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The Canadian Entomologist.

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CONTENTS.

THE LARVÆ OF DONACIA PISCATRIX, LAC., AND CRASSIPES, FAB.*

BY E. DWIGHT SANDERSON, NEWARK, DEL.

Though the larvæ and life-histories of several species of the *Chrysomelid* genus *Donacia* have been described more or less fully by European entomologists, I have been able to find but one such note in American entomological literature. In 1877 Dr. A. S. Packard gave a brief description of the larva and life-history of *Donacia cincticornis*, Newm., var. *proxima*, Kby., in the report of the U. S. Geological Survey for that year (p. 806), together with figures of the larva and cocoon (Pl. LXX., figs. 17-19) which he found on the roots of *Nuphar advena*.

Recently I have been fortunate in being allowed to study the Chrysomelid larvæ in the collection of the U. S. National Museum, and among them was glad to find several species of this genus and *Hæmonia*, which with it form the tribe *Donaciinæ*. Specimens of eggs, larvæ and pupæ of *Donacia piscatrix* and larvæ of *Hæmonia nigricornis* are both present from the Detroit and St. Clair Rivers, collected, I judge, by Messrs. Hubbard & Schwarz, and larvæ of *D. semicuprea*, *D. crassipes*, and *H. zosteræ* from Europe. The larvæ of *Donacia piscatrix* and *crassipes* I have found so very similar that they may be described together without mentioning the minute points of difference.

Several very distinct or typical shapes exist among Chrysomelid larvæ, which to a certain extent are characteristic of different tribes. Such are (1) the short, inflated larvæ of Chrysomela and its allies; (2) the case-bearing Cryptocephalinæ and Clythrini, with their recurved

*Read before the Entomological Society of Washington, May 3rd, 1900.

abdomens and long legs; (3) the flattened, elongate larvæ of the leaf-eating Gallerucini and Halticini, which also always possess anal prolegs; (4) the very elongate, cylindrical root and stem mining forms of the last mentioned tribes; (5) the thin larvæ of the Hispidæ, with their flat, wedge-shaped heads, rudimentary legs (though sometimes apodous) and abdomen deeply serrated laterally; and (6) the Cassidæ with their sharp, spine-like lateral tubercles and long fecifork bearing its mass of excrement over the body.

The larvæ of the Donaciinæ have, however, a form quite distinct from any of these, though resembling most closely - as in many other respects—the Criocerini, which in turn are nearest the Chrysomelini. The body is nearly cylindrical, and forms a distinct, even arc. The head is from one-third to one-half the width of the prothorax, into which it is more or less sunken. The body gradually enlarges to the sixth and seventh abdominal segments, and then tapers abruptly caudad. *D. piscatrix* is 13 mm. long by 3.75 mm. across the sixth abdominal segment, the head being .66 mm. wide and the prothorax 1.5 mm. The segments and folds are quite sharply distinct.

The coloration is that common to most subterrestrial larvæ, the body being a yellowish-white, and the head, articulations of the legs, spiracles, and plates upon the eighth abdominal segment, dark brown.

Just behind each antenna are found four small black ocelli, and another occurs below it. The antennæ are about 0.1 mm. long, and are peculiar in that the accessory digit borne at the apex of the second segment is longer than the third. The latter bears two small digits and a stout long seta at its apex. Upon the basal segment are three small ocelli-like structures occurring commonly on most Chrysomelid larvæ. They do not seem to be the bases of broken setæ, but as to what they are or their function, I am ignorant. Possibly they are sensory pits.

The labrum is irregularly rectangular in outline, and rather large, being about .12 mm. broad. The anterior emargination common in all the nearly related genera is indicated by markings, but has become closed and almost obsolete. The setæ are unusually stout.

The mandibles of Chrysomelid larvæ are typically five-dentate, though many variations occur, and many of the Eumolpinæ are entire. In Donacia only the two outer teeth are developed, the three inner ones being represented by the serrated inner edge in *D. crassipes*, though apparently

entirely lost in *piscatrix*. A comparison with the mandibles of *Hæmonia* and *Crioceris* brings out this degeneration quite clearly.

The maxillæ are very highly specialized and entirely different from those of any other Chrysomelidæ. The cardo is unusually large (.15 mm.), being nearly one-half the whole length (.35 mm.), while the stipes is proportionately shorter. The palpus consists of the usual four segments, which are but obscurely defined; is rather stout, and between .15 and .2 mm. long. But the most peculiar feature of the maxilla is the relation of the lacinia and galea. In most Chrysomelid larvæ the lacinia is rudimentary or merely represented by a stout chitinous process, or spine, at the inner base of the galea, though in many of the Gallerucini and others it is as large or larger than the galea. Usually the galea is composed of a large curved sclerite, articulated to the stipes just mesad of the palpus, with its outer face on the under side of the maxilla, but so curved that at its tip it is concave on the mesal side, appearing like a hood to the small lacinia, and surmounted by numerous stiff setæ. In *Donacia* the galea seems to have faced around until its concave inner face opens directly ectad. It is surmounted by a long thin concave, transparent process, nearly the length of the last three segments of the palpus, being either a single highly specialized seta, or a number of them grown together. The inner chitinous margin of the stipes is decidedly produced at the base of the lacinia. From it project two chitinous bands nearly to the tip of the galea. At this point it is articulated to them by a socket joint, a long, stout, concave, chitinous, sword-like process, about .1 mm. long, which is encased within the sheath-like process arising from the galea. Between the chitinous bands forming the anterior margin, the base of the lacinia, and the galea, is a hollow space. At the apex of this, just below the articulation of the two processes, is a small oval mass, whether muscular or chitinous I am unable to determine, which seems to be connected to the base of the chitinous bands of the anterior margin. In the cavity of the inner chitinous process are seen two slender, whitish filaments or threads, and though they could not be traced for their entire length, they seem to arise from this oval mass, immediately below. The most plausible explanation of the use of this curious contrivance seems to be that it is used for piercing the tissues of the food plants, though this is entirely a matter of conjecture.

The labium is rudimentary, and the palpi are mere papillæ of a single segment .02 mm. or .03 mm. in length, with no trace of another segment

or palpiger, though the anterior margin of the mentum is clearly defined.

There are no true tubercles upon the thoracic or abdominal segments, the setæ thickly studding both dorsal folds of each segment laterad nearly to the spiracle, caudad of which is an area covered with setæ. On the ventral aspect are five areas of setæ, the central one being composed of two areas coalesced upon the mesal line.

Many European writers have described the larvæ of Donacia as having but eight segments, but as Schmidt-Schwedt has pointed out, the ninth and rudimentary tenth are easily recognizable and are very clearly seen in the last embryonic stage, as shown in the figures of Kölliker. Indeed, the latter figures show two long, filiform, lateral appendages attached to each of the ninth and tenth segments. In Lema, Crioceris, and one or two other genera, the anus is found opening in the ninth abdominal tergite, but in Donacia it opens at the caudal margin of the seventh tergite, and true tergites of the eighth and ninth segments are wanting, this space being but slightly chitinized and containing no true sclerites.

But the most striking feature of the *Donacia* larvæ is the pair of brown, chitinous, sickle-like appendages borne upon the eighth abdominal segment. These are about .5 to .66 mm. in length and reach nearly to the tip of the abdomen. For many years the function of these organs was somewhat of a puzzle to those European entomologists who had studied these larvæ, though in 1842 Kölliker gave a clue to their function in his paper on the embryology of *D. crassipes*, Fab., stating that on the third caudal segment are two cylindrical tubes connecting with the main tracheal trunks ("—atque ex tertio dorso tubuli duo cylindrici cum trachearum truncis communicantes enati sunt" — Kölliker, Observationes de Prima Insectorum Genesi, etc., Turici, 1842). Perris, in his excellent article on the larva and life-history of *D. sagittariæ*, Fab. (Ann. Soc. Ent. Fr. 2d ser. t. VI., 1848, p. 33, Pl. II., No. 2, fig. 1-2), stated that their function is wholly unknown. Heeger thought they enabled the larvæ to cling to the roots of the plants, and aided them in creeping.

The manner in which these larvæ are enabled to breathe under water and to form a cocoon filled with air has also been somewhat of a problem. At the base of each appendage is what to all appearances is a very large spiracle. Perris thought that these are closed by a thin membrane, but that the air of the tracheal system is purified through

them by osmosis, a highly improbable conjecture, considering the small surface they allow for such diffusion. Von Seibold (Amtlichen Bericht der 34sten Versalung der deutschen Naturforschen und Aerste, Karlsruhe,. 1859, Seite 211), in describing *D. linearis*, thinks these to be true stigmata and that the larvæ breathe the air found in the intercellular spaces of the roots, first eating into the root and then inserting the sickle-shaped appendages so that the stigmata are placed close to the openings thus made.

The most careful study of this matter has been made by Dr. E. Schmidt-Schwedt (Bul. Ent. Zeit., Bd. XXXI., Heft II., p. 325, Pl. V., figs. 1–11, 1887) upon *Donacia crassipes*, Fab. The cocoons were found in October on the roots of the white water lily (*Nymphea alba*), and were usually found to contain beetles. How these were filled and kept replenished with air was a problem which had never been satisfactorily explained. He soon found an opening toward the end of the cocoon on the side next the root leading into a passage communicating with the air passage in the root, which explained how the cocoon might readily become filled with air coming out from the root and expelling the water. Though not entirely clear, I should judge from the figures and text that he believed this air passage to be a cavity eaten out by the larva. Later, however, he describes and figures the cavities made through the cocoon and into the root tissues by the two appendages. In the cocoons of *D. piscatrix* and *Hæmonia nigricornis* it is clear that the cocoon is entire next to the root, with the exception of a pair of elliptical holes at one end, leading to two corresponding cavities in the roots and very evidently formed by these appendages. I could find no marks of feeding beneath the other ends of the cocoons, and at least the air is replenished if it is not originally taken into the cocoon through these two passages. Dr. Schmidt-Schwedt points out that usually when a plant is thus wounded a corky formation ensues, but that such is not the case in this until the beetle has emerged from the cocoon and the water is admitted, when a cork formation at once takes place and the passage is closed. It seems evident that the larva, breathing as will be further described, merely forms the cocoon close to its body, thus expelling all the air, withdraws the appendages from the two passages and transforms to the pupa, which thus admits the air from the roots and remains open, replenishing the air for the pupa and beetle.

