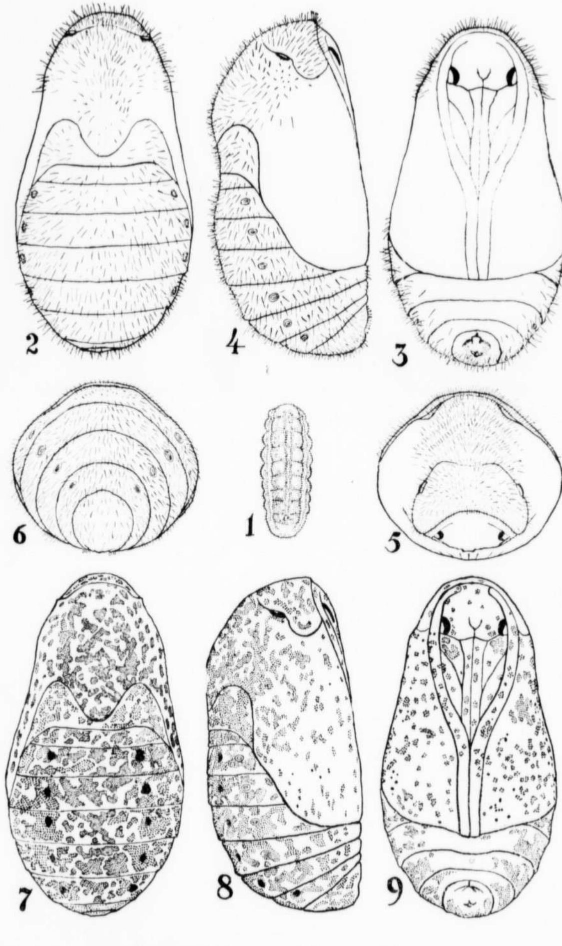

INCISALIA IRUS, GODT.

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STUDIES IN THE GENUS INCISALIA.

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

INCISALIA IRUS. (Continued from page 144.)

Hymenopterous parasite.—On April 13th, 1906, chrysalis No. 112 gave birth to an ichneumon fly, which Mr. D. B. Young has kindly identified for me as *Anomalon pseudargioli*.

An error corrected.—In 1881, Mr. W. H. Edwards published in Papilio (Vol. I, pp. 150–152) a "description of the preparatory stages of *Thecla Henrici*," a specimen of which he succeeded in raising from one of a number of eggs laid on plum by an imprisoned female. Dr. Scudder, who failed to find characters warranting the separation of *irus* and *Henrici*, quotes this description in his "Butterflies of the Eastern United States and Canada" as referring to *irus*, and, strangely enough, this error has been copied in all subsequent literature, even where the author recognizes the specific validity of *Henrici*. For example, in Dr. Holland's "Butterfly Book" we read that "an epitome of all that is known (of *irus*) is to be found in 'The Butterflies of New England.' The caterpillar feeds on young plums just after the leaves of the blossom have dropped away." And in the next section, "these (the early stages of *Henrici*) have been described by Edwards in the 'American Naturalist' (Vol. XVI, p. 123). The habits of the larva are identical with those of the preceding species." It so happens that the short note in the "American Naturalist" is merely a second statement of the facts published in Papilio (noted above), from which Dr. Scudder quoted his description and applied it to *irus*. Thus has arisen much confusion as to the propriety of regarding *Henrici* as a species, and misapprehension concerning the larva of *irus* and its food.*

Let it then be understood that the only published account of the early stages of this species, except Scudder's description and figures of the egg, is that found in the "Lépidoptères de l' Amérique Septentrionale" (Paris, 1833), tome 1, p. 102.

*The foot-note on page 142 of the current volume of THE CANADIAN ENTOMOLOGIST (May) is, therefore, a misstatement.

Boisduval's description.—Boisduval has there described the mature larva from the notes of John Abbot as follows: "It is of a yellowish-green, with two broken dorsal lines, a lateral line and eight oblique dashes of a slightly darker green." The figure given bears out the text. The chrysalis, according to this author, is "ferruginous, furnished with little hairs, with two darker longitudinal lines." In the plate it is much too dark to admit of being called ferruginous. It is further stated that "in Georgia this species (larva?) is found, though rarely, on several species of *Vaccinium*."

In comparing the description of the caterpillar with that herewith given, it must be borne in mind that Abbot evidently regarded the lighter tint as the ground colour, the darker areas as markings; while I have considered the reverse to be the case.

Larva at birth.—Easily distinguished from new-born *niphon* by the inconspicuousness of the short, nearly straight, backward-directed bristles of the laterodorsal series, which in *niphon* are black. Body pale yellow, hairs colourless, laterodorsal bristles a little dusky. Spiracles and dorsal shield pale yellowish-brown. Head yellowish, with a brown labrum and black ocellar fields. Length, 1.26 mm. Exact duration of the first stage not determined accurately, certainly something less than three days.

Second stage.—Body relatively broader, light green; substigmatal fold more pronounced; hairs relatively shorter, more numerous, buff or light brown; head yellow-green. Otherwise, as in previous stage. The larvæ which have been feeding upon pollen are dull orange or brownish, those which have eaten the white carina are very pale green. By giving them only the pistil and stamens for food they regain the usual colour. From 7 to 10 days after birth the caterpillar comes out of the flower and spins a silken mat. Upon this it may remain as much as two days before the skin is cast.

Penultimate stage.—Length just after the second moult, at rest, 3.7 mm.; extended, 4.1 mm. Head brilliant green to dirty yellow-green. Spiracles and dorsal shield a little browner than before. General colour pale green, nearer the violet end of the spectrum than the green of the preceding stage, marked with a weaker tint of the same colour as follows: A slender mediodorsal line extending from the posterior edge of the third thoracic to the anterior edge of the eighth abdominal segment. On either side of this and separated from it by a narrow line of green more dusky than on any other part of the body, a rather broad stripe interrupted by the incisures. These stripes meet on the anterior part of the third thoracic segment, and are progressively reduced from the fifth to eighth abdominal segments. There is also a line running along the substigmatal fold from the third thoracic to the last abdominal segment, and an obscure spot on each of the first six abdominal segments above the spiracle line. Plate 2, fig. 1, shows the dorsal aspect of the larva immediately after the second moult.

The final moult occurs when the caterpillar has attained a length of about 8.3 mm., but no definite period can be set as the duration of this stage, its length depending greatly upon the health and appetite of the individual. The same is true of the stage immediately preceding pupation, though in general it may be stated that when a caterpillar has had an unusually long penultimate stage the ultimate stage is abbreviated. This last moult is accomplished within twenty-four hours.

Ultimate stage.—Scarcely different from preceding stage. Head gray-green, sometimes more or less yellowish. Dorsal shield inconspicuous, light brown near the incisure, shading to creamy-white on its anterior margin. Mediodorsal stripe, dorsal and substigmatal lines as before. From first to eighth abdominal segment a series of oblique dashes of the lighter tint, one to a segment, meeting the dorsal line just back of the anterior incisure and running downward and backward almost to the spiracle line. These are well developed only on the second, third, fourth, fifth and sixth abdominal segments, where they are sometimes accompanied by a small spot beneath and in front.

Variation.—The larvæ are remarkably constant, the only variation being in the relative values of the two tints. The lighter of these is occasionally so lacking in chroma as to appear by contrast almost white. Usually the difference is slight, and the markings in consequence are obscure. I endeavoured to raise this species on *Vaccinium* to determine how much variation might be due to a difference in the food. My failure was conspicuous; fifteen caterpillars just from the egg died rather than touch *corymbosum*, *vacillans* or *pennsylvanicum*, and others, further developed, placed upon these plants forsook them immediately. With the same purpose I furnished an equal number of newly-born larvæ with plum twigs. One only found the young fruit to its liking; the others died without making any attempt to feed. The single exception lived to complete the second moult. The ground colour was a little deeper and of a more bluish-green, the markings nearly white. This is the larva from which fig. 1 was drawn. It is not typical, and was sketched merely to assist in determining the nature and extent of the markings, which are more or less elusive in ordinary specimens.

Length of larval life.—Only two caterpillars were reared from egg to chrysalis. One born on May 16th pupated June 10th. The other, born May 15th, pupated June 14th. The length of larval existence may therefore be stated to be about 25 or 30 days.

The chrysalis.—As stated previously, the caterpillar forms a rude shelter of such light material as it may be able to find. In nature it doubtless drops or crawls to the ground when fully grown, and searches for a spot suitable for a winter residence. It may wander some distance, for the restless period immediately preceding pupation is several days in length, and as much as a week may elapse between the last meal and the formation of a chrysalis.

