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THE CANADIAN  
ENTOMOLOGIST.

VOLUME XV.

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*EDITED BY WILLIAM SAUNDERS.*

LONDON, ONTARIO.

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ASSISTED BY

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No. 1

## TO OUR READERS.

With the present issue THE CANADIAN ENTOMOLOGIST enters upon the fifteenth year of its existence. During that long period it has had many friends, but these were never more numerous than at present, for the good work it has done and is still doing is recognized by all. While thanking those who have so kindly aided us in the past, we solicit a continuance of their support, and at the same time would request any of our younger Entomologists who may have observed any facts worth recording in reference to the habits or life history of any of our insects, to send them for publication, and thus aid us in our endeavors to make the fifteenth volume at least equal to any of its predecessors in usefulness.

We also take this opportunity of reminding our subscribers that subscriptions for the current year are now due. Remittances should be sent to the Secretary, F. Baynes Reed, London, Ontario.

## ENTOMOLOGY FOR BEGINNERS.

BY THE EDITOR.

### *THE APPLE LEAF-CRUMPLER—Phycita nebula.*

During the winter there will often be found on apple trees clusters of curious little cases, partly and sometimes wholly hidden by portions of crumpled and withered leaves, as shown in figure 1. The withered leaves are firmly fastened to the cases by silken threads, and the cases to the bark of the twig on which they are placed. Each case resembles a long miniature horn, wide at one end, tapering almost to a point at the other, and twisted in a very odd manner, as shown at *a* and *b*, figure 2. It is curiously con-

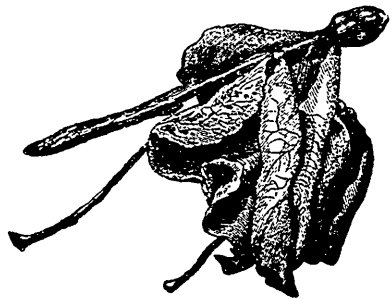


Fig. 1.

structed of silk interwoven with the castings of the artificer, is lined internally with smooth, whitish silk, externally it is rougher and of a yellowish brown color.

Within this curious structure there dwells a small caterpillar, which during the winter months remains torpid, awakening to activity with the warmth of spring. As the leaves of the apple tree begin to expand, the larva draws those that are nearest to it towards the case, and feeds on them, retreating quickly within its case when danger threatens. When full grown it is about six-tenths of an inch long, its body tapering slightly towards the hinder extremity. The head is dark reddish brown and the body dull greenish brown: the next segment to the head has a dark horny plate above and a flattened blackish prominence on each side. The head and anterior segments are shown at *c* in the figure. On each of the other

segments there are several small black dots, from each of which arises a single pale brown hair. When mature, which is usually during the early part of June, it closes the end of its case, and changes to a chrysalis within, about four-tenths of an inch long and of a reddish brown color, and in about a fortnight the moth appears.

When its wings are spread, the moth (*d*, figure 2) measures about seven-tenths of an inch across. Its fore wings are pale brown, with streaks and patches of silvery white, the hind wings plain brownish white: the under side of both wings paler. There is only one brood in a year. The moths deposit their eggs in the summer, and the larvæ construct their cases and attain about one-third of their growth before winter sets in.

Where these insects are abundant they become very injurious, consuming the young growth as it expands and materially affecting the vigor of the tree. To subdue them, pick the crumpled leaves with the cases from the trees and destroy them.

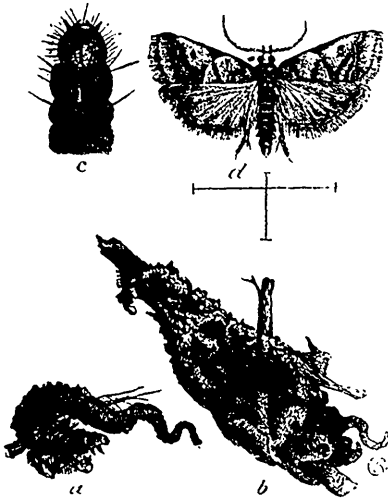


Fig. 1.

NEW SPECIES AND NOTES ON STRUCTURE OF MOTHS  
AND GENERA.

BY A. R. GROE, A. M.

(Continued from Vol. XIV, Page 237.)

## YRIAS VOLUCRIS, n. s.

♂. Allied to *Repentis*, the lines having the same general course, but they are brown, not black, and the ground color is darker. The space included by the discal rounding of the t. p. line is not so large. The reniform shows a black included streak and the black costal dots on median space are as in its ally. The angles of the t. a. line are less sharp. There is a minute apical black mark on the margin, before which a paler shade, an approximation to the ocellate mark of *Clientis*. On hind wings the distinct black mesial line is wanting. Beneath the wings are paler at base and the lines very faint. *Expanse* 26 mil. Arizona. B. Neumoegen, Esq.

This species has a slight bluish cast above; the underlying color is more yellowish and brown. Several fresh specimens, undoubtedly distinct from *Repentis*.

The species may be arranged in the following order: *Clientis*, *Volucris*, *Repentis*, *Crudelis*.

