., 156
 piceaella Kearf., n. sp., 155
 thujaella Kearf., n. sp., 154
Rhodomiscodes Packard, n. gen., 244
Rhynchagrotis meta Smith, n. sp., 3
 niger Smith, n. sp., 3

Scelionidae, table of subfamilies, 86
Scelioninae, table of genera, 91
 Schaus, William, article by, 230
Scopelosoma colorado Smith, n. sp., 21
Scotogramma, general notes on, 18
 albinuda Smith, n. sp., 19
 Serpent flies, remarks by R. Osborn, 174
 Smith John B., articles by, 1, 188
 Snodgrass, R. E., articles by, 178, 183
 Southwick, E. B., Lecture by, 115
Spilomicrinæ, table of genera, 28
Stegomyia amesii Ludlow, n. sp., 130
 nivea Ludlow, n. sp., 139

- Strategus julianus*, remarks on, 114
 Swenk, Myron H., article by, 129
Symphysa adealis, Kearfott, n. sp., 145

 Teleasinae, table of genera, 89
 Telenominae, table of genera, 87
Termes flavipes, true female of, 113
Thalassa montezumæ Muls., 211
Thaumatopsis daeckeellus Kearf., n. sp.,
 149
Theristus Hubn., 58
 Tipulidae, terminal abdominal segment
 of females, 178
Trachoma Wall, table of species, 57
 falciferella Wals., 57

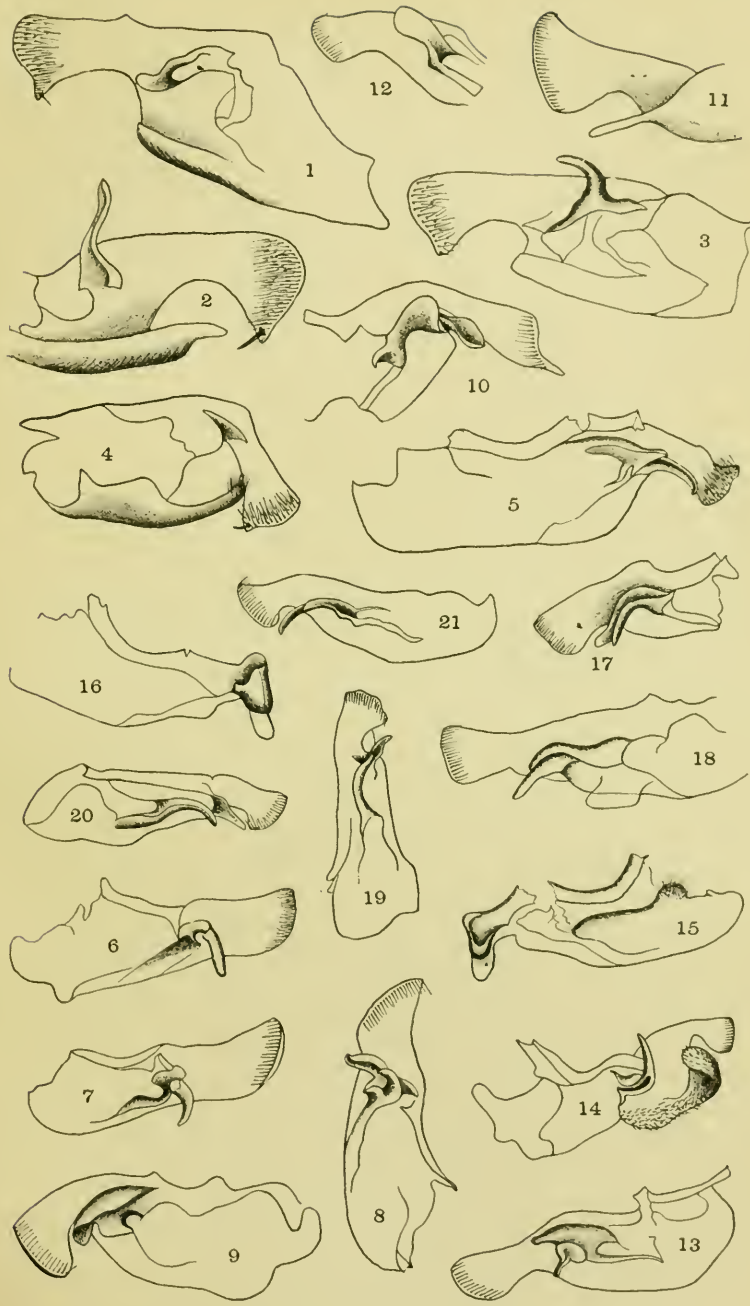
Trachoma senex Wals., 58
 walsinghamella Busck, n. sp., 57
Trox unistriatus, food of, 249

 Webster, F. M., article by, 59
 Weeks, A. C., article by, 221

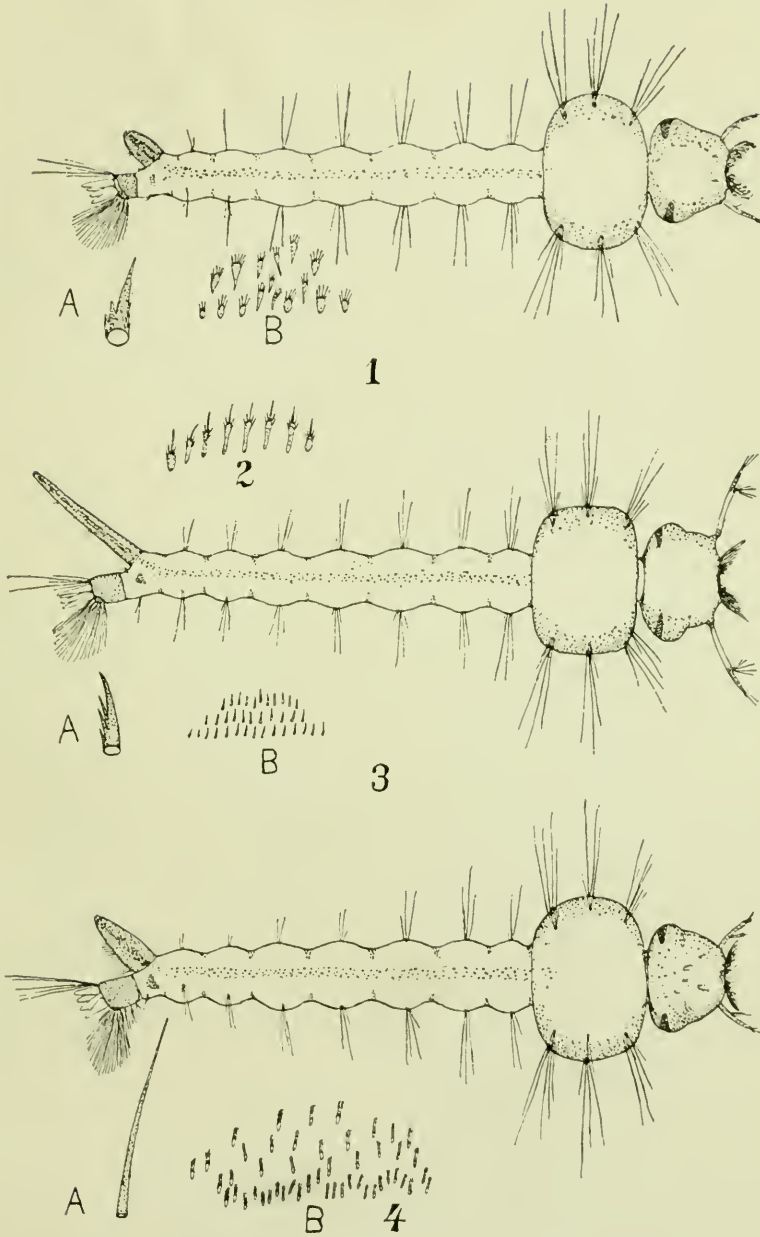
Xanthopastis timais Cram., larva of, 104