The shape of the chrysalis is shown in detail in the plate. Fig. 2 exhibits the dorsal aspect, fig. 3 the ventral, fig. 4 the lateral, fig. 5 the anterior, and fig. 6 the posterior. These are drawn from the same specimen.

In his "Brief Guide to the Commoner Butterflies" Scudder states that the chrysalis has "a slender dorsal ridge on mesothorax." The same statement is made in the descriptions of *niphon* and *augustus*, and in the key which precedes the descriptive text this "slender ridge" is given as a generic character. I fail to find any mention of a ridge in W. H. Edwards's description of the chrysalis of *Henrici*, nor does Hy. Edwards say anything of it when describing what he believed to be *augustus*. I am at a loss to account for the statement. The ridge is certainly not found in *irus*.

As may be seen from the figures, the chrysalis is covered with short hairs, except on the wing-cases, the face, legs, tongue, antennæ and the ventral surface of the abdomen. The whole surface is covered by raised lines, which on the abdomen and thorax are definite in arrangement, and form a fairly regular reticulation, elsewhere they appear like wrinkles in the heavy chitinous shell. This ornamentation is pronounced, and renders difficult the determination of the various brown spots which cover the chrysalis. The thoracic spiracle is dull straw-yellow and conspicuous; the abdominal spiracles may be, for the same reason, visible to the naked eye, or may be inconspicuous because concolorous with their surroundings. The ocellar ribbon is black.

The ground colour is ordinarily brownish yellow, in some specimens with an olivaceous tinge, in others very dull and grimy. This is sometimes nearly uniform over the whole pupa; again, it may be darker on the abdomen. In one specimen the ground colour ventrally is ruddier than it is elsewhere. The surface is marked by irregular blotches of dark brown, sometimes nearly black. These blotches are largest on the abdominal dorsum, where they usually obscure the ground colour to a greater or less extent; on the thoracic dorsum they are moderately large, do not, as a rule, cover the field so completely, and with it stand in sharper contrast. Spots smaller and scattered below the spiracle line on the first four abdominal segments, usually absent on the abdomen ventrally. On the wing-cases, head, tongue, legs and antennæ these markings are reduced to minute, nearly circular, dots (though several may blend together), distributed sparsely. In some individuals there is a series of shallow pits on the first five abdominal segments (possibly wanting on the first), situated midway between the spiracles and the mediodorsal line, one to a segment. These are black when they appear, but seem to be absent in most cases.

When the ground colour is darker and the blotches larger than usual the chrysalis may appear almost black. Figs. 7, 8 and 9 show the maculation in this species.

When the imago emerges in the spring the mesothorax and metathorax of the chrysalis shell split along the mediodorsal line, the prothorax usually comes away entire, and the metathorax and wing-cases to the fourth abdominal segment separate from the abdomen.

A SYNONYM.

In The Canadian Entomologist, March, 1905, I published the description of an apparently new mosquito, giving it the generic name *O'Reillia*. Shortly afterwards Mr. Theobald referred to one of his new genera as having "heart-shaped" wing-scales, and as that was a fairly good description of the wing-scales in *O'Reillia* I suspected I had inadvertently described Mr. Theobald's genus.

Recent correspondence with Mr. Theobald has confirmed me in this opinion, and I hasten to make acknowledgment — *O'Riellia*, Ludlow, must sink as a synonym of *Etorleptiomyia*, Theobald.—[C. S. Ludlow, Laboratory of the Office of the Surgeon-General U. S. Army, Washington, D. C.

PRACTICAL AND POPULAR ENTOMOLOGY.—No. 14.

WORK FOR JUNE—CATERPILLAR HUNTING.

BY ARTHUR GIBSON, DIVISION OF ENTOMOLOGY, CENTRAL EXPERIMENTAL FARM, OTTAWA.

Everyone interested in the study of insect life eagerly awaits the approach of spring. It is at that time, probably more than at any other, that the keenest interest is shown in the subject by the majority of our collectors. How often, however, one begins enthusiastically in spring to collect insects of *all* kinds, becomes fascinated with the work and within a very short time gathers together a collection worthy of some notice; but, frequently, as the season advances, the interest begins to lag and soon something else takes the attention and the subject is dropped. Many a good beginning is thus ended. The month of June is distinctly the time of greatest interest to study the life-histories of insects. Many collectors, while continually adding specimens to their collections throughout the season, pay little attention to their habits or try to discover any new facts concerning their life-histories. The work of many of our collectors would be rendered more attractive and much more valuable if they would only take time to give a little attention to the early stages of the insects which they collect or study in the perfect state. This short article is merely a plea to beginners or collectors of a few years, to take up some *special* branch of the work in the hope of finding out new facts which, while adding much to their own pleasure, will also be of use to others who may be making a more critical or extended study in the same order of insects.

Taking it for granted, then, that the beginner, or even the collector of some years, wishes to pay special attention to butterflies and moths, late spring is a splendid time to hunt for their caterpillars. There is a fascination about rearing insects to the perfect state which is never experienced in the ordinary collecting of the imagoes. Then, besides, there is the charm of discovering some new fact which was hitherto unrecorded. Many of our caterpillars pass the winter in a half or full grown condition, and if collected in May and June soon become mature and change to the pupal state. Thus in a very short period the beginner will gain much experience which will be of service to him when endeavoring to trace out the complete life-history of a species. Even if his chief desire is to obtain perfect specimens, he will be well repaid with the result of his labours.

As the Rev. Dr. Fyles mentioned in the April popular article, many caterpillars hibernate under pieces of board, flat stones, etc., in fields and open places in woods. Along the grassy sides of railroad tracks there are usually numbers of strips of bark, broken pieces of plank, etc., and if these are examined, many noctuid and arctiid larvæ can be found. At Ottawa, in early May, we place pieces of plank, bark, etc., along roadsides and in open spots in woods. These make excellent traps for larvæ which have hibernated and which, after feeding during the night crawl under such shelters to hide during the day. The traps are visited every day or so, and a great many specimens are found. Larvæ collected in this way should be kept separately in some kind of small jar or tin box. Ordinary small glass jelly jars are very useful for this purpose. The object of keeping each caterpillar by itself is to be sure of its identity when the moth emerges. If a number are put into the same small jar, some will likely be eaten by the others, especially if there is not plenty of food in the jar. Some earth should be put in the bottom of each jar for those larvæ which pupate in the ground. Fresh food should be given every day and care taken to keep the jars clean. When the caterpillars are found, full notes should be taken on their length, appearance and habits. There is a vast lack of definite knowledge on the early stages of many of our common caterpillars, so it is important to take complete notes.

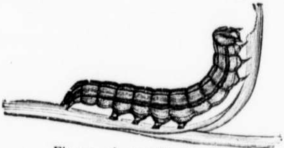

Fig. 27.—A noctuid caterpillar.

If at all possible, at least one specimen of each kind should be preserved for future reference and study. This is best done by inflation, and specimens thus prepared are more valuable than those put in liquids. Proper apparatus may be purchased from dealers in entomological supplies, such as: an oven, in which to dry the empty skins while being inflated; a spirit lamp to furnish heat; some glass tubes drawn out to different sizes at one end; some clips made of watch spring and held to the glass tubes by means of a band cut from rubber tubing; a double rubber bulb with about three feet of tubing attached; and a pair of fine curved forceps. The process, briefly, is to (1) kill the caterpillar in a cyanide bottle; (2) place it on a piece of blotting paper, cover it with a strip of the same paper, and gently press out all the body contents through the anal orifice, using the pair of fine forceps; (3) slip the anal segment over one of the glass tubes, fastening it with one or two of the spring clips; (4) connect the glass tube to the tubing of the double bulb and inflate the larval skin by gently squeezing the outside bulb, at the same time, with the other hand, holding the caterpillar in the oven to dry. When perfectly dry, the larva should be carefully removed from the glass tube and mounted with shellac on fine wire, one end of which should be first wound several times around an insect pin. Naturally, at first, specimens will be spoiled, but with care good results will soon be obtained. It is best to begin with hairless larvæ.

After the month of June, many caterpillars which have hatched from eggs laid during spring, can easily be collected by beating them off trees and shrubs of almost all kinds. Specially-made beating-nets may be purchased from dealers in entomological supplies, but, for the needs of the beginner, an old umbrella held upside down, does very well. The umbrella should be held beneath part of the plant with one hand, while the larvæ are beaten from the foliage into it, by means of a light stick held in the other hand.

