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Effect of the Pesticide, Malathion on Non-target Organism, Earthworm *Lampito mauritii*

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ABSTRACT

Malathion, a pesticide in the organophosphate chemical family is the most commonly used pesticide in our country. Symptoms of exposure to malathion include headache, nausea, vomiting, burning in eyes, difficulty in breathing and lethargy. Earthworms have been used as biomarkers for assessing chemical environmental pollution. Due to their low cost, easy handling, their direct body contact with the soil and ethical issues related to mammalian studies, earthworms were chosen for the present study. Three doses of malathion 150, 300 and 600 mg/kg soil were used as treated soil. The effect of application of malathion on the earthworm *Lampito mauritii* was studied for 5, 10, 15 and 30 days exposure by evaluating the body weight, number of cocoons laid and the hatching efficiency of the cocoons. The results showed that there is a direct dose response relationship with respect to both, the concentration and time of application of malathion. The results have been statistically analysed.

INTRODUCTION

Organophosphorus pesticides such as Parathion [o,o-diethyl-o-(4-nitrophenyl)-phosphorothioate] and malathion [o,o-dimethyl S-(1,2-dicarboethoxy ethyl) phosphorodithioate] are extensively used to control a wide range of sucking and chewing pests of field crops, fruits and vegetables (Gertrudis Cabello et al. 2001). The toxic effect of organophosphorus insecticides, which represent a major class of agricultural chemicals, is to conjugate with the natural compliment of cholinesterase enzymes in the body, thereby inactivating them. Malathion is also present in lotions and shampoos marketed for the treatment of head lice and mites in humans.

Malathion kills insects because it is converted inside animals into malaoxon, a chemical that inhibits an important central nervous system enzyme called acetyl cholinesterase (AchE) (U.S. EPA 2000). When the enzyme is inhibited, the transmission system jams, resulting in restlessness, hyperexcitability, convulsions, paralysis and death. All insecticides in the organophosphate chemical family share a similar mode of action (Ware 2000).

According to reports made to the California pesticide illness surveillance program between 1998 and 2001, exposure to malathion caused headache, nausea, vomiting, dizziness, burning in eyes, sore or burning throat, abdominal cramps, etc.

One of the more publicly visible issues involving pesticide use in plant protection involves harm to desirable 'non-target' species such as birds, fish, earthworms and other wildlife. Toxicity of pesticides to earthworms, an important group of animals in soil health, is not routinely determined in laboratory trials. Information on this subject is based on some field trials that have been conducted by turf grass researchers, often entomologists.

Moreover, earthworms have been used as biomarkers for assessing chemical environmental pollution (Landrum et al. 1992). Due to low cost, easy handling and ethical issues related to mammalian studies, earthworms were chosen for the present study. It was believed to be of interest to analyse the effect of organophosphate pesticide, malathion on the biomass and reproduction capacity of the earthworm *Lampito mauritii*.

MATERIALS AND METHODS

Sexually matured earthworms (*Lampito mauritii*) kept under standard conditions were used for the present study. They were kept in plastic boxes with 1 kg soil (particle size < 2mm). 50% moisture was maintained. A commercial solution of malathion was applied at dosage of 150, 300 and 600 mg/kg soil. Control was maintained with distilled water. The effects such as percentage survival of worms and their total body weight at each time interval were measured. After 10 days of exposure the cocoons were recovered from the control and experimental boxes and placed in petri dishes with humid non-contaminated soils for 5 weeks to observe the number of worms emerged out in each sample. Number of cocoons laid after 10 days and the number of worms hatched in 5 weeks duration were measured.

RESULTS AND DISCUSSION

Table 1 and Fig. 1 show the percentage survival of the worms under different doses of malathion at specific time intervals of 5, 10, 15 and 30 days. It was found that the survival decreased regularly with time of exposure and also dosage of exposure and at high dosage there were no survivors by 30 days. It was also observed that the body weight significantly decreased with increased dosage of the pesticide and increased time duration. Mortality has been the most frequently used parameter to evaluate the chemical toxicity on earthworms (Moriarty 1983). Weight loss also is a valuable indicator of physiological stress related to toxic exposure of worms to malathion.

