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No. 2.

PHYLLAPHIS COWENI, CKLL. (Plate I, Figures 1 to 6).

BY C. P. GILLETTE, FORT COLLINS, COLORADO.

Aphid. Cowen: Bull. 31, Tech. Ser., Colo. Ex. St., p. 125, 1895.

Pemphigus Coweni, Cockerell, CAN. ENT., XXXVII, p. 391, 1905.

Mr. Cowen being unable to place this louse in a genus known to him, did not attach a name to it, though his descriptions of both gall and louse make it certain that he was studying the species under consideration.

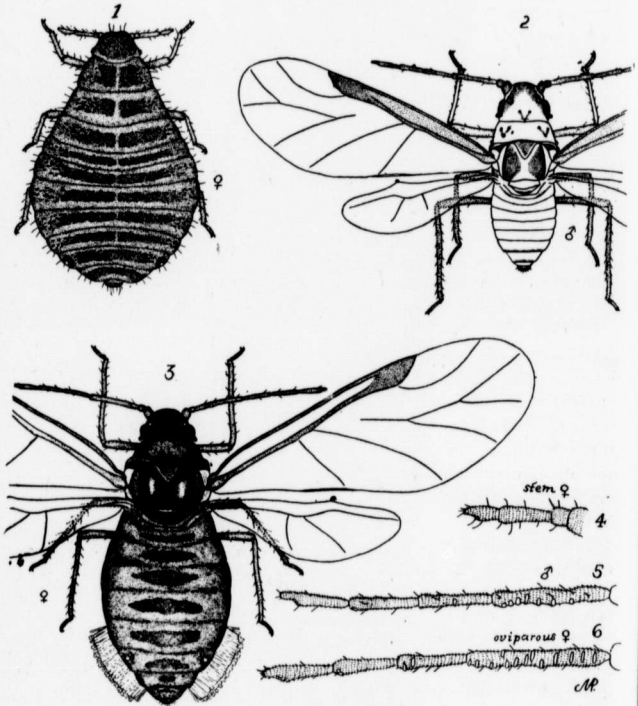
The louse has the general appearance and habits of a *Pemphigus*, and was so placed by Prof. Cockerell, who saw only the apterous form and pupæ. On Aug. 5th, 1908, the writer was in the foothills a few miles west of Fort Collins, at an altitude of about 8,000 feet, where Bearberry (*Arctostaphylos uva-ursi*), the host-plant of this louse, grows in great abundance. Apparently every plant was infested, as was evident from the numerous pod-like leaves that were conspicuous everywhere. The galls are formed by about one-third of the leaf surface folding lengthwise upon the other two-thirds, inclosing the lice and becoming swollen so as to resemble minute pea-pods. If the galls were beneath leaves so as to be shaded, they were green in colour, but if exposed to the sun they were more or less deep red in colour. The galls varied between 10 and 20 mm. in length.

Many apterous lice, including stem-mothers, and numerous pupæ, were present in the galls, but no adult alate forms were seen, and apparently all the lice, except stem-mothers, were to become winged. Syrphus larvæ were common in the galls.

Plants bearing galls were taken and placed in the insectary, where syrphus flies and great numbers of the alate viviparous females, alate oviparous* females and alate males were reared. These I have described below.

A glance at either of the alate forms figured in the accompanying plate will be sufficient to see that this can not be a *Pemphigus*, as the fore wing has the cubital vein with two forks, when it should have none. I

*This is the only species, except in *Chermes*, where I have seen alate oviparous females.



PHYLLAPHIS COWENI, GILLETTE.

have therefore placed the species in the genus *Phyllaphis*, where it seems more nearly to belong.

It seemed as though the stem-mother must be the immediate parent of all the colony in each gall, but she probably was mother of the viviparous alate females only, and these probably gave birth to the true sexual forms.

Stem-mother : Plate I, figs. 1 and 4.

General colour varying with age, the older specimens being darkest. The light-coloured specimens are dull sordid yellow, with transverse broken bands of very dark olive green over a large portion of the abdomen. The older and darker specimens appear almost entirely black. The head, antennæ, entire legs, including coxæ, and genital plates, dark brown to blackish in colour. The legs and antennæ are very short and stout. The femora of the hind legs do not exceed in length joints 3 and 4 of the antennæ combined. General shape of the body stout pyriform, the older specimens being very much truncated posteriorly. Length varying from 1.25 to 1.50 mm.; width varying little from 1 mm.; joints to the antenna four; the 4th joint having an unguis which is about half as long as the short 4th joint; joint 3 a little less than half the whole length of the antenna. There are no visible sensoria except one at the base of the unguis, and I cannot make out any transverse annulations upon joints 3 and 4 except as indicated by minute stout hairs arranged in transverse rows.

The body is sparsely set with rather stout hairs; the entire surface above and the antennæ are also closely set with very short stout hairs, giving it a velvety appearance; vertex convex, slightly bilobed; cornicles very slightly raised above the surface, located about midway on the 6th segment, and surrounded by a dark area; cauda subobsolete; beak just attaining middle coxæ. In dark specimens of the louse the cornicles are often difficult to see.

Pupa.

Very light to dark green in colour. In each gall there are a few pupæ smaller and lighter coloured than the others, which I take to be the males. Wing-pads of the female pupæ blackish; length of female pupa before last moult 1.80 to 2 mm.; antennæ 6-jointed, joint 3 longest and about equal to joints 4 and 5 together.

Alate Oviparous Female : Plate I, figs. 3 and 6.

General colour of body dark olive green, with head and lobes of

mesothorax black; beneath, the colour of the abdomen is a light olive green; the antennæ and legs are dusky brown to blackish; on either side of the abdomen, opposite the cornicles and beneath the lateral margins of segments 5, 6 and 7 is a heavy tuft of white cottony secretion. This cottony secretion, apparently, is not formed on any other portion of the body, or by any other of the lice. Length of body 1.50 to 1.70 mm.; length of wing 2 mm.; antenna varying from .65 to .85 mm.; third joint longest and almost exactly equal to joints 4 and 5 combined; joint 6 with its short unguis equal to or slightly longer than either joint 4 or 5. As in case of the stem-mother, the joints are distinctly covered everywhere with very short stout hairs or points. On the terminal joints these minute points are arranged in more or less distinct annulations. Joint 3 has about 15 transverse tuberculate sensoria; joint 4 two to five similar sensoria; legs distinctly shorter than in the viviparous form, the hind tibiæ measuring only about .51 mm. in length; vertex quite convex; cornicles slightly raised above the surface, somewhat more prominent than in the stem-mother; cauda broadly rounded, scarcely elevated; anterior wings with three transverse veins, the third transverse vein being twice forked; the branch forming the second fork arises about midway between the first fork and the tip of the wing; stigmal vein moderately curved; stigma transparent, very short and hardly longer than broad; posterior wing with two cross nervures; both wings hyaline; beak just attaining second coxæ.

Lice that emerged during the night began depositing eggs by noon of the following day.

Viviparous Female.

Differs from the oviparous form in having the legs longer; tibiæ of hind legs measuring about .68 mm. This form also lacks entirely the waxy secretion which forms upon the sides of the venter on joints 5, 6 and 7 in the oviparous form.

Alate Male: Plate I, figs. 2 and 5.

The male is much smaller than the females, and the general body colour is light yellow. The compound eyes and the sides of the head in front of them are black. The lobes of the mesothorax and scutellum are dusky brown to black. In most specimens a distinct dusky V-shaped spot occurs upon the dorsum of the head and one near either lateral margin of the prothorax. Antennæ and legs dusky yellow. Darker specimens have the head largely dusky brown, and the antennæ and legs dusky

or with very little yellow showing. Length of body, .80 mm. to 1 mm.; vertex rather sharply rounded; length of wing, 1.60 mm.; length of antennæ, .80 mm.; joint 3 longest, joints 4 and 5 equal; joint 6, with unguis, of the same length as the two preceding joints; joint 3 with about seven and joint 4 with about one transverse sensoria.

DESCRIPTION OF PLATE.

Phyllaphis Coweni, Ckll.—1, stem-mother; 2, male; 3, oviparous female; 4, antenna of adult stem-mother; 5, antenna of male; 6, antenna of oviparous female. M. A. Palmer, artist.

Figures 1, 2 and 3 are enlarged 30 diameters, and figures 4, 5 and 6 80 diameters.

THE PREPARATORY STAGES OF EUCHLOË SARA, BOISD.

BY KARL R. COOLIDGE AND ERVAL J. NEWCOMER, PALO ALTO, CALIF.

Euchloë sara, with its variety *Reakirtii*, Edwards, is a common and early butterfly in California, flying in the open fields about wild mustard (*Brassica*) and other crucifers. *Reakirtii* may sometimes be seen as early as February, and later, in April and May, *sara* appears, continuing on the wing until October. *Sara* is one of the early Californian pioneers, having been described by Dr. Boisduval in 1852.¹ In 1869 W. H. Edwards² described *Reakirtii*.

