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# Studies on effect of pesticides to earthworms

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## ABSTRACT

The experiment on effect of pesticides to *Eudrilus eugeniae* earthworms species was conducted at the Department of Agricultural Entomology, Regional Agricultural Research Station, Bijapur, The results of the experiment revealed that, when the food material was topically applied with various pesticides, there was wide variation among the treatments (pesticides) with respect to mortality of adult earthworms ranging from 0.0 to 31.3 and 0.0 to 33.3 per cent during 2004-05 and 2005-06, respectively. Significantly highest per cent mortality of 31.3 and 33.3 per cent was recorded with the endosulfan @ 2.0 ml/litre of water during2004-05 and 2005-06, respectively . The highest juveniles mortality of 31.69 per cent was recorded during 2004-05 and it was 35.85% during 2005-06 with the topical application of endosulphan 35 EC. The lowest juvenile mortality of 8.10 % and 8.13 % was recorded with the streptomycin sulphate during 2004-05 and 2005-06, respectively.The average data of two years study indicated that the highest mortality was with endosulphan 35EC (33.77%) followed by dimethoate (22.38%), alphamethrin (20.06%), cypermethrin (19.42%) and the lowest was with the streptomycin sulphate treatment (8.13%). Fungicides/bactericides , among the pesticides were safer to earthworms when applied topically on the earthworm food material.

**Key words :** *Eudrilus eugeniae* , *E*arthworm, Pesticides.

## INTRODUCTION

Different species of earthworms contribute in different degrees to the mixing of the organic and inorganic components of soil. The earthworms move large amounts of soil from the deeper strata to the surface the amounts moved in this way range from 2 to 250 tons per hectare per annum, equivalent to bringing a layer of soil between one mm to five cm thick to surface every year creating a stone free layer on the soil surface. Earthworms also affect soil structure through their burrowing activities for better aeration and in filtration. Earthworms generally prefer soils with near neutral pH values and the absence of worms in acid soils leads to the accumulation of thick mat of slow decaying organic matter as the surface characteristic feature of soils (Wood, 1995).

Chemical intensive farming has many harmful side effects and limitations such as increased incidence of pest and diseases, biomagnifications of chemicals through food chains, destruction of physical and chemical properties of soil, atmospheric pollution etc. and we are also facing the disposal problem of waste materials like solid and liquid excreta of livestock, human population and urban wastes. These aggravated problems can be resolved by recycling wastes through vermiculturing by using suitable and potential earthworm species. Vermicomposting of wastes and *in situ* vermiculturing in various crops form a component of significance in bioremediation and its utility in the crop husbandry.

The earthworms activity in soil is known to influence various physical, chemical and biological properties. This activity is associated with increased enzyme activities and microbial population in the worm casts compared to non-ingested soil (Lee, 1985).

In the agricultural front pesticides usage for crop management /plant protection is increasing in recent days. Use of synthetic pesticides for pest management known to remain as active ingredients in the produce after harvest and in the plant residues like stlks,husks etc. Plant residues after the harvest of the produce is used as feed for the earthworms for the production of vermicompost. Some of the pesticides are toxic to the earthworms which are going to affect the normal functions of the earthworms and earthworm reproductions. Hence, the studies on safe chemicals for the earthworms are need of the hour.

## MATERIALS AND METHODS

The studies were conducted at the Department of Agricultural Entomology, Regional Agricultural Research Station, Bijapur. It is situated in the northern dry zone (Region II and Zone-3) of Karnataka at $15^0$ 49' North lattitude, $75^0$ 43' East longitude and altitude of 573 m above the mean sea level. The rainfall is confined to the monsoon period from June to November with occasional showers in pre monsoon months of April and May with an average rainfall of 594.3 mm per annum The mean maximum and minimum temperatures are 33.6 and 18.2

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C, respectively. The relative humidity values are uniformly high during the monsoon months from July to September than March to May.

The *Eudrilus eugeniae was* collected from Vermiculture Unit, Department of Agricultural Entomology, Regional Agricultural Research Station, Bijapur.

