comparison of the insect with Herrich-Schaeffer's figure will show.

Ranatra quadridentata Stal No. 152. The specimen under this name and number is a typical *R. americana* Mont.

Belostoma americanum Leidy No. 155, Harris No. 109 is *Lethocerus obscurus* Duf.

Under the label *Notonecta insulata* Kirby, No. 156, are placed Harris' Nos. 17δ and 17ε which Uhler has referred to *N. undulata* Say in his work cited. He remarks that "It varies also in size, ranging from 9 to 12½ millims in length." The discrepancy in size arises from the fact that 17ε is *N. variabilis* Fieb. The other specimens are correctly labelled as they stand.

To recapitulate: The following species did not appear in Uhler's paper under their proper names, but as the species with which they are synonymous.

Lygæus kalmii Stal = *L. turcicus* Uhl., not Fabr. for all except those from Michigan, for the specimens under No. 54.

Emblethis vicarius Horv. = *Gonianotus marginepunctatus* Uhler, not Wolff. for specimen No. 65.

Pelocoris carolinensis Bueno = *Naucoris poeyi* Uhler, not Guérin, for specimen No. 148.

Ranatra protensa Mont. = *R. fusca* Uhl., not Palisot de Beauvois, for specimen No. 151.

Ranatra americana Mont. = *R. quadridentata* Uhl., not Stal for specimen No. 152. (N. B.—This applies to all the specimens from the Northern and Eastern United States, as well as Canada, so determined by myself and others, prior to 1910.)

Lethocerus obscurus Dufour = *Belostoma americanum* Uhl., not Leidy, for specimen No. 109.

Notonecta variabilis Fieb. = *N. undulata* Uhl., not Say, for specimen 17ε.

WOOD-BORING TRICHOPTERA.¹

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In the cold, alder-bordered streams of the uplands swamp near Ithaca, N. Y., are found Caddis-worms whose case-making habits

¹ Contribution from the Limnological Laboratory of the Department of Entomology in Cornell University.

differ greatly from those of described American Trichopterous larvæ. Instead of the usual dwellings of stones or twigs, or tubes of silk, these utilize fallen twigs of wood from the stream-bottom. The twigs are hollowed from end to end, and lined with silk, forming portable cases which are a natural part of their surroundings. These belong to an undescribed species, whose larvæ abound among the litter of branches and twigs, from the surrounding forest. In spite of their abundance they are most inconspicuous among the débris. They crawl with a jerky motion, as if swayed by the passing current, or rest, as if lodged, on a submerged branch, and when disturbed, let go, drifting down stream with the current.

The twigs used as cases vary greatly in length and diameter, apparently being selected at random from the litter on the bottom of the forest stream. Sometimes pieces of heavy bark or fragments of broken wood are used. A cylindrical hole always penetrates the wood from end to end. In some twigs the chamber forks near the anterior end, one outlet curving downward and opening to the exterior at one side, while the other perforates the end of the stick. The side outlet, when present, forms the anterior entrance to the case, the other in the end being plugged with silt or with small pebbles. Sometimes the chamber curves downward without forking, as in Fig. 13. The chamber is always lined with silk. (Fig. 13 represents a case with the silk tube cut away, except around the larva.) Although there is considerable variation in the size of the twigs used their average size increases with the growth of the larvæ. To ascertain how the change in cases is made several experiments were made with captive larvæ. Some were removed from their cases and put in cages with twigs of appropriate size. These larvæ did not attempt to use the wood for making new cases, but merely spun silken tubes to which particles of silt adhered; others, which had one side removed from their cases, repaired the damage with silk and silt. One larva repaired the damaged side with silt and fragments of bark and then proceeded to cut away the two ends of its case. It worked from the damaged side of the case, cutting narrow incisions across the twig until the opposite side was reached. The operation of cutting the two incisions across the twig ten mm. in diameter consumed about 24 hours. Two specimens, which were retained in aquaria in the laboratory, attached the anterior ends of their cases securely, by

means of silk, to the ends of solid twigs, and then drilled into the wood, emitting, during the task, an abundance of very finely powdered wood. One of these new dwellings proved too long for its occupant. It was accordingly girdled with a circular incision which was deepened until one end of the twig was completely cut away. Several sticks similarly ringed were found in the creek where the larvæ occur. No doubt this is the usual method of changing cases, as larval growth proceeds.

