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The Canadian Entomologist.

VOL. VIII. LONDON, ONT., DECEMBER, 1876. No. 12

NOTES ON CANTHARIDES.

BY THE EDITOR.

Read at the Recent Meeting of the American Pharmaceutical Association in Philadelphia.

The fact that we have in America several species of Cantharides, as well as some other closely allied vesicating insects which might at any time be used as a substitute for *Cantharis vesicatoria* (the Spanish beetle), has long been known. The species, however, to which attention has heretofore been chiefly drawn are some of the smaller ones found in the more northern parts of the country, especially *Epicauta (Cantharis) vittata* and *cinerea*, while the larger species south and west have been almost overlooked. The northern species referred to compare very unfavorably in size with the European *vesicatoria*, a feature which adds to the cost of collecting them; it would also appear that this difference of size has often carried with it the impression of a corresponding inferiority. Another bar to their successful inrroduction has been found in their color. By a strange misconception the presence of the brilliant green particles of the wing-cases in the powdered imported insect, has been associated with their activity, and any sample of powdered cantharides or of prepared emplastrum, where these brilliant particles are wanting, would by many physicians be at once condemned. The recent introduction of the Chinese beetle *Mylabris cichorii* has done much to remove the latter objection; still, notwithstanding that it has been shown by Prof. Maisch (see Proc. Am. Pharm. Assoc., 1872) that the *Mylabris* is much stronger than *vesicatoria*, yielding, according to his analysis, fully double the quantity of cantharidin, the relative market price of the insects belonging to the two species indicates that popular prejudice still favors the use of *vesicatoria*. Our *vittata* and *cinerea*, when powdered, nearly resemble the *Mylabris* in color.

In the western and southern portions of this continent we have species which are large and abundant, and which there is every reason to believe possess all the activity we need, and the chief object of this paper is to draw attention to this fact, and if possible to acquaint our members with the appearance of these species, and detail their life history and habits as far as they are known, so that those who reside in these more distant regions may be induced to collect them in sufficient quantities to admit of their being thoroughly tested. It is not probable that they would be found in any respect less valuable as vesicating agents than the Spanish beetle.

Through the kindness of Dr. George H. Horn, of Philadelphia, whose extensive contributions to our knowledge of American Coleoptera have made his name familiar both in Europe and America, we have been supplied with much information in reference to the species here treated of; an acknowledgment is also due to Prof. C. V. Riley, State Entomologist of Illinois, for some valuable notes on the habits of these insects. We have also had a lithographic plate prepared by Messrs. Sinclair & Sons, of Philadelphia, under the kind supervision of Dr. Horn, in which each of the species referred to is figured of the natural size, excepting 7 and 8, which are somewhat enlarged. This plate is remarkably well executed, and is probably one of the best plates of Coleoptera ever published; besides the American species, it contains figures of *M. cichorii* and *C. vesicatoria.*

We shall first enumerate the species, giving brief descriptions, as plain and void of technicalities as possible.

1. *Meloe angusticollis* Say.—This insect (see fig. 1 on plate) is of a dark bluish violaceous color, with the head, thorax and wing-cases thickly punctured with minute dots or impressions. The thorax is slender, narrower than the head; feet slightly hairy, with the spines of the legs reddish. Found in the Eastern States and in many parts of Canada; occasionally abundant under stones.

2. *Cysteodemus armatus* Lec.—Entire body bluish black; thorax with a strong lateral spine on each side; wing-cases very convex, and much larger than the abdomen, which they cover, and with very coarse elevated reticulations on their surface. This insect varies greatly in size; the figure represents a medium sized specimen.

Extremely abundant in Arizona and the desert regions of California wherever the greasewood, *Larrea Mexicana*, grows. This insect is not as good a vesicant as some others; the proportion of hard tissue in its structure is large as compared with the softer and more active portion, too large, perhaps, to admit of its being of much value.

3. *Mylabris cichorii* Linn.—All parts of this insect are black, excepting the wing-covers, which are of an obscure yellow, with three transverse, black, irregular, undulating bands, the one at the apex broadest. The first band is sometimes interrupted, and occasionally reduced to three or four spots.

Found in abundance in the southern portions of China, and also throughout India, on the flowers of the wild chicory and other composite plants. It is also said to occur in southern Europe, extending from Italy through Greece and Egypt to China. For further details in reference to this insect the reader is referred to an interesting and valuable paper by Prof. Maisch, in the volume of Proceedings for 1872, p. 246.

4. *Macrobasis albida* Say.—All parts of body black, densely covered with minute greenish or yellowish-white hairs. The thorax is slightly longer than wide, the wing-covers broader than the thorax, becoming wider behind, and are densely punctured.

Abundant in Texas, New Mexico and on the plains.

5. *Macrobasis atrivittata* Lec.—Also black; form more elongated than *albida;* head thickly clothed with fine black hairs, with a small white space in front of the eyes; thorax with grayish hairs, with a large black space in the middle; the wing-covers have black hairs, and their apex and sides are margined with gray; there is also a moderately broad grayish stripe extending from the humerus to near the apex.

