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The Canadian Entomologist.

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THE GENERA OF THE HESPERIDÆ OF THE EUROPEAN FAUNAL-REGION.

BY DR. A. SPEYER.

(Translated from the Stettiner Entomologische Zeitung for 1878, pp. 167–193.)

[Of marked value, as is everything upon the Lepidoptera proceeding from the pen of Dr. Speyer, the present paper—an arrangement of the Hesperidæ which will generally be conceded to be quite in advance of any heretofore presented—will prove of special interest to the American student, in connection with the arrangement a short time ago presented by the same author, of some of our American species (Edwards' *Catalogue of the Lepidoptera of North America*), associated with the European species (my *Entomological Contributions*, No. iv., p. 71). The admirable discussion in this paper of the value and relative importance of the several structural features of the Hesperians, cannot fail of being of eminent service in the systematic arrangement of our numerous species. Great care has been taken with the translation to render it a faithful one. The thanks of the appreciative reader are due to Mr. W. H. Edwards and Mr. O. von Meske for providing for the translation, and to Prof. Uhler for its supervision. The remaining two-thirds of the paper will be given in the two following numbers of this journal.—J. A. LINTNER.]

A task set for me by American friends* induced me to undertake, in connection with the North American Hesperidæ in my own collection,

* I have been able to comply with the wish of my friends, to aid them in the arrangement of the Hesperidæ (for the purpose of publishing a new Catalogue of their Rhopalocera) only within the narrow limits to which I am confined by my very imperfect acquaintance with the American species of the family. In addition to the statement

also, a revision of the European species; the result of which I here submit, although the work is not so thorough as it should have been—some subjective deficiencies pertaining to it, as the non-examination of the neuration of the wings, etc.

The European Hesperian Fauna is so poor in species that, in comparison with the Fauna of the whole world, it is almost lost: even with the addition of the much richer Fauna of temperate North America, still appearing as only a small fragment of the whole, affording no satisfactory insight into the correlation of the forms, and causing the arrangement and limitation of the species to remain uncertain.

But so long as we are without a general System of the Hesperidæ which would meet present requirements, nothing remains to be done but to work up the individual Faunæ for one's-self: in order, in the first place, to meet the absolute wants of our collections and special catalogues, and secondly, to prepare the way for a complete work at some future time. That the attempts made hitherto to divide this multiform family into genera have remained rather unsatisfactory will not be disputed, and possibly least of all by the excellent authors themselves. Herrich-Schæffer, at least, who in the true scientific spirit undertook such a task in his *Prodromus Systematis Lepidopterorum* (1868), plainly understood its imperfection. It is, however, much to be regretted that this great work, based upon such comprehensive studies, has not been completed, for, as is known, it remains as a fragment.

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already made in the Catalogue which I have received through the kindness of the author (*Catalogue of the Lepidoptera of America, North of Mexico, Part I., Diurnals*: By W. H. Edwards, Philadelph., 1877), I would remark, that, of the one hundred and eleven species there included, only forty-four have been in my possession, and that the American representatives of the genera *Carterocephalus*, *Thymelicus*, *Lintneria*,† *Achlyodes*, *Erycides*, *Pyrrhopyga* and *Megathymus* have been entirely wanting. That the generic diagnoses prepared by me somewhat hastily should have the honor of publication, I neither expected nor desired. How far these diagnoses will be sustained in their extension to the species unknown to me, and whether, and how far especially, the entire classification would have been modified, if instead of a part only, the whole number of species in nature were known to me, I am at present unable to judge. Finally, that Mr. Scudder, and not myself, is the author of the genera *Amblyscirtes* and *Pholisora*, has already been mentioned by Mr. Edwards. The genus *Thymelicus* Herrich-Schæffer (*Prodromus*, etc., p. 44, 1867) had already been well characterized.

† [This name having been previously used by Mr. Butler, for a genus of the Sphingidæ, it has been withdrawn by its author, and *Systasea* substituted for it. See this journal, vol. ix., p. 120.—J. A. L.]

The Hesperidæ are regarded by me as a group equal in systematic value to all the other Rhopalocera, and one which forms a transition to the Heterocera. They approach the latter through the possession of an attachment to the anterior tibiæ, the double-spurred posterior tibiæ of most of the species, and in the pupa being enclosed in a net-work of threads. No other group of the Diurnals, so far as I know, has two pairs of spurs on the posterior tibiæ. Besides the Hesperidæ, the Papilioninæ (Equites) alone have the tibial epyphysis, and in these alone the thread-enclosed pupa is found, at least in one of the genera *(Parnassius)*. In other respects, however, the Papilioninæ are far removed from the Hesperidæ.

The Hesperidæ are still more decidedly characterized as a genealogical transition group, between the Heterocera and the Rhopalocera, in that they possess besides, in particular cases, two characteristic physiological and anatomical peculiarities—the position of the wings when at rest, and the catch-bristle *(haftborste)* of the hind wings.

