

ACUTE TOXICITY OF THREE PESTICIDES AND THEIR EFFECT ON THE BEHAVIOUR OF THE EDIBLE CRAB SCYLLA SERRATA (FORSKAL)

G. SUBBA RAO AND T. KANNUPANDI

Centre of Advanced Study in Marine Biology, Annamalai University,
Parangipettai - 608 502, Tamil Nadu

ABSTRACT

Technical grade heptachlor, phosalone and carbaryl were tested for acute toxicity to the edible crab *Scylla serrata*. The 96 h LC 50 values of the three pesticides were 322, 406 and 466 µg/l respectively. Heptachlor produced instant hyperactivity, hyperexcitability and finally death due to exhaustion. However, phosalone and carbaryl induced similar effects resulting in gradual death. Profuse defaecation was observed in crabs exposed to phosalone and carbaryl.

Key-words : *Scylla serrata*, heptachlor, phosalone, carbaryl, toxicity.

The indiscriminate utilization of pesticides has resulted in the ubiquitous occurrence as well as contamination of the aquatic system with these harmful chemicals. Though most of the pesticides have specific targets, the deleterious effects of these pesticides are often reflected in the non-target organisms such as crabs of the aquatic system. All pesticides are toxic to some degree. Hence, the aim of the present study was to determine relative sensitivity of 3 pesticides viz. heptachlor, phosalone and carbaryl to a single species of the edible crab *Scylla serrata*.

Juvenile crabs *S. serrata* 2.5 ± 0.5 cm carapace width and 8.0 ± 1.0 g weight were collected from Pichavaram mangroves (lat. 11°29'N; long. 79° 47'E). Transportation, maintenance, acclimatization and experimental methods were followed as suggested by APHA (1976). Hansen, Schimmel and Goodman (1978) and Parrish (1985). Salinity was maintained at 30 ± 1.5 ppt throughout the experiment. All the parameters such as temperature (28 ± 1.0 °C), dissolved oxygen (4.30 ± 0.16 ml/l) and pH (7.2 - 7.5) were kept constant throughout the study period. Five crabs were exposed to each test concentration. The bioassay was repeated in triplicate. Heptachlor (organochlorine), phosalone (organophosphate) and carbaryl (carbamate) were the three pesticides selected for the semi-static toxicity bioassay. LC 50 values were computed by using Finney's method (1971).

Juvenile crabs exposed to heptachlor produced the behavioural changes such as (1) erratic movements, (2) increased ventilatory movements of the scaphognathites, (3) loss of equilibrium and (4) failure to revert to normal position when inverted accidentally. Organochlorine pesticides affect the central nervous system (GESAMP, 1976;

Venugopalan and Sasibhusana Rao, 1979). Crabs exposed to phosalone and carbaryl were less active as compared to heptachlor, death was gradual and defaecation was profuse, a characteristic feature of poisoning by organophosphates and carbamates (O'Brein, 1967).

Table I - Median lethal (LC 50) concentration ($\mu\text{g/l}$) for the insecticides at various time intervals.

Insecticide	Hours limits	LC50 & confidence	Slope 'S' of regr. line & confidence limits
Heptachlor	24	617.3 659.1 - 1938.0	-4.4 3.4 - 7.0
	48	442.9 387.4 - 572.1	-8.8 5.2 - 15.0
	72	397.7 342.9 - 495.9	-8.6 5.2 - 16.0
	96	322.8 281.1 - 371.9	-12.6 7.0 - 19.9
	120	290.6 250.2 - 331.1	-12.6 7.2 - 18.2
Phosalone	24	718.9 872.2 - 3025.5	-5.0 35 - 6.1
	48	474.4 410.1 - 572.5	-10.3 5.7 - 16.5
	72	433.7 372.2 - 510.3	-10.8 6.0 - 18.0
	96	406.1 352.7 - 464.4	-13.3 7.0 - 20.6
	120	355.6 300.7 - 404.9	-11.8 6.6 - 18.7
Carbaryl	24	846.66 1244.64 - 6800.12	-3.78 3.00 - 5.36
	48	564.57 496.77 - 670.81	-12.91 6.51 - 18.39
	72	496.02 432.39 - 575.48	-12.94 6.65 - 19.78
	96	466.27 407.97 - 532.50	-14.41 7.27 - 20.80
	120	401.62 339.71 - 455.32	-12.56 6.74 - 17.36

The 96 h LC 50 value of heptachlor ($322.8\mu\text{g/l}$) (Table I) indicates that it is less toxic to *S. serrata*, a tropical species, as compared to temperate species *Callinectes sapidus* (Butler, 1963) and *Cancer magister* (Armstrong, Bichanan, Mallonm Caldwell and Millemann, 1976) the 96 h LC 50 values were 63 and $130\mu\text{g/l}$ respectively. No reports are available on acute toxicity of phosalone to crabs excepting 24 h LC 50 ($1650\mu\text{g/l}$)

value for *Uca lactea annulipes* reported by Subba Rao and Kannupandi (1984). Stewart, Millemann and Breese (1967) and Subba Rao and Kannupandi (1984) reported 24 h LC 50 of carbaryl for *Hemigrapsus oregonensis* (10.05 µg/l) and *U. lactea annulipes* (1450 µg/l) respectively. However, toxicities of all the three pesticides tested (heptachlor, phosalone and carbaryl) on the crab *S. serrata* in the present investigation varied altogether from the temperate allied species. Tropical species were less sensitive than the temperate species.

Hyperactivity is associated with increased metabolic rate, and hence, high acute toxicity. This was evidenced by increased rate of defaecation observed in the present study. Therefore, it is possible that tropical crabs might be less susceptible to pesticides stress than their temperate counterparts. The degree of toxicity of the three pesticides noticed was in the order of heptachlor > phosalone > carbaryl. Furthermore, all the three pesticides induced behavioural changes characteristic to the respective group of insecticides viz., organochlorine, organophosphate and carbamate.

ACKNOWLEDGEMENTS

Thanks are due to the Director and to authorities of Annamalai University, for facilities, and to Drs. V.K. Venugopalan and T. Balasubramanian for their valuable comments. Thanks are also due to the University Grants Commission (New Delhi) for the award of SRF to G.S.

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