When hunting caterpillars in May and June, cocoons and pupæ of a number of different species of moths will be found beneath boards, dry stumps, etc. The cocoons of the two Halisidota Tussock Moths shown here will often be met with. These latter, which are oval brownish cocoons, if saved and brought into the house will soon give the perfect insects. It may be, however, that some will be parasitized, and instead of producing moths, tachina flies somewhat like the ordinary house-fly, except in size, or four-winged ichneumon flies will be seen in our breeding cages. Such surprises, however, are not always disappointments, as a knowledge of our parasitic, or beneficial, species is of much value. Were it not for these parasitic forms, our native species of injurious insects would soon multiply enormously and quickly destroy all vegetation.

Fig. 28.—*Halisidota caryæ.*

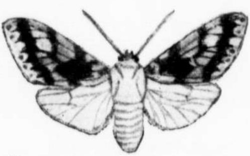

Fig. 29.—*Halisidota maculata*, Harris.

LIFE-HISTORIES OF NORTH-AMERICAN WATER-BUGS.

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

At every turn, since beginning my studies in the aquatic Hemiptera some four years ago, my attempts to verify some observation have been balked by the extreme meagreness of the information on the subject running all through the field of entomological literature. This lack is far more noticeable with regard to the immature stages of the Cryptocerata and of the aquatic and semi-aquatic forms of the Gymnocerata. As a result, my general work has been in the neglected field of investigations in life-histories and habits, rather than in the more commonly accepted form of labour on classification and systematic phylogenetics. During this period a number of partial experiments, more or less unsuccessful, were made, until in the past year, 1905, four species were completely worked out in the full life-cycle from the ovum to the mature Hemipteron. In the following pages will be given in quite a little detail the results of my experiments in raising *Belostoma fluminea*, Say, *Ranatra quadridentata*, Stal., *Microvelia americana*, Uhler, and *Microvelia pulchella* ? Westwood (Uhler).

I.

Life-history of *Belostoma fluminea*, Say.

It is a familiar fact to all collectors of the Hemiptera, that in a number of the genera of the family *Belostomatidæ* (the genera *Belostoma*, Latreille, *Abedus*, Mayr, *Diplonychus*, Laporte, and *Hydrocirius*, Spinola), the ova are borne on the back, covering the hemelytra. Uhler[1] records this fact without committing himself as to the sex of the bug, but for long (in fact, from the very beginning of entomology until within not more than six or seven years) it was held that the egg-bearers were females, and that the ova were deposited on its own back by each female. Authors have even gone to the extent of describing the process at length, going into details of "a long protrusile ovipositor which the insect can extend over her own back."[2]

This absurdity has had a large circulation, although how so flat and broad an insect could carry concealed within itself a necessarily bulky organ such as that imagined, has not to my knowledge been satisfactorily

1. Standard Natural History, Insects, p. 258.

2. Léon Dufour, Essai Mongraphique sur les Belostomides, Ann. Soc. Ent. Fr., 1863, Vol. III, p. 378. Dimmock, Belostomidæ and other Fish-destroying Bugs, Ann. Rep. Fish and Game Comm., Mass., 1886, p. 71. Comstock, Introduction to the Study of Insects, 1888, p. 189; Manual for the Study of Insects 1899, p. 131; Insect Life, 1899, p. 133.

explained. Dr. David Sharp calls attention to Dimmock's hitherto accepted statement, and states that Schmidt found the egg-bearers in *Diplonychus* were all males.[3] It was an American woman, Miss F. W. Slater,[4] who finally established the fact that the female seized the male forcibly and converted him into an animated portable incubator, an observation noted by Dr. L. O. Howard in his Insect Book, p. 279. I have observed the process several times in my aquaria, although not from the very beginning. The female places herself on top of the male, her thorax extending outward and her legs hooked under him ; now, starting somewhere near the middle and sidling along every little while, she works her way around him as she fastens her eggs on his back by means of the waterproof glue secreted for that purpose. The male all the while hangs from the surface, back up, with his legs curled up under him, bravely bearing up under his burden. The egg-bearing male, however, like others of the same sex, dislikes exceedingly this forced servitude, and does all he can to rid himself of his burden. From time to time he passes his third pair of legs over the dorsum, apparently in an endeavour to accomplish his purpose. In general, however, he keeps to his position at the surface, and every now and then moves up and down quite rapidly with a peculiar springy motion. If he is not able to get rid of it, as sometimes happens, he carries his burden till in due time, some ten days or so, all the little ones are emerged, when he at last frees himself from it. This egg-bearing of the male, I imagine, is for the purpose of protecting the ova from the voracious appetites of the adults. I have observed males that succeeded in casting off the unhatched ova seize them and greedily suck them. The females, also, are not free from this vice. A peculiar fact in connection with the phenomena of oviposition is that copulation takes place while the function is being performed, the female interrupting her labours to approach the male.

As development progresses, the ovum swells and lengthens. In emerging, the young nymph escapes through a lid at the top of the egg, and when all, or at least the greater part, of the ova are empty, the male casts off the entire mass of shells, and goes about his business. The same female may again burden him, and so far as aquarium observations go, she deposits several batches of eggs, averaging from 25 to 125[5] each, so she may become the mother of a progeny running into the hundreds.

3. Cambridge Natural History, Insects, Part II, p. 566.
4. American Naturalist, 1899, pp. 931-933.
5. Dimmock says (l. c.) about 175.

From four or five batches of ova numbering about 200 all told, three adults were obtained, which took respectively 43, 53 and 54 days to arrive at maturity, from the date of oviposition, the last being unduly long in the last nymphal instar. It is, therefore, evident that several broods are possible in the course of one summer. There are five nymphal instars, or seven altogether in the full life-cycle from the egg to the adult. The adults overwinter, burying themselves in the mud of their haunts, and they may sometimes be found in warm days in early spring[6] all covered with mud and lethargic, perched on some rock on the shore, in the sun. Oviposition begins in the spring, and continues through the summer. It is not unusual to find in August the adult male with freshly-deposited ova, in company with all the nymphal instars, at one and the same time and place. I have found egg-laden males as early as the middle of May, and as late as the end of August. The last date would allow the young to arrive at maturity by the first week in October, before the weather got too cold. Active adults have been secured as late as the middle of October, and partly torpid ones on a cold day in early November.

Belostoma fluminea is, in common with all water-bugs, a predaceous carnivore, feeding on the juices of insects and snails, and very probably of such small or weak vertebrates as it can overpower. In times of stress it will feed on its own nymphs, which in turn are not averse to preying on each other when hungry, which is always. In my aquaria they are fed flies, which are put in alive, but their sufferings are over as soon as they are seized. The bug apparently injects some paralyzing poison into its victims. Ordinarily, the prey is seized by the raptorial anterior pedes, and at times all three pairs are employed to hold fast some powerful insects or large victim, such as a snail.

This water-bug's favourite haunts are muddy-bottomed ponds, where it lurks among the weeds at the bottom. Sometimes it is found in little bayed-in places in streams, where there is a back-water, with grasses growing into it from the banks, or from the bottom. On one occasion a single individual was found under a stone on the pebbly banks of the Rahway River, near Cranford, N. J.

Belostoma also is parasitized by a water mite, but it does not appear to be injured in any way by its guest.

Both the adult and the nymph obtain their air supply from the atmosphere, by piercing the surface with the terminal abdominal segments In the adult there is a broad pilose band at each side of the abdomen,

6. March 21st, in one instance.

covering the entire width of the connexivum, save for a narrow stripe at the external edge. This band begins about two-thirds of the way up the last connexival segment, and is lost under the edge of the metasternum. On each of abdominal segments 2 to 6 there is visible in this sericeous stripe an oval stigma from which arise tracheæ that lead into the main respiratory system. The spiracles of the first segment are not visible without dissection, and lie in the membranous portion under the metasternal episterna. The main system has its origin in the two strap-like appendages issuing from the dorsum of the 5th abdominal segment, which are evidently the highly specialized 7th abdominal ring.[7] These are each covered at the base by a pilose flap which extends from the segment, and between them lie the genitalia. Near the base and below the outer edge of each of the appendages is a deep-sunk orifice in which lies the great spiracle from which springs the large tracheal trunk of the main system. Each of these large stem-tracheæ goes straight up into the thoracic region, each connecting with the other and with the seven abdominal and three (sec. Schiodte) thoracic stigmata by branches at intervals. The dorsum is covered with short pile, and as it is somewhat hollowed beneath the hemelytra, is apparently employed as a reservoir for storing air. When the bug is at the surface, the end of the abdomen and the hemelytra separate, the hairy ends of the strap-like appendages being visible just under the edge of the membrane, and the air enters here.

