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Adult Emergence in Two Univoltine *Callosamia Promethea* Populations: Preponderance of the Early Emerging Morph in the North and of the Late Emerging Morph in the South (Lepidoptera: Saturniidae)

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ADULT EMERGENCE IN TWO UNIVOLTINE *CALLOSAMIA PROMETHEA* POPULATIONS: PREPONDERANCE OF THE EARLY EMERGING MORPH IN THE NORTH AND OF THE LATE EMERGING MORPH IN THE SOUTH (LEPIDOPTERA: SATURNIIDAE)

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ABSTRACT

Callosamia promethea is common on wild black cherry, *Prunus serotina*, at the University of Michigan Biological Station in northern lower Michigan. In this area the early emerging morph is preponderant, while to the south in northern Indiana, the late emerging morph is preponderant.

The diapause terminating mechanism determines the phenology of the active stages of insects and thereby has a profound effect on their ecology. A number of insects exhibit a biomodal emergence pattern, with an opportunistic group emerging early in spring and another group delaying emergence for a month or more (Waldbauer 1978). This is a bet-hedging strategy that avoids the possibility of losing all of the progeny of a pair to, for example, a late cold spell in spring or a severe drought in summer. The bimodal emergence of *Hyalophora cecropia* (L.) (Lepidoptera: Saturniidae) was discussed in detail by Sternburg and Waldbauer (1969, 1978) and Waldbauer and Sternburg (1973). The bimodal emergence pattern of a univoltine population of *Callosamia promethea* (Drury) (Lepidoptera: Saturniidae) from near Medaryville in northern Indiana was described by Sternburg and Waldbauer (1984).

We here show that the late emerging morph predominates (over 99%) in the south near Medaryville, Indiana, while the early emerging morph predominates (over 99%) in the north at the University of Michigan Biological Station in northern lower Michigan, near the northern limit of promethea's range (Ferguson 1972).

COLLECTING AREAS AND METHODS

As part of a project that involved the release and recapture of male promethea moths, we deployed seven promethea traps in a mile-wide circle in northern lower Michigan near Pellston in Emmet County. The traps were on the property of the University of Michigan Biological Station (UMBS), on a low, sandy plain locally known as the Pellston Flats. They were in an area that includes second growth woodland, dominated by *Populus tremuloides* Michx., as well as savannah-like clearings with scattered woody plants, including saplings of *Prunus serotina* Ehrh., which is often a promethea food-plant. The traps, described by Sternburg et al. (1977), were baited with newly emerged, virgin, pheromone-releasing female promethea moths from 14 June to 9 August 1983. The traps were emptied of males and rebaited daily except from 20 July to 9 August, when they had

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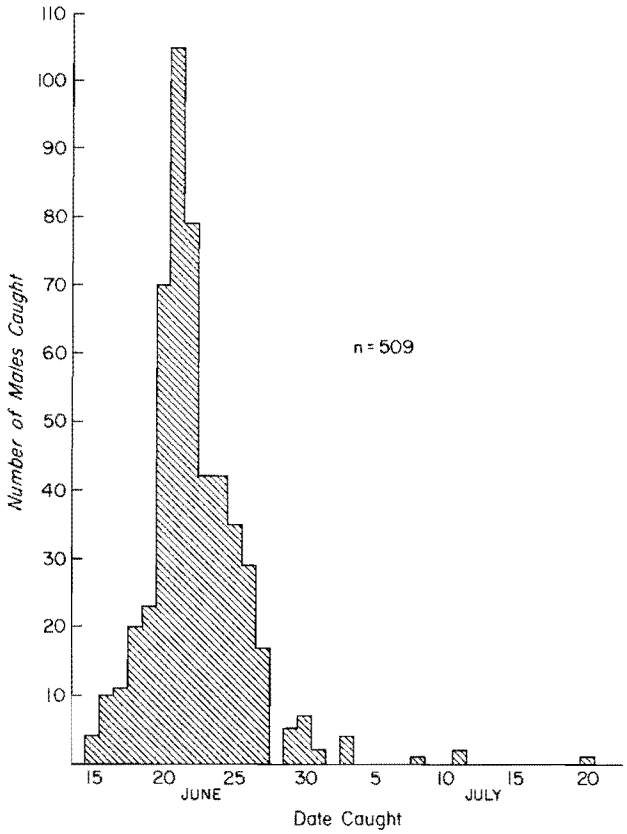

Fig. 1. Wild, male *Callosamia promethea* moths caught in traps baited with virgin females at the University of Michigan Biological Station near Pellston in 1983.

bait in them only every second day. Captured wild males were not released. In 1984 we ran a similar circle of traps from 14 June to 16 July just south of the central station facilities. They had bait in them only every second day.

