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## Notes on Emergence, Swarming, and Mating of *Hexagenia* (Ephemeroptera) <sup>1</sup>

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The western end of Lake Erie produces yearly prodigious numbers of *Hexagenia* mayflies belonging to three species: *H. limbata* (Serville), *H. rigida* McDunnough, and *H. affiliata* Mc-

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Dunnough. These are named in the order of relative abundance and of seasonal emergence. The specimens recorded by Wiebe (1926) as *H. bilineata* (Say) from this region were evidently one or more of the above species, since *bilineata* appears to be limited in distribution to the Mississippi River drainage. It should be pointed out that some mayfly taxonomists (McDunnough 1927; Spieth 1940) have subdivided *H. limbata*, by far the most common species in the Great Lakes Region, into two subspecies: *H. limbata occulta* (Walker) and *H. limbata viridescens* (Walker). Both of these subspecies occur in the Put-in-Bay area.

Several specimens of an albino form of *H. rigida* were collected in July 1940. The identification of these unusual specimens in the absence of color markings is based upon the form of genitalia which is distinct for this species. A single albino specimen of this species had been collected previously by Mr. Dale W. Jenkins on July 1, 1938. Further collecting and study may show that this is a subspecies of *rigida*.

The emergence of *Hexagenia* begins toward the end of June and continues to September; the peak of emergence is reached during July and is due primarily to individuals of *H. limbata*. However, soon after the beginning of the *limbata* emergence, *H. rigida* makes its appearance and is followed about the middle of July by *H. affiliata*; hence, all three species are present at the same time. Except at the very peak of abundance when specimens are found about equally distributed almost everywhere, it was noted that local concentrations of *Hexagenia* individuals were dependent to a large degree upon wind direction. Emerging subimagos tend to be carried and to fly with the wind; therefore, during a period of on-shore breeze individuals accumulated on one side of an island while relatively few specimens could be found on the opposite shores.

In a personal communication from Dr. Langlois the writer has learned that the emergences of *Hexagenia* were not as large in the summers of 1941 and 1942 as they were in 1940 and 1943. This observation seems to indicate a cyclic trend in the population numbers of *Hexagenia* which has also been noted by the author for other localities (unpublished data).

Typical examples of swarming were observed from South Bass Island during the forepart of July 1940. Swarming activity was begun about 8:00 p.m. (E.S.T.) by a few male individuals taking to the air from the trees and shrubs that had furnished them with resting places and concealment during the subimaginal period and during the daytime. Most individuals flew low to the ground at the start but as the numbers increased the swarm moved gradually higher. Dense swarms were observed over the islands of South Bass, Rattlesnake, Middle Bass, and Gibraltar. These swarms were so thick as to appear like clouds of smoke weaving up and down over the tree-tops of the respective islands. Swarming took place well over the land and individuals were most concentrated over the trees fringing the shores. Very few individuals were seen flying over the water as compared to the numbers over the land. The location of swarms over land and the trees in particular is apparently correlated with the fact that the females, which are relatively cumbersome in flight owing to the weight of the egg packets, do not usually take part in the actual swarming activity which is carried on primarily by the males, are most numerous in the trees along the shore, and enter the swarming males only to mate. At various times especially huge flights resulted from the accumulation of individuals over several days owing to the cool, rainy, and windy weather of the days immediately preceding the flights. Such weather inhibits swarming activity. By 8:30 p.m. many mating pairs were seen. The swarming continued until darkness obscured further observations.

In the course of nightly observations it was a common occurrence to see males of one species *in copula* with females of another species. Also imago males often attempted copulation with female subimagos. At times two or three males were seen clinging to a single female. Occasionally two males were seen flying together as though attempting to mate, the fore legs of one individual grasping securely the mesothorax of the other as in the manner described below for male and female. The greater length of the fore legs of mayfly males in general is well-known. The advantages of this sexually dimorphic character

are apparent when the details of the way in which the male grasps the female are observed. The relatively sluggish flight and large size of *Hexagenia* individuals are especially propitious to the capture of copulating pairs and for observing the intricacies of the method used by the male for maintaining his attachment to the female while the pair is in flight. The male approaches the female from below and the already upwardly extended fore legs are securely anchored to the mesothorax of the female. The tarsi of the male are crossed over one another across the mesonotum of the female, are passed around the anterior edge of the fore wing base, and the respective tarsal claws are hooked into the pleural wing recess which is located ventrally on each wing near the base. The capture of numerous pairs demonstrated these facts repeatedly; however, observations had to be made rapidly for the pairs became separated easily when disturbed. Actual copulation was accomplished when the abdomen of the male was curved upward and the abdomen of the female was encircled by the forceps usually about the ninth segment. The observations made by Cooke (1940) upon *Stenonema vicarium* (Walker) wherein it is stated that the male placed the fore legs over the prothorax and the head of the female are worthy of note. During the writer's experience in observing *Hexagenia* pairs the fore legs of the male often became unseated from their normal attachments on the mesothorax and then appeared to be attached to the prothorax.

## LITERATURE CITED

- COOKE, HERMAN G. 1940. Observations on mating flights of the mayfly *Stenonema vicarium* (Ephemera). Ent. News, 51: 12-14.
- MCDUNNOUGH, J. 1927. Notes on the species of the genus *Hexagenia* with description of a new species (Ephemeroptera). Can. Ent., 59: 116-120.
- SPIETH, H. T. 1940. The North American Ephemeropteran species of Francis Walker. Ann. Ent. Soc. Am., 33: 324-338.
- WIEBE, A. H. 1926. The first three larval stages of *Hexagenia bilineata* Say. Ohio Jour. Sci., 26: 267-275.