Found in Texas, and is probably quite abundant, but we have not been able to obtain definite information on this point.

6. *Macrobasis segmentata* Say.—This insect is black also, with the segments of the body beneath margined with whitish. The thorax is nearly as broad as long, and its posterior edges are grayish. Wing-covers finely punctured and sparsely covered with short black hairs.

Occurs with *M. albida*, and is also abundant.

7. *Epicauta vittata* Fab.—The head of this species is of a light reddish color, with darker spots; antennæ black; thorax black, with three yellow lines; wing-covers black margined with yellow, and with a yellow stripe down the middle. Abdomen and legs black, covered with grayish hairs.

Is found throughout the United States and Canada, but more abundant northward and westward of the Carolinas, extending to near the base of the Rocky Mountains. In the south it is replaced by *lemniscata*, a species closely resembling *vittata*, but differs in having another white stripe. This species has been tested, and has been found fully equal to *vesicatoria* as a vesicant.

8. *Epicauta cinerea* Forster.—Black, closely punctured, and clothed with grayish hairs; beneath clothing dense, upper surface variable. Head sparingly hairy. Thorax densely punctured, sometimes entirely covered with gray hairs, often with a large triangular central space black, divided by a grayish line along the middle. Wing-cases finely punctured, and either entirely grayish or margined with grayish all around.

Occurs all over the United States east of the Rocky Mountains, and in many parts of Canada. In the Southern States it becomes larger, with the wing-cases entirely gray; fully equal in strength to *vesicatoria.*

9. *Cantharis vesicatoria* Linn.—Color, above and below, a beautiful shining golden green; head, thorax and wing-covers closely punctured; antennæ black.

Found most abundant in Spain, Italy and the south of France; also found in all the temperate parts of Europe, and in the west of Asia.

10. *Cantharis vulnerata* Lec.—Body black; head orange yellow, sometimes with a broad black stripe down the middle; wing-cases black.

Extremely abundant throughout the entire Pacific region west of the Sierra Nevadas. Dr. Horn has seen bushels of this insect in some localities literally strewing the ground; also very common on a species of *Baccharis;* he has experimented with them and found them powerfully vesicant, and producing strangury very readily when taken internally in the form of tincture.

11. *Cantharis Nuttalli* Say.—Head deep greenish or golden green; antennæ black; thorax golden green with a polished surface, and a few small scattered punctures. Wing-cases golden purple, striped with green. Body beneath green, polished; thighs purplish, feet black. This large and beautiful insect is extremely abundant in Kansas and Colorado.

12. *Pyrota mylabrina* Chev.—Entire body and legs dull ochre yellow. Thorax with two, sometimes four black spots; wing-covers with three transverse black bands, divided in the middle by the suture, the anterior one being sometimes further divided into four spots; knees and feet

black. Found from Kansas to Mexico, and is abundant throughout the whole region.

13. *Tergrodera erosa* Lec.—Body and legs black; head and thorax reddish, the former with a deep groove; wing-covers bright yellow, their surface roughened with coarse reticulations, with a median and apical black band, which in some specimens are wanting. Abundant in Southern California and peninsula of Lower California, on a low herbaceous plant with a blue flower.

In all these species the female is more valuable than the male, especially when well distended with eggs, owing to the relatively larger proportion of the soft parts. Eggs have the same power as the other soft parts; the blood Dr. Horn believes to be more active than any other portion.

Having referred in detail to the perfect insects, it is now proposed to sketch their history as far as known through the earlier stages of their existence.

The life history of *Meloe*, which has been well worked up in Europe, may be taken as a type of all the species mentioned, since all the facts accumulated on this subject point to a similarity in the character of the transformations and habits, which in the vesicating insects are very remarkable.

In the 20th volume of the "Linnean Transactions" there is a memoir on the natural history of *Meloe*, from which many of the following facts are derived.

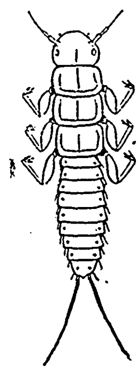
The *Meloe* beetles, when fresh from their pupa cases in spring, are feeble, move slowly, and have their bodies small and contracted, but after feeding a few days these enlarge greatly, the abdomen of the female expanding to twice its original size owing to the enormous quantity of ova within its body in process of development. The abdomen will then measure an inch or more in length, and appears to be dragged along with difficulty. They are fond of basking in the hot sunshine, and are said to be most active during the early and middle parts of the day. When confined in boxes for the purpose of observing their habits, it is necessary to expose them much to the sun and supply them with an abundance of food; they are then quite at home, and their proceedings may be easily watched. They drink freely of water and require their food to be well wetted. In a few days after leaving their winter quarters they pair.

