



Cook

INCISALIA AUGUSTUS.—THE EGG.

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## ENTOMOLOGICAL SOCIETY OF ONTARIO.

### REMOVAL TO GUELPH.

On the 4th of May the President of the Society, Mr. J. D. Evans, C. E., Trenton, sent a circular letter to all the members of the Council of the Society, asking for their opinion respecting the proposed removal of the headquarters of the Society from London to Guelph. In a letter, dated June 18th, he announces that he has received replies from all the members, and that the vote stands in favour of the removal *eleven*, opposed to it *four*; one member abstained from voting. He adds: "Since the vote in favour of the move stands nearly three to one, I hereby declare the decision for the removal to Guelph carried."

The Society's lease of its present quarters in the Public Library Building, London, terminates its second year on the 1st of September next, and at that time another tenant is prepared to take over the premises and relieve the Society of the remainder of its term; to this arrangement the Library Board has given its consent. The removal will therefore be carried out during the latter part of August.

The Ontario Agricultural College at Guelph will provide, rent free, suitable accommodation for the Society's library and collections, etc. To the former there will be assigned a special section in the fireproof Massey Hall Building, and the collections will be kept entirely distinct from those belonging to the College. All the property of the Society will be entirely under the control of its own officers, and subject to any regulations that its Council may draw up. A written agreement to this effect between the College and the Society will be duly executed.

Much regret is felt by all the members of the Council, and no doubt by the members of the Society in general, that the headquarters should be removed from London, where they were established a few years after the formation of the Society in 1863. Unfortunately, interest in entomology has almost entirely died out in London, and there seems to be no one there available for the supervision and care of the library and collections. The sections also in Botany, Ornithology, Geology and the Microscope have, one after the other, ceased their active operations, and no meetings

of any of them have been held during the last two years. At Guelph, on the other hand, there is a large and active list of members. During the first and second years of the College course attendance at lectures on Entomology is compulsory, and during the third and fourth years some of the students specialize in the subject, and make it a serious and scientific study—these naturally become active members of the Society, and continue their connection with it after they leave college and scatter over the country. There will also be at Guelph a continuity of work and interest through the permanent staff of a Professor, Lecturer and Demonstrator of Entomology. The books and specimens will be much more largely consulted and the usefulness of the Society greatly extended. It is therefore believed that the contemplated removal will be in the best interests of the Society.

#### STUDIES IN THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y.

##### II.—*Incisalia angustus*.

*Time of flight*.—Species single brooded; butterflies to be found during late April and early May. I have taken the male as early as the 11th of April, but usually the first imagoes appear about the 20th. They become abundant by the first of May, after which time the females may be observed ovipositing, and the males rapidly disappear. After May 10th worn individuals only are seen, some of which may endure even to the end of the first week in June.

*Oviposition*.—Eggs are laid during the first two weeks in May (and probably later) on *Vaccinium vacillans* and *Kalmia angustifolia*. Since the caterpillars will eat *V. corymbosum* and *V. pennsylvanicum* quite as readily as *V. vacillans*, it is probable that these plants also are oviposited upon. I have been unsuccessful in attempts to induce the larvæ to feed upon any other of the indigenous *Ericaceæ* or *Rosaceæ*.

When placed upon *Kalmia* the egg is tucked in between the individual buds of the fascicle, often so deeply that the buds must be broken apart to find it. When placed upon *Vaccinium* its position depends upon how far open is the flower bud selected by the female. If she finds it possible to thrust her ovipositors between the green bud and the brown shelly scales, or between the outer and inner series of the latter, she does so, and the scale, springing back to its former position, completely covers

and conceals the egg. When, on the other hand, the bud is scarcely open, the egg is placed upon the outer face of the bud scale, near the stem. A confined female, after ovipositing on all the buds of the plant supplied, placed her two last eggs on the petioles of leaves. Ovipositing takes place in the middle of the day, and each female disposes of about sixteen eggs. In nature, these are placed singly, never more than one on any plant, but unlike *irus*, the female of this species will often oviposit several times within a radius of a few feet.

*The egg.*—Turban-shaped, top slightly depressed; micropyle, a rosette of cells, still further depressed; bottom flat or irregularly indented. Sides ornamented with low rounded bosses in series, each connected with the nearest ones surrounding it by slightly elevated ridges, which are broadened out midway between the bosses, and are exceedingly irregular in outline, a character which serves at once to distinguish the egg from that of the congeneric species (as far as these are known). Cell walls of bottom and of micropyle narrow, clear-cut and of uniform width. At the edge of the micropyle the walls broaden abruptly, and the sculpture of the surrounding area is similar to that of the sides, except that the bosses are wanting. Plate III, fig. 1, shows the micropyle and depression; fig. 2, a part of the surface sculpture from the region of greatest diameter; and figs. 3 and 4, the top and side. When first laid, the egg is light green, with a faint bluish tinge, which disappears within a few hours. The colour gradually changes as the embryo larva develops, from light green to yellow-green, to greenish-yellow, and, finally, from four to thirteen hours before the birth of the caterpillar, to chalky-white.

*Period of incubation.*—On May 10th, 1905, I obtained sixteen eggs from a female confined over *Kalmia*. These were laid between 10 a.m. and 3.30 p.m., and all hatched between 2 and 11 p.m. on May 15th. An egg laid on *Kalmia* at 11.11 a.m., May 3rd, 1905, hatched during the early morning of May 9th. Another, laid on *Vaccinium* at 11.38 a.m., May 8th, 1905, hatched between 10 a.m. and 2 p.m. on May 11th. Only one egg was secured this spring. It was laid at 1.20 p.m., May 14th, and hatched at 3.25 p.m. on the 18th. From these instances it will be seen that the period of incubation varies from three to almost six days.

*The larval stages.*—I have been unable to discover eggs on the food plants, except when I have seen the female oviposit, and although I have spent many hours in the search, I have never found a newborn larva.

It is altogether probable that the feeding habits at this time are such that the presence of the caterpillar on a plant is not indicated by any obvious mark. My knowledge of such habits is, in consequence, more or less speculative, and based upon what I have learned from watching the larvæ bred in captivity and upon analogy with the related species.

When the caterpillar finds itself upon *Vaccinium* it ascends to the corolla, and eats therein an irregular hole just above the calyx. Through this it crawls well into the flower and feeds indiscriminately upon the style, stamens and maturing ovary. Its resemblance to the lower part of a stamen is striking, and when at rest on one of these it is practically invisible. I once sought for twenty minutes for one which I knew was somewhere in a cluster of three flowers, and eventually discovered it head down on a stamen. By the time the protecting and concealing corolla has fallen the larva has turned green, like the young fruit into which it bores in a manner similar to that of *Henrici*, as described by W. H. Edwards. From this time it feeds openly, probably mostly at night, concealing itself during the day beneath a leaf or among the berries. Larvæ in advanced stages may be sought with some success on rainy or cloudy days on plants, the fruit of which has been attacked in the manner characteristic of fruit-eating *Lycenidæ*, although many such evidences will be discovered for every caterpillar found. In three years I have found two; Mr. Harry Cook has also secured two in the same length of time.

I have found it impossible to raise this species on *Kalmia* in the laboratory. The young larvæ can eat only tender tissues, and *Kalmia* dries out very quickly. Nor have I ever been able to discover a caterpillar on this plant. Therefore, I know nothing of the feeding habits when it is selected as the food plant. Certainly some variation in coloration is to be looked for in individuals which have fed from birth on *Kalmia*, if it is the petals which are eaten, for the brilliant green of those taken from *Vaccinium* would render them conspicuous amidst the rosy flowers of the laurel. Curiously enough, the "*Vaccinium* larvæ" refuse to eat *Kalmia*.

I have been unable to detect more than two moults in this species, although it would seem reasonable to expect a third, as *irus*, *Henrici* and *niphon* moult three times. It scarcely seems possible that with the precautions taken I should have twice failed to note one of the moults,

yet there is some discrepancy in the records of the two larvæ which I succeeded in raising from the egg. Since one cannot be positive about what was *not* seen, I give the records just as they stand in my notes—records of what *was* seen. For brevity I use the word "up" to indicate that the larva has taken its position on the silken mat preparatory to moulting; the word "off" to indicate that the skin has been cast; and the word "final" for the last mat to which the chrysalis is to be attached. Where the time is marked with an asterisk it indicates exactitude; elsewhere approximation made by halving the time which elapsed between observations. As these were taken at least four times daily (often more), there is no possibility of any approximate record being more than three hours out of the way.

	FIRST MOULT.		SECOND MOULT.		PUPATION.		
	BORN.	UP.	OFF.	UP.	OFF.	FINAL.	PUPA.
1905.....	May 11. Noon.	May 15. 9 p.m.	May 16. 1.30 p.m.* (2.8 mm.)	May 20. 10.07 p.m.*	May 22. 4 p.m. (5 mm.)	June 6. 1 a.m.	June 9. 3 a.m.
1906.....	May 18. 9 p.m.	May 21. 7 p.m.	May 23. Noon* (2.3 mm.)	May 30. 9 p.m.	May 31. 9 p.m. (4.6 mm.)	June 7. 9 p.m.	June 10. 3.26 a.m.*

It will be seen that the 1905 specimen developed rapidly, completing two moults in eleven days and attaining a length of 5 mm. The ultimate stage was unusually long (more than two weeks) and the larva was three days on its mat before it became a chrysalis. On the other hand, the 1906 larva grew to a length of only 4.6 mm. in thirteen days, was only a week in final stage, and became a chrysalis in two days and six hours.

When nearly full-grown the caterpillar seems to prefer a diet of leaves, and for a day or two refuses the fruit, after which it crawls to the ground, and though several days may pass before it finds a spot suitable for the change to chrysalis, it does not again touch food. The extreme length attained is 17 mm., but the larva decreases rapidly in size during this walking tour, as is the case with *irus*.

*Pupation.*—The caterpillar pupates among the dried leaves and dead grass on the ground, selecting a dark coloured surface in some protected spot. No "cocoon" were formed by any of those raised by me, although they were offered the same opportunities accorded *irus*, which does form such a shelter.

(To be continued.)

## A FEW NOTES ON THE LEPIDOPTERA OF 1905.

BY E. F. HEATH, CARTWRIGHT, MANITOBA.

The season was a very unsatisfactory one for Lepidoptera in my neighbourhood, so far as quality was concerned, and yet several new species turned up—new, that is to say, to this district—and there were sundry other occurrences which I think may be worthy of record.

All Rhopalocera were very scarce; even the more common and abundant species in general did not occur in the tenth part of their usual numbers. I added, however, a species to my collection, *Debis portlandia*, Fabr., of which I took a couple, and saw one or two more. Of the other genera—especially the "Blues" and "Hair Streaks"—very few were to be seen.

