

BIOLOGICAL NOTES ON AMPULICOMORPHA CONFUSA ASHMEAD AND ITS FULGOROID HOST(HYMENOPTERA: DRYINIDAE AND HOMOPTERA: ACHILIDAE)¹JOHN COLBURN BRIDWELL²

Forty-three years ago W. H. Ashmead (2) described a small, blackish winged wasp in the U. S. National Museum from California as *Ampulicomorpha confusa* as the unique North American representative of the peculiar tribe Embolemini in the family Proctotrypidae. After describing this insect he added that he had seen another individual of the species from Nevada in the collection of the American Entomological Society. There seems to be no record published of this species having been taken since, but there is another specimen with the type in the National Museum taken by W. F. Fiske in North Carolina. It was not until 1924 that any further record of the presence of the Emboleminae in our country was published. C. T. Brues (3) described a species of the wingless genus *Myrmecomorphus* as *Pedinomma nearcticum* from one individual from near Boston and another from Long Island. In the U. S. National Museum there are three individuals belonging to this genus which seem to represent three species. One of these from near Boston probably represents Brues' species. Another was taken by A. H. MacAndrews in North Carolina, and the third was taken by Pergande in Mexico. Besides these American Emboleminae, the U. S. National Museum has a specimen of *Embolemus ruddii* Westwood and some specimens of an undescribed *Embolemus* from Java. These peculiar insects have been but rarely taken in Europe and the limits of variation have not yet been established. Seven nominal species are recorded: two in *Embolemus*, supposedly winged males, and four in *Myrmecomorphus*, wingless males and females. None of these have been taken in series except *Embolemus ruddii*. A single species of *Myrmecomorphus* has been described from Chile. The biology of these insects has remained entirely unknown until the summer of 1936, when it became my good fortune to encounter *Ampulicomorpha* and to learn the main facts of its life history.

On April 13, 1936, while examining some rotten oak logs near the locally well-known Gravelly Spring, about two miles east of Vienna, Virginia, a white oak log covered with a small shelf fungus was found to support many insects of various orders and a small winged, blackish wasp was seen to run swiftly over the surface of the bark and hide

¹ Published posthumously. See Mr. Bridwell's obituary, p. 27.—Ed.

² In November 1954, Mr. Bridwell gave five unfinished drafts of this manuscript to G. B. Vogt, Entomology Research Division, USDA, to prepare for publication. The work might otherwise have been destroyed in a fire, along with numerous other papers, in Mr. Bridwell's home in 1955. Of the five drafts, the third was selected for publication as the most complete; it is modified only in those portions enclosed in brackets [] by slight changes of wording or insertion of excerpts from the other drafts. Unused taxonomic notes, all unfinished drafts, and the specimens used in this study are deposited in the U. S. National Museum. Mr. Bridwell made brief reference to the findings presented herein in 1937 (1).

among the fungi. This was captured and on examination it proved to be an *Ampulicomorpha*, which had no appreciable characters to distinguish it from the type of *Ampulicomorpha confusa* Ashmead. On April 23, while examining some pine logs (*Pinus rigida* Mill. and *P. virginiana* Mill.) in a similar condition of decay and bearing shelf fungi, two other individuals of *Ampulicomorpha* were seen and one of them captured. These logs lay on the ground in the space between the tracks of the Washington and Old Dominion and Arlington and Fairfax Railroads, a little west of the place where they cross each other about one mile east of Vienna.

Careful re-examination of the logs in both stations showed some firm, half ellipsoidal cocoons firmly attached to the wood beneath the loose bark and covered with the debris from the adjacent surface, but unfortunately those found no longer contained living contents, the adults having emerged. They were, however, as was subsequently learned, the cocoons of these wasps. Careful consideration of the insects seen upon these logs made it clear that the only insects common to the pine and oak logs which seemed likely to be the prey of the wasps [were] some fulgorid nymphs found on both. When these were submitted to P. W. Oman he told me that they must be nymphs of some achilid (Fulgoroidea) species, presumably *Epiptera* or *Catonia*. Subsequent rearing showed the nymphs upon the pine logs to be those of *Epiptera floridæ* (Walker) while the nymphs from oak were not distinguishable.

These nymphs occur in small colonies beneath the loosened bark of oak and pine logs in close association with white sheets of compacted fungus hyphae, and each nymph bears on each side of each of the three tergites before the pygofer a subquadrate glandular area which secretes numerous fine, straight threads of "wax" which are fragile and easily detached and the location of each of the colonies may be recognized even after the insects are gone by the fibers remaining.

It was not until August 16 that *Ampulicomorpha* was again encountered. [On the pine logs an adult was found very near one of the still problematic cocoons with an emergence hole. Other cocoons with living contents were found in places where the former presence of the fulgorid nymphs was indicated by the wax strands. Still others were associated with the nymphs themselves, which were rapidly transforming to adults. But I did not then or subsequently find any remains of nymphs which indicated the method of attack by the wasps upon them. On this and subsequent visits up to August 27, more than 20 viable larvae and pupae were found in cocoons. Also, some adults were taken in the open, so that altogether some 10 adults were secured. On August 18 it was discovered that the females were winged, and with difficulty were distinguishable from the males.]

From this material, it was possible [by September 2, when the last wasp died] to follow out the biology of the species and to learn that it is in all essential particulars a dryinid biology.