The eggs are deposited in the earth. A small excavation is made by the female, sometimes as much as two inches in depth, into which, when finished, she projects her body with the head just perceptible at the entrance. After remaining in this position ovipositing for about two hours, the body is withdrawn and the earth raked with her feet into the hole until it is entirely closed. These burrows are commonly made among the roots of grass in a dry soil and a sunny spot, often on the margins of a dry footpath. The female always deposits two and sometimes three or four separate layings of eggs, at intervals of from two to three weeks. The first is always the most abundant, amounting usually to three or four thousand. After each deposit the abdomen seems to be almost entirely emptied; the insect then feeds voraciously, and fresh ova are soon developed.

The eggs when first deposited are about one-twentieth of an inch in length, slightly conical, obtuse at both ends, and of a bright orange color. They are placed in such a way that they may be parallel to each other, and adhere together at their sides, with one end directed to the entrance of the burrow. The duration of the egg stage is greatly influenced by temperature, averaging from four to five weeks.

From the egg there escapes a little active, agile creature, somewhat resembling a *pediculus* in habits; in fact, the larva of one of the European species was described by so eminent an Entomologist as Kirby, in 1802, as *Pediculus melittæ*. This young larva, a magnified illustration of which is given in Fig. 49,* is of a bright yellow color, and of an elongated form, with fourteen segments. The three segments which constitute the trunk are strong and powerful, for the attachment of the legs, which are furnished with sharp pointed claws, especially adapted for clinging securely to any object. The anal segment on its under surface is developed into a pair of short prolegs. It moves with great celerity with its six true legs; it can also make use of its anal prolegs, and thus climb a nearly smooth and vertical surface.

Fig. 49.



The young larvæ of most insects, if food is not supplied to them within a day or so of the time of their escaping from the egg, will die of starvation, but these young creatures will live from two to three weeks without food and maintain their activity, a wonderful adaptation to the circumstances in which they are placed. When hatched they crawl to the

* The small outline alongside shows this larva of the natural size.

surface and run up the stems of various plants, and often lodge themselves in the flowers and there await the visits of bees and other insects who alight to collect pollen or honey. They watch their opportunity, and attach themselves with great readiness to any of these insects who may come within their reach. It is astonishing with what celerity they fasten themselves to their victims the instant any part of its body is accessible, and with what tenacity they adhere to it, seizing it by the leg, wing, or hairs of the body, and crawling up and adhering around the insertion of its legs between the head and thorax or the thorax and abdomen, exciting the greatest possible uneasiness in the winged insect, who vainly endeavors to detach them from its body.

Some observers are of opinion that the parasite draws nourishment from the bee on which it fastens, but the main object of this instinctive attachment seems to be to get access to the cells in which the young and food are stored. Once here, the young larva of *Meloe* is said to attack the larva of the bee or other hymenopterous insect whose nest is thus invaded, and being furnished with strong mandibles, they thrust them into the soft parts of their victims, and prey on their substance through the wounded integuments, while the young bee is nourished with the stored pollen and honey. In this state, having no longer any use for their active limbs, they are gradually reduced to mere tubercles, and after a change of skin, the once active and sprightly creature assumes the form of a thick, fleshy maggot. In this form it continues to feed on the young bees or the bee bread and honey stored for their use, and after passing through some remarkable changes while in the larval condition, first changing to a semi-pupa, then to another form of larva, it subsequently assumes the true pupa state, in which condition it remains in its snug retreat until the following spring, when it bursts its bonds and appears as a beetle.

The young *Meloe* larvæ often attach themselves to the hairs of insects which construct no cells and do not store up food for their young; and in such cases, which must be very numerous, they necessarily perish. In the light of this fact we can appreciate the importance of the great fecundity of the females.

The larva of *Cantharis vesicatoria* is almost identical in form with that of *Meloe*, but soon after escaping from the egg it changes from a yellow to a darker hue, and finally to a deep black.

The history of our American species is as yet very fragmentary. Dr. Packard has observed the larva of *Meloe angusticollis*, and found it to differ but little from its European congeners. Prof. Riley has made some observations on *Epicauta vittata*. He describes the eggs of *vittata* as follows: Length 0.08 inch, five times as long as wide, elliptical and so uniform in diameter that it is difficult to say which is the anterior end, though there is a slight difference. Egg sometimes very slightly curved. Color very pale whitish yellow, smooth and shining.

The young larva is yellowish-brown, borders of head and thorax and of joints somewhat more dusky than general surface; tip of jaws and eyes dark brown. Legs and venter paler; venter not corneus except at sides and across segments eleven and twelve. About ten stiff hairs visible superiorly on the posterior border on the middle segments, with a cone-like prominence at the base of each and six minor bristles in front of them. There are also rows of fainter ventral bristles.

The curious history of these insects throws some light on the fact that while in some localities they are enormously abundant one season, they will be very scarce another. It is to be expected that there would be an alternation between the abundance of certain species of hymenopterous insects and Cantharides. When the insects they prey on are abundant the blistering beetles multiply amazingly, and during this immense multiplication exhaust the stock of material on which they feed to such an extent that a year of great abundance in any given locality can scarcely fail to be followed by a season of corresponding scarcity. In other, and sometimes adjacent localities, where the same causes have not operated to a like extent, the insects may be common enough. The great abundance of the sociable and solitary bees in the great plains of the West will probably always afford food sufficient to admit of the maturing of large broods of Cantharides.