## PHEOCYMA UMBRINA, n. s.

♂ ♀. Soft brown, the male broken up by paler whitish linings to the subterminal line, the reniform, following the t. a. line and on secondaries across the middle of the wing. T. a. line oblique; t. p. line uneven, widely exerted; s. t. line upright, a little indented on vein 2, and just below costa. In the female these light shades are wanting and replaced by soft brown; the reniform being a little pale. Fringes dotted, especially noticeable beneath, where the under surface is blackish, discoloured, with the common extra-mesial line distinct. On hind wings above, the outer line is thick and black, expiring before costa, followed by pale lining in the male. *Expanse*, male, 32, female 33 mil. Arizona. Coll. B. Neumoegen, Esq. This species differs by its soft brown color. A fine variety of the female has the s. t. line preceded by a dark brown shade, covering much of the wing.

## PERIGEA EPOPEA, Cram.

Since publishing the "New Check List," I have investigated the synonymy of this species. It has received many names, not only owing to

its variability, the bluish-gray shining fore wings being variously deep in color and intruded on by the brown shadings, but on account of its wide habitat. It is migratory, ascending the coast to Maine. I have taken it on Staten Island in October. Mr. Thaxter took it in Jamaica, W. I. It is found along the Gulf Coast. It is No. 478 of the "New Check List."

Its natural history will probably be found to run parallel with other immigrants from the South.

CARNEADES, n. gen.

Like *Agrotis*, but with a navel-shaped tubercle on the clypeus. Tibiæ armed. Eyes naked. Body untufted. Vestiture hairy. Male antennæ sub-simple, ciliate. Size moderate, like *Agrotis campestris*.

CARNEADES MOERENS, n. s.

♂. Of a faded rusty yellowish fuscous. Lines fuscous, double, rather indistinct, scalloped. Stigmata concolorous, the orbicular round, with central dark dot. The reniform indistinct, with an inferior stain. Terminal space a little darker than the wing. Collar with a faint line. Thorax like fore wings. The untufted abdomen yellowish. Hind wings pale, with diffuse pale fuscous subterminal shading; a mesial line. Beneath pale, with common faint line and rather long discal streaks. Arizona. Coll. B. Neumoegen, Esq.

ANARTA SUBMARINA, n. s.

Body untufted. Eyes hairy. Apices of primaries sharp. Tibiæ unarmed. Fore wings pale olivaceous gray. Lines marked doubly in black on costa, but else single, approaching inferiorly; t. a. forming three curves; t. p. dentate. Median shade visible. Stigmata lost. S. t. line obsolete. A very indistinct terminal series of dots. Fringes somewhat fuscous, cut with pale. Hind wings dark, fuscous or blackish, a little paler at base; a mesial line. Head and thorax like fore wings. Beneath whitish with a distinct, extra discal, common line, outside of which is a diffuse subterminal shading continued on both wings. A discal lunule on primaries, wanting, or with hardly a trace of it, on hind wings. Montana. Four specimens. Coll. B. Neumoegen, Esq.

The cut of the wings is different from the other species, costa straight; but it may be placed here for the present.

RHODOSEA, n. g.

Looks like *Heliophila*, allied to *Rhodophora*. Wings entire, wide, costa straight, internal margin parallel, outer margin oblique. Eyes naked, un-

lashed. Front very globose and full between the eyes. Fore tibiae with two terminal claws: the other tibiae sparsely spinose. Body untufted, abdomen exceeding hind wings. Antennae simple. Fore wings vinous pink without marks of any kind, longitudinally shaded.

RHODOSEA JULIA, n. s.

Fore wings pink, the thorax behind and a patch on internal margin at base of primaries pale yellow. A pale yellow streak along the cell. The color appears as if longitudinally laid on in diffuse streaks. Head and thorax in front rosy. Fringes pale. Hind wings whitish, shaded with blackish, beneath white. Fore wings beneath shaded with fuscous, except at apices and terminally, where they are pinkish or pale; the pale streak appears running to margin. *Expanse* 34 mil. No. 975. New Mexico. Prof. Snow.

PHÆGARISTA SEVORSA Grote.

I find that my *Fenaria Sevorsa* is a member of this tropical genus, hitherto undetected in our territory. Our species may be known by the yellow undotted hind wings with their even black border, and the details of the markings of primaries, when compared with the East Indian *F. Transiens*, in which the sexes differ in markings. The single specimen which I had to describe from has the body somewhat flattened by accidental pressure, which assisted my mistake in the location of the insect. It is otherwise bright and fresh. The genus was not known to me in nature previously, and the mistake was an easy one under the circumstances, the species looking much like Lederer's *Chrys. ugida*.

SYNEDA HUDSONICA G. & R.

♂ ♀. Four specimens of this distinct species, the males with a bright brown mesial band on primaries above, are in Mr. Neumoegen's collection from Montana, taken by Mr. Morrison.

MELIPOTIS NIGRESCENS G. & R.

The male of this species is unquestionably *Flavipennis* Harv. The species is perfectly distinct from Hubner's *Fasciolaris*.

MELIPOTIS STYGIALIS Gr.

Two specimens in Mr. Neumoegen's collection vary in size. This species and *M. Sinualis* Harvey may be found to fall in with previously described West Indian forms.

MELIPOTIS VERSABILIS Harvey.

Two specimens in Mr. Neumoegen's collection make me think that



this is distinct and not a variety of *Jucunda*. Both have been accidentally omitted from the "New Check List."

TRICHOCOSMIA, n. gen.

