NOTES ON *HYDROPHILUS TRIANGULARIS* SAY*

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Although much study has been given to the European species *piceus* and much has been written of its life-history, anatomy and metamorphosis, scarcely anything has been published concerning the American species *triangularis* Say. Since the brief account given by H. Garman in the American Naturalist in 1881 I find but few references to this species in American literature. As this is one of our largest beetles, and is commonly met with in aquatic collecting, I hope this short account gathered from a brief study during the summer of 1912 may be of use to others working in this group.

The beetles undoubtedly hibernate and egg-laying occurs early in June. Garman found the egg-cases about the first of June at Normal, Ill., and in one case the female was in the act of finishing her case. I found the completed egg-cases at Ithaca on June 24 and 26. These egg-cases are peculiar and interesting structures. Although Garman has given a good description of the nidus, it may be worth while to redescribe it, as his paper is now inaccessible to the average worker in entomology.

The egg-case (pl. XXII, fig.2) is always attached to pieces of floating leaves, bits of weeds, etc., and never, as far as I know, to living plants. The case with the projecting horn-like mast floats gracefully on the surface of the water. The cases must be sought with considerable care, as they are not easily recognized among the floating debris. I have found them most commonly in shallow pools with abundant vegetation and rich in insect life (Pl. XXII, fig. 1.) The leaf to which it is usually attached serves as a float and aids in keeping the mast erect and above the surface of the water. The case is smooth, brownish in colour, the upper surface closely adhering to its support (Pl. XXII, fig. 2.) It measures about 22 mm. wide, 24 mm. long and 15 mm. deep. The horn-like process is usually about 7-8 mm. long, and projects from the front of the case almost at right angles to the upper surface. It is dense, hard and almost black in colour, composed of closely-woven strands of silk. Below it expands into a broad hatchet-shaped plate, as seen in figure 2. It is supposed that this horn, which is really a very

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small tube with dense walls, functions in the admission of air into the egg chamber. Whether this is so or not I could not determine in the few experiments I performed. Below the broad expanded base of the spine is a narrow lunar-shaped opening (figs. 2 and 3). This allows the entrance of water beneath the egg-case proper, and through it the newly-hatched larvæ escape. This outer sheet of silk enveloping the egg-case is very thin and semi-transparent. Through it one can readily observe the young larvæ as they hatch and crawl into this space before venturing out into the open pond.

The eggs form a disk-like mass suspended from the roof of the egg-case (Pl. XXII, fig. 3.) They are all arranged vertically, closely applied to each other and in a single layer. Above the eggs the roof is composed of a considerable thickness of rather loosely-woven silk, leaving comparatively large, open spaces. Each egg measures 4 mm. long and about 1 mm. in diameter, yellow in colour, and loosely wrapped in its own coat of silk. Although I have examined these egg-cases carefully, I have never found any water in the portion containing the eggs. It would seem as if the open spaces in the loosely-woven silk and connected with the horn-like process in front serve as a means of air supply for the developing embryos. The number of eggs in a single case is very large, and it is not known how many egg-cases may be made by a single female. In the two egg-cases counted there were 112 and 130 eggs, while Garman found 107 in the one counted by him.

The young larvæ on hatching do not immediately leave the egg-case. On the evening of June 25th I saw quite a number of the newly-hatched fellows crawl out into the space below the eggs, but they did not venture further. Next morning this space was literally swarming with them, so crowded that they could not attack each other. Shortly after they began to emerge; slowly at first and then more rapidly. Soon the small aquarium was a seething mass of wriggling savages. They nipped at each other fiercely, each shying off, but soon one got a death-grip. The successful grip is directly back of the large head (fig. 29), for then the larva is helpless, and the other little savages soon close in and complete the killing. One is not much of a feast for over a hundred hungry chaps, and the first taste is only the beginning. After considerable manœuvring, another is seized and the

