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Recovery of Acetylcholinesterase Activity from Fenitrothion-Induced Inhibition in the Freshwater Field Crab (*Oziotelphusa senex senex*)[1]

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Due to indiscriminate and widespread use of pesticides in agricultural and public health operations, many non-target species, some of them very important members of the food chain, are adversely affected. A tiny little village "Handigodu" in Karnataka State hit the headlines of news media in October 1977, when a large number of agricultural labourers of that area were reported to have suffered orthopedic affliction rendering them unfit for work. The disease termed as the "Handigodu Syndrome" is characterised by painful swelling and immobilization of hip and knee joints, ultimately leading to wasting away of lower limbs. The root cause of this condition is believed to be the long-term consumption of pesticide-exposed crabs and fish (NIN 1977). In view of this, an elaborate programme to evaluate the impact of pesticides on the physiology and biochemistry of several non-target species of aquatic ecosystem has been undertaken. It is well known that the arresting of acetylcholine breakdown due to inhibition of acetylcholinesterase forms the basis of action of organophosphorus and carbamate pesticides (ALDRIDGE 1971, METCALF 1971, CORBETT 1974).

Our knowledge of the effects of pesticides on the acetylcholine-acetylcholinesterase system in invertebrates is limited (KOELLE 1963, O'BRIEN 1967, DAHM 1971, MADDRELL & REYNOLDS 1972, RAMANA RAO & RAMAMURTHI 1978). This report deals with the temporal changes in the acetylcholinesterase (AChE) activity in thoracic nerve mass of the fresh water rice field crab Oziotelphusa senex senex after the injection of sublethal doses of Fenitrothion.

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MATERIALS AND METHODS

Details of collection and maintainance of crabs were described in an earlier paper (PADMANABHA NAIDU & RAMAMURTHI 1961). Only intermolt uninjured crabs of either sex in the weight range of 25 to 30 g were used. Technical grade Fenitrothion (96% W/V) dissolved in acetone and appropriately diluted with crab ringer (VAN HARREVELD 1936) was used. Three sublethal doses of 5, 7.5 and 10 µg were chosen. The crabs were divided into 4 groups of 6 each. Three groups were used for administration of the 3 sublethal doses by injection with a microsyringe through the arthrodial membrane at the base of the third walking leg. The fourth group served as a control. At different time-intervals 1, 6, 12, 24 and 72 h after injection the thoracic ganglionic mass was dissected out and the AChE activity was determined by the method of METCALF (1957). The protein content was estimated by the method of LOWRY et al. (1951).

RESULTS AND DISCUSSION

All the 3 sublethal doses administered caused inhibition of AChE in a very short time of 1 h (Table 1). This indicates that the crab AChE is very sensitive to Fenitrothion. COPPAGE & MATTHEWS (1974) observed 75% inhibition of AChE in the ventral nerve cord of moribund pink shrimp Panaeus duorarum exposed to lethal concentration (LC 50 = 48 h) of malathion. The quick inhibitory response observed in the present investigation appears to be due to direct introduction of Fenitrothion into the circulatory system.

Maximal inhibition was recorded at 12 h after injection for all the 3 doses. Comparison among the doses used revealed that the magnitude of inhibition increased with the increase in dose. By 24 h a decrease in the level of inhibition was observed leading to further relief by 72 h. The 72 h values of enzyme activity, though found to be still lower than the uninjected control, clearly indicated recovery from the inhibition. The pattern of enzyme activity observed at 24 and 72 h suggests that Fenitrothion was being actively metabolized or being removed from the site of action thus enabling the enzyme to resume unhindered hydrolysis of ACh. The spontaneous recovery of inhibited AChE was reported

TABLE 1

EFFECT OF FENITROTHION ON AChE ACTIVITY OF THORACIC NERVE MASS OF O. SENEX SENEX

Values are means (μ moles of ACh hydrolysed, mg protein^{-1}, hr^{-1}) $\pm$ S.D. of 6 individuals. % Change and 'p' calculated for normal-injected

Period after injection (h)	Dosage injected (μg)		
	5	7.5	10
Normals	55 $\pm$ 5	-	-
1	48 $\pm$ 4 - 13% P < 0.01	28 $\pm$ 9 - 49% P < 0.001	35 $\pm$ 8 - 36% P < 0.001
6	36 $\pm$ 7 - 35% P < 0.001	29 $\pm$ 8 - 48% P < 0.001	28 $\pm$ 5 - 49% P < 0.001
12	24 $\pm$ 7 - 57% P < 0.001	17 $\pm$ 2 - 69% P < 0.001	13 $\pm$ 5 - 77% P < 0.001
24	27 $\pm$ 7 - 51% P 0.001	19 $\pm$ 8 - 65% P < 0.001	21 $\pm$ 4 - 62% P < 0.001
72	34 $\pm$ 6 - 39% P < 0.001	25 $\pm$ 3 - 54% P < 0.001	31 $\pm$ 3 - 43% P < 0.001

(HOBBIGER 1951). It is interesting to note that eel cholinesterase inhibited by TEPP showed 45% recovery in 28 days (WILSON 1951). COPPAGE & DUKE (1972) reported that fish brain AChE inhibition in one lake in Louisiana after malathion spraying was similar

to one observed in the laboratory at lethal concentration. However in the lake population the enzyme activity returned to normal in 40 days after spraying of the chemical. In the present investigation it was observed that the crab nerve mass AChE exhibited fairly good recovery within 3 days after the single injection of the toxic chemical.

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