The nymphal respiratory apparatus is quite different. In place of the sericeous band, the entire abdomen is thickly covered with long pile; and it appears bright and silvery in the water, and rounded out from the great quantity of air it carries. The connexival spiracles, of which there is one at each segment, are not large, and connect by tracheæ with the main respiratory system. There is a pair of very large spiracles in the cleft sixth abdominal segment, one on each side, from which the main tracheæ rise. The metasternal episterna are produced into long, narrow plates, fringed with long hairs, extending over the first, second and half the third abdominal segments. According to Dr. Sharp,[8] Joanny Martin is of the opinion that these plates are for respiratory purposes. It is possible that they may be used for the storage of air, or perhaps as a means of reducing the quantity held by the pile, by exercising pressure to

7. Dufour in Mém. Soc. Ac. Sci. Liege, 186, p. 197, expresses the guarded opinion that the strap-like appendages of *Belostoma* (=Amorgius) *indicum* are respiratory in their function.

8. Cambridge Natural History, Insects, Part II, p. 567.

force it out. It is certain, however, that they have some connection with the respiratory system. The functions of the pile were long since reccgnized by Burmeister.[9]

Hereafter follow the notes made from the various instars bred:

OVUM.—Shape: Imperfectly oval, the upper end being the more pointed, the lower rounder. Size: Long., 2 mm.; lat. 1 mm. at widest part. Colour: Light yellowish-brown, shading into dark brown, nearly black at the upper end. When freshly occluded, the ova are of a light yellowish hue. Markings: Under a high power (150 diameters) the corium is seen to be shagreened with very small graining, otherwise entirely free from the more usual condition of ornamentation in the Hemiptera. During incubation the ovum increases in size and changes in form. Just before emergence it is as follows:—Shape: Elongate oval, noticeably tapering from the apex to the base. Size: Long., 3 mm.; lat., 1.1 at greatest breadth.

The ova, as already noted, are deposited by the female on the back of the unwilling male. They are embedded about half their length in the waterproof glue mentioned previously. The preceding descriptions of the ovum are not perhaps as accurate as they should be, since they have been drawn up from alcoholic material. The peculiarity of growth during embryonal development is not unusual, the ova of the various water-bugs I have bred showing it more or less, but none so markedly.[10]

The 200 or more ova occluded in my aquaria had a period of incubation of between six and twelve days. The ova from which were raised the three individuals carried through to maturity, took respectively seven and two eleven days. As a general rule, the greater part of the eggs hatch simultaneously, and the male then sheds its unwelcome burden, the unhatched remainder, if fortunate, emerging a day or two later. The nymph comes out through a round lid that splits off the top of the egg and is attached thereto by a hinge extending about one-quarter the circumference. The process of emergence I very fortunately saw, and the following account is a transcript of my notes made as the little bug came out of its shell. After the round lid is split off, the head is gradually pushed out. By slow successive heaves, the remainder of the body is drawn out until it stands erect, with the chorion as a base, holding the posterior

9. Handbuch, Vol. II, p. 195.

10. Cf. Bueno, Journal New York Entomological Society, Vol. XI, p. 168.

abdominal segments still within it. The legs are still held in the shell, and pressed against the body. A few last heaves set free first the anterior pair, then the other two, and the little bug falls forward. Assisted by its legs, it pulls out of the shell and remains quiescent a moment, then feebly swims away.

First Instar.

Shape: The general shape is much as in the adult. The head is shorter and broader; the distance between the eyes is greater, the eyes themselves being small. The thorax is wider than long, the abdomen is rounded at the tip and covered with pile beneath. The flattened sides are broad, and the deeper abdominal middle is about as wide as one of the sides. The tarsi are all one-jointed,[11] about half as long as their respective tibiæ, and armed with two claws each, those of the anterior tarsi of unequal length, the inner claw being about one-third shorter than the other. The femora are all grooved for the reception of the tibiæ, and sparsely fringed at the edges. The exterior side of the femora is armed with stout spines, which are also found in the tibiæ of the second and third pairs of legs. The antennæ are short, club-shaped, and one-jointed, about one and one-half times as broad at the base as at the apex, and twice as long as the greatest diameter.

Size: Long., 4 to 5 mm.; lat., abd. 2.4 mm.

Colour: Generally somewhat translucent grayish or brown.

Markings: The head has a darker median stripe, produced by the lancets. There are five white spots on the connexival edges, and also near the middle of the body on each side. The legs are more or less banded.

When just emerged the shape of the nymph is more or less narrow and elongated, but in an hour or so it broadens out to the form previously noted. The colour is then a transparent yellowish, and, as in the other Cryptocerata, their transparency in their earlier stages exhibits very plainly the dorsal vessel in motion, as well as the oily globules of the unabsorbed yolk. Shortly after emergence, the young nymph casts off the amnion as a clear pellicle, almost like a diaphanous moulted skin.

When very young, the nymph finds it hard to pierce the surface film. In fact, for some time after hatching, they appear unable to break

11. Dufour (Essai Monographique sur les Belostomides) notes that all larvæ of Belostomids have uniarticulate tarsi.

readily through it to get their prey, so that lack of food prevented me from carrying to the first ecdysis more than six nymphs out of about fifty secured from ova. Of these nymphs, two moulted in seven days, and one each in eight, eleven, twelve and thirteen days respectively, the shorter periods being in late June and August, the longer in early June.

Second Instar.

Shape: Very like the first instar, except that the head is more shaped and the eyes comparatively larger. The antennæ are now distinctly two-jointed and a little more slender, the basal joint being about one-half as long as the second. The legs are as in the first instar, except that the fringing hairs and spines are naturally better developed.

Size: Long., 6 to 7 mm.; lat., 3.4 to 3.7 mm., measured from cast skins and mounted specimens.

Colour and Markings: As in the first instar.

Only three survivors reached the second moult, one in seven, one in five, and the third in six days. My further notes were all made from three individuals.

Third Instar.

Shape: Much as in the preceding instars, except that the abdomen is perhaps a little more rounded posteriorly. The head is still nearer the adult form, with the eyes a little larger. The antennæ are distinctly three-jointed in this instar, still club-shaped, and about twice as long as wide. The wing-pads first appear in this instar. The legs and tarsi are not changed, save that the smaller of the ungues of the anterior tarsal claw is much reduced in length, being barely two-fifths the length of the other. The fringing ciliæ are thicker, and the tibiæ of the third pair, near the tarsal joint, have two parallel comb-like rows of stout bristles. The various spines on the legs are much stouter and better developed.

Size: Long., 8.5 to 9 mm.; lat., 3 7 to 4 mm.

Colour and markings continue much the same, except, of course, for a deepening of the same due to the further stage of development.

The survivors reached the third moult in seven, six and seven days respectively.

The colour after casting off the outgrown integument is greenish yellow, the stomach contents and viscera showing as a darker brownish patch, through which the nearly *black* pulsating dorsal vessel runs. In about six hours the colour changes to the mottled grayish already noted.

Fourth Instar.

Shape: No great variation is shown in this instar, save that the form is perhaps a little more elongate in proportion to the preceding instars. Head is more close to that of the adult, with a slight modification in the eyes. The antennæ, which appeared three-jointed in the preceding instar, show two processes arising from the main stem, which is still club-shaped, somewhat curved outwardly, and three and one-half times as long as wide. They are much lower down the edge of the eye than in the previous stages. The wing-pads are much larger. The legs show a greater development; the fringing ciliæ are more abundant in the second and third tibiæ, and the spines much larger and more regular. The smaller claw of the anterior tarsus is further reduced, being now barely one-third the length of the other. The combs on the third pair of tibiæ are much more apparent, and there is a third broken row above the two others.

Size: Long, 10 to 12 mm.; lat., 6.7 mm.

The colour and markings are still unchanged.

The three nymphs cast their skins for the fourth time in six, five and seven days. Here the colour on leaving the cast skin is green, a very light green, differing in this slightly from the other nymph. In a few hours the normal spotted gray nymphal coloration is attained. The integument even at this advanced period is so transparent that the contraction of the dorsal vessel is visible through the back.

Fifth Instar.

Shape: Differs from adult only in the more rounded abdomen and absence of wings and strap-like appendages. The head is still proportionally broader. The antennæ are now much larger, much lower down the inner margin of the eye, and very distinctly palmate, three and a half times as long as wide. The wing-pads are large. The lower margins of the eyes are provided with long fringing hairs. The legs are the same, with one-jointed tarsi. The shorter claw of the anterior tarsus still persists, very much reduced.