 Yponomeutidae, synopsis of genera of
 Cerostoma group, 47
 Yama-mai moths, 112

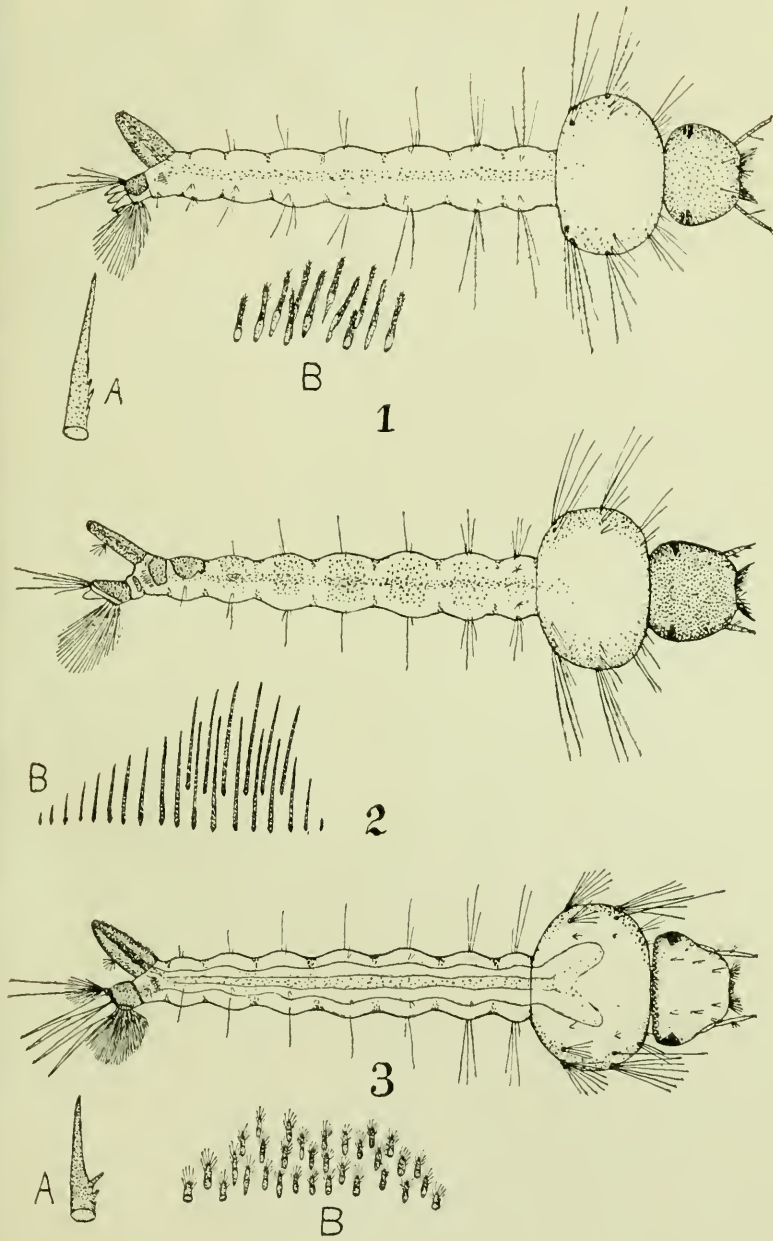
Zelleria celastrusella Kearf., n. sp., 150.



Genitalia of Noctuidæ.



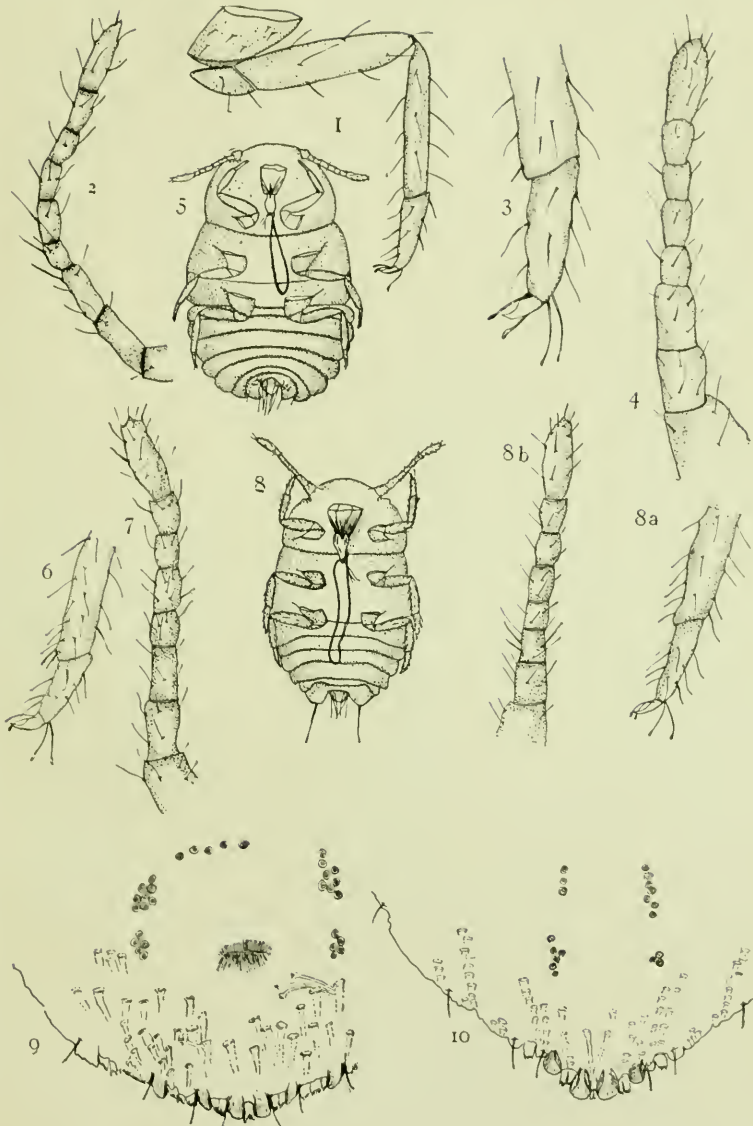
1, *Culex teniorhynchus*; 2, *Stegomyia fasciata*; 3, *Culex nigrifolius*;
4, *Culex consobrinus*.



1, *Culex triseriatus*; 2, *Culex signifer*; 3, *Culex bimaculatus*.