The food of the larvæ, as demonstrated by examinations of the contents of many stomachs at different seasons, consists of fine powder rasped from submerged wood.

The larvæ are active during the summer, fall, and winter. In February, with the thermometer below 20° Fahr., they were apparently as active as during the heat of summer. By the end of April they had left the middle of the stream and had firmly attached the anterior ends of their cases to some solid support near the streams margin. At this time flat stones were fastened over both ends of their cases, a frequent practice of the larvæ at all seasons, during periods of rest.

The specimens in captivity emerged from June 4 to July 11.

The wood-boring habits of this species may, when we are familiar with more larvæ, prove a not uncommon method of case-making. I have found identical cases in streams on the Western slope of the central range of the Colombian Andes, and also in the Valley of the Magdalena River, east of this range. Similar habits are described and figured by G. V. Hudson in "New Zealand Neuroptera" 1904 for *Triplectides obsoleta* (*Pseudonema obsoleta*) of the family Leptoceridæ. Hudson, however, states that *T. obsoleta* under natural conditions sometimes constructs cases of fragments of leaves.

Following is the description of the wood borer from New York State.

(?) *Ganonema nigrum* sp. nov.

Length of body 11 mm.; front wing 15 mm.; expanse 32 mm. Dominant color of wings and body dull smoky black. Head black or dark brown with jet black hairs. Antennæ dark brown with black hairs. Maxillary and labial palpi lighter brown with black hairs. Membranous intersegmental portions light, broken between the head and the prothorax on the venter by a projection of the prothorax and on each side by a similar projection. On each side of the neck there is a white, somewhat

oval, prominence which bears long black hairs. The chitinous portions of the prothorax are black or dark brown with several lighter areas which bear tufts of long black hairs. Ventral side of the prothorax mostly white and unchitinized, except for a narrow median strip which projects backward between the coxæ of the mesothorax. A narrow chitinous plate projects obliquely upward and forward from each front coxa and bears a tuft of long black hairs. The meso- and metathorax are black with narrow borders of lighter color along the sutures. The abdomen has three narrow black lateral lines, the middle one narrowest and extending only as far forward as the second segment; above and below these lines the color is dark brown, below them it is lighter. One or two gill-like processes, some of which bear black hairs, project from the sides of each of the first five abdominal sutures. The femur, trochanter and tarsus of each leg is rather densely clothed with short black hair. Each fore coxa has two parallel rows of black hairs between which the femur fits when the leg is folded. Each of the two succeeding coxæ is provided with a single row of long hairs. For details of the genitalia consult Figs. 2, 3, 4, 5, and 6.

Larva: Length 18–20 mm., width 3 mm. Color of chitinous portions of head and thorax black when viewed with reflected light, when viewed with transmitted light mounted specimens show faintly lighter markings. The legs are black, ringed with white. Fleshy portions of prothorax and abdomen are pale brownish white. The anal hooks are brown.

The Head is narrowest at its anterior end and broadens very gradually to near its base where it narrows. Behind the place of its greatest diameter it is inclosed within the first thoracic segment. The distribution of setæ on the dorsal surface is shown in Fig. 7. The frons, Fig. 15, has a semicircular line of setæ curving away from the cephalic margin and three other, more, widely separated setæ near each side. Like the heavily chitinized portions of the head and thorax, the frons is thickly marked by minute transverse lines from each of which arise several very minute hairs, giving except under high power, a somewhat scale-like appearance. The mandibles, Fig. 2 are deeply grooved along their inner margin to the very tip of the apical tooth. Besides the apical tooth, two lateral teeth are present on each edge of the groove. From the groove arise three well-defined brushes of hair. The inner brush is directed inward and backward; the middle and cephalic brushes are directed inward and toward the front; the cephalic brush is the most dense and is composed of extremely fine hairs. The labrum, Fig. 9, is crossed by a row of 18–20 strong setæ whose bases almost touch, except on the median line, where there is a greater space. On each latero-anterior angle there is a patch of long fine hairs and in the middle of the cephalic margin a dense line of short hairs.