Size: Long., 15 to 17 mm.; lat., abdomen, 8.4 to 8.8 mm.; wing-pads, 8.8 to 9.4 mm.

Colour and markings a little more accentuated, but otherwise unchanged.

The three nymphs arrived at the adult instar, two in eleven and one in eighteen days, but it is to be noted that the latter is an unduly long period in comparison with that of the other two, and with those elapsing between the other instars. The full life-history of each of the bred individuals is as follows :

	No. 1.	No. 2.	No. 3.
Ova deposited............	May 20	June 5	August 19
Emergence	" 31	" 16	" 26
1st Ecdysis	June 11	" 24	September 2
2nd "	" 18	" 29	" 10
3rd "	" 25	July 4	" 17
4th "	July 1	" 9	" 24
5th "	" 12	" 20	October 12

The above gives periods for the full development from occlusion of the ova to the adult of 53, 45 and 54 days, the one whose development occurred in midsummer having the shortest period. One of the adults survived in my aquarium till early January. It was sluggish, but finally died as a result, doubtless, of the abnormal conditions under which it laboured.

A most noteworthy fact in the development of *Belostoma fluminea* is the progressive diminution in size of the claw on the anterior tarsi, which finally disappears at the last moult. In the genus *Amorgius* this is not the case—the nymphs have two equal-sized claws on the anterior tarsi, long and well-developed, one of which disappears at the last moult. This may be seen in the nymphs of *Amorgius annulipes, A. obscurum* and *A. americanum.* On the other hand, the nymph of *B. Boscii* is single-clawed in the anterior tarsi in the third to fifth stages, which peculiarity it shares with *Abedus breviceps.*

This paper treats only of the more obvious structural differences in the nymphal instars, because lack of material as well as of time to devote to entomology, has prevented the deep study necessary to satisfactorily elucidate many obscure points. What is set down is the result of personal observations, the life and habits have been carefully studied from the living bug, and the anatomical features have been investigated by dissections and microscopical examinations.

In conclusion, I may say that *Belostoma fluminea* is so common a bug, and so easily kept in captivity, that it is possible for any one to breed them and check my results, which I sincerely trust may be done before long.

NOTES ON AMERICAN HEMIPTERA.

BY DR. E. BERGROTH, HIBBING, MINN.

I.

ARADIDÆ.

1. *Aradus concinnus*, Bergr.—Female: Fifth ventral segment as long in the middle as at the sides, with a transverse obtuse-angulated keel a little in front of the almost straight middle part of the apical margin, this keel at the ends coalescing with the apical margin, apical angles of the segment reaching a little beyond the slightly rounded apical margin of the middle part of the sixth ventral segment, which is broader than long, apical angles of this segment nearly reaching apex of second genital segment, which does not project behind apex of abdomen and is half as long as the transverse first genital segment, this more than twice as broad at base as at apex, apical genital lobes shortly prominent beyond apex of abdomen, somewhat distant interiorly, inner margin rounded, apical margin oblique, notched before the middle, dorsal genital segment broadly rounded at apex.

I described this neat little species from a single male from South California without nearer locality. Mr. Heidemann has received both sexes from Palm Springs, Cal. It is the only known American species of the group called *Piestosoma* by Laporte.

2. *Aradus Behrensi*, Bergr.—Of this species, hitherto known only from California, Mr. Heidemann has sent me a specimen from Hood River, Oregon.

3. *Aradus Hubbardi*, Heid.—Of this species Mons. Schouteden has sent me a brachypterous female from Truckee, Cal. (5,800 ft.). In this the corium extends only a little beyond the middle of the second abdominal segment and the membrane is very short, appearing only as a rounded border of the apical margin of the corium, not extending behind its apical angle. I have never before seen a brachypterous imago of this group of the genus.

4. *Aradus cincticornis*, n. sp.—Ovate, male not narrower than female, blackish-brown, basal part and expanded lateral parts of the pronotum yellowish, apical half of scutellum light brown with the apex black, corium, connexivum and under-side of the body mottled with yellow, apical angles of connexival segments yellow, second joint of antennæ sparingly and minutely speckled with yellow, third joint whitish except at base, legs often minutely speckled with yellow, apex of tibiæ testaceous.

Head about as long as the pronotum in the middle, and distinctly longer than broad, longitudinally impressed at the sides with a small tubercle a little in front of and within the strongly-prominent substylated eyes, apical process parallel from the apex to near the base, reaching the middle third part of the second antennal joint, antenniferous spines a little divergent, with a small tooth on the outer margin, antennæ slender, almost filiform, second joint distinctly shorter than the head, longer than the third and fourth joint together, very slightly incrassated at the apex, fourth joint a little longer than the third, rostrum reaching to or a little beyond the middle of the mesosternum. Pronotum more than twice as broad as long in the middle, dilated on the sides, with the greatest breadth behind the middle, sinuated at base in front of the scutellum, lateral margins obtusely angulated, remotely and bluntly dentate, antero-lateral and postero-lateral margins almost straight, disk with the usual six keels, the two inner keels reaching the apical margin, approximated before the middle, external keels much abbreviated, not reaching the middle, median keels reaching the middle of the fore half, ending in a tubercle. Scutellum with a central tubercle, lateral margins raised, nearly parallel towards the base. Hemelytra in the male extending a little beyond the middle of the dorsal genital segment, in the female only reaching the base of this segment, lateral margin of corium ampliated near the base, membrane grayish, with more or less distinct small fuscous spots. Abdomen rather strongly rounded on the sides, lateral margin of connexivum distinctly subangularly prominent just before the apical angles of the segments. Length, ♂, 6 mm.; ♀, 6.5 mm.

Males : Apical lobes of genital segment broad, rounded, with some short and blunt marginal teeth.

Female : Fifth ventral segment a little shorter in the middle than at the sides, apical margin straight in the middle, apical angles extending beyond the middle of the median lobes of the sixth segment, these lobes taken together about as broad at apex as their length, apical angles of sixth segment not reaching the apex of the first genital segment, which is very short, four times shorter than the middle the sixth ventral segment, second genital segment but little shorter than the first, hairy, protruding between the apical genital lobes, the outer margin of which is rounded, with a few obtuse teeth.

ALABAMA.

Allied to *A. similis*, Say, and *Hubbardi*, Heid., but it is more broadly ovate in both sexes, differently coloured, with the lateral margin of the abdomen more undulate, and with the genital and female ventral segments differently shaped.

5. *Aradus Falleni*, Stal.—Taken by Mr. Heidemann near Washington, D. C., the most northern locality recorded for this species.

6. *Aradus gracilicornis*, Stal.—Mr. Heidemann has sent me specimens from Chiricahui Mountains, Arizona. It was hitherto known only from Cuba.

7. *Aradus niger*, Stal.—This species, although rare, seems to be widely distributed. It is recorded from Colorado by Gillette and Baker under the unpublished name, *A. obliquus*, Uhl.

8. *Aradus Heidemanni*, n. sp.—Elongate-ovate (♀), fuscous, unicolorous, external margins of pronotum, abdomen and basal part of corium very finely crenulate. Head distinctly longer than broad, scarcely shorter than the pronotum in the middle, with a U-shaped impression above and a small, rather acute forwardly-directed tubercle a little within and in front of the eyes, apical process narrowly conical, just a little passing the base of the second antennal joint, antenniferous spines a little divergent, with a distinct tooth on the outer margin, antennæ cylindrical, second joint shorter than the width between the eyes, third joint a little shorter and narrower than the second, fourth joint distinctly shorter than the third, rostrum not quite reaching base of head. Pronotum about twice as broad as long in the middle, scarcely broader than the base of the hemelytra, almost trapezoidal, apical margin truncate, lateral margins a little rounded from the base to a little before the middle, basal margin deeply sinuate in front of the scutellum, disk with four anteriorly convergent keels and a much abbreviated obtuse keel within the lateral angles. Scutellum distinctly longer than the middle of the pronotum, lateral margins reflexed, slightly rounded, apex obtuse. Hemelytra in the macropterous female reaching the base of the dorsal genital segment, corium nearly reaching apex of third segment, somewhat dilated and rounded near the base. Abdomen slightly roundedly prominent near the apical angle of the fifth connexival segment, lateral margins of the sixth segment straight, apical angles obtuse, apical margin broadly truncate, with the female genital lobes much projecting beyond the truncated margin. Length, ♀, 7.8 mm.