Concerning the structure and function of these larval appendages, he

states that in cross section each is seen to be composed of five canals, two pairs above and a single larger passage below, which opens below slightly before the tip. By inserting the appendages into the roots the larvæ are enabled to draw in the air found in the large vascular bundles, through this opening in this lower channel, which supposedly connects with the tracheal system. Concerning the two upper pairs of canals he says nothing except that they are highly chitinized to secure the firmness of the appendage, but concerning the lower, remarks: "How this formation —a chitinous tube opening at the end—came to pass histologically I was not able to ascertain till the present observations. It comes near calling to mind a tubular outgrowth of the hypodermis at the stigma. In accordance with this is the fact that the wall of this questionable canal, especially near to the base of the appendage, is not simple, but is double, and no cells are to be found between." (Free translation.) In support of this view he found that small pairs of scars which when cross-sectioned exactly correspond in size to the tips of the appendages, and are at the correct distance from the scars where the larva had been feeding, could be readily found, and these I have found on stems bearing the cocoons of *D. piscatrix*. Doctor Schmidt-Schwedt states, however, that in removing the roots of the food plant from the mud the larvæ always released their hold, and that when rearing them he did not find them with the appendages inserted until he darkened the breeding cage, and then that the *points* were found inserted, but that they were disturbed by the light and withdrew them in a short time. Perris states that he cut off these appendages at the base without injuring the larva. But as Dr. Schmidt-Schwedt says, he did not state how long they would live under water with them removed. On the other hand, neither does the latter writer state that he determined whether or no the larva would not live under water if entirely removed from the root.

I have not been able to study any live larvæ to determine the function and manner of use of these interesting appendages, though I hope to do so at an early date, but have made a very careful study of their structure, only, however, by means of free-hand sections. First, however, it may be noted that true spiracles occur on the cephalo-lateral angle of the mesa-thorax and upon the first seven abdominal segments, as in other Chrysomelid larvæ. The structure of the spiracles, however, is rather different from any others I have observed. I have not made any sections of them, but a lateral view is figured, showing them to be elongate and

apparently with a good-sized cavity within. Spiracles of other Chrysomelid larvæ have merely two lips or flaps, guarded inside by a few hairs. At the base of each of the sickle-like appendages occurs the eighth abdominal spiracle, which I believe to be open. The opening can be seen very clearly in one mount, though it occurs considerably below the surface of the body, and would probably not be seen except in a prepared specimen. A trachea branching from the main trunk can easily be seen opening at each of these spiracles. Around each of these and forming the base of the appendage is a circular, chitinous structure, apparently tubular. From this arises the appendage with no visible line of demarcation.

In cross section each appendage is seen to consist of five passageways. The lower side of the appendage is membranous and encloses the lower channel which extends up through the central portion, between the two main canals. This membrane is clearly an outgrowth of the outer cuticle, connecting the chitinous wall of the two lateral channels, and doubtless covering the whole appendage, though not discernible in a rough, thick section. The two lateral passages have thick, chitinous walls, marked with striations, seemingly tracheal tæindia. The two upper passages are open above, but can be readily closed by a wedge-shaped piece which runs along the top of the appendage. The lower canal has absolutely no connection with the tracheal system, as far as I can observe, and the membrane enclosing it below is continuous with that of the cuticle of the eighth segment. The lateral passages open into the tube surrounding the spiracle. At their base this is at first striated as are the passages, but the striations become irregular, forming a network, and finally a sieve-like or grate-like structure on the anterior portion. When the appendage is viewed laterally it is transparent enough to reveal a series of elliptical openings running along the upper portion, two series evidently arising from each of the lateral passages. From each of these openings arise several small tubes, sometimes branching slightly near the base, each of these structures resembling a rather coarse miniature gill. By breaking open a lateral passage from below one or two of these holes can be clearly seen. The outer series of holes and the tubules branching from each are easily seen both by a lateral view and cross section. The exact structure and position of the inner series I have not been able to determine so satisfactorily, but they seem to extend along the membrane forming the side of the wedge-shaped apex of the append-

age, the series from each lateral passage along either side, and each sending off a small branch toward the other, somewhat before reaching the lateral margin, where they terminate. Whether these tubules are open at the tips or not I have not been able to determine. If so, they doubtless act as a sieve through which the air is admitted to the lateral passages which convey it to the main tracheal trunks. But if we consider them as closed, as I am inclined, the whole structure is remarkably well adapted to aerating the tracheæ by osmosis, whether the pure air is secured from the air cells of the plants or from the water. The wedge-shaped apex of each appendage shuts down tightly on either side, thus making a solid cylinder with which to pierce the plant. That it does so pierce the tissue of the root while constructing the cocoon, and that the passage thus made replenishes the air of the cocoon, there can be no doubt. But whether the larva secures air from the intercellular spaces of the root by direct communication or osmosis, or by osmosis from the water, the appendages thus serving as tracheal gills, would seem to need demonstration, inasmuch as Dr. Schmidt-Schwedt observed only the points of these appendages inserted into the roots.

However that may be, I feel certain that the appendages are truly a highly specialized form of spiracle. I would hardly arrive at this conclusion had I not observed a very similar structure in the pupæ of the genera *Octotoma* and *Odontota* of the tribe *Hispini*. The larvæ of these species mine within leaves, and the pupæ remain within the leaves. Projecting caudad from either fifth abdominal spiracle—which is usually the last in Chrysomelid pupæ—is found a stout, chitinous spine about the length of a body segment. In the pupa of *Octotoma plicatula* the fourth spiracle is expanded caudally about half as much as the fifth, and the third is but slightly expanded, merely being produced to a point caudally. But the gradation is complete, and it is easily seen that the spine-like process of the fifth segment is but an outgrowth of the spiracle. Each of these spiracles, 3 to 5, has the external opening surrounded by a circular tube, also connecting with the trachea, and this circular tube is merely drawn out to a point, so to speak, to form the process of the fifth segment, the process gradually increasing in length and acuteness from the second to the fifth abdominal spiracle. This appendage forms merely a simple tube with the sides curled up and in to form an elongate cavity, in which the lining surface is membranous and finely reticulated. Further than this I was unable to observe any structure, as the projections are

hardly .12 mm. in length. The resemblance to the structure of the eighth abdominal spiracles of *Donacia* is, however, most striking, and, with the exception of the inner structure of the appendages, is complete. This difference, I think, can readily be accounted for and the evolution of a type of spiracle like that of *Donacia* larvæ be shown from a simpler form as found in these *Hispid* pupæ.

The life-history of *D. crassipes* has already been intimated. I do not know that the life-history of *D. piscatrix* has been carefully studied, but from facts obtainable I would judge it to be as follows: The eggs, which are of a brown colour, flattened oval in shape, about .75 by .25 mm., are laid in a double row, the line between the two rows being formed by the ends of the eggs, 20 to 30 of which are laid in a bunch. These are deposited early in summer on the roots of *Nymphæas*, upon which the larvæ feed. The cocoons are found on the roots or sometimes on the stems of water plants, and the beetles emerge either in the early fall or remain in the cocoons till the next spring.

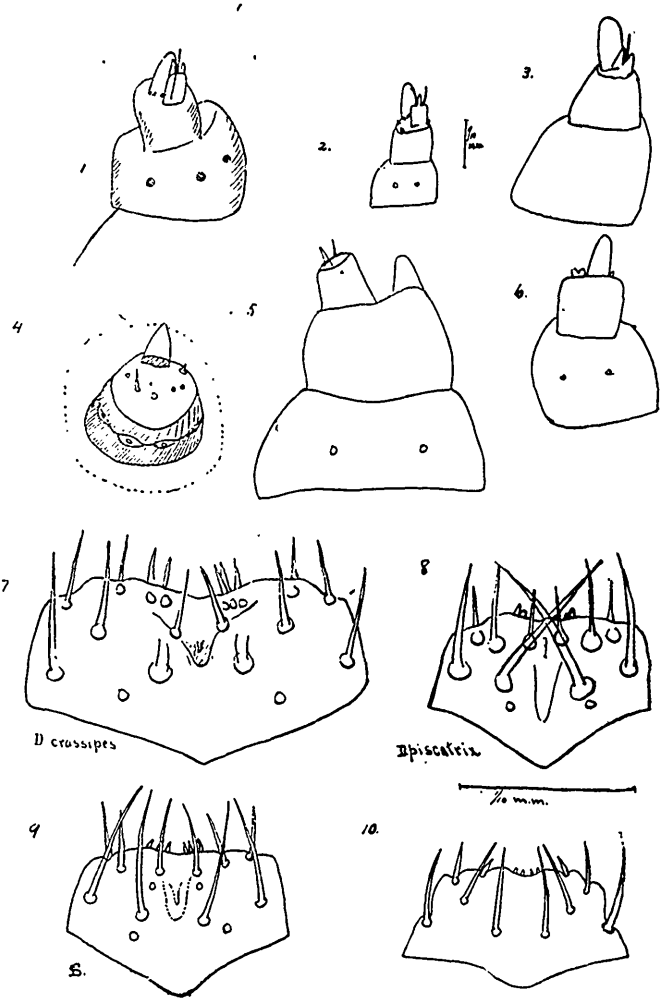
The larvæ of *Hæmonia* are much the same, the specimens I have seen being shorter, and plumper, with the abdominal appendages extending ventrad almost perpendicularly and covering the caudal segments. The best characteristic between the two genera is the loss of the ocelli in *Hæmonia*, which I judge is the more specialized genus. I have been unable to observe the prothoracic spiracle mentioned by Lacordaire.

Certainly, altogether, the larvæ of this tribe are most distinct from those of all other Chrysomelidæ, possibly even more so than are the adult beetles.

EXPLANATION OF FIGURES.

Figures are from camera-lucida drawings by the author, except Figs. 17-20.