feast is again repeated. This would have continued, I presume, till all but one were killed. To prevent it I placed in their midst a young tadpole which had just died. For a short time they seemed shy of it, such a feast was surely too good, but when they closed in it was with a rush. Soon there was nothing to be seen but a wriggling mass of fierce savages tearing and biting at every available spot. As one secured a tender morsel he would rush off with it, hoping to enjoy it in peace, but only to be attacked by his neighbour. This fighting and scrambling continued until the entire tadpole was devoured. Later in the evening of the same day I gave them a dead minnow, and next morning only the bones were left. In the meantime one would occasionally succumb to the attacks of his neighbours, and my stock was slowly decreasing in numbers. On June 28 I placed a living tadpole in the aquarium, and there followed a savage attack on it. The larvæ seized it by the tail, mouth, and eyes, and every available spot where a grip could be secured was tried time and time again. It was not long before they succeeded in overcoming the tadpole, and then followed a feast mingled with occasional cannibalistic attacks. For sometime after this I continued to feed them on tadpoles, and they seemed to thrive.

On July 3rd one larva molted. This one was separated from the rest, and an attempt made to rear it. The next day most of the other larvæ died on account of the extreme heat. The one that had molted continued to thrive on tadpoles, snails or other food which I gave it. It was interesting to see how readily it would remove a snail from its shell by means of its powerful mandibles. The flattened head made it easy to get under the shell, and the mandibles did the rest. On July 24 this larva entered the soil to pupate. It had evidently molted a second time, but I had failed to find the shed skin, or else it was eaten by the larva itself. It took a little over twenty-four hours to dig out a large pupal cell under a stone in the rearing-cage. Pupation occurred on July 26, and the pupa resting in its cell is shown in figure 4. The adult emerged on the 6th. The time of development is then as follows:

June 25.—Young larvæ began emerging.

July 3.—First molt occurred.

July 13 (about).—Second molt occurred (?) (Supposed, not observed).

July 24.—Entered the soil to pupate.

July 26.—Pupa formed.

Aug. 6.—Emergence of adult.

Two other larvæ which I collected the same season pupated on July 15th and the adults emerged on the 25th.

At the time of transformation of pupa to adult it is interesting to observe how long it requires for the beetle to acquire its normal black colour. At the time of transformation to adult the thorax, head and legs are bright reddish brown. The rest of the body is pure white. Gradually it becomes reddish brown, turning to black. In about twenty-four hours after transformation the beetle is perfectly coloured and ready to emerge.

Description of larva.—First stage (fig. 29). The young larva on leaving the egg-case is light brown in colour, later becoming dark velvety brown and measures over 8 mm. in length, from the tip of the abdomen to the tips of the extended maxillæ. The head is large, light brown in colour, somewhat depressed and prominent, the mouth-parts forming a very conspicuous feature. It measures, exclusive of the extended mouthparts, 2 mm. long by 2.25 mm. wide, and appears very

Fig. 29.—*H. triangularis*, young larva just hatched.

large in proportion to the body, the thorax measuring less than 1.5 mm. wide. The antennæ are prominent, each consisting of three segments. The ocelli are six in number, placed in two parallel rows at the side of the head, directly behind and below the antennæ.

The body is densely clothed with dark hairs, giving the larva a velvety appearance. Amongst the hairs may be found scattered brown setæ. The seven abdominal spiracles are prominent. On the dorsal side of the last abdominal segment are openings leading to the large longitudinal tracheal trunks which supply air to all parts of the body. This pair of spiracles, with the two pairs on

the thorax, make in all ten pairs. I have not attempted to determine whether the lateral spiracles are closed or not.

Arising from the under side of the last segment is a pair of light coloured cerci, cylindrical, soft and flexible, measuring .9 mm. in length. The function of these cerci is not known, unless they serve to aid the larva in maintaining itself on the surface film when it requires a fresh supply of air.

The legs are long, of the same colour as the head, and well fitted for walking or running. The femora of all three pairs of legs are also provided with swimming fringes. The larvæ, however, are not very capable swimmers, only swimming short distances between supports.