Synonymy and Distribution.—*Sara*, with its so-called varieties, is distributed almost everywhere west of the Rocky Mountains, from Arizona to Vancouver. As shown by Edwards (CAN. ENT., XXIV, p. 52), *sara* proceeds from eggs of *Reakirtii*, although some of the pupæ may go over and produce *Reakirtii* in the spring, the dimorphism being that of *Papilio ajax*. *Thoosa*, Scudder, is a synonym of *julia*, Edwards, and *flora*, Wright, and *mollis*, Wright, are but slight modifications of *sara*. *Brown-ingii*, Skinner; *stella*, Edwards, and *julia*, Edwards, we would consider but geographical forms of *Reakirtii*. Both *Sara* and *Reakirtii* are dimorphic, some females being white and others yellow, with all intergradations. The males are only occasionally slightly yellowed. *Reakirtii* may be distinguished from *sara* by its smaller size, and the discal band on primaries is blacker and more waved. Beneath, on the secondaries, the greenish tinge is more pronounced than in *sara*, and the apex and external margin of fore wings is heavier. Henry Edwards, in a letter to W. H.

1. Ann. Soc. Ent. Fr., 2, 10, 285, 1852.

2. Trans. Am. Ent. Soc., 2, 369, 1869.

Edwards (Butt. Vol. 1), writes: "As to *sara*, I first met with it two years ago in Santa Clara County, and was at once struck by its larger size, the yellow colour of most of the females, and the absence of the irrorated line along the anterior margin, as well as by the much fainter green markings on the under side of lower wings. Unlike *Reakirtii*, the species seems to prefer the open fields, flies much more slowly, and alights often upon flowers of *Brassica*, *Nasturtium*, etc. I am so accustomed to the two forms, that I can now distinguish them by the flight alone."

Preparatory Stages.—Scarcely anything is known of these. Edwards³ refers to the relationship of *sara* and *Reakirtii*, as shown by records of the pupæ. Again, in his supplement to the Butterflies of the United States (v., 3, p. 2, 1897), he refers to this. G. R. Minot, in a note in Entom. News (p. 158, 1902), briefly describes the egg, and records the oviposition on the "common mustard."

Food-plants.—Lennert⁴ reports the oviposition of *sara* and *Reakirtii* in the Yosemite National Park on the stalk of *Thysanocarpus pusillus*. In this locality *sara* has the same food-plants as *ausonides*, viz., *Brassica campestris*, L., and *nigra*, L. But there must be others also, as *sara* is found abundantly in the higher hills, where *Brassica* is very rarely met with.

Oviposition.—For the past several years we have observed numerous instances of oviposition. As a rule the eggs are tucked between the young sepals, but there is a great irregularity in this. Sometimes the eggs are placed on the peduncles, and quite often on the under side of the leaves, upon which the larvæ readily feed. On June 27, '07, a ♀ was observed ovipositing. Eight eggs were seen to be laid, one on a leaf, two on peduncles, and the others on the buds. She was then captured, and by the next afternoon she had deposited forty-five more eggs in the pill box in which she was confined.

Egg.—Length almost 1 mm.; fusiform, laterally marked with raised vertical ridges not quite so prominent as in *ausonides*, between which are finer cross-veinlets; base flattened. Colour light lemon-yellow when first laid, changing to orange in from twenty to thirty hours, and this colour is quite uniform until just before hatching, when the colour is duller.

First Instar.—Length, 1.5 at rest; in motion nearly 2 mm. Colour dirty yellow, sparsely covered with black hairs. Head rather large, black. The duration of the egg stage to the emergence of the young larvæ varies

3. CAN. ENT., XXIV, p. 52, 1892.

4. Entom. News, 6, 137, 1895.

considerably, according to the condition of the weather. Our records show from four to eight days.

Second Instar.—Much as in preceding; a little over 3 mm. in length; colour generally lighter.

Third Instar.—Length about 6 mm. Colour greenish, with a yellow lateral stripe and a light dorsal line, sparsely hirsute; head black or dark green.

Fourth Instar.—Length about 15 mm.; uniformly dull grassy green; head rather darker, large, bilobed, with many ferruginous coloured short hairs; body also covered with same clothing, and also more scattered long black bristles. A whitish lateral stripe edged below with darker; ventral stripe very faint.

Fifth Instar.—Average length about 27 mm.; colour slightly darker than in preceding stage, head concolorous. A rather wide lateral band on the line of the spiracles, and continuing on the side of the head; dorsal line obscure. Head small, more so than the body, distinctly bilobed; head and body covered with many short black tubercles or hairs.

Pupation.—The method of pupation and spinning the girdle is so similar to various well-known species of *Pontia*, that we do not repeat it here. We have never been able to find the pupa in nature, but Mr. F. X. Williams tells us he has found several pupæ of both *sara* and *ausonides* suspended at the base of the food-plant.

Pupa.—Colour very light silvery-gray, the ventral area lighter; pronotum bluntly produced, the wing-cases thereon marked in white; ventral line and ridges dark; outline curved, more so than *ausonides*, but not so much as in *lanceolata* or *pima*; spiracles indicated by blackish points. Considerable variation occurs in the curvature of the profile; one pupa we had was very straight, more so than in any of the other species; palpi case more or less recurved, sometimes quite noticeably so. Normal length 22 mm.

We are much indebted to Prof. Chas. A. Shull for copying for us the text in this genus from Edwards's Butterflies of North America.

ENTOMOLOGICAL SOCIETY OF AMERICA.

The fourth meeting of the Entomological Society of America was held in Baltimore, Dec. 30 and 31, in affiliation with the American Association for the Advancement of Science and other Societies. The number in attendance was exceptionally large.

The sessions were called to order on Wednesday morning by the

President, Dr. Wm. Morton Wheeler. The report of the Committee on Nomenclature was received. It will be printed in the "Annals" and brought up for discussion next meeting. Appropriate minutes were adopted in regard to the deaths of Drs. Ashmead and Fletcher, and the deaths of Messrs. C. A. Davis, A. Craw and A. V. Taylor were also announced by the Chair. The election of the following Fellows was announced: E. P. Felt, S. W. Williston, A. D. MacGillivray, T. D. A. Cockerell, E. D. Ball, and also the election of 39 members.

The following suggestion was considered and referred to the Committee on Nomenclature: "That the Entomological Society of America should undertake to get out a list of all names of insects, to be used as a standard code, like the A. O. U. code." The following resolution was adopted and referred to the Executive Committee with power to act: "That it is the sense of the Society that the duty on insects is objectionable and should be abolished."

An amendment to the constitution was proposed, to be voted on at the next meeting, abolishing the present requirement that officers shall be chosen only from the list of Fellows. An additional by-law was adopted, as follows: 6. "Any member may become a life member upon payment of \$50 at one time, and shall be exempt from further assessments. He shall receive during his life one copy of each issue of the Annals."

The following officers were elected: President, Dr. Henry Skinner; First Vice-Pres., Prof. Herbert Osborn; Second Vice-Pres., Dr. A. D. Hopkins; Sec.-Treas., J. Chester Bradley. Additional members of the Executive Committee: Prof. J. H. Comstock, Dr. John B. Smith, Dr. W. M. Wheeler, Rev. Prof. C. J. S. Bethune, Mr. E. A. Schwarz and Prof. Lawrence Bruner. Standing Committee on Nomenclature (for three years), Dr. E. P. Felt, to succeed himself. Member of the Editorial Board, to fill the vacancy caused by the death of Dr. Fletcher, Rev. Prof. C. J. S. Bethune.

On Wednesday afternoon a joint session with Section F., A. A. S. was held, at which Dr. John B. Smith presided. At both this and the following session on Thursday very full and interesting lists of papers were read.

The sessions closed with an exceedingly interesting address on Thursday evening by Dr. E. B. Poulton, Hope Professor of Zoology in Oxford University, England, on "Mimicry in the Butterflies of North America." The address was illustrated by many beautiful lantern slides, and was attended by a large and appreciative audience. It, and also the full minutes of the sessions, will be published in the "Annals of the Entomological Society of America."—J. CHESTER BRADLEY, Sec.-Treas., Ithaca, N. Y.

THE EGGS OF LUTZIA BIGOTII, BELLARDI (CULICIDÆ).

BY ALLAN H. JENNINGS, ANCON, CANAL ZONE, PANAMA.

On May 30, 1908, while collecting along a rapid mountain stream on the Island of Caldera, Porto Bello Bay, Rep. Panama, I secured several masses of mosquito eggs, which subsequently proved to be those of *Lutzia Bigotii*.

They were taken from a small pool in the rocky bank of the stream, the water of which was supplied by the stream itself, the pool being nearly filled with vegetable matter consisting of dead leaves, twigs, petals of flowers, seeds, etc.

Nearly full-grown larvæ of *Lutzia* were present, as well as many of *Anopheles eiseni* and many of several species of *Culex*, none of the latter, however, being bred.

The eggs were cylindrical, about one thirty-second of an inch in length, as nearly as could be estimated (no means of accurate measurement being at hand), slender, and terminated in a nearly hemispherical head of the same diameter as the body of the egg, which, however, was drawn to a low point or apex. The body of the rod-like egg was of a pale yellowish-white, with a metallic reflection appearing almost golden in certain lights, while the apex or head, which was sharply defined, was of a pale blue colour.

The eggs were arranged in a double row, forming a raft or boat. The largest mass contained twenty-five pairs, but with nothing to indicate its original size. Several smaller masses were taken from the same pool, but whether they had formed a part of the same or another raft it is impossible to say.

The eggs adhered to each other rather tenaciously, and did not become separated by being poured into a collecting vial nor by the rather rough journey back to camp.

The "boat" floats low in the water, the rod-like portion being nearly submerged, only the "head" showing above the surface.

I should think that these eggs were laid during the night of May 28th.