AGENCY FOR THE EXCHANGE AND SALE OF COLEOPTERA.

Mr. E. P. Austin, of Cambridge, Mass., has established an agency for the exchange and sale of Coleoptera. Parties having Coleoptera which they desire to dispose of, either in exchange for other species or for cash, should write Mr. Austin.

ON SPECIES OF CATOCALA.

BY A. R. GROTE,

Director of the Museum, Buffalo Society Natural Sciences.

Catocala simulatilis Grote.

The male is now taken by Mr. Jas. Angus. The species is larger than *obscura*, agreeing with it in tone and in the white fringes of hind wings; it may be distinguished by the strongly marked median lines of primaries with a deeper toothing. The lines in *obscura* are thread-like, inconspicuous, and with shallower indentations. The opinion expressed that *simulatilis* is the ♀ of *obscura* must be the result of error; as I remarked at the time of describing the species, such a sexual variation would be without a parallel in the genus. *Residua* is distinguished from *obscura* and *simulatilis* by its blackish fringes to the hind wings.

Catocala flebilis Grote.

There occurs a variety of *C. retecta* with shaded fore wings, which may be mistaken for *C. flebilis*, which has peculiar pearly ash fore wings with the outer margin more oblique. Whether Mr. Strecker has figured a variety of *retecta* for *flebilis* is uncertain from the coarseness of his figure. This suffusion of the primaries occurs in *amatrix* among the red-winged species (Group 3).

Catocala Angusi, n. s.

♂ ♀. Six specimens received from Mr. Angus belong to a new form with black hind wings and blackish fringes, except at apex. It belongs then with the series of *C. insolabilis* and *C. residua*, and is similarly sized. It may be distinguished from *residua* by its paler, evenly grayish primaries and by the t. p. line having a longer costal tooth, as in *simulatilis*. Lines distinct; subreniform open. From *insolabilis* it varies by the want of the bright blue gray tint of fore wings and the absence of the darker shade on internal margin. It varies by having in some specimens a basal black shade, and again another from reniform to below apex. Behind the t. p. line its last sinus is usually a blackish shade. Beneath the body is white and the wings as in allied forms, with the outer white bands very narrow. One specimen has the black suffusions very broad, the ground color of the wing very pale gray, and the subterminal gray band distinct, as it usually is in *residua*. The latter species may be known by the deeper tone of primaries from base to subterminal line. The fore wings in *Angusi* are not dusky as in *residua*, *simulatilis* and *obscura*, but slightly greenish gray, not very bright.

Catocala mira Grote.

This form is mentioned by Prof. Snow. It is as large as *polygama*, without determinate greenish or brown shades on fore wings. Lines black; t. a. more denticulate than in the three allied forms, *crataegi*, *polygama*, *pretiosa*. The pale shade over the sub-reniform from costa is without dark irrorations, distinct. The primaries are pale, more gray and smoother than in contrasted forms. The hind wings are of a *deeper* yellow, bands very similar, while the internal margin is notably *free* from dusky hair and scales. Beneath the black band is broader than in its allies. I do not think that any of these four forms now intergrade. They may be considered as distinct "species."

Catocala cerogama, var. *Bunkeri*.

This form of *cerogama*, received from Mr. Robert Bunker, has the band on secondaries extremely narrow and the yellow basal shade entirely lost. On the fore wings the median space is deeply brown tinted, setting off the white sub-reniform.

Catocala habilis, var. *basalis*.

Differs from the type in the presence of a basal black ray on primaries. On hind wings the median band is broader; the fringe is medially scalloped in black. The terminal inflection of the t. p. line on primaries is deeper and more distinctly black marked. The form seems to be a little larger than the type. Specimens received from Mr. Robert Bunker, taken about Rochester, N. Y.

In studying the black-winged series we may divide them by the fringes in sub-groups.

Fringes white:

1—*epione*.	6—*desperata*.
2—*sappho*.—	7—*retecta*.
3—*agrippina*.	8—*flebilis*.
4—*lacrymosa*.	9—*simulatilis*.
5—*viduata*.	10—*obscura*.
	11—*Robinsonii*.

Fringes blackish :

12—Levettei. *15—residua.*
13—insolabilis. *16—tristis.*
14—Angusi.

It is somewhat strange that there are as yet no black-winged species known from California. One is described from Siberia, *C. dissimilis* Bremer.

Catocala relicta.

