EFFECT OF INSECTICIDE MALATHION ON COCOON PRODUCTION IN EARTHWORM *EISENIA FOETIDA*

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ABSTRACTS:
Malathion is an organophosphate pesticide. Eisenia foetida were treated with Sub-lethal doses of 0,50,150,250 ml/kg soil were used. Control groups were added only tap water. Each group was analyzed after 15 days and 30 days post treatment. After copulation the number of cocoons formation and cocoon viability were recorded. Numbers of cocoons were decreased on exposure to high doses 250ml/kg soil of Malathion. Viability percentage was also calculated.

Keyword: Pesticide Malathion, Eisenia foetida, Cocoons production and viability.

INTRODUCTION:
A great proportion of biomass of terrestrial invertebrates is represented by earthworms which play an important role in increasing the nutrient content of the soil. *Eisenia foetida* is the standard test organism used in terrestrial ecotoxicology, because it can be easily bred on a variety of organic wastes within short generation times. Earthworms play a vital role in the maintenance of soil structure, functions, and fertility. Their activities modify soil aeration, drainage, and availability of nutrients for plants generally integrate soil organic and mineral elements to improve soil structure. Earthworms have been selected as a suitable representative of soil organism as they are key components of soil biota and contribute to the overall productivity of agricultural soils through their feeding, casting and burrowing activities (Culy and Berry 1995). Choo and Baker (1998) found that cocoon production in *Aporrectodea trapezoids* was inhibited by endosulfan and fenamiphos. Bustos-obreg and Goicochea(2002) studied the effect of exposure to commercial parathion on reproductive parameters such as sperm and cocoon production and genotoxicity of male germ cells of *Eisenia foetida.* Earthworms are hunted as food by some birds like Robins and Chickens. Earthworms are good friends to the gardner and farmer as they are continually ploughing and manuring the soil. Biomarkers are biological response that can be related to exposure to toxic effect of environmental chemicals(Peakall 1994). Evaluation of the effects of the pesticides on maturation and fecundity can be related to disturbances of earthworm population densities. Fecundity in earthworms is sensitive to pesticides (Brunninger *et al.* 1994). Population densities of earthworms may not be immediately affected, there can be reproductive changes, which may reduce populations in the longer term. The aim of this study was to determine the effects of organophosphates Malathion on fecundity of the common earthworm *Eisenia foetida*. Addison and Holmes (1995) made acute toxicity studies for determining effect of fenitrothion on earthworm.

MATERIAL AND METHODS:
Eisenia foetida were selected for study because it is a readily available, easily maintainable and is cheap test species. Aim was to study the effect of exposure to commercial organophosphate on cocoons production in ***Eisenia foetida***. Healthy, sexually matured Earthworms (***Eisenia foetida)***

approximately weighing 1 to1.3 gm and length 3 to 12 cm were collected from the ***Rewa*** (M.P), India. They mature within 50-55 days and incubation period of cocoon is 20-23 days. Earthworms were acclimated in the laboratory in culture pots with moistened soil, before the commencement of the experiment. 30 earthworms were kept in each pot which were filled with 1 Kg soil. The earthworms were fed with organic matter, such as decaying leaves, compost manure etc.

Eisenia foetida were exposed to Malathion via the soil. Malathion concentration series were prepared by diluting the stock solution. Series of different concentration of Malathion (50,150,250 ml/kg) were prepared. The concentration series were subsequently mixed with soil. In the control group tap water was used. 4 pots were prepared for experiment.

In each pot 30 worms were added. Worms were exposed to different concentration of Malathion for 15 days and 30 days. Cocoon production of E. *foetida* was observed.

Malathion is an organophosphate which binds irreversibly to cholinesterase. Malathion is an insecticide of relatively low human toxicity. IUPAC name of malathion is **Diethyl 2-[(dimethoxyphosphorothioyl) sulfanyl] butanedioate.** Malathion is a pesticide that is widely used in agriculture, residential landscaping. It is the most commonly used organophosphate insecticide.Bonner et al. (2007). It is capable of inhibiting carboxyesterase enzymes activity in those exposed to it.

RESULTS & DISCUSSION:

Cocoon production was affected by pesticide exposure (Table 1). Earthworms exposed to the high concentration of malathion produced fewer cocoons per adult. The effects were observed in the group of earthworms that had been exposed to the high concentration of malathion. These earthworms matured slowly. Furthermore, cocoon production in the resulting adults was reduced to 55.55% and 43.75% compared to controls exposed for 15 days and 30 days respectively. These results indicate effects on cocoon production. A decline in cocoon production was observed between 15 days and 30 days in all groups. Cocoons productions after 15 days were observed and compared with control group. 39 cocoons were observed in control group. *Eisenia foetida* were exposed to malathion. *Eisenia foetida* treated with 50 mg/kg produced 36 cocoons. Further earthworms treated with 150 mg/kg produced 29 cocoons and higher concentration 250 mg/kg produced 18 cocoons. After 30 days of exposure to different doses (50,150,250mg/kg) of malathion cocoons production were observed and compared with control group. 40 cocoons were produced in control group. *Eisenia foetida* treated with 50 mg/kg produced 34 cocoons. Further earthworms treated with 150 mg/kg of malathion produced 27 cocoons. At higher concentration 250 mg/kg 16 cocoons were produced. In fig. 1 the mean value of cocoon production rate was calculated for the 15 days and 30 days of exposure to various concentrations of malathion and in control condition too. It was observed in most of cases that the mean cocoon production rate is decreasing as increasing the number of exposure days and concentration.