Nisoniades Tages carries its wings, as I have observed towards evening in sleeping examples resting upon flowers, directed backwards and sloping like the roof of a house, as in the night-moths. The same observation had already been made by Prof. Zeller, not only in *Tages*, but in freshly excluded examples of *H. malvarum* O., which last had the antennæ placed sideways and laid along the thorax, and the abdomen turned upwards, so that the observer was reminded of a sleeping *Heterogenea testudinana* (*Isis*, 1847, p. 288). Whether others have also made the same observations with this or other species, I do not know. I have not myself given the subject much attention. So far as I remember, I have always found the other Hesperians, when at full rest, sitting with erect wings, in the normal position of the Diurnals; but not with separated wings, as has been mostly stated.

A fully developed *retinaculum** occurs only in the male of *Euschemon rafflesiae* Macleay, and it is remarkable that the home of this singular genus is Australia, where so many primitive forms have been preserved that elsewhere have been overthrown by terrestrial revolutions, or destroyed by the concurrence of more progressive rivals.

Looking away from these possibly single cases, the Hesperidæ form a very natural, in themselves closed, division of the Diurnals, and as such

* [The *frenulum* of many authors.—L.]

much easier to circumscribe than to analyse as natural and sharply defined genera. To their characteristic peculiarities belong (after the venation of the wings, etc.) as an easy and evident characteristic, the brush of stiff hairs which springs from beneath the base of the antennae, which Hübner thought to be, in his definition of *Astyci* (Verz., p. 102), like the "curve on the cone of the ear." It arises very near the base of the antennae, between them and the upper margin of the eyes, and almost on the place occupied by the ocelli, but a little farther forwards, near the middle of the base of the antennæ—the ocelli, when present, lying on the posterior margin. It is developed alike in both sexes, but varies in regard to length, form and color in the different genera and species. As a rule it is black, occasionally mixed with gold, rarely entirely rusty, or pale-yellow. Where it is particularly long and stout, as in *Pyrgus*, *Scelothrix* and *Nisoniades*, it is somewhat curved over the eyes, as if to serve as a shade for them. The inferior hairs are more elongated than the upper ones. It is very short in several *Pamphila (Goniloba)* species and in the American genus *Eudamus (Goniurus)*, but is not entirely absent from any species examined by me. In some American genera this otherwise simple hair-formed structure, in which the hairs are close set, takes the form of a plate of hairs, by reason of their being spread out at the end, as in *Copaeodes* sp., *Pholisora* Scudd. As a short character for this organ, we retain the name given by Hübner, "Lockchen" [a small lock of hair], although it is only by particular perfection to be compared to a lock of hair.

The appendage to the anterior tibiæ (epiphysis cruralis, *schienblattchen*)* a bare, mostly reddish-yellow, blunt thorn-shaped, or lancet-shaped, chitinous plate, projects, in the Hesperidæ, from the middle of the inner side of the tibiæ and reaches to their end. It lies quite close to the tibiæ, and its free surface is clothed with a flat tuft of hairs, so that the structure is sometimes not readily recognized. Its absence separates two (which perhaps should be united) natural genera, poor in species, from the remainder of the family.

That the presence or absence of the spurs on the middle of the posterior tibiæ is of as little use as elsewhere in founding genera, the already described genera will suffice to show. It even seems as if the Hesperidae were destined to add to the, until now, single example of variability in

[* The tibial epiphysis of Guenee and of Edwards' Catalogue.—L.]

the number of spurs in the same species (*Acidalia rusticata*), a second instance of a varying species (see below *Pamphila Alcides*).

Of no more value in a systematic relation are the spines (*dornborsten*) of the tibiae, so far as I can judge from the limited number of species that I have examined. The genus *Pamphila* affords ample evidence of this; *Pyrgus*, also, attests to its truth, for its only spined species, *cribrellum*, no one would ever think of separating, because of this peculiarity, from *tessellum*, etc.

The spines the most generally occur on the middle tibiae, where they are always the most strongly developed; occasionally they are only present here. Then follow, both in frequency of occurrence and in their development, the posterior tibiae; and lastly the anterior tibiae. Often the spines of both these legs are so slight, or so covered up by hair and scales, that one has great difficulty in recognizing them, and their actual presence seems a matter of doubt. The manifold differences which are presented in the form of the club of the antennae are of value for systematic purposes; but, unfortunately, these differences are not often sharply defined and are difficult to express clearly in words. And there are not wanting species deviating from their generic association only in these points, that is to say, aberrent forms (such as *Pyrgus Poggei*), which could not be separated without an unnatural disruption of genera.

The palpi, particularly in the form and direction of their apical joint, afford some useful generic characters, while they offer, also, negative indications similar to those taken from the form of the knob of the antennae. Some other valuable systematic peculiarities are developed only in the male sex, while the female has in general remained a step behind. Their use as generic characters, therefore, cannot be recommended in this, as in other difficult groups, nor can they be wholly dispensed with. To these belong the costal fold and the discoidal stigma of the fore wings, the hair-pencil of the hind tibiae, the appendages of the hind breast,* and the abdominal fossa (*bauchgrube*).