Male unknown.

Female: Fifth ventral segment a little shorter in the middle than at the sides, the apical angles reaching apex of the middle lobes of sixth segment, apical margin trisinuate in the middle; central lobes of sixth segment dilated towards the apex, taken together much broader at apex than the length of the segment, apical margin trisinuate in the middle part, apical angles almost reaching apex of second genital segment; first genital segment twice as long as second, this not protruding between the apical genital lobes, which are rather broadly distant and broader than long, rounded on the inner side and shallowly notched on the outer side; dorsal genital segment almost truncate at apex, scarcely projecting beyond apical margin of last connexival segment.

Astoria, Oregon (coll. Heidemann); Yale, British Columbia (my coll.).

The specimen from Yale is a brachypterous female; it is of a more grayish-black colour, the lateral margins of the pronotum are quite straight, the corium is not longer than the scutellum, rounded at apex, and the membrane is entirely wanting. It much resembles the brachypterous form of *niger*, but is larger, with the antennæ and female genital segments differently shaped.

This interesting species belongs to the subgenus *Quilnus* of Stal, distinguished by the very short rostrum and the trapezoidal pronotum. This subgenus is represented by three species in the palæarctic region (*A. parvicollis*, Stal, from South-eastern Europe and the Island of Cyprus; *A. mirus*, Bergr., from Austria, and *A. brevirostris*, Horv., from Siberia), and by two nearctic species (*A. niger*, Stal, and the above described new species). They live on conifers; unlike other Aradi, which are mostly found under the bark, *mirus* dwells on the twigs and needles of the live trees.

9. *Mezira Jamaicensis*, n. sp.—Elongate, brownish piceous, abdomen ferruginous, apical margin of connexival segments pale yellow. Head about as long as broad, antenniferous spines short, slightly divergent, first joint of antennæ considerably passing apex of head, second joint shorter than first, incrassated towards apex, third joint longer by a half than the second, slender, a little incrassated at extreme apex, fourth joint a trifle shorter than second, postocular teeth acute, not passing the eyes. Pronotum almost straight at base, sides rounded, sinuated before the middle, apical angles rounded. Scutellum slightly carinate in the middle. Hemelytra (♀) reaching base of sixth dorsal segment, corium reaching the middle of second connexival segment, apical margin straight, membrane blackish, with two subconfluent pale spots at base. Abdomen scarcely broader than pronotum. Length, ♀, 6 mm.

Jamaica (coll. Montandon).

Distinguished from the allied species by the almost parallel body and by the colour.

[N.B.—The genus *Brachyrrhynchus*, Lap., must bear the younger name, *Meziïra*, Am. S., the first name being preoccupied (Sélys, Aves, 1831). The allied genus, *Coloborrhynchus*, Champ., the name of which is also preoccupied (Owen, Reptilia, 1874), I propose to call *Coloborrhinus*.]

CATALOGUE OF THE GENERA OF THE HEMIPTEROUS FAMILY APHIDÆ.—Second Supplement.

BY G. W. KIRKALDY, HONOLULU, HAWAIIAN ISLANDS.

In the Annales of the Belgian Entomological Society (Vol. 50, pp. 30–6, Feb. 2, 1906), my friend Mr. Schouteden has added a considerable number of genera and species to my list, extending it to 1906.

The number of omissions, even before 1905, is so large, comparatively, that it demands some explanation from me.

1. Some of the remarks, as, for example, the identity of *Aristaphis* and *Pterocomma*, are matters of opinion, though Mr. Schouteden is more likely to be right in this matter than I. These, however, are few in number, and are incidental to all list-making.

2. Some of the omissions were rectified in the first supplement, and it is instructive, as illustrating the difficulty of procuring, or, rather, of knowing of the existence of, some of the papers, that Schouteden did not know of one or two added there by me.

3. I can scarcely hold myself justly responsible for ignorance of many of the papers, as they were in publications inaccessible here, and were not included in any of the usual records. An author can certainly publish where he wishes, but he ought to send copies for record to the Zoological Record, Bericht der Entomologie, or similar works.

The Zoological Record for 1904 was not received here till February, 1906, consequently I lost an opportunity of revising my list.

4. Almost all of the omissions are of European species, the most notable being several species of *Phylloxera*, described by Pergande.

5. In the same Annales, p. 42 (Feb. 27), Mr. Schouteden adds another omitted genus (dating from 1857 !) and makes one or two minor alterations in his own paper.

A FURTHER NOTE ON EUCHŒCA COMPTARIA AND THE ALLIED SPECIES.

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

I am glad that Dr. Dyar has given us a note on the *Euchœca comptaria* problem, and that up to a certain point he supports my view.

Without a doubt, he is right in insisting that the type species of *Nomenia* must be called *12-lineata*, Packard.

I am pleased, too, that he has associated Mr. Pearsall's name with another part of the *12-lineata* of authors. I should have suggested this course in the present paper had I not been anticipated.

We are now, I think, all agreed that *E. comptaria*, Walker, is the correct designation for the insect which has hitherto been considered to represent *12-lineata* in the east, and not for the one commonly known as *perlineata*, Pack. This is what I asserted in my first note,[1] and is *not* the view taken by Hulst in Dyar's Catalogue. But Mr. Pearsall now claims, and apparently Dr. Dyar takes it for granted that he is right, that this supposed eastern form of *12-lineata* is really the *perlineata*, Packard, and he brings forward as evidence two specimens now in the Packard collection at Cambridge, bearing labels "*perlineata*" "type."

But, in the first place, it is quite evident from the locality labels on these insects that they are not really types at all. The original types of *perlineata*[2] were ♂ and ♀ from "Albany, New York, Lintner." These specimens have disappeared. The specimens now in the collection, and which Mr. Pearsall has examined, are two males, "West Virginia, Mead."

In the second place, if these two moths are really *comptaria* rather than *perlineata*, which I cannot yet feel quite sure of in my own mind, and if we accept them as genuine types, which, as I have just shown, they cannot be, even then we cannot allow them to have any weight as against the excellent description[2] and the two capital figures[3] published by Packard.

It is naturally very satisfactory when a type specimen is available to confirm an original, perhaps too meagre, description, but if description and type conflict, then the rule is, or, at any rate, the *practice* is, to give the weight to the *description*. It is the *description*, and that only, that is

1. Can. Ent., XXXVII., 239.
2. Proc. Bost. Soc. Nat. Hist., XVI., p. 20.
3. Mon. Geom. Moths, Plate VIII., figs. 25 and 68.

published to the whole world, and from the description in the present case entomologists have for 30 years applied the name *perlineata* to the insect Mr. Pearsall now renames *E. exhumata*.

If the description were vague, which it is not, the figures in the monograph are unmistakable.

Dr. Dyar suggests that the *Melanthia condensata* of Walker[4] may be this species, but I am informed that Walker's single type is a specimen of *E. lucata*, as his description would lead one to suppose. Walker's *Cidaria inclinataria*[5] is, as I have elsewhere stated,[6] a synomym of *Xanthorhoe ferrugata*.

I conclude, therefore, that these species must, after all, be listed pretty much as I placed them in my first note, the only difference being that I am now willing to admit our western *Euchœca* to specific rank as *E. Pearsalli*, instead of uniting it with *E. comptaria*, as I was at first disposed to do.

The list will stand:

Nomenia duodecimlineata, Packard.
= unipecta, Pearsall.
Euchœca Pearsalli, Dyar.
= 12-lineata, Auct. (western form).
Euchœca comptaria, Walker.
= 12-lineata, Auct. (eastern form).
= salienta, Pearsall.
Euchœca perlineata, Packard.
= exhumata, Pearsall.
Euchœca lucata, Guenée.
= condensata, Walker.

A CORRECTION.

An inexcusable blunder was committed by me some years ago. On page 791, Proc. U. S. Nat. Mus., XXVI, for 1903, I described an insect under the name *Psinidia sulcifrons*, var. *amplicornis*. For the word *sulcifrons* the specific name *fenestralis* was intended, and should be substituted throughout the description.

A. N. CAUDELL.

4. Cat. Lep. Het., B. Mus., XXIV., 1273, 1862.
5. Cat. Lep. Het., B. Mus., XXVI., 1727, 1862.
6. CAN. ENT., XXXVII., 240 and 413.

DESCRIPTIONS OF TWO NEW GEOMETRID MOTHS FROM ALBERTA.

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

Xanthorhoe circumvallaria, n. sp.—Expanse, 35 mm.