Fig. 1.—Antenna, *Donacia piscatrix.*
" 2.— " *Donacia crassipes.*
" 3.— " *Haemonia zosterae.*
" 4.— " *Crioceris merdigera.*
" 5.— " *Chrysomela varians.*
" 6.— " *Haemonia nigricornis.*
" 7.—Labrum, *Donacia crassipes.*
" 8.— " *Donacia piscatrix.*
" 9.— " *Haemonia nigricornis.*
" 10.— " *Haemonia zosterae.*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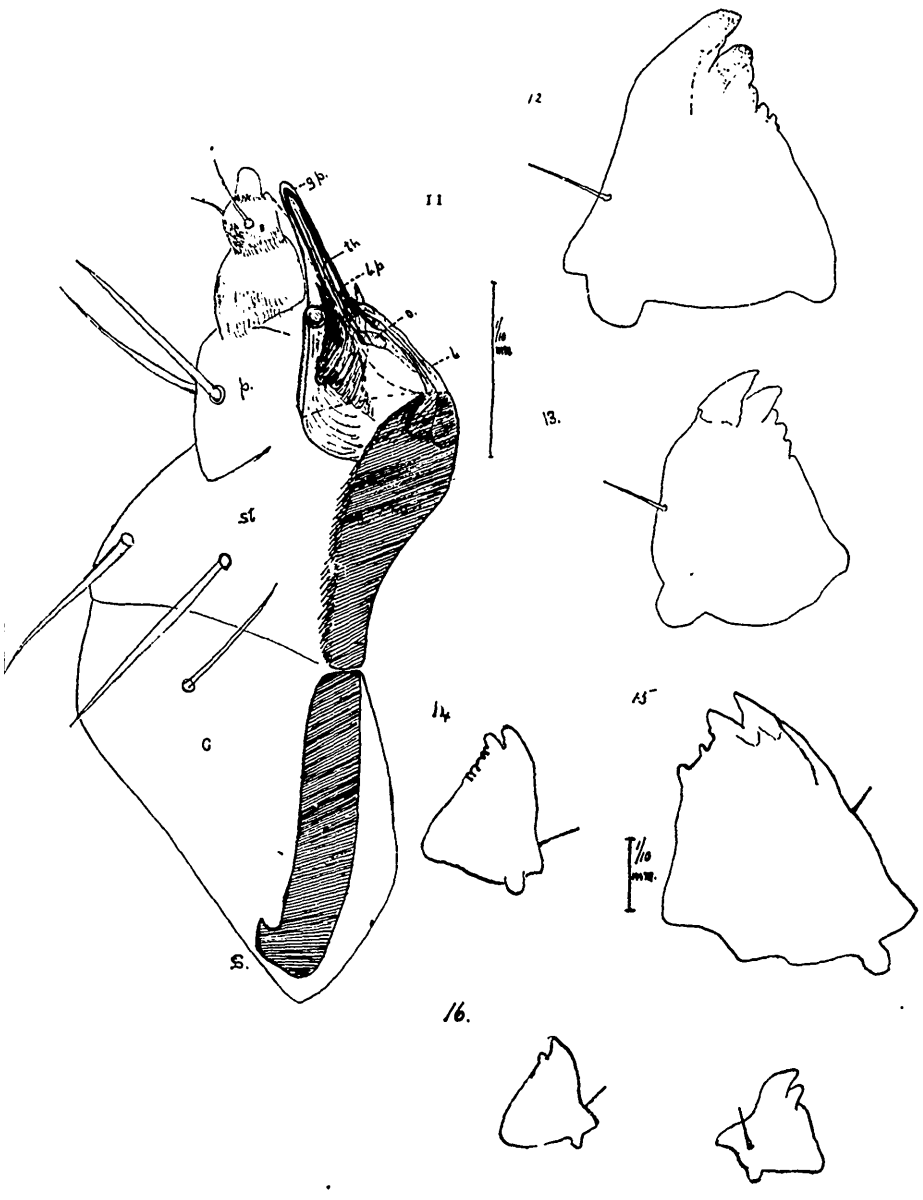
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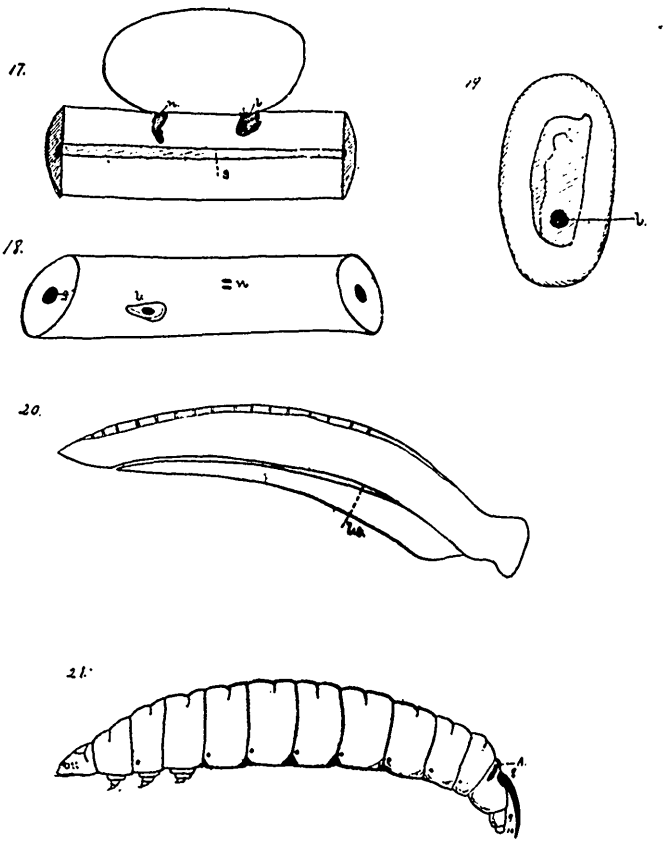


Fig. 11.—Maxilla, *Donacia piscatrix* and *crassipes*.
c., cardo; st., stipes; p., palpus; G., galea; l., lacinia; l. p., process of lacinia; g. p., process of galea—or sheath; th., threads in lacinial process; o., ovoid mass.

" 12.—Mandible, *Haemonia nigricornis*.

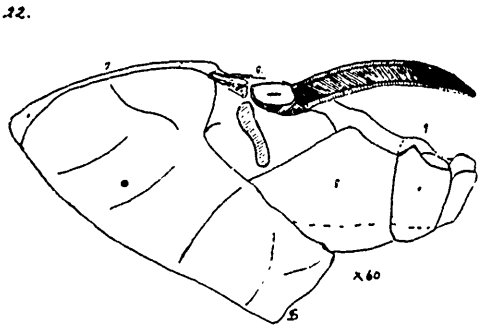
" 13.— " *Haemonia zosteræ*.

" 14.— " *Donacia crassipes*.

" 15.— " *Crioceris merdigera*.

" 16.— " *Donacia piscatrix*.

" 17-20.—(after Schmidt-Schwedt).



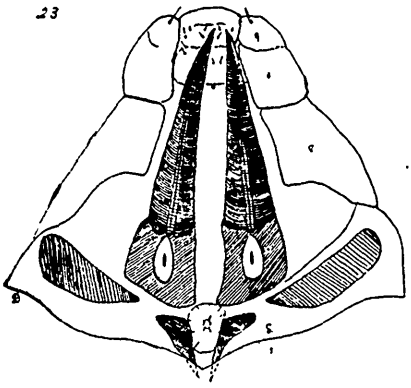


Fig. 17.—Longisection of stem and cocoon of *D. crassipes*. n., cavity made by abdominal appendages; l., feeding cavity.

" 18.—Exterior view of root, showing feeding spot (l) and scars of abdominal appendages (n).

" 19.—Under side of cocoon when removed from stem; l., opening ("Oeffuung in demselben").

" 20.—Lateral aspect of an abdominal appendage; l.c., lower canal ("der untere unpaare kanal").

" 21.—Sketch of larva of *Donacia crassipes*, enlarged; a., anus.

" 22.—Lateral aspect caudal segments of larva of *D. crassipes*.

" 23.—Dorsal aspect of same.

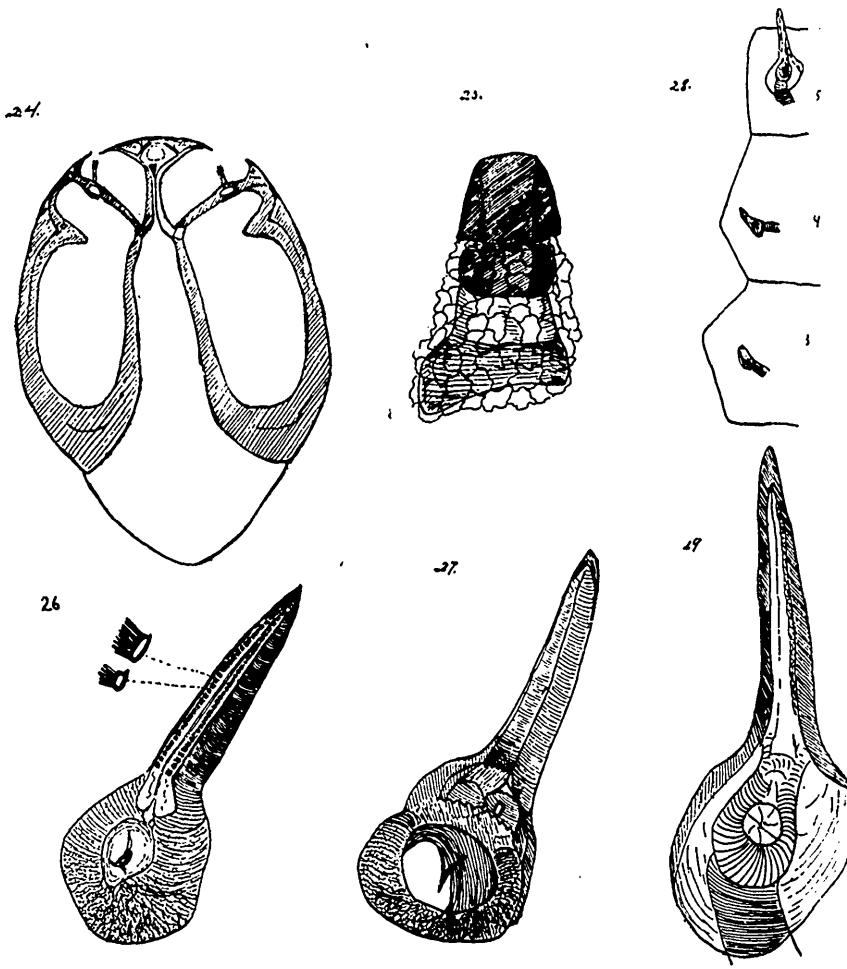

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Fig. 24.—Transection of appendage of eighth abdominal spiracle.
" 25.—Lateral view of abdominal spiracle (1–7) covered with epithelial cells.
" 26.—Dorsal aspect eighth abdominal spiracle.
" 27.—Ventral " " " "
" 28.—Third, fourth and fifth abdominal spiracles of pupa of *Octotoma plicatula.*
" 29.—Fifth abdominal spiracle of same.

