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**PARASITES RECOVERED FROM OVERWINTERING MIMOSA
WEBWORM, *HOMADAULA ANISOCENTRA* (LEPIDOPTERA:
PLUTELLIDAE)¹**

F. D. Miller, Jr.², T. Cheetham³, R. A. Bastian³, and E. R. Hart³

ABSTRACT

The mimosa webworm, *Homadaula anisocentra*, overwinters in the pupal stage. Two parasites, *Parania geniculata* and *Elasmus albizziae*, are associated with overwintering pupae or the immediate prepupal larvae. Combined parasitism during the winters of 1981–82, 1982–83, and 1983–84 was 2.1, 3.9, and 2.9%, respectively.

The mimosa webworm (MWW), *Homadaula anisocentra* Meyrick (Lepidoptera: Plutellidae) is an important pest of ornamental honeylocust *Gleditsia triacanthos* L., as well as of mimosa, *Albizia julibrissin* Durazzini, throughout most of the North American range of these trees. The aesthetic loss resulting from extensive defoliation by MWW larvae has limited the desirability of honeylocust, especially, as a landscape tree in many areas.

The MWW is a bivoltine species in the north-central United States. The first generation larvae pupate within webbed leaves on the tree. The second-generation larvae disperse from the foliage in the fall and spin cocoons in cracks and crevices on trees, houses, and other vertical objects, and overwinter in the pupal stage.

Nine species of insects have been reported as primary parasites of the MWW (Table 1) (Krombein et al. 1979; J. W. Peacock, USDA-Forest Service, pers. comm.). It was not known, however, which of these species were associated with the overwintering stage of MWW and what impact such parasites might have. As part of a major research project on the overwintering survivorship of the MWW, a study was made to determine the role of parasitism on this overwintering population. This study had the following objectives: (1) to identify any parasites associated with overwintering MWW, (2) to determine the level of parasitism in overwintering MWW, and (3) to determine the effects of winter temperatures on parasite survival.

MATERIALS AND METHODS

In early September of each year for 1981, 1982, and 1983, field observations of larval activity were conducted to determine the time of larval maturation. Before dispersal and pupation began, artificial pupation chambers made from corrugated cardboard wraps were placed on infested honeylocust trees in Ames, Iowa, to collect overwintering MWW (Miller and Hart, 1987). These wraps were collected in late October, after all MWW

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Table 1. Reported primary parasites associated with mimosa webworm larvae and pupae.

Diptera
Tachinidae
<i>Hemisturmia tortricis</i> (Coq.) ^b
Hymenoptera
Braconidae
<i>Agathis cincta</i> (Cresson) ^a
<i>Apanteles hyphantriae</i> Riley ^a
Ichneumonidae
<i>Enytus obliteratus</i> (Cresson) ^a
<i>Diadegma</i> sp. ²
<i>Ophionellus foutsii</i> (Cushman) ^a
<i>Parania geniculata</i> (Holmgren) ^{a,b}
Eulophidae
<i>Elasmus albizziae</i> Burks ^{a,b,c}
<i>Paraolinx canadensis</i> Miller ^a

^aKrombein et al., 1979.

^bJ. W. Peacock, USDA-Forest Service, personal communication.

^cJ. Appleby, Illinois Natural History Survey, rearing record.

larval movement and pupation activity had ceased and temperatures had reached levels that precluded significant activity by most other insects. The cardboard wraps were cut into strips containing at least 150–200 cocoons each and the strips randomized. Sixteen strips were then placed in each of four (1981), five (1982), and one (1983), selected, typical overwintering locations in the city (Miller and Hart, 1987; Hart et al. 1986). From each location, subsamples of 150–200 cocoons, 10–15 from each of the 16 strips, were removed at approximately 14-day intervals and returned to the laboratory for examination for as long as laboratory emergence indicated that MWW or associated parasites survived winter conditions. Laboratory studies included observations of parasitism level on prepupal and pupal MWW, parasite development, and condition of host material.

The insects sampled from the microhabitats were examined for mortality by gently nudging each pupal cocoon. Those that showed movement were considered to be alive and unparasitized. After the laboratory examination, each corrugated cardboard section for a given subsample was placed in a 3.7-ml plastic creamer cup and sealed with a lid that contained 8–10 small holes to allow for ventilation and to reduce fungal growth by regulating humidity in the cup. The date, sample number, and location were recorded. The cups from each sampling period were placed in an environmental chamber set to a temperature regime of 20°C (day) and 16°C (night) that corresponded with a 16:8 (L:D) photoperiod. Humidity was maintained at approximately 55%. These conditions simulated June field conditions when both MWW and parasites emerge. The cups were examined every 1 or 2 days for parasite and MWW emergence. After emergence, the parasites were removed from the cups and placed in 70% alcohol for subsequent counting and identification.