Palpi and front dark gray, with a plentiful intermixture of brown scales. Thorax dark fuscous. Abdomen above dark gray, beneath lighter gray.

Fore wing: ground colour gray, but almost entirely obscured by blackish-brown scales.

The basal area is darkened by about four parallel wavy fuscous lines; the space between the basal and intradiscal lines is paler and crossed by two dark lines parallel with the basal. Median space uniform blackish-brown, slightly lighter around the large jet-black discal spot; in worn specimens can be seen traces of two darker cross lines, one intra- and one extra discal, within this area; the extra-discal line is black, very irregular, the most prominent outward projection being between veins 3 and 4, this line is followed by a clear white line, then a brownish parallel line, then a gray space (ground colour of the wing), twice as broad as the brown line, next a dark band of the same colour as the median space, extending to the margin and divided into two parts, the outer a little paler than the inner, by a conspicuous white zigzag submarginal line, a marginal row of geminate black dots; fringe checkered gray and brown.

Hind wing: clear white, with a distinct black discal point, and extra-discal black line and a submarginal black band about 2 mm. in width; marginal dots as on fore wing; fringe white, cut with black at the ends of the veins.

Beneath the whole fore wing to the extra-discal line is smoky-black; extra-discal line darker, and the extra basal space is also marked by a darker shade, especially towards the costa; a small dark spot on costa, opposite the discal spot; beyond the extra-discal line is a white band; the rest of the wing is black to the submarginal white zigzag line, which is marked from the costa to vein 3; beyond this line the apical portion of the wing is gray; discal spots on all wings enlarged.

Hind wing marked as on upper side, but the basal area is lightly peppered with dark scales.

Types, two males and two females in my cabinet.

Collected by Mr. F. H. Wolley Dod, near Billings's lumber mills, Millarville, Alberta, on 26, vi, 1898, and 24, vii, 1904.

A fifth specimen from the same source I have sent to the United States National Museum, and others (co-types) are in Mr. Wolley Dod's collection.

Aplodes Hudsonaria, n. sp.—Expanse, 31 mm.

Palpi and front rose-pink, the latter pale on the front edge, but not so distinctly white as in *A. mimosaria.*

Head white above and between the antennæ; collar green; antennæ white above at base, brown towards the tips; thorax bright green; abdomen, first three segments greenish, each bearing a white dorsal spot; rest of the abdomen white. Legs white, anterior tibiæ pink on inner side, and second pair of tibiæ with three pink spots, one at each extremity and one in the middle.

Wings bright green, of the tint of *A. mimosaria*, with two white lines on each wing.

On the fore wing the basal line is irregularly curved, fading out towards the costa; outer line almost straight, not quite parallel to the outer margin (as is the similar line in *mimosaria*), but inclining towards that margin as it nears the costa, which it does not quite reach; costa white above, pink at the base beneath. Hind wing, basal line rather straight, extending from costa to just below median vein, then obsolete; outer line commencing on costa, nearer to the base than usual, curving strongly below median vein, so that if produced, on the same curve, from its vanishing point just below vein two, it would reach the *base* of the wing instead of the inner margin.

In the direction of this line this species differs from all other species of American *Geometrinæ* known to me.

Discal points on fore wings reddish in one of the type specimens, obsolete in the other; on hind wings discal marks are elongated and greenish, as in *mimosaria;* the discal marks on all wings are more evident on the under-sides. Fringes white, spotted with pink.

This species seems to represent *A. mimosaria* in the west, but can be quite easily distinguished by the peculiar outer line on the secondaries and by other points noted in the description.

Types, two males, taken at light on July 7th, 1905, by Mr. A. F. Hudson, at a point on the Red Deer River, 50 miles north-east of Gleichen, Alberta, and kindly presented to me by Mr. F. H. Wolley Dod. A third male is in Mr. Wolley Dod's collection.

Since writing this description, I have seen two female moths, taken at Victoria in August, 1903, by Mr. A. W. Hanham, which appear to belong to this species. The only difference I notice is that the outer line on the hind wing is more distant from the base of the wing in the Victorian specimens than in the Alberta types. One of Mr. Hanham's specimens has been generously given to me, the other remains in his own cabinet.

THE TEGMINAL POSITION IN GRYLLUS.

BY FRANK E. LUTZ, COLD SPRING HARBOUR, LONG ISLAND, N. Y.

In Chap. X of the Descent of Man, Darwin says that when the male of *Gryllus campestris* is chirping, "first one wing is rubbed over the other, and then the movement is reversed." I have carefully observed several hundred males of our native Gryllus, and it seems to me that one tegmen ("wing") is always uppermost. This is, at first sight, a very minor point, but it leads to some rather interesting thoughts.

Among crickets one tegmen when at rest overlaps the other along the median dorsal line. Among the males, as shown below, it is usually the right tegmen that is placed over the left, while among the females there is a much nearer approach to equality of the two conditions. Thus :

Locality.	♀.				♂.			
	Right Uppermost.		Left Uppermost.		Right Uppermost.		Left Uppermost.	
	No.	%	No.	%	No.	%	No.	%
Perkins Cove, Me., Fall 1904...	106	67.5	51	32.5	135	97.8	3	2.2
New Fane, Ver., Fall 1904.....	14	43.8	18	56.2				
Cold Spring Harbour, N.Y., Fall '04	450	65.9	233	34.1	433	98.4	7	1.6
Gotha, Fla., Fall 1903.........	53	72.6	20	27.4	34	100.	0	0.0
Gotha, Fla., Spring 1904......	119	71.3	48	28.7	83	98.8	1	1.2

During the season of 1905 I had under observation in the laboratory about 100 each of males and females of our native Gryllus. Of these males, when left to themselves, every one kept for the rest of his life the tegminal position he had when he became mature. The females, however, frequently changed theirs. Thus, to take two successive records, which are typical :

No. 190. Matured Aug. 7, **L**; Aug. 19, **R**; Aug. 23, **L**; Sept. 5, **R**; died Sept. 14, **R**.

No. 191. Matured Aug. 5, **R**; Aug. 19, **L**; Aug. 23, **L**; Sept. 5, **R**; died Sept. 9, **R**.

If we take a male after the chitin of the tegmina has hardened, and reverse the tegminal position—say, change **R** to **L**—he will almost immediately show signs of uneasiness, raise his tegmina, and move them back and forth until he has succeeded in changing them to their original position. If, however, we make the change as soon as he has moulted, and while the tegmina are still soft, the new position will be retained after they are hardened. If we now attempt to change them back to the natural position the cricket will return them to the unnatural one. As far as I could tell, such a cricket could chirp just as well as one whose tegmina had not been tampered with, although he was using the sound-producing organ which would naturally not have been used at all. As indicated above, this organ—the "file" on the under side of the left tegmen—is unused in about 98% of our native Gryllus, and yet it is, to all appearance, as well developed as the other. I have counted and measured the "teeth," studied the venation of the "drum," and, in short, have failed to discover any significant difference between the sound organs of the two tegmina.

In the Locustidæ we find a very different condition. Here there is no file on the right tegmen, and this is *always*—as far as I have seen—carried under the left. However that may be, we have in this very closely-related family, which is really scarcely distinct from the Gryllidæ,* a specialization which is just hinted at (but in the reverse way, *i. e.*, right uppermost) in Gryllus. The constant position of the tegmina is here nearly reached, but the unused sound organ is still intact.

The condition of the females is also interesting. It is easy to see a possible reason why the female should change the tegminal position more often than the male. The tegmina do not overlap so far. But why is it that in spite of this, with the exception of the New Fane, Ver., collection, about twice as many have the right tegmen uppermost as otherwise? Is it a lagging behind the males in specialization and an inheritance from them?

The mention of inheritance brings me to the final and most important point. Is the abnormal left-tegmen-uppermost condition inherited? I am trying to test this, but "left-winged" material is very scarce. If it is inherited, and if isolation is a true biologic factor, there ought to be localities where the "left-winged" condition is common, perhaps even prevalent. I made the unfortunate mistake of asking Mr. C. D. Howe, who kindly sent me what I have from New Fane, Ver., for only females, as at that time I was interested chiefly in females, and so I have not, now, any males from that place. Thirty-two is rather a small

*There seem to me to be more fundamental differences between Gryllotalpa, Grylloides and Gryllus than between Gryllus and the Locustidæ.

number, but as it gives quite a preponderance of left-tegmen-uppermost, I would not be surprised if we have here an isolated colony where "left-wingedness" in the male is common—a survival of a more generalized state, perhaps. I hope to get more material from there. Meanwhile, I would like to ask those all over the country who have opportunity, to examine the male crickets with this simple point in mind. I would be extremely grateful for any such material or information regarding it. It has a bearing on several very important questions.

