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# Acute Toxicity of Two Molluscicides, Mercuric Chloride and Pentachlorophenol to a Freshwater Fish *(Channa gachua)**

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Mercuric chloride and sodium pentachlorophenate (NaPCP) are commonly used molluscicides in curbing the population of freshwater vector snails which transmit the trematode larvae that are of medical and economic importance (CHENG 1974). As an effluent, $HgCl_2$ and because of its use as a broad spectrum biocide, NaPCP, contaminate the water bodies throughout the world and thereby act as toxicants for extramolluscan biota. Even though, the lethal effects of $HgCl_2$ and NaPCP against molluscan snails, e.g., Biomphalaria, Lymnaea (DUNCAN 1974) are well documented and toxicity of these and other contaminants for marine and estuarine organisms is extensively studied (See VERNBERG 1974, VERNBERG et al. 1977, RANGA RAO 1978), their effects on the associated fauna and flora of vector snails have been sparsely investigated. C. gachua, an important food fish, is a coinhabitant of the gastropod snails in Indian and other freshwater bodies. Hence it was considered worthwhile to analyse the toxic effects of $HgCl_2$ and NaPCP at the organismic level of C. gachua.

## MATERIAL AND METHODS

Locally collected adults (860-920 mm length) were allowed to acclimate to the laboratory conditions for two weeks prior to their exposure to the molluscicides. They were fed with pieces of live earthworms. Feeding was stopped before 12 h of experiment.

Static bioassays were performed in test containers consisting of metal-framed glass aquaria containing 10 L of tapwater (pH 7.5, temperature 24-25 C, dissolved $O_2$-4.4 mL/L).

Test solutions ($HgCl_2$ and NaPCP) were changed after every 24 h so as to compenate any change in the concentration owing to alterations in the physical conditions of water. The percent mortalities in various concentrations, at particular exposure period viz. 24, 48, 72 and 96 h were converted into probit values and plotted against the log of concentrations (MILLER & TAINTER 1944). $LC_{50}$ was determined by finding out the corresponding concentration for probit 5 (Probit value for 50% mortality).

## RESULTS AND DISCUSSION

100% Mortality was observed in higher concentrations of both the toxicants within first 10-12 h of exposure. After death, a film of coagulated mucous was observed over the entire body and gills. Table 1

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shows $LC_{50}$ values of molluscicides for Channa for 24, 48, 72 and 96 h.

TABLE 1

| $LC_{50}$ (ppm)* | Exposure Period (h) | | | |
|---|---|---|---|---|
| | 24 | 48 | 72 | 96 |
| $HgCl_2$ | 4.1 | 2.2 | 1.6 | 1.4 |
| NaPCP | 0.79 | 0.56 | 0.43 | 0.39 |

* Obtained by Probit analysis.

$LC_{50}$ values of both the molluscicides show that, of the two NaPCP is more deleterious than $HgCl_2$. The concentration of NaPCP required to achieve 50% mortality in 24 h is 0.79 ppm which is nearly five times lesser than that of $HgCl_2$ (24 h $LC_{50}$ - 4.1 ppm) under same conditions. The $LC_{50}$ values of NaPCP for 48, 72 and 96 h are also far lesser than that of $HgCl_2$ for same exposure periods. Perhaps, the higher susceptibility of the fish to NaPCP may be because of its greater uptake and/or lowered rate of detoxification (see KOBAYASHI 1978, BORTHWICK & SCHIMMEL 1978).

In comparison with other freshwater fishes, toxicity value of NaPCP for 96-h exposure of Channa is critically higher. In static tests, the 96-h $LC_{50}$ value for blue gills, Lepomis microchirus was 20 microgram/L (0.02 ppm), for goldfish, Carassius auratus, 50 microgram/L (0.05 ppm) (INGLIS & DAVIS 1972) and for sockey salmon, Oncorhynchus nerka, (WEBB & BRETT 1973) was 63 microgram/L (0.063 ppm) in flow through toxicity tests. Similarly for $HgCl_2$, 48-h $LC_{50}$ value of C. gachua is considerably more than its freshwater brethren, Tilapia mossambica for which toxicity value is 1.0 ppm (CHANDRAMOULI & RAMAMURTHI 1978). The air breathing behaviour of C. gachua might have enabled it to survive at comparatively higher concentrations of these toxicants.

THURBERG et al. (1977) have reported heavy accumulation of cadmium and mercury in gill tissue of marine lobster, Homarus americanus and have given it as probable cause of change in gill tissue respiration. Mercury deposition in gill and other tissues of Crassostrea has been reported by CUNNINGHAM & TRIP (1976). Such accumulation of mercury is quite possible in gills and other tissues of C. gachua and in case of such an eventuality bioconcentrated mercury can drastically inhibit metabolism and/or produce neurological disorders (WALDICHUK 1974) of the fish and in turn lead to death.

The presented data reveal that both the molluscicides, $HgCl_2$ and NaPCP lack specificity and thus their 'blanket' use in snail control operations, if any, poses a threat to the environmental health. Hence it is imperative to rigorously screen all candidate molluscicides for their specificity by examining their toxic impact on the coinhabitants of the vector snails, especially which are of commercial importance.

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REFERENCES

BORTHWICK, P. W. and S. C. SCHIMMEL: In: Pentachlorophenol-chemistry, pharmacology, and environmental toxicology" (K. Ranga Rao, ed.) New York: Plenum Press, 1978.

CHANDRAMOULI, P. and R. RAMAMURTHI: IV All India Symposium on Comparative Animal Physiology, Tirupati, Pp. 120, (1978).
CHENG, T. C.: Molluscicides in Schistosomiasis control. New York: Academic Press, 1974.
CUNNINGHAM, P. A. and M. R. TRIP: Mar. Biol. 31, 321 (1975).
DUCAN, P.: In: Molluscicides in Schistosomiasis control. (T. C. Cheng, ed.). New York: Academic Press, 1974.
INGLIS, A. and E. L. DAVIS: U. S. Fish. Wild Life Service, Bureau Sports Fisheries and Wild Life Tech. Paper No. 67 (1972).
KOBAYASHI, K.: In: "Pentachlorophenol: Chemistry Pharmacology and Environmental Toxicology" (K. Ranga Rao, ed.). New York, Plenum Press, 1978.
MILLER, J. C. and M. L. TAINTER: Proc. Soc. Exp. Biol. Med. 57, 261 (1944).
RANGA RAO, K.: "Pentachlorophenol: Chemistry Pharmacology and Environmental Toxicology", New York: Plenum Press, 1978.
THURBERG, F. P., A. CALABRESE, E. GOULD, R. A. GRAIG, M. A. DAWSON and R. K. TUCKER: In: "Physiological Responses of Marine Biota to Pollutants, (Vernberg, F. J. *et al*., eds.), New York: Academic Press, 1977.
VERNBERG, F. J., A. CALABRESE, F. P. THURBERG and W. B. VERNBERG: Physiological Responses of Marine Biota to Pollutants, New York: Academic Press, 1977.
VERNBERG, F. J. and W. B. VERNBERG: Pollution and Physiology of Marine Organisms. New York: Academic Press, 1974.
WALDICHUK, M.: In: Pollution Physiology of Marine Organisms (Vernberg, F. J. and Vernberg, W. B., eds.), New York: Academic Press, 1974.
WEBB, P. W. and J. R. BRETT: J. Fish. Res. Board. Can. 30, 499 (1973).