At the end of each winter, the total number of MWW examined and the total number of parasites of each species were tabulated. Mean percent parasitism was calculated from these data.

RESULTS AND DISCUSSION

Only two parasite species were reared from overwintering MWW in the Ames, Iowa, area (Table 2). These were identified as *Parania geniculata* (Holmgren) (Hymenoptera: Ichneumonidae) and *Elasmus albizziae* Burks (Hymenoptera: Eulophidae) by the authors.

P. geniculata is widely distributed throughout North America, and host records indicate that it is most often a parasite of small Lepidoptera, particularly Tortricidae, on trees and shrubs (Krombein et al. 1979). Eggs are deposited in late instar caterpillars and the larvae develop as internal parasites within the host pupae. We observed that only one adult parasite emerged from each parasitized MWW pupal case. The head region of the pupal case had been removed upon emergence and resembled a cap while the remainder of the pupal case was left intact. In the laboratory, adult *P. geniculata* tended to emerge about 4 days after adult *E. albizziae* and about 22 days before adult MWW emergence.

Parasitism of the MWW by *E. albizziae* was first reported by Burks (1965). The appearance of this species in Camden County, New Jersey, near an international harbor, along with the resemblance of *E. albizziae* to certain Oriental species of *Elasmus*, led Burks to conclude that it had been introduced recently from Asia.

Field and laboratory observations indicate that *E. albizziae* parasitized MWW prepupae after they had situated themselves in a suitable overwintering site and before pupation was completed. Development of parasitized MWW stopped in the prepupal condition within the pupal cocoon. About 21 days after MWW cocoon formation, *E. albizziae* pupae were observed in the pupal cocoons with the prepupal body fluids already consumed. Emergence was about 4 days before that of *P. geniculata*, and about 18 days before that of adult MWW emergence.

A mean of approximately 10 *E. albizziae* pupae occurred for each parasitized MWW (Miller 1984). Only the larval MWW head capsule was found within the pupal cocoon after parasite emergence. The infestation in any group of host pupae appeared scattered, with many adjacent cocoons being unparasitized.

E. albizziae is considered to be parthenogenetic, and males are quite rare. Burks (1971) observed the first known male in 1967 and stated that he had seen "thousands of females but only 9 males." Only a single male was found in the overwintering material collected during this study.

Both *P. geniculata* and *E. albizziae* seem to be susceptible to the same extreme low winter temperatures as the MWW. During the winter of 1981–1982, mortality of MWW pupae in the field approached 100% by mid-January 1982 (Miller and Hart, 1987). Parasite mortality for both species also approached 100% by that time. Extreme low temperatures also occurred during the winter of 1983–1984, with field mortality of MWW

Table 2. Percent Parasitism of Overwintering Mimosa Webworm pupae for the winters of 1981–82, 1982–83, and 1983–84.

Year	Total MWW Sampled	<i>Parania geniculata</i> recovered	<i>Elasmus albizziae</i> recovered	Percent Parasitism ^a
1981–82	3,992	25	609	2.1
1982–83	10,393	188	2,141	3.9
1983–84	743	6	157	2.9
Total	15,128	219	2,907	—

^aPercent Parasitism = {[No. *P. geniculata* + (No. *E. albizziae*/10)]/Total number of pupae sampled} × 100.

pupae and both parasite species approaching 100% by late December 1983. These low temperatures approached or exceeded the supercooling point (temperature at which lethal ice formation occurs) of the MWW pupae during both winters (Miller and Hart, 1987).

During mild winters (i.e. 1982–1983), both parasite species survived throughout the entire winter regardless of their overwintering site location. Mimosa webworm pupal mortality never exceeded 40% during the entire winter (Miller and Hart, 1987). Data were not collected on parasite mortality, however, and it is not known what, if any, effect these mild temperatures had on parasite survivorship rates. The only significant difference ($t = 2.61$; $P < 0.05$) in mean percent parasitism among the three winters occurred between 1981 (2.1%) and 1982 (3.9%) but the reason for, or implications of, this significance are not clear.

The efficacy of parasitism in reducing damage by lepidopterous pests depends in part on the larval instar that is parasitized. If we consider that both of these species parasitize late instar larvae or prepupae, from an economic or practical control standpoint, this is of limited immediate benefit because the feeding damage had already occurred. Parasite data were not collected on first generation MWW parasite populations following any of the winters. Recent studies in the same Ames, Iowa, area have indicated that parasitism by *E. albizziae* can reach high levels (50–60%) in first generation MWW larvae (R. Bastian, Iowa State Univ., pers. comm.). Further studies are needed to determine the factors responsible for this difference in parasitism levels between the two generations, and for the effects that this may have on defoliation levels.

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