At 8 p.m. on May 30th, or presumably 48 hours after being laid, hatching began, the young being easily identified, and showing the characteristic attitude and habits of the larva of this species. They immediately began preying voraciously upon each other, and materially reduced their numbers before the next morning, when they were separated.

In hatching the young larvæ emerged from the bottom of the egg, the clear yellowish-white colour becoming dark and blackish and the cohesion of the empty cases being lost, the eggs fell gradually apart and the mass finally disintegrated.

The young larvæ were carefully separated and grew rapidly, increasing by the next morning fully 50 per cent. in length and doubling their size within 24 hours. The adults began emerging in ten days from date of oviposition, though an unavoidable lack of food material for a short time may have slightly lengthened the normal time of development.

TWO NEW SEED-INFESTING CHALCIS FLIES.

BY CYRUS R. CROSBY, CORNELL UNIVERSITY, ITHACA, N. Y.

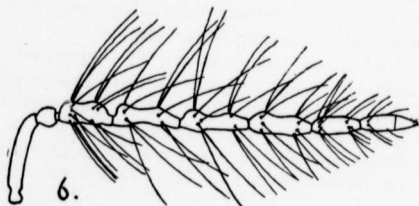
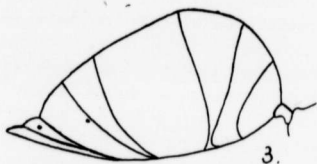
Prodecatoma phytophaga, n. sp.—Female: Length, 2.4 to 2.7 mm.; abdomen, 1.2 to 1.3 mm.

Head and thorax densely umbilicate-punctate. General colour black; face, cheeks and a ring around the eyes light yellowish-brown; sides of prothorax, lateral angle of scapulæ, mesopleuræ and ventral side of abdomen more or less suffused with brownish; pronotum with two small brownish spots sometimes obsolete.

Head seen from above as wide as the thorax, concave behind, strongly convex in front, a distinct frontal furrow present, in which the front ocellus is placed; seen from in front a little wider than high; the eyes small and widely separated. Face with a system of fine ridges radiating from the clypeus.

Propodeum with a median longitudinal depression, broad and regularly concave; propodeum on the sides rugose-reticulate, within the furrow densely, finely and distinctly reticulate-punctate; anterior end of depression with two smooth submedian pits, posterior end with a semi-circular row of similar pits. Between this row and the insertion of the petiole there is a transversely striate elevation. No median carina present, except between the two anterior pits. Colour of propodeum black, except that in some specimens there is a testaceous streak on each side of median depression.

Antennæ dusky, under side of scape yellowish; club and scape of about equal length; pedicel short; funicle joints submoniliform, the first slightly longer than the others; club elongate-oval, obtusely pointed at tip, the last two segments not separated by a distinct suture. Coxæ black, in some specimens more or less yellowish; rest of legs dull yellowish;



PRODECATOMA PHYTOPHAGA, CROSBY.

posterior femora with a black area on the outside; posterior tibiæ more or less infusate. Wings hyaline; veins brownish. For relative length of veins see figs. 1 and 2.

Abdomen seen from above pointed ovate; segment 5 twice as long as 4, its posterior margin broadly concave; segment 3 two-thirds as long as 4; dorsum of abdomen black, the venter brownish, the amount of brownish varying in different specimens; sometimes a band runs up on the side of segment 5 so as to be visible from above; on segment 6 the brownish on the anterior margin is nearly continuous across the dorsum; on segment 7 the black is confined to a large basal triangular spot, which does not quite attain the tip. The abdomen is smooth and shining, with a very delicate hexagonal reticulation of impressed lines. The relative length of the segments as seen from the side is shown in fig. 3.

Male: Length, 2.7 mm.; abdomen, 1.2 mm. Differs from the female in having the thorax entirely black (in two specimens only are the pleuræ brownish), in the greater amount of black on the head and in the very small amount of brownish on abdomen.

Median longitudinal depression of propodeum with a distinct furrow, irregularly rugose, sometimes with the ridges so arranged as to give a median carina.

Antennæ black, with the scape yellowish, except distal half above; pedicel below and ring-joint yellowish; the funicle joints pedicellate and distinctly constricted in the middle, clothed with two whorls of long hairs. The first joint of the club is more distinctly separated than the last two. Posterior femora and tibiæ darker than in the female.

Petiole much longer than posterior coxæ, three-fifths as long as rest of abdomen, finely rugulose, with a short median and two lateral carinæ at the posterior end. Abdomen seen from the side straight below, highly arched and squarely declivous in front. The relative proportion of the segments as seen from the side are shown in fig. 4.

Described from 5 females and 17 males, reared during the summer of 1908 from seeds of Virginia Creeper, *Parthenocissus quinquefolia*, collected at Ithaca and Taughannock Falls, N. Y. Under natural conditions the adults appear during late July and early August.

Eurytoma rhois, n. sp.—Female: Length, 1.7 to 2.8 mm.; abdomen, .9 to 1.5 mm. General colour black; head and thorax densely umbilicate-punctate.

Dorsal view of the head is shown in fig. 7. In form and sculpture the thorax is very similar to that of *Eurytomocharis triodiae*. Propodeum

coarsely rugose on the sides; the longitudinal median depression broad and shallow, densely and distinctly reticulate-punctate, except in the longitudinal furrow, which is rugose and much wider in front than behind, where there is frequently a single or rarely a double longitudinal carina. In the smaller specimens the median furrow is entirely lacking.

Antennæ slightly clavate, dusky, except scape beneath, which is dull brownish-yellow. The relative length of the segments is shown in fig. 8; viewed at a different angle the club is a little broader. Coxæ black; femora black, tip yellowish-brown; tibiæ brownish, more or less infuscate medially; tarsi nearly white. On the cephalic face of front coxæ there is a deep diagonal furrow bounded in front by a distinct ridge. This ridge near the upper outer angle makes a sharp turn and extends transversely around on the side of the segment. Mesosternum has a distinct median pit in front; median carina lacking, except posteriorly, where it is represented by a delicate ridge. Wings hyaline. (Figs. 9 and 10.)

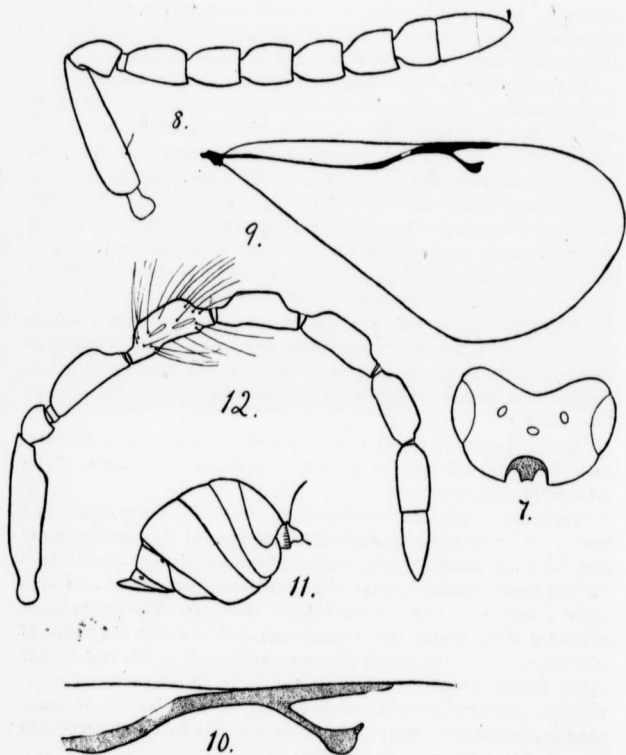
Abdomen smooth, without sculpture, subcompressed, seen from the side broadly ovate, the tip sharp-pointed; segments 2, 3, and 4 subequal, the fifth longer than 3 and 4 together, the sixth very narrow and gently emarginate in front of the spiracle of the seventh; the seventh segment clothed with fine white pile. (Fig. 11.)

Male: Length, 2 to 2.4 mm.; abdomen, .9 mm. These measurements are only approximate on account of the contracted condition of the abdomen in these specimens.

Propodeum with the median longitudinal depression wide and shallow, the furrow much less distinct than in female. The legs and wing-veins are much darker than in female. Antennæ black; scape at base and ring-joint brownish. Scape slightly enlarged beneath towards tip; pedicel subglobose; the five funicle joints subequal, arched above, not constricted at the middle, briefly pedicellate, and each with two whorls of rather short hairs; club as long as scape, two-jointed. (Fig. 12.) Petiole slightly longer than the hind coxæ, and finely but distinctly rugulose-reticulate; coxæ with the same sculpture above. The body of abdomen is highly arched above, squarely declivous in front; the fourth segment is longer than the fifth and sixth together.

Described from numerous specimens reared during the summer of 1908 from seeds of Sumac, *Rhus hirta*, collected at Ithaca and Taughanock Falls, N. Y.

Schreimer (Zeitschr. wiss. Insbiol., IV, pp. 26-28, 1908) gives an account of the phytophagous habits of another species of this genus, to



EURYTOMA RHOIS, CROSBY.

which Mayr has given the manuscript name of *Eurytoma Schreimeri*. It infests the seeds of the plum in Astrakan, Russia, and causes considerable damage to the crop, the infested fruit dropping while still quite small.

EXPLANATION OF PLATES 2 AND 3.