Table 2 and Fig. 2 give the details of number of cocoons laid by the control worms and malathion treated worms after a period of 10 days exposure and also the number of hatchings from the total capsules after 5 weeks incubation. The results show that at lower concentration of the pesticide, number of cocoons laid is not affected much, but slightly decreased with increased time of exposure. Whereas, there is marked decrease in the number of cocoons with increased dosage. This shows that there is considerable effect of malathion on the reproductive ability of earthworms. So this parameter can be used to evaluate the toxicity of xenobiotics on earthworms. With increased dosage, the worms became coiled and very inactive.

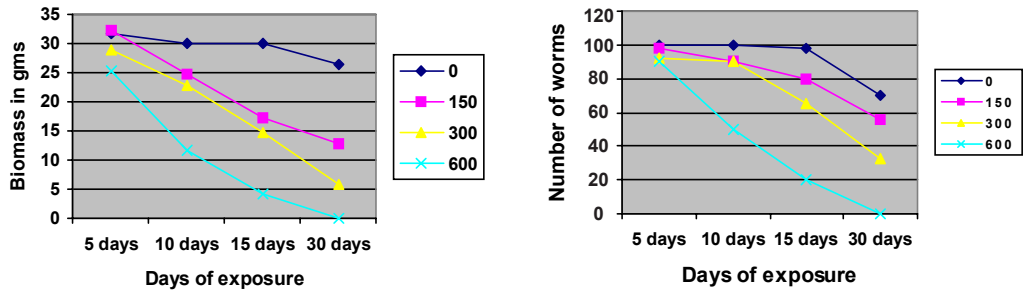

Fig.1: Effect of exposure to different concentrations of malathion on the survival and biomass of *Lampito mauritii*.

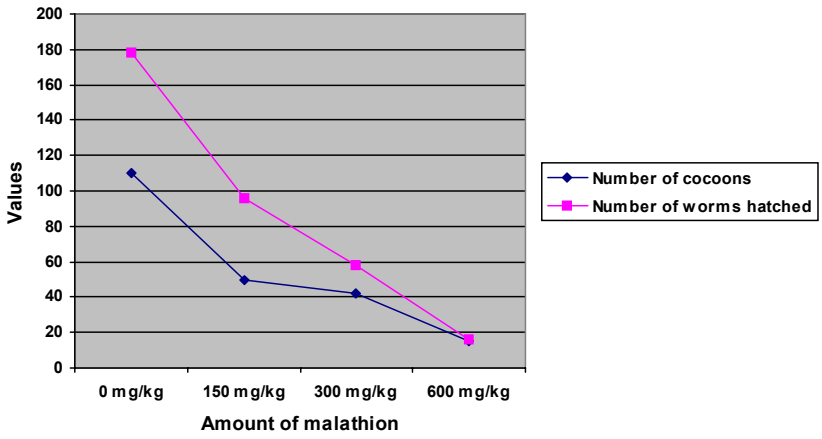

Fig. 2: Impact of malathion on the reproductive ability of earthworm *Lampito mauritii*.

Table 1: Effect of exposure to different concentrations of malathion on the survival and biomass of *Lampito mauritii*.

Amount of malathion in mg/kg of soil	5 Days of exposure		10 Days of exposure		15 Days of exposure		30 Days of exposure	
	No. of worms	Biomass in g	No. of worms	Biomass in g	No. of worms	Biomass in g	No. of worms	Biomass in g
0	100	31.6	100	30.0	98	30.0	70	26.4
150	98	32.1	90	24.7	80	17.3	56	12.7
300	92	28.9	90	22.7	65	14.7	32.5	5.9
600	90	25.4	50	11.8	20	4.1	0	0

Values are mean of six individual observations.

Table 2: Impact of malathion on the reproductive ability of earthworm *Lampito mauritii*.

Amount of malathion in mg/kg of soil	Average number of cocoon/box	Number of worms hatched
0	110	178
150	50	96
300	42	58
600	15	16

Similar results were observed in the parathion treated earthworms, *Eisenia foetida* on their sexual maturation, sperm count and hatching viability (Van Gestel & Van Dis 1988, Robidoux et al. 1999).

To conclude, during the use of agropesticides along with the pest concerned, some other non-target organisms are also affected which leads to various other problems. Hence, suitable alternatives such as biopesticides should be used to reduce the problem of pests and use of chemical pesticides.

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