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Scientific Notes

Toxicity of malathion to silver barb (*Barbodes gonionotus* Bleeker) fingerlings

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Abstract
Static bioassays were performed to observe the toxic effect of malathion to *Barbodes gonionotus* at 0.0 to 20.0 ppm concentrations. Malathion at 5.0 ppm was harmless to *B. gonionotus* and concentration above 6.0 ppm were found to be lethal. Malathion at 2.06 ppm was safe for the *B. gonionotus*.

Key words: Toxicity, Malathion, *B. gonionotus*

Thai silver barb or rajpunti (*Barbodes gonionotus*) was introduce to Bangladesh from Thailand has shown considerable promise as a culturable species in ponds, ditches and other seasonal water bodies with low cost inputs at low level of management. The fish is becoming popular in paddy-fish culture systems also. The main problem of widespread culture of *B. gonionotus* in rice field is the indiscriminate use of insecticides for control of insect pests. Pesticides may cause extensive damage to different vital organs of fishes (Gosh and Dutta 1985) and also cause degradation of aquatic ecosystem which gradually reach disastrous limits and thus become a potential killer of fish population (Mckim *et al.* 1974).

A good number of literature's has been reported on the toxicity of agrochemicals to varieties of cultivable fishes (Ghosh and Dutta 1985, Haque 1989 and Hoque *et al.* 1993), with little information is available on the toxic effects of malathion to fishes. Since malathion has become a regular part of pest management in rice field, therefore, it is essential to evaluate the toxic effect of malathion to *B. gonionotus* with a view to formulate recommendation for the safe use of this pesticide in rice-cum-fish culture practice in Bangladesh.

The study was conducted at Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh, during the period during August'98. Twenty six aquaria each of 90 litre capacity were used for this purpose. Two aquaria were kept as control. Healthy rajpunti of three months old were acclimatized to the laboratory condition by keeping in holding tank before bioassay experiment. Initially a few screening tests were performed to find out the mortality range of *B. gonionotus*. The fishes were supplied mixed plankton food collected with a plankton net (mesh size, 150 μm).

Malathion chemically known as O, O-dimethyl phosphorodithioate of diethyl mercaptosuccinate with 57% active ingredient was collected from local BADC dealer and tested at 0.0, 2.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 12.0, 16.0 and 20.0 ppm concentrations with three replications. Ten fishes of uniform size (7.6±1.0 cm, 6.3±1.9g) were placed to each aquarium at least 24 hour prior to the addition of the pesticide to water. Relative toxicity of malathion to rajpunti was determined by means of standard 96-h semi-static bioassay (APHA, 1975) method. Initially the observations were made at 3 hourly intervals and after 24 hours, the interval time was 6 hours. The behaviours of the fish was observed regularly at 3 hours interval. Dead fishes were recorded and subjected to a binomial formula after Ward and Parrish (1982):

$LC_{50} = (AB)^{1/2}$

Where A = Highest toxin concentration in which none of the test organisms died.

B = Lowest toxin concentration in which all organisms died.

Safe level of concentrations were calculated using the following formula,

$C = 48h\ LC_{50} \times 0.3/S^2$

Where C = Harmless concentration and S = 24h LC_{50}/48h LC_{50}

Toxicity to fish depends on a number of factors such as species, age and health of fish, concentration of chemicals, exposure period and physico-chemical characteristics of water. During the period of investigation temperature of water was 28.0 $\pm$ 0.5 while dissolved oxygen content varied between 4.3 to 5.5 ppm. The total hardness of the water was in the range of 108 - 110 ppm and pH was fairly stable (8.0 $\pm$ 0.3). The physico-chemical parameters of the water were within the desirable range for fish (Boyd 1979).

