Bull. Environ. Contam. Toxicol. 31, 120–124 (1983)
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Acute Toxicity of O,O'-(thio-di-4, 1-phenylene) bis(O,O-dimethyl phosphorothioate) (temephos) to *Lebistes reticulatus* and *Sarotherodon galilaea*

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Temephos is one of the larvicides being used for the control of Simulium damnosum in the Volta River Basin area in the Onchocerciasis control programme (OCP) in some West African countries. Some of the reasons for selecting temephos are its low toxicity to fish (BHATNAGAR et al 1969; TRAVIS and SCHUCHMAN 1968) and its relatively low persistence in aqueous media. Many reports, BARNES (1968), WALLACE (1971), SAMMAN (1977), dealt mainly with short periods, 10, 15, 30 min and 24 h of application. These are perfectly legitimate in cases of running streams and may illustrate small changes in an organism, but these changes may not tell whether such changes are within the range of adaptation of the organism or are deleterious to the success of it. But, however, in lakes and other reservoirs with slow discharge rates, 96 h and longer testing periods may present a more accurate picture.

The investigation reported here is the acute toxicities of temephos to two species of fish by the static method. This is part of a project aimed at studying the effects of both lethal and sublethal levels of the larvicide to tropical species of fish in the tropical environment.

MATERIALS AND METHODS

Lebistes reticulatus (guppies) have been selected because they are easy to find in small streams and gutters in and around Accra, are hardy, and can stand a number of polluted conditions. They do not occur in large bodies of water; but for their decorative use, they are of no commercial value. The second species Sarotherodon galilaea is of commercial value, occurs in many rivers and lakes in the country, and cannot stand polluted conditions.

The guppies were collected with scoop net from gutters near our laboratories and acclimatized in laboratory in fresh water aquaria for one week. During this period they were fed on crumbs of bread and poultry feed.

The Sarotherodon galilaea were harvested from fresh water aquaria in the Institute. They were similarly acclimatized and fed in laboratory glass aquaria.

The temephos obtained from Dow Chemical Company, Midland, Michigan, was insoluble in water. Two separate stock solutions of 4000 ppm each were prepared by dissolving accurately weighed amounts

in acetone and ethanol respectively. These stock solutions were used in preparing different strengths of solutions in filtered aquarium water in 20 - L glass aquaria. The control solutions contained no larvicide but only filtered aquarium water.

Ten fish were placed in the solutions and the controls in triplicate. Observations were made initially at 30-min intervals and later hourly. The number dead on each observation in each tank was recorded. The dead fish were removed and the fresh weights and lengths of the dead fish were taken. The solutions and controls were changed once a day for 4 days i.e. 96 h. Thereafter those still living were put in aquarium water only for 48 h. The percentage mortality was plotted against the concentrations on logarithmic probability paper and the 96 h LC50 calculated using the equations:

$$s = \frac{LC84/LC50 + LC50/LC16}{2}$$

$$fLC50 = {}_{s}2.77/\sqrt{N}$$

LC50 x fLC50 = upper limit
LC50/fLC50 = lower limit
N = No. of fish, s = slope of the line

The median mortality in hours was plotted against concentrations.

RESULTS AND DISCUSSION

From preliminary tests it was found that the two species were not killed in 96 h by 2400 and 6000 ppm of acetone and ethanol in aquarium water. However none of the test solutions contained one hundredth of this strength of solvent.

The weights of the guppies used ranged from 0.10 to 0.5g with a mean of 0.34g. Their lengths were between 1.8 and 3.5 cm with a mean of 3.06 cm. The S galilaea had a mean weight of 0.52g and ranged from 0.28 to 0.75g. Their lengths were between 2.8 and 3.7 cm with a mean length of 3.13 cm. Since S galilaea attains much larger size, the samples used can be described as juveniles, but the guppies were mainly matured ones and could not be any bigger. The mortality in control tests was less than 4 per cent within the 96 h.

The 96 h - LC50 of temephos dissolved in acetone and ethanol for guppies was 1.9 mg/l. Within the 95% confidence limits the upper and lower limits were 1.99 and 1.81 mg/l respectively. For S galilaea the 96 h - LC50 for temephos dissolved in acetone and ethanol was 0.47 mg/l with the upper and lower limits of 0.51 and 0.44 mg/l for the 95% confidence limits. The plots of median mortality times against concentrations on a semi-logarithmic paper produced curves which were asymotic about LC50's, figures 1,2. The shapes of the curves indicate that the temephos was not acutely toxic to the two species at concentrations lower than the thresholds found. Thus with regard to these species as non-target organisms the applications of the temephos in either acetone or ethanol to