Food material required for experimentation as well as for the maintenance of earthworm culture was prepared by using organic wastes (*viz*., dried leaves, sunflower stalks, green leafy matter) and dung. Organic waste and dung were mixed in the proportion of 10:1 and were arranged in a brick wall pit (above ground) of size 10m x1mx0.33 m (LxWxH) in layer wise. Each layer was alternated with dung layer. The pit was closed with a thin layer of soil (1 cm) and covered with 6-12" mulch layer to enhance the decomposition process. The pit was watered regularly. After 45 days, the decomposed organic matter was thoroughly mixed, collected and stored in the laboratory for further use. About 25 kg of decomposed organic matter was taken and put in trough of size 60x45x30 cm. Different pesticides were topically sprayed on decomposed organic matter at their recommended dosages.The pesticides used to test the safety to earthworms included carbaryl 50 WP, phorate 10 G, chlorpyriphos 20 EC, monocrotophos 36 SL, endosulphon 35 EC, cypermethrin 10 EC l, alphamethrin 10 EC, dimethoate 30 EC, copper oxy chloride, mancozeb, thiophenite methyl, streptomycin sulphate and bordeaux mixture. Organic matter was sufficiently wetted and

Table 1 : Effect of pesticides on adults of earthworm(*E. eugeniae)* when topically applied on food material.

| S. No | Pesticides | Recommended Dosage/ha | Percent Mortality | | |
|---|---|---|---|---|---|
| | | | 2004-05 | 2005-06 | Mean |
| 1 | Carbaryl 50WP @ 4g/l | 4.0 kg/ha | 3.3 | 2.61 | 2.95 |
| | | | (10.47)* | (9.28) | (9.87) |
| 2 | Phorate 10 G | 20 kg/ha | 10.31 | 11.0 | 10.65 |
| | 20kg/ha80g/plant | | (18.72) | (19.37) | (19.04) |
| 3 | Chlorpyriphos 20EC | 3.0 litres / | 3.34 | 4.60 | 3.95 |
| | | ha | (10.47) | (12.39) | (11.43) |
| 4 | Monocrotophos 36 SL @ 1.0 | 1 .0 litre / | 16.64 | 14.63 | 15.65 |
| | ml/ litre of water | ha | (24.04) | (22.46) | (23.25) |
| 5 | Endosulphan 35 EC @ 2.0 | 2.0 litre / ha | 31.31 | 33.32 | 32.33 |
| | ml litre of water | | (34.02) | (35.24) | (34.63) |
| 6 | Cypermethrin 10 EC @ | 500 ml/ha | 13.35 | 14.30 | 13.80 |
| | 0.5ml/ litre of water | | (21.39) | (22.22) | (21.80) |
| 7 | Alphamethrin 10 EC @ 0.25 | 250 ml/ha | 7.34 | 7.00 | 7.15 |
| | ml/l litre of water | | (15.68) | (15.34) | (15.51) |
| 8 | Dimethoate 30 EC @ 1.75 | 1.75 1itre/ | 3.33 | 8.00 | 5.65 |
| | ml/ litre of water | ha | (10.47) | (16.43) | (13.45) |
| 9 | Copper oxychloride 3g/ litre | 3 kg / ha | 0.0 | 2.00 | 1.00 |
| | of water | | (0.0) | (8.13) | (4.06) |
| 10 | Mancozeb | 2 kg / ha | 0.0 | 3.00 | 1.50 |
| | | | (0.0) | (9.98) | (4.99) |
| 11 | Carbendizim | 1 kg / ha | 0.0 | 2.00 | 1.00 |
| | | | (0.0) | (8.13) | (4.06) |
| 12 | Thiphenite methyl 1g/ litre of | 1 kg / ha | 1.0 | 4.00 | 2.55 |
| | water | | (5.47) | (11.54) | (8.64) |
| 13 | Streptomycin Sulphate 0.5 g/ | 500 gm /ha | 0.0 | 1.00 | 0.54 |
| | litre of water | | (0.0) | (5.74) | (2.87) |
| 14 | Bordaxmixture | 1 % | 0.0 | 0.0 | 0.0 |
| 15 | Untreated control | - | 0.0 | 0.0 | 0.0 |
| | SEm ± | - | 2.92 | 2.1 | 2.60 |
| | CD at 1% | - | 8.61 | 6.4 | 7.80 |
| | C.V(%) | - | 3.98 | 3.81 | 2.45 |

* figures in parenthesis are angular transformed values

twenty-five adult earthworms were released in each trough. Three replications were maintained. Sampling was made at 10 days after release of earthworms and observations were recorded on number of live and dead adults and juveniles/25 x 25 x 20 cm. Later the data were subjected to suitable statistical analysis.

## RESULTS AND DISCUSSION

The data on adult earthworms mortality due to various pesticides and fungicides are presented in Table 1. Among the different pesticides and fungicides have no or negligible effect on adult earthworms mortality whereas different pesticides also have marginal effect during both the years of study. Average values of two years study indicated that the highest mortality percentage was recorded with the endosulphan application (32.3%) and the lowest was with the streptomycin sulphate (0.54 %). Bordeaux mixture application topically on the food material did not have any effect on adult earthworms. Different insecticides had different levels of effect but fungicides had at par effect on adult earthworms.

