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DIPTEROUS PREDATORS OF THE MOSQUITO IN UTAH AND WYOMING

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The brackish marshes bordering the Great Salt Lake are prolific mosquito breeding areas; they also are the habitat of predaceous flies which find a plentiful source of food in the mosquito larvae and pupae that become stranded in shallow water and mud during the dry periods of late spring and early summer. Inspections conducted in this area during May and June of 1945 and 1946 afforded the writer several opportunities to observe five species of predaceous flies which were preying on mosquito larvae and pupae.

The observations were made at a time when the marginal areas of the extensive marshland were rapidly drying out, resulting in a heavy concentration of larvae and pupae in the shallow water of numerous pools. Many pools had evaporated until all that remained was a mass of squirming larvae and pupae, while hoofprints and similar isolated depressions had become entirely dry, causing the extinction of myriads of immature mosquitoes. Cast pupal skins covering the surfaces of some breeding places and hordes of adult mosquitoes which arose when disturbed in their resting places in the salt grass indicated that a tremendous mosquito population already had emerged from the vast marshland.

Adult mosquitoes collected in the area with an insect net showed approximately 60 per cent to be *Aedes dorsalis* (Meigen), 30 per cent *A. niphadopsis* Dyar and 10 per cent *A. campestris* Dyar and Knab. Larvae of the three species were found inhabiting the same brackish pools in a number of instances.

While examining the mosquito breeding places my attention was attracted by the presence of large numbers of predaceous flies which were capturing and feeding upon the larvae and pupae. The predators were particularly numerous in situations where the rapid drying of breeding places was leaving the larvae and pupae stranded on mud or concentrated in shallow water. The majority of the flies were running about over the mud, or were exploring moist cracks and crevices from which wriggling larvae and pupae were being extricated; others were "skating" across the surface of the shallow pools, examining various small objects floating on the water, in search of food.

Of the five species of predaceous flies under observation the most numerous were *Ochthera mantis* (DeGeer), of the family Ephydridae. This species is abundant in many localities near Salt Lake City and is readily identified by the greatly incrassated, heavily-spined anterior femora. The other four predaceous species, belonging in the family Dolichopodidae, were identified as *Hydrophorus gratiosus* Aldrich, *Thinophilis spinipes* Van Duzee, *Tachytrechus granditarsis* Greene and *Dolichopus nigricauda* Van Duzee. The last named species previously has been reported feeding on mosquito larvae in the Alamosa, Colorado area, by Bishop and Hart.

The ephydrid flies and the two dolichopodids, *H. gratiosus* and *T. spinipes,* were observed to employ their heavily-spined, prehensile fore legs in seizing their prey and manipulating it during the feeding process. The other two species of dolichopodids merely seized their prey by means of the large suctorial flaps which surround the protuberant proboscis. The anterior legs of the latter two species are not prehensile and were seldom used in holding or manipulating the prey which, in the case of small mosquito larvae, were entirely engulfed in the remarkably enlarged and modified mouthparts. Large, vigorously wriggling larvae and pupae that could not be wholly engulfed were held securely while the body fluids were being consumed.

These predaceous flies were observed to be amazingly adept at capturing mosquito larvae and pupae in shallow water. However, they were seldom observed to capture larvae or pupae where the water was of sufficient depth to afford the latter a means of escape. This might indicate that these dipterous predators are of little significance in the biological control of mosquitoes in situations where depth of water is great enough to permit freedom of movement for the larvae and pupae.

It has been reported by Mr. L. P. Nielsen, that pupae of *A. dorsalis* may remain alive in the moist holes and cracks of a pond several days after the water has disappeared, and that 25 to 30 per cent of the pupae in such situations may survive and become adults. Where such conditions obtain, as is frequently the case over wide areas in the extensive marshlands surrounding Great Salt Lake, these dipterous predators undoubtedly destroy large numbers of larvae and pupae and probably play a minor role in the natural control of mosquitoes. Bishop and Hart report that 93 mosquito larvae were accounted for in a period of 7 days, mostly by two small dolichopodid flies, identified as *D. walkeri* Van Duzee.

Two species of Asilidae have been observed by the writer to capture and feed on adult mosquitoes. These were identified through the

kindness of Dr. Stanley W. Bromley as *Cyrtopogon willistoni* Curran and *C. bimacula* Walker. The former species was observed preying on mosquitoes at Garden City, Utah, on August 10, 1946; the latter at St. Charles, Idaho, on July 11, 1945. The voracious asilids apparently had little difficulty capturing the mosquitoes in mid-air, and would repeatedly discard freshly-caught prey in order to pursue and capture new victims. Mosquitoes discarded by the predators were picked up by the writer and later identified as *Culiseta inornata* (Williston).

It is hoped that the notes given here, and those to be found in articles listed in the bibliography, will help to stimulate the interest of other workers whose observations may supplement our present inadequate knowledge concerning the natural enemies of the mosquito.

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Strawberries Damaged by a Diplopod

An introduced diplopod, *Nopoiulus minutus* (Brandt) was found damaging the strawberry fruit in Provo this summer. This small worm-like thousand-leg creature which is about 10 mm in length and 1 mm in diameter attacks the ripe berries which touch the moist soil. As many as a dozen *N. minutus* were taken from a single berry and most the berries touching the ground were infected. This organism ordinarily lives in the soil feeding upon plant and animal matter. It is hoped that it will not prove to be a serious pest to strawberry growers in this area. At present it is not known just how widespread it is in Utah. Dr. R. V. Chamberlin (Proc. Biol. Soc. Wash., 34, 1921, pp. 83-84) reports that it is common in New England and Atlantic seaboard states, but not in the western states. In fact this seems to be a new record of its occurrence in Utah. Dr. Chamberlin determined the species for me.

Fruit inspectors should check berries in the future to see if they are infected by this European diplopod.

—Vasco M. Tanner