In my first general paper on the North American species of *Catocala* (Proc. Ent. Soc. Phil., Jan., 1872), the brief notice of *C. relicta* includes the statement that "the narrow central fascia of the secondaries is pure white." Up to this time I find no notice of a distinct powdering of blue scales which edge this fascia (more noticeably sometimes about the middle of the wing) on my present examples. It is not easy to see these blue scales at first, but the attention once directed to them, they become apparent. This discovery leads me to compare more closely our species with the European *fraxini*, which it is held to "represent," and which has the central fascia of the hind wings entirely bluish. The European species seems to be larger than *relicta;* the transverse posterior line less perpendicular, more deeply notched and more outwardly exserted opposite the cell, with more prominent teeth. Above the primaries are evenly dusted with dark scales in *fraxini*, and consequently more unicolorous; the darkest specimens of *relicta* evidently owe their color to a spreading of transverse blackish shades, the ground color, however narrowed, being white. The edge of the hind wings is white in *relicta*, gray in *fraxini*. Beneath both the species are pure white. The similarity of the under surfaces in these two species led me to reflect on the fact that in the Noctuidæ variation seems to be shown first on the upper surface of the primaries; it will be recollected that these are the more often exposed. There is, then, more white on *relicta*, on both wings; the central and principal portion of the fascia on the hind wings being pure white. With a large material in all stages it would be interesting to more fully compare the two species, which have probably a common origin. It is interesting, meanwhile, that the blue color is retained in both forms, although in one it may not always be expressed. If the two species had a common parentage, the blue color has been affected most probably by the different surroundings of the now separated forms.

The fact that the under surface in *fraxini* is bright and white as in *relicta*, while the upper surface of the wings is more obscure than in the American species, is worthy of note. I think that if we may localize the features of variation in markings as occurring first on the upper surface of the wings, especially on the primaries, we may draw some conclusions as to the relationship between different species of Noctuidæ from the degree of similarity beneath. I have elsewhere shown that the variability of *C. relicta* in the tone of the fore wings is not a sexual character.

NOTES ON SOME OF THE GENERA OF MR. SCUDDER'S "SYSTEMATIC REVISION."

BY THEODORE L. MEAD, CORNELL UNIVERSITY, ITHACA, N. Y.

After reading Mr. Peabody's paper in the August number of the CANADIAN ENTOMOLOGIST, I determined to verify some of the measurements given as characterizing Mr. Scudder's genera, as it seemed hardly possible that many of the numerical relations there given should prove absolutely constant; and after examining a large number of species and specimens, these relations proved variable beyond all expectation. The measurements of the venation were taken directly from the wings by the aid of a thin sheet of transparent gelatine ruled with lines $\frac{1}{50}$ of an inch apart, the wings having been bleached by Mr. Dimmock's admirable process.

Recently I have carefully gone over the measurements of the same specimens, of the groups Lycaeides, Glaucopsyche and Cyaniris, with a microscope, measuring by means of an eye-piece micrometer and mechanical stage to the nearest thousandth of an inch, and find that the former measurements coincide sufficiently with these to warrant confidence in accepting the remainder as substantially correct.

The results prove that the venation of the wing is very variable even in specimens of the same species, and that no generic distinctions whatever can be based on slight differences in the proportionate length of the cell and wing, or the origin of the first and second branches of the subcostal nervures of primaries.

I have reduced the proportions of these parts mentioned by Mr. Scudder to percentages, so that comparison will be easy. The species of Lycænidæ examined were as follows: Of *Lycæides*, *anna*, *melissa*, *acmon*, *Scudderii*; of *Glaucopsyche*, *lygdamas*, *oro*, *Couperii*; of *Cyaniris*, *pseudargiolus* (6), *violacea* (5), *neglecta* (2), *lucia*; of *Everes*, *comyntas* (4).

In the first place, the 1st superior branch of subcostal is given as arising in *Everes* at 50 per cent. +, of the distance from base to apex of cell. I find it to vary from 50. to 54.5. In *Lycaeides* it should arise at 67.; I find 52.2 to 59.8. In *Cyaniris* the Revision gives "scarcely ⅔" (67.—); I find 55.7 to 64. In *Glaucopsyche* it should arise "somewhat beyond the middle" (50. +); I find 57.8 to 63.1. The reader will notice how these numbers overlap each other, thus totally failing to give any distinction between the groups.

The second branch of the same nervure should arise in *Lycæides* at 50 per cent. of the distance between the 1st superior and 1st inferior branches; I find 44.8 to 47.4. In *Glaucopsyche*, also 50 per cent., my results being 37.7 to 46.9. In *Cyaniris* this nervure should arise at "less than half way from base to apex of cell" (50 per cent.—); I find 43.4 to 51.9, and in *Everes* instead of 25., I find 30. to 33. In this last case the numbers do not overlap, probably because only one species (4 specimens) of *Everes* was examined, since the variation among individuals in the other groups is very considerable, and this is the only instance of the kind that I have found in comparing the venation of these genera.

Again, in length of cell as compared to length of wing, *Everes* varies from 43. to 49. per cent. (Revision gives 50.—); *Cyaniris* from 47.3 to 52.2 (Revision gives 50.); *Lycæides* from 47.3 to 48.9 (Revision gives 50 +), and *Glaucopsyche* from 49.3 to 51.1 (Revision gives 50 +).

I have adduced these Lycaenas since the published article tabulates their differences, but Mr. Peabody has kindly forwarded me advance sheets of a similar arrangement of the characters of other groups, and there the variation is perhaps even more striking than with the Blues.