The costal fold affords in the European species, in which it is present, only unimportant differences. It begins near the base of the anterior margin and terminates on or near its middle. The portion of the anterior margin, which it here covers, is not clothed with scales, but with a peculiar

* [*Hinterbreast*:—Metasturnum (Burmeister), postpectus (Kirby).—L.]

coat of felt, the color of which differs from that of the rest of the surface. With only one exception *(Pyrgus Poggei)*, it is, in all the European Hesperians, either well developed or entirely absent; in this respect it is a good characteristic, but as a generic character, is only to be taken *cum grano salis*, unless we would separate, without good reason, forms which are naturally associated.

I call that the discoidal stigma which Dr. Herrich-Schaeffer has designated as "schuppenwulst" (a pad of scales), forming a peculiar structure in the disk of the fore wings. The expression employed by Herrich-Schaeffer would give a quite false idea of the nature of this structure. The deep black streak of which it consists wholly or in part, is neither a puffy elevation nor formed of scales, but is composed of a dense felt-like substance of very fine, short, stiff and bristly fibres, as may be seen by placing scrapings of it beneath the microscope. In its simplest form (*Thymelicus lineola*) it is nothing but a slender black streak, the surrounding part of the wing, presenting no alteration in its normal scaly covering. In case of increased extension of the streak, however, the change affects also the surrounding area. The scales of the wing that encircle it are raised and undergo various alterations, some of them assuming the form of the antenna of a Diurnal butterfly. Still greater changes take place in the structure of the whole area in the midst of which this streak is placed in some American species (*Pamphila Huron* Edw.).

Less diversity appears in the situation and direction of the black streak. It generally starts from the dorsal-vein,* either at the end of the first third of its length, or a little before that point; then it runs across the first branch of the median-vein, where it is frequently contracted or sometimes interrupted by raised scales, advancing in an oblique course upward and outward to the origin of the second and third branches of the median at the lower corner of the middle cell. Among the species known to me, there occurs only in *Pamphila mathias* F., an essential deviation in the situation and direction of the stigma.

While the stigma furnishes good specific characters, it is of no generic value, since in nearly related species it is at one time present and at another absent. What appears to be of greater importance is the presence or absence of a hair-tuft on the posterior tibiae. Of the Hesperidae here

* [Generally known to American Entomologists as the submedian vein.—L.]

referred to, only two genera possess it, *Catodaulis* and *Scelothrix*, and for which latter, in addition to the sheath-formed appendages of the metasturnum, it forms the most important separative character from the nearest related genus, *Pyrgus* (which see).

A more or less deep and extensive excavation on the side of the first abdominal segments (bauchgrube = abdominal cavity) may be observed in the males of a great many genera of Hesperidae, although not always easy to be recognized, as it is generally covered by long hair, which is either spread smoothly or matted in confusion. It is most fully developed in those genera whose males are provided with a costal-fold, particularly in *Scelothrix*, where the upper half of the abdomen appears as if eaten out. What seems most surprising is the apparent absence of it in some males belonging to species which show it very distinctly. These specimens being quite fresh and fully scaled, it is but natural to suspect that the cavity is first found or becomes visible after coition and the evacuation of the contents of their testicles. Nevertheless, the cavity actually exists in other specimens that are in equally good condition, and exhibit it as distinctly as the worn ones. A male of the American *Eudamus Tityrus* F., which I impaled immediately after its exclusion from the pupa, shows the cavity remarkably well developed. So there remains an enigma to be solved by further research, and especially by the examination of fresh specimens. The cavity seems, however, of little systematic value, on account of its gradual appearance, which allows no sharp limits to be drawn.

The neuration of the wings has not been examined by me to the extent required, nor with that accuracy which could only be attained by denuding the wings, so as to enable me to decide whether they furnish a more solid foundation for a natural division of the Hesperidae than the parts described above. This, I consider, the principal defect of my work. For he who would undertake to establish a natural system of this group could not possibly avoid performing that task. Neither have I examined the anal appendages of the males, although I do not suppose that the result of such an investigation would pay for the labor which it would involve.

The Hesperian Fauna of the European province (taken in the extent ascribed to it in my *Geographical Distribution of the Lepidoptera*, etc., I., p. 90, and II., p. 298) is by far poorer in species than any other of the six great zoological "Regions" into which, according to Wallace's latest researches,* the earth is divided—the still little known region of Australia not excepted.

This poverty of species appears the more striking since the area of our Fauna is not only the largest,' but also the most thoroughly searched. Although it does not extend to the tropics, that genuine home of the Hesperidae, it is, nevertheless, in this respect not less favorably situated than is North America north of Mexico, yet still falls far behind that country.