Allied to *Cosmia*, but with hairy eyes. Vestiture flattened hair, mixed with broader scales on thorax, close and short. Wings entire. Abdomen untufted, a little exceeding secondaries. Tibiæ unarmed. Surface of the unlashd eyes covered with short hairs. Clypeus smooth. Palpi rather short. The type is a smaller insect than *Cosmia Orina*, with similarly shaped wings.

TRICHOCOSMIA INORNATA, n. s.

♂ ♀. Fore wings faded reddish ochery, markings obliterate. In the freshest specimens the pale s. t. line may be made out, a rounded t. p. line, somewhat broadly shaded with darker ochery; a stain on median vein. Hind wings pure white above and below, immaculate. Thorax like fore wings. Abdomen white. Arizona. Six examples. In coll. B. Neumoegen, Esq.

CAPIS CURVATA, Grote.

Mrs. C. A. Fernald has kindly sent me a male which I have examined and given all the structural characters possible, but those previously given would allow of the genus being placed next to *Sisyrhyna* in a synopsis.

BYSSODES OBRUSSATA, Grote.

A well marked male in Mr. Neumoegen's collection from Indian River has the fasciæ bright yellow; on hind wings the red spots reduced and an orange border to the wing, running also outside the metallic band. The color of the common band varies in depth. Veins on secondaries sometimes marked with yellow.

URAPTERYX POLITIA, var. FLORIDATA, n. var.

♂ ♀. Belongs to Guenee's Group 2, but differs in detail from all the species he describes. Primaries and secondaries dark yellow, the former with a small purple costal v-shaped spot, the wings are sparsely speckled with purple, which is gathered into larger patches subterminally and about anal angle. A discal dot. Hind wings with a purple straight line bordered by a small dark spot before anal angle. Beneath the line is repeated more diffusely and above the wing is washed with purplish before line, the color widening to internal margin. *Expanse* 44 mil. Indian River. Coll. B. Neumoegen, Esq.

The colony of tropical insects at the southern extremity of the Floridian Peninsula is one of exceeding interest. The more muscular insects such as Sphingidæ and Noctuidæ seem to be often the same species as the West Indian. There is probably a constant accession of fresh blood. I do not separate the Florida *Edwardsii* of Butler from Cuban *Alope*. But the feebler winged Bombyces and Geometrids seem to differ slightly and seem to have undergone a local modification. My notes on the fauna of the Peninsula are not yet ready for publication, but they show some remarkable results parallel with my already published studies of the distribution of the Lepidoptera.

SCOLECOCAMPA OBSCURA, n. s.

Fore wings ochrey fuscous with an interrupted black terminal line, two dots on the cell and indications of a rounded, bent, single outer median line. Thorax like primaries. Hind wings dark fuscous. Beneath paler, without markings on either wing. Palpi obliquely ascending, fuscous. Antennæ pale. One specimen. Coll. B. Neumoegen, Esq. Arizona. Allied to *Bipuncta*, but darker and stouter.

PHASIANE IRRORATA Pack.

A large specimen of this species, which may be known by the broad pale yellowish median bands, is contained in Mr. Neumoegen's collection from Arizona.

SEMIOTHISA S-SIGNATA Pack.

Arizona specimens vary by the wings being pale ochrey without marks except the black, curved inferior portion of the outer line. Again all marked with dark blotches. The S-shaped black line is more even than in Packard's figure, but I do not think there is room to suspect a different species.

SEMIOTHISA COLORATA, n. s.

This is smaller but in form like *Ocellinata*. No discal mark on fore wings, which show three dark costal spots, the lines obsolete. The wing is washed with faint reddish ochrey. Subterminal line cloudy, blackish continuous, upright, followed by a paler shade. Hind wings light gray, with but little of the warmer tint of primaries: a discal point. Beneath with discal marks on both wings, and with a well marked subterminal band on the whitish secondaries. On fore wings above the terminal space shows an irregular blackish shading. External margin even. Wings sparsely

irrorate. *Expanse* 22 mil. Arizona. Six or eight specimens in coll. B. Neumoegen, Esq.

SEMIOTHISA CALIFORNIATA. Pack.

♀. Mouse gray. Fore wings crossed by three fine brown lines, the outer somewhat flexed and dotted on the veins, deeply marked on costa. Discal dot an annulus on the bent median shade or second line. Hind wings crossed by three lines, the outer broadest and bent, the inner illegible: a solid discal dot above and below. The discal mark on primaries beneath is an annulus. Under surface evenly and somewhat closely mottled with dark. On fore wings above a slight cloud outside of the third line between veins 3 and 4. Body gray. Beneath somewhat ochreous and pale; a common narrow and faint dark outer line angulate below costa and corresponding to the third line of upper surface of primaries. *Expanse* 27 mil. Arizona. Coll. B. Neumoegen, Esq.

I re-describe this fresh specimen to show that, while it varies a little from Dr. Packard's description, and this more in the way of looking at the markings than in anything real, the Californian species really occurs in Arizona.

SEMIOTHISA DISLOCARIA. Pack.

A fine pair of this very distinct and remarkable species is contained in Mr. Neumoegen's collection from Texas. The pectinated ♂ antennæ and the discolorous veins and robust form are distinguishing characters.

PHASIANE NEPTATA. Pack.