The Thorax: Prothorax heavily chitinized above and on the sides. The area between and in back of the coxal cavities is membranous, except two narrow spots immediately in front of the mesothorax. Mesothorax with a chitinous area which extends back over the metathorax as far as the caudal margin of the hind coxæ. Within this area there is a well-defined square bearing eight setæ, Fig. 7. The sides are not chitinous, except for a small black triangle behind each coxa, which bears a circle of about twelve setæ; the venter is free from heavy chitin, except for two narrow yellow spots on the caudal margin. The metathorax is without heavy chitin above. On the sides the distribution of chitinous plates is the same as on

EXPLANATION OF PLATE 2.

Ganomema nigrum sp. nov.

Adult.

- Fig. 1. Wings of Female.
- Fig. 2. Male genitalia, dorsal view.
- Fig. 3. Male genitalia, ventral view.
- Fig. 4. Male, genitalia, lateral view.
- Fig. 5. Female genitalia, dorsal view.
- Fig. 6. Female genitalia, ventral view.

Larva.

- Fig. 7. Head, thorax and first abdominal segment, dorsal view, pigmentation indicated on one side only.
- Fig. 8. Mandible.
- Fig. 9. Labrum.
- Fig. 10. Diagram showing distribution of gills on one side of abdomen in relation to segments and lateral line.
- Fig. 11. Front leg.
- Fig. 12. Hind leg.
- Fig. 13. Larva in case which has been split longitudinally and the silk lining in part removed.
- Fig. 14. A few of the hooklets covering the lateral hump of the first abdominal segment.
- Fig. 15. Frons.
- Fig. 16. Caudal portion of abdomen, lateral view.
- Fig. 17. Caudal portion of abdomen, dorsal view.

Pupa.

- Fig. 18. Dorsal plates of the left side numbered according to the segments on which they occur.
- Fig. 19. Anal appendages, dorsal view.
- Fig. 20. Mandible.

Lloyd—Wood-boring Trichoptera.

the mesothorax, the upper mark, however, is not so dark in color as on the preceding segment and bears more setæ, which are less circular in arrangement. The venter differs from that of the mesothorax, only in having the chitinous areas near the caudal margins darker in color. The front leg, Fig. II, is little more than half the length of the succeeding legs, but is more robust. It bears three stout spurs on the inner angle next to the tarsus and one isolated spur on the distal margin. On the inner margin of the basal segment of the tarsus there is a single row of short stout spines. The inner surface of the tibia bears numerous very short spines. The inner surface of the femur is sparsely armed with short triangular teeth. The coxa, on its inner margin, has a few short spines and over its entire surface has rows of fine, short hairs like those described for the frons. The two succeeding legs (Fig. 12 shows the hind leg), differ from the front leg in being longer and less robust and in having fewer and weaker short spines. Each of these legs has but one tibial spur.

The *Abdomen* is cylindrical and almost uniform in circumference throughout its length. The humps on the first segment are not greatly developed. The lateral humps bear an area of short curved spines whose points are directed forward. The gills are distributed on segments 2-8, above and below the lateral line, as diagrammed in Fig. 10. The lateral line, near the caudal margin of the seventh abdominal segment, ends at the beginning of a fleshy raised line, Fig. 16, which crosses the suture between the seventh and eighth segment and, inclining upward, extends to the caudal margin of the eighth segment. Each side of this fleshy line is armed with curved, bifurcate spines directed backward. The anal hooks and the arrangement of setæ on the last abdominal segments are shown in Figs. 16 and 17.

Pupa: Length, 13 mm. Mandible Fig. 20. Tarsi flattened and fringed on each side by a row of black swimming hairs. Lateral line black. A narrow black line parallels the lateral line beneath, to the caudal margin of the eighth segment, where the two converge. A narrow black line above the lateral line contains the spiracles. Abdominal segments 2-9 with paired tufts of hair near their caudal margins above. On the caudal margin of the first abdominal segment there is a pair of lobes, Fig. 18, covered with sharp spines. Above these lobes are sparse backward-pointing teeth. The chitinous plates of the abdomen are shown in Fig. 18. The posterior end of the pupa is represented in Fig. 19.

TWO NEW SPECIES OF BORBORIDÆ.

BY CHARLES W. JOHNSON,

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Leptocera frosti sp. nov.

Female: Shining black. Front broad, face light brown, vibrissæ large, with a row of six smaller bristles extending to the posterior angle of the cheek, above this row near the middle, two prominent bristles, mouth parts and antennæ black, second joint slightly longer than the third, arista dark brown, pubescent and