

NOTE ON THE LIFE HISTORY OF *ENCHENOPA BINOTATA* SAY (MEMBRACIDÆ) ON THE BUTTERNUT¹

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Enchenopa binotata Say occurs in abundance in the vicinity of Ithaca, N. Y., on the butternut, and its life history on this host differs in some interesting respects from that which has usually been described for this insect.

The species is well known and widely distributed throughout eastern United States and its unique form and interesting habits have been productive of numerous references to its appearance. Dr. J. A. Lintner in 1882 described in some detail its habits and particularly its peculiar egg-mass in his First Report² and Matusch has given an excellent account of its usual life history with a complete series of drawings showing the froth-covered egg-masses, eggs, consecutive instars of the nymphs and views of the adults in his paper in 1912 in the *Journal* of the New York Society.³

The most characteristic feature of the life history of this species of membracid as compared with other Membracidæ is its peculiar habit of covering its eggs with a frothy mass which has often been confused with other insect deposits. The eggs are usually laid in two nearly parallel slits in the bark and the froth is placed over the slits in curious corrugated layers. This has often been observed on bitter-sweet, locust, grape and certain viburnums and on the hop-tree (*Ptelea trifoliata* L.) on which the insect appears to be particularly abundant and which Lintner states is its favorite host. The nymphs are gray-brown, sometimes tinged with greenish, and the adults light ferruginous brown with characteristic yellow bands on the pronotum. The males are usually darker than the females. These habits are to be noted commonly in this locality when the insect chooses for its host the locust (*Robinia pseudacacia* L.) or the bitter-sweet (*Celastrus scandens* L.) on both of which plants it is very common. Locally, however, the species is much more abundant on the butternut (*Juglans cinerea* L.) than on any other host, and it is on this tree that it deviates from its usual habits.

It was first reported as inhabiting the butternut by Fitch in 1851⁴ but apparently its life history on this host has not been recorded. Here

¹ Contribution from the Entomological Laboratory of Cornell University.

² Lintner, J. A. First Annual Report on the Injurious and other Insects of the State of New York. Albany, 1882, 281-288 p.

³ Matusch, I. Observations on the Life History of *Enchenopa binotata* Say. Journ. N. Y. Ent. Soc., March, 1912, Vol. XX: No. 1, p. 58-67, pls. V and VI.

⁴ Fitch, Asa. Fourth Annual Report of the Regents of the University of the State of New York on the State Cabinet of Natural History. 1851.

the eggs are laid, not in the bark of the slender twigs, but at the base of the buds and in the buds themselves. In oviposition the female rests on the bud with the head pointed towards the apex and inserts the ovipositor in the base of the bud, usually between two of the lower scales, especially when the winter eggs are being deposited. The ovipositor sometimes enters the twig just below the scales but in almost all cases the insect has some part of its body resting on the bud. Oviposition lasts from ten to twenty minutes after which the insect moves slightly around the twig or to a neighboring bud and repeats the process; three consecutive ovipositions by one female have been noted in the field. This process is most commonly observed during the latter part of August. The egg-slits are rather large, about 1.5 mm. long at the opening and 3 mm. long at the bottom of the slit, and since the buds at the time the eggs are laid, are not usually more than 6-8 mm. in diameter, and the twigs below the buds, which are occasionally infested, about 5-6 mm. in diameter, the egg-mass occupies a considerable part of the host. Two such slits are made, side by side, and about 2 mm. apart. They diverge at the bottom, however, the planes of the slits being at a considerable angle, so that the bottoms of the slits are some distance apart, often at opposite sides of the bud. In each of these punctures from three to six eggs are laid, the usual number apparently being five on each side. The eggs are about 1.5 mm. long and .3 mm. in greatest diameter, often slightly flattened, somewhat curved, more or less flask-shaped and of an opaque white color. The eggs are seldom covered with the frothy deposit so characteristic of this species on other hosts. At first I believed that it was never present, but I have occasionally succeeded in finding it. When present it is not white but a dirty yellow and much thinner and smoother than that which covers the eggs on the locust, on which host I have often seen the insects excrete the substance. I have never found this frothy mass on the buds but only on the twig at the base of the bud. Whether the epidermis of the butternut is or is not conducive to this method of egg protection would be a matter of conjecture.

