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Uptake of Fenvalerate by the Ostracod *Chrissia halyi* (Ferguson)

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Once a pesticide is introduced into the environment there is a reasonable chance that it will eventually finds its way into water. Therefore aquatic systems probably represent one of the most important complex environment as far as describing the fate and behaviour of pesticides. Zooplankton comprise a large portion of the living matter in natural waters and play an important role in biogeochemical cycles. Ostracods are one of the important zooplanktonic groups and constitute a significant percentage of the benthic fauna in a number of fresh water basins. The abundance of these organisms provide a very good food to the fish and other invertebrates (Victor and Fernando, 1979). Being benthic in nature it is assumed that these ostracods can accumulate the toxicants at a higher level, at the same time being primary consumers they are assumed to be important organisms transferring the toxicants to higher trophic levels. In the present study an attempt has been made to see the accumulation of fenvalerate, a synthetic pyrethroid in the ostracod Chrissia halyi (Ferguson, 1969).

MATERIALS AND METHODS

The Ostracods C. halyi were collected in large numbers from the local ponds in and around Osmania University Campus along with water and algae. The Ostracods were separated with the help of pasteur pipettes and introduced into a cement tank the size of 4 x 2x 1 1/2 ft. (1xbxh) filled with tap water . The physicochemical properties of the water were as follows - pH - 7.5-7.8 mg/L; dissolved oxygen 7.8 mg/L; temperature 27 + 2° C, total hardness - 134 mg/L as $CaCo_3$, alkalinity - 102 mg/L. The organisms were acclimatized to the laboratory conditions for a week after which they were used for the experiments. They were fed with the algae, cladophora. Technical grade fenvalerate (95% pure) was obtained from Rallis India Ltd. To determine the LC50 values, 10 adult organisms per 10 ml of water were exposed in a petridish to six serial concentrations of fenvalerate, the same number of organisms without the insecticide were maintained as controls. The experiment was repeated six times and the mortality was noted at the end of 72 hrs. The LC 50 value was determined by the method of Finney (1964). It was found to be 0.4µg/L. For GLC analysis, about 1600 adult ostracods were picked up from the cement tank using a pasteur pipette. These were divided into three groups, the first and second containing 600 organisms each served as experimental and the third group with 400 organisms served as control. The experiment was carried out for a period of 7 days, the exposure studies were for 3 days and recovery studies for 4 days. The first group were exposed in a petridish to a

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sublethal concentration of 0.13 µg/L (1/3 of LC50, 0.4 µg/L) and the other, to a slightly higher concentration of 0.3 µg/L for a period of three days. The toxicant and control water was renewed every 24 h. About 200 organisms each from both the control and experimental groups were isolated after 1 and 3 days and immediately freeze dried before analysis. After three days the remaining 200 organisms from the treated group of both the concentrations were transferred separately into a toxicant free medium and the residues were noted after the fourth day.

The method described by Marei and Co-workers (1982) was followed with minor modifications for the detection of fenvalerate by GLC. The sample containing 200 organisms was extracted in n-hexane (5 ml) and sodium sulphate (5 mg) using a homogenizer. It was re-extracted again with n-hexane (5ml) for 1 min. This hexane extract was transferred to a separating funnel followed by 10 ml of acetonitrile. Vigorous shaking for 2 min. and 3-5 min. of standing gave separate hexane and acetonitrile phases. The acetonitrile phase was separated in another separatory funnel. To this half the volume of fresh n-hexane (5 ml) was added. The n-hexane phase was later discarded and the two acetonitrile phases were concentrated. The extract thus obtained was cleaned up using a glass column (0.75 x 30 cm). The column was rinsed with solvents (2 ml) and packed dry with a small plug of glass wool and 2cm florisil, topped with anhydrous sodium sulfate 2 cm. The column was tapped gently to settle the absorbent. The sample extract was transferred to the column. The extract recovered was evaporated to dryness using a rotary evaporator and the residue was dissolved in a known quantity of acetone for GLC estimation.

The GLC analysis was carried out on a Packard model 421 chromatograph with a Ni^{63} ECD and a coiled glass column OV 101 60/80 mesh. The column temperature was 240°C, injector and detector temperatures were 270° C and 300° C. Nitrogen was used as the carrier gas at 60 ml/min. An online integrator provided the retention time and area of each peak. A stock solution of 1µg/L of fenvalerate was prepared as an external standard. 95% of recovery was observed.

RESULTS AND DISCUSSION

The data obtained in the present investigation has been presented in Table 1. The organisms exposed to fenvalerate showed accumulation after Id in both the concentrations. The accumulation reached a maximum on day 3 of exposure indicating that with the increase in time of exposure the accumulation of the insecticide also increases. The organisms when transferred to a toxicant free medium showed recovery in few. In 0.13 µg/L concentration only 40% of the organisms survived and a decline

Table 1. Accumulation / Possible degradation levels of fenvalerate (µg/L) in C halyi,

Concentration µg/L	Exposure period (d) 1	3	7
0.13	0.03	0.08	0.01 40% survived
0.3	0.11	0.21	
	S.E. ±0.02	±0.01	All dead

Values are mean ± SE of six observations.

in the residues was observed indicating that the toxicant may have degraded or partially eliminated. In 0.3 µg/L concentration mass mortality of the ostracods was observed which may have been due to the higher concentration of fenvalerate.

Ostracods are found every where throughout the year in all seasons. These benthic organisms transform the fine particulate detritus and algae they utilize for food into animals proteins supplying to larger carnivores. Apart from a variety of fish, bottom dwelling invertebrates like snails, insects, worm and young forms of almost all fish prey on these crustaceans.

Though pyrethroids do not biomagnify through the food chain, (Surender Kumar et al. 1991) the mass mortality of the organisms due to its effect at a very low concentration as was observed in the present study indicates that the pyrethriod fenvalerate is very toxic and accumulates to a great extent in crustaceans. Similar findings were reported by Schoor and Mckenney (1983). As these ostracods constitute a major food source to many invertebrates and fishes, their disappearance from any pond due to contamination by this insecticide may cause disruption in the biotic community.

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