ARTICLES

TOXICITY OF SEVERAL ORGANOPHOSPHORUS INSECTICIDES TO *GAMBUSIA AFFINIS* (BAIRD AND GIRARD) IN LABORATORY TESTS

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The effects of insecticides on natural predators of aquatic mosquito forms are of concern in mosquito control operations. In a transient water situation, such as an irrigated pasture, the effects of insecticides on predators are usually not directly apparent because most predators, even if they survive the insecticide applications, will die later as the area dries out. In other situations such as lake or river margins or rice fields where water stands for long periods, preservation of predators can be of importance when insecticide treatments are necessary to bring mosquito infestation under control.

The surface feeding minnow, *Gambusia affinis* (Baird and Girard) is an efficient predator of mosquito larvae and pupae in situations where dense growths of vegetation or floating debris do not interfere with its movement. Hess and Tarzwell (1942) indicated that when larval populations of mosquitoes increased, the number of *Gambusia* eating them, as well as the number eaten per fish also increased. This relationship was expressed in a formula called the forage ratio. Yet in no case did *Gambusia* give complete control of mosquito larvae.

Local mosquito abatement agencies throughout California have been active in the distribution of this fish as a mosquito control agent since its introduction to the State April 1922, at which time the State Department of Public Health secured the first shipment of fish of this species from Texas and established a hatchery in the lily pond at Sutter's Fort, Sacramento (Lenert, 1923).

Since chemical control operations are sometimes required when larval populations of mosquitoes build up disproportionately to *Gambusia* populations, it is of value to know something of the comparative toxicities of mosquito larvicides to this fish. Insecticides with low toxicity to the fish can frequently bring larval populations to a level that may be held in check by the fish population, allowing the biotic potential of the fish to offset the need for repetitive chemical control.

EXPERIMENTAL. In this study the effects or eight organophosphorus insecticides on *Gambusia* were compared with malathion and parathion, the insecticides most widely used by California mosquito abatement agencies.

The compounds were made up as 1.0 percent weight/volume acetone solutions from technical or purified samples. The 1.0 percent stock solutions were then diluted further with acetone into decreasing concentrations. Dosages corresponding to the 24 hour LC_{90} on fourth instar *Culex quinquefasciatus* Say larvae, determined from laboratory tests, were selected for testing against the fish since these

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TABLE 1—Organophosphorus insecticide tests on *Gambusia affinis*

Compound	P.P.M.	24 hr. percent mortality	Average mortality
Thimet [a]	0.05	70, 90, 90	83
Guthion [b]	0.05	80, 30, 60	53
Malathion [a]	0.05	30, 50, 40	40
Parathion [a]	0.004	30, 30, 40	33
Trithion [c]	0.2	0, 20, 0	7
Korlan [d]	0.1	10, 0, 0	3
Delnav [e]	0.05	0, 0, 10	3
Dibrom [f]	0.03	0, 0, 10	3
Dylox [b]	0.5	0, 0, 0	0
Hercules 3895G [e]	0.05	0, 0, 0	0

[a] American Cyanamid Co.; [b] Chemagro Corp.; [c] Stauffer Chemical Co.; [d] Dow Chemical Co.; [e] Hercules Powder Co.; [f] California Spray Chemical Co.

concentrations approximate minimal lethal dosages to mosquito larvae in the field.

The tests were conducted by collecting *Gambusia* with a net from an irrigation ditch about seven miles from the laboratory. Netted fish were placed in a ten-gallon milk can containing water from the natural habitat and transported to the laboratory. Fish were also obtained from ponds maintained at the San Joaquin Fish Hatchery at Friant.

At the laboratory, the fish were poured into large, enamel pans and transferred by a tea strainer to one-half gallon, cylindrical, ice cream cartons containing 500 ml. of distilled water. Ten unsexed fish averaging between 2.5 and 3.0 cm. in length, were placed in each carton. Five ml. of the insecticidal solution were then pipetted into the carton. No food was provided during the test period. No mortality occurred in the controls which were run with each batch of treated fish.

During treatment, the fish were held in a constant temperature cabinet at 70 ± 4°-F. for 24 hours. Each concentration was run in triplicate. The results of the tests are presented in Table 1.

These tests indicate that Thimet, Guthion, malathion, and parathion would cause rather high mortality of *Gambusia* at field dosages. High mortality of *Gambusia* associated with Guthion applications has been observed in the field previously, as has the relative low toxicity attributable to field use of Dylox (Lewallen and Brydon, 1958).

Literature Cited

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