A PARASITE THE SUPPOSED CAUSE OF SOME CASES OF EPILEPSY.

BY G. H. FRENCH, CARBONDALE, ILLINOIS.

Gastrophilus epilepsalis, n. sp.

Larva: Length, 1-12 inch; of the shape shown in the accompanying figure (Fig. 30), with twelve joints besides the head, or thirteen joints; head rounded, with two brown-black hooks, the side view of the cut showing only one of them; head a little longer than broad, rounded; the first incisure with a patch of bristles below the hooks, but not anywhere else; incisures 2 and 3 without bristles; incisures 4 to 12 armed with several rows of minute bristles, all very short except those on 12, pointing backward; joint 13 rounded. Extending back from the hooks and of the same colour, only in places paler, is a marking that seems to be a chitinoid support for the hooks, beneath the cuticle. Colour a dirty yellowish white.

FIG. 30.

Usually it is not wise to describe a species as new from a larva, but for the following reasons it seems best in this case. Last November, at the meeting of the Southern Illinois Medical Association, in Chester, Ill., Doctor H. C. Adderly, of that town, reported to the Association a case under his charge of a boy, then 10 years old, who had been subject to epileptic spasms for four years, often having as many as twenty spasms in twenty-four hours. Upon producing a free catharthesis (the general condition of the bowels being constipated), he noticed that the excreta was "literally alive" with

an entozoan. Some of these were sent to St. Louis for identification, but were reported as unknown to them.

With the report Dr. Adderly exhibited a few of the entozoa in a small vial of formaline. These were later brought to me by Dr. A. M. Lee, President of the Association. They were new to me. From correspondence with Dr. C. W. Stiles, of the Bureau of Animal Industry, Washington, D. C., and others, I have decided that the entozoan is new and therefore propose for it the above name. Doctors Howard and Coquillett pronounce it without hesitation the larva of a species of *Gastrophilus*, though in some points it seems to me to resemble some species of the allied genus *Dermatobia*.

For several reasons this entozoan found in the enteric canal of this boy seemed to be the cause of the epilepsy. 1st. After a free catharthesis the spasms would cease for from three to six weeks, or till a new brood were grown. 2nd. The boy had with the spasms globus hystericus, which is reflex from the pelvic organs. 3rd. That the spasms were those of genuine epilepsy there was no doubt, as there were all the usual symptoms, including mental aberration. 4th. Two other cases of epilepsy are known to the writer where these parasites have been found, one in Chicago and the other in Sparta, Ill. 5th. Upon Dr. Adderly's changing his treatment from that usually followed in epilepsy to anthelmintics, the boy recovered, having had only one spasm since beginning that line of treatment. Under date of May 19th he writes me: "My little patient seems to be in excellent health, and I hope it will be permanent."

As to the adult state of this larva I can say nothing now, nor how it gains entrance to the human system. I had hoped to get more material before writing this, from which I might answer both of these questions, but as yet have not succeeded. But the continuous infestation of the enteric canal by dipterous larvæ is not new. Dr. J. Gasser, of the military hospital of Oran, Algeria, reports a case of ten years' standing. The date of this report was 1895.

An interesting exhibit prepared for the Paris Exposition is a complete set of bed hangings manufactured in Madagascar from silk procured from the halabe, an enormous spider found in certain districts of the island. Aside from being so unusual, this exhibit seems to indicate that there is a future for silk manufactured from spider's web. The matter has received the attention of M. Nogue, the head of the Antananarivo Technical School, who has already achieved wonderful results. Each spider yields from three to four hundred yards of silk, which can be taken from the animal every ten days, it being set free in the interval. The silk of these spiders is stated to be finer than that of the silkworm and of an extraordinary golden colour. It is extremely tenacious, and can be woven without the slightest difficulty.—*N. Y. Post.*

HARPALUS CALIGINOSUS AS A STRAWBERRY PEST, WITH NOTES ON OTHER PHYTOPHAGUS CARABIDÆ.

BY F. M. WEBSTER, WOOSTER, OHIO.

In nearly all of our books relating to beneficial insects, published within the last twenty years, there is almost sure to be found, somewhere, the figure of a larva tragically devouring a smaller larva, the larger having been originally figured as that of *Harpalus caliginosus*. Although attention has for some time been called to the fact that the larva thus figured really belongs to another species, the true *H. caliginosus* being as yet unknown, yet the use of the figure in its old application still goes on. The carnivorous habits of the beetle itself, however, have been pointed out by Dr. Lintner, in his Twelfth Report, p. 209, where it is recorded as feeding on the army worm, and in Insect Life, p. 228, Vol. VII., as feeding upon grasshoppers. The writer has also observed it preying upon other insects. For this reason, notwithstanding its known fondness for seeds and grain, it has been looked upon, generally, as a beneficial species, its known vegetable food consisting either of seeds of no economic value, or the amount of grain being too small to be taken into consideration.

On June 12, 1898, I received from Mr. J. A. Fisher, Flushing, Ohio, complaints of a very serious injury to ripening strawberries, and Mr. C. W. Mally, then my assistant, was sent out to investigate the cause of the trouble. Other strawberry growers, in the neighborhood of Flushing, were found to be also suffering from the same depredation, but, though Mr. Mally worked faithfully, he was not able to solve the problem of the author of the ravages, which, in some cases, resulted in a loss of the larger portion of the crop. Considerable numbers of a Lygæid, *Myodocha serripes*, were found about the berry fields, some of them in the act of puncturing the fruit, and, I might add here, that in nearly every case where complaints of this injury have been reported to me, this last insect has been sent as the culprit. On 25th of the same month, Mr. Oliver Garlough, Clifton, Ohio, in almost the opposite corner of the State, reported the same trouble, except perhaps more emphasized, also accusing the *Myodocha* as the cause thereof.

My assistant had noticed in his investigations at Flushing, that wherever the strawberries had been attacked there would be found, on the ground or on prostrate leaves directly underneath, scattered fragments

of the hulls of the seeds of the strawberry (see plate 6), thus showing that the pest must have possessed a biting mouth and a fondness for seeds, and while this placed the Lygæid beyond the boundaries of consideration, nothing else was found to point to any other insect, although some observations made more than twenty years before led me to suspect some Carabid as the true author of the trouble. The fruit itself was comparatively little eaten, the surface, especially in case of that nearly or quite ripe, being badly torn and lacerated; not much gouged out, as would likely follow the attacks of a fruit-eating insect or myriapod. Despite the fact that very few Carabids had been found about the affected strawberries, I strongly suspected that, sooner or later, we should find one or more of these doing the injury.

On June 6, 1899, there came complaints of the same sort of injury from Mr. William Hoyle, Radnor, Ohio, a new locality, Mr. H. being very confident that the Lygæid caused the trouble, as he had found many of these on the berries. More urgent matters claimed my attention, and no investigation of this outbreak was attempted, and no other attacks were reported to me during the year.

June 6, 1900, I received a note from Mr. Fisher to the effect that the same trouble that had occurred in 1898 had again commenced, and a few days later a telegram reported continued serious effects. On June 12 I visited the locality, personally, and found fully half of the fruit being rendered worthless, the injury being done during the time between evening and late morning, say between 8 p. m. and 7.30 a. m. The injured fruit had been but little eaten, but nearly every seed was missing and the hulls scattered underneath. I have noticed this, rarely, for years, but as it never appeared to amount to more than a trivial injury, I had done no more than to wonder at the nature of the author thereof. The *Myodocha* were present, but it was clear that the work was not of their doing. Searching about a cluster of badly-injured berries, one *Harpalus caliginosus* was found underneath a clod, but, as the berries had evidently been attacked several hours before, this proved nothing. Further examinations resulted very much the same, until I found a cluster of ripe berries, the surface of which were raw and bleeding from a seemingly fresh attack, and, as usual, one of the *Harpalus caliginosus* was found hiding in a small crevice in the ground near by. After two or three such had been captured, a microscopic examination of the contents of the alimentary canal revealed the broken and crushed fragments

Harpalus Caliginosus as a Strawberry Pest. (Plate [illegible])

of the substance of the seeds in great abundance. Material collected in early morning and examined microscopically, showed the alimentary canals literally packed with this sort of food. I did not take the beetles in the act of working their destruction, as they are exceedingly shy, but some days after my return, a letter was received from Mr. J. Marion Shull, North Hampton, Ohio, enclosing with a cluster of injured strawberries a specimen of the pest, and stating that he had observed them in the very act. This was my first letter from Mr. Shull, and he could have known nothing of my investigations, and I am indebted to him for the drawings from which the accompanying illustrations were engraved.

The damage has, the present year, proved very severe, several strawberry growers reporting that half their crop had been ruined. Mr. Shull states that nine-tenths of their crop was destroyed within 48 hours, while Mr. A. H. Miller, of Osborne, stated that of his Crescents not five per cent. were picked, and of ten other varieties none were picked at all. This was the first year that Mr. Miller had been troubled by the pest, though he is perfectly familiar with the insect itself. Of the different varieties attacked, the Cumberland, Haverland and Greenville are said to suffer the worst, though this may not result from any selection of varieties by the beetles, but may be owing to better opportunities for hiding away during the day. Prof. M. V. Slingerland wrote me early in July of this year, stating that he had received complaints of similar injuries to the strawberry in New York. The beetles have been excessively abundant in the city of Wooster, literally swarming during some evenings and driving people from their front porches and verandas, forcing them to sit indoors during the early evenings, especially in the near vicinity of the electric lights. Although there are many acres of strawberries grown in the near vicinity of the city, strangely enough, I have been unable to learn of any injury from the attacks of these beetles, and have wondered if it were possible that the electric lights had attracted them from the surrounding fields to the city.