Hardly any of the spring species of Noctuids came to my sugared trees, and except a few hibernated specimens, I got little or nothing, until the black currants came into bloom. From them I netted a nice series of "Sharks" of several species, but, strange to say, I did not get a single *Cucullia intermedia*, Speyer, which used to be rather plentiful, to the exclusion of the other species of the genus. *Peridroma saucia*, Hbn., came out in great force later on, and in endless variety. It was accompanied by *Dargida procinctus*, Grt., of which I took fifteen or sixteen examples—five or six times as many as I have seen during all my previous years of collecting. I think I recollect having seen it stated that when, three or four years ago, the larvæ of *saucia* did so much damage in British Columbia, the larvæ of *procinctus* were also found with them.

*Orthosia paleacea*, Esp., as it has hitherto been called, or *O. discolor*, as I should prefer to call it, was fairly abundant, and I took a very nice series showing considerable variation, and with them a few of *O. punctirena*, Smith. I have only recently become aware that this moth, *paleacea* (or *discolor*) was supposed to be the equivalent, or identical with the *Euperia fulvago* of the English lists. I had it in my English collection, and I have not seen here a single specimen identical in colour. Besides, *fulvago* has the black spot in the reniform, whereas *discolor* is without it. The specimen given in Dr. Holland's Moth Book must surely have been of European origin, or, if not, our moth here in the Northwest must be a different species to what occurs further south. I might here suggest of what great assistance it would be if the American entomologists, who are so busy altering generic names that have been in use for, in some cases, a hundred (and even more) years, would kindly publish a list of

their alterations in dictionary form, so that when in doubt as to a name one could see at a glance to what their new names referred. At the same time, I think they are making a mistake in these alterations for the sake of some priority of a name given by some obscure writer, and which has been ignored by his immediate successors, to whom his work must have been known, and which possibly is the less appropriate of the two, and how do they know that the rest of the world will adopt their nomenclature?

To say the least, it does not appear to me to be the way to popularize entomology, which should be one object, if not the chief one, of all writers on the subject. People get rather disgusted when, having acquired one set of names, they have, for no real scientific or economic reason, to forget them and learn others.

At light I hardly took anything, although besides a lamp in the window I had constantly a "trap" in an excellent situation. The trap was built from a sketch given me by my kind friend, Mr. Merrick, of New Brighton, Pa., and judging from the number of flies that came therein to an untimely end, and one catch of moths, it would have been most effective had there been any number on the wing during the season generally. I took no Sphingidae, no Arctians, very few Geometers, and hardly a Micro, and none of the other species which come to light. The flies consisted chiefly of Tipulæ and various water-flies, with a few Ichneumons. If any of my readers would care for such "small deer," I should be happy to save them on receiving instructions how to preserve them. The legs of "Daddy Long Legs" seem to have a rooted objection to remaining attached to their parent bodies, and I should be glad to know how best to deal with them for safe transit.

There was a fair show of *Xylinas* up to almost the middle of September, and I took for the first time that nondescript, *capax*, G. and R., which seems to be stuck on to the *Xylinas* for want of a better place, though I should much question if it really belongs to that genus. After this date the nights became so cool that nothing hardly showed at treacle, and the late autumn species were conspicuous by their absence.

A *Polia* was tolerably abundant, which has hitherto gone by the name of *confragosa*, Morr. I sent some to Mr. Wolley Dod, and he, doubting the correctness of the determination (which was not mine, by the way), sent some to Dr. Dyar, who says he thinks they are a new species between *medialis*, Grote, and *contadina*, Smith.



Some of the *Catocalas* were fairly represented. I took a long series of *briseis*, Edw., showing considerable variation, and a *relicta* so dark that I think it would pass muster as *elda*, Behr. *Cratægi*, Saund., and *præclara*, G. and R., appeared as usual, but the other species I have taken here were almost entirely wanting.

One curious thing happened during the season's collecting, which is, perhaps, worth recording: On the evening of Aug. 29th I was rather late in starting out with my treacle pots to refresh my baited trees, and the moths were just on the wing. At the first tree I came to I saw a large moth flying about which seemed new to me. I rushed back to my house, a few yards away, for my net and killing bottle, but the moth was gone when I got back, and I saw him no more. The next night, on the same tree, and at the same time, to a very few minutes, the same moth—or another—was there again, and I secured it, and it turned out to be *Homoptera lunata*, Drury, its first appearance here.

I have almost forgotten to mention that *Aletia (Alabama) argillacea*, Hbn., has been prospecting in Manitoba to see if the cotton plant—or a suitable substitute—was comprised in its numerous productions. One pioneer fell a victim to its taste for sweets, and now adorns my collection.

#### ON THE OCCURRENCE IN CANADA OF *HIMERA PENNARIA*, LINN., A EUROPEAN GEOMETRID MOTH.

BY GEO. W. TAYLOR, WELLINGTON, B. C.

A Geometrid moth sent to me for determination by Dr. Fletcher some time ago, appears to belong to the well-known European species, *Himera pennaria*, Linn. This species has not previously been recorded as occurring on this continent, and there is always the suspicion of a mistake when a species belonging to the Old World fauna is reported in America for the first time; but this species is distinctly labelled as captured by Mr. L. Fanshawe at Tamarisk, Manitoba, and I see no reason to doubt the genuineness of the record.

The genus *Himera* (= *Colotris*, Hubner) is a peculiar one, and contains only this single species.

A peculiarity by which it may be easily recognized is the presence of a little tuft of hair arising from below the base of each antenna, and drooping across the eyes to the middle.

In our lists this genus should be placed immediately before *Ennomos*.

## NOTES ON THE CLASSIFICATION OF THE PERLIDÆ.

BY NATHAN BANKS, EAST FALLS CHURCH, VA.

In a recent paper on the genus *Chloroperla* I divided this genus, as it had been used, into two genera; neither of which being a true *Chloroperla*, I proposed the names *Isoperla* and *Alloperla*. The character I used in this division was one proposed by Prof. Needham to separate the *Perlina* from the *Nemourina*. This is the condition of the median vein near the base of fore wings, whether united to the radius, or running parallel to the radius. In *Isoperla* the median vein is as in *Perla*, running parallel to the radius; while in *Alloperla* the median vein is like the *Nemourina*, united at an angle to the radius. From a study of the anal region of the fore wings I find that these two genera can be more readily known by another character, and that in this respect also *Alloperla* is related to the *Nemourina*. This new character is the condition of the two lower branches or veins from the anal cell; in *Isoperla* (type *C. bilineata*, Say), these two veins arise separately, as in *Perla*, but in *Alloperla* (type *C. imbecilla*, Say), these two veins unite before the cell, or rather, there is one forked vein instead of the two simple ones. This latter condition obtains in the *Nemourina*. The application of this character places the same species in *Isoperla* and *Alloperla* as does the condition of the median vein.

In the *Nemourina* there is one forked vein from the lower part of the anal cell, the outer branch bowed up to form an elongate cell. In the *Capnina* there is but one vein from the anal cell below, and this is not forked, a character which will distinguish this tribe from other *Perlida*. In the *Trans. Amer. Ent. Soc.*, XXVI, p. 240, 1900, I separated the *Capnina* by the unbranched radial sector; there are, however, one or two exceptions, or rather, the apical venation is confused so that the radial sector appears branched; the character of the anal region seems to be constant, and the two characters together will readily distinguish this tribe.

The *Pteronarcini* differ from all other *Perlida* in having a series of cross-veins in the anal region; as well as by their approximate anterior coxæ.

In the true *Perlina* there are two simple branches from the anal cell below; but in two species of *Acroncuria* (*pacifica* and *nigrita*) there are three branches, or one simple and one forked vein; in some other species of *Acroncuria* one of the branches is sometimes forked.

Several authors have divided the *Perlida* into two sub-families, *Perlina* and *Nemourina*, but the structure of *Alloperla*, related to *Perla*

by well-developed setæ, to *Nemoura* by venation, shows that the differences between these groups are not of more than tribal value. If it is desired to have two sub-families, I think that the *Pteronarcini* should be opposed to all other *Perlidae*. However, I think that four tribes better express the relationships of the groups.

These four tribes may be tabulated as follows :

- |   |                       |
|---|-----------------------|
| 1. Well developed setæ present . . . . .  | 2.                    |
| Setæ obscure or absent ; one branched vein from the anal cell of fore wings ; no series of cross-veins in anal region ; never greenish or yellowish species . . . . .                                   | <i>Nemourini</i> .    |
| 2. A series of cross-veins in anal region of fore wings ; anterior coxæ approximate . . . . .   | <i>Pteronarcini</i> . |
| Rarely a series of cross-veins in anal region ; anterior coxæ widely separate . . . . .   | 3.                    |
| 3. Anal cell with two simple or one branched vein from below ; radial sector generally forked beyond or at anastomosis ; median vein usually running parallel to radius in base of fore wings . . . . . | <i>Perlini</i> .      |
| Anal cell with but one unbranched vein from below ; radial sector usually not forked beyond nor at anastomosis ; median vein running into radius much before base . . . . .                             | <i>Capnini</i> .      |

The genus *Perlinella*, like *Chloroperla* of authors, contains some discordant species. The type of *Perlinella*, *P. trivittata*, has some cross-veins in the anal field, a character of *Pteronarcys*. The *Perla placida*, Hag., and some allied forms, differ from *Perlinella* in lacking such cross-veins, and are more allied to *Perla*. They differ from that genus, not only in venation, which is allied to *Perlinella*, but also in having much longer setæ, with very elongate joints. Therefore I place *P. placida* as the type of a new genus, *Perlesta*, distinguished by the characters given in the table below. The *Perlinella frontalis*, Bks., differs from *Perlinella* and *Perlesta* in having a forked vein from the anal cell, instead of two simple veins ; it is therefore related to *Alloperla*. It differs from *Alloperla* by having a series of cubital cross-veins in the hind wings, and by the two-branched radial sector of fore wings. It therefore belongs to new genus *Paraperla*.

All the species originally placed in *Chloroperla* are now placed by European authorities in *Isopteryx*, a later genus ; therefore *Chloroperla* replaces *Isopteryx*.

The genera of *Perlidae*, now known to occur in the United States and Canada, may be distinguished by the following tables of the four tribes. A

few names may require explanation. *Perlodes* replaces *Dictyopteryx*, as the latter name is preoccupied in Lepidoptera; *Neoperla* replaces *Pseudoperla*, the latter having been used previously in the Orthoptera. Prof. Klapalek, who has seen the type of *Teniopteryx fasciata*, Burm., places it in the genus *Rhabdiopteryx*.