This species occurs in Arizona and resembles *Mellistrigata* in the color of the lines. The course of the outer line is different. Mr. Neumoegen's collection.

APATELA VULPINA. n. s.

This is allied to *Leporina* and *Lepusculina* (Populi Riley). The wings are not "d'un blanc grisâtre saupoudré de fins atomes noirs." but of a creamy, yellowish white, not irrorate. The secondaries are not of a "blanc sale." but pure immaculate white. The markings are as in *Leporina*; a black basal dash: the t. a. line consisting of three black spots: a small ringed orbicular sometimes wanting: a small lunate black reniform. T. p. line fragmentary but without the dash at internal angle "en T" of *Lepusculina*, or at most the smallest remnant of it. The markings of these three are alike, but *Vulpina* is slight, like *Leporina* and would have been

placed in a group with it by Gueneé. The larva has been discovered and will be described by Mr. Thaxter. N. Y. (Dr. Bailey.)

HADENA PLUTONIA, n. s.

♂. Allied to *Vultuosa*: very deep almost black brown. A black streak at base on internal margin and black irregular dashes before s. t. line. Lines double, marked on costa, else difficult to make out. Orbicular oblique, concolorous, a little paler, incompletely black-ringed. The wing is of a burnt brown that makes all description difficult by obscuring the markings. Anal hairs ochery. Hind wings fuscous with pale fringes. Beneath the hind wings are paler, ochery towards inner margin: a dot and two extra mesial lines. On fore wings terminal space a little paler. Palpi brown, paler in front. *Expanse* 36 mil. Kelley Point, Maine. Mr. Thaxter.

SPHOSOMA CONGRUA Walker.

This species has at length been discovered. Mr. Thaxter has reared it from the larva. On my first visit to the British Museum I examined Walker's types and made the following description of his specimens:

♂. Primaries white with a very few sparsely arranged brown dots and an S-shaped subterminal brown line, incompletely drawn across the wing. Abdomen entirely white. ♀. Anterior wings with but one or two exterior dots, almost immaculate white. Secondaries immaculate in either sex. Inwardly the fore coxae and femora are dark yellow without the black spot sometimes in *S. Virginica*, than which this species seems a little slighter. Beneath the male has faint discal marks wanting in the female. Palpi and antennae much as in *C. Virginica*. All the tarsi and tibiae are brown inwardly."

The species may be distinguished from *Latipennis* by the yellow front legs, and from *Virginica* by the unspotted abdomen. At the time I made these notes I had never seen the species, nor have I seen it until now. I was doubtful about its being North American: But very likely it is a form that Mr. Strecker calls *Antigone*, which must join that author's long list of synonyms.

CARIPETA SUBOCHREARIA, n. s.

Larger than *Dirisaria* and deeper in color. Thorax, head and costa of fore wings bright ochraceous. Rest of the wing deep brownish ochrey. Outer mesial band followed by a broad, uneven yellowish white shade. S. t. line dentate, edged with scattered pale scales. Discal spot yellowish white.

rounded. Inner line preceded by yellowish white shading, bent on disk. Fringe checkered. Hind wings brown with lead colored powdering. Fringe marked with dark at end of veins. Beneath pale brown, reflecting markings. Two specimens. Mr. Neumoegen's collection. North Carolina. *Expanse* 35 mil.

ONCOCNEMIS CURVICOLLIS, n. s.

♂ ♀. Eyes naked. Tibiæ with a claw on front pair. Body rather slender. Light gray. Collar a little cut out behind, and projected in front. (This latter character is sometimes accidentally caused; in *C. Occata* I was misled by it to refer the species to *Cleophana*.) No lines. Transverse lines marked on costa. Orbicular with dark gray centre, finely annulate within with pale. The wings show longitudinal light and dark marks. Hind wings whitish in male, with improminent smoky borders in the female, not as dark as *Major*, to which this is allied. Hind wings dark in the female. Thorax dark gray. Stigmata much as in *Major*: in one specimen the claviform contrasts by its pallor. The orbicular seems less sharp. This species seems to differ by the collar being more cut out, the slenderer body, want of any determinate subterminal markings. *O. Curvicollis* is before me in three specimens from Arizona expanding 34 mil.

Neither *Atricollaris* nor its ally, *Grisicollis*, have the collar excavate; *Copihadena* has no character that I can see. Neither has *Metahadena*, which, if the front tibiæ are really armed, as now stated by Mr. Smith, must be referred to *Oncocnemis*. While *Cibalis* and *Gracillima* are allied in marking, *Curvicollis* belongs to the series of *Chandleri*, *Riparia*, *Major* and *Aqualis*. *Pernotata* Gr. shows a faint resemblance to the European *Campicola*. The genus is fairly numerous in species; I should be glad to divide it, but I cannot see on what grounds either of Mr. Morrison's genera are to stand. I relied on Mr. Morrison's diagnosis that the tibiæ were unarmed in referring *Atrifasciata* to *Homohadena*. There is no longer any doubt that *Riparia* is not a variety of *Chandleri*, as which Mr. Morrison described it. We have now three Eastern *Oncocnemis*: *Riparia*, *Saundersiana* and *Atrifasciata*, besides the Texan *Occata*. In all we have 24 species so far described. Most of the types are in the collections of Messrs. Neumoegen, Tepper and Graef. I feel some doubt about the distinctness of *Major* and *Curvicollis*, the latter is slighter and paler, even less distinctly marked subterminally, and the collar is more excavate. *Aqualis*, from California, is also near to these. *Mead-*

ana I do not know except from a view of the type. The rest seem very distinct.