Both Dr. Bos and Miss Ormerod state that *Harpalus ruficornis* eats the fruit as well as the seeds of strawberries, but I think that further investigation of the European species will disclose the fact that, like its American relative, it is the seeds that are its favourite food, and though, as stated by Miss Ormerod, it will live in confinement on strawberries, yet when free in the fields it will prefer the seeds, as in her Twenty-first Report, p 115, she quotes one of her correspondents as stating that the

ground in many places where the beetles had been at work was covered with a powdery dust—the seeds eaten off the berries. The seeds of the strawberry are not very easily detached from a ripe fruit without taking more or less of the substance along with it, and in the case of our *Harpalus caliginosus*, there were sometimes small pits eaten out of the berry. I attributed these to the work of other insects. Miss Ormerod calls attention to the increasing seriousness of this injury in England, in her Reports for the years 1894, 1895, 1897, and 1899; in one instance, at Bone Hill, near St. Alban's, the beetles were so numerous about 10 p.m., June 14, 1897, that members of a family sitting in front of the house supposed that the insects were dropping from the roof. From a comparison of the figure of an injured strawberry, which is used in illustration by Miss Ormerod, in her reports of the ravages of *Harpalus ruficornis*, with the figure drawn by Mr. Shull, from life, it will be seen that the work of the two species is very much alike.

As our species is very large and conspicuous, they are easily seen after one has learned where to search for them, and when their work is first observed they can be hunted out and killed, or perhaps they might be poisoned with a mixture of wheat bran, sweetened water and arsenic, placed under boards laid down between the rows of plants.

The Carabidæ, to which family of insects *Harpalus caliginosus* belongs, are generally considered beneficial, as they are supposed to feed, largely at least, upon other insects injurious to the fruit and grains of the husbandman. The number of exceptions to this rule, however, appears to increase as we come to gain a more exact knowledge of the actual food habits of the species of the family, though it must be remembered that these outcroppings of a phytophagous food habit are usually only occasional, and perhaps in some cases confined to certain seasons of the year, when, like the robin, they collect a tax from the husbandman for the good that they have done him during other portions of the year.

In Europe, *Zabrus gibbus* and some species of *Amara* have been long known as occasionally destructive, and, in 1892, Dr. J. Ritzema Bos reported *Harpalus ruficornis* as destroying ripe strawberries in Goes, Zeeland, Holland. (Biolo. Centralb. XIII., p. 255.) As stated in the foregoing, Miss Ormerod, in her Reports for 1894, 1895, 1897-8-9, has called attention to similar and increasing depredations of the same species on the strawberry in England. The latter author also finds *Calathus*

latus, *C. cisteloides*, *Pterostichus madidus* and *P. vulgaris* occasionally injurious to cultivated crops.

In our own country, *Omophron labiatum* has long been known as injuring young corn in the Southern States. Mr. Townend Glover, the first United States Entomologist, as early as 1863, stated that he had observed *Harpalus caliginosus*, in two instances mounted high on grass, apparently feeding on the seeds. (Rep. Comm. Agr., 1863, pp. 565-6.) For several years prior to 1879 the writer had observed both this species and *Harpalus pennsylvanicus* feeding upon the seeds of the common ragweed, *Ambrosia artemisiæfolia*, and the latter species was also observed feeding on a kernel of wheat, seeds of timothy and seeds of panic grass, *Panicum crus-galli*, tearing the latter out from the heads. (Prairie Farmer, Nov. 15, 1879.) In a later issue of the same publication, I also gave an account of the seed-eating habit of *Anisodactylus sericeus*, which squeezes out the immature seeds of *Poa pratensis* and devours them. In 1880 the writer also recorded the fact of *Harpalus herbivagus* feeding on the young shoots of *Poa pratensis* in early spring. (Am. Ent. N.S., Vol. 1, p. 173.) During the same year, and in the same publication (p. 251), Prof. William Trelease also recorded the fact of *Harpalus caliginosus* feeding on the seed of *Ambrosia artemisiæfolia*, while on p. 277 of the same publication, Mr. Wm. A. Buckhout stated that he had observed the insect, in 1876, feeding on what he at the time supposed to be the pollen of the staminate flowers as well as upon the seeds. Recently, Dr. Howard wrote me that Mr. F. H. Chittenden had observed hundreds of these beetles at the same time feeding upon the seeds of this same species of plant. Nearly or quite all of these observations on the *Harpalus caliginosus* feeding on Ambrosia seeds were made in September, at a time when the newly-developed adults are probably near the beginning of their career, as we usually find them hibernating in cells in the ground at the depth of several inches, and hence this is only a clue to their food habits during a particular period, and while they may and do feed largely upon the seeds of this weed at that time, they can hardly be said to favour phytophagous food at other times of the year.

In 1882, microscopic examinations of the alimentary canal in a large number of Carabidæ, carried on by Prof. S. A. Forbes, the material for which had been collected by the writer, in most instances the beetles having been captured under circumstances that would lead to a suspicion of vegetable feeding, revealed the fact that a considerable percentage of

the food found in the alimentary canals of 82 individuals, belonging to 18 genera and 32 species, was of a vegetable character. Collections not made by the writer, and coming from an orchard seriously affected by cankerworm, 71 specimens, and 10 from a field infested by chinch bug, and others from a cabbage patch that had been attacked by cutworms, indicated, in most cases, the partiality of the Carabidæ for animal food, where this was abundant and easily obtainable (12th Report State Entomologist of Illinois, pp. 105-116).

In 1885, *Agonoderus pallipes* was reported to the U. S. Department of Agriculture, from Illinois and Iowa, as damaging young corn by gnawing the seed kernels and eating the sprouting roots (Bull. 12, O. S., U. S. Dep. Agr., Div. Ent., pp. 45-6, 1886), similar reports of injury coming also to the writer from farmers in Indiana during the same year. Since that time it has also been reported to me as working a like injury in Ohio.

In 1886, Dr. J. A. Lintner reported injury to the foliage of the strawberry by *Bembidium quadrimaculatum*, in Connecticut (3rd Report State Ent., N. Y., p. 98).

From all of this it would appear that many of our Carabidæ are naturally, and by preference, of carnivorous habits, but during a scarcity of this kind of food, can subsist upon that of vegetable character.

PARTIAL LIFE-HISTORY OF DICHOGAMA REDTENBACHERI, LED.

BY HARRISON G. DYAR, WASHINGTON, D. C.

The Pyralid genus Dichogama has not yet been reported from United States territory on the mainland, but at least three species occur in southern Florida. The following notes were made on the larva of one of them, *D. Redtenbacheri*.

Stage II. (?)—Head flat before, clypeus high, mouth pointed; luteous, ocelli black; width .4 mm. Body a little flattened, translucent, yellowish, a geminate lateral brown stripe. Cervical shield large, colourless, brown dotted on the tubercles and on lateral edge; anal plate small, not marked. Tubercles small, brown; setæ long, stiff, pale. Skin sparsely granular; segments scarcely annulate.

Stage III.—Head whitish with streaks of brown dots on the lobes converging to clypeus, mouth brown; width .7 mm. Body flattened, green from the food; a double broken lateral black band reaching from the spotted cervical shield to the colourless, spreading anal feet. Feet all pale.

Stage IV.—Head whitish, heavily black spotted except over the

clypeus; width 1.1 mm. Cervical shield transparent, black dotted at tubercles and edge. Body flat, green dorsally from the food; a white broken subdorsal line on joints 3 to 13, and double black lateral one crossing tubercles ii. and iii. Feet colourless; setæ long, white.

Stage V.—Head dark, the spottings obscured; width 1.7 mm. Body purplish dorsally (in this specimen), with distinct yellow subdorsal line on joints 3 to 13, double lateral black line and broken, pale yellow, stigmatal one. Subventral region whitish. Setæ long whitish; tubercles, except iii., minute.

Stage VI.—Apparently interpolated; width of head 2.2 to 2.5 mm. As in the next stage.

Stage VII.—Head round, the apex below prothorax, clypeus high, reaching the cervical shield in the ordinary position of retraction; antennæ as long as mandibles; whitish, with remote scattered dashes or patches of dark brown, principally in a double line on each side of the vertical notch and also in a parallel row across the centre of the lobe obliquely; width 2.7 to 3.0 mm. Cervical shield large, membranous and transparent, so that the retracted head is plainly visible through it. Anal plate concolorous with the body. Body a little flattened, segmental incisures marked; segments 3-annulate, the anterior annulet small and not reaching the dorsum. Skin translucent, not strongly marked. Greenish, a broken, yellowish white, subdorsal line above tubercle i.; a similar stigmatal line; slight whitish streaks in the lateral space; a double waved and broken lateral brown line covering tubercle iii., which is much larger than the others and conspicuous. This line varies in distinctness, sometimes being obsolete, represented only by the large dark tubercle. Slight whitish markings subventrally. Tracheal line white, its ramifications visible by transparency. Cervical shield slightly brown dotted. Feet colourless, normal. Tubercles normal; on abdomen, i. dorsad to ii., all small except iii., iv. + v., vi. single, vii. of three setæ; on thorax ia + ib, iia + iib and very large, iv. + v. Tubercles sometimes surrounded by blackish. The subdorsal and stigmatal pale lines extend over joints 3 to 12. At the end of the stage the larva turns red and seeks a place for spinning. The cocoon is composed of leaves fastened together and bitten in an ellipse, the inside lined with silk.

Food-plant.— The larvæ live among the leaves of *Capparis cynophallophora*, fastening them together with silk and hiding among the skeletonized remains, or in an abode of fresh leaves united with silk.

DESCRIPTION OF THE FULL-GROWN LARVA OF GRAPTA J-ALBUM.

BY DR. JAMES FLETCHER, OTTAWA.