*Pteronarcini.*

1. In the fore wings the space between the basal part of radial sector and median vein shows some complete or incomplete cross-veins; larger species.....*Pteronarcys*.  
This space is free from cross-veins; much smaller species.....*Pteronarcella*.

*Perlini.*

1. Many cross-veins between apical branches of the radial sector, as well as between radius and radial sector.....*Perlodes*.  
Few, if any, cross-veins between apical branches of the radial sector, and rarely between radius and radial sector.....2.
2. Several cross-veins in middle part of fore wing beyond the anastomosis.....*Acroneuria*.  
Few, if any, cross-veins in middle part of fore wing beyond the anastomosis.....3.
3. Ocellar triangle more than twice as broad as long; usually one cross-vein between radial sector and radius, near end of latter.. *Isogenus*.  
Ocellar triangle not twice as broad as long; only abnormally a cross-vein between radius and radial sector beyond anastomosis.....4.
4. But two ocelli.....5.  
With three ocelli.....7.
5. Setæ but little longer than width of abdomen; the pronotum much broader than head.....*Peltoperla*.  
Setæ much longer; pronotum barely broader than head.....6.
6. Ocelli about one or two diameters apart; joints of setæ only one or two times longer than broad.....*Neoperla*.  
Ocelli four or five diameters apart; joints of setæ three to five times longer than broad, often a cross-vein in anal field of fore wing.....*Atoperla*.
7. A series of cross-veins in anal field of fore wing; a series of cross-veins in the cubital area of hind wings; setæ not longer than abdomen.....*Perlinella*.  
No cross-veins in anal field of fore wing, except those to form the cell.....8.

8. From the anal cell there extends below one vein, which is soon forked; the median vein unites with radius near base, usually but one cross-vein beyond the end of subcosta . . . . . 9.  
From the anal cell there extend below two simple veins; the median vein near base runs closely parallel to radius for some distance . . . 11.
9. No veined anal field in hind wings; only two cross-veins in cubital area of hind wings; small greenish species . . . . . *Chloroperla*.  
A veined and folded anal field to hind wings . . . . . 10.
10. A series of cross-veins in cubital area of hind wings; radial sector of fore wings forked twice beyond anastomosis . . . . . *Paraperla*.  
No series in cubital area of hind wings, only one near base and one near tip; small greenish or yellowish species . . . . . *Alloperla*.
11. Hind wings with but two cross-veins in cubital area, one near base, one near tip, small greenish or yellowish species . . . . . *Isoperla*.  
Hind wings with a series of cross-veins in cubital area; radial sector usually twice-forked . . . . . 12.
12. Setae longer than abdomen, joints of middle three to five times as long as broad, first fork of radial sector much beyond anastomosis . . . . . *Perlesta*.  
Setae shorter than abdomen, joints of middle only one or two, rarely three, times as long as broad . . . . . *Perla*.

*Nemourini.*

1. Second joint of tarsus subequal to first . . . . . 2.  
Second joint of tarsus much shorter than first . . . . . 4.
2. An oblique cross-vein beyond end of subcosta . . . . . 3.  
No oblique cross-vein beyond end of subcosta . . . . . *Teniopteryx*.
3. Radial sector forked twice beyond anastomosis; in fore wings the cubitus, beyond cross-veins, bends up to form an elongate cell . . . . . *Tenionema*.  
Radial sector forked but once beyond anastomosis; the cubitus not forming an elongate cell . . . . . *Rhabdiopteryx*.
4. An oblique cross-vein beyond subcosta; wings not involute. *Nemoura*.  
No cross-vein beyond subcosta; wings involute . . . . . *Leuctra*.

*Capnini.*

1. Apical submarginal space with cross-veins . . . . . *Capnura*.  
No such veinlets . . . . . 2.
2. The space beyond discal cell longer than discal cell . . . . . *Arsapnia*.  
This space much shorter than discal cell . . . . . *Capnia*.

## NEW SPECIES OF NOCTUIDÆ FOR 1906.

No. 2.\*

BY JOHN B. SMITH, SC. D., NEW BRUNSWICK, N. J.

*Cyathissa quadrata*, n. sp.—Ground colour creamy-white, more or less washed with luteous, the maculation black, contrasting. In type it is like that of *percara*, and the lines are identical in course; there is the same basal dash, and the quadrate pale blotch on the costa in median space is very similar. But there is no green shading whatever in the wing, the black markings are more intense, more contrasting, usually broader, and, in the median space, they extend below the costal pale area, shading into smoky-brown at about the middle of the wing. There is also a costal black patch just beyond the t. p. line, which is not present in the older species. The secondaries have the dark median band and dusky outer border well defined, whereas in *percara* these are entirely absent or only indicated. Beneath, the body is deep sooty-black, with the legs contrastingly white-marked.

Size as in *percara*.

*Habitat*.—San Bernardino Ranch, Cochise Co., Arizona; 3,750 feet; in August. F. H. Snow.

One male and two females in good condition. This species bears almost the same relation to *percara* that *ochracea* does to *pallida*, and the replacement of the green by luteous will serve to distinguish them, as well as the heavier and more extensive black markings. There is no question of discoloration of green, such as is sometimes seen in *percara*.

*Cyathissa ochracea*, n. sp.—White with a slight creamy tinge. Disc of thorax with ochraceous scales in some specimens. Primaries, basal space white, shaded with ochreous along the inner margin, two black dots on costa. The median space is defined by broken, irregular, narrow black lines, is ochraceous, fading out to white on the inner margin, and with a large quadrate white blotch on costa; this with sharply-defined black-edged margins. Beyond the t. p. line on the inner margin is a large blackish blotch, which does not quite reach the inner angle. Elsewhere the space beyond t. p. line is rather irregularly shaded with ochreous. Secondaries white, tending to a dusky shading toward anal angle. Beneath white; primaries with maculation of upper side faintly reproduced; secondaries with a narrow extra-median line and a small discal spot.

\*No. 1 is in the Journal of the N. Y. Ent. Soc. for March, 1906.  
July, 1906

Expands: .75-.90 inches = 19-22 mm.

*Habitat*.—Baboquivaria Mts., Pima Co., Arizona, July 15. O. C. Poling.

One male and three females in good condition. The maculation is like *percara*, but the green is replaced by ochreous, and there is no longitudinal mark at base. The ochreous shade is not a discoloration.

*Cerma marina*, n. sp.—Ground colour dark, brownish-gray, with black powderings, which, on the primaries, are reinforced by amethystine scales in all the lighter areas. Head and thorax with gray-tipped scales, disc of patagia with greenish admixture. Primaries so powdery as to obscure the ordinary maculation; but in general the median space is darker than the rest of the wing, and the claviform and space between reniform and orbicular are darker still and nearly blackish. Basal line gray with black scale edges, extending across the cell. T. a. line gray, outwardly oblique, broken, irregularly sinuate, outwardly marked by black scales. T. p. line outcurved over cell and incurved below, irregularly denticulate, outwardly pale shaded. A broad but rather indefinite median shade band crosses between the ordinary spots and darkens the outer part of the median space. S. t. line pale, punctiform, irregular. A series of black terminal lunules and fringes cut with gray. Claviform clouded with blackish, of moderate size. Orbicular large, round, incompletely defined, marked by green scales. Reniform large, upright, centrally constricted, incompletely defined, marked by greenish scales. Secondaries dirty-gray or whitish, fringes darker, an incomplete submarginal line toward anal angle. Beneath smoky, paler toward base, a common extra-median darker line and the inception of a median band on costa of all wings.

Expands: 1.00-1.05 inches = 25-26 mm.

*Habitat*.—So. Arizona, Poling; Santa Catalina Mts., Pinal County, Arizona, Dr. Barnes.

One male and one female. The species is darker and more obscurely marked than any of those previously described, except *galva*, Strck. The latter is from New York and lacks all green, recalling *olivacea*.

*Setagrotis dolens*, n. sp.—Ground colour somewhat bluish ashen-gray. Head and thorax concolorous, vestiture hair and elongate flattened scales. Abdomen a little more yellowish. Primaries with a tendency to a brownish shading outwardly. Basal line a dark dot on costa and median vein. T. a. line single, nearly upright, a little outcurved in the inter-spaces. T. p. line single crenulate, obscure or altogether lost, somewhat

acutely bent on costa and even below. An obvious smoky median shade is oblique from costa over reniform and darkens the outer part of median space. S. t. line pale, broken, very even, accompanied by a somewhat rufous smoky shade. A series of small terminal lunules. Fringes a little rufous. No claviform. Orbicular concolorous, round when visible, indicated by orange scales. Reniform darkened by median shade, and more or less edged with orange scales. Secondaries in the male gray; in the female smoky-yellowish, in all with a discal lunule. Beneath, primaries gray, with an incomplete smoky outer band. Secondaries whitish, powdery, with a round discal spot and an incomplete punctiform outer band.

Expands: 1.35-1.60 inches = 34-40 mm.

*Habitat*.—Arrowhead Lake, British Columbia, June 8-15; Beulah, Manitoba, Aug. 28.

One male and two females in good condition in Dr. Barnes's and my own collection. The species is allied to *Quebecensis*, and like that resembles a *Carneades* (*Euxoa*) of the *Bostoniensis* type. It differs from the eastern species in the less obvious maculation and in the outward rufous shadings. There is quite a bit of variation indicated since the male has nothing except the reniform and median band that is at all obvious.

*Euxoa esta*, n. sp.—Head, thorax and primaries smoky black, with minute yellow powderings. Collar with a deeper velvety-black median line, dorsal tuftings of thorax and edges of patagia with some white scales. Primaries with all the maculation obscured, yet most of it traceable on good specimens. Usually the median lines are traceable by yellow atoms more or less black-edged each side, the t. p. being most obvious. S. t. line punctiform, also marked by yellow atoms and velvety-black defining scales. There is a very narrow pale line at base of fringes. At base is a black longitudinal mark. Claviform narrow, black-margined, sometimes with yellow atoms, extends not quite to centre of median space. Orbicular moderate in size, round or oval, concolorous, ringed by black and yellow scales. Reniform kidney-shaped, moderate in size, with a ring of yellow scales margined by black. Secondaries in male yellowish-white at base, becoming smoky outwardly; in female smoky throughout, but paler basally; the tendency is to a smoky discal spot. Beneath, primaries whitish to extra median line, smoky and powdery beyond; secondaries



whitish, outer marginal region powdery; a small discal spot and a distinct outer transverse diffuse line or band.

Expands: 1.30-1.48 inches = 32-36 mm.

*Habitat*.—Wellington, British Columbia, July 30, Aug. 14 and Sept.