Plate 2, fig.	1.—	<i>Prodecatoma</i>	<i>phytophaga</i> ,	♀ wing.
" "	2.—	"	"	stigmal area of ♀ wing.
" "	3.—	"	"	♀ abdomen from side.
" "	4.—	"	"	♂ abdomen from side.
" "	5.—	"	"	♀ antenna, hairs omitted.
" "	6.—	"	"	♂ antenna.
Plate 3, "	7.—	<i>Eurytoma</i>	<i>rhois</i> ,	♀ head from above.
" "	8.—	"	"	♀ antenna, hairs omitted.
" "	9.—	"	"	♀ wing.
" "	10.—	"	"	stigmal area of ♀ wing.
" "	11.—	"	"	♀ abdomen from side.
" "	12.—	"	"	♂ antenna.

THE JAPANESE COCCIDÆ.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

In the Bulletin of the Imperial Central Agricultural Experiment Station of Japan, Vol. 1, No. 2 (1907), Mr. S. I. Kuwana has published a new list of the Coccidæ of Japan, with numerous new species. I am indebted to Dr. L. O. Howard for the loan of the work, which is probably little known in this country. A very beautiful *Icerya*, illustrated by coloured figures, is introduced as *I. okadæ*. It is, however, exactly like *I. seychellarum* (Westwood), and I do not see any reason for separating it from that species, except that according to the figure the femur is much stouter. *Cerococcus muratæ* is a most interesting species, but I think it should be known as *Solenophora muratæ* (Kuw.). *Pseudococcus takæ* (*Dactylopius takæ*, Kuw.) is a new species on bamboo; the figure of the antennæ shows nine joints, although the description indicates only eight. From the figures, and the general appearance, one might suspect the insect to be a *Phenacoccus*. *Ripersia oryzæ*, Kuw., found at roots of rice, has large subcylindrical caudal lobes, and cannot be regarded as a true *Ripersia*; no doubt the discovery of the larva and male will throw light on its affinities. *Aclerda* (?) *biwakoensis*, Kuw., on *Phragmites*, should be compared with *A. japonica*, Newstead; it might be the same, but for apparent differences at the caudal end. *Pulvinaria Kuwacola*, on

mulberry leaves, is a curious species with a very short ovisac. *Lecanium kunoensis*, Kuw., is very much like *L. cerasorum*, Ckll., and may possibly be the same. *Eulecanium glandi* (*Lecanium glandi*, Kuw.) is an immense species, 15 mm. long, found on apple, pear, etc. *Xylococcus matsumurae* is given as a new species, but it was originally introduced to our notice in *Insect World*, March, 1905. It is not a *Xylococcus*, but forms a remarkable new genus. The table of genera allied to *Xylococcus*, as given in *CANAD. ENTOM.*, Oct., 1899, p. 275, may be enlarged as follows :

Antennæ of adult female 8-jointed ; first joint extremely large ; second short, very much broader than long ; joints broader apically than basally ; last joint oblong, longer than any except the first ; body elongated, $3\frac{2}{3}$ times as long as broad, blunt posteriorly ; legs well developed, the anterior femora noticeably stout ; tibiæ much longer than tarsi ; no mouth. (Russia) *Steingelia*, Nassonow (type *S. gorodetskia*, Nassonow).*

Antennæ of adult female 9-jointed.

With an anal tube producing a long rod or thread of wax ; last joint of antenna of larva moderate, with long bristles

(Europe, U. S.) *Xylococcus*, Loew.

With no anal tube ; last joint of antenna of larva exceedingly large, with short bristles (Japan, Ceylon) *Kuwania*, Ckll.

Antennæ of adult female with 10 or 11 joints.

Female with a marsupium, in which the eggs are laid

(Australia) *Callipappus*, Guérin.

Female without a marsupium ; broad posteriorly, not elongated, antennæ 10-jointed, close together ; larva with antennæ 7-jointed, and very peculiar crab-like legs, the femur large ; male without whorls of long hairs on the antennal joints ; caudal brush long, arising from the apical segment ; rudimentary hind wing with very large hooks (Japan)

Matsucoccus, Ckll. (type *Matsucoccus matsumurae*, Kuwana).

Matsu is the pine-tree, on which the new genus was found. It is evidently related to *Callipappus*, but much less specialized, probably representing the general stock from which *Callipappus* arose.

In his list, Mr. Kuwana enumerates only two species of *Asterolecanium* ; but he himself has sent me two others ; one new, the other (collected by Mr. Kuroyuwa in the Lu Chu Islands) is *A. bambusæ*, Boisd.

*I received this insect some years ago from Professor Nassonow, and understood that he was about to publish it, which he has done in *Ann. Mus. Zool. Acad. Imp. Sci., St. Petersburg*, xiii, p. 345. The specimen is now at the Bureau of Entomology, U. S. Dept. of Agriculture.

NEW HISTORIES AND SPECIES IN PAPAPEMA (HYDRÆCIA).

BY HENRY BIRD, RYE, N. Y.

(Continued from Vol. XL, page 30.)

For some years past the writer has wondered if the species of *Papaipema*, boring as a larva in *Helianthus giganteus* throughout this section of the Atlantic seaboard, was really the *necopina* of Grote. The fact of its restricted occurrence, which a wider knowledge of our fauna has yearly accentuated, made us wonder whether Buffalo, N. Y., the type locality, would in any likelihood support this species. Ten years back this local form was sent to Mr. Grote when he was at Hildesheim, Germany, and confirmed by him to be the *necopina* he had described twenty years before. His types, however, were not with him for comparison, being in the British Museum, and there remained a slight difference in the description of his species and the local form. With each succeeding year that it was bred at Rye, and the occurrences were in goodly numbers, we became more impressed with the constancy of the species, and that, in the slight degree wherein it differed, this discrepancy always held. Later comparisons by different ones of the British Museum types with Rye material elicited no suggestion of a tangible difference. Finally *imperturbata*, working in *Helianthus divaricatus*, was encountered, and it differs from the description of *necopina* quite as much as the seaboard form. Certainly it and the latter are very distinct, though superficially the moths are much alike. At this time both are sent to the British Museum, as Sir George Hampson is studying the group in the preparation of his Catalogue. He reports the species in *H. giganteus* to be undoubtedly *necopina*, though noting the presence of a transverse posterior line on the primaries, which does not occur in the originals. Later on he asks, "Can there be a third species and this the typical *necopina*?"

At about this time, however, material for identification had been received by the writer from Messrs. Lucas and Moeser, of Buffalo, and bred by them there, among which appeared a form running larger than *imperturbata*, though returned as probably that species. It certainly was not "*necopina*" as we had so long known it. The matter was deemed worthy of further investigation, and on a kind invitation to explore some of their favourite preserves in July, 1908, a few profitable days were spent in that locality. It soon became apparent that the species they had reared was a very common and well-established one there, occurring everywhere that neglected areas allowed the growth of *Helianthus tuberosus*, its

apparently preferred food-plant, to flourish. In some places the larvæ were so plentiful as to overrun the burdocks and probably other weeds, but in no instance was it found in *Helianthus divaricatus* which grew in the infested localities or elsewhere. *H. giganteus* was not noticed at all.

In due course, for it is not a late species, as is the seaboard form, a series of the moths come forth and prove conclusively that we are dealing with *necopina*, Grote, at last. Some variation is found to exist, and it appears the types are well-developed specimens of the darkest form. The larva is a vigorous one and possessed of a good appetite, which the rugged food-plant allows to be satisfied. It enters the plant a few inches above the ground level and works downward two or three inches below this line, but in no instance does it get down to the tubers, which are much deeper. Its work produces an elliptically elongate swelling, about twice the size of the normal stem and from three to five inches long. The original aperture of entrance is, after a while, given up for a larger one lower down, from which the abundant castings are ejected. At maturity this opening is enlarged that the larva may leave, for the pupal change does not occur in the gallery. From their advanced condition at July 15th it was evident that the larvæ must have emerged from the hibernated eggs in the last days of May, as we found the brood well on in the penultimate stage. It is characterized as follows :

Head normal, well rounded, shining and of golden-russet colour, mouth-parts tipped with brown ; width, 2.4 mm.

Body cylindrical, a little larger at the middle in this stage. The dorsal line is broad and continuous ; the subdorsal equally pronounced, except on the first four abdominal segments, where it is lost. The colour is a pale, burnt-sienna ground, on which the dull yellowish-white stripes are plainly shown. The shield on joint one is fully as wide as the head and nearly covers the segment above. It is paler than the head, shining, of a honey-yellow hue, edged laterally with black. The tubercles are small and nearly of one size ; IV, the largest of the lateral ones, is the size of the spiracle ; the latter shining black, the tubercles brownish-black. I and II on joint eleven form the corners of a pronounced square, and are not confluent. The anal and leg plates are normal and agree with the thoracic in texture. There is no symptom of the accessory tubercle IVa on joint ten. Length, 40-43 mm.

Maturity finds the larva a little more robust, the colour faded to a soiled whitish translucence, with the lines lost or nearly so. The tubercles

are smaller and fainter, otherwise no change. Plates the same, the thoracic is the most noticeable marking. Length, 43-45 mm. Larvæ at Buffalo became normally mature July 22-28; the parasitized or diseased examples are in evidence some days later. *Necopina* larvæ belong to the major section of the genus in having the continuous dorsal line and no accessory tubercle IVa on joint ten. Excepting a very slight degree of colour or size, there is little to differentiate them from a dozen other species.