In the table giving the distinctions whereon are based the genera *Speyeria*, *Argynnis* and *Brenthis* of Mr. Scudder, taking up every character *seriatim*, we find, first, that the antennæ of *Speyeria* and *Brenthis* are "a little longer than the abdomen," and of *Argynnis* "considerably longer than the abdomen." Taking the length of the abdomen as the unit, I found that the antenna measures in *Speyeria* 1.12 and 1.13, in *Brenthis* from 1.15 to 1.44, and in *Argynnis* from 0.93 to 1.37, which is certainly not in accordance with the characters as given.

The next characters relate to the number of joints of the antennæ, viz., 52 for *Speyeria*, 41 to 49 for *Argynnis*, and 33 to 34 for *Brenthis*. This matter I have not investigated.

The palpi and eye are compared, the length of the eye being taken as unity; in *Speyeria* they are stated to be 1.50, in *Argynnis* 2— to 2, and in *Brenthis* 2—. I find *Speyeria* 1.29, *Argynnis* 1.07 to 1.60, and *Brenthis* 1.33 to 2.

The fore tibiæ are compared with the hind tibiæ, being as .33 + in *Speyeria*, .40 ♂ or .40 + ♀ in *Argynnis*, and .50— ♂ or 50 ♀ in *Brenthis*. I find *Speyeria* .36, *Argynnis* .40 to .45, and *Brenthis* .29 to .44.

The tarsi are said to be scarcely shorter than the tibiæ in *Speyeria*, in *Argynnis* .75 +; I find for *Speyeria* .80, and for *Argynnis* .80 to .88.

The middle tibiæ are said to be "a little shorter than the hind pair" in *Speyeria* and *Argynnis*, "scarcely shorter" in *Brenthis*. I find for *Speyeria* .89, for *Argynnis* .85 to .96, and for *Brenthis* .81 to .93.

The 1st superior branch of the subcostal nervure is said to arise in *Speyeria* "beyond the middle of the outer half of the upper margin of cell" (*i. e.*, at 25 per cent.—, inside apex); in *Argynnis* "in the middle of the outer two-fifths of the upper border of cell" (*i. e.*, at 20 per cent. inside apex); and in *Brenthis* "shortly before the apex of the cell." For *Speyeria* I find 22.1 and 24.; for *Argynnis* a range of from 13.5 to 23.6, and for *Brenthis* from 2.6 to 17.5. In a single species of *Argynnis*, viz., *atlantis*, I find in 10 specimens taken at random the surprising variation of from 14. to 23.6.

The next character is the only one among all those given for these three genera that I have been able to verify from specimens, and even here the variability is startling.

Mr Scudder gives the second branch of the subcostal as arising in *Argynnis* at "half way between the 1st and the apex of the cell" (*i. e.*, at 50 per cent.) and in *Brenthis* as at a similar distance beyond it (*i. e.*, at 100 per cent. beyond). For *Speyeria* no corresponding character is given. I find in all specimens which I have examined that this 2nd branch is given off in *Argynnis* within the apex, and in *Brenthis* beyond it, but the precise point varies in *Argynnis* from 55.6 to 15.0 per cent. within apex; and in *Brenthis* from 114. to 1500. per cent. beyond it, Mr. Scudder's unit (the distance between the origin of 1st branch and apex of cell) being adopted.

The last characters relate to the length of cell, which the Revision gives for *Speyeria* as 40 per cent. of length of wing, for *Argynnis* as "considerably less than" 50, and for *Brenthis* as "nearly" 50. The measurements give for *Speyeria* 40.5 to 46.1, for *Argynnis* 39.3 to 47.6, and for *Brenthis* 39.7 to 48.7, the average of the 26 specimens of *Argynnis* being 44.5, and of the 13 of *Brenthis* 44.1.

Hence we find that out of all the characters given in the Revision as separating these three genera, there are none that divide *Speyeria* from *Argynnis*, and but a single peculiarity separating *Argynnis* and *Brenthis*, and that sometimes varying fifteen hundred per cent. from the numerical ratio assigned to it, leaving out of account, for the present, the number of joints in the antennæ, which I have not been able to investigate as yet. In venation and length of cell, *Euptoieta claudia* agrees with *Brenthis*, being about midway between *bellona* and *myrina*, so that though we might be inclined to accept this character as sufficiently separating *Argynnis* and *Brenthis*, the latter group would need further limitation to exclude *Euptoieta*. The Melitaeas and Phyciodes also have the second branch outside the cell.

A table is appended giving these measurements reduced to percentages, for *Speyeria*, *Argynnis* and *Brenthis*, showing how extremely variable the species and individuals are, and that such proportions are not in any wise to be depended on even for specific characters. A large number of measurements have been made in the genera *Phyciodes* and *Melitæa*, but these results must be reserved for a later paper, since their reduction and comparison will require considerable time, and since a number of additional measurements remain to be made in order to complete the series.

TABLE.

Length Antenna.

(Abdomen = 1.)