Kirby's *Synonymical Catalogue of Diurnal Lepidoptera* (1871) embraces eleven hundred and two species of Hesperians, known either by descriptions or figures. Staudinger's *Catalogue of Lepidoptera of the European*

* See this excellent work: "*The Geographical Distribution of Animals*, by A. R. Wallace; Authorized German edition by A. B. Meyer, 1876." I would here call attention to the fact that the boundaries of the first primary region of Mr. Wallace, which he names Palæarctic, almost exactly coincide with those of our European region. The only difference is that Wallace places the boundary farther south—in Africa to the Tropic of Cancer, in Asia to the Himalaya range, and farther eastward into the south of China. But this difference can hardly be considered as such, for, Lepidopterologically, we cannot determine the southern limit of these almost unknown regions, but hypothetically. Moreover, Wallace's boundary lines do not rest upon a very sure basis; Japan and Northern and Central China are overlapping provinces of such mixed animal population that we are almost as well justified in adding them to the northern adjacent (Indian) Faunal-province as to the southern. Thus, then, nearly the same result has been reached in two different ways. Ours, which is only applicable to one order of insects, is based upon a plain comparison of the statistics of the local Faunas known to us, and the principle laid down by Schouw, according to which that part of the earth's surface which is to be established as a natural kingdom must possess at least one-half of its species and one-fourth of its genera as peculiar to itself. Wallace, in his investigations embracing the whole domain of zoology, lays the principal stress on the distribution of the Mammalia, and takes into consideration their present and also their pre-historic condition, as far as the latter may be determined from the fossil remains in former epochs of the earth. Now, if two divisions of the animal kingdom, so widely distinct, both by their organization and means of distribution, as the mammals and butterflies, return essentially the same answer to the zoographer respecting the extent of the region to which our division of the world belongs, this, certainly, may be considered a strong guarantee of the probability that we have made no mistake, but that we have, indeed, found a region which is consistently natural in all its belongings. For the present I retain the old name of European Faunal-region, together with its accustomed boundaries, which will be in conformity with Staudinger's Catalogue. Staudinger, as is well known, annexes thereto Arctic America, and for good reasons, although on no better grounds than our Transatlantic colleagues would have in adding to their Faunal-region the Arctic portion of the Eastern hemisphere.

Fauna, published the same year, includes only forty-six species, including certainly by error the assumed European species, *Hesperia Ætna* Bdv. Meanwhile, to restore due proportion, there should be deducted from the number given by Kirby, the varieties which he admitted as distinct species and those which he mentions under more than one name. The number of such seems to be quite considerable, if I may judge from those known to me, of those which I do not know. Nevertheless, I suppose it will not amount to more than one-tenth of the whole, so that, by accepting the round number one thousand, and placing to account the discoveries of the last six years, this number may perhaps be regarded as too low rather than as too high. Hence the proportion (46 : 1000) of the number of our Hesperians to the total number known, would be about as one to twenty-two. Europe, strictly, has only twenty-eight species, and it is hardly probable that this number will be increased by new additions.

The Fauna of North America claims particular interest because of its many close relationships to ours, and the impossibility of separating its Arctic products from those of the Eastern hemisphere. Edwards' later Catalogue enumerates, as before stated, one hundred and eleven Hesperians as inhabitants of the Extra-tropical parts of North America, including *Sylvanus* and *Tages*, but excluding a number of Scudder's species which Edwards regards as varieties. North America is thus far more than twice as rich in species as our Faunal-region; but still, in proportion to her vast territory, is poor in comparison with the tropical parts of the earth, and above all if compared with South America, where not only the Hesperian Fauna, but the Diurnals especially, have developed in their greatest abundance.

The genera common to both the American and European Faunas are *Carterocephalus*, *Thymelicus* (from both of these I have as yet seen no American species), *Pamphila*, *Pyrgus*, *Scelothrix* and *Nisoniades*; the ten other genera adopted by Edwards have no representatives in our Faunal-region. North America is poorer than Europe in species of the genera *Pyrgus* and *Scelothrix*, but as an offset to that, it is far richer in species of *Pamphila* and *Nisoniades*, especially of the former, of which Edwards mentions fifty-eight. The southern portions of the Union are populated by tropical forms, of which certain representatives (*Eudamus Tityrus* Fab. and *E. Pylades* Scudd.) extend to New York and farther north.

(To be Continued in Following Number.)

THE ABBOT SPHINX—*Thyreus Abbotii* Swainson.

BY THE EDITOR.

The subject of this illustration is another of the large grape-feeding insects which is found occasionally on both cultivated and wild vines, as well as on the Virginia Creeper. In fig. 7 we have the full-grown larva

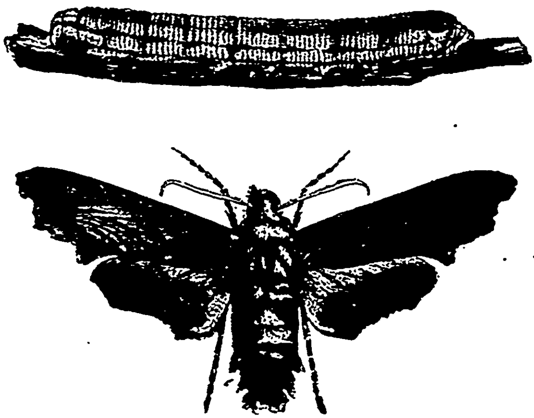

Fig. 7.

figured, as well as the moth. This larva is said to vary considerably in appearance, the ground color ranging between reddish-brown and dirty yellowish.