The mature larva.—(Fig. 30.) The larva ready to pupate measures 40 mm. ($1\frac{9}{16}$ ins.) long and about 9 mm. wide at its

Fig. 30.—*H. triangularis*, mature larva.

widest part. It is dark brown in colour, the head being reddish brown. The under surface of the body is almost a grayish brown. The legs are the same colour as the head. Extending from the anterior margin of the thorax

on each side of the median line to the tip of the abdomen is an irregular narrow grayish brown line. These lines stand out prominently in alcoholic specimens.

The head is large, depressed, reddish brown in colour with numerous darker markings. It is not out of proportion to the rest of the body, as in the case of the young larva (compare figs. 29 and 30). The antennæ are located on the upper side of the head, 4-jointed, 1st joint, 3.25 mm.; 2nd, .24 mm.; 3rd, .64 mm.; 4th, .64 mm. (Figure 31). An antennal sclerite is present and well differentiated. Each eye consists of six ocelli, situated behind and below the antennæ in two parallel rows of three each.

The mouthparts are well developed and prominent. The suture between the labrum and clypeus is very indistinct or lacking. The clypeus-labrum is black, broadly emarginate in front. The mandibles are large and powerful. The right is more slender, longer and more strongly curved with a large tooth on its cutting edge. The left is shorter and thicker, and lacks the large tooth, though a slight elevation marks the position (fig. 31).

A maxilla is shown in figure 31. The maxillæ stand out prominently, particularly in the young larvæ. The cardo is

Fig. 31.—(From left to right.) Antenna, right mandible, labium, left mandible, maxilla.

greatly elongated, the lacinia being reduced to a mere joint. The palpus is 3-jointed.

The pupa.—The pupa at time of transformation is pure white in colour, the eyes soon becoming dark, while the prothorax soon takes on a reddish-brown tinge. It measures, including the cerci, 24 mm. long by 14.5 mm. wide at its broadest part. The pupa rests in its chamber, as shown in figure 4, and is quite active when disturbed or exposed to the light, turning over or changing its position by sudden muscular contractions of the abdomen. The tender pupa does not come in contact with the soil, but rests on large, strong spines. (Pl. XXII, fig. 4).

The head lies incurved under the prothorax, and is not visible in a dorsal view. It is perfectly smooth, lacking spines or setæ.

The anterior margin of the pronotum at each side bears three long, backward-curving spines. Near the posterior margin there is a row of eight shorter spines. There are also several very short spines on the disk. On the dorsum of both the second and third thoracic segments is a pair of spines. The dorsal side of each of the first seven abdominal segments bears a transverse row of four spines (Pl. XXII, fig. 4). The spines of the outer row are much longer and dark brown at the tips. The ninth segment terminates in a pair of long, large cerci nearly 3.5 mm. long. In the pupal chamber the pupa normally rests venter downward, resting on the large curving spines of the pronotum and the cerci. On turning over it rests on the dorsal spines of the abdomen and thorax, so that the tender pupa is never brought directly in contact with the soil.

DESCRIPTIONS OF FOUR NEW TABANIDÆ, WITH
REMARKS UPON *CHRYSOPS CURSIM*.

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***Tabanus birdiei*, n. sp.**

Female—Length 14-17 mm. Face white, densely covered with white hairs. Palpi yellow, slender, sparsely clothed with short hairs, extreme tip infuscated. Antennæ: two basal joints and base of third reddish yellow. Upper extremity of first joint black and covered with short black hairs. Third joint with upper angle rectangular or even obtuse, the joint beyond angle black. Eyes naked, purple with two green bands. Front wide, parallel, reddish brown, densely covered by white pollen and scattered erect black hairs. Callus prominent, shining brown, nearly square with a short, stout, tapering prolongation above. Thoracic dorsum brown with strongly marked white lines. Abdomen brown and white, the latter predominating and occupying the posterior margins of the segments, expanding into three rows of triangular spots. Venter yellowish, covered with white pollen. Legs tawny, tips of tibiæ and tarsi infuscated. Wings hyaline, large distinct clouds on cross-veins, divarication of third vein and at extremity of anal cell. First posterior cell somewhat coarctate.

Nine females, March and April, West Palm Beach, Fla. Named in remembrance of a young friend to whose kind assistance I am indebted for many fine specimens of Tabanidæ.

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