NOTES ON THE LIFE HISTORY OF SOME TABANID LARVAE (Diptera)[1]

GWLADYS N. HATTON
Livestock Insects Laboratory, Kamloops, B.C.

A considerable number of tabanid larvae were collected during June and July in 1946 by the staff of the Dominion Livestock Insects Laboratory, Kamloops. These were kept alive in the laboratory by different rearing methods and detailed notes were made on the feeding habits, number of molts, and the activity, of each individual larva. In addition, a survey of local ponds was made for tabanid egg masses and pupae.

In 1934, the late Mr. Donald Cameron* reported finding four tabanid larvae on the margin of Moose Lake near Kamloops. He kept them alive for several months, remarking that "they were very resistant to dry conditions and sometimes when apparently dead and dried up, would immediately become active when moistened again".

Nineteen larvae and one pupa were collected on two trips to this lake in June 1946, and during successive trips to other likely ponds around Kamloops, a total of sixty-one larvae was found. Tabanid larvae were taken from Stake Lake on the Lac le Jeune road, Strawberry Heights (Rayleigh, B.C.), ponds on the highway near Savona, and from a slough on the Lac du Bois range.

Pupae were more difficult to find as they were usually on the surface of the ground and well protected by their brown colouring. The first evidence of pupation was on June 15, and during the remainder of June and July, seven pupae were found—of which four emerged. These were kindly identified by Dr. C. B. Philip of the Rocky Mountain Laboratory, Hamilton, Montana, as *Chrysops furcatus* Walk. ♀, *Hybomitra* sp. near *hoemaphora* Mart. ♀, *Hybomitra* sp. ♂, and *Hybomitra illotus*, O. S., ♂.

The ideal shoreline for collecting tabanid larvae is a fairly steep slope covered with moss and loose black humus soil. They are probably easier to find in a steep bank because of the concentration of larvae in a smaller area due to the moisture gradient.

Moose Lake on the Tranquille range where the larvae were most easily found in June, is a small alga covered pond in the timber, bordered with tall grasses and damp mossy hummocks. By searching steadily through the black mud with a trowel a few inches from the water's edge, and parting the clods of earth and roots with the hands, it was possible to find about three larvae an hour. Most of these were at a depth of from one to three inches, but later on some were found just under the moss on the surface of the mud and several large larvae were taken from some fairly dry moss a foot above the water. There is some evidence that the larvae usually move to a dryer area to pupate; this was also noted in the laboratory.

On July 12 a slough on the Lac du Bois range was found to provide a much easier collecting area. Along the shore line a thick mat of grass and debris had been washed up, and by turning this over, the tabanid larvae could be picked out almost at the rate of one a minute.

The first larvae collected were maintained in the laboratory under the following conditions: some in damp mud, some in damp sand as recommended by Isaac (1924), and others in large vials containing half an inch of water and a short roll of rough paper towelling, following Philip's (1928) modification of Marchand's technique. The first two methods were discarded for the third, as the larvae escaped repeatedly from the dishes of mud and sand. In the vials the larvae crawled between two layers of the paper and remained at the bottom completely

1 Contribution No. 2514, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.

* Formerly of the staff at the Livestock Insects Laboratory, Kamloops, B.C.

submerged in water with their respiratory siphons extended to the surface.

Continuing to use Philip's method, the larvae were kept alive very successfully by feeding them every two or three days on fly maggots and pieces of earthworm. Each larva was fed individually between two pieces of damp towelling on the table top. It was necessary to keep them covered while feeding as they are thigmotropic and tend to refuse food in order to crawl in search of cover. Notes were kept on their feeding habits. When offered a piece of food they actually pounced on it, making a sharp clicking noise, and often they have been observed to attack one another in the same way when being fed. When collecting the larvae, each one was placed in an individual vial since, if they were all together, several would be killed by the time they reached the laboratory.

The activity and amount eaten by each larva varied considerably from day to day. One large larva which had been inactive for a week escaped from a vial through two layers of cheese-cloth, and when discovered two days later, was actively crawling along the hall two flights of stairs below. Immediately before a molt they became very active and refused any food. In one instance a larva escaped through a cheese-cloth cover, continued through a water bath and ended up in the folds of a cardboard box where it was found the next day. However, although dried out, it was still alive, and ultimately pupated.

Three of the larvae fed in the laboratory pupated and emerged. The pupal periods lasted nine, ten and thirteen days. In July and August several larvae molted, but none pupated. The majority remained active all winter, feeding every few days on earthworms.

Dr. Philip has determined these last emergences as: *Chrysops furcatus* Walk. ♂, *Hybomitra* sp., near *sonomensis*, ♀, and *Atylotus incisuralis* Walk. ♀.

The first search for egg masses was made on August 9 around the Lac du Bois slough and although the larvae were abundant around the margin, no egg masses could be found. The water plants forming a fringe about four feet wide around the slough, and growing in black mud with water three to four inches deep, to all appearances provided ideal oviposition sites. A week later, after a very thorough search of this area, two egg masses were found on the under and upper sides of the leaves of the water parsnip, seven inches above the water. They were both brown with a flat surface and 0.7 cm. and 1.5 cm. long in the shape of a triangle. The eggs were laid in a single layer.

Short pieces of plant bearing the eggs were placed in separate vials and kept on moss in a glass covered aquarium to keep them moist. Thirty larvae emerged from the larger egg mass six days after collection, and three days later, on August 23, minute parasitic flies emerged from the remaining unhatched eggs. They continued to emerge for the next four days and appeared to occupy the greater part of the egg mass.

McQueen Lake on the same range proved to be a better collecting area, and in two trips there, thirteen egg masses were found on the tall sedges along the margin. These were of at least two species, as ten were shiny coal black, built up in a rounded mass, three layers of eggs deep, and located on the under side of the blade. The other three were brown and deposited on the upper side of the blade with a flat sloping surface to their triangular shaped mass, and no distinct layers of eggs apparent. Larvae emerged from two of these egg masses, but the remaining eleven were parasitized.

The parasites were determined by Dr. C. F. W. Muesebeck of the United States National Museum as *Telenomus emersoni* (Girault). This species has been stated by Cameron (1926:38-39) to be a fairly common parasite of *Chrysops moerens* Walk. and *Chrysops mitis* O. S. in Saskatchewan.

The newly hatched larvae fed well

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 midsummer'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 kamtschatcense)*.

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