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Cocoon production assessment for *Eudrilus eugeniae* exposed to monocrotophos (Organophosphorus Insecticides)

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Abstract

The earthworm *Eudrilus eugeniae* was exposed monocrotophos (MCP) in laboratory controlled soil. Cocoon production was measured over 28 days to determine the impact of MCP. Cocoon production was more sensitive than other parameters such as growth, mortality, etc. Cocoon production was highest in the control to compare with experiments. When the 300ppm MCP concentration is increased 3 numbers of cocoons produced after 14th day and when the duration of exposure is increased of 28 days it revealed 1 number of cocoon at higher concentration of 300 ppm. Our research findings strongly conclude food play a major role in reproduction potential (cocoon production).

Keywords: Cocoon, *Eudrilus eugeniae*, Monocrotophos

Introduction

India is an agriculture based country with more than 60-70% of its population dependent on agriculture (Kanekar *et al* 2004). But 100% of India depends the agriculture for food intake. In our India, during the period of 1960s to 1980s, there was a remarkable increase in the agri production due to green revolution (Gupta 1996). In other side, farmers of India mostly depend on synthetic fertilizer and pesticides for better yield. Very large numbers of pesticides are currently used for agricultural activities. Pesticides fundamentally classified into herbicides, insecticides, fungicides, nematicides, micro-biocides, etc. Insecticides are further divided into

neonicotinoid insecticides, antibiotic insecticides, insect growth regulator insecticides, pyrethroid insecticides, carbomate insecticides, organophosphorus insecticides, etc.

Today, Monocrotophos (MCP) occupies a prime position in agricultural management in India and its consumption in India is estimated at 6000 metric tones per annum (Anon 2001). MCP was one of the pesticides widely used by farmers in a survey (Cheng 1993 & Govindarajan and Prabaharan 2015). It has been discontinued from use in the United States but, it is still used internationally.

Eudrilus eugeniae is an earthworm species indigenous in Africa but it has been bred extensively in the USA, Canada, Europe and Asia for the fish bait market, where it is commonly called the African night crawler. *E. eugeniae* belongs to the phylum Annelida, class Oligochaeta. It fertilizes its eggs inside a cocoon secreted by the clitellum. The clitellum is a reproductive structure characteristic of the oligochaetes (Ruppert & Barnes 1996). The main objective of this current research was to find out the impact of monocrotophos (insecticides) on non-target organisms such as earthworm reproduction potential.

Material and Methods

Agrochemicals

Monocrotophos (MCP) was used for carrying out the current work. MCP is organophosphate insecticide.

Soil

For conducting the toxicity test, soil were collected from Pasumalai, Madurai, Tamilnadu.

Earthworm

For conducting the reproduction potential test, earthworms were purchased from SS Vermicomposting farms, Madurai, Tamilnadu, India. Earthworms are very carefully brought to the laboratory with the help of cotton box. 40 clitellate worms were selected and divided into four vessels were randomly allocated to this experiment.

Result

Table: 1 Number of cocoon productions after exposure of *Eudrilus eugeniae* to different concentration of monocrotophos for 28 days.

No of Earthworms exposed	Different concentration of monocrotophos (ppm)	Number of cocoon production after exposure period (28 days)	
		14	28
10	Control	29	27
10	100	15	14
10	300	3	1
10	500	Nil	Nil

Earthworm exposed to high concentration of monocrotophos produced fewer cocoons. The effect of insecticides in cocoon production of earthworm (*Eudrilus eugeniae*) exposed to two different periods such as 14 days and 28 days of long term exposure. Cocoon production is one of the parameter for assessing the effect of monocrotophos it appears to of a rapid measurement and point biomarker for laboratory and its field studies. Cocoon production was highest in the control to compare with experiments. Although overall cocoon production rates of *E. eugeniae* was low.

Number of cocoon production in control after 14 days were observed and 29 cocoons were produced followed by which and after 28 days 27 cocoons were observed. When *Eudrilus eugeniae* is exposed to a concentration of 100 ppm of monocrotophos it produced 15 numbers of cocoons during 14^{th} day. After 28 days a drastic reduction in cocoon with 14 numbers was recorded. Further when the concentration is increased to 300 ppm 3 numbers of cocoons after 14^{th} day and when the duration of exposure is increased of 28 days it revealed 1 numbers of cocoons (Table 1) at higher concentration of 300 ppm.

The cocoon production was affected by the insecticide which exhibited 3 number of cocoon after 14^{th} day and 1 number of cocoon after 28 days of exposure. It may be speculate that cocoon production was affected and influenced by the insecticide monocrotophos. Due to high concentration of MCP in 500ppm 100% mortality was recorded. However, cocoon production rates significantly reduced.

Discussion

Earthworm consider as an ideal organism for assess for toxicity of insecticide, because they play a fundamental role on soil ecosystem. Earthworms are exposed to a wide variety of agricultural chemicals and they are recognized as effective indicators of vicinity. Reproduction potential of earthworms also important endpoints used in environmental ecotoxicity (Wu *et al* 2011). However, earthworm cocoon production rate can acts useful biomarkers to measures the soil toxicity level. Reipert *et al* 2009 stated that the acute earthworm test is a part of the basic test set, but the earthworm reproduction test is considered ecologically more relevant. It is observed that increased concentration / more concentration increase the mortality of earthworms.

In our study, the MCP has produced a prominent change in the cocoon production potential of the *Eudrilus eugeniae*. The cocoon production rate of the *E. eugeniae* decreases because of impact of MPC as compared to the control. Toxic effects of MPC affect the cocoon production potential of the earthworms.

Meinhardt 1974 stated that cocoon production of *L. terrestris* normally takes 12-13 weeks. The first cocoon produced in earthworms after 30 days only (Matuseviciute & Eitminaviciute 2005).

Joanna Jarmul-Pietraszczyk and Aleksandra Jastrzebska 2012 reported all applied herbicides negatively affected reproduction rate of *Eisenia fetida* and *Dendrobaena veneta* earthworm species. Fischer Erno 1989 also indicates negative impact of herbicides on earthworm's reproduction and herbicides are totally prevented cocoon production in *E. fetida*.

Reinecke and Kriel 1981 concluded the cocoon production can be influenced by environmental temperature. Similar results obtained by Sorour and Larink 2001 observed that spermatozoa could be damaged by the impact of pesticides. The pesticides have affecting the spermatogenesis of earthworms.

Our findings says food play a major role in reproduction potential this finding supported by Evans and Guild 1948 concluded that nitrogen rich diets help in rapid growth of earthworms and facilitate more cocoon production. Spurgeon *et al* 1994 reported that cocoon production rates were low due to lack of suitable food in the artificial soil.

Since experimental period was only 28 days, no cocoons were observed in all the containers. Similar result was reported under heavy metal bioaccumulation by *Lampito mauritii* and *Eisenia fetida* (Govindarajan *et al* 2010). These observations suggest that reproduction is affected by unfavorable conditions.

Conclusion

Based on the findings of the present research, it can be concluded that the lethal effects of MPC. Significantly affect the cocoon production of the *Eudrilus eugeniae*. Therefore, we conclude this parameter can be useful to assess the impact of MPC insecticides on non-target soil organisms. Due to these work we recommend the organic manuring system instead of inorganic system.

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