13. Theodore Bryant.

One male and three females, all in good condition, two of them from Dr. Barnes's collection, two from my own. This is allied to *velleripennis*, which I have from the same locality, but is not so black, and the vestiture is somewhat more roughened. The type of maculation is much the same, but in the old species there is no yellow powdering. *Punctigera*, which is also allied, is a smoother species, in which there is a brownish tinge, and the yellow margins to the ordinary spots are broader, not made up of elevated individual scales.

*Hadena bultata*, n. sp.—Ground colour a reddish luteous, powdered and overlaid by a darker, more brownish colour, in which there is a vague rosy or coppery tinge. Head and collar concolorous, somewhat deeper in shade, collar and patagia well marked, but not up-lifted, dorsal tuftings small. Primaries with all the usual maculation obvious, but variably distinct, never contrasting. Basal line single, narrow, irregular, outwardly oblique. T. a. line single, irregular, as a whole a little outcurved, tending to obsolescence, sometimes with a paler preceding shade. Median shade line a little smoky, outwardly oblique through the bottom of reniform, then forming almost a right angle, evenly oblique to the inner margin. T. p. line smoky, single, almost crenulate, outwardly bent over cell and evenly oblique below. S. t. line of the pale ground, a little sinuate, feebly defined. A series of dusky terminal lunules, beyond which is a yellow line at the base of the fringes. Claviform of good size, broad, reaching the median shade, concolorous, outlined in coppery red-brown. Orbicular round or nearly so, moderate in size, outline and centre a little darker than ground. Reniform large, a little constricted, darkened by the median shade. Secondaries smoky-yellowish with a glistening surface, a vague smoky discal spot and extra median line. Beneath yellowish, with a smoky exterior line and discal spot on all wings.

Expanse: 1.40-1.50 inches = 35-38 mm.

*Habitat*.—Glenwood Springs, Colorado, end of June and early July. Dr. Barnes.

Two males and two females in fair condition. The species is unlike the usual type of *Hadena*, but is an ally of that series in which the secondaries are slightly excavated below the apex. The range of variation is in the greater or less powdering which may reach a point making it difficult to distinguish the markings.

*Mamestra tuana*, n. sp.—Ground colour dull, smoky-brown, powdery. Head and collar somewhat paler, crossed by darker transverse lines. Tips of collar and thoracic tuftings paler. Primaries with all the maculation complete, not contrasting. Basal line yellowish-brown, margined with black, lunate, and interrupting a thick, diffuse basal black streak. T. a. line geminate, outer portion black, inner brown, included space lighter brown, outwardly oblique and outcurved between the veins. T. p. line geminate on costa, outer portion lost over cell, inner black, oblique to the cell, then forming a distinct obtuse angle evenly to the inner margin. Beyond the t. p. line the wing is paler to the narrow, sinuate s. t. line, which is of the ground colour, usually followed and sometimes preceded by black marks. A slender black terminal line followed by a yellowish line at base of fringes, from which the fringes are cut interspaceally, the yellow being interrupted by a brown interline. There is a somewhat obscure median shade line, which is oblique over the reniform and runs close to the t. p. line below the cell. Claviform concolorous, distinctly black-ringed, short and broad, sometimes with a dusky shading across the cell. Orbicular of good size, round or obliquely oval, a little paler, incompletely black-ringed. Reniform upright, of good size, broadly oval, a little darker than ground, obscurely black-ringed, the outer border margined with white, forming the only conspicuous feature in the wing. Secondaries smoky-fuscous, a little paler at base, fringes with a yellow line at base. Beneath smoky, powdery, with a well-defined common extra median line and a well-marked discal spot on secondaries.

Expands: 1.15–1.32 inches = 29–33 mm.

*Habitat*.—Huachuca Mts., Arizona.

Three males and eight females, in fair condition, all of them from Dr. Barnes, and all without date. The species is rather a well-marked one, between *noverca* and *Goodelli*, with the wing form of the latter rather than the former. The little touch of white on the reniform lightens up the wings materially.

*Mamestra saretta*, n. sp.—Ground colour bluish ash-gray, head and thorax somewhat powdery. Front crossed by a black transverse line

below antenna. Collar with a black median line; patagia with a black submargin. Thoracic and abdominal tuftings well marked. Primaries with a yellowish or brownish shading in the median cell above the claviform, sometimes confined to the reniform only. Basal space paler gray costally, the area limited inferiorly by a somewhat irregular black streak, which extends almost to the t. a. line. T. a. line outwardly oblique, outcurved, reaching the inner margin at or just before its middle, even, geminate, outer part black, slender; inner smoky-gray, obscure. T. p. line rather even, geminate, mostly lost over the cell, with a sharp, well-defined incurve in the submedian interspace, where it is black and preceded by a white lunule. S. t. line punctiform, irregular, variably marked by irregular preceding dashes and following shades, best marked by a whitish lunule opposite hind angle. A lunate black terminal line, followed by a slender yellowish line at the base of the fringes, which are cut with black and gray. Claviform narrow, pointed, extending across the cell, accompanied by a black shading that forms a more or less conspicuous bar. Beyond the t. p. line the dusky shading is continued through the interspace, cut by the lunule of the s. t. line. Orbicular narrow, oblique, elongate, usually open to costa, black-ringed and usually a little paler than ground. Reniform large, oval, a little drawn in centrally from the outer side, somewhat oblique, black-ringed, more or less shaded with yellowish or brownish. Secondaries white in the male, with a mere trace of blackish edging, whitish in the female, becoming smoky outwardly. Beneath whitish, primaries smoky on disc; secondaries with a trace of a punctiform outer line and discal spot.

Expands: 1.00-1.12 inches = 25-28 mm.

*Habitat*.—Arizona; Huachuca Mts., May 8-15; Wilgus, Cochise Co.; Gila Co., May 14 and June; Minnehaha, Yavapai Co., Aug. 20 and Oct. 2-5.

Nine males and four females from Dr. Barnes, seven males and ten females from Mr. Hutson. The species resembles *vicina* in general appearance, and some of the larger examples might, if alone, be readily referred to that species; but with the series at hand, the smaller size, brighter blue-gray colour and clear white secondaries of the male stand out conspicuously and make for an easy recognition of the species.

*Orthodea gigas*, n. sp.—Ground colour a rather bright brownish-red over luteous, the markings smoky. Head and thorax concolourous, collar and patagia marked, a small dorsal tuft obvious anteriorly. Primaries

without strong contrasts, more or less powdery and dotted, all the maculation traceable. Basal line geminate, smoky, somewhat diffuse, a little outcurved. T. a. line geminate, broken, the two portions not entirely parallel, a little oblique outwardly and somewhat outcurved in the interspaces. T. p. line often broken, the inner more or less lunulate or crenulate, outer more or less punctiform, as a whole rather abruptly bent opposite upper end of cell, and then almost evenly oblique to the margin. In some specimens a supplemental series of dusky and yellow venular dots crosses the s. t. space. Median shade broad, almost the darkest part of the wing, oblique from costa between ordinary spots, then parallel with and close to the t. p. line. S. t. line punctiform, yellowish, preceded by a dusky shade, which really marks the line, and this dusky shading sometimes extends beyond, into the terminal space. Sometimes only the veins are darkened and there is a checkered appearance. A series of small dusky lunules is at the base of the fringes which have a dusky interline. Claviform absent. Orbicular round or oval, not well defined, concolorous. Reniform moderate in size, kidney-shaped, incompletely defined, usually a little gray-powdered. Secondaries dark smoky with yellow fringes. Beneath smoky, varying in shade, with a distinct extra median, and less marked s. t. common transverse lines, and on the secondaries a distinct dark discal spot.

Expands: 1.40-1.60 inches = 35-40 mm.

*Habitat*.—Southern Arizona, Poling; Huachuca, Arizona; Santa Catalina Mts., Pinal Co., Arizona, Aug. 26-30.

Three males and three females in good to fair condition, all from Dr. Barnes. The species is altogether unlike any of our previously-described forms, and was at first sight associated with *Pronoctua*, as probably a form of *phyllophora*. It belongs in that section of *Eriopyga*, as used by Hampson, in which the front is unmodified, anterior tibiae are unarmed, abdomen not tufted, vestiture of thorax scaly hair, male antennae ciliate, femora clothed with thin hair, and cell of male with long fine decumbent hair.

*Himella flosca*, n. sp.—Ground colour a mottled-dull smoky-gray, in which all the maculation is obscured. Front of head tending to become a little paler; collar pale-tipped. Primaries so mottled and the usual lines so broken and little contrasting that it is difficult to trace them. The geminate basal line is usually well enough marked. T. a. line seems almost evenly oblique outwardly; but is with difficulty followed out. T. p.

line a little outcurved over cell and even less incurved below, almost entirely lost. S. t. line yellowish, almost evenly parallel with the outer margin, sometimes emphasized a little by darker preceding scales, and this is the best marked line on the wing. No claviform. Orbicular round or nearly so, small or moderate in size, somewhat paler-ringed. Reniform of good size, upright, centrally a little constricted, incompletely pale-ringed, with a tendency to a few white scales at the lower outer angle. Secondaries smoky in both sexes, rather darker in the male. Beneath smoky, more or less powdery; secondaries paler, both wings with variable outer lines and discal spots.

Expands: 1.06-1.20 inches = 26-30 mm.

*Habitat*.—Huachuca Mts., Arizona. Dr. Barnes.

Six males and two females in fair to good condition. An undersized female from Wilgus, Cochise Co., may belong here, but offers some points of difference that make it doubtful. The species looks more like an *Orthodes*, but has only a slight covering of silky hair in the cell on the under side, and the wing-form and general habitus is not unlike *contrahens*.

*Teniocampa fractura*, n. sp.—Ground colour a pale reddish luteous. Head and thorax immaculate. Primaries with all the lines broken, but easily traceable. Basal line geminate, smoky, marked on the costa and through the cell. T. a. line geminate, nearly upright, outer line sometimes nearly complete. T. p. line almost parallel with outer margin, punctiform, geminate, outer series incomplete, dots of inner series closely placed. S. t. line pale, preceded by a dusky shading, only a little irregular. A series of obscure terminal dots and a yellow line at base of fringes. No claviform. Orbicular round, concolorous, incompletely outlined by blackish scales. Reniform barely traceable, large, upright, concolorous, indicated by scattered scales. Secondaries dull, very pale, smoky-yellowish, scarcely darker in the male. Beneath with a reddish tinge, secondaries paler, with a variably marked outer line, incomplete on secondaries, and on the latter a small discal spot.

Expands: 1.08-1.12 inches = 27-28 mm.