As we have never met with the larva ourselves, we shall copy Mr. Riley's description of it as it was found by him in Missouri: "I have reared two individuals which came to their growth about the last of July, at which time they were both without a vestige of green. The ground color was dirty yellowish, especially at the sides. Each segment was marked transversely with six or seven slightly impressed fine black lines, and longitudinally with wider non-impressed dark brown patches, alternating with each other and giving the worm a checkered appearance. These patches become more dense along the sub-dorsal region, where they form two irregular dark lines, which on the thoracic segments become single with a similar line between them. There was also a dark stigmatal line, with a lighter shade above it, and a dark stripe running obliquely downwards from the posterior to the anterior portion of each segment. The belly was yellow with a tinge of pink between the prolegs, and the shiny tubercle at the tail was black with a yellowish ring round the base. The head, which is characteristically marked, is slightly roughened and dark, with a lighter broad band on each side, and a central mark down the middle, which often takes the form of an X."

The chrysalis, which forms in a superficial cell on the ground; is black inclining to brown between the segments.

The moth is of a dull grayish-brown color, with the fore wings somewhat lighter beyond the middle and variegated with dark brown. The hind wings are yellow, becoming paler near the body, with a broad border of a dark brown hue. The margins of both wings are irregularly cut.

This moth has been taken in the vicinity of Hamilton, and we believe also in Amherstburg, Ontario, but we have not heard of its having been captured anywhere else within our Province; but as it is widely distributed, being found in nearly all the Eastern and many of the Western States, it is likely to be yet met with in other localities among ourselves.

ON THE LARVÆ OF LYC. PSEUDARGIOLUS AND ATTENDANT ANTS.

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

In ENT., x., p. 80, I stated that Dogwood was found to be the spring food-plant of this species, that is, of the larvæ proceeding from eggs laid by the form *violacea*; but probably there are other plants serving the same purpose, some of which bloom earlier than Dogwood, for fresh examples of the butterfly, form *pseudargiolus*, were taken on 21st April and on several subsequent days, and this was long before any of the larvæ feeding on Dogwood could possibly have produced them. Prof. J. H. Comstock has recently sent me quite a number of mature larvæ taken by him at Ithaca, N. Y., feeding on the flower heads of Viburnum acerifolium, and in confinement the larvae will eat Clover, Nasturtium, Begonia, Asclepias, &c., eating the anthers. But I have been unable to make the females lay eggs on Clover in confinement. On the Dogwood, so long as anthers are to be had, the larvae live on them, but as the flowers mature and fall off, they are forced to eat through and into the hard seed vessel, and I have even seen them boring into the woody stem below. These were belated larvae, and such as when mature produce the variety *neglecta*. The larvae being starved are small, and the resulting butterfly is small. *Neglecta* is flying now, and many examples are very diminutive. The color of the larvae feeding on Dogwood varies much from the color of those which feed on Cimicifuga racemosa, few being white in the last stages, but nearly all dull crimson or green, or a mixture of the two. Nevertheless a small percentage of the larvae on Cimicifuga are also green or crimson, though most are white. I have not seen ants about the Dogwood, and on introducing them to larvae confined in glasses, they manifested no knowledge of the larvae, and were wholly indifferent to them. And only on rare occasions have I been able to discover the tubes on 11th segment protruded even partially with any of the Dogwood caterpillars kept in the house. When I did see them, they pulsated incessantly, out and in at least once a second. In two instances, after repeated examinations, I chanced to see the tubes fully expanded, but accompanied by this pulsating movement, the withdrawal being more or less complete. No teasing or irritating at any time availed to make them appear, but severe pressure, resulting in the death of the larva, applied to the sides of the 11th segment, did produce them. But even by this pressure I could not discover the organ of 11th segment, nor force any fluid from it. As with the fall food-plant, Actinomeris squarrosa, the Dogwood is neither sweet nor juicy, and it may be that the larvae feeding on these plants do not secrete the fluid. Prof. Comstock found it different with the Viburnum, and stated that the "tubes on the penultimate segment were seen to evaginate repeatedly at the solicitations of the ants."