The pupal change occurs outside of the boring under a slight depth of soil or refuse. It is a very normal pupa, and shows no character of individuality. The head and thoracic region are smooth, and show no unusual development. The anal spur consists of two minute points. Colour glossy chestnut-brown. Length, 20-24 mm.

The dates of emergence for a dozen specimens are Aug. 24th to Sept. 9th.

This species does not occur at Rye, N. Y., but seems most diffused north and north-westward. *Imperturbata*, Bird, from Western Pennsylvania, appears to be a geographical race, of smaller size and having paler secondaries. An absence of larval difference points to this end; though a different food-plant, a pupal change in the burrow and a slightly later emergence bespeak some individuality from the features prevailing in the Buffalo colonies of *necopina*.

Establishing the identity of Grote's species leaves the local form, discovered many years ago by the writer, without name, and for which the following is proposed:

Papaipema maritima, n. sp.—Ground colour of the imago dark grayish-brown, or it may become somewhat olivaceous. Head is of the darker shade, the white scales at the base of the antennæ are not seen in this species. The antennæ are simple, a little heavier in the male. The vestiture of the thorax is heavy and looser than with most species, of the uniform ground hue densely powdered with grayish-white atoms. The erect thoracic tuft is loose, of conical form rather than the adze shape which usually holds. At rest it is tilted a little forward of perpendicular. The abdomen lacks the white powderings and the tufts are hardly discernible. The denuded head is perfectly smooth in front. Primaries nearly uniform in colour, powdered with grayish-white scales, the median space slightly darker; the t. p. line may be faintly made out, though it is never prominent. The t. a. line is still more faint, but it can usually be seen in the lower half of its course; both are indistinctly double. Ordinary spots

wanting. Secondaries dark smoky, the veins a little darker; a vague median shade line usually shows above. Beneath the wings are a lighter or mouse-gray, well powdered, especially the secondaries, across which the median line is traced in the dark ground colour. The sexual characters of the male are of the normal pattern. Expanse, 44 to 48 mm.

Habitat: The Atlantic seaboard in the neighbouring latitude of New York City.

One hundred and eight examples without mar or blemish are before the writer, and show scarcely any variation. In point of size their constancy is quite remarkable for the genus, and the phase of variation consists in a tendency of the ground colour to fade to an olivaceous hue. It is a rather heavy and broad winged species, larger and darker than *necopina*, has the t. p. line more conspicuous and lacks the bluish tone of the subterminal space which generally holds with the latter. A great many specimens have been disseminated from Rye under the *necopina* label, and attention must now be called to their incorrect determination. Co-types will go to the U. S. National and the British Museums.

Confined with their growing food-plant, these moths mate and oviposit sparingly. The ova are placed singly, or in clusters of several, about the base of the plant and live over the winter. The egg is nearly globular, the lateral diameter greatest, measuring nearly .7 mm. Colour is pale, shading yellowish, or in some cases to a flesh tint. Its period extends from the middle of October to first of June.

The young larvæ, upon hatching, at once enter the stems of the food-plant about two inches up and begin feeding, the original entrance serving as an orifice for disposing waste. They are very slender and delicate, yet able to bite their way into the solid stem. The first pair of abdominal legs are aborted and the larva moves in a semilooping manner. On entering the second stage the dark central portion of the body becomes evident and the white longitudinal lines appear, but all are discontinued on the first four abdominal segments. We are now able to place the larva in that section containing *cerussata*, *sciata*, *inquasita*, etc., and from this time to maturity this prominent feature continues. June 28th finds them well on in the third stage; a period of nine days per stage seems to prevail, as with other species. Larvæ now measure 24 mm. in length, and are of the usual smooth cylindrical form. The rounded head is of a golden-yellow hue, does not show the black side line as it occurs in *nitela* and others; width, 1.9 mm. The longitudinal lines on the thoracic

joints are white and overbalance the dark purplish-brown body colour ; dorsal line narrower than subdorsal or substigmatal ; they do not entirely cross these joints, but end at the middle of the third segment ; their continuation on the last five joints shows the ground colour appearing in a stripe of width equal to the lines. The dorsal is here as wide as the subdorsal, but the substigmatal becomes blended with the white of the under side. The inception of these lines is really on the posterior edge of joint seven, as it plainly crosses the suture between seven and eight. The appearance of such a contrasting and queerly-marked larva seems odd for a boring species where little colour generally occurs, but it is conventional for *Papaipema*, and we are enabled by a little change in this pattern and some structural details to arrange the species in a very convenient table. While at variance with the disposition of the moths in some respects, it is to be considered more fundamental, doubtless. The tubercle arrangement is normal for the stage ; on joints two and three I, II and IIIa are small and in line directly across the segment ; III, IV and V are large, in triangular setting ; IV very large, the size of the other two combined. On the abdominal segments this one is not quite so large, yet it exceeds the others ; all are shining black, and bear a single, stiff, fine seta, nearly a millimeter in length. The thoracic and anal plates are as usual, the former edged with black at its lower side. The features hold through the succeeding stages, the colour becoming lighter with each moult and the tubercles proportionately smaller. At maturity we have a translucent, whitish larva, which tapers more posteriorly than any other, the anal extremity with its protective shield being proportionately very small. The tubercles can scarcely be discerned even with a lens ; III and IV on the thoracic joints being the only conspicuous ones. Even I and II on joint twelve, which usually hold their prominence, have faded to uncertain definition. The thoracic plate loses its black edging, but remains as wide as the head. Well-developed larvæ attain a length of 52 mm. Maturity is reached about Aug. 15th, and pupation occurs within the boring. The pupa differs from any other species in possessing two small tubercles in front, one between the antennæ, the other slightly above. It might be expected the moth would show a corresponding structure, but this does not occur. At the middle of the thoracic region the pupa shows a slight constriction and the abdominal segments taper more than usual. It is extremely active, and can bend to a greater angle than others. When disturbed, as they so frequently are, they revolve rapidly, standing upright

on the anal extremity and bend until the head rests against the wall of the gallery. Length, 25 mm.; emergence Sept. 23rd to Oct. 10th. The habits of *maritima* have been extensively observed, for it is so easily located, and its near-by occurrence has placed it conspicuously before the writer, during the fifteen years following its first discovery. Yet in all this time there has never been seen a single moth at large, though they breed within a few hundred yards of windows, where for many years all comers to light were welcome. At sugar, at electric light, or gas lamp, never a specimen; it would remain unknown to us still if we had never lifted the lid of a breeding-box. This secretive and inactive condition becomes conspicuous when it can be said thousands of larvæ have no doubt been noticed in this Rye locality and hundreds of the moths reared without serious effort. Like their congeners, they are very punctual in their date for emergence each year, and a glance at the calendar will note the day for gathering a supply of the ripe pupæ. Still their concerted emergence will be influenced by weather conditions to some extent; a warm sunny day following the cold or wet conditions that appear in early fall will find them coming out in numbers, most notably in the evening hours, between eight and ten.

The food-plant is *Helianthus giganteus*, and it makes an admirable plant for the operations of a boring larva. While there is ample stem, wherein such examples as *cataphracta* and others are wont to extensively tunnel when they happen to select it, *maritima* works only at the base, and the plant which is growing rapidly at the time of the intrusion counterbalances the effect by the formation of a large gall directly above the root. These ovate swellings, sometimes more than twice the diameter of the plant, and an inch and a half across, give easy intimation of the larval presence. An old and vigorous root clump may frequently harbour eight or ten larvæ, and usually the last year's galls may be also seen, though a single stem is never tenanted by more than one. And while this gall formation is an individual feature of the species, it is the neat door they prepare for the emergence of the moth that has always interested the writer. The last act of the larva before the final ecdysis is to gnaw a U-shaped opening through the walls of the gall to the epidermis, which is left intact, except that around the lower periphery minute perforations are made. None are made across the top, however, and in a few days this skin becomes dry from receiving no sap, shrinks a little and breaks free at the bottom, while it hangs very nicely from the top where no perforations were made. Without this door the moth could not possibly escape, and

while other species make a similar exit and leave a portion of the epidermis over the opening, there is no apparent design in the matter. So the most gentle push will swing this portal from within, and, unfortunately, a similar pressure will answer from without, a fact soon discovered by the vulgar herd. But *maritima* has never had any experience with the outside world, and soon its handiwork is destroyed by the scores of stragglers that are ever seeking the seclusion afforded by such a commodious chamber, and a perfect door is rarely opened by the moth for which it was intended. Conditions which make *maritima* especially favourable for observation are directly traceable to the food-plant, and it is a pleasure to conceive we can now see it at work in a manner that prevailed primitively. In *Helianthus giganteus* we meet a plant which flourishes many years from its root-clump without change, sending up rugged stems, often a dozen or more, to the height of eight feet, each succeeding year. It is one of those strong, coarse weeds that easily work out their salvation in the competition with their neighbours, and is naturally well disseminated. While a plant of the open, it attains greatest perfection in those semi-swampy conditions that prevail where the fresh-water streams of long ago have met the arms of the sea and deposited at tide-water level the rich humus and peat formation that have been the accumulations of centuries. The north shore of Long Island Sound presents innumerable instances of this nature, and from their underlying peaty deposits and the slightly saline character, a certain portion of these areas is immune from the advance of an arboreal growth, and the primitive forest never claimed them. Here the flora is naturally somewhat unique, and the insect life, of course, conforms to it. Our *Papaipema* species have not been slow to avail themselves of such conditions, an evidence of their aristocratic proclivities, and flourish here according to a more or less prearranged schedule. Furthest out where the salt-meadow conditions prevail and where the spring tides overflow the soil twice monthly, grows a luxuriant fringe of *Solidago sempervirens*, its roots deep in the meadow muck and containing *P. duovata*. Immediately inside this *Helianthus giganteus* begins to appear where a handful of upland soil serves to temper the muck, and *maritima* will be found in the outermost vanguards. From the moment upland proper begins there is a revel of those rank plants which perennially hold their own; the coarse *Aster umbellatus* tenanted by *P. impecuniosa*, *Lilium superbum* a choice tit-bit for *cataphracta*, *Cicuta maculata* containing *marginidens*, and *Thalictrum polygamum* with its ever-present *frigida*. As we come to