*Habitat*.—Huachuca Mts., Arizona. Dr. Barnes.

Four males and two females in fair condition. The species by its simple male antennae and general appearance is allied to *peredia* and *fulvata*, but is more simply marked and somewhat broader-winged.

*Tenioampa Indra*, n. sp.—Ground colour luteous, in the female tending to smoky-brown. Head and thorax without markings. Primaries with basal and median lines geminate; in the male more or less obviously defined by smoky or blackish scales, in the females better marked by the pale filling, which in the male is concolorous; the darker the wing, the better the pale stands out. Basal line a little outcurved, extending to submedian vein. T. a. line outwardly oblique, a little curved and a little outcurved in the interspaces. T. p. line abruptly bent on the subcosta, then a little sinuate, but on the whole nearly parallel to outer margin; the outer portion of line is punctiform, and occasionally, when the dark shading extends inward, the entire line appears crenulate. An obscure, diffuse median shade over reniform, and below it close to the outer line. S. t. line of the pale ground, relieved by dark preceding shades or powderings, a little irregular, reaching the margin at or just within the inner angle. A series of small blackish terminal lunules and a yellow line at base of fringes. Orbicular somewhat irregular, moderate in size, concolorous, scarcely relieved by yellowish scales. Reniform of good size, broad, kidney-shaped, or a little constricted, ringed with yellowish and dusky filled; secondaries smoky, paler at base, and altogether paler in the male. Beneath powdery, primaries smoky on disc, with a crenulated outer line; secondaries paler, with an incomplete outer line and a discal spot.

Expands: 1.10-1.30 inches = 27-32 mm.

*Habitat*.—Arizona: Minnehaha, Yavapai Co., Sept. 25 to Oct. 3; Huachuca Mts., Chiricahua Mts., Wilgus, Cochise Co.; Tonto Basin, Gila Co.

Eighteen males and twenty-four females, of which all save nine were sent in by Mr. Hutson, and the remainder came through Dr. Barnes. The species is allied to *oviduca* and *Utahensis*, differing from the eastern form by its larger size and less stumpy primaries, in addition to differences of maculation, and from the western in the distinct s. t. line, completely filled reniform and altogether more powdery appearance.

*Perigonica punctilinea*, n. sp.—Ground colour a creamy-gray, tending to luteous, more or less powdered with black or brown atoms. Head and thorax immaculate. Primaries ranging from almost uniform powdery to a fairly well-marked form, in which all the ordinary maculation is traceable. Basal line single, upright, punctiform, marked on the veins only. T. a.

line single, upright or a little curved, punctiform, marked by dots on the veins and by powdery atoms in the interspaces. T. p. well removed outwardly, best marked on the costa, then with an abrupt outward bend over cell, evenly curved toward the inner margin, punctiform on the veins as usual. The median shade is marked by an outwardly oblique trigonate blotch, the point of which reaches the bottom of the reniform, and below this the shade is inwardly oblique, diffuse, and tends to become obsolete. S. t. line marked on costa by a dusky triangular preceding blotch and, below that point, partly by a narrow yellowish line and partly by preceding or following powderings. A punctiform line at the base of the fringes. Orbicular wanting. Reniform narrow, upright, dark-filled and forming the most persistent of the markings, traceable in all specimens. Secondaries smoky with paler fringes. Beneath, powdery, with a punctiform outer line and a discal spot on all wings.

Expands: 1.26-1.40 inches = 32-35 mm.

*Habitat*.—Southern Arizona, April 15-30. Poling.

Two males and five females in fair to poor condition. This species has less conspicuously angulated and pointed primaries than any other of the genus, and approaches *Teniocampa pectinata* somewhat in habitus. The general appearance and the type of maculation suggest *Perigonica*, however, and for the present I consider the reference to that genus warranted.

*Lythrades minutissima*, n. sp.—Head white in front. Thorax dull ochreous, with disc and patagia obscurely white-lined. Primaries pale creamy-yellowish, interspaces marked with ochreous to or a little beyond the middle, and from that point the veins are white-marked, the line extending through and cutting the fringes. Secondaries whitish. Beneath, primaries pale smoky-yellowish, secondaries white.

Expands: .56 inch = 14 mm.

*Habitat*.—Yavapai Co., Arizona, May 21, 30, 31. Hutson.

Three male examples in good condition. This, while not the smallest in expanse, is the slightest of the Heliothids known to me, and is almost Pyralidiform in appearance. The darkening by the ochreous interspaces through the centre of the wing is characteristic.

*Campometra protea*, n. sp.—Ground colour dull yellowish-brown, overlaid by darker or lighter scales, ornamentation dark brown or black. Head usually darker brown. Collar with a broad brown band across the middle, or the lower half of the collar is dark. Thoracic disc, including

patagia, crossed by alternate pale and dark bands, the contrasts varying. Abdominal rings narrowly dark banded. Primaries, basal line single, black, accompanied by a pale shade line, extends obliquely inward across the costal area. T. a. line broken near the centre, dislocated, forming rather a band than a line, and this band may be black or brown, or brown with black margins. The median line is black, narrow, a little irregular and somewhat curved, and this usually marks the division between the paler basal third of the wing and the darker outer half of the median space. T. p. line single, black, irregular, well and somewhat acutely curved over the cell, reaching the inner margin a little beyond the middle. S. t. line pale, irregular, forming a somewhat well defined jog below the apex, preceded by dusky or black shadings. A lunate or almost scalloped terminal black line followed by pale or yellowish venular marks and a dusky interline on the paler fringes. The orbicular is a black point, which may or may not be obvious. The reniform is an irregular, nearly upright, black line, beyond which is a diffuse whitish or pale shading. Secondaries with basal two-thirds of a somewhat paler ground than primaries, crossed by more or less obvious brown or blackish lines to a distinct narrow black line, which borders a dusky band that is outwardly limited by the black, pale bordered s. t. line. Terminal line and fringes as in primaries. Beneath an even, dull, deep smoky-brown, with a common darker extra median line, within which are three less obvious similar lines, and a discal spot on all wings.

Expands: 1.20-1.48 inches = 30-37 mm.

*Habitat.*—Yavapai Co., Arizona, May 21-31. Hutson. Babaquivera Mts., Pima Co., Arizona, in September. Poling. Readington, Arizona. Dr. Barnes.

A series of over 50 examples is before me at present, and I have had nearly as many more for comparison, all from the same general faunal region. No two examples are entirely alike, and the above description applies to a form in which all the normal markings are well defined. In the actual course of the lines there is little real variation; but in the amount of contrast between the spaces there is much. The basal and terminal spaces may be bluish-powdered; the outer half of the median space may be contrastingly dark, or it may be scarcely shaded; the whitish shade beyond reniform may be scarcely noticeable, or it may extend to the costa and form a large quadrate blotch. As a general thing the males are the smaller, although the largest males exceed the smaller females.



I suspected when I first received this large lot of specimens that it might be one of the Central American species, and sent examples to Sir George F. Hampson for comparison. He assures me that the species is not represented in the British Museum collections, and as it fits no description known to me I assume that it is new.

*Campometra paresa*, n. sp.—Head and collar deep, almost blackish-brown. Disc of thorax, including patagia, whitish, more or less powdered with brown scales. Abdomen deep brown, incisures narrowly black-ringed. Primaries with a broad whitish costal area, starting from the entire width of the wing at base, narrowing gradually to before the s. t. line, where it is abruptly terminated; terminal space beyond s. t. line also whitish, interrupted by a dusky cloud at about its middle. The intervening triangle is deep, blackish-brown. The costal pale space may be without obvious marks except costal dots at inception of usual lines, or it may be crossed more or less obviously by the basal line, which is narrow and inwardly oblique; by the t. a line, which is broken, dislocated and fasciform; by the median line, which is narrow and linear; and by the t. p. line, which is black and outwardly oblique. An extension of the median dark triangle reaches the apex and dilutes the pale terminal space at that point. S. t. line pale, outwardly shaded by reddish, irregular and a little sinuate in course. The reniform is pale, narrow, ovate, and breaks into the dark triangle from the costal area. There is a rivulous black terminal line following the scallops of the wing margin. Secondaries blackish-brown from base to s. t. line, the latter a little sinuate, pale, followed by a reddish shading, the space beyond whitish, with brown powderings; a blackish or brownish cloud breaks the pale area in some examples. Beneath, dull smoky-brown, with a dusky discal spot and obscure transverse lines at and within the middle on all wings.

Expands: 1.24-1.48 inches = 31-37 mm.

*Habitat*.—Yavapai Co., Arizona, May 23-31. Hutson. So. Arizona, Poling.

Six males and four females in fair to good condition. Although this species looks like *selenis*, it is really so close to *protea* that I was at first inclined to believe it only an extreme variety. The maculation, so far as it is traceable, is almost identical, and the description of the former will answer very nearly for the present species. But though I had so many examples, I could not get any real intermediate forms to this type with whitish costal and terminal area, and as this was also uniformly darker on head, thorax and abdomen, I concluded to risk description.

*Homopyralis edilis*, n. sp.—Ground colour a reddish luteous, overlaid and powdered by brown and black scales forming the ornamentation. Head, collar and palpi deep chocolate-brown; thoracic disc more powdery. Abdomen of the ground colour, the segments obscurely dusky-ringed. Primaries with outer half of basal space shaded with dusky to the t. a. line, which is single, black, irregular, upright, and preceded and followed by a bar of the ground colour. At the edge of this bar in the cell is the black, punctiform obicular, and beyond it and to the black, oblique oblong reniform, a brown shade fills the cell and extends across the wing, forming the most obvious feature. The outer edge of this dark median fascia is at about the middle of the wing, and beyond it the pale ground extends to the dusky terminal space, broken on the costa by a deep brown blotch, which fills the s. t. space at that point. T. p. line slender, black, single, irregular, tending to become lost. S. t. line indicated only by the dusky shading, except at costa, where it is defined by the dark blotch. A series of black terminal lunules, each followed by a yellow edging which does not cross the fringes. The secondaries have the maculation of the primaries continued across the disk, and an oblong black discal spot. Beneath, pale yellowish, powdery, with obscure smoky median lines and a discal spot on each wing.

Expands: .74-.82 inches = 18.5-20.5 mm.

*Habitat*.—Yavapai Co., Arizona, June 23, 27, Aug. 2, 3, 8, 24. Mr. Hutson.

Five males and one female in fair to good condition. The August captures are labelled Minnehaha. In a general way the species resembles the eastern *tactus*, but is smaller, slighter and with a broader median band, in which the reniform is neither as large nor as conspicuous.