A. atlantis	.93
A. aphrodite	1.06
A. Bremnerii	1.08
A. aphrodite	1.11
S. idalia	1.12
"	1.13
A. cybele	1.13
B. bellona	1.15
A. atlantis	1.21
A. cybele	1.21
B. myrina	1.21
A. aglaia	1.24
A. aphrodite	1.26
"	1.33
B. euphrosyne	1.37
B. freya	1.42
B. epithore	1.44

The Revision gives

Speyeria........"a little longer."
Argynnis.......... "
Brenthis.. "considerably longer."

Length Palpi.
(Eye = 1.)

A. cybele	1.07
A. Bremnerii	1.17
S. idalia	1.29
B. myrina	1.33
A. atlantis	1.40
B. bellona	1.43
A. aphrodite	1.50
B. euphrosyne	1.56
A. aphrodite	1.58
A. aglaia	1.60
B. epithore	1.75
B. freya	2.00

The Revision gives

Speyeria	1.50
Argynnis	2—. to 2.
Brenthis	2—.

Length Fore Tibia.
(Hind Tibia = 1.)

B. bellona	.29
B. myrina	.29
S. idalia	.36
B. epithore	.37
B. freya	.37
A. Bremnerii	.40
A. aphrodite	.41
A. cybele	.42
B. euphrosyne	.44
A. atlantis	.45

The Revision gives

Speyeria	.33 +
Argynnis	.40 or .40 +
Brenthis	.50— or .50

Length of Tarsi.
(Fore Tibia = 1.)

A. cybele	.80
S. idalia	.80
A. Bremnerii	.88
A. aphrodite	.89

The Revision gives

Speyeria	1.—
Argynnis	.75—

Length of Middle Tibia.
(Hind Tibia = 1.)

B. freya	.81
A. atlantis	.85
A. aphrodite	.86
B. epithore	.87
B. euphrosyne	.89
B. bellona	.93
B. myrina	.93
A. Bremnerii	.95
A. cybele	.96

The Revision gives

Speyeria........"a little shorter."

Argynnis....... "a little shorter."
Brenthis....... "scarcely shorter."

1st Branch s. c. from apex cell.

(Length cell = 100.)

B. bellona	2.6
B. chariclea	8.8
B. myrina	12.9
B. freya	13.3
B. arsilache	13.3
A. aglaia	13.5
A. aphrodite, var	13.6
A. atlantis	14.0
B. thore	14.3
B. amathusia	14.5
B. triclaris	15.1
A. Bremnerii	15.4
B. epithore	15.8
A. atlantis	16.1
B. helena	16.2
A. atlantis	16.7
B. selene	16.7
A. atlantis	17.2
A. cybele	17.2
B. dia	17.2
A. Meadii	17.4
B. euphrosyne	17.5
A. cybele	17.6
A. atlantis	18.1
A. cybele	18.2
"	18.5
A. atlantis	18.7
A. aphrodite	18.9
A. aglaia	19.5
A. diana	19.5
A. cybele	20.0
A. atlantis	20.0
A. Edwardsii	20.1
A. cybele	20.2
A. aglaia	20.4
A. Edwardsii	21.2
A. atlantis	21.3
S. idalia	22.1
A. atlantis	22.2
A. cybele	23.1
A. atlantis	23.6
S. idalia	24.0

The Revision gives

Speyeria........ ...25.—
Argynnis........... ...20.
Brenthis.." shortly before apex."

2nd Branch s. c. from apex cell.

(Distance 1st Branch to apex = 100.)

	Inside
A. atlantis	55.6
A. aphrodite, var	50.0
A. atlantis	48.0
A. Meadii	47.4
A. cybele	44.4
A. atlantis	44.4
A. aglaia	42.9
A. Edwardsii	42.9
A. atlantis	41.7
A. cybele	39.1
"	38.7
A. Edwardsii	38.5
A. aglaia	36.4
A. cybele	35.8
A. atlantis	35.8
A. cybele	34.8

A. diana	33.3
A. cybele	33.3
A. atlantis	33.3
"	28.6
A. aphrodite	28.0
A. Bremnerii	25.0
S. idalia	23.5
"	22.2
A. atlantis	20.0
A. aglaia	20.0
A. atlantis	19.0
"	15.0
	Beyond
B. euphrosyne	114.
B. dia	146.
B. thore	150.
B. arsilache	162.
B. selene	182.
B. helena	191.
B. epithore	200.
B. triclaris	240.
B. freya	244.
B. myrina	250.
B. amathusia	282.
B. chariclea	433.
B. bellona	1500.

The Revision gives

Argynnis	50. inside
Brenthis	100. beyond

Length of Cell.

(Length wing = 100.)