On the 14th June, at one of the excursions of the Ottawa Field Naturalists' Club to Cumberland, Ont., I was fortunate enough to find beneath an elm tree (*Ulmus americana*), a full-grown larva of *Grapta J-Album*, of which the following is a description :

Length, one and one-half inches. Shape slightly fusiform, gradually tapering to the end from fourth segment. General colour, a delicate glaucous green, or white washed with green—with black spines, which from the size of the body appear to be rather sparsely distributed. The three dorsal series of spines black, springing from a bright yellow field, which is three times the diameter of the base of the spine. The head large, very bristly and tuberculate. Head black at the sides and white in front ; face white, cheeks and sides of head black, including the ocellar field and two large apical compound spines ; the cheeks black, covered thickly with large white elongated and slightly curved cone-shaped (or sugar-loaf shaped) setiferous tubercles, which are almost long enough to be called short thick bristles, each one bearing at its apex a slender bristle. These bristles are black or darkened on the tubercles of the upper and lower parts of the head. Ocellar field black and distinctly margined against the white face ; mandibles black, frontal triangle white clearly outlined with black ; head bearing on each side of apex a large, stout, conspicuous, jet black branched spine, with about five smaller sized spinelets, all of which bear black bristles at apex. Behind the cheeks and running down from the apex, being in fact a continuation of the white face, is a white band, which gives the appearance of the head being white, with a large black area on each side, which includes the apical compound bristles and the mouth-parts.

Down the dorsal area are three series of black branched spines, with 5 to 7 branches—a medio-dorsal series, a lateral series, and a supra-stigmatal series—all black and bearing from five to seven spinelets. The spines of the lateral series half as long again as those of the three other series of bristles. Spiracles black, and beneath these is a sub-stigmatal series of branched spines similar to those above the spiracles, but white ; the bristles only at the tips of the branches being slightly infuscated. The position of the branched spines of the larva is as follows : The

medio-dorsal series is one-third from the front margin of the segment. The lateral series and the infra-stigmatal series slightly posterior to the spiracle and in the same line. The supra-stigmatal series slightly anterior to the spiracle and in almost the same line as the medio-dorsal series.

Prolegs and thoracic feet white, slightly darkened towards the claws, and all pretty thickly covered with white deflexed bristles. On segment No. 2, instead of the large branched bristles which occur on the rest of the body, are simple short thick bristles exactly similar to those on the face, and each bearing at its apex a slender black bristle. The skin is white and semi-translucent, allowing the green contents of the body to show through. This together with the shape of the larva gives the caterpillar a considerable resemblance to an *Apatura* larva. The inter-segmental folds are white and the M-shaped dorsal markings of *Grapta* larvæ are white and indistinct. The pale delicate green colouring of this larva gives it a very un-Grapta-like appearance.

PUPATION.

On Sunday evening, June 16th, the larva was found to be suspended for pupation. At 7.15 p.m. gentle undulations of the abdomen (peristaltic motions), accompanied by straightening out and slowly drawing up of the body, were noticed, and the contents of the body seemed to run down to segments one to eight.

7.25—Last segment apparently empty.

7.27—Body drawn up several times and then straightened out, undulations running along the body as if an effort were being made by the insect to shrink away from its skin.

7.35—The bases of some of the thoracic tubercles pale as if air were under them. These were the areas which afterwards in the pupa were gilded. The skin at the base of the prolegs apparently loosening and little folds showing.

7.40—Colour of the body darkening, the peristaltic motions continuing all the time.

7.43—The muscles apparently relaxed and the body hung down almost the full length.

7.45—The body drawn up vigorously 3 or 4 times, the peristaltic motions continued energetically and with some effort.

8.00—Muscles relaxed and the body hanging down loose again without movement for about half a minute.

8.05—Body contracted and drawn up vigorously, and with a wriggling, impatient, twisting movement four or five times repeated.

8.12—The two posterior abdominal and anal prolegs apparently drawn in from the skin.

8.15 to 8.45—The body constantly drawn up vigorously, the undulating movements of the body kept up almost continuously, with three or four short intervals of rest of about a quarter of a minute each, during which the muscles were relaxed and the body hung down almost straight, the head and three thoracic segments only being slightly curved upwards.

8.45—Segments No. 12 and 13 showing minute wrinkles in the skin.

8.46—Body relaxed for a few seconds and then drawn up slowly, but more firmly and to a greater degree than previously; at the same time the body was twisted slightly from left to right, and the skin began to pass up perceptibly over the anal segments, this movement proceeding segment by segment as though the insect were crawling through the skin towards the head.

8.47—The skin burst over the 3rd and 4th segments, and by the undulating movement of the body was gradually drawn back until the chrysalis emerged; the skin on ventral surface adhering longest, and apparently the greater part of the weight of the body was borne and the body of the pupa was held from falling by reason of the moisture of the skin, which made it adhere to the soft pupa. I could detect no effort on the part of the chrysalis to hold on to the skin by grasping it between the folds of the abdomen, although this was probably the case when the cremaster was withdrawn and slid over the edge of the empty skin. This was done in a most definite manner; the empty head-case and part of the skin, being in the way, was pushed on one side, and the cremastral hooks by a vigorous gyrating motion of the body twisted into the silk. When firmly attached the body was twisted vigorously round and round for nearly three minutes, from 8.53 to 8.56, in the effort to get rid of the empty skin, the body being drawn up and curved considerably while this was being done, as if with an effort to pull the empty skin away from the silk by means of the abdominal spines, although of course the whole body at this time was very soft. At 8.56 the empty skin was thrown down, when the pupa at once hung motionless and the characteristic spines and projections expanded and took their permanent form. The mat of silk was large and loose, with several detached strands running to adjoining objects. The silk mat white, with no distinct button as in most of the

other species. Both at the time the larva was found beneath a stone in a wall at Cumberland, Ont., and in the box where the pupa was afterwards formed, there were several loose threads of silk over the body and entangled in the spines.

The chrysalis immediately after formation was of a beautiful semi-translucent emerald green, which later, and by the following morning, changed to a ruddy transparent bronze, washed with olive green. The six gold blotches on dorsum large and conspicuous. General shape of the chrysalis somewhat similar to that of *Grapta Interrogationis*, but more robust; rather larger but almost identical in shape with that of *Vanessa Californica*, particularly with regard to the outline of the thoracic protuberance.

The chrysalis formed on 17th June and the pupal period lasted 11 days. This would seem to indicate that this species, like all the other Canadian Graptas, is double-brooded, but I never remember to have seen the butterfly flying at Ottawa except in spring and autumn.

NEW HISTORIES IN HYDRŒCIA.

BY HENRY BIRD, RYE, N. Y.

(Continued from page 234.)

Hydræcia rutila, Gn.

This was the next discovery of the season, and as work in former years had never unearthed more than one new larval condition per season, it became evident 1899 was being especially fortunate. We may well say unearthed, as it was actually necessary to do considerable digging to get at these fellows, so far down were they in roots below the surface. The preferred food-plant is *Solidago sempervirens*, a plant particularly local to the Atlantic seaboard, and it was naturally supposed we had to deal with an insect thus restricted in its range. Other things conspired to get ideas rather elevated, for it was not known, of course, before the moth appeared what species the larva might prove. There seemed an unusual feature in that among the numerous stems arising from one root cluster, when one was found infested, there would surely be *two* examples—no more, no less—found in the bunch. This happened in every case, and occurs so often as to lose the aspect of being any coincidence. Many times but one larva would be found at first; further searching, however, always disclosed a mate. Burrowing well down

in the roots, they still have quite an extended gallery high up in the stem. The reason for this was one day apparent when a very high tide covered the marshes with several inches of salt water. In no way discomfited, our friends now make use of their upper chamber, which in cases of this kind is their only salvation. *Hydræcia* larvæ when mature drown easily and are not able to withstand immersion in any such manner as do the boring genera *Nonagria* and *Bellura*.

So, taking all things into consideration, it was inferred some species quite out of the ordinary should come of it, and there was almost a disappointment when common everyday *rutila* was the final result. In our particular location, where a blackish stream meanders through the salt meadows, the food-plant grows at the very edges of the bank, and the rather novel mode of getting larvæ without leaving the rowboat was experienced. Here, too, was a good example of their fondness for location, as the old stems of last year containing the empty pupa shells were frequently met, plainly showing a residence of former generations. Plants thus situated were subjected to inundation at every spring tide, not to mention the freshets when the ice breaks up in March. The stems and root stocks are slender for the working of so large a borer, and it is ever a tight squeeze with them. So all waste material must be passed out of the larger ventilating aperture—there are several of these —and this is not made at the ground level, but some distance up in the stem, for reasons very apparent. These larvæ are not given to *Solidago* alone, but have a number of substitutes which do equally as well. Becoming mature about August 15th, they are influenced by the stay-at-home notions which most of the other species possess, so favourable to the collector, and change to pupæ within their burrows. Thirty days is about the average of this period, and the moths when emerged are attracted to light in numbers nearly equal to *nitela*; at least that is the experience at Rye.

It seems to have been an unsettled question as to how, when and where these moths deposited their eggs? From appearing rather late in the season, it was quite naturally supposed by some that the moths might hibernate over the winter and lay eggs the following spring. What little circumstantial evidence that had come to light from former studies did not, however, point in this direction, and particular pains were taken the last season to keep the moths in surroundings as nearly natural as possible so that eggs might be secured. The plan worked well and the

desired results were gained under what seemed reasonable to consider normal conditions. Nocturnal insects are of course less likely to be noticed in the act of oviposition, so it was with a great deal of satisfaction that a female *rutila* was observed thus engaged and too busy with the work in hand to mind an eavesdropper. With a nervous haste quite out of keeping with the lethargy previously displayed, she is now all animation. One is reminded of the prying movements of an ichneumon while searching out a host, or the wasps when gathering spiders for their mud houses. With antennæ in constant motion, all cracks and crevices that the plant stock afford are explored and such as furnish an apparently proper shelter may receive an ovum thrust well in out of harm's way. What seems to the onlooker as a needless amount of exploring is done, and one is struck with the important part the antennæ play in this. In the cases observed, oviposition did not occur after the third night, and the number of eggs were rather under the amount expected, never exceeding a hundred, although accuracy as to an exact count was quite out of the question. Having finished this function an exhaustion follows, in which the moth has hard work to keep an equilibrium, often falling to the ground and remaining with legs in air, feebly moving. Impelled by what we call instinct, she has now fulfilled her mission, and there remains the final tragedy which is close at hand. The average life of the imagoes of this group may be reckoned at from ten to fifteen days, the weather conditions, of course, figuring importantly, though it is likely the males often exceed this. The egg is less than spherical, flattened at the vertex so that the diameter here is less than the lateral measurement, which is $\frac{4.5}{100}$ of a millimeter. It is ribbed very closely with rows of fine granulations, radiating from the vertex, which is indicated by a slight depression. Colour is pale, shading somewhat yellowish. They are deposited singly or in pairs. Examination of these ova in the early winter revealed the fact that all had hatched, thus adding another instance where the unexpected had happened. From the late date, we may presume hibernation occurs before the first moult, but as the wire cloth of the insectary offered no hindrance to such small fry, any statements here are mere guesswork.