Mr. Hutson's collections in this genus included also a specimen of *H. cinctus*, described from Prof. Snow's material, and in the allied genus *Yrias* a large series of *Y. clientis*, *Y. repentis* and *Y. volucris*, as well as smaller numbers of *Y. irentis* and *Y. albiciliatus*.

*Renia Hutsoni*, n. sp.—Head, thorax and primaries fawn-gray, tending to reddish; the males darker, with smoky powderings. Head and thorax immaculate. Primaries, t. a. line upright or a little oblique, smoky, with a preceding yellowish line, tending to become broken and diffuse in the male. T. p. line smoky, almost parallel with outer margin, even, followed by a yellowish line. S. t. line yellowish, a little irregular, preceded by a variable, often broken dusky shading, reaching the inner

margin very close to the t. p. line. There is an almost upright diffuse median shade through the middle of the median space. Orbicular a small, round, yellowish dot, scarcely traceable in the female, more obvious in the male. Reniform narrow, upright, yellowish, with or without a black dot inferiorly. Secondaries dull, smoky. Beneath, powdery, primaries with one, secondaries with two more or less imperfect transverse lines, all wings with a discal lunule.

Expands : .95-1.05 inches = 24-26 mm.

*Habitat*.—Arizona, Minnehaha, Yavapai Co., Aug. 18 to 21. Mr. Hutson. Southern Arizona, Aug. 1-15. Poling.

Seven males and four females, all in at least fair condition, and all save one taken by Mr. Hutson. The species is an ally of *flavipunctalis* and *pulverosalis* by its even median lines, but differs obviously in size, in the obscure maculation and in general habitus. The males are uniformly darker, more powdery and narrower-winged than the females, and, as a rule, the secondaries are immaculate. In one specimen an extra-median pale line is fairly defined, and in two others it is indicated toward the inner margin.

#### BARON C. R. VON OSTEN SACKEN.

It is with deep regret that we record the death of our greatly-esteemed friend, Baron Osten Sacken, the eminent Dipterist, who died at Heidelberg, Germany, on May 20th, in the seventy-eighth year of his age. He was born at St. Petersburg on the 21st of August, 1828, and for many years was attached to the Russian Embassy in Washington, and afterwards was Consul-General for Russia in New York. During the twenty-one years he spent in America he prepared and published his own works on Diptera, and those of Dr. H. Loew, who was unable to write in English. To him is entirely due the first scientific knowledge of the North American species belonging to this great order of insects. A little over two years ago he published the "Record of his life-work in Entomology," a review of which will be found in the CAN. ENT. for December, 1903, Vol. XXXV, p. 344, and to which we would refer the reader who wishes for further information respecting the career of this remarkable man. He was an honorary member of the Entomological Society of Ontario. Only a few months ago the writer had a cheery, interesting letter from him; he was then in excellent health and spirits, though so near to fourscore years of age.

C. J. S. B.

## PRACTICAL AND POPULAR ENTOMOLOGY.—No. 15.

## MITES AFFECTING FARM HOMESTEADS.

BY TENNYSON D. JARVIS, ONTARIO AGRICULTURAL COLLEGE, GUELPH.

Of late years there has been a considerable demand for information relating to insects which are found in houses, and which either annoy the occupants by their direct attacks or are injurious to household goods and provisions. It is therefore hoped that the contents of this article will be found of interest and practical benefit to those who have experienced the ravages of these minute insects.

It was upon the urgent request of Mrs. R. Eby, whose house was infested with mites, and situated at Alma, in Wellington County, about 20 miles from Guelph, that I decided to go down and make a personal investigation, and, if I deemed it necessary, to fumigate the house. When I arrived I found the conditions of the house to be exactly those that harbour mites. The house was poorly lighted, and left in a semi-dark condition, owing to blinds being drawn to exclude flies. The interior finish of the house was rough and poor, the wardrobes being made of unfinished rough lumber, and therefore admirable hiding places were afforded the mites by the numerous crevices and dark corners. The walls were badly cracked, and the partitions of the house were poorly fitted together, exposing loose joints and holes. The walls were covered with dark paper.

After having made a thorough examination of the house and its internal conditions, I proceeded to ask Mrs. Eby for information regarding the outbreak, and when the presence of the mites had been first observed.

It would appear that about two years ago the cellar was overrun with mites, but these were most likely of different species to those affecting the house at this time. The cellar had been thoroughly whitewashed, using a spray pump, and an effectual extermination resulted. Since that time no more mites had been seen in the cellar.

Next, mites were found in the barn on hay, and the inhabitants of the house then thought that they had been introduced by being carried in on the clothing of the men. This, however, did not account for the present outbreak in the house, as these also were of different species.

*Food Habits and Life-history.*

It might be as well, before entering further into a discussion of what methods were adopted for the eradication of the mites, to briefly discuss the life-history and a few characteristics of the species found.

The mite was identified as *Tyroglyphus longior*, and is a very minute, colourless, eight-legged creature, which is usually found swarming in numbers over and in old cheese and various stored products, such as dried meats, dried fruits, vanilla, and flour of different kinds. It is rapid in its movements, has a cylindrical body, and has numerous shining hairs sticking out on the sides. The species is common to Europe and the United States.

All through the summer months, and in warm houses during the winter months, these creatures breed with astonishing rapidity and fecundity. The rapidity of multiplication, and the extraordinary numbers in which these mites will occur under favourable conditions, are almost incredible. The females bring forth their young alive, and these in turn rapidly reach full growth and reproduce. Through the summer months the mites are soft-bodied, and have comparatively feeble powers of locomotion, but it has been ascertained that when necessity requires it, and when the insects happen to be in the proper stage of growth, they have the power of not only almost indefinitely prolonging existence, but of undergoing a complete change of form, acquiring hard, brown, protective covering, into which all of the legs can be drawn in repose. It has been proved by Van Leeuwenhock, who was an eminent Dutch naturalist, that the softer form can undergo a fast of eleven weeks without apparent discomfort, and it is now known that in the hard shell, or Hypopus state, it may remain for many months without food.

Strange as it may seem, the mites affecting this particular farm homestead were found almost exclusively living in cracks and crevices, and around and on old clothing and rags of all descriptions. Very few indeed were found infesting the pantry or attacking cheese or any other household provisions. This apparent attraction for old clothing was soon observed by the women of the house, and they at once adopted a plan for trapping them. Numerous old rags were gathered together, and scattered around the house in all directions. The next morning they were all gathered together and carefully shaken over a table, and all the mites that fell off were then killed at once by hand. On all the traps not more than from one to two dozen mites were found per day.

The presence of the mites in the house, and their habit of congregating on the clothing, caused a great deal of more or less imaginary discomfort to the ladies of the house, although the species is one that is

not parasitic. Between dread of the mites and excess of work in trying to exterminate them, Mrs. Eby was reduced to a state bordering on nervous prostration, brought on by undue excitement and a false notion that the mites were there to stay for good, no matter what means be adopted to effect a remedy.

*Method of Treatment.*

After securely shutting the windows and doors of the house, I fumigated thoroughly with Hydrocyanic acid gas, using 24 ozs. to 1000 cubic feet. This strength was used in order to insure that the gas might enter the partitions and circulate around the wood thoroughly. The unfavourable internal condition of the house made it difficult to estimate the exact strength required to kill all the mites. After the fumigation all the rag traps that had been left around were subjected to a careful and thorough examination, and all the mites present were found to be dead, except one sole survivor, that was taken from a trap placed in one of the wardrobes. This being so, nothing would satisfy the exacting demands of the occupants but another immediate and stronger fumigation. This was at once carried out, 32 ozs. to 1000 cubic feet space being used. This appeared to prove quite affective, and no more living mites were to be found.

Before the fumigation, the Ebys tried burning sulphur for 24 hours at a time, and found this treatment to be of no avail, the mites being quite as abundant after the treatment. Turpentine and Carbon bisulphide had also been tried, but with little or no effect.

In conclusion, instructions were left to carry out the following plan of procedure: Close all the openings in the walls, and repaper the house with light-coloured paper. The wardrobes to be made of planed and finished lumber, and papered. To fumigate with Hydrocyanic acid gas, 24 ozs. to 1000 cubic feet space if the mites should reappear. Nothing, in fact, but the utmost cleanliness and watchfulness will prevent the appearance of the mites. All energies must be bent towards prevention. Food supplies and old clothing liable to be infested should be inspected daily during hot weather.

A report has recently been received from Mrs. Eby, stating that a few mites are yet living. This point goes to prove their extreme tenacity of life, and it is altogether likely that in every such house kept dark, and fitted with unfinished rough lumber, mites will be found.

## LIFE HISTORIES OF NORTH AMERICAN WATER-BUGS.

BY J. R. DE LA TORRE BUENO, NEW YORK.

## II.

Life-History of *Ranatra quadridentata*, Stal.

Of the water-bugs, perhaps *Ranatra* and *Nepa* are better known than the others in their anatomy and earlier stages. Dufour's classic on the anatomy of *Nepa cinerea*, L., and *Ranatra linearis*, L., has been followed by the work of other investigators in these two species, and the peculiar filamentous ova of the two genera have long been favourites with students. But nevertheless, thus far no complete life-history has been worked out for either of them. In the following pages are presented the results of my preliminary breedings of *Ranatra quadridentata*, Stal.

The remarkable eggs of *Ranatra* have received much attention from European entomologists, and the use of the two filaments adorning them has been the subject of much speculation. They are deposited in the early spring in the decaying stems of rushes, and in the course of three weeks or so the little bugs emerge. They very much resemble the adult, except that they are, of course, much smaller. After five moults, they reach maturity in some eight weeks or so. It is possible that there may be two broods from ova deposited early in May, but there are no data bearing on this point, although I have taken young nymphs as late as September. In copulation, the male is below and to one side of the female. The adult female is furnished with a pointed, keeled, toothed ovipositor, and can be readily distinguished from the male, in which the ventral portion of the genital segment corresponding to the ovipositor is not keeled, is flatter, and more rounded at the extremity.<sup>1</sup>

*Ranatra quadridentata* frequents deep waters, where it clings quite fast to the stems of rushes or grasses, with its air-tube or siphon piercing the surface film. At times it swims about, while at others it simply floats head down, with the tip of its air-tube at the surface. It will also float parallel to the surface of the water, at a greater or less distance from it, and in such cases the air-tube makes an angle with the body, varying in sharpness according to the depth at which the bug lies. One *Ranatra* was taken perched on a lily-pad, the tip of the siphon touching its surface, and the legs straight and inclined backwards. This is much the position it assumes on taking flight. After balancing itself a moment in this posture, the bug crouches far back, with its legs much bent, and then suddenly leaps into the air with a loud whirring noise made by its wings.