the shade of the encroaching wood, we find the Brakes tenanted by *inquasita* and *pterisii*, the Speedwell with its *sciata*, the Ironweed with *cerussata* in its crown. In the deeper shadows *Collinsonia Canadensis* shelters both *astuta* and *duplicata*. If fortunate in the locality, the *Heracleum lanatum* may contain *Harrisii*. A little farther up the bed of the ancient stream, if a Sphagnum bog has formed, there may lurk in the Pitcher plants the glorious *appassionata*. When such localities have escaped the torch for a number of years, more *Papaipema* species may be found there to the square yard than in any other territory.

In the perpetuation of species, "survival of the fittest" may have its place among the higher animals and elsewhere, but among insects, and with *maritima* in particular, we are impressed with what is rather a survival of the most fortunate. The casualties from parasitism, disease and depredations of enemies of one sort and another bring the fatalities up to an alarming percentage. But after all, if the progeny of a single pair amounted to more than another pair in the general outcome, we should soon have to do with pests rather than the elusive and long-overlooked occurrences of our *Papaipema* species. With the one under consideration the mode of larval habit lends nicely to such study, and this question of a balance in nature is admirably demonstrated. It, of all the congeners, shows the least disposition to ever leave its burrow, and, as it is so easily located in the conspicuous gall, it is not difficult to tell just how many of a certain locality and brood attain maturity or fall to eventualities. The question how many ova may have been deposited there and escaped the mites, which destroy such numbers shortly after they are laid in the fall, or have survived other vicissitudes of the winter period, to ultimately give up their larvæ, is only problematical. From the moment a larva locates in a plant we know it, and it is easy to figure out the average which mature, and this is surprisingly small.

Of parasites, the most abundant is a Hymenopteron, a species of *Hemiteles*, which attacks many of the other species as well, most notably, perhaps, *nitela* and *pterisii*. Occurring with it is a wingless form of some *Pesomachus* species, whose presence with the former was a surprise. The *Hemiteles* larvæ attain maturity as the host-larva reaches the last moult, causing it to succumb before pupation. The parasites at maturity pierce the skin of the host and immediately spin up a tough, brownish cocoon, of elliptical form, longitudinally creased and about three millimetres in length. From 30 to 40 usually infest one host, and all emerge and spin

their cocoons within a few hours. These are formed in a mass about, though not adhering to the disabled host, and become gummed together into a hard cluster. The winged adults escape by biting an opening at the end of the cocoon. To definitely determine the pupal period, a mass of 32 cocoons from a certain host was obtained Aug. 3rd and placed in a test tube, when, on the 31st day, 18 *Hemiteles* species and two curious ant-like creatures appeared. A lens showed the latter to be possessed of an ovipositor, and to be only ant-like in their movements, all specimens, in fact, being females. Just what these wingless *Pezomachus* species may be doing in this mass of cocoons, which all seem alike, unless they are secondary parasites, does not appear. They are quite as large as the *Hemiteles*, though lacking wings. But there are interesting phases of polymorphism at work here, for it is found later that a good proportion of the *Hemiteles* pupæ live over the winter, and these evidently carry the perfect sexes. Four days later three minute examples of a secondary parasite, without question, *Loxotropha flavipes*, Ashm., appeared. Just how these little creatures work out their life-cycle must be a complex proposition, especially if dependent on other species than their present host. It is probable they pass the winter as adults, for they have been found as late as Dec. 1st hidden away in the *maritima* galls. In following up their career much would depend upon what period of the host's development they attacked. *Maritima* is preyed upon by another parasite of similar character, in a species of *Apanteles*. In this instance from 50 to 60 parasitic larvæ will emerge mature from the nearly full-grown host and spin up a cluster of pretty white silken cocoons, which open with a circular lid at one end to permit the escape of the imago. About 80 per cent. of these proved females, and the pupal period was ten days longer than the *Hemiteles*. No hyperparasite was observed, nor any cocoons holding over the winter. This species occurs infrequently with *maritima*, but very commonly infests *P. duovata*.

Of the larger Ichneumon parasites, there are several species which have been noticed, though their numbers never seem great. *Ichneumon letus*, Cress., is quite often found, and probably does not reach the larva until late, for its emergence is always from the chrysalis. It is very late, too, in the pupal period before its presence is noted; apparently healthy and very active pupæ will, a few days before the time of giving up the moth, suddenly become dark and rigid, and soon one of these active wasps will eat its ways out of the pupal shell. It is hardly possible that

this insect enters the gallery to place an ovum upon, or in direct contact with, the host-larva, unless it waits until the doorway is made for the moth's exit, for the ventilating orifice is too small to permit it to enter. There is a period of several days between the making of the door and the final ecdysis, when the larva is less active and shrinking for the change, and which render it especially vulnerable, and it is believed this is the time of attack. True, the ovum of the Ichneumon might be merely thrust within the ventilating opening, and the larva yet reach its host from this proximity. If the above supposition is correct, there would be a period of four weeks for the developments, and this seems sufficient.

I am indebted to Mr. J. C. Crawford, of the U. S. National Museum, for the determination of these Hymenopterous parasites. Of parasitic Diptera several have been noticed; one, a large hairy fly (*Masicera myoidæa* ?), is a rapacious enemy. In another case it appears the infestor may be simply a scavenger, as its larva had only been noticed about a decomposing caterpillar that had succumbed apparently from some previous trouble. Its pupa winters over as do the numerous puparia of another species whose presence within the galls was not understood. But they occur so commonly and in such numbers as to be reckoned with, in the life that flourishes here. Of the visitors, transient and permanent, which make these burrows their domicile, to the discomfiture of the original tenant, the most numerous and obtrusive are those common myriapods, the "sow-bugs," which gain access in some numbers through the ventilator, and later, by the exit door crowd the chamber to its full capacity. From twenty to thirty are often packed about the chrysalis, which wriggles and spins around as their movements excite it. We might fancy *maritima* pupæ have acquired their unusual activity and freedom of movement from the turmoil going on about them. It is due to these visitors that the hinged lid of the exit door is so soon broken down, and then such an enticing aperture naturally suggests security to other denizens of dark, damp places. Centipedes, snails, slugs, stray Coleoptera, and many species of ants are regularly seen. While these are mere visitors that congregate after the pupal change, and do not molest the pupa, unless it has died from fungous disease, the actions of two of the ants always appeared suspicious. In any breeding experiments with this genus the first move is to guard against the attacks of two common house-ants, these minute

red ones that appear in such multitudes about old houses, and the large rapacious black ones. The former will attack either larva or pupa, the grease possessed by these boring larvæ making them more sought for apparently. The black fellows await the emergence of the moth, and while yet soft from the pupa, before the wings have expanded, will rend it to pieces in an incredibly short time. What effect these ants have on the mortality in the field is unknown, for there would be nothing left to tell the tale were the action not observed. So when two ants of similar character are noticed, it is wondered if they are there with intentions against the owner. One is a small red ant, that occurs only in empty galls, and which has taken up its abode there, as later the pupæ are to be seen. But what has become of the *maritima* larva, it is not usual for it to be driven out by the mere presence of a visitor that is not hostile? And with the other, a pair would usually be found in a gall containing a live pupa, and they seemed to be very quietly awaiting events. So the matter was referred to Prof. W. M. Wheeler, who knows so much of ants and their ways, to prove an alibi in their case if he were able. His reply is as follows :

" I think you have misinterpreted the intentions of these poor insects with regard to your moth larvæ.

" The smaller ant is *Leptothorax curvispinosus*, Mayr, an ant which lives in small colonies and nests, by preference in hollow stems and galls. It is frequently found in the galls of *Gelechia*, on golden-rod, and no doubt would utilize the galls of *Papaipema* in the same manner. It is a timid creature, which feeds on minute insects and the honey-dew that may be spattered by the plant lice on the surfaces of leaves.

