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HISTORICAL AND BIOLOGICAL OBSERVATIONS OF LEPIDOPTERA CAPTURED BY AMBUSH BUGS (HEMIPTERA)

DAVID M. WRIGHT[1]

Department of Microbiology, Hosp. Univ. Pennsylvania,
3600 Spruce St., Philadelphia, Pennsylvania 19104

ABSTRACT. Ambush bug predation on Lepidoptera represents a unique invertebrate predator/prey relationship. Since its first description more than 100 years ago, it has been infrequently studied and reported. Observations on predator's sex and method of capture are presented along with a summary of lepidopteran families utilized as prey.

In a recent note Pyle (1973) reported what he believed to be the first account of ambush bugs (Phymatidae) preying on North American Lepidoptera. Subsequently, Fales (1976) added 14 observations and suggested that this phenomenon may occur more frequently than realized. I have made several field observations of invertebrate predators preying on Lepidoptera and have taken special interest in this behavior. I present here the first photographic account of an ambush bug/lepidopteran encounter, plus a summary of captures that have appeared in the entomological literature over the past century.

On 16 June 1979 at the St. Charles of Borromeo Seminary in Overbrook, Pennsylvania, I witnessed a capture involving *Wallengrenia egeremet* (Scudder) (Hesperiidae) and two ambush bugs, *Phymata fasciata* (Gray), on an inflorescence of *Apocynum cannabium* L. (Apocyanaceae). The butterfly was busily nectaring at inflorescences that are occupied by ambush bugs at this time of year. Suddenly, in an instant, the butterfly was pulled downward into the inflorescence. Closer examination revealed that two coupled ambush bugs were piercing and probing the butterfly's ventral surface while the latter's wings continued to beat rapidly and convulsively. Within two minutes the butterfly was subdued, most likely by the predators' toxins which probably were placed in strategic ventral ganglia. The coupled ambush bugs then proceeded to feed on the butterfly's haemolymph for the next 160 min with the large female manipulating and rotating the prey. After 90 min of feeding, the smaller male (8 mm) ceased to feed and rested on the female's dorsum (Fig. 1) while the female (10 mm) continued to feed for another 70 min before dropping the drained remains of the butterfly to the ground. Shortly after the moment of capture the butterfly's proboscis was observed to be quite mutilated. The two galeae were separated and twisted. This damage was prob-

[1] Present address: Director of Laboratories, North Penn Hospital, Lansdale, Pennsylvania 19446.

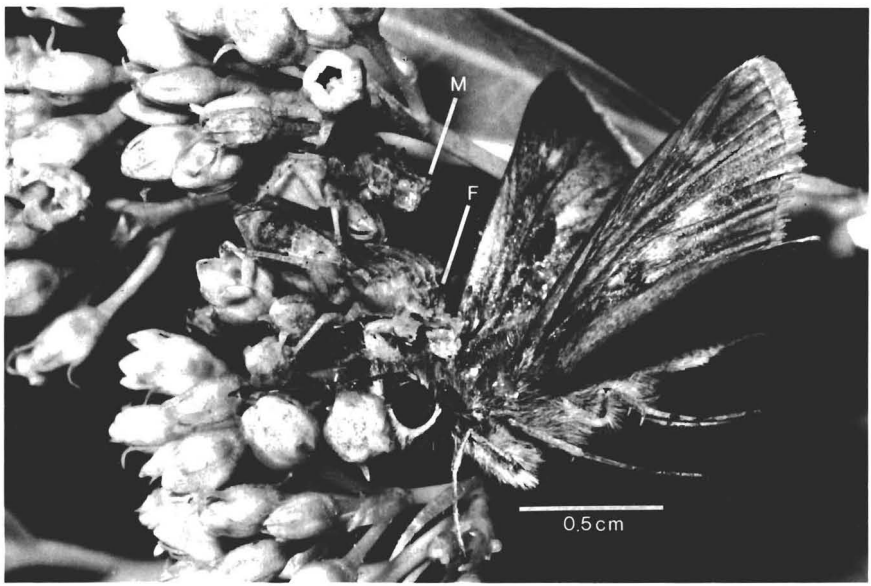

FIG. 1. *Wallengrenia egeremet* captured by two ambush bugs, *Phymata fasciata*, at Overbrook, Pennsylvania. The large female (F) is shown actively feeding on the prey, while the smaller male (M) has ceased to feed but remains coupled to the female.

ably inflicted when the ambush bug seized the proboscis and gave a violent jerk to draw the prey near. Balduf (1939) repeatedly observed that butterflies and moths were most often seized near the apex of their extended proboscis.