The nymphs first appear locally about the first week in May. The earliest field record is May 3, 1912. There are five instars, each of which may be recognized by more or less distinct characters of the thorax and abdomen. The nymphs are covered with a white powdery coat which is almost woolly in the younger stages. On the butternut the nymphs retain this white covering throughout the entire five stages and the last nymphal skin is snowy white, particularly on the thorax and on the sides of the abdomen. The opposite is true of the nymphs on other hosts, which, as observed by Matusch (ibid., p. 65), lose this powdery coating after the second molt. The development of the nymphs re-

quires approximately six weeks; a colony which had just emerged on May 10, 1913, was enclosed in netting and of these the first adults appeared on June 21.

The ecdysis consumes from ten to fifteen minutes, the epidermis first splitting on the top of the head, then down the dorsal line of the thorax and finally down the abdomen. The head is first released, appearing rather suddenly, the legs are withdrawn more slowly, and the abdomen gradually worked out of its old skin, leaving a very perfect exuvium. For the last molt the insect moves to the underside of a leaflet and fastens itself securely by the first two pairs of legs. The newly emerged adult is very soft-bodied and almost white, but the normal colors appear in about forty-five minutes.

The adults are first seen in large numbers about the first of July. There is no evidence to show that they winter over in the adult stage. They are usually found grouped about the petioles of the leaves, sometimes on the leaflets, rarely on the twigs and never on the trunk. Unlike most of the local forms of the family, they are often found high up on the trees, although generally preferring the sunny ends of the lower branches. They are very active and fly well, leaving the petiole with a quick "snap" and flying occasionally for several hundred feet. The adults are most numerous in this vicinity in late July and early August and at this time are very abundant. On August 9, 1912, over 200 individuals were collected from one tree in the course of a half hour's collecting and on July 22, 1914, 162 specimens were taken from the lower branches of another tree in a few minutes by three persons collecting. The insects on the butternut are much darker in color than the individuals on other hosts. The males and females are alike in color, both being of a very deep brown, almost black, and both sexes being darker than the males of the species usually appear. So noticeable is this, that when mounted in a cabinet with specimens of the same species collected on other hosts, the difference is at once remarked. It would be interesting to know whether the sap of the butternut on which the insects feed, has anything to do with this variation in color.

It is interesting to note that locally, at least, *Enchenopa binotata* is not attended by ants, and there seems to be no record of such attendance in literature. This is rather remarkable in view of the fact that most of our Membracidæ, particularly in the nymphal stages, are so attended. The nymphs of this species show the same extended anal tube as the nymphs of those species which excrete the fluid which attracts the ants, and they appear in numbers sufficiently large as to be easily discovered by the latter if there was any occasion for this mutual relationship. It should be noted in this connection, however, that

Baer has described¹ a species of the same genus, *Enchenopa ferruginea* Walk., as being attended by ants, and he has observed this species giving off the so-called "honey-dew."

Enchenopa binotala appears commonly in this vicinity on locust, bitter-sweet, wild grape, sycamore, hickory and willow, as well as on the butternut but on none of the former hosts does it show the dark color, the absence of the frothy deposits or the habit of laying eggs in the buds.

This species appears to be of decided economic importance, since it has been reported on a wide variety of host plants and has been known to seriously injure many of them. In the case of the butternut the buds are often entirely destroyed and adventitious growth is found starting from beside the punctured buds which have failed to develop.

I am indebted to Miss Leona Smith for a very fine series of both nymphs and adults of this insect, all collected from the butternut.

EFFECT OF LOW TEMPERATURE ON THE OYSTER-SHELL SCALE

(*Lepidosaphes ulmi* Linn.)

By R. L. WEBSTER

The writer has already noted in general the fact that certain low temperatures of January, 1912, killed the eggs of the oyster-shell scale in many localities in Iowa.² Late in 1912, nearly a year after the extreme cold weather, some further data were obtained on the subject. Circular letters requesting samples of the scale were sent out from the office of the State Entomologist to correspondents that had previously sent in specimens. Again in December, 1914, letters requesting additional scale-infested twigs were sent out. All these samples were examined by the writer for sound eggs.

The results in the two years were very different. In the first case, scarcely any scales containing sound eggs were found. In the second, however, most of the samples contained scales with sound eggs. The scale had been practically wiped out in 1912, but in January, 1915, had regained most of the lost ground.

An account of the examination of the samples follows. The notes used are from the files of the entomological section of the Iowa Agricultural Experiment station at Ames.

In order to understand the significance of these observations a brief outline of the life history of the oyster-shell scale is necessary. During

¹ Baer, G. A. Note sur un Membracide myrmecophile. Ann. Soc. ent. France, 1903, LXXII: Bull. 306.

² JOURN. ECON. ENT., Vol. 5, p. 470, 1912.