MATING FLIGHTS OF *EPHORON ALBUM* (EPHEMEROPTERA: POLYMITARCIDAE) IN MICHIGAN

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ABSTRACT

Mating flights of the mayfly *Ephoron album* (Say) were observed on the Sturgeon River in Houghton County, Michigan, on five evenings between 16 and 22 August, 1977. Peak emergence occurred about 30 minutes before sunset on 19 August and the flight period lasted about two hours. Many more adult males than females were collected on three evenings, but on one evening females greatly outnumbered males collected.

In August, 1977, we observed large numbers of *Ephoron album* (Say) (Ephemeroptera: Polymitarcidae) flying over the Sturgeon River in Chassell Township, Houghton County, Michigan (Fig. 1A). The dense clouds of adults resembled those described by Thomas Say in 1824, on the Rainy River (Needham, Traver and Hsu, 1935). *E. album* is a moderate-sized, North American mayfly whose nymphs burrow in sand and gravel substrates of larger rivers and shoal areas of large lakes. The nymph creates a current in its burrow by moving the gills and feeds on organic matter strained from the water by brushes on the forelegs and mouthparts. Britt (1962), in a study of this species in western Lake Erie, found that the egg stage lasts about 8.5 months, the nymphal stage about 3.5 months and the adult stage less than one hour. Britt reported adults emerging from 25 July until 20 September, but the bulk of the emergence was in late July and early August. He found that the main emergence began each evening when the light intensity dropped below 3.2 foot candles. The longest flight period he observed was 105 minutes on 5 August, 1949.

This white mayfly has been recorded from Ohio, Michigan, Indiana, Illinois, Iowa, Minnesota, Nebraska, Montana, Utah, Idaho, Nevada, Washington, and Oregon (McCafferty, 1975). A single collection of 19 adult females from Berrien Springs, Berrien County, Michigan, collected 14 July, 1962, by F. Giles, was listed as a new state record by Koss (1970). Britt (1962) said that the distribution of *album* is not well known owing to the short life span of the adult and the difficulty collecting nymphs. Britt found the eggs would not hatch unless subjected to several weeks of near freezing temperatures followed by temperatures above 10°C, and believed that these temperature requirements explained the relatively narrow north-south distirbution of this species between about 40° and 50° north latitude.

OBSERVATIONS AND DISCUSSION

The mating flights were first observed about sunset on 16 and 18 August at the mouth of the Sturgeon River. On 19 August systematic observations were made at three stations along a 5 km stretch of the river (Fig. 1B). The day was clear and bright. At 7:00 p.m. E.D.T. the air temperature was 13°C and the water temperature was 19°C. At 7:22 p.m. the first adults were seen flying a few centimeters above the water in mid-channel. About 8:15 p.m. the number of adults suddenly increased and the air above the river to a height of 1 to 2 m was thick with their white bodies. The river surface was covered with cast nymphal and subimago skins. Ducks, nighthawks, smaller birds, and fish fed on the mayflies. The mayflies flew in horizontal paths upstream and downstream in

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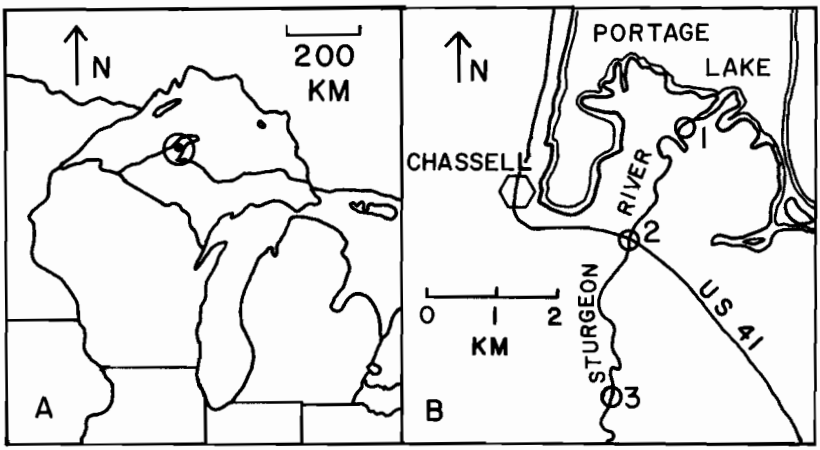

Fig. 1. A shows the location of the study area in the Keweenaw Peninsula of the Upper Peninsula of Michigan. B shows the location of the three observation stations on the Sturgeon River near Chassell in Houghton County, Michigan.

about equal numbers. They were strong fliers and often were able to avoid capture by an insect net. At stations 2 and 3 they avoided the edges of the river, but at station 1, where the river was more exposed to a breeze, some landed on shore vegetation.