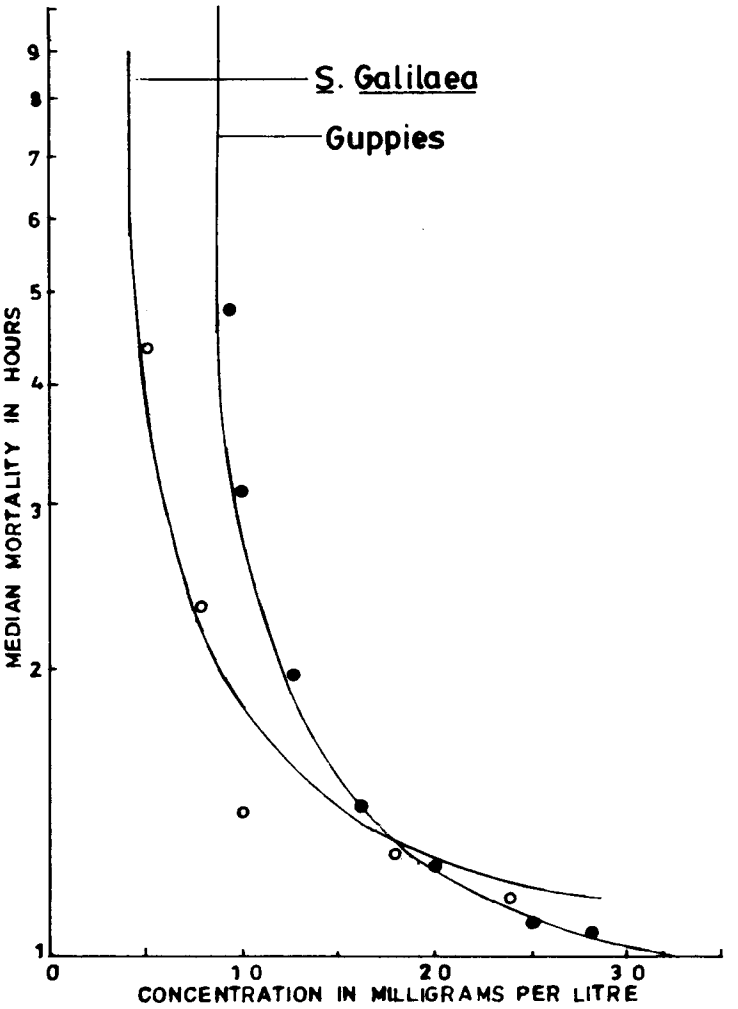

FIG. 1. TOXICITY OF TEMEPHOS DISSOLVED IN ACETONE TO GUPPIES AND S. GALILAEA

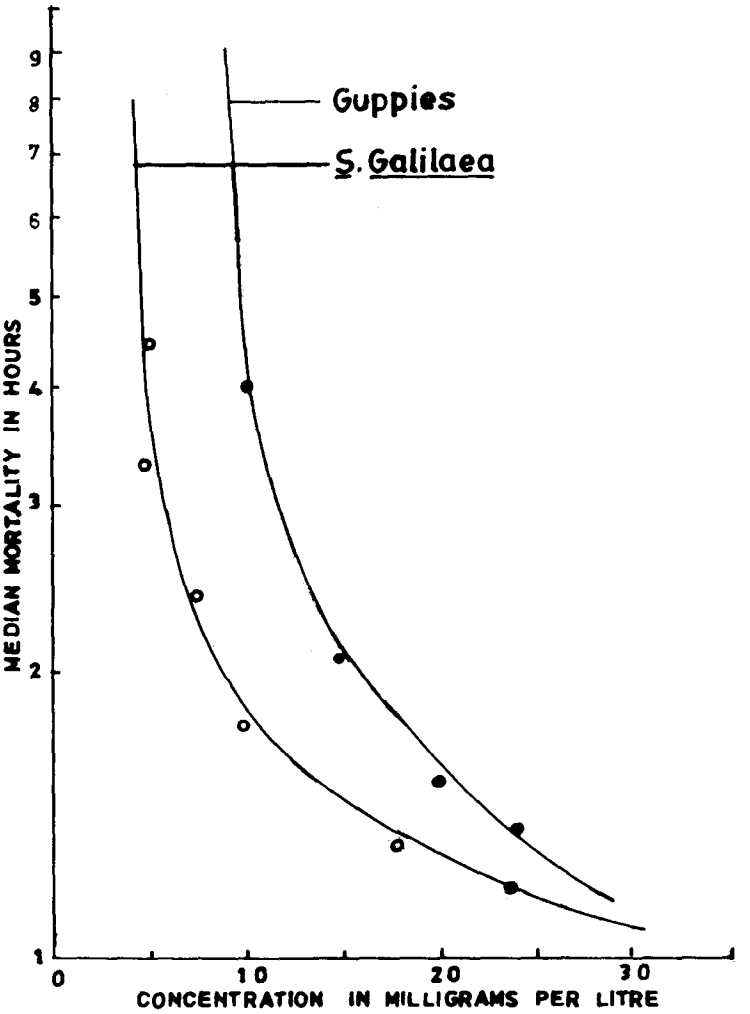

FIG. 2. TOXICITY OF TEMEPHOS DISSOLVED IN ETHANOL TO S. GALILAEA AND GUPPIES

water bodies as larvicide in concentrations less than their thresholds may be safe if no latent damage due to sub-lethal amounts results.

The guppies appeared to be more resistant to the effect of the temephos. This might be due to the fact that they were living in a more polluted environment, and could tolerate a number of contaminated conditions. Guppies grown in uncontaminated waters may show different results. This has to be investigated. On the other hand the more tolerance of the guppies might be due to the fact that their sizes were adult whereas the S galilaea were juveniles. But, however, since the two species were not the same, difference in their resistance to the chemical was not unexpected.

Acknowledgements: I am indebted to CSIR for providing facilities for the study and to W.A. Lamptey and to G.W.K. Adu-Parku for their help in the laboratory work.

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Accepted April 12, 1983