" The large ant is the dealated queen of *Lasius claviger*, Roger. This insect had no intention of molesting your moth larvæ, as you supposed, but was seeking a small cavity in which to found her colony. The queens do not prey on other insects, but are plentifully supplied with nutriment in the form of a large fat body, and they draw on this exclusively while they are bringing up their first brood of workers. Of course, ants will take advantage of any small, nearly-closed cavity with hard walls for nesting purposes. This is especially true of small species, or the timid queens who are just starting out to form their colonies, and, of course, we would do the same if we were in their places ! "

Aside from casualties already mentioned, an observer of the life-history of *maritima* cannot fail to encounter the work of two animals that

take toll in no small measure from the final outcome. Field mice and skunks consider these pupæ most delectable diet, and their thoroughness is so apparent in the demolished galls, one wonders how any escape their keen noses. The writer has drawn attention to this in an early paper, when the species was referred to as "*necopina*" (CAN. ENT., Vol. XXX, 131), how they always select a gall containing a pupa, and never one that contained a parasitized larva. This is easier than might appear, for they have but to feel for the exit door to know that a larva has matured and pupated therein. When there is no door there will be no pupa, for the *Hemiteles* had the first chance. The mice gnaw a hole half an inch in diameter or larger in the side of the gall, sufficient to extract the pupa, while the skunks with their greater strength tear a rougher and larger opening, and do a noticeable amount of scratching about the root-clusters. As very few pupæ escape in any locality these animals go over, they become an important factor in the economy of the species. So far as observed, no others suffer in this manner from these animals, though why the pupæ of *impecuniosa* escape is not easily explained.

In a final word as to the ontogenetic features displayed in *maritima*, that most at variance with the congeners is the tuberculate character of the front of the pupa, though the larva shows some individuality from its immediate associates, as, in fact, does the moth. The supposed great similarity to *necopina*, which has deceived all, vanishes when the species become properly known. While the tubercle is not continued in the imago, it may be inferred we have to do with a species connecting with *Ochria*, whose moth possesses an armature of this nature on the head, and which may be needed to force its way out of the chamber containing the pupa. With our species there is not this need, and the moth has lost the character, though a trace remains in the chrysalis.

There is the other alternative, of considering a pupal armature of use in opening a way to the surface through intervening tissues, in those cases where the moth emerges free at the outside of the burrow. Then *maritima* would be leading up to this specialization of *Ochria*. But no *Papaipema* make this effort of wriggling to the outlet, and all make openings to allow of the escape of the moths. Neither the pupa of *Ochria* nor its action is known to the writer, but the larva of *O. flavago* reflects a different phylogeny, more in keeping with *Gortyna*.

THE FRUIT-INFESTING FORMS OF THE DIPTEROUS GENUS RHAGOLETIS, WITH ONE NEW SPECIES.

BY J. M. ALDRICH, MOSCOW, IDAHO.

The typical forms of *Rhagoletis* in North America are distinguished by their black colour, the scutellum conspicuously white or yellow and bearing four bristles, the wings with cross-bands, which may be somewhat oblique and curved; the anterior cross-vein is situated about the middle of the discal cell; first vein bristly along its whole length, the third vein only at base.

Two aberrant forms are included in the catalogue, *suavis*, which is pale yellow, and *caurina*, which does not have bands on the wing. The complexity of the relations of Trypetid genera makes it difficult to assign all species to groups where they obviously fit, and it may be better to admit these two species provisionally than to assign them to other genera without examining specimens.

Mr. Doane, Ent. News, 1898, 69, suggests that *Rhagoletis zephyria* of Snow is a synonym of *R. pomonella*, and this I think is correct.

Mr. Coquillett, Jour. N. Y. Ent. Soc., VII, 260, 1899, refers *Acidia fausta* and *suavis* to *Rhagoletis*, and I also agree with this; the former, in fact, is the nearest known relative of *intrudens*, the new species described below:

Table of Species of Rhagoletis.

- | | |
|---|------------------------------|
| 1. Colour pale yellow | <i>suavis</i> , Loew. |
| Colour black or blackish | 2. |
| 2. Wing pattern in scattered spots, not bands | <i>caurina</i> , Doane. |
| Wing pattern in bands | 3. |
| 3. Abdomen with pale cross-bands | 4. |
| Abdomen without cross-bands, entirely black | 8. |
| 4. A hyaline cross-band extends entirely across the wing through the distal part of the discal cell | 5. |
| The hyaline portion not extending entirely across | 7. |
| 5. Humeral and stigmatic cross-bands confluent behind. <i>tabellaria</i> , Fitch. | |
| Humeral and stigmatic cross-bands not connected | 6. |
| 6. With a brown spot on the apex of the third vein | <i>cingulata</i> , Loew. |
| Without such spot | <i>ribicola</i> , Doane. |
| 7. The entire brown pattern of the wing continuous | <i>pomonella</i> , Wlsh. |
| The brown pattern discontinuous | <i>striatella</i> , v. d. W. |

8. Femora yellow..... *formosa*, Coquillett.
 Femora black..... 9.
 9. The humeral cross-band enclosing a hyaline triangle in
 front..... *fausta*, Osten Sacken.
 The humeral cross-band not enclosing a hyaline triangle. *intrudens*, n.sp.
Rhagoletis intrudens, n. sp.

Shining black; the following parts yellow: Front, face, antennæ, except apical part of arista, palpi, proboscis, cheeks, humeri, a streak from the humerus to the wing below the dorso-pleural suture, scutellum, halteres, all the legs, except coxæ and femora. Wings as figured, the veins whitish in the pale portions and blackish in the rest; the pale portions of the membrane are distinctly white, not transparent except close to the margin; anal cell with only a blunt point; first vein distinctly hairy to the tip.

Chetotaxy: Postvertical pair of bristles rather large, conspicuously white, all other bristles black; vertical 2, orbital 1, fronto-orbital 2 reclinate, lower fronto-orbital 3 cruciate, on lower edge of cheek 1, humeral 1, notopleural 2, dorsocentral 1 (behind the suture, there may be another where the pin is inserted), presutural 1, supra-alar 3, post-alar 0, scutellar 2, mesopleural 2 (on the posterior edge), pteropleural 1, sternopleural 1.

Abdomen uniform shining black, with rather coarse hairs, larger on the posterior margins of the segments; on the posterior margin of the fifth segment a row of well-developed bristles; sixth segment a little longer than the fifth, hairy; ovipositor retracted in the described specimen.

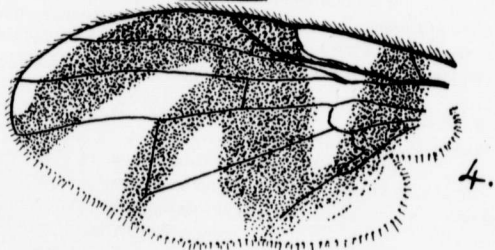
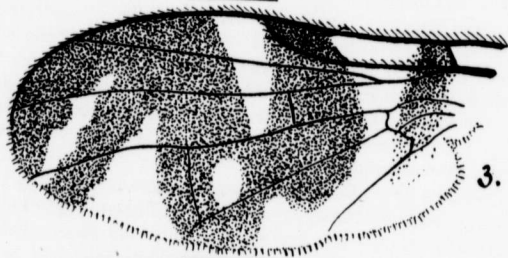
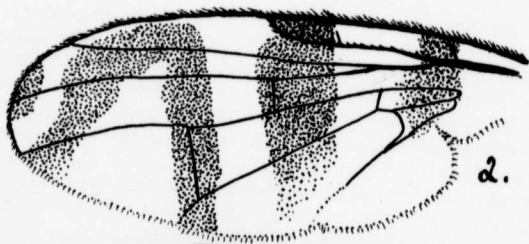
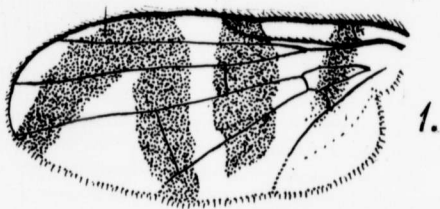
Third joint of antenna reddish, with an acute upturned point at end; arista pubescent; palpi with a few black hairs at tip.

Length, 4.1 mm.; of wing, 3.9 mm.

Described from one female specimen with the following label: "6.3142. W. R. Palmer, Victoria, B. C. Emerged at Ottawa, 19, VI, 1907."

It is highly probable that the same species occurs in the vicinity of Kendrick, Idaho, as I have found late sour cherries there considerably affected with a dipterous larva, which I have not reared.

A few words on the economic relations of the species may be worth while. The habits of but four species of our fauna are known; all these species are figured in the accompanying illustration, the pattern of the wing being sufficient to separate them. All the drawings are on the same



FRUIT-INFESTING FORMS OF RHAGOLETIS.

scale, and made with camera lucida. The upper figure represents the wing of *Rhagoletis ribicola*, Doane, which affects the garden gooseberry and currant in the State of Washington and in northern Idaho. It is a native species, as I collected an adult on a wild gooseberry at Pollock, Idaho, many miles from a railroad; its original food was doubtless the wild species of currant and gooseberry, so abundant in the Pacific Northwest.

There is another Trypetid, *Epochra Canadensis*, Loew, that infests currants and gooseberries from Maine to Vancouver Island, but as it belongs to a different genus I allude to it here only to note the similarity of habit, and perhaps save some one from a wrong identification of its larva.

The second figure shows *R. cingulata*, an eastern species infesting cherries. It has been reported so far only from New Jersey and New York, and doubtfully from the vicinity of Boston. I am indebted to Professor Mark V. Slingerland for specimens enabling me to figure this wing.

The third figure shows our new species, *R. intrudens*, and the fourth is the apple maggot, *R. pomonella*, Walsh. The last is now pretty well distributed in the eastern United States and Canada, but has not yet appeared west of the Rocky Mountains, as far as I know, although I have a specimen from Colorado. Walsh, in his original article, states that the larvæ are found in fruits of *Cratægus*, the thorn-apple, as well as in apple. As it is a native species, we may suppose that the wild crabs and the thorn-apples were its original food-plants.