From Cimicifuga I have collected many eggs and scores of larvae, and day after day I have watched the latter on the stems of the plant. So long as the larvae were small no ants were seen attending; but they have been constantly found with nearly mature larvae. The ants have been of four species, the first scarcely more than $\frac{1}{10}$ inch long, the second $\frac{2}{10}$ inch, the third $\frac{25}{100}$ inch, and the fourth $\frac{3}{10}$ inch, but the specific names I have not yet ascertained. Most often it has been the second of these which attended the larvae, and from two to eight in company, on the same stem, with from one to three or four larvae. The third species is frequently seen, but only from one to three have been seen on the stem. Of the fourth I have seen but a single ant and in one instance. I have watched and experimented in various ways on both larvae and ants, shifting either from one stem to another, fresh larvae to ants and ants to larvae. The ants, when discovered on a stem, will invariably be on or near the larva. They run over the body, caressing with antennae, plainly with the object of persuading the larva to emit a drop of the fluid on 11. Most of this caressing is done about the anterior segments, and while the ants are so employed, or rather, while they are absent from the last segments, the tubes of 12 are almost certainly expanded to full extent, and so remain, with no retracting or throbbing, until the ants come tumbling along in great excitement, and put either foot or antenna directly on or close by the tubes, when these are instantly withdrawn. The ants pay no heed to the tubes, do not put their mouths to them, or to the openings from which they spring, nor do they manipulate that segment. They seek for nothing and expect nothing from it. But they do at once turn to 11, caress the back of the segment, put their mouths to the opening, and exhibit an eager desire and expectancy. By holding the glass steadily on 11, a movement of the back of this segment will soon be apparent, and suddenly there protrudes a dull green, fleshy, mamilloid organ, from the top of which comes a tiny drop of clear green fluid. This the ants drink greedily, two or three of them perhaps standing about it, and they lick off the last trace of it, stroking the segment meantime. As the drop disappears this organ sinks in at the apex and is so withdrawn. The ants then run about, some seeking other larvæ on the same stem, some with no definite object, but presently all return, and the caressings go on as before. The intervals between the appearance of the globule varied with the condition of the larva. If exhausted by the long continued solicitings, some minutes would elapse, and the tubes meanwhile remained concealed ; but a fresh larva required little or no urging, and one globule followed another rapidly, sometimes even without a retracting of the organ. I have counted six emissions in seventy-five seconds. The larva did not always await the approach to the 11th segment, but gave out the drop unsought and as soon as it was aware of the presence of the ant. Now and then the drop was preceded by a bubble several times larger than itself.

As I have stated, the tubes are usually expanded when the ants are absent from the last segments, and are certainly retracted when they come near. I counted the length of these periods of expansion, 10, 20, 50, and in one case 82 seconds, the period always ending with the approach of the ants.

When I placed a fresh larva, taken from the house, on the stem, as soon as the ants discovered it there was immense excitement among them, and a rush for the last segments. The larva forthwith relieved itself by the excretion of the fluid, and the tubes stood out with domes expanded between the times of secreting. If I placed a fresh larva on a stem on which were no ants, there was no excitement in the larva, no appearance of the tubes and no movement in 11th segment. I have watched repeatedly to make sure of this. But if ants were now transferred to the stem, the moment the caressings began the larva changed its behavior.

From what I have seen, I am led to believe that these tubes are merely signals to the ants, and that when the latter discover them expanded they know that a refection is ready, and rush to the orifice on the 11th segment. If the tubes serve any other purpose, I have failed to discover it. There is no duct visible on the dome of the tube when largely magnified, and the ants seek nothing of the tube or on the 12th segment. It might be supposed that the tubes are used for intimidation, to frighten away enemies, but they certainly are not. They are in some way connected with the organ in 11, and in the younger stages, when the larvae suffer most from enemies, neither tube nor this organ is available. The outward openings, and the orifice in 11, are visible in the youngest larval stages, but till near maturity the larva has no use of the tubes and cannot emit the secretion. The ants rarely attempt to caress or solicit young larvae, but pass them by with indifference. When I have occasionally seen an ant run about one of these, the larva manifested great annoyance, throwing up the hinder segments to drive away the intruder. The larva plainly considers the ant as a something to be got rid of—as an enemy. If the tubes could now be thrust out the ant would be attracted, not repelled. But the moment that the tubes are free, and the secretion ready to flow, which I believe to be immediately after 4th and last moult, but may perhaps be just after 3rd moult, and is certainly not earlier than that, the larva submits quietly to the attentions of the ants, and invites and rewards them. Dr. Weismann wrote: "You should try and observe what enemies the larvae have. It is conceivable that there are such enemies as are afraid of ants." I find four species of parasites about these larvae. Two are Dipterous. These are of the size of the common house fly. They deposit eggs on the skin of the larva (in an instance observed, on the back of 2nd and 3rd segments, near the junction, and at the second larval stage), and as the grubs hatch they eat their way into the larva, to emerge when both they and the larva are full grown—of course, destroying the latter. Another is Hymenopterous and minute. Its egg is deposited in the very young larva, probably at first stage. The grub eats out when the larva is half grown, at once spins a silken cocoon, from which in a few days the new parasite comes forth. The destruction of larvae by these, and very likely, other similar parasites, is immense. Of about a dozen mature larvae received from Prof. Comstock, but one reached chrysalis, all the rest giving out one of the Diptera spoken of. If any parasite attacked the mature larva, the grub of the former would live within and destroy the chrysalis, and instead of a butterfly therefrom, the parasite would emerge. Multitudes of chrysalids of other species of butterflies are thus destroyed; but in *pseudargiolus* there appears to be a singular immunity from enemies at this stage. I have never yet seen a parasite emerge from a chrysalis. Why this species, and doubtless many other *Lycaenæ*, are thus favored will perhaps in some degree appear from a little incident to be related. On 20th June, in the woods, I saw a mature larva on its food-plant, and on its back, facing towards the tail of the larva, stood motionless one of the larger ants (designated above as the third in size). At less than two inches behind the larva, on the stem, was a large ichneumon fly, watching its chance to thrust its ovipositor into the larva. I bent down the stem and held it horizontally before me, without alarming either of the parties. The fly crawled a little nearer and rested, and again nearer, the ant making no sign. At length, after several advances, the fly turned its abdomen under and forward, thrust out its ovipositor, and strained itself to the utmost to reach its prey. The sting was just about to touch the extreme end of the larva, when the ant made a dash at the fly, which flew away, and so long as I watched—at least five minutes—did not return. The larva had been quiet all this time, its tubes out of sight and head buried in a flower bud, but the moment the ant rushed and the fly fled, it seemed to become aware of the danger, and thrashed about the end of its body repeatedly in great alarm. But the tubes were not protruded, as I was clearly able to see with my lens. The ant saved the larva, and it is probable that ichneumons would in no case get an opportunity to sting so long as such vigilant guards were about. It strikes me that the larvae know their protectors, and are able and willing to reward them. The advantage is mutual and the association is friendly always.

