The Toxicity of Endrin and the Effect of Pretreatment of Phenobarbital and Hexobarbital on Mortality in Four Fresh Water Fishes

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A considerable degree of contamination of agricultural products and man's environment occurs due to the wide use of insecticides in controlling various types of insects and pests on farms. Endrin (1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a octahydro-endo-endo-1,4;5,8-dimethanonaphthalene) and its metabolites may enter the aquatic ceosystem by runoff. These may create problems for inland fishery if they prove lethal and for toxicologists if sublethal doses are consumed by the fishes or its feed because these chlorinated hydrocarbons have a tendency towards getting deposited in the fish body (ALLISON et al. 1964; BURDICK et al. 1964).

The four species chosen for the present study are abundant in this area, form the major catch and are of ecological importance. These species were examined for the toxicity of endrin and a possible effect of addition to the surrounding water, the well known inducers of drug metabolism, phenobarbital and hexobarbital (CONNEY 1967) on the tolerance of the fishes.

MATERIALS AND METHODS

The four species used in the present investigation were 1. Nemacheilus botia, 2. Nemacheilus denisoni, 3. Poecilia granulosa, and 4. Lepidocephalichthys thermalis. The fishes were collected from river Kham near Aurangabad about three miles away from the laboratory, and were acclimatised for 24 hours in laboratory in aged tap-water. The containers were wide mouth gallon jars. Each species was divided into following three groups of 8-12 animals irrespective of sex. The fishes used were of the same size.

Group A	Endrin treated
Group B	Phenobarbital addition to water before endrin treatment
Group C	Hexobarbital addition to water before encrin treatment

Phenobarbital sodium and hexobarbital sodium concentrates were added to the surrounding water of fishes in groups B and C respectively, so as to reach a concentration of 1 ppm. The water was changed after every 24 hours. Group A served as untreated control. The treatment was carried out for 7 days and on the eighth day fishes were transferred to water containing 1 ppm endrin

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TABLE 1. Toxicity of endrin and the protective effect of phenobarbital and hexobarbital on the mortality due to endrin in four fresh water fishes.*

Species	Group[a]	Time required to reach mortality percent (in minutes)			
		25%	50%	75%	100%
1. N. botia	A	38	46	63	100
	B	57	80	105	135
	C	62	88	125	160
2. N. denisoni	A	17	31	41	60
	B	30	45	60	75
	C	43	71	78	100
3. L. thermalis	A	23	31	37	50
	B	53	71	76	90
	C	49	55	69	83
4. P. granulosa	A	10	19	27	40
	B	20	30	40	52
	C	38	50	67	88

* 8 - 12 animals were used in each group.
a A-Control untreated.
B-Phenobarbital pretreated.
C-Hexobarbital pretreated.

TABLE 2. Effect of phenobarbital and hexobarbital pretreatment on the percentage of mortality due to endrin in four fresh water fishes.*

Species	N. botia			N. denisoni		L. thermalis		P. granulosa	
Group**	A	B	C	B	C	B	C	B	C
Percent mortality	25	10	10	11	6	7	7	4	7
	50	15	15	26	13	9	9	13	9
	75	25	35	31	23	11	11	46	13
	100	76	68	75	56	20	40	75	30

* 8 - 12 animals were used in each group.

** A - Control untreated.
B - Phenobarbital pretreated.
C - Hexobarbital pretreated.

except in the case of N. botia, where the concentration of endrin was 0.01 ppm. The fishes were judged dead when the gills and the operculum did not show any movement. Endrin was prepared in alcohol (0.1 ml/1 water). In another experiment, it was observed that similar concentrations of alcohol did not show any mortality. During all these studies the fishes did not receive any additional food. The tap-water coming from a well, served as a source of planktons as a feed.

RESULTS AND DISCUSSION

During preliminary studies we observed that species N. botia could not survive in 1 ppm endrin and hence 0.01 ppm concentration was selected.

Table 1 summarizes the effect of pretreatment in different species on the course of mortality due to endrin. Results suggest that the rate of mortality was significantly delayed due to the treatment of phenobarbital or hexobarbital. Hexobarbital showed a better protection in three species as compared to phenobarbital except in the case of L. thermalis, where phenobarbital offered the highest protection.

Table 2 shows the comparative percentage of mortality due to endrin in the four species of fishes pretreated with phenobarbital and hexobarbital. Difference was noticed right from the start. However, it became more predominant at a later period.

These results suggest a protective effect of two classic inducers of hepatic drug metabolism, phenobarbital and hexobarbital on the endrin toxicity in fishes. The observed difference in the magnitude of protection due to two different inducers could be due to species variation. Phenobarbital and hexobarbital in the liver cause induction of hepatic mixed function oxidase system which plays a vital role in biotransformation of various foreign compounds. In the present studies it is possible that phenobarbital and hexobarbital pretreatment in fishes could develop some capacity to tolerate the toxicant on the CNS level. However, further studies are in progress to know the possible controlling factors.

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