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# Molt-Inhibition in the Crab *Oziotelphusa Senex senex* Following Exposure to Malathion and Methyl Parathion

P. Sreenivasula Reddy, A. Bhagylakshmi, and R. Ramamurthi

Department of Zoology, Sri Venkateswara University, Tirupati-517502 (A.P) India

Due to discriminate and indiscriminate use of pesticides in agriculture and public health operations, many 'non-target' species, some of them very important members of food chain are adversely affected. The tragic incidence of "Handigodu syndrome" of Karnataka (India) has been attributed to be due to 'long term' consumption of pesticide-poisoned crabs and fish by the local population (National Institute of Nutrition 1977). In view of this an elaborate program to evaluate the impact of pesticides on the physiology and biochemistry of some 'non-target' species of aquatic ecosystem has been undertaken.

The crab Oziotelphusa senex senex is abundantly available locally and usually considered as poor man's protein. The acute toxicity levels of Malathion and Methylparathion to the crab has been examined by Bhagyalakshmi and Ramamurthi (1980) and by Nagarathnamma and Ramamurthi (1981) respectively. Its chronic effects on the metabolism of Oziotelphusa including blood biochemistry were reported earlier (Bhagyalakshmi et al. 1982, 1983; Reddy et al. 1982, 1983). Physiological changes in tissues of crabs that were chronically exposed to sumithion, an organophosphate pesticide, were also reported (Bhagyalakshmi et al. 1982, 1984a, 1984b). In this paper, we report subacute physiological stress induced by Malathion and Methylparathion on the molting cycle of the crab.

## MATERIALS AND METHODS

Adult, healthy, male crabs Oziotelphusa senex senex collected from local rice fields were used. The crabs were intermolt (Stage $C_4$) individuals having a carapace width 35-40 mm and body weight 30-32 g. They were kept singly each in 1000 mL glass aquaria at 30°C under a 12:12 light:dark regimen. Simple tap water, supplied by a college overhead tank was used. The water was analyzed for various physico-chemical characteristics and the average values are as follows: pH 7.3; dissolved oxygen content, 6.2 ppm; hardness 38 ppm of

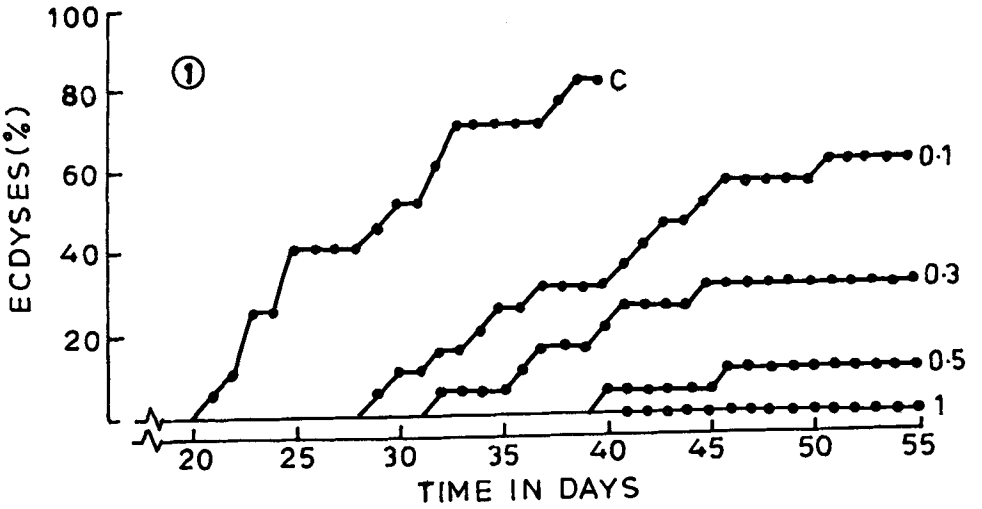
$CaCo_3$. During acclimatization and experimentation crabs were fed on earthworms twice a week to avoid any possible effect of starvation on molting activity and the medium in which they were kept was changed daily. The fluid level in the individual containers was about 40 mm deep. The crabs were induced to undergo ecdysis by removing four walking legs (Skinner and Graham 1972). This method to induce moulting activity was used because the rate of ecdysis of intact crabs in the laboratory is ordinarily very low (Reddy 1981).

