

when placed on pieces of earthworm. The midgut showed red in the almost transparent young larvae after they had fed, and even in these minute larvae the black chitinous jaws were apparent. They were very resistant to dry conditions; a small larva left overnight on some towelling revived when moistened with a little water. However, no larvae hatched from egg masses were successfully reared through to the adult stages.

As the majority of the collected larvae have been feeding all winter, it will be

interesting to note whether this forced activity in any way modifies their development, since under natural conditions they would remain dormant during the winter.

Much yet remains to be learned about the early stages of many of our tabanid species, to say nothing of such mysteries as what happens to the minute adult parasites from one fall until the following mid-summer's egg supply, and further studies in this field should bring to light interesting data.

LITERATURE CITED

- Cameron, A. E., 1926. Bionomics of the Tabanidae (Diptera) of the Canadian Prairie. *Bul. Ent. Res.* 17 (1):1-42; plates 1-5; text-figs. 1-18.
 Isaac, P. V., 1924. Papers on Indian Tabanidae. *Agr. Res. Inst., Pusa, India, Dept. Agr. Memoirs, Ent. series, Calcutta*, 8:53-62.
 Philip, C. B., 1928. Methods of collecting and rearing the immature stages of Tabanidae (Diptera). *Journ. Parasitol.* 14 (4):243-253; text-figs. a-b.

SOME NOTES ON THE HABITS OF *ARZAMA OBLIQUA* ON VANCOUVER ISLAND. (Lepidoptera: Phalaenidae)

RICHARD GUPPY
Wellington, B.C.

Arzama obliqua Walk. belongs to a group of Phalaenid moths which, though neither abundant nor conspicuous, have attracted attention because of the peculiar habits of the larvae. These mine in the stems of their food plants instead of feeding on the leaves in the ordinary manner.

The species of the genus *Arzama* are known by the common name of "cattail moths", from their usually recognized food plants, *Typha latifolia* or related "cattails".

Prof. J. H. Comstock in his "Introduction to Entomology", gives some data regarding *Arzama obliqua* which I reproduce in part on account of its bearing on my observations.

"Two or more species of noctuids infest the cat-tail plant, *Typha*, in this country. The larvae of both are at first leaf-miners, later they bore in the stalks. Our most common species is *Arzama obliqua*. According to the observations of Classen (1921) the full-grown larva overwinters in its burrow in the cat-tail plant and transforms in the spring. But the late

Prof. D. S. Kellicott, who made a special study of this species, informed me in a letter written in 1882, that the larva leaves the cat-tail plant in the fall and conceals itself under bark, in old wood and even in the ground until spring when it pupates, and emerges as a moth in May. It is evident therefore, that individuals of this species differ as to the location in which they pass the winter."

I found these larvae to be quite abundant in a low lying swampy area near my home, while they were wintering under loose bark on fallen cedar logs. There are no cattails anywhere in the vicinity; later I ascertained the caterpillars were feeding in the leaf stems of skunk cabbage (*Lysichiton kamschatcense*).

I have not been successful in rearing these larvae from the egg. Possibly it is necessary that the ova should be deposited on growing leaves of the food plant.

When taken from *Lysichiton* stems in late August of 1946 they were evidently far past the leaf mining stage, though still quite small. This however appears to have

been a late season. In all stages of growth except the final instar, these larvae have a waxy semi-transparent appearance. The color at this time is a light brown, with a dark patch on the first thoracic segment. When full grown they lose the transparency and become dark gray, the mark on the thorax is still in evidence. At this stage they resemble the typical Phalaenid larvae known as cutworms, except in size, being up to 50 mm. in length.

In his description of the related genus *Bellura*, Prof. Comstock describes a modification of the hind end of the caterpillar which supposedly allows these aquatic larvae to breathe while only the caudal extremity is held against the surface of the water. Briefly, this consists of a reduction in size of the last abdominal segment which allows room for two large spiracles on the posterior part of the preceding segment.

Though Comstock does not mention this arrangement as being common to *Arzama* spp. also, it could be clearly observed in all the *A. obliqua* larvae which I examined. The extraordinarily large size of all the spiracles is also very noticeable. The *Arzama* larvae could not be described as aquatic, and the use, if any, to which this specialization is put is a matter for conjecture. It may indicate a close relationship with, and derivation from, the genus *Bellura*. The feeding of these larvae on such widely different plants as *Lysichiton* and *Typha*, indicates great adaptability, and they may on occasion take to water lilies, or other truly aquatic plants.

Their burrows in the stems of *Lysichiton* leaves extend from below the ground level, and are from 1 to 2 feet in length according to the size of the leaf. No opening can be found in the upper end of the boring. It is difficult to ascertain whether the lower end is open, owing to the leaves being bunched together and attached below the ground level to a tough rootstock. My observations lead me to believe that there is usually an opening at the lower end, which would at least account for the absence of excrement, which I never found in the borings. The insects evidently tra-

verse the length of the burrows several times during their larval life, enlarging it each time to suit their increasing girth.

These *Lysichiton* feeding larvae must of necessity abandon their leaf stem homes on the approach of winter, since the fleshy leaves, on withering, soften and disintegrate almost at once. During winter I found the caterpillars nearly always under the loose bark on fallen cedar trees. Some digging in the soft decayed cambium is usually done in order to construct an oval hibernation cell. The material chewed out is used to plug up any space between the bark and cambium, including the aperture by which the larva entered. I have also found them under the bark of dead willows and alders, and occasionally in the wood of much decayed fir logs. My activities in stripping all the bark from cedar logs in the area under observation, must be considered as having some effect in forcing them to take to second choice locations.

I was not able to ascertain just when pupation takes place, but at least it is not until the spring, a short time before the adult insects appear. Occasionally a larva may leave its hibernation cell in order to search for a better hideout, but no feeding takes place at this time. As a rule pupation takes place in the cell in which the winter was passed.

The adult moths appear during the latter half of June in this locality. I have one record for June 10th; others are from June 27th to July 5th. Mr. J. R. J. Llewellyn Jones of Cobble Hill, to whom I sent several larvae, informs me that adults emerged on June 1st and June 8th.

From such information that I have been able to gather, it appears that the species is widespread in North America, but not abundant anywhere in Canada.

ACKNOWLEDGMENTS. I am indebted to Mr. Llewellyn Jones for determination of specimens of *Arzama obliqua*, and also for information regarding the habits of the species which led me to make the researches described above. My thanks are also due to Floyd L. Caesar for information on the habits of the moth in Eastern Canada.