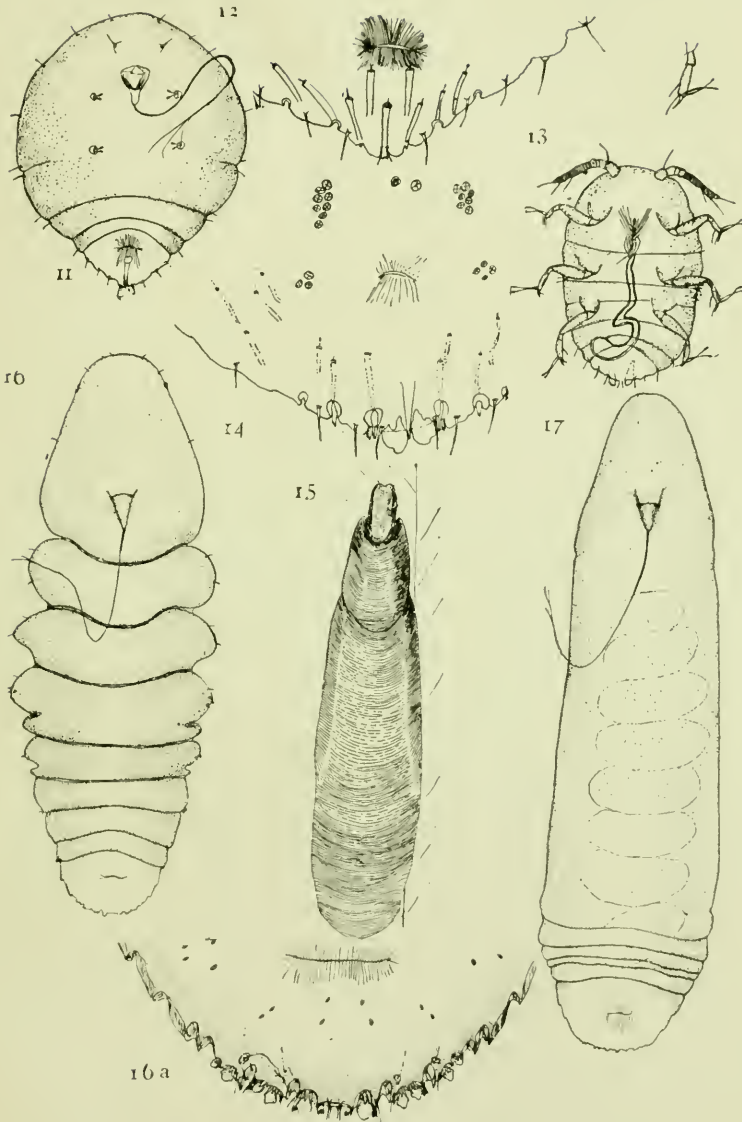


North American Coccinellidæ.

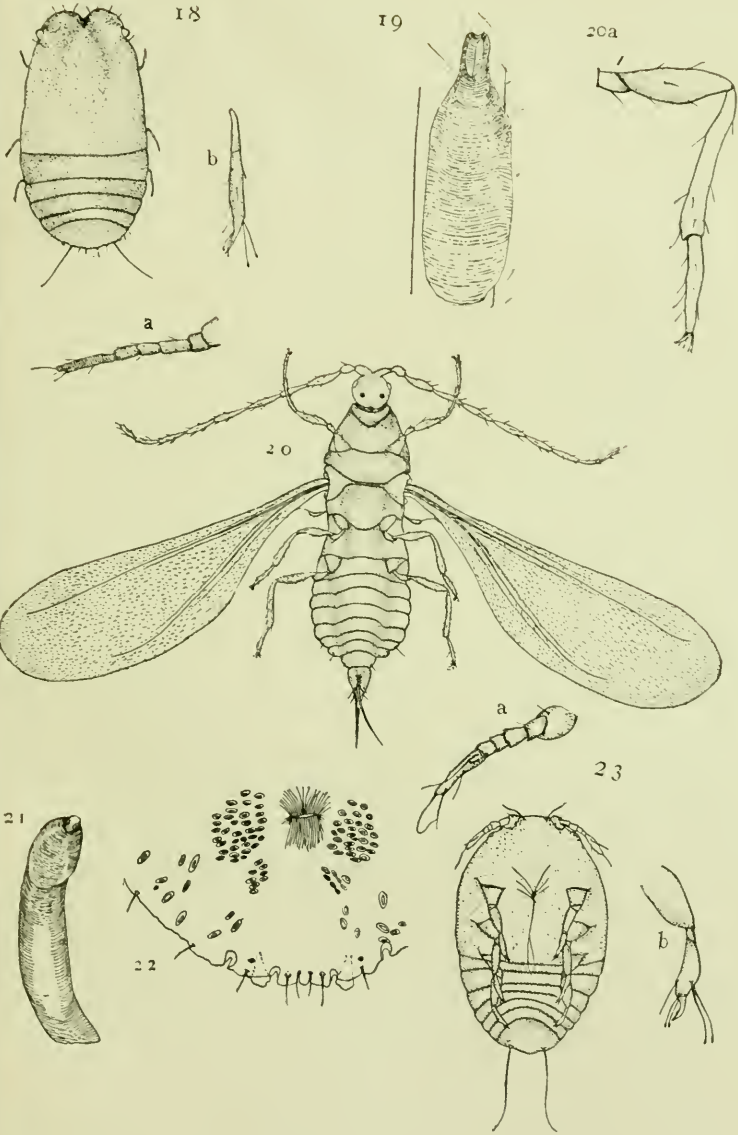


New Coccidæ.

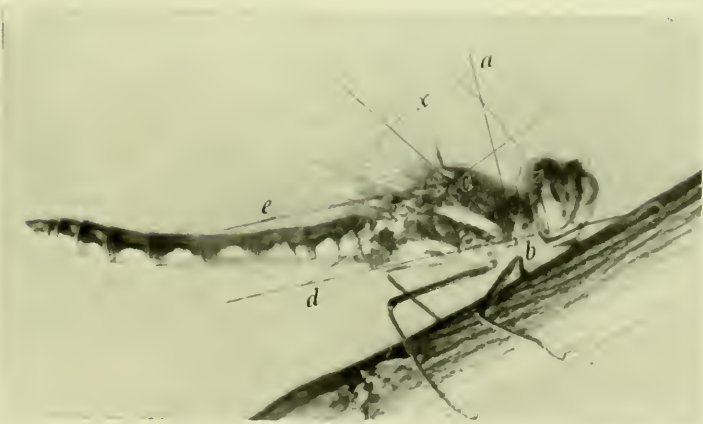
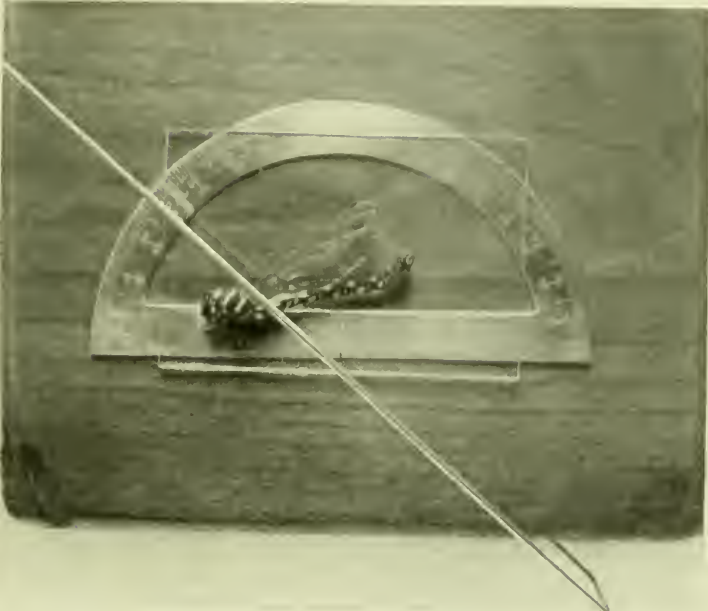