PLAGIOMIMICUS Grote (1873).

The three species which I now refer to this genus agree in the peculiar frontal excavation, the smaller of them (*Tepperi*) showing it less prominently. There is a perfect resemblance in the markings; the position of the lines and the dark triangular spot crowning the subterminal field of primaries above, especially in the form of the thorax and in the peculiarity of the tegulae, which spread away from the thorax and are furnished at tips with elevated scales. In the two larger species (*Pitychromus* and *Expallidus*) the cup-like frontal excavation is completely exposed.

1. *Pitychromus* Grote. Bull. B. S. N. S. I., 1827. 1873. *Schinia media* Morr., Proc. Bost. S. N. H., 123, 1875.  
Southern, Western and Middle States.
2. *Expallidus* Grote. Montana.
3. *Tepperi* Morr., Proc. Ac. N. S. Phil., 68, 1875; Grote. Bull. B. S. N. S., 111., 75, 1875.  
Texas.

*P. Tepperi* is a lovely species of a dusky green tinge, and the neat markings show very distinctly against the ground color. Mr. Morrison gives the unarmed fore tibiae as a distinguishing character of *Polenta* as compared with *Schinia*. But the genus is not allied to *Schinia*, but to *Fala* and *Stibadium* and *Stiria*. The characters of the "front" and the tegulae are not noticed by Mr. Morrison, who based his genus on a single erroneous character. The fore tibiae are armed in all the species, not unarmed in *Tepperi*, as stated by Mr. Smith.

CATOCALA SEMIRELICTA Grote.

In Mr. Neumoegen's collection is a specimen exactly like my type and figure and description: the white patches on the primaries, the pinkish red secondaries, the abbreviate black band, are all represented. There is, then, an intermediate specimen in which the fore wings are a little grayer all over, and then the type form described as *Pura*. There is not a shadow of a doubt on my mind, after seeing these, that they all belong to one species. Documentary evidence exists that before its description Mr. Strecker also regarded *Pura* as the same as *Semirelicta*, or very near it. Finally it seems to have been agreed to refer *Semirelicta* as a variety of

*Briséis*, and then to re-describe its probably more usual form as a new species.

#### CATOCALA ARIZONÆ.

This has the fore wings more purely brown, a reddish or rusty brown, no yellow admixture. The whole wing is tinted with a brownish shade and there is not the division of colors as in *Junctura*. The hind wings are pinkish red and the abbreviate band broader than in *Junctura*. Thus there is a certain resemblance to *Amatrix*, which I alluded to in my original description. Although without figures these differences cannot be brought out in words as they should be, a study of Mr. Neumoegen's fine material will convince any student of the correctness of my separation.

#### CATOCALA WALSHII.

This species as found in Kansas and Illinois, also in New Mexico, seems to me identical with *Aspasia*. *Arizona* is a larger, rich brown species reared in Arizona by Mr. Doll and probably identical with the Texan form which has been distributed by Belfrage as "*Walshii*." This Texan form is *not* the true *Walshii*, and while it has not received a special name, I regard it as a variety of *Arizona*. Walker's *Junctura*, according to Mr. Butler, is = *Walshii* as taken by Prof. Snow. The statement that *Arizona* was = *Walshii* is based on an erroneous identification of the latter species, which appears to have been named three times.

#### CATOCALA JUNCTURA Walk.

Fore wings dusky gray, shaded with yellowish brown over the reniform and subterminal space. Base yellowish brown shaded, though often this latter tint is confined to the double t. a. line. The two colors are blended so that there is no distinctness in the shading. The dentate s. t. line includes a paler gray shade. Hind wings pinkish red with the median band rather narrow, abbreviate. *Expanse* 80 mil. Illinois; Ky.; Missouri; Kansas; New Mexico.

With this, *Walshii* W. H. Edwards, and *Aspasia* Strecker, are in my opinion absolutely identical. Types in coll. B. Neumoegen, Esq. Taken by Prof. F. H. Snow.

A form collected by Belfrage in Texas, in Mr. Neumoegen's collection and labelled "*Walshii*," may be a var. of that species. It is larger.

I do not wish to name any more varieties in this genus, but in Mr. Neumoegen's grand collection there are two specimens which seem to me

*Junctura*, but have gray primaries without darker shades. There is also an unnamed variety of *Verrilliana* with yellow secondaries, from Arizona.

The synonymy of the species here discussed should be as follows :

- 1173 *Junctura* *Walk.*  
                   *Walshii* Edw.  
                   *Aspasia* Streck.  
 1174 *Arizonae* *Grote.*  
 1186 *Semirelicta* *Grote.*  
                   *Var. Pura* *Hulst.*

I have *Catocala Violenta* also from New Mexico, collected by Prof. Snow.

(To be Continued.)

THE FOOD RELATIONS OF THE CARABIDÆ AND COCCINELLIDÆ. By S. A. FORBES. From Bulletin No. 6, Ill. State Lab. of Nat. Hist., Normal, Ill., Jan., 1883, 8vo., pp. 31.