Butterflies ambushed by more than one bug have been previously reported (Pyle, 1973; Fales, 1976) but the details of the predators' sex were lacking. The term "coupled" as used in this report is not synonymous with copulation. It was coined by Balduf (1939) to describe the physical relationship of a pair of ambush bugs in which the male rests or perches passively on the dorsum of the female. During the courting season the male ambush bug frequently occupies this position for several hours or even days. He will also join in the feast when the larger, more active female has caught a prey. Thus at certain times of the year, it is not unusual to see more than one ambush bug feeding on a single prey. In general, when males are single they capture smaller insects, e.g., dipterans. For proper determination of sex, a small hand lens or dissecting microscope is necessary. Males may be distinguished by the elongated, rounded external covering of the genitalia, while the female genitalia is covered by a triangular flap-like shield.

The first report of ambush bugs preying on Lepidoptera appeared

TABLE 1. Summary of records of Lepidoptera captured by ambush bugs (Hemiptera: Phymatidae).

Family	Number of species	Number of individuals
Noctuidae	10	30
Hesperiidae	10	27
Pieridae	4	19
Nymphalidae	4	13
Lycaenidae	3	8
Ctenuchidae	1	4
Pyralidae	1	1
Total	33	102

more than 100 years ago (Glover, 1876). Near the old Maryland Agricultural College, Glover witnessed an ambush bug concealed among the petals of a rose, "busily employed in sucking out the juices of a small blue butterfly which it had caught and killed." Glover's "small blue butterfly" undoubtedly was one of the two common Plebejinae of Maryland, either *Celastrina argiolus pseudargiolus* (Bdv. & LeC.) or *Everes comyntas* (Godart); however, insufficient detail is presented to make a species determination. The first correct identification of a lepidopteran prey was made by Prof. J. A. Lintner (1878), former New York State Entomologist, from a specimen sent to him by Mr. G. W. Duvall of Annapolis, Maryland. The butterfly victim had been ambushed on goldenrod (*Solidago* sp.) and was determined by Lintner to be *Chrysophanus americana* D'Urban (=American Copper, *Lycaena phlaeas americana* Harris). I have attempted to catalogue (available from author upon request) all the lepidopteran captures by ambush bugs recorded in the literature during the past century since the first report (Glover, 1876; Lintner, 1878; Barnard, 1879; Riley, 1883; Adams, 1915; Balduf, 1939, 1940; Pyle, 1973; Fales, 1976; Neck, 1977; Nielsen, 1977). A summary of this catalogue presented in Table 1 shows that 102 individual captures have been recorded, distributed among 7 lepidopteran families and 33 species. All identified prey had been captured by members of the genus *Phymata*. To date, there are no recorded captures by the other phymatid genus *Macrocephalus*. Although these data do not provide a clear analysis of the bionomics of this unique predator/prey relationship, they do provide an interesting estimate of its overall distribution among different lepidopteran families. Noctuids and hesperiids constitute the majority of recorded prey and it is a little surprising that noctuids were the single most frequently recorded family. The Noctuidae are generally regarded as having nocturnal habits and it is easy to over-

look the diurnal and crepuscular habits of some of its members. Willis and Burkill (1895, 1903a, 1903b) recorded nearly 40 species of British moths visiting flowers in the daytime; in certain locales they recorded a greater number of visitations by noctuids and geometrids than all Rhopalocera combined. The pattern of lepidopteran feeding habits may vary from place to place and thorough predator records may be a useful tool in learning more about this important aspect of lepidopteran ecology.

Predation on Lepidoptera by ambush bugs, without doubt, occurs more frequently than the records summarized here would indicate. Balduf (1940) has shown in Illinois that Lepidoptera may constitute up to 20% of the total diet of a *Phymata* population over a season. I encourage lepidopterists to maintain a keen eye for this phenomenon, and would be most interested in learning of any further ambush bug/lepidopteran encounters.

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