Mature larvæ are very cylindrical; the longitudinal stripes, though faint, are traceable and unbroken; in this respect, as well as entire general appearance, it resembles *cataphracta* very strongly. The thoracic segments show very light, the rest of the body has the brownish body

colour more in evidence. The head, shield and plate are light in colour, shining, and of normal proportions. The spiracles are all black; the tubercles are umber and do not stand out very strongly. On thoracic joints two and three, I. a and I. b are hardly discernible; II. b, III. and IV. in their triangular setting are less noticeable than ordinary, the first named very small, the second intermediate, and the last large, of the size usually seen. On seventh abdominal segment IV. is situated at the upper corner of the spiracle, indicative of a root borer. All legs light, the crochets alone showing black. The head, lacking the side line, measures .12 inches across; the entire length of larva is 1.7 inches. Maturity is reached about August 19.

The pupa is very cylindrical; colour a light chestnut brown. There is little divergence from the usual form, though attention might be drawn to the conspicuousness of the eyes, showing darkly through the shell. The anal segment is also much darker. The cremaster consists of two sharp parallel spurs. Length .8 inches; duration of condition about twenty-eight days.

Previous to the pupal change the larva makes a slight attempt at lining or plugging a portion of its burrow with bits gnawed from the harder parts of the stalk and fastened with a few silken shreds, this acting as a sort of cushion upon which the pupa rests. This has been noticed occasionally with other species, but seems the rule with *rutila*. An irregular opening for the moth to escape is made through the epidermis, but this outer skin is left intact. In a few days it becomes black, looking like a blister or contusion, and offers a point upon which the collector may profitably work. There being no swellings and only an occasional dead stalk, it is often a hard matter finding these fellows.

Hydræcia impecuniosa, Grt.

Never for a moment had this species been considered as belonging to the local fauna; indeed, such a rarity seemed quite out of ordinary reach. The few scattering examples that had found their way into collections, though showing it widely distributed, were so insignificant in point of numbers that a "round-up" of goodly proportions was especially gratifying. The discovery of the larva savours so of luck, pure and simple, that a statement of the case may not be without interest.

The large number of *Hydræcia* larvæ that were desired for comparison last season made special effort necessary, and one day when gathering in a quantity of *cataphracta*, which happened in this case to be boring

wild parsnip, an *impecuniosa* larva was very unexpectedly forced upon our notice. That the parsnip stocks might the more easily be examined, for they were growing amidst a thick and tangled undergrowth, the stems were pulled up roots and all and were then split open carefully so as not to injure or lose the enclosed larva. By some chance a small weed was caught in the hand and came up by the roots along with the parsnip. Imagine the surprise when seeing at the base of this weed, which proves to be some kind of Aster, a large exit aperture, clearly the work of an *Hydræcia*, and inside a larva entirely new and quite ready for pupation. What it would prove was of course not known at the time, but it was gladly welcomed as extending an acquaintance to one more species. Later, several pupæ were secured, enough, presumably, to establish the identity of the species, the intention being that more complete observations be reserved for another year. Luckily one of the lot emerged very early, and knowing the species to be of such unusual occurrence, we deemed it well worth while giving up some time to further searches for more. Five hours spent the following day in a favourite resort brought ninety-seven pupæ to light, quite ready to give up the imagoes, having the wing-cases dark coloured by reason of the partly-formed organs within. Such a windfall was certainly very pleasing of itself, yet it could not but convey the unflattering conviction that with the supposedly careful work in former years this species had unquestionably existed all the while in a locality constantly examined and yearly giving up a goodly number of other species. Such an occurrence is but another point in the evidence that goes to show more depends on knowing where, than how, to look.

The food-plant is *Aster umbellatus*, and work is carried on mainly in the root, although the lower part of the stem is also tunnelled. Procedure is as usual, perhaps the strongest individual characteristic being the very large and irregular opening made for the moth's escape. This is situated an inch or so above the ground level, the stalk being often eaten half off through to the epidermis, and would surely fall were it not that it grows in such dense clusters the spreading branches of one plant help to support others. The epidermis, of tissue paper consistency, soon becomes dried and black, and as there are generally a number of perforations about the edge, it often shrinks, tears away at some point, then hanging as a hinged lid. There is not, however, any such accuracy of workmanship as is displayed by *necopina* in this act. Situated so conveniently, we might imagine these pupæ to be greatly exposed to the attacks of skunks and

other insectivorous marauders, but observations so far have noticed no such depredations. Though parasitic troubles seemed few, a good proportion fell victims to a fungous growth, this latter often assuming fantastic shapes as its development encloses the chrysalis. It may be that this fungus is not directed primarily against the insect, as its growth was often seen lining the whole interior of the burrow with a fine network of fibrous tendrils, and in many cases the ripe pupa, very much alive, was wriggling around upon a bed of this material. It was this feature, that of seeing a *live* pupa in direct touch with such apparent contamination, which seemed remarkable, for in all previous experiences where any mould or mildew was to be noted about a burrow the pupa would always be as dead as the proverbial door nail.

Eggs were obtained October 9th from females confined with the growing plants, and were practically identical with those of *rutila*, excepting the colour shades to greenish rather than to yellow. They are deposited in rows or clusters of a dozen or more, and, like that species, gave up the young larvæ in the late fall; just when, will have to be determined another year.

Mature larva: Size is small and at once separable from the other closely allied species. Its colour, a flesh tint, is purest white on the first three segments, and there is not the semi-transparency so usually noted. Head is of moderate proportions, a shining red russet in colour, and lacks the black side dash; measures .09 inches. Shield is lighter and yellowish, strongly edged at the sides with black. Anal plate large, darker in colour and blends with what is sometimes a preceding plate into one confused area. The body, while of the usual cylindrical build, shows a perceptible tapering on the last two joints. Tubercles prominent, shining black, and stand out contrastingly as in *purpurifascia*. On abdominal segments I. exceeds II. in every case, and IV. is notably large. The position of the latter on joint seven is high up above the corner of the spiracle, the apparent root-boring characteristic. The setæ are few and weak. Thoracic feet black, as are the crochets of the abdominal ones. Mature larva measures 1.3 inches. They change to pupæ August 15 to 25.

The pupa is of the usual glossy chestnut brown, very cylindrical; the indentations between the abdominal joints are slight; length .8 inch. A noticeable feature is the very dark hue assumed by the wing-cases just previous to emergence, the abdominal part retaining to the last the original light shade. Moths emerge about September 30.

The thoracic tufting of this species from its smaller size seems more prominent than in some others. Indeed, this character so noticeable throughout the group can only be fully appreciated by securing moths direct from pupæ and which have not marred their beauty here by flight. The rather loose, though ample, vesiture of the thorax is so well blended with certain ground colours of the primaries, together with minor peculiarities of the anterior tufts, that it is quite possible to separate the species by the thorax alone when unfaded, perfect material is at hand. This may seem a rather broad statement, yet it is the lack of perfect material that has resulted until recently in the confusion of certain species.

Mr. Grote, when conducting his studies in the earlier days, gives a figure (Papilio, pl. 1, Vol. II.) showing a profile view of *rigida* that illustrates nicely the proportions of this tufting.

Hydræcia Harrisii, Grt.

A number of mature larvæ of this species came into my possession last season, due to the kindness of Dr. Roland Thaxter, who has long had this insect under observation at Kittery Point, Maine. That section so far seems the only one which has produced this species in numbers; the examples in collections invariably bear that locality label. As its food-plant and early history have already been discussed by my donor who furnished the types for the original description, the references here will have only to deal with some of the tubercle arrangements which are of interest by way of comparison, for there were some suspicions at the start that it might prove a variety of *purpurifascia*. So great was the similarity between these larvæ and the one found working in *Cicuta*—both, in fact, being *Umbelliferæ* feeders—that it was thought possible the local and the Maine examples might be the same until emergence proved the contrary. Since, comparisons of blown larvæ have pointed out sufficient structural differences; but a slightly greater size in favour of *marginidens* seemed at first the only apparent discrepancy.

Mature larva: General dimensions are typical, colour the light indistinct translucence. A dorsal stripe is vaguely seen, apparently dependent on the pulsating internal fluids for accentuation. Head measures .11 inch across; shield and anal plate ordinary. Tubercles are

prominent, for the most part shining black. On thoracic joints two and three, III., IV., and V., are most prominent, placed in the conventional triangular form; III.a is in evidence on all abdominal segments before the spiracles. On the seventh one, IV. is below the spiracle in the usual noctuid position, and so differs in this important point from *purpurifascia*. Leg plates are ordinarily distinct. Extreme length 1.65 inches.

Of other Hydrœcia species to be associated with these, there remain two known to occur at Rye, which have so far escaped notice in their earlier stages. These are *inquæsita*, G. & R., and the newly-described *circumlucens*, Sm. The former has a wide range and is represented in most collections, but one rarely sees a perfect example. It is a rather thinly-scaled species, and suffers so much from the effects of flight that it has long been sought in its larval state, so that perfect examples might be secured, for it is prettily shaded with the characteristic warm red-brown and purple of the group. It is probably a root feeder and confined to one variety of plant; just what one, though, remains as yet a nut to be cracked.

Circumlucens occurred to me some years ago, a single example having the temerity to fly in at an open window. It appears early in the season, ranges well northward, and may be considered an associate with *cerina* and *rigida*. A happy day, indeed, will it be when this species gives up its secret of food-plant and habit.