Per cent mortality of the test fish at different concentrations are shown in Table 1. It can be seen from table 1 that the mortality of fish increased gradually with concentrations of toxin. Malathion below 5.0 ppm was ineffective to kill any fish within 96 hours. Malathion at 9.0 ppm killed all the *B. gonionotus* in 24 hours. Low rates of mortality were observed in *B. gonionotus* when exposed to 6.0 ppm of malathion for more than 72 hours. Mortality was found to increase as the dose of the malathion was increased. Total mortality within 3 hours (3h LC_{100}) was observed at 12.00 ppm. Nine ppm of malathion killed all the fishes in 24 hours whereas diazinon and sumithion caused total mortality (24h LC_{100}) at 6.00 ppm and 5.00 ppm respectively on more or less same size *B. gonionotus* (Hoque *et al.* 1993). Lower than 5.0 ppm concentration did not cause any mortality. The safe level of this insecticides was found to be 2.06 ppm for *B. gonionotus*. In the same species the safe level is 1.63 and 1.42 ppm for diazinon and sumithion respectively (Hoque *et al.* 1993). Sharama *et al.* (1981) reported that malathion was safe for *Clarias batrachus* at 2.72 ppm concentration, whereas it was 1.12 ppm for *Labeo rohita* of 10.5 cm size at temperature of 21.0°C (Rahman 1989). These variations appeared to be related with the differences in species of fish.

Median lethal dose concentration (LC_{50}) of malathion were estimated to be 13.85, 9.16, 8.36, 7.07, 7.07, 6.70 and 6.52 ppm for 1, 3, 6, 12, 18, 24 and 48 hours of exposure respectively (Table 2). The LC_{50} value of malathion for 96h exposure was found to be 56

ppm for *Heteropneustes fossilis* (Ghosh and Dutta 1985), 4 ppm for *Chana punctatus* (Dubale and Shah 1979) and 0.35 ppm for *C. striatus* (Choudheri *et al.* 1984), which are air breathing fishes. LC_{50} value of malathion for some non-airbreathing fishes like fatheads, blue gills, gold fish and guppies was 23.0, 0.09, 0.045 and 0.84 ppm (Pickering *et al.* 1962). LC_{50} does for 48h in *Tilapia mossambica* was reported to be 5.54 ppm (Sailatha *et al.* 1981). The 24h LC_{50} for *B. ticto* was 4.0 ppm and *B. daniconius* was 6.0 ppm (Singh and Sahai 1984).

Table1. Cumulative percentage mortality of rajpunti to malathion at different concentrations

Doses (ppm)	1h	3h	6h	12h	18h	24h	48h	72h	96h
0.0 - 5.0	0	0	0	0	0	0	0	0	0
6.0	0	0	0	10	10	10	10	10	10
7.0	0	0	0	10	30	30	30	30	30
8.0	0	10	20	50	70	70	70	70	70
8.5	0	10	30	60	80	90	100	100	100
9.0	0	40	60	70	90	100	100	100	100
10.0	0	100	100	100	100	100	100	100	100
12.0	0	100	100	100	100	100	100	100	100
16.0-20.0	100	100	100	100	100	100	100	100	100

Table 2. Values of LC_{50} of malathion at varying time intervals

H	A	B	LC_{50}
1	12.0	16.0	13.85
3	7.0	12.0	9.16
6	7.0	10.0	8.36
12	5.0	10.0	7.07
18	5.0	10.0	7.07
24	5.0	9.0	6.70
48	5.0	8.5	6.52

H= Time passed during the experiment (in hour)
A= Highest toxin concentration (ppm) in which none of test organisms died
B= Lowest toxin concentration (ppm) in which all test organisms died
LC_{50}= Calculated median lethal concentration (ppm) of malathion against rajpunti calculated from Binomial test $LC_{50} = (AB)^{1/2}$ of Ward and Parrish (1982)

After application of malathion in the aquarium the fish exhibited various signs of distress. At high concentrations an initial period of excitation was noted. Fish swam rapidly and opercular rate increased. A severe reaction involved in fin extension and temporary body curvature. Similar reaction was observed by Hoque *et al.* (1993). Most of the fish came to the surface water showing sign of suffocation with in 10 to 15

minutes. Gradually they lost equilibrium, became paralyzed and finally settle down to the bottom of the aquarium and remained to same position till death. Similar reactions were also observed in tilapia, *Oreochromis nilotica* (Haque 1989) and in *B. gonionotus* (Hoque *et al.* 1993).

In aquatic medium the organophosphorus insecticides enter into the blood stream of fishes cause rupture of the gill epithelium, hemolyse the red blood corpuscle and destroys the nerve impulses by inhibiting the cholinesterase (O'Biren 1967). This inhibition results in the apparent death of the organisms. The rate of inhibition is related to the degree and duration of exposure.

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