THE EFFECTS OF BAYTEX ON SOME AQUATIC ORGANISMS [1]

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Data from small experimental tests indicate that Baytex (o – Dimethyl o – / 4 – (methylthio) – M – tolyl / phosphorothioate) is one of the more promising chemicals for use as a larvicide against chironomid midges. However, before this insecticide can be recommended for general use, more information about its toxicity to fish and other aquatic organisms must be obtained.

There have been numerous laboratory studies of the effects of pesticides on aquatic organisms (Henderson and Pickering, 1957; Tarzwell, 1958; Henderson, *et al.*, 1959; Katz and Chadwick, 1961; Davis, 1961; Pickering, *et al.*, 1962), and several studies have been made of the effects of insecticides on aquatic organisms in the field (George, *et al.*, 1957; Harrington and Bidlingmayer, 1958; Frey, 1961; Bridges and Andrews, 1961; Ruber, 1963). However, the literature contains comparatively little information on the effects of Baytex, a relatively new insecticide, on common aquatic organisms. Therefore, experiments were set up in the field and in the laboratory to determine the effects, if any, of Baytex on populations of common organisms in an aquatic environment.

METHODS. Most of the laboratory work was confined to fish toxicity studies. These were run with mosquito fish, *Gambusia affinis;* golden top minnows, *Fundulus chrysotus;* blue gills, *Lepomis macrochirus;* shell crackers, *Lepomis microlophus;* and warmouths, *Chaenobryttus gulosus,* in 1½-gallon aquariums.

Long range effects of Baytex on other aquatic organisms were studied in plastic-lined ponds of about 300-gallon capacity. These artificial ponds were approximately 5 by 5 feet and 3 feet deep in the center. To each pond was added 40 undiluted Ekman dredge samples, which together contained about 2,000 midge larvae plus other aquatic organisms, and 5 fish, mainly *Gambusia affinis.* Since the water for the ponds was pumped directly from a drainage canal, it, too, contained many microorganisms. Before the ponds were sampled they were allowed to stand for two weeks to allow the various organisms to adapt themselves to their new environment.

Both plankton and bottom samples were taken from each pond. The plankton samples were taken by dragging the net through the water parallel to the sides and once across the center; a total of five samples per pond was taken. The five bottom samples were taken at random with a dipper attached to a pole. The samples were then placed in baby-food jars, capped, and taken back to the laboratory where they were examined under a microscope. All organisms that were easily visible at 15x magnification were counted and recorded. Observations were made of the snail, clam and fish populations for any toxic effects from Baytex residue.

Water samples were also taken so that the concentration and species composition of the phytoplankton could be made for each pond to determine if Baytex had any effect on it. The pH of the water was checked weekly for any changes due to the pesticide.

Two separate field experiments were run with these small ponds. The first one consisted of only two ponds, one of which was treated with a granular formulation of Baytex at the rate of 0.2 pound technical per acre; the other pond served as an untreated check. The second experiment was set up like the first, except that six ponds were used, to allow sufficient

[1] Contribution No. 126, Entomological Research Center, Florida State Board of Health.

replication for adequate correlation of the data. Three ponds were treated with Baytex and the remaining ponds served as checks. The results of these two experiments were basically the same. Unfortunately, only five different groups of animals, Oligochaetes (annelid worms), Copepoda, Cladocera (water fleas), Ostracoda and chironomids (midge larvae) were present in numbers sufficient to serve as indicators of possible effects of Baytex. Hydra were prevalent throughout the first experiment and will be discussed for that test.

RESULTS. None of the fish showed any overt symptoms of Baytex poisoning at a concentration of 0.025 p.p.m., which is the equivalent of an application of 0.2 pound per acre over water 3 feet deep. All the fish but *Gambusia affinis* were killed within 48 hours at a concentration of 5 p.p.m. of Baytex. Some mortality occurred at concentrations of 2.5 p.p.m. after 48 hours. As these data clearly illustrate, there is little danger of acute poisoning to these species of fish with Baytex when it is applied at the rate of 0.2 pound per acre as a midge larvicide.

Within a week following the Baytex application in the first experiment, both the Cladocera and chironomid populations were almost completely gone in the treated pond. The Cladocera did not re-establish themselves until almost five months later. About seven weeks after the application the chironomid population commenced to increase gradually, although it took almost four months to build up to its original level. It should be emphasized, however, that the cold temperatures during this first experiment may have slowed the increase of chironomid and Cladocera populations. This experiment ran from November 6, 1962 to April 17, 1963. (December was the coldest month of the 1962–63 winter in the Winter Haven area.) Cladocera quickly revert to a bisexual stage when the environment becomes unsuitable. The eggs may then lie dormant for several months or until the environment is again favorable. Although not confirmed, this might account for the slow recovery of the Cladocera population. One interesting fact is that the few midge larvae observed during the first seven weeks following treatment were rarely *Glyptotendipes paripes,* the common pest species in the Winter Haven area, but mainly members of the subfamily Tanypodinae.