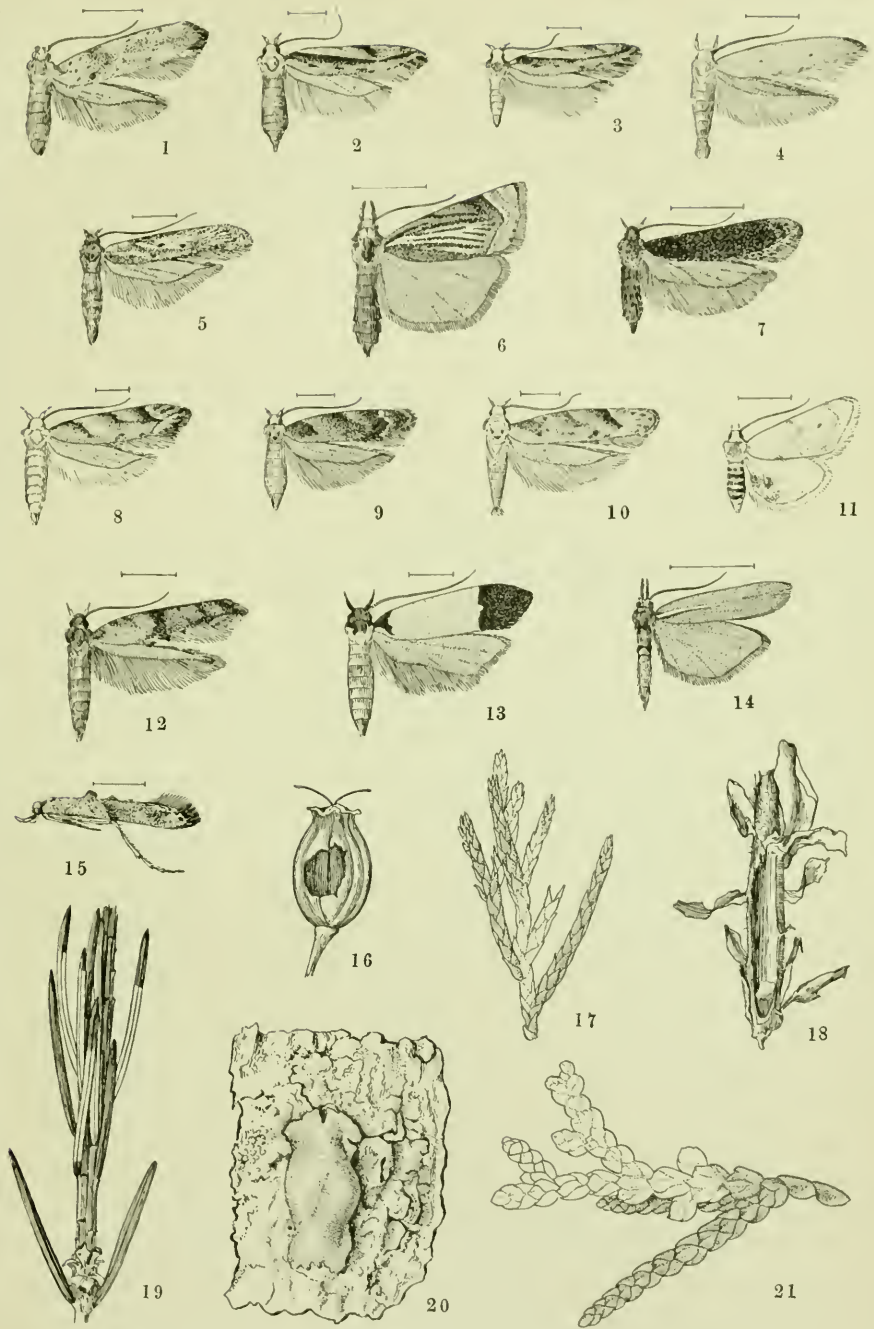
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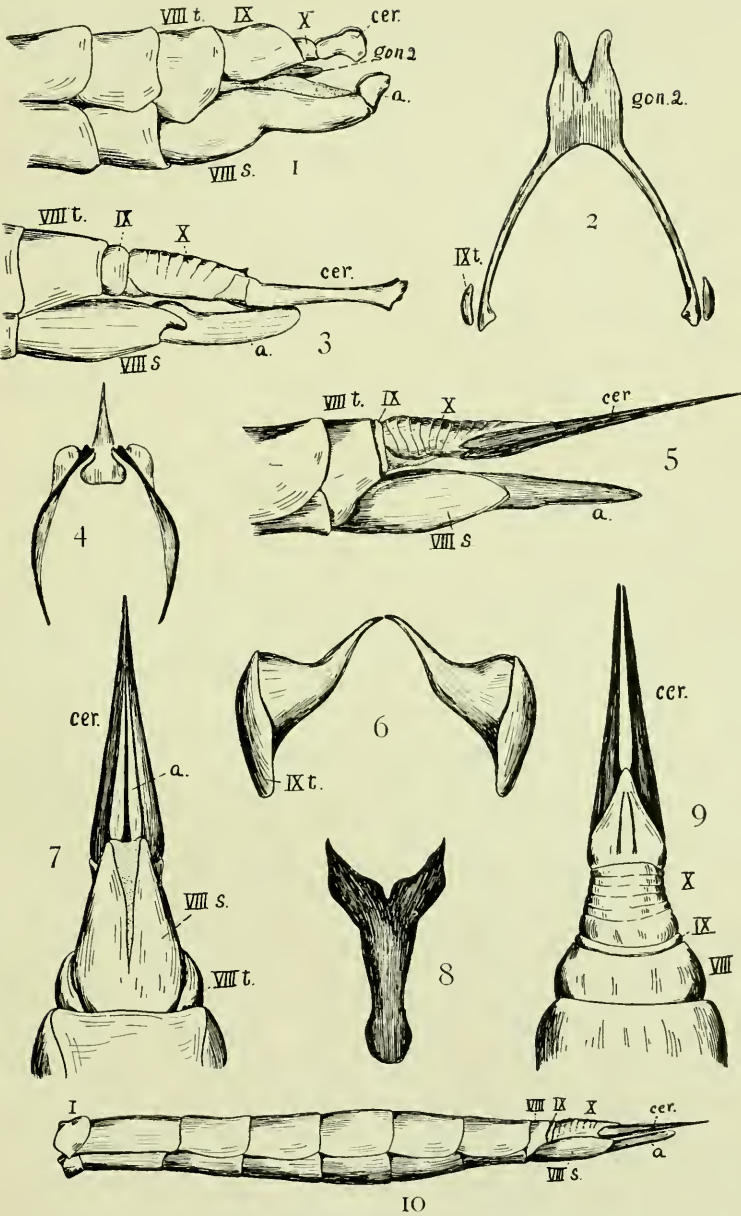