Table 1

Number of cocoon production after exposure of *Eisenia foetida* to different concentration of Melathion for 15 days and 30 days (Mean ± S.D.)

S. No.	No. of earthworms	Different con. of Malathion in (ml/kg)	Number of cocoon production after Exposure period 15 days	30 days
1.	30	Control	3.9±0.56	4.0±0.70
2.	30	50	3.6±0.60	3.4±0.50
3.	30	150	2.9±0.90	2.7±0.55
4.	30	250	1.8±1.29	1.6±0.66

Cocoon viability In different groups cocoons viability was recorded. Cocoon of experimental worms were compared with cocoons of control group. Cocoon viability was calculated using Van Gestel's (1992) method. The viable

percentage of cocoons was 84.61% of control group. On exposure to 50,150 mg/kg of malathion for 15 days Viable percentage was 80.55%, 58.62% respectively. Thus we see after exposure to high dose 250mg/kg of malathion numbers of cocoons decreased and viability percentage was also decreased (Table 2) compared to the control group. Worms exposed to low doses 50,150 mg/kg of malathion for 30 days viability was 85.29%% and 70.37% respectively. After treatment to high doses 250mg/kg of insecticide number of cocoons was 16 and viability of cocoons was 43.75% on 30 days exposure. Thus there is decrease compared to the control group (Table 3). Yasmin and Dsouza (2007) studied effect of pesticides on reproductive organs of *Eisenia foetida.* Farrukh and Ali (2011) studied effect of dichlorovos organophosphate on growth, reproduction and avoidance behavior of earthworm *Eisenia foetida.* Espinoza-Novarro et al (2004) studied sub lethal doses of malathion alter male reproductive parameters of *Eisenia foetida.* Bansiwal and Rai (2010)studied malathion toxicity on certain organs of earthworm *Eisenia foetida*.

Table 2: The percentage of viable cocoons of *Eisenia foetida* exposed to Malathion for 15 days and control worms

S. No	No. of earthworms	Malathion con. In (mg/kg)	No. of cocoons produced	No. of Viable cocoons	No. of non viable cocoon	%of Viable cocoons
1.	30	Control	39	33	06	84.61
2.	30	50	36	29	07	80.55
3.	30	150	29	17	12	58.62
4.	30	250	18	10	08	55.55

Table 3

The percentage of viable cocoons of *Eisenia foetida* exposed to Malathion for 30 days and control group worms.

S. No	No. of earth worm	Different con. in (mg/kg)	No. of cocoons	No. of viable cocoons	No. of non viable cocoons	% of viable cocoons
1.	10	0	40	35	05	87.5
2.	10	50	34	29	05	85.29
3.	10	150	27	19	08	70.37
4.	10	250	16	07	09	43.75

Acknowledgement:

We are thankful to principal and Head of Zoology Department , Govt. Science College Rewa (M.P.) for providing laboratory facilities during tenure of this research work.

REFERENCES:

1. Addison J.A. and Holmes S.B.(1995). Comparison of forest soil microorganism and acute toxicity studies for determining effects of fenitrothion on earthworms, Ectoxicology and Enviromental safety, vol.30. No.2, pp.127-133.
2. Bansiwal K.A. and Rai. (2010). Assesment of malathion toxicity in certain organs of earthworm Eisenia foetida. Department of environmental sciences, M.L.S. university, Udaipur,473-476
3. Bonner MR, Coble J, Blair A et al. (2007). "Malathion Exposure and the Incidence of Cancer in the Agricultural Health Study". American Journal of Epidemiology 166 (9): 1023–1034.
4. Brunninger, B., Viswanthan, R. and Beese, F., 1994. Terbuthylazine and carbofuran effects on growth and reproduction within three generations of Eisenia andrei (Oligochaeta) Biol. Fertil. Soils 18: 83-88.
5. Bustos-Obregon, E. and Goicochea, R. (2002). Pesticide soil contamination mainly affects earthworm male reproductive parameters. Asian J. Androl., 4:195-9.
6. Choo, L.P.D. and Baker, G.H. (1998). "Influence of four commonly used pesticides on the survival, growth and reproduction of the earthworm Aporrectodea trapezoids

(Lumbricidae), "Australian Journal of Agricultural Research, Vol. 40, No. 8, pp. 1297-1303.

7. Culy, M.D. and Berry, E.C., 1995. Toxicity of soil-applied granular insecticides to earthworm populations in cornfields. Down to Earth 50: 20-25.

8. Espinoza-Navarro and Eduardo Bustos-Obregon (2004). Sublethal doses of malathion alter male reproductive parameters of *Eisenia foetida.* Int. J. Morphol. 22(4):297-302

9. Farrukh, S. and Ali, Ayesha, S. (2011). Effects of Dichlorovos Organophosphate on Growth, Reproduction, and Avoidance Behavior of Earthworm *Eisenia foetida, Iranian Journal of Toxicology*, Volume 5, No. 14. 495-501.

10. Peakall, D.B., 1994. Biomarkers, the way forward in environmental assessment. Toxicol. Ecotoxicol. News 1: 55-60.

11. Van Gestal C A M, Dirven-van Breemen E M, Baersclman R, Emans H J B, Janssen J A M, postuma R, Van Vilet P J M (1992) comparison of sublethal criteria for nine different chemicals in standardized toxicity test using the earthworm Eisenia andrei. Ecotox environ saf 23:206-220

12. Yasmin s, Dsouza D. ,2007. Effect of pesticides on the reproduction output of Eisenia fetida. Bulletin of environmental contamination and toxicology. 79(5):529-32