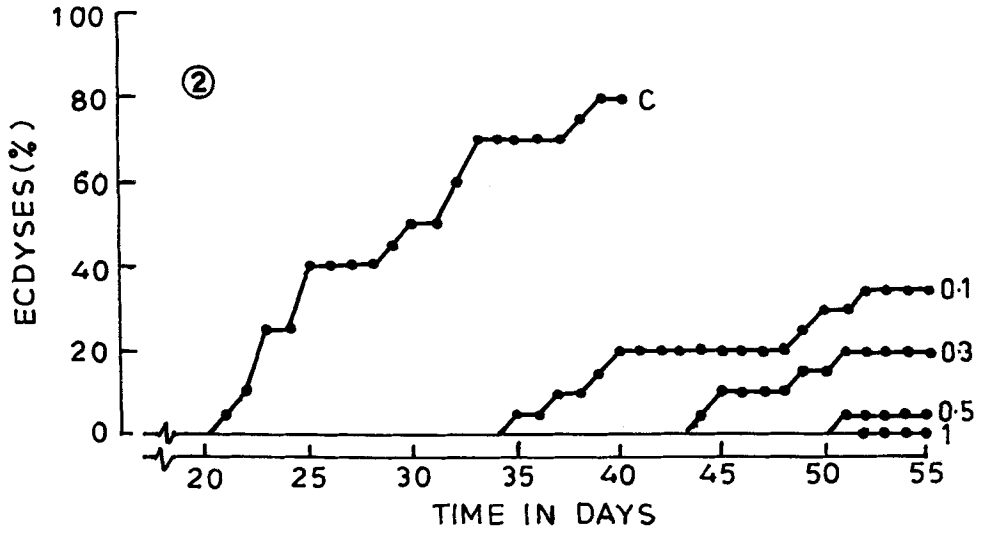
The technical grade (95% W/V) Malathion (0,0-dimethyl S-1, 2-dicarboxyethyl phosphorodithioate) and methyl parathion (0,0-dimethyl 0-4 nitrophenyl phosphorothioate) supplied gratis from Cyanamid India Ltd. and Bayer India Ltd., respectively, were used in this investigation. The preparation of stock solutions and other test conditions were essentially similar to the procedure described earlier (Bhagyalakshmi and Ramamurthi 1980).

Three hundred and sixty crabs were divided into nine equal groups. Four walking legs were removed from all the crabs. One of the groups served as control while the others were exposed to either 0.1, 0.3, 0.5 and 1 ppm Malathion or Methylparathion, from the day of limb removal until the animals completed at least one ecdysis or until the termination of the experiment (55 days). The media for control and experimental crabs were replaced with fresh solutions daily.

## RESULTS AND DISCUSSION

No mortalities occurred in either the experimental group or in the control group during the experiment. The crabs lacking four walking legs that served as controls underwent ecdysis at a rapid rate (Fig. 1 and 2). However, the crabs, that were in the Malathion or Methylparathion underwent ecdysis at a much slower rate than did the controls (Fig. 1 and 2). The degree of molt-inhibition increased with the concentration of pesticide-exposed. Depending on the concentration exposed, these pesticides caused either a complete inhibition of molt, a delay in the incipience of molt or decrease in the percentage of molting individuals. Delays in molting of crabs exposed to pesticides have been previously observed (Buchanan *et al.* 1970; Epifanio 1971; Bookhout *et al.* 1972; Armstrong *et al.* 1976).




Molt-inhibition in the crab following exposure to (1) Malathion and (2) Methyl parathion
Number on each curve indicates concentration(mg/L)

A possible explanation for a relationship between pesticide exposure and incidence of molt delay is related to the neuroendocrine control of molting. The interrelationship of the X- and Y organs in crustacean ecdysial processes has been well documented (Passano 1960; Lockwood 1967). The neurosecretory X-organ-sinus gland complex produces a molt-inhibiting hormone, that acts directly on the Y-organ, an endocrine gland, to depress the synthesis or release of its 'molting hormone'. If these pesticides affected the X-organ in such a way that production or release of the molt-inhibiting hormone continued beyond the normal time, the effect would be to delay initiation of the molting process. Further this suggestion finds support from our unpublished histological observations. Examination of the eyestalk sections revealed that the quantity of neurosecretory material in the neurosecretory cells in the medulla terminalis X-organ of the crabs exposed to these pesticides was significantly greater than in control crabs. This observation is consistent with the previously obtained data which showed that eyestalks of crabs (Uca pugilator), exposed to pentachlorophenol contained more neurosecretory material than did the eyestalks of control crabs (Nagabhushanam et al. 1979). Another possibility is that these pesticides act directly on Y-organ and affect production or release of 'molting hormone' by the Y-organ. But this hypothesis is less attractive because these organophosphate pesticides are believed to be neurotoxins (O'Brien 1967) and molting hormone production by the Y-organ is not a neurosecretory process (Passano 1960).

Another possible cause of delay of molting may be starvation of crabs (Passano 1960). We observed that crabs exposed to pesticides did eat, but low quantity with less apetite. We did not make quantitative determination of food consumption during the tests. The amount eaten or the efficiency of food utilization may have been reduced by the pesticides and molting thereby delayed. One should therefore be extremely cautious in using these organophosphate compounds in areas where crustaceans occur.

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