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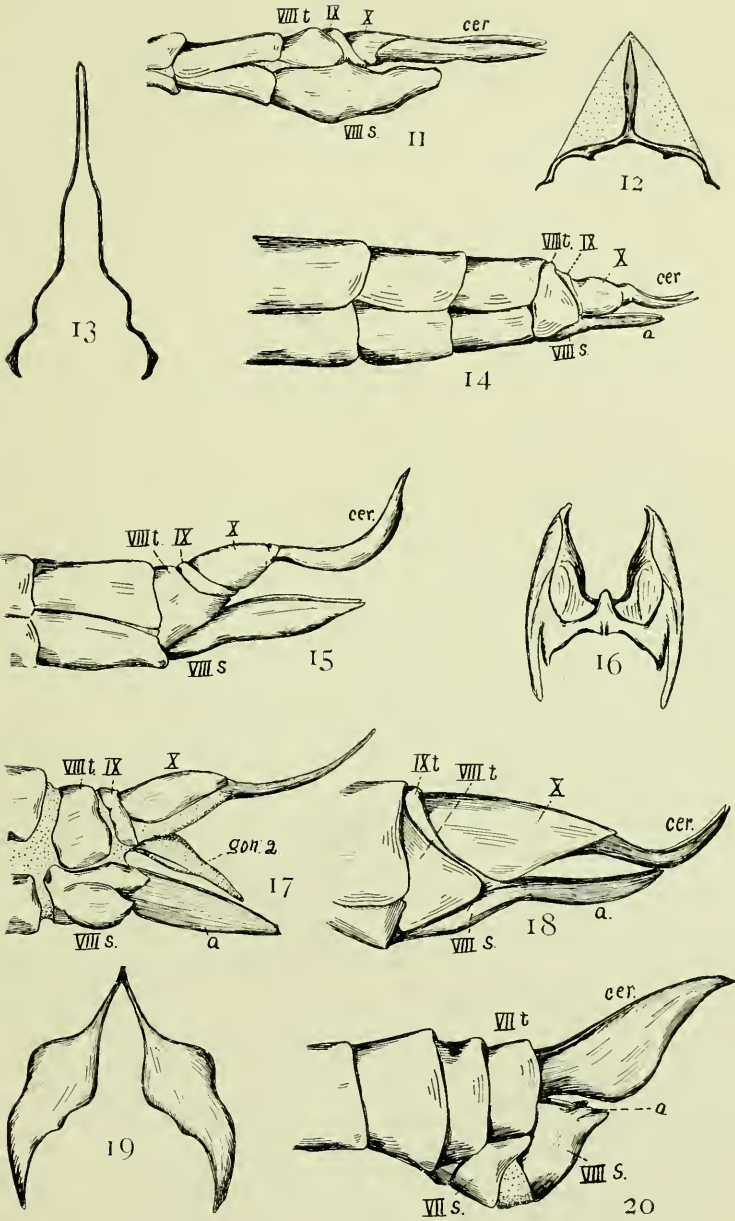


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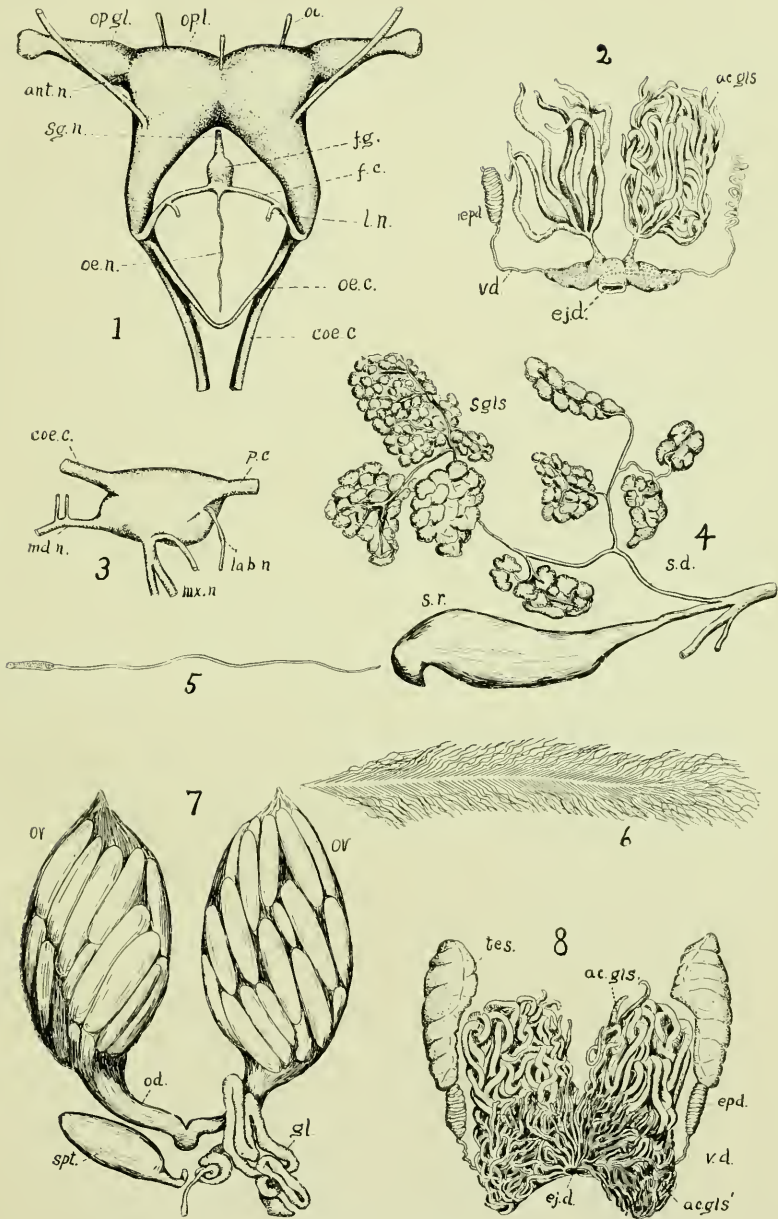
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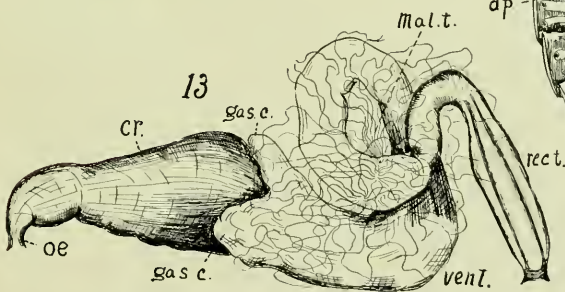
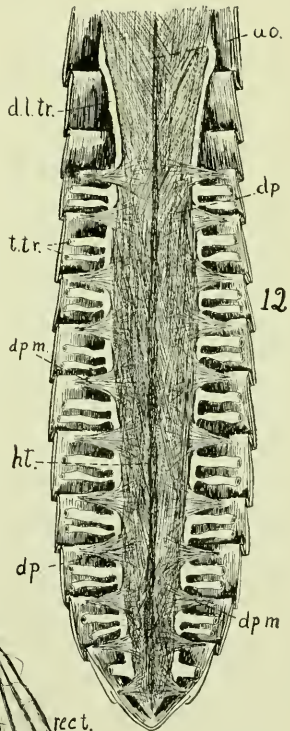
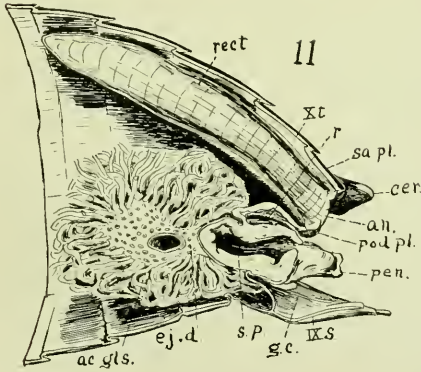
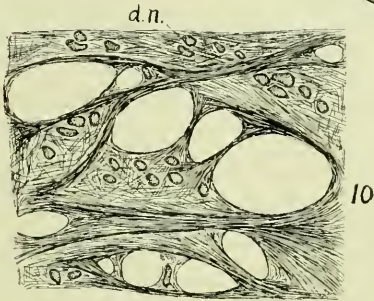
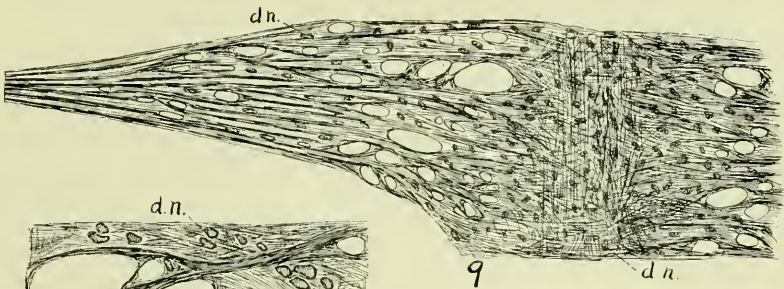
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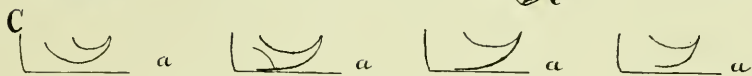
Terminal Abdominal Segments of Female Tipulidæ.