On 10 November 1983, we collected promethea cocoons in the area which had been within the circle of traps as well as in areas from about 1.8 to 8 km west of the circle. The cocoons were taken to Urbana, Illinois, the next day and held on a screened porch where they were exposed to ambient outdoor temperatures. They were checked daily from the beginning of May until emergence was complete.

RESULTS AND DISCUSSION

The 1983 daily trap catches of wild, male promethea moths at the UMBS are shown in Figure 1. The great majority of the moths were caught in the second half of June. There was a peak on 21 June, and the last of the scattered late males were caught on 20 July, although we continued to trap until 9 August. Four males were caught on 15 June, the first day on which we ran the traps. The emergence of the moths could, therefore, have begun

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earlier but probably only a few days before. The average date of the last freeze is 6 June at Pellston, and the trees do not leaf out until late May.

In 1982, during a two-week period of trapping, one male was caught on 23 July at the station central facilities. In 1984 we trapped from 14 June to 16 July just south of the central facilities, capturing 276 males between 14 June and 12 July. As in 1983, the great majority of these moths (271) were caught in the second half of June, between 14 June and 26 June. Fifty-one males were caught on the first day of trapping, suggesting that the emergence may have started even earlier in 1984 than it did in 1983. Previous to these collections, there were only two records of promethea from the UMBS area (Voss 1969).

On 10 November 1983, we collected in the vicinity of the UMBS, 52 promethea cocoons that appeared to contain live pupae as judged by shaking the cocoons. All of the cocoons were found on wild black cherry, *Prunus serotina*. The emergence of moths from these cocoons was tightly clustered in late May and early June. Moths emerged from 39 of them at Urbana on the following dates: 31 May, 1 male; 1 June, 3 males, 1 female; 2 June, 3 males, 2 females; 3 June, 1 male, 2 females; 4 June, 4 males, 2 females; 5 June, 7 males, 4 females; 6 June, 3 males, 6 females.

There was a possibility that some of the collected cocoons could have been spun by the progeny of native females and the Indiana or Wisconsin males that we had released within the circle of traps. If so, their emergence dates might not have been typical of the UMBS moths. That this was not the case is shown by the fact that five cocoons collected well away (1.8–8.0 km) from the circle emerged on 1 and 2 June with the moths from cocoons collected within the circle.

We are confident that the group of male promethea moths that was caught in the second half of June at the UMBS corresponds to the early emerging morph of the univoltine promethea population from near Medaryville, Indiana (Sternburg and Waldbauer 1984). The most convincing evidence is that when cocoons from the UMBS were moved to Urbana, they produced moths in late May and early June, corresponding to the emergence time at Urbana of the few early emerging promethea moths from Medaryville in other years (Sternburg and Waldbauer 1984). The UMBS moths caught on 20 and 23 July in 1983 and 1982, respectively, and possibly some of the other moths caught in July 1983, apparently correspond to the late emerging morph from Medaryville.

In the two years that it appeared, the early emerging morph from Medaryville was represented by much less than 1% of the entire emerging population. The late emerging morph from Medaryville, including over 99% of the samples, delayed emergence at Urbana (40°6′ N latitude) by more than a month (Sternburg and Waldbauer 1984). (Cecropia cocoons from Chicago [41°51′ N] emerged about two weeks early if moved to Urbana. Thus, we judge that the Medaryville promethea cocoons, which were moved a lesser distance, emerged about 10 days early at Urbana.) At the UMBS the converse was true. The early emerging morph constituted well over 99% of the males trapped, while the late emerging morph constituted at most less than 0.01% of the total number of males trapped (Fig. 1).

The preponderance of the late emerging morph in the south (Medaryville, Indiana 41°5′ N latitude) and its almost complete replacement in the north (UMBS, 45°40′ N) is presumably adaptive. Almost all of the Medaryville moths emerge in early July. This is well past the earliest possible date for emergence but avoids the uncertain weather of spring. At the UMBS, almost all of the promethea moths emerge very early in the season, probably as early as they can, depending upon ambient temperatures. In this instance, the moths probably cannot emerge much later without the danger of their progeny encountering a frost in August or September before they spin the cocoon and molt to the pupa. At the UMBS the average date of the first frost in fall is 1 September.

ACKNOWLEDGMENTS

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