A. Edwardsii	39.3
B. myrina	39.7
S. idalia	40.5
A. aglaia	41.3
B. amathusia	42.2
B. freya	42.5
A. diana	42.6
B. arsilache	42.9
A. cybele	43.2
B. selene	43.4
A. cybele	43.4
A. atlantis	43.5
B. chariclea	43.6
B. helena	43.6
B. epithore	43.7
A. cybele	43.8
" (2)	43.9
"	44.1
A. Edwardsii	44.2
A. atlantis	44.3
B. dia	44.4
S. idalia	44.4
A. atlantis	44.4
B. triclaris	44.6
A. aphrodite, var	44.7
A. Meadii	44.7
A. atlantis	44.9
"	45.0
"	45.3
"	45.5
A. Bremnerii	46.0
S. idalia	46.1
A. atlantis (2)	46.2
A. aglaia	46.6
B. thore	46.7
A. aglaia	46.7
A. atlantis	47.6
B. euphrosyne	47.6
A. aphrodite	47.6
B. bellona	48.7

The Revision gives

Speyeria	40.0
Argynnis	"considerably less than" 50.
Brenthis	"nearly" 50.

MISCELLANEOUS.

Mr. W. H. Edwards, of Coalburgh, W. Va., wishes to know how far north the black variety of *turnus*, female, is found, and also how it compares in abundance with the yellow variety at the west and south. We trust that some of our readers will be able to supply the needed information.

J. C. Wasserman, 50 Beverley Terrace, Cullercoats, England, wishes to exchange British Lepidoptera for Canadian; parties desirous of exchanging will please write him.

Wm. Barnes, Decatur, Illinois, wishes to exchange insects from Decatur for Canadian insects, and with this view will be glad to correspond with Canadian collectors.

Mr. H. K. Morrison, of Cambridge, Mass., has been engaged during the past summer in collecting the insects of Southern and Middle Georgia and of the Black Mountains of North Carolina (6,700 feet high), the latter a region hitherto unexplored. He has succeeded in obtaining a large series of insects of all orders, especially Lepidoptera and Coleoptera.

CORRESPONDENCE.

OBSERVATIONS ON SPHINGIDÆ.

My summer's experience with the larvæ of rare Sphingidæ is, that *Smerinthus astylus* Westwood, *Smerinthus myops* Harr., *Darapsa versicolor* Clemens, and *Darapsa choerilus* Walk. are all double brooded. A characteristic of *astylus* is its caudal horn, which is armed with two spines at its tip, appearing bifurcate at first glance. These spines are constant from its hatching. Color of horn, dark brown at tip and base; pale green in centre*, pointing forward. The long life in its larval condition, and consequent exposure, may in a measure account for its exceeding great rarity. Have fed some from six to seven weeks.

Smerinthus myops.—I have found that the red blotches on larvæ are not uniform, and are more prevalent on the late brood, although some are entirely green and correspond in color to similar spots found on the leaves of the wild cherry at that season.

Darapsa versicolor.—Caudal horn points backward, is straight until the last moult, when it assumes a fine curve to the rear. Color of curved

* At last moult the dark brown is faded to an extremely light shade.

horn, black above, orange beneath.' The larva presents two colors, pale green and brown, which are not sexual distinctions. Eggs of all pale green, slightly flattened. GEO. W. PECK, New York.

NOTES ON VANESSA LINTNERII, FITCH.

In 1856, Dr. Fitch described a butterfly allied to *Antiopa*, and named it in honor of its discoverer, J. H. Lintner.

A butterfly was captured here last summer that is nearly as far removed from *antiopa* as *Lintnerii*. I copy Dr. Fitch's description, and point out the differences. He says: "This butterfly is closely related to *antiopa*, or white-bordered butterfly. Its wings have perfectly the same form and are similarly colored to those of *antiopa*, but their pale border is twice as broad as in that species, occupying a third of the length of the wings, and it is wholly destitute of the row of blue spots which occur in *antiopa* forward of the border."

The specimen before me differs from the one described by the Doctor in two respects: the wings are shorter proportionally than in *antiopa*, and shaped more like those of *Vanessa J-album*. In the second place, the lobes or tails of the hind pair of wings are larger and not as pointed as those of *antiopa*. Again, the Doctor says its ground color is deep rusty brown, much more tinged with liver reddish than *antiopa;* the fore margin of the anterior wings is black, freckled with small transverse white streaks and lines, but is destitute of the two white spots which are seen in *antiopa*. My specimen has the white spots mentioned by the Doctor, but they are small and not well defined. The specimen before me coincides with the remainder of Dr. Fitch's description, which is as follows:

"The broad outer border is of a tarnished pale ochre yellow hue, speckled with black the same as in *antiopa*, and becomes quite narrow at the inner angle of the hind pair of wings. The wings beneath are similar to those of *antiopa*, but are darker and without any sprinkling of ash gray scales or any whitish crescent in the middle of the hind pair, and the border is speckled with gray whitish in wavy transverse streaks, without forming the distinct band which is seen in *antiopa*."

ROBERT BUNKER, Rochester, N. Y.

ERRATA.—On page 160 of present volume, 15 lines from bottom, "P. O. Zeller" should be P. C., and 3 lines from bottom, "since he," &c., should read "since—." This sentence has no reference to Mr. Scudder, which by an error of the printer it is made to have.

On page 213, 17 lines from bottom, for *Hypsaphalus* read *Hypocephalus*.

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