Through the kindness of the author, we have been favored with a copy of the above paper, which embodies the results of a very laborious series of microscopic examinations of the contents of the alimentary canal of insects belonging to the Carabidæ and Coccinellidæ. In the Carabidæ the results of the dissection and study of 175 specimens are given, representing 38 species and 20 genera. Of the Coccinellidæ, the results of the dissection of 39 specimens are given, accompanied by carefully compiled tables presenting the evidence in the most convenient and accessible forms. Prof. Forbes' experiments show clearly that the opinions hitherto held by Entomologists as to the food of these insects are in many respects incorrect. While it is shown that the insects belonging to the genus *Calosoma* live almost exclusively on animal food, those of *Chlœnius* and *Galerita* to the extent of nine-tenths, and those of *Pterostichus* three-fourths; the species of *Harpalus* take only about 12 per cent. of animal food, *Anisodactylus* 21 per cent., *Amara* and *Amphasia* 23 per cent., and *Agonoderus* about 33 per cent.; the whole series of Carabidæ examined averaging 57 per cent. of animal food, the remainder being vegetable and consisting mainly of the pollen of flowers and the spores of fungi.



Of the Coccinellidæ examined, animal food constitutes but little more than one-third of the whole, the other two-thirds consisting of 45 per cent. of the spores of fungi, 4 per cent. of those of lichens, and 14 per cent. of pollen. Prof. Forbes has laid all who are interested in this subject under grateful obligations to him for his valuable contributions to our knowledge in this department.

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DESCRIPTION OF THE PREPARATORY STAGES OF  
PYRAMEIS ATALANTA, LINN.

BY W. H. EDWARDS, COALBURGH, W. VA.

(Continued from Vol. 14, p. 234.)

ON THE LARVAL HABITS.

The habits of these larvæ in Europe may not improbably differ in some respects from the habits in America. Our hot summers, as compared with England, at least, may compel more or less change. With us, speaking of my own district, and of the False Nettle, *Boehmeria*, as the food plant, the eggs I believe to be always laid on the young terminal leaves, as Dr. Harris states is the case with the Nettle, *Urtica*. I come to this conclusion, not because I have found eggs on the terminal leaves, for I do not remember that I have ever found an egg of *Atalanta* laid by a free female; but because the larvæ, in first stage, have always been observed on these leaves. I have repeatedly obtained eggs from females tied in bags over the food-plant. On 1st Aug., 1881, upwards of 100 were so obtained. They were laid everywhere, on leaves, stem and bag. When the larvæ hatched, those on the lower leaves made an effort to reach the upper ones, and finding these occupied, accepted any position they could get, turning up the side of a leaf, when necessary. Several lived on the same leaf, each in its own case however. But in a free state, the young larva has always been found by me on the very small terminal leaf, which it has closed up from the base. Dr. Harris says: "*It spins a little web to cover itself, securing the threads all around to the edges of the leaf, so as to bend upwards the sides, and form a kind of trough, in which it remains concealed. One end of the cavity is left open, and through this the caterpillar thrusts its head while feeding.*" This does not properly describe the proceeding on *Boehmeria*. On this the newly hatched larva begins at

the base of the leaf, and spins threads across it. It is not difficult to bring the edges together, as the leaf is but partially opened, the edges being somewhat curled in. Within a few hours, the whole leaf will be found to be stitched in the manner which I will describe at one larval stage later. But an opening is not left at the tip for the larva to thrust out its head; nor does it begin at the tip and eat downward. That would apply to the larva from second moult onward. The young one eats the substance of the leaf within its case, at some distance from the tip, leaving the framework untouched. It makes its resting place quite close to the base, and there it will remain till after it has passed the first moult. The case at this stage is never so eaten that it does not afford protection to the larva, and protection at the youngest stage is most important, as it is then, if ever, that the little ichneumon-fly deposits its egg. The net-work of the frame of the leaf would seem sufficient to keep out many sorts of enemies. Most of the feeding is done at night. At last, some morning, the tenant will be found to have deserted its case, and to have shut itself up in one of the second pair of leaves, and it is now past the first moult. I experimented on several larvæ just past this moult. One was placed on the terminal leaf of a plant set in a flower-pot in my room. A few minutes later, it had descended to the second pair, and taken possession of one of them. Its first movement was to gnaw nearly through the mid-rib quite at the base of the leaf, and also to cut a hole on either side the rib at the break. The leaf was thus made to droop several degrees, and at the same time the sides moved closer together. Then spinning began. Threads were laid obliquely across the open space, one end fastened to the base of the leaf on one side, the other a little above the base. After the edges had been bound for a short distance in this way, a change was made and threads were spun directly across, and over the first ones, beginning at the base. One set of threads drew the edges, the other held them. Then the oblique threads were laid again, and the cross threads, and so on, alternating, till at 90 minutes from the start, sometimes working, sometimes resting, the little creature—.2 inch only—had closed half the length of the leaf. It had also spun some cross threads within, which would help hold the sides in place. Next morning the leaf was completely closed, and to get a view of the larva I had to slit the case with scissors. This was the usual mode at the younger larval stages, only that at the first, on the terminal leaf, the rib was not bitten nor were holes made at the base.