A FOSSIL WATER-BUG.

BY T. D. A. COCKERELL, BOULDER, COLO.

Among the fossil insects collected at Florissant, Colo., by Judge J. Henderson and Dr. F. Ramaley, of the University of Colorado, is a species of Corixidæ, represented by numerous individuals. It occurred, as Judge Henderson informs me, in the first railroad cutting east of Florissant, a little above the middle of the section there exposed. The shale containing the specimens is very much lighter than that in which the other Florissant fossil insects seen by me are imbedded, and it is believed to belong near the top of the series. It may represent a later period than that in which most of the numerous species described by Scudder lived, and it is certain that the insects now described differ from the three species of Corixidæ described from Florissant.

Corixa Florissantella, n. sp.

Length, 6⅓ mm.; breadth, 2¼ mm; corium and membrane minutely reticulated, not at all striated; face convex; scutellum concealed by pronotum, except posterior angle; pronotum without visible markings; corium with the margins of the posterior (apical) part rather broadly pallid, and with a broad, more or less distinct transverse dark band just above the beginning of the membrane; just before the dark band is a suffused light band, and in front (basad) of this the corium is dark; membrane black; abdomen ending in a pair of large subtriangular plates, not asymmetrical; swimming (posterior) legs well developed, hairy as usual, extending about ¾ mm. beyond end of abdomen. Length of tegmina, 4½ mm.; breadth about 1 mm.; middle legs projecting about 4 mm. beyond body. Florissant. Following Kirkaldy's table (Entomologist, 1905, p. 234) this would seem to be a genuine *Corixa*, but it lacks pale lines on the pronotum. In Scudder's table of the Florissant species, it falls with *C. Vanduzeei*, Scudd., but that differs entirely in the markings, and probably belongs to the genus *Callicorixa*.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

TORONTO BRANCH.

The 109th meeting of the Toronto Branch was held in the Provincial Museum on March 20th.

The event of the evening was a paper by Dr. Brodie, entitled "Insect Intelligence," in which attention was drawn to some classes of insects which seemingly exhibit an unusual amount of brain development in the will-power shown in the deliberate selection of ways and means. This was followed by a discussion, in which Dr. Abbott gave some interesting examples from personal observation of the skillful way in which insects adapt themselves to abnormal conditions.

The 110th meeting was held on April 17th.

Mr. Williams exhibited some fine Stick insects which he had received from Natal.

Dr. Brodie had a specimen of a hawk-owl, taken in Saskatchewan. This bird, related to both hawks and owls, is not strictly nocturnal, although it feeds at night on insects. Its feet are feeble. It is seldom seen near Toronto, and is not common anywhere. It ranges from Muskoka to British Columbia, always in wooded countries.

Mr. Paul Hahn presented a beautiful little moth, *Orchemia diana*, to the Society, some specimens of which he had collected in Algonquin Park.

Dr. Brodie gave an instructive paper on the Tussock Moth pest. He showed the prevalence of parasitism in checking the increase of the moth, and recommended the collecting and destroying of egg masses, leaving all other cocoons undisturbed. The paper was followed by a discussion.—ELSIE BLACKMORE, Secretary.

ADDITIONAL SPECIES OF MINNESOTA DIPTERA.

Since the printing of the Tenth Annual Report of the Minnesota Entomologist in December, 1905, about 75 additional species of Diptera captured in that State have been named, representing the following families:

Agromyzidæ, Anthomyidæ, Bibionidæ, Cecidomyidæ, Chiromonidæ, Culicidæ, Dolichopodidæ, Drosophilidæ, Empidæ, Ephydridæ, Geomyzidæ, Helomyzidæ, Leptidæ, Lonchopteridæ, Muscidæ, Mycetophilidæ, Ortalidæ, Oscinidæ, Pipunculidæ, Psilidæ, Sapromyzidæ, Scatophagidæ, Sciomyzidæ, Sepsidæ, Simuliidæ, Syrphidæ, Tachinidæ, Trypetidæ.

These species have been listed, and a copy of the list mailed to each Station Entomologist and others known to be interested. Any one failing to receive a copy, and desiring one, can obtain it by writing to Mr. F. L. Washburn, Experiment Station, St. Anthony Park, Minn.

A NEW TORTRICID FROM TEXAS.

BY AUGUST BUSCK, U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

Cydia grindeliana, sp. nov.—Antennæ blackish brown, with short greenish cilia. Labial palpi light greenish yellow, tipped with black. Head and thorax light greenish yellow. Fore wings light straw-coloured, overlaid and streaked with light greenish yellow, and in some specimens with light olive. Costal edge from base to apex with short black and silvery-white strigulæ. Ocellus light shining yellow, edged anteriorly and posteriorly by narrow perpendicular silvery metallic lines, and containing three short black dashes, two on the anterior margin and one on the apical margin; above this is a small area, thickly mottled with dark brown scales, and the whole is surrounded by a narrow silvery line. Termen edged with dark brown; cilia yellow, with white base, and with dark brown scales, forming a more or less complete marginal line. Hind wings light silvery fuscous. Abdomen silvery fuscous. Legs yellowish, tarsi annulated with black.

Alar expanse: 17–19 mm.

Habitat: *Clarendon, Texas* (October).

Food-plant: *Grindelia squarrosa*, var. *nuda*. U. S. Nat. Museum. Type No. 9804.

The species is nearest *C. olivaceana*, Riley, and *C. griseocapitana*, Walsingham, but lighter, more bright yellow than either. From both it also differs in the dark-tipped labial palpi. From *C. olivaceana*, which it most resembles in general colour, it differs by the continuous series of small costal strigulæ, and in the absence of the oblique olive costal streak at apical third. The strigulæ it has in common with *C. griseocapitana*, but that species has a more dingy whitish colour, irrorate with olive; that species, type of which I took careful notes on last spring in the British Museum, also has the oblique costal streak at apical third, and has the cilia irregularly dusted with brown. The type of Riley's species is: U. S. National Museum, besides several other specimens. That species feeds on *Solidago*.

The types of the present species were bred by Mr. W. Dwight Pierce, of the U. S. Dept. of Agriculture. The larva feeds in the flower-heads of *Grindelia*, and pupates in a loose cocoon in the same place.

A NEW INJURIOUS PINE-NEEDLE MOTH.

BY AUGUST BUSCK, U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

Recurvaria pinella, new species.—Antennæ dark purple, with silvery-white annulations. Second joint of labial palpi black, with apex and a large spot on the inner side silvery white; terminal joint white, with a narrow black annulation on basal half. Face white, iridescent, sprinkled with darker scales. Vertex and thorax dark purple. Fore wings dark purple, sparsely sprinkled with lighter scales. From basal fourth of costa to basal third of the dorsal edge is a thin, very indistinct and ill-defined oblique white fascia. Along the dorsal edge below the fold are two or three very small tufts of black and white raised scales. Cilia dark purple, apical part with a still darker blackish basal line along the edge of the wing. Hind wings light fuscous; cilia yellowish. Abdomen bronzy fuscous; female with protruding horny, hairy ovipositor. Legs purplish black, with white bars; tarsal joints tipped with white.

Alar expanse: 9–10 mm.

Food-plant: *Pinus ponderosa.*

Habitat: *Manitou, Colorado, Prof. C. P. Gillette.* U. S. N. M. Type No. 9811.

The larva mines the leaves of *Pinus ponderosa* exactly in the fashion of the common *Paralechia pinifoliella*, Chambers, in the Eastern States, and is, according to Prof. Gillette, of some economic importance.

Prof. Gillette, who has shown me beautiful drawings of this insect and its work, will shortly give a fuller life-history.

In coloration the species comes nearest to *Recurvaria nigra*, Busck, but that species has the thin cross line at apical third of the fore wing instead of at basal third as in the present species. Venation and oral characters typical.

ANNOUNCEMENT.

The Rev. C. J. S. Bethune, editor of THE CANADIAN ENTOMOLOGIST, has been appointed Professor of Entomology and Zoology at the Ontario Agricultural College, Guelph.

All communications intended for him personally, or as editor of this magazine, should be addressed, after June 11th, to

REV. PROFESSOR BETHUNE,
ONTARIO AGRICULTURAL COLLEGE,
Guelph, Canada.

Books and Exchanges (as hitherto) to The Entomological Society of Ontario, London, Canada.

Mailed June 5th, 1906.