Internal Anatomy of *Peranabrus scabricollis*.



Internal Anatomy of *Peranabrus scabricollis*.

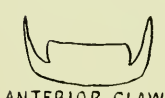
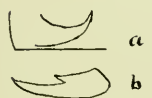


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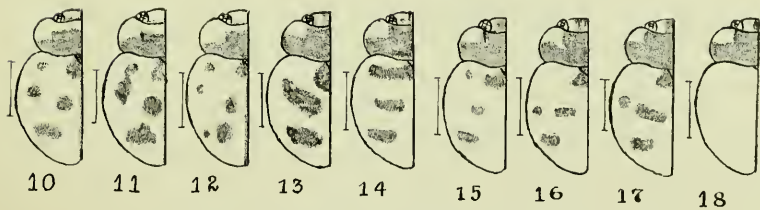
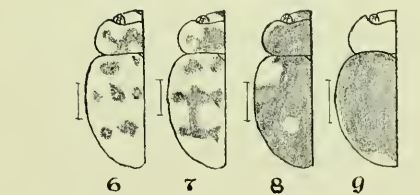
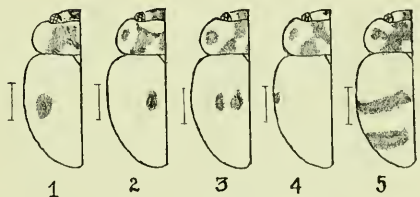
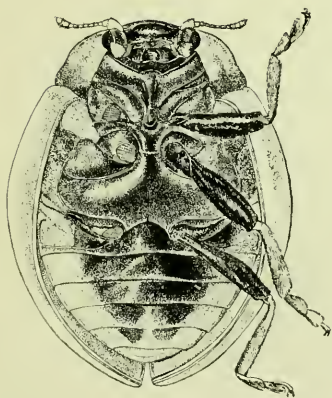
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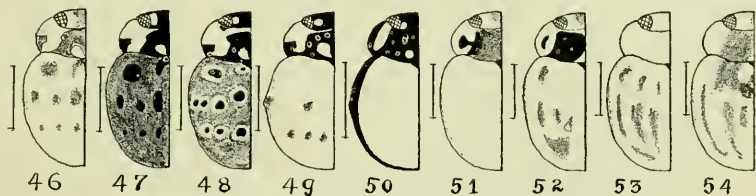
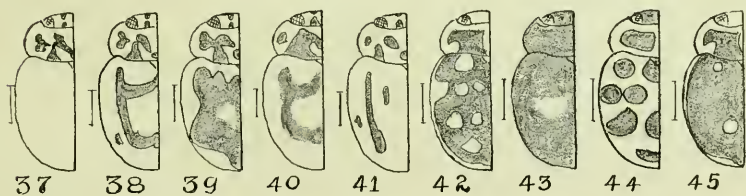
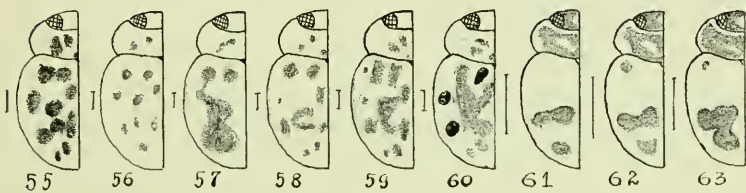
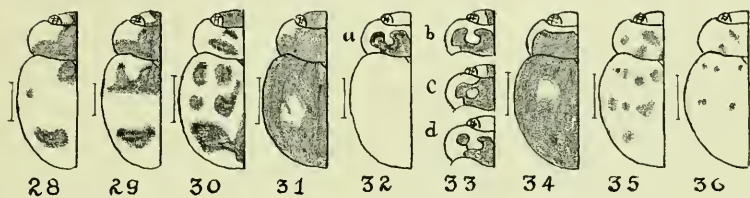
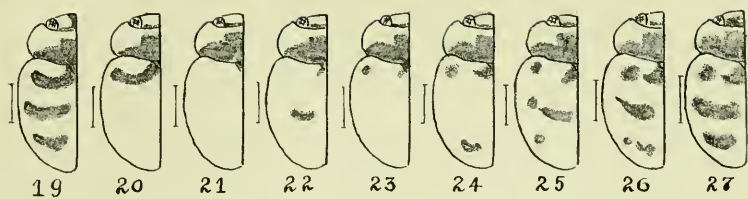


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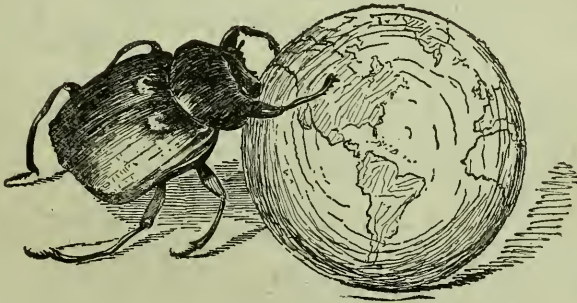
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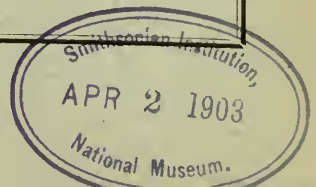
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CONTENTS.