My larvæ displayed much ingenuity, overcoming obstacles, and by no means proceeded always in the same way. Another just past first moult, descended as before to second pair, but instead of breaking the rib to let the leaf fall, set itself to attach threads to the upper leaves *to hold its leaf up*, and then closed the edges. Doubtless it had its sufficient reasons for so building. In this instance, the leaf stood at about 30° above horizontal, in the first, the leaf had been a little below horizontal.

A third larva at same stage proceeded in quite another way. It remained on the terminal leaf, and stitched one edge of it to the near edge of one of second pair: (in this plant the pairs of leaves alternate on the stem, one being at right angles to the other). An hour later, it was stitching the other edge of the other leaf of the second pair. After another hour, it had begun to draw up the tip of its own leaf and at length got this turned over and bound down, shutting itself in a sub-triangular case very different from the usual one. During the next few days I could discover no trace of this larva having fed, and on the fourth day, it had left its case and closed up a leaf by the edges, *after biting off the stem*, as related in larva No. 1. At the lower, or tip end as it hung, this case touched the next leaf below perpendicularly, and was stitched to it, and that day and the next the larva fed off the tip of its case, and as fast as eaten this was drawn down to the lower leaf, so that the open end was pretty well closed against the ingress of any enemy. The following day seeing no change in the eaten parts, I cut the case and found the larva dead, and a cocoon of an ichneumon-fly by its side.

Finally, a fourth larva overcame many troubles in this wise. It was placed on one of the second pairs of leaves, and it closed the edges without biting the mid-rib, until it had gone one-third the length of the leaf, when it returned and broke the mid-rib and also eat the two holes at its base. We may suppose that the larval mind at first decided that the leaf would come together without the rib being broken; and second, discovered that this was a mistake, whereupon rectification was made. At all events that is what a human architect would have done. After which the larva proceeded to close the rest of the leaf;—all this occupying three hours. Next day I accidentally broke off this case, and pinned it to another leaf. The following morning the wilted case had been deserted, and a fresh leaf was being closed up. A day later this last case fell of itself, but struck lower leaf, and presently was bound to it by a few threads. Three or four hours later my larva had climbed another stem of the plant, making

journey of some twelve inches in length, and there it found and closed another leaf. This made three cases by this one small larva. The day after it took possession of the third case, I found it dead, with a cocoon by its side. It would seem as if a premonition of what was to happen impelled these parasitized larvæ to make extraordinary preparations for their final resting places, and I have constantly observed that an unusual amount of spinning had been done, coating the inside of the case thickly, where dead larvæ were found. These cases are closed more carefully than others, so that on inspection it is difficult to find an aperture which would admit anything. I have seen no other parasite about *Atalanta* larvæ than the fly, *Apateles gelechiæ*, and a single cocoon of this, when found, has always rested by the side of a larva of second stage, and no other.

The question may be asked, when does the fly deposit the egg which leads to the destruction of the larva? It is not laid in the egg, for if it was no larva would emerge therefrom. Butterfly eggs are often stung by parasite flies so minute as to be scarcely discernible, and from the egg, a few days later, will issue several similar flies, each about .02 inch long. I apprehend that our larva is stung by this fly just after it has come from the egg, and before it has made for itself a case, for except at this little interval of time, the leaf is closed. And when a hole is eaten in the side, the netting spoken of, would apparently suffice to keep out this particular enemy. In the next stage there is no such close protection, and probably not much need of it, for I have not found an *Atalanta* larva infested at any stage after the second. Accordingly, after the first stage there is nothing to screen the holes made in the case, the nerves being eaten as well as the substance of the leaf, and I have never been able to find a web, or threads extended across the opening. When the whole outer end of the case is devoured, as sometimes happens in second and third stages, there is nothing to prevent any enemy entering.

The fly then stings the larva, most likely at the very beginning of the existence of the latter, deposits in the body a single egg, and from that there is hatched a grub which feeds on the fatty portion of the larval interior, avoiding any vital organ, till at the close of the second larval stage it has devoured nearly all but the mere shell, and is itself then full-grown, and eats its way out of the side of the dying larva. Presently this grub has encased itself in a cocoon of its own spinning, a white cylinder, .15 inch long, and there it lies by the remains of the caterpillar, in the tomb

she had spent so much labor upon, and which now serves to protect the cocoon. until, a few days later, a pretty, gauze-winged fly, not much over .1 inch long, comes forth, ready to begin its career of destructiveness.

This is one of Nature's ways of keeping down butterfly caterpillars. But the parasites that aid in this work are themselves kept in check by a similar process. On one occasion I found quite a number of minute flies issuing from one of the *Atalanta* parasite cocoons. They would have been unnoticed but that the cocoon was lying in a closed glass tube. A hole was discovered, as if made by a pin, and through this the flies had come. In this case the secondary parasite must have found its way into the apparently tight case of the caterpillar, and stung the grub of the *Apateles* just as the latter broke its way out, and while it was yet naked.\* I found also a minute red spider inside one of the cases with a grub of the fly, and spiders do their part in keeping down parasites.