1. Cf. Uhler in Standard Natural History, Vol. II, p. 255.  
July, 1906

The prothorax is much bent forward, and the anterior legs are bent back over it just before the insect takes flight. The European *R. linearis* is recorded as flying by night.<sup>2</sup>

*Ranatra* swims slowly, with an alternating motion of the second and third pair of legs.<sup>3</sup> Uhler states,<sup>4</sup> that *R. fusca* may be seen resting at the bottom, stilted on its long hind legs. I have not seen this myself. It also creeps among the grasses.

The food of *Ranatra*, I have found, consists of those unwary insects that fall into the water. These it seizes in its raptorial anterior legs and draws slowly to its beak, which moves and twists about, touching the prey until a suitable place is found to penetrate with its lancets.<sup>5</sup>

The *Ranatra linearis* (of which the greater part of the literature treats) is said to feed on the larva of *Ephemera*.<sup>6</sup>

*Ranatra* hibernates as an adult, and is sometimes found frozen in the ice of ponds. It seeks some sheltered place under an overhanging bank, or delves into the mud,<sup>7</sup> and there it lies torpid till the spring comes, when it can be found all muddy and grown over with green algæ. I have taken it sluggish in early November from a hole under the bank of a pond. As in most water-bugs it is parasitized by a species of *Hydrachna*. Its stridulation has previously been noted, and is a peculiar faculty. The coxal plate rasps can be seen in the earliest stages of the nymph.<sup>8</sup>

The peculiarities of the respiratory system of *Nepa* and *Ranatra* have been the subject of a number of important studies. The chief of these are, of course, Léon Dufour's "Récherches anatomiques sur la *Ranatra linearis* et *Nepa cinerea*,"<sup>9</sup> and his masterly "Récherches anatomiques et physiologiques sur les Hémiptères." These two works,

2. Amyot & Serville, Histoire Naturelle des Insectes, Hémiptères, p. 443.

3. Bueno, Entomological News, Vol. XVII, p. 3. Also noted by Westwood, Introduction, Vol. II, p. 462; and Schödte, Ann. & Mag. N. H.? (4), Vol. VI, p. 236.

4. Standard Natural History, Vol. II, p. 254.

5. Bueno, CANADIAN ENTOMOLOGIST, Vol. XXXV, p. 236.

6. Westwood, op. c., p. 461.

7. Marshall and Severin, "Some points in the anatomy of *Ranatra fusca*, P. Beauv.," Tr. Wisc. Acad. Sci., Arts & Letters, Vol. XIV, pp. 487-508, Pls. XXXIV-XXXVI. (See p. 487.)

8. CANADIAN ENTOMOLOGIST, Vol. XXXV, pp. 235-7, and Vol. XXXVII, pp. 85-7.

9. Ann. Génér. sc. phys. (Brussels), Vol. VII, pp. 194-213 (1821).



although written in the early years of the last century, are to this day of the utmost importance in the study of the Hemiptera. Locy's work<sup>10</sup> follows in the footsteps of his predecessors, and gives nothing new on this point. In the paper by Schiödte on morphology and classification,<sup>11</sup> the subject is carefully treated. This will be referred to later, since his views have been borne out by my dissections. The only other paper on the subject known to me is that by Marshall and Severin, previously cited, and to be referred to later. In regard to the last paper, it may not be out of place here to mention two points, one being the form of the generic name, which is given as "*Ranantra*" (recte *Ranatra*), and the other that the figures, which have been drawn with the aid of the camera, as it is specifically stated, undoubtedly are of *Ranatra quadridentata*, Stal., and not *R. fusca*, P. B.

The substance of Schiödte's remarks on the respiratory system of *Nepa* is that they have, in common with all other Heteroptera, ten pairs of spiracles, three thoracic and seven abdominal. In this view, consequently, the respiratory semi-tubes are the highly specialized appendages of the seventh abdominal segment. Attention is called to the three pair of large sieve-like false spiracles of the abdomen, to which further reference will be made, and to the very small, nearly obliterated, true spiracles.

In accordance with the results of previous investigators, the main trunk tracheæ have their origin in the large spiracles situated a short distance above the insertion of the two halves of the air-tube, in the halves themselves. Thence they go up through the bug's body to the head, giving off branches, many capillary, which go in to aerate the organs, and also the nine main branches to the spiracles.

Agreeing with Schiödte (op. c.), I have found ten pairs of spiracles. It is to be noted that some authors consider the siphon or air-tube the lengthened peritreme of the seventh spiracle, a view that would seem to be reasonable. It is also worthy of notice that there apparently is no device for closing this spiracle, which appears merely as a round opening, as if the tubular trachea had been cut off straight across. The sixth pair of spiracles is situated in the lateral pieces of the subdivided sixth abdominal segment. The next three pair are placed in the peritreme of

10. "Anatomy and Physiology of the Family Nepidæ," Am. Nat., Vol. XVIII, 1884.

11. On some new Fundamental Principles in the Morphology and Classification of the Rhynchota, Ann. Mag. N. H. ser. 4, Vol. VI, pp. 225-249.

the false stigmata. The two remaining pair are situated, that of the second segment on the longitudinal lateral abdominal seam, and that of the first near the prothorax. All but the first pair of these spiracles, although connected with the stem-tracheæ by branches, appear to be rudimentary and nonfunctional, being merely an irregular slit in the integument. The second pair can be recognized from the inside only, by the tracheal connection, but there is no apparent opening. The so-called stigmata of the third, fourth and fifth abdominal segments *have no apparent connection with the tracheal system*. I have demonstrated this in several dissections by isolating the respiratory system *in situ*, and following the branch tracheæ to their termination in the body-wall. These branches lead to the thickened wide border surrounding the sieve-like portion of the false stigmata, which broadens on the inner side to accommodate the true slit-like rudimentary spiracle, to which the trachea can clearly be seen attached. The late Joanny Martin<sup>12</sup> has followed the development of these in the nymphal *Nepa*, and finds that they are formed independently of the true functional stigmata of the nymph, which at the last moult are narrowly obliterated. What the present function of these peculiar structures may be is rather obscure, although it is possible that they may be useful in aerating the body fluids by extracting oxygen from the water by osmosis. The structure of these stigmata in *Nepa* is well shown in Dufour's work cited on the anatomy of the Hemiptera, figs. 194 to 200.

Returning to the respiratory system, we find on the upper side of the metathorax, under the wings, a large functional spiracle, which connects by an ample trachea with the main system. This Schiödte calls the "spiracula metathoracica." Further along we come to his "spiracula mesothoracica," the second thoracic, which is smaller, and lies in the seam between the meta- and mesothorax, concealed by the mesothoracic epimera. The first pair of thoracic spiracles, which no other author appears to have recognized, are situated at the cephalic margin of the mesothorax, in the membrane connecting it with the prothorax, and covered by the latter. This pair is Schiödte's "spiracula prothoracica." They are the largest spiracles in the insect, and are peculiar because of their oblong rectangular shape, with rounded corners, and because they open not at the end of a trachea, but in the wall of a large tube, which is here parallel to the mesothoracic cephalic margin. The function of this spiracle is

12. "Origine et formation des faux stigmates chez les Nepidæ (Hémiptères)." Bull. Mus. de Hist. Nat., Paris, No. 3, pp. 1-2 (1895).

possibly to fill the large air-chambers that are found in the thorax of *Ranatra*, when the head is bent forward at the moment of taking flight, as previously described.

The respiration of the adult while in the water is evidently through the air-tube or siphon. This may also be used when out of the water, but the main reliance is probably in the thoracic spiracles in the latter case. The great disparity in size of the latter as compared to the former is in all likelihood due to the violent exertions *Ranatra* makes while in the air in flight, these, so far as known, being the only occasions on which it leaves its natural element. Of course, while in its customary surroundings, its sluggish habits make deep breathing unnecessary, and, as suggested before, the so called false stigmata may be functional in some way when the bug is submerged.

The air-tube, as Marshall and Severin point out,<sup>13</sup> may be cut off short without causing the insect any apparent inconvenience. This, of course, has further proof in the varying lengths of the tube in different individuals of the same species, in different species, and in different genera. What is more remarkable, is that a difference in length between the two halves of the tube seems not to affect its usefulness. Among my captures was a *Ranatra* in which one-half of the siphon was broken off within an eighth of an inch from the body, and which lived for some months in my aquarium. When entering the water after being out of it for any length of time, the two halves of the air-tube are moved alternately in and out. Sometimes the silvery column of air can be seen rising in it little by little, from the abdomen, till at length it reaches the distal end of the siphon. Miall<sup>14</sup> claims that in *R. linearis* the continuity of the tube "is maintained by a multitude of hook like bristles, which project from the opposed edges." This is not the case in *Ranatra quadridentata*, in which these fringing hairs are simple. Indeed, the fact that the bug can separate the halves at will as well as move them independently of each other, would seem to militate against this view. Further, the natural formation of a surface film where water is in contact with air in limited areas, would render such a device unnecessary.

In the nymph the respiratory system is very different from that of the adult. The principle, of course, is the same in both, since both breathe atmospheric air which they get by piercing the surface film by means of a

13. Op. c., p. 494.

14. Natural History of Aquatic Insects, p. 353.

device at the end of the abdomen that conveys the air to its destination. Here, however, the similarity ceases. While in the adult the siphon is as previously described, in the nymph this bisecting tube is replaced by an involution of what may be the seventh abdominal segment, which is rolled up and has an open joint beneath, the edges being fringed with hairs. The sides of the abdomen are folded under, covering the inferior part of the abdomen on each side to within a third of the distance to the keel, which is fringed with hairs, as are the bent-under abdominal edges. These bent-under edges are continuous with the rolled siphon. Under these edges, in the channel thus formed for the passage of air, lie the functional abdominal spiracles. The false stigmata appear as dark thickenings of the dorsal integument, but show no opening or internal connection in the nymph as pointed out by Martin (*op. c.*). The edges of the folded-over connexivum are indented under the darkened areas. The abdominal spiracles are plain circular openings, to which the tracheæ run. They present no peculiar features. Owing to lack of material, and partly to the great difficulty in dissecting nymphs satisfactorily when in the fifth instar on account of the formative processes then so actively at work, it has not been possible to demonstrate the thoracic spiracles. This is reserved for another occasion.

The detailed life-history which follows is lacking in many particulars, but this was in a great measure unavoidable, as my material in some of the instars consisted only of the cast larval skins. These are in many ways very good for showing details of structure, but owing to their extreme thinness it is at times impossible to mount them satisfactorily.

OVUM.—Shape: Imperfectly oval, flattened at the upper end, from which arise two long thread-like processes, longer than the ovum and thickened at the base, diminishing in thickness toward the apex.