None of the other common organisms, such as copepods, ostracods, hydra, and annelid worms, exhibited any noticeable population changes ascribable to the treatment. Also there was no discernible decline in the fish, tadpole, clam or snail populations following the treatment. Other aquatic forms[2] observed in the treated ponds were never in sufficient numbers for use in evaluating the effect of Baytex on them.

Both *Anopheles* and *Culex* larvae were frequently found in the untreated pond but never in the treated one. On several occasions about 100 *Culex* larvae were introduced into the treated pond, but within a week they were gone. They may have been destroyed by fish, although fish were also present in the untreated pond.

As stated earlier, the results from the second experiment were very similar to those from the first one. Neither the chironomid nor the Cladocera populations were suppressed for as long, but this may be partially due to the variation in temperature conditions when the two experiments were conducted. The second experiment was treated January 2, 1963 and observed through April, 1963. The average number of chironomids found in the treated ponds (Fig. 1) surpassed the populations in the untreated ponds within eight weeks after the treatment. The Cladocera population (Fig. 2) in the treated ponds showed a gradual increase after four weeks and it too had surpassed the populations in the check ponds eight weeks later. The sharp decline of Cladocera in the untreated ponds may have

[2] Protozoa, rotifers, nematodes, Bryozoa, amphipods, Eubranchiopoda, water mites, dragonflies, damselflies, backswimmers, larvae of Tabanidae.

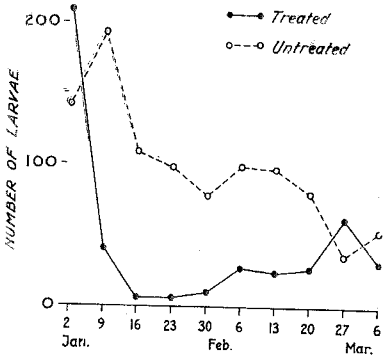

FIG. 1.—Average number of chironomid larvae per bottom sample in ponds treated with Baytex at 0.2 pound per acre and in untreated ponds.

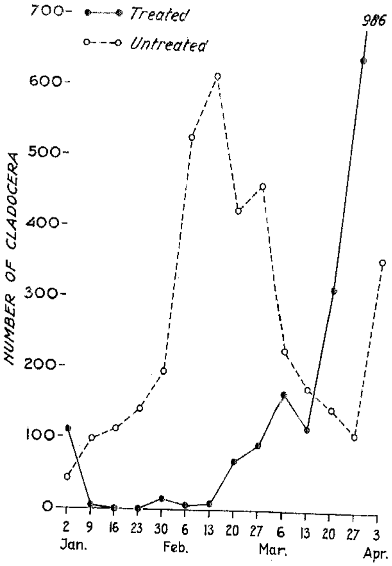

FIG. 2.—Average number of Cladocera (water fleas) in bottom and plankton samples in ponds treated with Baytex at 0.2 pound per acre and in untreated ponds.

been caused by the contamination of two check ponds with sodium arsenite which had been sprayed on vegetation along the edges of these ponds. Traces of arsenic were found in the water from these ponds two weeks after the date of contamination. It is worth noting that annelid worms, which are frequently used as indicators of water pollution, were found in consistently greater numbers in the treated ponds.

As in the first experiment, the second Baytex treatment showed no adverse effects on the Copepoda and Ostracoda; also there were no noticeable signs of toxicity to snails, clams or fish. There were approximately 50 *Gambusia* of various sizes in each of the treated ponds when the experiment was terminated. This was approximately 10 times the original population and slightly more than in the untreated ponds.

The Baytex application seemed in no way to affect phytoplankton. In the earlier algal counts there was little variation in species or density among the different ponds. At the beginning of the test a large population of *Cyclotella,* a diatom, was present in all ponds; later this genus disappeared from all ponds and the Chlorophyta and Cyanophyta took over as the major phytoplankton forms. Although there was a variation in generic composition from pond to pond, it was not consistent in either the treated or the untreated ponds and was no doubt due to isolation of the ponds, differences in nutrition present and incidental introduction of genera to the ponds by outside factors such as birds and inquisitive mammals. Butler (1963) reported a 7.2 percent decrease in the productivity of natural phytoplankton communities during a four hour exposure to 1 p.p.m. of Baytex.

At the dosage used the insecticide did not affect the pH of water in any of the ponds.

DISCUSSION. At the rate of 0.2 pound per surface acre over a 3-foot depth of water, Baytex in a granular formulation exhibited no overt toxic effects on fresh water copepods, ostracods, hydra, annelid worms, snails, clams or the mosquito fish *Gambusia affinis.* Also, there was no apparent poisoning of these common aquatic organisms over a period of four months. There were, however, very definite indications that this compound is very toxic to midge larvae and to Cladocera (water fleas). Within a week following the Baytex treatment both the midge and Cladocera populations were almost eliminated from the small test ponds and it required over two months for these two organisms to return to their normal numbers. Baytex did not affect the pH of the water, nor did it influence the production of algae commonly present in the fresh water lakes of central Florida.

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