But to return to our larvæ. One in 3rd stage; that is, after 2nd moult, very soon closed the large leaf it had been placed on, first biting the mid-rib. This habit of severing the rib obtains quite to the last stage, as is evident from inspection of the deserted cases met with in my searches. Another in same (or 3rd) stage rested for two days under the bit of leaf it was attached to when I pinned it to the plant, making no attempt at a case, but went outside the bit of leaf to feed. The third day it moved up the stem and took possession of a leaf of the second pair, but instead of bringing the edges fully together in the usual way, did so but partially, and twisted the end of the leaf up and over till the case was completely closed.

A larva in 4th stage, *i. e.*, after 3rd moult, began at once to draw the edges together, not having bitten the mid-rib. The case was closed at 11 a. m. By 3 p. m., same day, this larva had constructed a new case, quite capacious and made of three leaves. Before deserting the first one, it had eaten fully half from the outer end. Next day, it had bitten off the main stem of the plant, just above its case, and had eaten the top leaves. This larva finally, after its 4th moult, left the plant and pupated in the top of the guaze bag, which covered the plant and flower-pot.

I brought in another larva, which had just passed its 3rd moult. After moving about and examining several leaves, at 30 minutes from arrival, it had established itself between two of the second and third pair, which

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\* Mr. Howard, of the Agricultural Dept., Washington, informs me that this little fly is of the genus *Tetrastichus*, the species probably undescribed.

happened to come near together, the upper one drooping. When I first noticed what was doing, the larva was busy in bringing the edges of the two leaves on one side together. An hour later it had brought both sides together, and soon after eat a large piece out of the lower leaf. Two days later, it had made another case, in this instance also finding and making use of two horizontal leaves. To reach these leaves it had gone down one stem twelve inches and up the other as much. In this last case this larva passed 4th moult. Soon after, I took it out and laid it near the top of the stem, turning up three leaves and pinning the edges of the middle one to the other two, so leaving the upper side open. An hour later, the gap had been closed by bringing the edges of the two outer leaves in, and all the tips were drawn together. A fourth leaf had furnished a meal. Next day the case was spoiled, half eaten up, and the larva had escaped, there being no bag over the plant. But it was recovered and placed in a fresh plant, and soon made a commodious case by bringing three or four of the topmost leaves together. Two days later, it had suspended for pupation from the apex of this case. This is the only instance in which I have known one of these larvæ to pupate on the food-plant.

Another day I brought in one which had passed its 4th (and last) moult. At night it was resting quietly on the stem of the plant, but in the morning was found shut in a roomy case, made by biting the stem near the top, so that it fell over, though it was not separated, and this, with two large leaves, were made into the case. Late that day the case had shrivelled, and the occupant being forced to leave had got on the outside of it. But presently it had brought down another leaf and bound it lengthwise to the case and concealed itself thereunder. One day later pupation was found to have taken place at the top of the bag. The behaviour of this larva partly agrees with what Newman relates, so far as to the biting off the stem and making a large case, and had not this shrivelled, perhaps the pupa would have been formed within it. In my searches, I came on one full-grown larva concealed in exactly such a case as I have just described, and had to regret afterwards that I had not tied a bag over it, in order to see whether pupation occurred in the case or not. But, except in this one instance, I have never seen that sort of a case, nor have I ever found a chrysalis suspended to the food plant, in or out of a case. Surely I would have found chrysalids on the food plant if it was usual for the larvæ to pupate where they fed! Dr. Harris must be right when he says that the larva "searches for a place in which to transform." Very probably Mr.

Newman is right also when he says that in England pupation occurs in the cases, on the food-plant; and the difference is caused by climate.

I constantly came upon empty cases one-half and two-thirds eaten, and it is plain that the larva in its later stages may occupy and devour two or three per day.

The summing up of these observations is this: the young larva, when on *Boehmeria*, conceals itself very soon after it has left the egg, by bringing the edges of its leaf together. It does not now go outside to feed, but eats of the substance of the leaf, rejecting the framework. Here it remains till after the first moult, and then migrates to a larger leaf and closes the edges of it, after biting nearly in two the midrib and cutting two holes at base, to cause the leaf to droop and the sides to come together more easily. It feeds inside the case, at some distance from the tip end, and its resting place is near the base. Here the second moult passes, and that over, another move is made, rendered necessary by the case having been much eaten. After the third moult, and usually not before, the end of the case is devoured, beginning at the tip, and thenceforward there is no special protection to the larva against parasites or enemies. Finally, after having built, occupied, and half devoured several cases, the larva goes away from the food plant to pupate.

The one occupation of the larval life is to secure privacy, in the early stages, with a prevision of nasty flies and spiders, and in all stages, with a detestation of sunshine, daylight and bad weather: and to effect this they labor long and industriously. Their cases once made, they may enjoy a rest, and lie curled up and asleep probably, except when impelled by hunger to arouse themselves. And they do not have to forage for a meal as most animals do, but may devour of the walls of the houses they live in. When there comes an end to this supply, they set forth to find suitable leaves, out of which they shall construct other houses, to be eaten in like manner. Even though they occupy these but an hour or two, and they serve for but one hearty meal, they must be closed up as if a month's residence was anticipated.

We have no other butterfly in our fauna whose caterpillar has a habit quite like that of *Atalanta*: *Paphia Troglodyta* Fab. (*Glycerium* Edw. But.) would seem to come nearest to it. Some of the Graptas make shelters in the nature of sun-screens or umbrellas, as *G. Comma* and *G. Satyrus*, not intended probably as a protection against enemies.