

G. F. Edmunds

Ovoviviparous Mayflies of the Genus *Callibaetis* (Ephemeroptera: Baetidae)

By GEORGE F. EDMUNDS, JR., University of Utah,
Salt Lake City

Of the several records of the occurrence of ovoviviparity in the genus *Callibaetis*, Nedham and Murphy (1924) were first to record the phenomenon in the species *Callibaetis vivipara* Nedham and Murphy of Brazil. Doctor Osgood Smith (Needham, Traver, Hsu, 1935) reported a single female of *Callibaetis* sp. as containing well developed nymphs. Berner (1941) described this condition in *C. floridanus* Banks and *C. pretiosus* Banks from Florida and *Callibaetis* sp. from Michigan and gave an excellent description of the nymph within the chorion and after its liberation which occurs at approximately the time of ovopositing. *Cloeon dipterum* Linn., the only ovoviviparous mayfly reported in a genus other than *Callibaetis*, was recorded by Von Siebold as early as 1837.

The author was first attracted to this study in 1943 when he noticed how rapidly *Callibaetis claudiae* Edmunds* established itself in temporary pools. Several female imagos were dissected and some were found to contain eggs with well developed nymphs in them. The nymphs were carefully studied and found to agree with Berner's description of the nymph of *C. floridanus* Banks. Each specimen was found to contain 400 to 450 eggs. It was noted that the eggs of newly emerged imagos do not fill the abdominal cavity, thus considerable room is left for growth.

* This species is in the process of being described by the author. The description will appear in a future issue of this journal.

In Salt Lake City, September 21, 1944, *Callibaetis montanus* Eaton was observed ovopositing in puddles of waste sprinkling water that had accumulated on an asphalt pavement. This water had been standing only a few hours, yet there were a number of tiny white nymphs clearly visible against the black pavement. The eggs hatched within a few minutes after touching the water and the tiny nymphs began moving about in the shallow puddle. Several females were collected from the surface of the water at the time. One of these has two eggs containing well developed nymphs still clinging to the egg valve.

The addition of these two species to those previously reported increases the number in the genus known to be ovoviviparous to six or possibly seven species, depending on whether the New York (Smith) and Michigan (Berner) specimens were of the same or of different species. Thus, Berner's assumption that most if not all of the North American species of the genus are normally ovoviviparous is strengthened by these observations.

Berner noted the correlation of ovoviviparity and longevity in mayflies. He kept a female of *Callibaetis floridanus* Banks alive for eight days, and European workers have kept a female of *Cloeon dipterum* Linn. for twenty-one days. In June, 1944, the author kept two females of *Callibaetis claudiae* Edmunds alive in a flask for ten days and believes their death to have been due to desiccation rather than to any other cause. Berner states, and the author agrees, that this time is more than sufficient for the development of the eggs.

This extended longevity of the females coupled with the comparatively short life of the male produces a peculiar sex ratio in nature. Although the males are by far the most active, field collecting usually produces an overwhelming majority of females. Even though the author has made special efforts to collect male specimens, females are predominant in the collection at an eight to one ratio. Thus the fact that a considerable number of species are known only from female specimens seems to be further evidence of ovoviviparity throughout the genus.

Conclusions

1. It is probable that all species of the genus *Callibaetis* are ovoviviparous.
2. Longevity is necessarily correlated with ovoviviparity in the order Ephemeroptera.
3. The sexual ratio of an ovoviviparous species of Ephemeroptera is abnormal due to the longevity of the female and the comparatively short life of the male.

REFERENCES CITED

- BERNER, LEWIS. 1941. Ovoviviparous mayflies in Florida. *Florida Ent.* 24; 2: 32-34.
- NEEDHAM, J. G., and MURPHY, H. E. 1924. Neotropical mayflies. *Bull. Lloyd Lib.* 24, Ent. ser. 4: 1-79, pls. 1-13.
- NEEDHAM, J. G., TRAVER, J. R., and HSU, Y. 1935. *The biology of mayflies.* Comstock Publishing Co., Ithaca, New York.