The *Epiptera* nymphs, as stated, live in close association with hyphal sheets of fungi and when placed in confinement with the host material on bits of bark, they run about briskly until they find a favorable position where they may remain quiescent for long periods of time. When disturbed or startled, they make a single leap, which in the open may project them a distance of several inches. When an adult female *Ampulicomorpha* was placed in a glass tube with these nymphs a great commotion ensued and continued for several minutes. The wasp, her long antennae held at right angles to her body, ran rapidly in pursuit of the running nymphs and these, when closely pressed, jumped but often too late. Often the pursuit was too rapid to be followed by the eye, but soon a nymph would be seen firmly gripped by the wasp. Once seized, the nymphs were unable to dislodge the wasp, and the wasp would be seen with its head on the upper side of the body of the nymph in the space between the wing pads and the body disposed across the body of the nymph, and the abdomen of the wasp bent down and firmly pressed against its ventral surface, stinging at a point near the mid-ventral line behind the hind leg. In some cases, when more than one wasp was placed in a tube, two females attacked the same nymph on opposite sides. In no case was an external egg seen.

The *Epiptera* nymphs transformed so rapidly that when the *Ampulicomorpha* adults were available only a few nymphs were present. What at first seemed a series of unfortunate accidents was [further] reducing the scanty material at hand. Several nymphs were seen wounded on the middorsal line where the integument is destined to split in ecdysis. Not until the last available female made the last observed attack was this explained. In this case I was able to see the wasp gnaw away at the middorsal line of the nymph until the body fluid began to ooze forth, upon which the wasp fed.³ In the other attacks observed, which lasted perhaps from three to five minutes, the wasp was vigorously engaged in stinging and ovipositing. The nymphs, after being released, seemed none the worse for the attack and walked off about their affairs as if nothing had happened. None of the earlier observed attacks resulted in the development of any larvae, and it seemed this part of the story would not be secured, but after the last female had died one of the nymphs, perhaps four or five days after being placed with the wasp, showed a translucent, rounded mass under the wing pad, which increased in size for three or four days, remaining colorless, and then managed to complete its feeding and cocooning, while not under observation and these details were not seen. The larva, however, died without completing its transformation and was devoured by a mite. [It is pointed out that similarly in other Dryinidae the egg is inserted within the body of the prey and the resulting larva emerges into a larval sac beneath the

³ [R. C. L. Perkins (4) in his observations of the dryinid *Echthrodolphax* states that under unnatural conditions such as the confinement of a small jar or glass tube, and probably under the pressure of hunger the wasps attack their leafhopper hosts frequently killing them outright and to some extent devouring them.]

wing pad and after some days of growth entirely devours the body contents and then leaves the empty skin of the host to cocoon elsewhere.]

After a female *Ampulicomorpha* was placed in a tube with nymphs of *Epiptera* and some attacks upon the nymphs had been made, the commotion soon died down and wasp and nymphs became quiet, moving about only when disturbed. With the addition of fresh nymphs to the tube, the same commotion and attack would be renewed, followed again by quiet. While very few nymphs besides the preadult instar were available for use, it seemed that these were preferably attacked when present. In no instance did the wasps show any interest in adults of *Epiptera* present with them. While these experiments were going on, a species of *Catonia*, the other achilliid genus in the local fauna, was bred and on two or three occasions nymphs of *Catonia* were placed with the *Ampulicomorpha*, which showed no interest in them. It is desirable, however, that this matter should be further investigated since it is not quite certain that these may not sometimes be attacked.

The cocoons collected were placed in separate tubes for rearing, and when newly emerged males and females were placed together copulation resulted immediately, with almost no preliminary courting, and continued for some minutes. Thereafter the sexes seemed indifferent to each other but the addition of fresh males would result in renewed mating.

When males were placed in tubes with cocoons, they showed no interest in them, differing in this conspicuously from the males of the bethylid genus *Sclerodermus*, (studied some years ago), which would force their way into the unopened cocoons and mate with the young females within (5). Unlike that genus the cocoons remain intact after emergence, except for the opening through which the adult escapes.

While the *Ampulicomorpha* cocoons are often found in groups with a colony of *Epiptera*, they are never placed in cocoon masses such as are common among the bethylids, each one being formed separately and entirely distinct from the others, even when touching.

The pupae of *Ampulicomorpha* lie in the cocoons with the dorsum against the substratum so that the mandibles of the developing adult lie in contact with the wall of the cocoon, a little before its end and in emerging the adult itself unaided gnaws out an emergence hole and escapes with none of the subsocial behavior of *Sclerodermus*.

LITERATURE CITED

1. Bridwell, J. C. 1937. [Notes on the Prey of *Bembecinus* and *Ampulicomorpha* sp.] Proc. Ent. Soc. Wash., vol. 39: 14-15.
2. Ashmead, W. H. 1893. U. S. Natl. Mus. Bul. 45: 79-80.
3. Brues, C. T. 1922. Psyche 29: 7.
4. Perkins, R. C. L. 1905. Rept. Experiment Sta. Hawaiian Sugar Planters Assoc. Bull. #1(1): 1-69.
5. Bridwell, J. C. 1920. Proc. Hawaii Ent. Soc. 4: 291-314.