The few European species that are closely allied with the local ones under consideration seem equally scarce in collections there, as many of our species have heretofore been in American cabinets. This is likely due to ignorance of their early histories, and it may afford us some satisfaction to think we are at all abreast of our brethren on the other side, even in this small matter, since we are so far behind in a knowledge of life-histories generally. *Leucographa* as approaching our *rutila* and *xanthens* slightly similar to *marginidens*, are robust insects and must have great burrowing larvæ, which have burrowed to good purpose, indeed, if they have escaped the generations of lepidopterists there who are ever on the lookout for fresh details.

NOTE ON THE GENUS DYARIA, NEUM.

In re-examining the old slide from which the figure of venation (CAN. ENT., XXV., 214) accompanying the original description of this genus was made, I see distinctly three internal veins in the hind wings. It would appear as if one of them must have been obliterated by the balsam in the fresh mount, or else an error of observation was made. The correction refers the genus to the Pyralidæ and, according to Hampson's classification, to the Epipaschiinæ, where it appears allied to the Indian genus, Cœnodomus, Wals. (Hamps. Trans. Ent. Soc., Lond., 1896, 467.) I would not lay any stress on the apparent presence of the accessory cell in Dyaria. Vein 10 runs so closely approximated to the stalk of 6–9 that it is impossible to be sure whether there is a true anastomosis toward the tip or not in the single specimen mounted.

It is rather curious that the error in Mr. Neumoegen's figure has been exactly paralleled by Prof. Aurivillius, who figures *Alippa anomala (= Cœnodomus Hockingii)* with only two veins in the hind wings. He referred his genus to the Limacodidæ! This figure (Alippa = Cœnodomus) much more nearly resembles Dyaria than Hampson's does; in fact, there is no tangible difference, as he gives vein 6 stalked, and specially illustrates vein 10 running close to the stalk of 6–9, and nearly touching this at the bend before apex. He also italicizes the words, "vein 8 of hind wings touching 7 beyond the end of the cell." (Ent. Tid., XV., 176, 1894.)

At my request, Dr. Hulst has examined the type of Dyaria in the Neumoegen collection, and says: "Palpi upturned, thickly scaled in front, rather short, not over half of the front, end joint very inconspicuous, basal joint not hollowed out; maxillary palpi very small." In the ♀ before me the maxillary palpi are small, tufted with scales at the end. Of the antennæ, Dr. Hulst says "strongly bipectinate for two-thirds, then rather suddenly shortening, the rest filiform. Process present behind at base, fringed and crowned with long hairs." Dyaria may therefore be referred to the Pyralidæ near Cœnodomus. Its occurrence in North America needs verification, in spite of the positive statement published.

HARRISON G. DYAR.

TWO NEW SPECIES OF JASSIDÆ.

BY HERBERT OSBORN, OHIO STATE UNIVERSITY, COLUMBUS.

Deltocephalus apicatus, n. sp.—Head and pronotum yellow; scutellum and elytra reddish fuscous, the latter with hyaline apex. Length to tip of elytra, ♀ and ♂, 3 mm.

Vertex about as long as width between the eyes, margin rounded, apex prominent; front with sides nearly parallel to below the antennæ, then curving sharply to the base of the clypeus; clypeus slightly narrowed to tip. Pronotum, width more than twice the length, lateral margin short, posterior margin straight. Elytra passing the abdomen, with fully formed apical areoles (macropterous), or reaching only to tip of abdomen, with the apical areoles very much abbreviated.

Colour: Vertex, face and most of the pronotum yellow; ocelli black; very faint whitish parallel lines on the posterior part of the vertex, and in some specimens faint arcs on the front; three whitish lines on the pronotum; more or less of posterior part of pronotum, all of scutellum, and the elytra as far as the apical transverse veins, reddish brown or fuscous, fading apically to hyaline or with all the apical areoles hyaline. Beneath, sordid yellow, with the venter washed with fuscous.

Genitalia: Ultimate ventral segment of the ♀ moderately long, the lateral border sloping, the hind border slightly bisinuate and with a spot each side of middle extending on to disk and giving a trilobate appearance to the border; pygofers nearly reaching tip of ovipositor, thickly set with bristles on posterior half. ♂ valve rather long, anterior border strongly curved and posterior border evenly rounded; plates long, nearly reaching tip of pygofers, contracting sharply from base to middle, then tapering uniformly to narrow tip; pygofers thick, white, thickly set with short bristles.

Described from eleven specimens, four ♀s and seven ♂s, representing localities as follows in Eastern U. S.: 1, Md. (Mally); 1, Riverton, N. J. (Johnson); 1, Hyattesville, Md. (Hine); 2, Washington, D. C. (Hine); 3, Woodstock, Vt.; and 2, College Park, Md. (Ball).

This is a very characteristic little species, and shows a distinct dimorphism in a form with shorter elytra with imperfect apical areoles.

Paramesus furcatus, n. sp.—Beautiful golden yellow, with milky hyaline spots on elytra. Median lobe of ventral segment furcate. Female length to tip of elytra, 7 mm.

Vertex smooth, slightly depressed behind sharp anterior margin,

obtusely angulate, half as long as width between eyes and one half longer at middle than next the eye; front smooth, sutures converging regularly to base of clypeus, which is slightly wider at apex than base. Pronotum with a rather deep sinuous impression parallel to the anterior border, behind which it is faintly rugulose, posterior border scarcely concave.

Colour: Vertex bright yellow, unmarked; face yellow, with a fine black line just beneath the border of the vertex and extending to beneath the ocelli. Pronotum golden yellow, with faint median milky line. Elytra fulvous yellow or golden with metallic lustre and numerous oval milky hyaline spots arranged between the nervures and in the areoles of apical portion, an oblique fulvous fascia from basal third of costa to tip of clavus. Beneath uniformly yellow, except tibial and tarsal spurs, claws and the tip of median process of last ventral segment, which are fulvous or reddish, the tarsal claws inclining to fuscous.

Genitalia: Last ventral segment with broad lateral lobes, the inner borders of which run nearly straight to base of median process, which is strong, shallowly furcate, the spurs turned dorsad.

Resembles *vitellinus* in general colour and marking, but distinguished by the more slender form, the more angular vertex, the more deeply cut median process of last ventral segment, as well as the more brilliant metallic golden colour and greater length.

Described from one female received from Mr. O. O. Stover, of Orono, Me., who collected it at Pownal, Me., August 31st, 1899.

CORRESPONDENCE.

SIR,—While I thoroughly concur in your decision to exclude all further discussion of the Cunea-Congrua question from the CANADIAN ENTOMOLOGIST, especially in view of the very personal character which the controversy has assumed, I trust you will grant me space for the following brief personal explanation.

My reference to the Boers of the Transvaal was not intended to be offensive, and I have personally the greatest admiration for the stubborn courage in support of a hopeless cause shown by those misguided men, but as Dr. Fyles appears to have considered it offensive I beg leave to withdraw it.

I did not mean to imply that it was heinous to suggest that Dr.

Riley might have confused two or more species, as that has been done by many eminent entomologists, but to make figures with sufficient latitude to include such distinct species as Hyphantria Punctatissima and Spilosoma Antigone would be much less excusable. I certainly appear to have misunderstood Dr. Fyles on one if not two minor points. It is strange that so many of us have misunderstood him. While I am considerably younger than Dr. Fyles, which, however, is hardly relevant to the controversy, I am perfectly aware of the meaning of "bilateral symmetry," and in my copy of Smith & Abbot the figures of Punctatissima are perfectly symmetrical and not at all as described by Dr. Fyles.

But when an author illustrates the larva of a species on its food-plant and figures the perfect insect on the same plate, does he really thereby imply that all stages are to be found on the same plant at one time? And might Mr. Edwards's magnificent plate of Melitæa Phaeton in But. N. A., Vol. II., be therefore properly described as "quite a fancy sketch"?

It is quite true that I have never had Dr. Fyles's specimen in my possession, he having refused to allow me to take any of his specimens to compare with Walker's types in the British Museum, but I have seen it several times as well as other specimens of the same species which I have seen in several museums which I have recently visited, and I have had Mr. Winn's two specimens of the same form in my possession for weeks together, he having kindly permitted me to carry them to New York, Philadelphia and Washington, and just recently to the British Museum.

Internal and external are antithetic terms, but superficial was quite properly used by me to denote a slight general resemblance in maculation which, however, in my opinion disappears upon a more careful study of the details.

HENRY H. LYMAN.

Montreal, 16th July, 1900.

SIR,—July 6th was a very hot day in Orillia, over 90° in the shade, and the night still remained very warm. I, as usual, was at my favourite occupation of collecting; I had made several trips to the places which I keep regularly covered with rum and molasses during the season. This evening there was literally no standing room for the myriads of moths which crowded each other to get at the sweets. *Hadena arctica* was swarming—never saw so many in my life, and I have had quite a few

years' experience at sugaring. At light and sugar this evening I could have taken some 58 species of moths, though of course nearly all were represented in my collection. I have succeeded each year during the last eight years in adding from 18 to 25 new Heterocera to my collection, and hope to beat the record this year, but I certainly received a genuine surprise this particular night. I had made two or three rounds with cyanide bottle *only*, when on nearing one sugar station something that appeared immense to me flew away from the locality. I thought at first it was Polyphemus, but what could it be doing at sugar? Then perhaps a Catocala—never saw one so large. Though I had no lamp, I was satisfied at last it was something new; went into the house and got my net and made several trips to the same spot—no results. I said to myself, Well, I will wait for you, and sat down and lit a cigar. I was about two yards from the spot where I first saw the apparition. I waited patiently for about half an hour. Presently along came the same bat-like insect, and, after a few circles, alighted on the post and commenced sucking in the sugar along with the numerous moths—a giant among pigmies. As soon as it was at rest, I knew it at once as *Erebus odora*. I watched it feed awhile, a thing I never expected to see. After I netted it, I found it to be a fine female—looked as if it had just emerged from cocoon—abdomen was quite soft and scales in perfect condition. This I think, under the circumstances, is a very interesting capture, as I understand all previous ones made, in Canada at least, have occurred late in the fall and in out-of-the-way places, and it has been supposed they had wandered here from the South; but here is a perfectly fresh specimen, taken in the middle of summer, apparently quite at home and taking his sweets along with the rest of the Canadian moths. My own notion is it was bred in Orillia.

C. E. GRANT, Orillia, Ont.

Mailed Sept 1st, 1900.