New Noctuids for 1903. No. 2, with Notes on Mamestra and Scotogramma. By JOHN B. SMITH	1
Illustrations of the Larvæ of North American Culicidæ— III. By HARRISON G. DYAR	23
Classification of the Pointed-tailed Wasps or the Superfamily Proctotrypoidea—II. By WILLIAM H. ASHMEAD.	28
Notes on Coccinellidæ. By CHARLES W. LENG	35
Notes on the Cerostoma Group of Yponomeutidæ, with Descriptions of New North American Species. By AUGUST BUSCK.	45
The Price of Dairy Products as Influencing the Abundance of some Insects. By F. M. WEBSTER	59

JOURNAL

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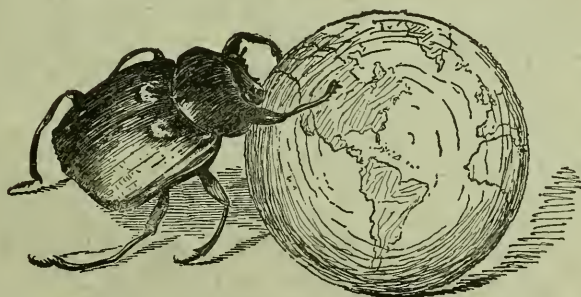
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CONTENTS.

Coccidæ of the Coniferæ, with the Descriptions of Ten New Species from California. By GEORGE A. COLEMAN	61
Classification of the Pointed-tailed Wasps, or the Superfamily Proctotrypoidea—III. By WILLIAM H. ASHMEAD	86
Winding Elbow-pins. By ALEX. D. MACGILLIVRAY	99
A Review of the North American Species of Pronuba and Prodoxis. By HARRISON G. DYAR	102
The Real Larva of Xanthopastes timais. By HARRISON G. DYAR	104
The Larva of Phiprosopus callitrichoides. By E. DAECKE	105
On the Generic Name of the Codling Moth. By AUGUST BUSCK	106
Proceedings of the New York Entomological Society	111

JOURNAL

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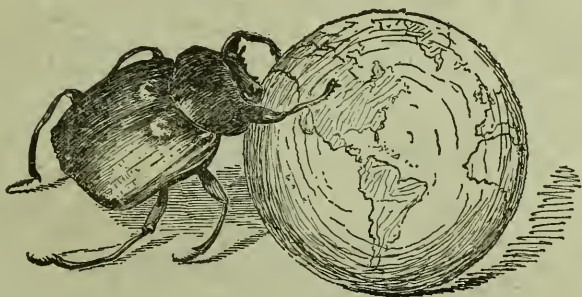
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CONTENTS.

The Skewness of the Thorax in the Odonata. By JAMES G. NEEDHAM AND MAUDE H. ANTHONY.	117
Phryganidia californica. By BEVERLY LETCHER.	125
A Preliminary List of the Pentatomidæ Within Fifty Miles of New York. By J. R. DE LA TORRE BUENO.	128
A Synopsis of the North American Species of Japyx. By MYRON H. SWENK.	129
Color Preference in Insects. By A. S. PACKARD.	132
Some Philippine Mosquitoes. By C. S. LUDLOW.	137
Two New Hymenopterous Parasites. By WILLIAM H. ASHMEAD.	144
Descriptions of New Tineaidea. By W. D. KEARFOTT.	154
Brief Notes Toward the Life-History of Pelocoris femorata. By J. R. DE LA TORRE BUENO.	166
Proceedings of the New York Entomological Society	173



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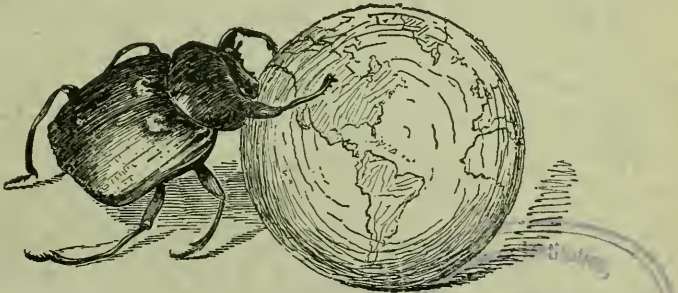
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CONTENTS.

The Terminal Abdominal Segments of Female Tipulidæ. By ROBERT E. SNODGRASS.	177
Notes on the Internal Anatomy of <i>Peranabrus scabricollis</i> . By ROBERT E. SNODGRASS.	183
New Noctuids for 1903, No. 5. By JOHN B. SMITH.	188
Notes on Coccinellidæ, II. By CHARLES W. LENG.	193
List of the Cicindelidæ of Mexico, etc. By WALTHER HORN.	213
Theory as to Evolution of Secondaries of Moths of the Genus <i>Catocala</i> . By ARCHIBALD C. WEEKS.	221
Additions to the List of New York Pentatomidæ. By NATHAN BANKS.	227
Note on Pentatomidæ. By J. R. DE LA TORRE BUENO.	228
On the Sleeping Habits of Some Aculeate Hymenoptera. By CHARLES T. BRUES.	228
New Noctuidæ from Tropical America. By WILLIAM SCHAUS.	230
Some New Neuropteroid Insects. By NATHAN BANKS.	236
New Generic Types of Bombycine Moths. By ALPHEUS S. PACKARD.	244
Proceedings of the New York Entomological Society.	249

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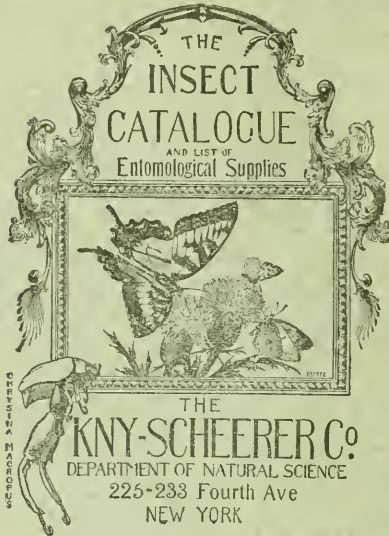
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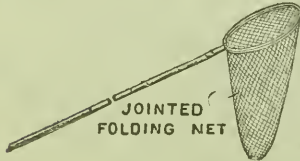