It remains only to notice *Rhagoletis cerasi*, Linn., which is a European species affecting cherries; it may be introduced into the United States or Canada at any time, in fact, there are one or two unconfirmed references to it in our literature already. It strongly resembles in wing-pattern the first of our figures, that of *R. ribicola*, but the clear transverse band in the middle of the wing is widened in front and contains a triangular brown spot, the base resting on the costa and the apex extending to the third vein.

EXPLANATION OF PLATE 4.

- Fig. 1.—*Rhagoletis ribicola*, Doane.
 “ 2.— “ *cingulata*, Loew.
 “ 3.— “ *intrudens*, n. sp.
 “ 4.— “ *pomonella*, Walsh.

With regard to the new species, *Rhagoletis intrudens*, described above by Professor Aldrich, this is the one referred to by the late Dr. Fletcher in his annual report for 1906, page 228, under the title, "A Cherry Fruit Fly, *Rhagoletis cingulata*, Loew." This insect caused noticeable damage to cherries, in 1906, in British Columbia.

Mr. W. R. Palmer, of Victoria, B. C., in whose orchard the insect was injurious, was asked to send to the Division some living puparia, but in 1907 he wrote that he was unable to find any during the winter. Writing under date of July 20th, 1907, he says: "We had a harder winter than usual, and they do not seem to be as prominent. They still stick to the same trees as last season."

No reports of injury by the larvæ of this fly have been received during 1908.—ARTHUR GIBSON, Division of Entomology, Central Experimental Farm, Ottawa.

LEPIDOPTEROUS GALLS COLLECTED IN THE VICINITY OF TORONTO.—No. 2.

BY DR. WM. BRODIE, TORONTO.

Eucosma Scudderiana, Clemens; *Pedisca saligneana*, Clemens.
(The High Solidago Gall.)

The galls were collected usually in the spring, February and March, occasionally late in the fall, and kept in a suitable jar, until all occupants were out; always two seasons.

Annual collections were made during 12 seasons, from 1883 to 1895, each collection averaging over 45 specimens. Most of the collections were from the vicinity of Toronto, a few from distant localities.

From 1854 to 1864 these galls were very common throughout North York, and are so still. I have found these galls at Owen Sound, North Bruce, Temagami, Algonquin Park, Tobermory, Manitoulin, North Bay, Essex, St. Mary's, St. Catharines, Whitechurch, Scugog and other localities, and no doubt they are common in Ontario wherever the host-plant, *S. Canadensis*, is found.

The galls are at the top of the main stems of the plants, usually within the flowering panicle, rarely on the branches of the panicle; usually but one gall on a plant, occasionally two, rarely three.

The galls are spindle-form, varying in size from 10 x 16 mm. to 12 x 28 mm.; diameter of stem below gall from 4 mm. to 5 mm.; the average of

ten galls collected in ten seasons, 100 specimens, was $9\frac{1}{2} \times 21\frac{1}{2}$ mm., diameter of stem below gall 5 mm.

The galls are unicellular, the larvæ for some time being closely confined in the cells. I do not think there is ever room for them to turn, and I am still in doubt as to their rather peculiar feeding habit.

The producers winter in the larva form, within the galls, pupate about May 1, and the imagoes emerge from June 1 to July 5; the average date of emergence is about the middle of June. From June 12 to July 1 I have taken specimens of the mature moth, while sweeping the hand net over *Solidago* blooms; it is a beautiful creature, strongly marked and readily recognized. The mature pupa pushes its way through the loosely-closed upper end of the gall, and the moth emerges into the environment of mature life.

The largest and most common parasite is *Macrocentrus pædisca*, Riley, easily recognized by its long ovipositor. This parasite emerges about the middle of July.

Perilampus platygaster, another parasite, emerges early in July; *Cryptus extrematis* still another parasite, seldom more than one individual from a gall; *Pimpla annulipes* also not rare. I bred *Copidosoma gelechia* from this gall, and once the secondary *Dibrachys boucheanus*.

From a lot of galls collected near Lake Simcoe, April, 1904, as well as producers and parasites, there emerged from May 2 to May 12, 1904, 18 specimens of a Diploisis, very much like gall producers; but, unfortunately, from the want of material I failed to determine whether these were gall producers or inquilines in *Eucosma* galls. The galls were all similar in size, shape and structure; normal *Eucosma* galls. In my notes I have entered as a provisional name for this species, *D. eucosma*.

I have found this gall restricted to the one host-plant, *S. Canadensis*, and there seems to be a fairly uniform relation between the producers and parasites in the vicinity of Toronto; so that year after year the galls are about equally numerous.

In Vol. 10, p. 202, CANADIAN ENTOMOLOGIST, Kellicott describes this gall, the habits and life-history of the larva and pupa of the producers.

Gnorimoschema asterella, Kell. (*Gelechia asterella*).

(The *Solidago latifolia* Gall.)

In Vol. 10, pages 203-4, of the CANADIAN ENTOMOLOGIST, D. S. Kellicott describes this gall and its producer.

He also gives a good engraving of the gall, but it is not that of a gall on *Aster corymbosum*, but on *S. latifolia*. The leaves at the top of the gall are evidently leaves of *S. latifolia*, and the angular form of the stem of the plant, which is always continued up the gall, is clearly shown by the engraving.

S. latifolia is one of our most common and beautiful forest flowers, having a wide geographical range over Ontario; and I have found the gall more or less common wherever the plant is found.

My first record of the gall is Aug., 1886, when I found it very common in a grand, primal, hardwood forest, in the Township of Whitchurch. My attention was directed to the galls from the fact that an ignorant old quack was using them as a cure for "fits," under the name of "Fitt Apples."

In a collection of 30 galls made May 29, 1890, a few miles north of Toronto, most of them were at the top of the stem, surmounted by a few leaves, occasionally but one, usually two. The galls at this date seemed to be mature, subtriangular, corresponding to stem of plant; from 20 mm. to 32 mm. long, and from 10 mm. to 15 mm. dia. In size, form and structure the galls closely resemble galls of *S. gallsolidaginis*. Rarely they occur on the middle and lower third of the stem of the plant.

From June 29, 1891, to June 25, 1896, annual collections of galls were made. Galls collected before the middle of June were immature, and seldom gave either producers or parasites. The producers had emerged from all the galls collected after the middle of August, but often contained larvæ and pupæ of parasites, *Cryptus*, *Pimpla*, *Copidosoma*, *Ephialtes*. The emergence of the producers was from July 28 to Aug. 20 in each season.

The following is an entry from my notebook, dated July 11, 1893: "Collected from wooded hillside, in St. James's cemetery, 35 galls, all terminal on stems of *S. latifolia*, all overtopped by a tuft of leaves, usually but two; plants not much dwarfed, but no flowers. July 13, 1893, from a wooded hill on the Don, collected 40 galls, all but one terminal, two galls on one plant."

From Aug. 7 to Aug. 20, 1893, producers emerged, and from July 17 to Aug. 17, 1893, four species of parasites: two *Pimplas*, one *Cryptus*, one *Ephialtes* emerged; *Copidosoma* occasionally the following spring, June, 1, 1894. The galls on growing plants appear to be full size, but still

solid, no open cavity, larva strictly confined in centre of gall, 3 mm. long. The parasites which I have bred from this gall are *P. conquisitor*, *P. inquisitor*, *C. extrematis*, *Ephialtes* sp., *C. gelechia*.

The structure of the galls, the habits of the larvæ, and the mode of exit from the gall, are very similar to those of *G. solidaginis*, and are all very fully described by Kellicott, in the article above referred to.

I have found what seems to be a lepidopterous gall, very rare about Toronto, on stems of *Aster corymbosum*, a spindle-form gall immediately under the flowering panicle, not at all like the gall figured by Kellicott but I failed to rear anything from them.

I found *A. corymbosum* very common all through the Temagami district, and the gall not especially rare, but as the galls I collected were immature, neither the producers nor parasites emerged from them.

THE OTTAWA NATURALIST for January consists of a series of tributes of respect and affection in memory of our deeply-lamented friend, Dr. James Fletcher. A meeting of the Ottawa Field Naturalists' Club was held on the first of December, and appreciative addresses were given by many colleagues and friends, all expressive of the highest admiration for his varied scientific attainments and the warmest affection for him whose kindness, geniality and unselfishness won the hearts of all who knew him. Mr. W. H. Harrington, an almost life-long companion, gives a most interesting account of their early days together, when they explored forest and field and stream collecting insects and plants, and how the intimate knowledge of nature thus obtained caused him to become such a recognized authority in both botany and entomology. All these addresses will be read with the deepest interest by the many friends of him whom they commemorate.

HONOLULU, HAWAIIAN ISLANDS.

About the middle of May the Hawaiian Board of Agriculture and Forestry hope to be in a position to engage an assistant entomologist. They want an economic entomologist inclined to take up Coleoptera or Parasitic Hymenoptera as a specialty, and one who is good at laboratory and field work. Their equipment and library are good. Salary \$1,500 to \$1,800 per annum, depending upon the man. The climate of Hawaii is unexcelled and opportunities good. Correspondence might be opened now. State age, schools, experience; also give references. Address: JACOB KOTINSKY, Superintendent of Entomology, Board of Agriculture and Forestry, Honolulu, Hawaii.

Mailed February 6th, 1909.