Only males molted in the winged stage. They landed on the water and on objects such as snags, bridges, and canoes to molt. The average time required by six males to molt was 171 seconds (range 105 to 240 seconds) (see Thew, 1958, for description of subimago molting). Many adult males flew with the subimago skin trailing behind, attached to the cerci. Mating pairs remained in contact for only a few seconds. One pair was observed to fall on the water. The male freed itself and flew off while the female remained on the surface.

The maximum number of flying adults occurred between 8:30 and 8:45 p.m., at which time dense clouds of mayflies covered the river to a height of 2 to 3 m. Sunset occurred at 8:59 p.m., and air temperature was 11°C at 9:08 p.m. At 9:00 to 9:15 p.m. the number of flying mayflies decreased abruptly. The number in the air continued to decrease until by 9:45 none were flying.

Mayflies were collected throughout this mating flight (Table 1). The ratio of males to females was 67 to 1. A collection made at station 1 on 18 August had a ratio of males to females of 4 to 1.

On 21 August observations were again made at station 3. The day had been cloudy until 6:00 p.m. when the skies cleared completely. At 8:00 p.m. adults began to fly, but there were only about one-fourth as many as on 19 August. The river surface had relatively few cast skins. The mayflies flew about twice as high as on 19 August. There were only three males among the 319 mayflies collected.

In order to determine if time of capture affected the sex ratio in samples, collections were made at 15 minute intervals at stations 2 and 3 on the evening of 22 August. The number of mayflies was much reduced from 19 August and considerable effort was required to capture 266 specimens. Table 1 shows that males were far more abundant than females in all except one sample and, in that sample, the two sexes were about equal. The overall ratio of males to females in the 22 August samples was 5 to 1.

Britt (1962) assumed the sex ratio of nymphs was equal and that winged males and females emerged at the same time, but because winged females have a shorter life span

Table 1. Number of *Ephoron album* males and females collected on the Sturgeon River, Houghton County, Michigan, in 1977.

Date	Station	Males	Females	Ratio of Males to Females
18 August	Station 1	131	32	4:1
19 August	Station 1	19	0	–
	Station 2	220	1	220:1
	Station 3	95	4	24:1
21 August	Station 3	3	316	1:105
22 August	Station 2			
	7:30-7:45 p.m.	3	0	–
	7:45-8:00 p.m.	14	1	14:1
	8:00-8:15 p.m.	12	2	6:1
	8:15-8:30 p.m.	26	8	3:1
	8:30-8:45 p.m.	13	12	1:1
	8:45-9:20 p.m.	37	6	6:1
	Station 3			
	8:15-8:30 p.m.	7	0	–
	8:30-8:45 p.m.	34	8	4:1
	8:45-9:00 p.m.	41	7	6:1
	9:00-9:15 p.m.	34	1	34:1
Total collected		689	398	

and die within a few minutes, males predominate in the swarms. This would explain why we found greater numbers of males than females in 14 of the 15 collections we took (Table 1). But the 21 August sample at station 3 with 316 females and 3 males is a puzzle. This collection was taken at the same location as the 19 August sample that had a male to female ratio of 24 to 1. Do female nymphs respond differently than males to weather conditions? The 21 August sample was taken on a day that was cloudy until 6:00 p.m. The Berrien Springs, Michigan, sample containing 19 adult females suggests that female swarms may not be unusual.

E. album is quite likely a much more common species than present collection records indicate. Persons interested in observing its mating flights and adding information about behavior and distribution should be out along large rivers and lakes shortly before sunset in July and August.

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