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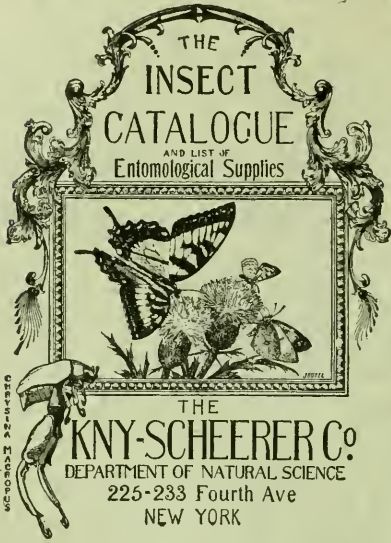
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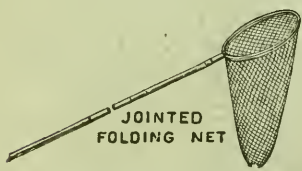


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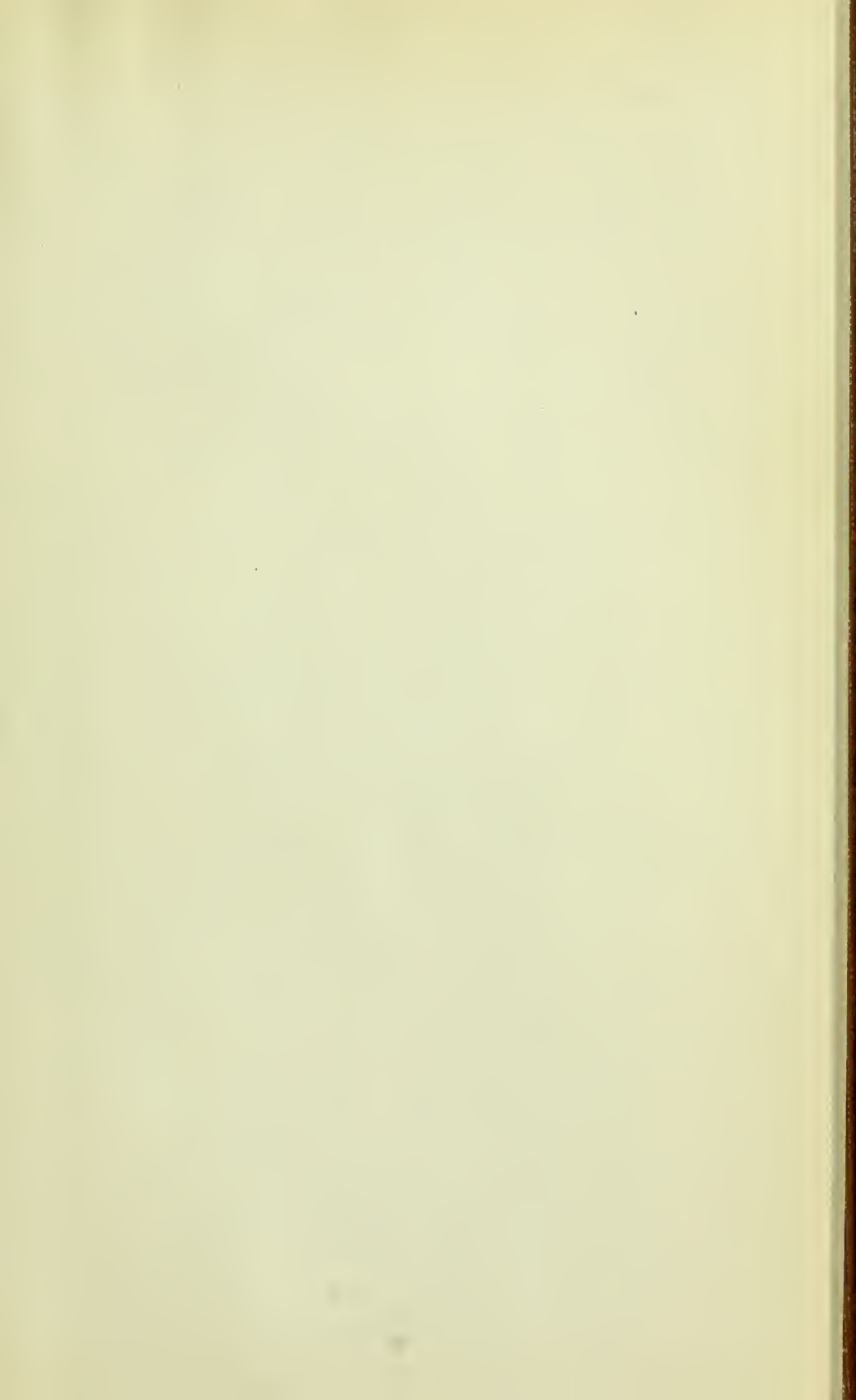
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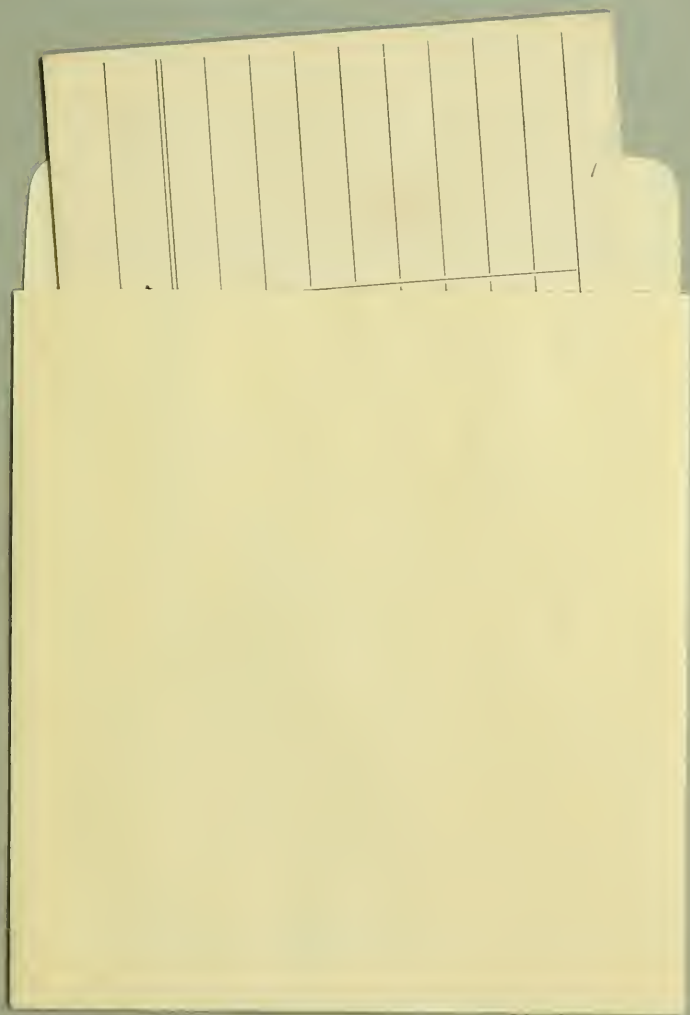
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