The highest juveniles mortality of 31.69 per cent was recorded during 2004-05 and it was 35.85% during 2005-06 with the topical application of endosulphan 35 EC (Table 2). The lowest juvenile mortality of 8.10 % and 8.13 % was recorded with the streptomycin sulphate

Table 2 ; Effect of pesticides on juveniles of earthworm (*E. eugeniae)* when topically applied on food material.

| S.No | Pesticides | Recommended dosage | Percent Mortality | | |
|---|---|---|---|---|---|
| | | | 2004-05 | 2005-06 | Mean |
| 1 | Carbaryl 50WP @ 4g/ litre of water | 4.0 kg/ha | 6.60 (14.87)* | 8.00 (16.43) | 7.32 (15.66) |
| 2 | Phorate 10 G 80g/plant | 20 kg/ha | 9.61 (18.05) | 9.00 (17.46) | 9.30 (17.75) |
| 3 | Chlorpyriphos 20EC 3.0 ml/ litre of water | 3.0 litres / ha | 3.33 (10.47) | 3.34 (10.47) | 3.35 (10.47) |
| 4 | Monocrotophos 36 SL @ 1.0 ml/ litre of water | 1 .0 litre / ha | 11.60 (19.91) | 12.30 (19.64) | 11.95 (19.77) |
| 5 | Endosulphan 35 EC @ 2.0 ml/ litre of water | 2.0 litre / ha | 27.60 (31.69) | 34.31 (35.85) | 30.95 (33.77) |
| 6 | Cypermethrin 10 EC @ 0.5ml/ litre of water | 500 ml/ha | 11.62 (19.91) | 12.60 (20.79) | 12.10 (19.42) |
| 7 | Alphamethrin 10 EC @ 0.25 ml/ litre of water | 250 ml/ha | 13.30 (21.39) | 11.31 (18.72) | 12.34 (20.05) |
| 8 | Dimethoate 30 EC @ 1.75 ml/ litre of water | 1.75 1itre/ ha | 14.60 (22.46) | 14.34 (22.22) | 14.50 (22.38) |
| 9 | Copper oxychloride 3g/ litre of water | 3 kg / ha | 3.32 (10.47) | 2.34 (8.72) | 2.80 (9.59) |
| 10 | Mancozeb | 2 kg / ha | 7.60 (16.00) | 8.30 (16.74) | 7.95 (16.37) |
| 11 | Carbendizim | 1 kg / ha | 9.60 (18.05) | 8.33 (16.74) | 8.95 (17.39) |
| 12 | Thiphenite methyl 1g/ litre of water | 1 kg / ha | 6.6 (14.89) | 7.30 (15.68) | 6.95 (15.28) |
| 13 | Streptomycin Sulphate 0.5 g/ litre of water | 500 gm /ha | 2.00 (8.10) | 2.00 (8.13) | 2.00 (8.13) |
| 14 | Bordaumixture | 1 % | 3.00 (10.47) | 3.00 (9.98) | 3.00 (9.98) |
| 15 | UTC | - | 0.0 (0.0) | 0.0 (0.0) | 0.0 (0.0) |
| | SEm ± | | 1.10 | 1.60 | 1.40 |
| | CD 2% | | 3.30 | 4.80 | 4.21 |
| | C.V (%) | | 4.25 | 3.96 | 4.26 |

* Figures in parenthesis are angular transformed values

during 2004-05 and 2005-06, respectively.The average data of two years study indicated that the highest mortality was with endosulphan 35EC (33.77%) followed by dimethoate (22.38%), alphamethrin (20.06%), cypermethrin (19.42%) and the lowest was with the streptomycin sulphate treatment (8.13%) untreated control plot did not have any effect on earthworms juvenile. The insecticides treatment chlorpyriphos 20EC has recorded even lower mortality (10.47%) when compared with the some of the fungicides like mancozeb (16.37%), carbendizim (17.40%) and Thiophenite methyl (15.29%).

The present findings are in conformity with the results obtained by Awakanavar *etal*. (2001) who reported that, endosulfan and pyrethroids are more toxic to earthworms besides benomyl, carbaryl, carbofuran and phorate to earthworms. Rupell and Loughlin (1977), and Stenerson (1979) reported that many carbamate insecticides produce tumors and swelling along the earthworm body.

In conclusion among the pesticides, treatment with endosulphan recorded significantly higher mortality of adult earthworms and juveniles.Where as, fungicides/ bactericides , among the pesticides were safer to earthworms when applied topically on the earthworm food material.

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