There is no compelling by rough means on the one part and no reluctant yielding on the other. The demonstrations made by the ants are of the most gentle nature, caressing, entreating, and as the little creatures drink in the sweet fluid, lifting their heads to prolong the swallowing with manifest satisfaction and delectation, then lick away the last trace, caressing the back of the segment with their antennae as they do so, as if to coax for a little more, it is amusing to see.

The tubes in this species are white, cylindrical, of nearly even size, rounded at the top, and studded there with little tuberculations from which rise the tentacles. These last are tapering, armed with little spurs disposed in whorls, and stand out straight, making a white hemispherical dome over the cylinder, and none of them fall below the plane of the base of the dome. Nor do they ever hang limp or lie across the dome, as described by Guenée in *L. bætica*. When the tube comes up, the rays are seen rising in a close pencil, and as the dome expands they take position. On the contrary, when the tube is withdrawn, the top of the dome sinks first and the rays come together in pencil again. The expanded tube and its dome are beautiful objects to look upon.

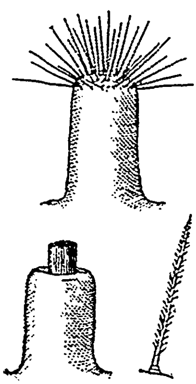

Fig. 8.

I desire to express my obligation to Dr. J. Gibbons Hunt, of Philadelphia, for microscopical observations made on these larvae. Aided by him, Miss Peart has been able to make several drawings, some of which I give herewith, showing the expanded tube and one of the rays, and the pencil of rays described.

The same organs are found in larvæ of *L. comyntas*, and their shape is precisely as in *pseudargiolus*.*

I stated on page 80 that all the black individuals of *violacea* taken proved to be males. I find no black female of this species, and presume there is none.

Coalburgh, 15th July, 1878.

* In Newman's British Butterflies, London, 1871, p. 125, I find this sentence quoted from Prof. Zeller: "I could not perceive that these caterpillars (*L. medon*) had a cone capable of being protruded, like that which we find in *L. corydon*, and which the ants are so fond of licking."

INSECTS OF THE NORTHERN PARTS OF BRITISH AMERICA.

COMPILED BY REV. C. J. S. BETHUNE, M. A.

From Kirby's Fauna Boreali-Americana : Insecta.

(Continued from Vol. x., p. 118.)

[275.] VI. HEMIPTERA.

FAMILY PENTATOMIDÆ.

383. PENTATOMA CARNIFEX *Fabr.*—Length of body 2½ lines. Several specimens taken in the road from New York to Cumberland-house.

Very near *P. oleracea*, and probably its American representative. Body black, a little bronzed; grossly and thickly punctured, the punctures on the upper surface the deepest. Head subtrapezoidal; promuscis pale in the middle; antennæ longer than the head; prothorax wider than long, with the lateral angles obtuse; signed with a sanguine cross, the arms of which extend from angle to angle; lateral margin, as well as that of the hemelytra and abdomen, white; scutellum longer than the thorax, obtuse with a subtriangular sanguine spot on each side near the apex; penultimate ventral segment of the abdomen margined with white; membrane white.

[276.] 384. PENTATOMA VARIEGATA *Kirby.*—Length of body 3 lines. A single specimen taken in the road from New York to Cumberland-house.

Upper surface of the body punctured. Head, excluding the prominent eyes, subtrapezoidal, black, with the margin below the eyes, white; promuscis extending to the base of the hind legs, pallid, black at the tip; antennæ black; prothorax transverse with lateral angles obtuse; pallid with a tint of flesh-colour, especially at the angles, with a broad anterior and narrow posterior black band, both abbreviated on each side, and the latter almost divided into two; scutellum an isosceles triangle, obtuse at the apex, black with the lateral margin pallid; hemelytra black with a pallid lateral margin, membrane embrowned; underside of the trunk black spotted with pallid and sanguine, punctured; tibiæ and apex of the thighs black; base of the thighs sanguine; abdomen below punctured at the sides, sanguine, with a large black discoidal spot, rather nearer the anus; nearly divided into two; on the sides and at the base naked, but a quadrangular space of the inner side of each division is covered with decumbent subcinereous pile.

N. B. The antepectus is entirely pallid, but the socket, if it may be so called, of the legs is redder at the margin than the rest.

