SCIENTIFIC NOTES

OBSERVATIONS ON *Culex pipiens* LARVAE INFESTED WITH *Vorticella* SP.

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Late in the summer of 1966 several breeding sites of *Culex pipiens* Linn. were found where all or nearly all of the 4th stage larvae were infested with the ciliate protozoon *Vorticella*. *Vorticella* attaches to a substratum by means of its contractile stalk. This substratum may be either organic or inorganic and may be either stationary or floating. In the instance described below *Vorticella* was observed in numbers from a few to over a thousand (figures 1 and 2) attached to the body wall of living, and normally relatively fast-moving, mosquito larvae. These conditions were observed in five roadside catch-basins and probably occurred in others. From two of the catch-basins all of the larvae were collected for further observation.

COLLECTION SITE. These catch-basins were located in the vicinity of South Huntington. They were so large (8 feet in diameter and 14 feet deep) that in spite of the drought, at the end of September they had water levels of from 2 to 9 feet in depth and were prolific sources of mosquitoes. In the side of each basin was a rectangular inlet opening measuring about 3.8 feet by 8 inches. These openings were on the same side of the road, about twenty-five feet apart. Presumably, water remains in these catch-basins the year around. The area is hilly and densely populated so that the debris in the road is washed down by heavy rain and collects in the catch-basins. This debris-laden water, in a dark site, protected from the wind, affords an ideal breeding site for *Culex pipiens*, with whatever pathogenic or other organisms may be associated with it.

OBSERVATIONS. At the end of August, water samples from two catch-basins containing fourth stage *pipiens* larvae with *Vorticella* attached to them were placed in suitable containers and kept out-of-doors for further study. Careful observation and examination failed to reveal any *Vorticella* specimens which were in the process of fission, budding or conjugation, nor were there any free swimming individuals. With a few exceptions they were attached to the body wall of the mosquito larvae between the large hairs and slightly more abundant on the thorax and anal segments.

There was unusually high larval mortality in both jars. In one jar 16 out of 50 larvae died; in the other jar 19 out of 50. In one similar jar containing 50 larvae from a source uncontaminated with *Vorticella*, only four larvae died. The movements of *Vorticella*-infested larvae were evidently impeded by the *Vorticella*, as they were somewhat slower than normal larvae. Possibly as a corollary of this they remained longer without taking air at the surface and remained longer in the fourth stage. The adults which emerged appeared to be normal.

In order to find out how much time it takes until *Culex pipiens* larvae become infested with *Vorticella*, at the beginning of October an experiment was made in which *pipiens* larvae from a duck pond were added to the water from the same two test jars, each containing larvae heavily infested with *Vorticella*. The newly added larvae included both large and small specimens of several stages. Since development was slow at this time of year, the culture could be observed for relatively long periods. After about ten days, all of the fourth stage larvae, and only the fourth stage larvae, had *Vorticella* attached to them. At no time were they observed attached to younger larvae. However, they were observed in lesser numbers attached to dead fourth stage larvae and to fourth stage larval skins, living pupae and to pupa skins and to bits of floating debris. It was inferred that *Vorticella* find optimum conditions on the living fourth stage larvae.

During the period between November 20 and December 6 there were several freezes and the temperature went down as low as 8° F. At these times the water in the test jars froze nearly completely at night and melted during the day. During this period, stalked, active *Vorticella* attached to still living *C. pipiens* larvae were observed. They were, however, somewhat less numerous and their stalks appeared to be longer. This observation also indicates that *Culex pipiens* ("Duckfarm strains") larvae as well as *Vorticella* showed a high tolerance to cold.

FIG. 1.—Living *Vorticella* attached to thorax of a living *Culex pipiens* larva.

FIG. 2.—Living *Vorticella* attached to abdominal segments of a living *Culex pipiens* larva.

DISCUSSION. In this association of organisms, the advantage would seem to be with *Vorticella*. By clinging to mosquito larvae, *Vorticella* accompanies its host as it searches for food and air. This could mean that the *Vorticella* does not have to depend only on food being brought within reach of its radius of stalk expansion and contraction. This, in turn, could result in faster growth and reproduction as well as a means of transportation and spread to a new environment. Furthermore, attachment at the apparently favored sites between the longer hairs (figure 1) affords a certain amount of protection.

If, as we have said, there are advantages to *Vorticella* in the described relationship, there appear to be disadvantages to the mosquito larvae. Although it would seem to be beyond doubt that the high mortality in larvae infested with *Vorticella* must be a cause and effect relationship, more research is needed to determine if this is true and to find out how it operates and whether it can be manipulated to develop a biological control measure from it.

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AERIAL FOGGING WITH BAY 39007 FOR THE CONTROL OF ADULT *Aedes sollicitans* (WALKER) AND *Aedes taeniorhynchus* (WIEDEMANN)

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Since Davis *et al.* (1960) demonstrated that aerial fogs of malathion were highly effective against salt-marsh mosquitoes, *Aedes sollicitans* (Walker) and *Aedes taeniorhynchus* (Wiedemann), this procedure has become one of the principal methods of applying insecticides from airplanes for control of adult mosquitoes in Florida. However, the need for additional insecticides that can be used as aerial fogs was emphasized by the report of resistance to malathion in *A. taeniorhynchus* in Florida (Glancey *et al.*, 1966). The objective of the tests described here was therefore to evaluate Bay 39007 (*o*-isopropoxyphenyl methylcarbamate) as an aerial fog against natural infestations of adult *A. sollicitans* and *A. taeniorhynchus*.

The insecticide was injected into the exhaust stack of a Stearman airplane owned and operated by the Brevard Mosquito Control District. The airplane was calibrated to deliver 150 gallons of liquid per hour and was flown at a height of 50–75 feet, at a speed of 85 miles per hour, and at swath intervals of 100 feet. The fogs were applied to 10 to 25-acre citrus groves near Titusville, Florida between 6 and 8:30 a.m. when wind speeds were less than 5 miles per hour at 6 feet above ground. By visual observations, fog coverage for each treatment was considered excellent.

A 10 percent oil soluble commercial formulation of Bay 39007 was used, either without dilution or diluted with No. 2 fuel oil to provide concentrations of 5 percent and 2.5 percent. Malathion, the standard for comparison, was diluted to 10 percent in No. 2 fuel oil containing 0.5 percent

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