Size: Long., 3 mm.; lat., 1 mm.; appendages, long., 5 mm.

Colour: White at the base, growing dark toward the apex; when freshly deposited clear white.

Markings: Surface of chorion thickly covered with irregularly circular pits, in the middle of which is a point. The processes appear smooth.

The egg of *Ranatra*, together with that of *Nepa*, has long been a favourite subject for study, owing to the alluring peculiarities of structure. Entomological works invariably refer to its bifilamented condition, especially to that of *R. linearis*, L., on which all the studies and experiments to date have been made. Shuckard, in his translation of

Burmeister, figures the ovum of the latter insect *in situ*, but his cut gives an erroneous idea of how they are deposited. Howard<sup>15</sup> briefly refers to the manner in which they are placed, and mentions the nature of the filaments. Sharp<sup>16</sup> quotes Korschelt to the effect that the filaments are pneumatic in function, although he doubts it. Burmeister<sup>17</sup> mentions the filaments and the manner of oviposition, and Packard also refers to this peculiarity.<sup>18</sup> The method of oviposition is also mentioned by Westwood, who quotes Rösel and Geoffroy, the former to the effect that the eggs are dropped at random, and the latter as stating that they are inserted in the stems of aquatic plants, leaving the filaments only exposed.<sup>19</sup> In addition to these two, Amyot and Serville<sup>20</sup> quote De Geer as to the form and filaments of the ova. The best account of the ova, with a sufficiently accurate figure, is that of Pettit.<sup>21</sup> This has the honour of being the first description of the ova of any American *Ranatra*, although the species is quite doubtful, owing to the obscurity in regard to the number of our native forms.

*Ranatra quadridentata* endeavours wherever possible to insert its eggs in some soft substance, either a growing plant or a decaying one. If these be not available, the ova are dropped loosely, although this is the last resort of the over-distended gravid female. The bug is provided with a sharp toothed ovipositor, which it digs into the plant stems, thereby making a hole for the reception of each egg. The ova of *Ranatra* also increase in size as embryonal development progresses. They reach maturity in about two or three weeks, the queer little bugs emerging through a round cap at the top which carries the filaments. On emerging they are greenish yellow, and so very soft that they bend double when picked out of the water. Later, in the course of a few hours, they attain the darker colour mentioned in the description.

15. Insect Book, p. 277.

16. Cambridge Natural History, Insects, Vol. II, p. 564.

17. Handbuch, Vol. II, p. 199.

18. Text Book of Entomology, p. 523.

19. Introduction, Vol. II, p. 461.

20. Histoire Naturelle des Insectes—Hémiptères, pp. 442-3.

21. The Egg of the Water Scorpion (*Ranatra fusca*). CANADIAN ENTOMOLOGIST, 1902, Vol. XXXIV, pp. 212-13.

The three individuals bred emerged, one in fifteen days (the only one that eventually reached maturity), and the other two, from ova deposited in my aquaria, in twenty days. Some others were varying periods in the embryonic stage, but these were not closely observed, although in general the period was about three weeks or less.

#### First Nymphal Instar.

Form in a general way resembles the adult. It is, however, broader in proportion to length. The head, including the eyes, is broader than long, excluding the rostrum. Each eye is less than one-third the width of the head, round and projecting beyond the thoracic margins. The thorax is a little under one-third the total length of the bug. It shows the three rings.

The rostrum is four-jointed, stout, the first joint stoutest, about twice as long as the second, and subequal to the third and fourth. The fourth or terminal joint is furnished with tactile hairs, as in the adult, the antennæ are short, club-shaped, one-jointed, the extremity nearly as broad as the length, situate near the basal joint of the rostrum. The thorax is a little under one-third the total length of the bug, and shows the three rings. The bifid air-tube is absent, its place being taken by the blunt extension of the terminal abdominal segment, as described in connection with the respiratory system. The legs are comparatively stout, the second and third pairs being nearly as long as the entire bug. The tarsi of the first pair are one-jointed and entirely destitute of claws; those of the second and third pair are also one-jointed, armed with long claws. The tibiæ of these two pairs are armed with a comb-like row of stout spines going partly around at the distal end, at the tarsal joint, and are furnished with a few coarse hairs at this end also. The first pair of pedes is the counterpart of those of the adult, except that they are much broader in proportion, and do not show the blunt, so-called apical tooth in the femur.

Size: Long., 8 mm.; lat., 1 mm. at thorax; air-tube, long., 1.5 mm.

Colour: Brownish of varying shades, including the legs, which are banded with lighter rings. The eyes are black or dark brown.

Markings: None sufficiently definite to be called such. There is a lighter median line in the thorax.

The nymph that finally reached the adult came to the first moult in fourteen days, the other two in eight days. The latter were from bred ova, and the transformation took place in July.

## Second Nymphal Instar.

Form as in the first stage, perhaps a little less broad in proportion to the length. Rostrum as before, except that it is perhaps a little less stout. Antennae still blunt, short and stout, but not so club-shaped. They now begin to show two equal joints. The legs as before, the first pair not quite so broad proportionally, with the blunt apical femoral tooth beginning to show as an undulation in the inner side of the femur. The tibiae of the second and third pair are better provided with spines, which increase in number distally. The terminal combs very apparent.

Size: Long., 13 mm.; lat. not measured, dimensions being taken from moulted skins.

Air-tube, 2.7 mm.

The survivor came to the second moult in nine days, the other two in six. These died on the 21st, due to their being carried about in water.

## Third Nymphal Instar.

Form, not greatly changed from the preceding instars, except for slight variations in proportions.

Rostrum, much as before, but a little slimmer. In this instar the tactile hairs at the extremity of the proboscis are quite noticeable.

Antennae appear imperfectly three-jointed in this instar. The suture separating the basal joint is quite noticeable, and that between the second and third joints shows as an incision in the outer margin of the antennae, from which a little impressed line goes about half way across. Below and above this indentation are two prominences, the beginning of the lobes of the segments. Both prominences are armed with a stout spine, that of the third joint being about twice as thick as that of the second. The third joint appears to be pitted at the rounded end.

Thorax much narrower, distinctly trisegmentate. Head closer to the adult shape, the eyes flattened on the inner side, and quite prominent. The wing-pads first appear in this instar, though very small and rudimentary.

Legs and tarsi as before, with the spines of the second and third pair of tibiae stronger, and the tibial comb more developed. In this instar the fringing hairs of the second and third pair appear, scattered on the femora and sparse on the tibiae, but quite long.

The false stigmata are quite noticeable at the sides of the abdomen, as darkened spots in the integument. The legs are now shorter than the

length of the bug, and reach but little beyond the extremity of the respiratory tube. The first pair are not quite as broad proportionally as in the previous instars, and show the same undulations of the femora where the second tooth will be.

Size: Long. (extremity of the rostrum to end of siphon), 19 mm.; lat., 1.4 mm.; air-tube, long., 4 mm.

My one nymph came to the third moult in seven days.

#### Fourth Nymphal Instar.

Form as before. Rostrum but slightly changed.

Antennæ evidently three-jointed, the prominences more developed, and the several spines on the third and second segments quite evident.

Legs and tarsi as before, with the peculiarities more accentuated. They extend only a little beyond the siphon, and are therefore not as long as the body by the length of the thorax.

Colour more or less mottled, with banded legs. General tint grayish.

Size: Long., 30 mm.; lat. (not taken, specimen being only a cast skin in this instar); air-tube, long., 7 mm.

The specimen attained the fourth moult in eight days. The shortness of the nymphal instars in the hot days of July is worthy of notice.

#### Fifth Nymphal Instar.

Form elongate as in the adult. Head, including eyes and exclusive of rostrum, broader than long. Rostrum as before, but nearer the adult shape. The second joint begins to show the basal constriction so notable in the adult.

The rostrum is shorter than the length of the head. Eyes transversely elongate, somewhat flattened on the inner margin, projecting beyond the expanded anterior portion of the prothorax. Antennæ are still two-jointed, the basal joint extending into a process, nearly as stout as the terminal joint, and about three-fifths as long. The suture between the joints is very faint. The joints are now abundantly furnished with the tactile spines, which reach full development in the adult. Prothorax widened anteriorly by the sockets of the anterior pedes, gradually constricted towards middle, and expanding again basally, but not quite as broad as the anterior portion; excavate anteriorly for the insertion of the head and truncate posteriorly. Prosternum not sulcate, deeply excavate posteriorly. Mesothorax with long narrow wing-pads of the hemelytra, pointed posteriorly in the middle. Metathorax concealed. First abdominal segment showing as a ring between the wing-pads of the



posterior alæ, which barely attain the extremity of the pads of the hemelytra. A straight suture marks off this segment from the next. The abdomen is more than twice the length of the thorax, the segment following the thorax slightly constricted. The sides of the abdomen are folded over itself, and are furnished with fringing hairs. There is an indentation in the edge at each segment that bears the thickening of the formative pseudostigmata. The abdomen has only six apparent segments and the siphon or air-tube. The false stigmata show in segments three to five, dorsally, as thickenings of the integument, darker than the surrounding skin. The siphon is jointed to the sixth segment, and freely movable. The abdomen is keeled beneath, the keel bearing a fringe of short hairs on each side, which meet those of the inflexed abdominal margin. The legs approach more closely to the adult. The second so-called tooth or prominence in the first pair is quite evident. The true tooth is large and triangular, and the clawless tarsus rests against it when the tibia is folded on the femur. The second and third pair are slender, ciliate, with globose coxæ; the tarsus of the second pair does not quite reach and the second goes slightly beyond the end of the siphon. Both these tarsi are one-jointed, and armed with prominent curved double claws.

Size : Long., 44.4 mm. (from tip of rostrum to tip of siphon); lat., 2.9 mm. (at the thorax, but *not* at wing-pads). Siphon., long., 12.3 mm.

Colour : More or less luteous of varying degrees, without any special pattern. The legs, which in the preceding instars are banded, are apparently unicolorous in this. This, however, may be the peculiarity of the two individuals from which this description has been drawn up. The eyes are black and shining.

This individual arrived at the adult in eight days.

The periods for each instar are as follows, for the individuals bred to maturity or to the third instar :

Ova taken, May 20, 1905.	Ova deposited, June 6, 1905.
Emergence, June 4, "	July 4, "
First moult, " 18, "	" 12, "
Second " " 27, "	" 18, "
Third " July 4, "	Died " 21, "
Fourth " " 12, "	
Fifth " " 20, "	

This gives 61 days from the ovum to the adult, or perhaps seventy days, if we allow for the time that may have elapsed before the ova were collected. The full number of instars is seven, as follows: one embryonal, five nymphal, and one perfect adult.