385. PENTATOMA TRILINEATA *Kirby.*—Plate vi., fig. 6.—Length of body 3 lines One specimen taken with the preceding.

[277.] Body underneath and the head black, a little bronzed; thickly punctured with rather deeply impressed punctures; antennæ reddish at the base, with the two last elongated and incrassated joints black; prothorax black anteriorly, posteriorly lurid with the lateral margin and an intermediate longitudinal impunctured line, which extends nearly through the scutellum, white; the scutellum has also a white linear spot and dot on each side at the base; the punctures of the thorax, scutellum, and hemelytra are black; the membrane of the latter is white; the legs and sides of the breast are lurid spotted or punctured with black; the elevated basilar portion of the bed of the rostrum is concave and has a semicircular outline, and its margin, viewed under a strong magnifier, is minutely serrulate.

FAMILY EDESSIDÆ.

386. EDESSA NEBULOSA *Kirby.*—Length of body 3–4 lines. Three specimens taken in the journey from New York to Cumberland-house, and in Lat. 65°.

Body pale yellowish, sprinkled with black impressed punctures, most numerous and largest on its upper surface, which is clouded with reddish-brown, or blackish shades; the antennæ are of a reddish-yellow; the lateral angles of the prothorax are more acute than in the *Pentatomæ;* the scutellum is acuminate or attenuated at the apex; the lateral margin of the abdomen has a black spot on each segment, which sometimes appears on the ventral segments.

VARIETY B. Smaller, with the ventral segments of the abdomen rufescent, and the clouding of the upper surface of the body blacker; the thorax also is black posteriorly.

FAMILY CAPSIDÆ.

387. MIRIS PUNCTULATUS *Kirby*.—Length of body 3 lines. Two specimens taken in Lat. 65°.

[278.] Body oblong, pale, somewhat lurid with a very slight tint of green. Head triangular, impunctured ; eyes a little embrowned, prominent ; antennæ as long as the prothorax, subtestaceous with the two last joints and the underside of the first black ; thorax, scutellum and hemelytra very minutely punctured ; a small portion of the prothorax adjoining the head is separated from the rest by an impressed sinuous line and is not punctured ; legs pale ; abdomen subpyramidal, black above, pale underneath.

388. MIRIS VENTRALIS *Kirby*.—Length of body 3 lines. Taken with the preceding.

Very similar to *M. punctulatus*, and perhaps only a variety, but the hemelytra are faintly clouded with black, the underside of the abdomen is dusky with two longitudinal reddish spots or stripes.

ENTOMOLOGICAL CLUB OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Annual Meeting of the Club will be held at St. Louis, Mo., on Tuesday, the 20th of August, 1878, at 3 o'clock, p. m. All Entomologists who are interested are invited to assist, and will report at the headquarters of the Association at the Lindell Hotel, on the 19th or 20th, where they will be informed of the exact place of meeting. The meetings of the Association will begin on the morning of the 21st of August. Prof. J. K. Rees, at St. Louis, will give information to members about car fares and accommodation.

B. PICKMAN MANN, Secretary.

NOTICE.—In consequence of a series of uncontrollable mishaps, the issue of the present number has been delayed nearly a month beyond its usual time.

CORRESPONDENCE.

ON THE SCARCITY OF PAPILIONIDÆ.

DEAR SIR,—

I have seen very few *Papilionidæ* of any species this season up to date, except *ajax*, which has been abundant as ever. But of *turnus*, usually exceedingly plenty in spring, I have seen scarcely half a dozen examples. No *troilus* and few *philenor*. So *Colias philodice* and all Pierids have been remarkable for their absence. But butterflies from hybernating larvæ, or hybernating imagos, in contrast with those from hybernating chrysalids, have been abundant — Melitæas, Argynids, Vanessans and Satyrids. On 2nd June, 1877, I rode for several miles along a creek not far from where I live, and *Papilios* swarmed. Passing a flat rock by the side of the creek, a space on it, which I computed as not less than four feet square, was studded with *Papilios* as thick as they could stand. When they rose it was like a cloud. Nine-tenths of these were *turnus*. Allowing one square inch to each butterfly, and this is ample, there were upwards of 2,300 butterflies in that mass. And I passed lesser groups with every mile as I rode; so that the total absence of the species this year is remarkable. It would seem possible that the extreme mildness of last winter allowed of the existence or activity of enemies (insect probably) who sought out and destroyed the chrysalids, but why *ajax* should have escaped is beyond my conjecture.

W. H. EDWARDS.

Coalburgh, W. Va., 16th June, 1878.

DEAR SIR,—

Mr. Bates is quite right in saying *Doryphora* will eat *Solanum dulcamara* and *Datura stramonium;* they have preferred these to tomatoes in my garden. A friend found them eating *Hyoscyamus*. The present season seems exceedingly favorable to production of *Nematus* and other grubs destructive of the currants and gooseberries.

H. H. CROFTS, Toronto, Ont.

DEAR SIR,—

A single specimen of the rare Sphinx, *Lepisesia flavofasciata*, was taken here on Lilac blossoms, May 28th.

CHAS. FISH, Old Town, Maine.