



Physiological Effects of Profenofos Insecticide Towards Consumption Rate and Assimilation Efficiency of Cow – Dung By Earthworms

Pontoscolex corethrurus Fr. Mull

Erwin Nofyan^{1*}, Mustafa Kamal¹, Syafrina Lamin¹, Indah Rahmasari¹

¹Biology Program, Faculty of Mathematics & Natural Sciences, Sriwijaya University, Jalan Padang Selasa 524, Palembang, Sumatera Selatan 30139, Indonesia.

*Corresponding author

E-mail address: erwinnofyan@unsri.ac.id (Erwin Nofyan)

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Abstract :

The purpose of this research is to determine the effect of insecticide profenofos to the rate of consumption and assimilation efficiency of cow-dung by earthworms *Pontoscolex corethrurus* Fr. Mull. This research used Completely Randomized Design with 6 treatments and 5 repetitions. Treatments that were given to samples are the insecticide profenofos with concentrations of 0 % (control); 0.1%; 0.2 %; 0.3 %; 0.4 %; 0.5 %. Data analysis was using Varians Analysis. If there was a real difference then data analysis continued with The Duncan Test on level of confidence of 95%. The results of this research show us that several concentrations of insecticide carbaryl have a real effect on the average of consumption rate and the efficiency of absorption. The lowest average of consumption rate on earthworm *Pontoscolex corethrurus* Fr. Mull is on concentration of 0,5 % (0.23 ± 0.02 mg/g day) and the highest average of consumption rate on earthworm *Pontoscolex corethrurus* Fr. Mull is on concentration of 0% (control) (2.53 ± 0.05 mg/g day). The lowest average of approach digestion earthworm *Pontoscolex corethrurus* is on concentration of 0 % (control) (40.78 ± 2.56 %) and the highest average of digestion earthworm *Pontoscolex corethrurus* Fr. Mull is on concentration of 0,5 % (70.76 ± 3.67 %).

Keywords: profenofos, rate of consumption, assimilation efficiency, *Pontoscolex corethrurus* Fr. Mull.

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1. Introduction

Insecticides are chemical compounds commonly used to eradicate plant pest organisms such as the use of synthetic insecticides. In particular, the insecticide Profenofos to eradicate plant pests, especially secondary crops, including potatoes, chilies, tomatoes, carrots, corn, and soybeans, undeniably has contributed greatly to increasing the production of these crops. However, the increasingly intensive use of the insecticide profenofos has clearly resulted in negative impacts on the aquatic and terrestrial environment as well as the death of non-target biota [1].

The death of non-targeted soil biota, including earthworms and collembola, is a side effect of carbofuran insecticides, which can be in the form of a reduction in the number of individuals, obstacles to metabolic activity, behavior, rate of feed consumption, growth and hatchability of cocoons in the soil biota [2]. Earthworms, especially

Pontoscolex corethrurus Fr. Mull, are soil biota that are commonly found in agricultural land and have a beneficial role in the soil ecosystem.

The *Pontoscolex corethrurus* Fr. Mull earthworm plays a role in the decomposition and mineralization of organic matter. The process of decomposition of organic matter causes changes in soil structure, thereby increasing soil aeration and the ability of the soil to hold water [3]. The application of various concentrations of the insecticide profenofos mixed with feed in the form of cow feces showed a significant effect on the production and viability of the earthworm cocoon *Pontoscolex corethrurus* Fr. Mull [4]. Provision of various concentrations of synthetic insecticides pyrethroid mixed with cattle feed in the form of feces showed a marked influence on the growth and production of earthworm cocoons *Pontoscolex corethrurus* Fr. Mull [5].

The use of profenofos insecticide on agricultural

plants by spraying on stems, leaves or immersion in the soil, can be accumulated by earthworms which are non-target animals or non-target animals. Profenofos insecticide accumulation by non-target or non-target animals is important to know, because it plays a role in the chain of insecticide transfer to a higher level of organisms. So it is necessary to do a research: "Physiological Effects of Profenofos Insecticide Toward Consumption Rate and Assimilation Efficiency of cow- dung by Earthworm *Pontoscolex corethrurus* Fr.Mull

This study aims to study the physiological response of the consumption rate and assimilation efficiency of the *Pontoscolex corethrurus* Fr.Mull earthworms at various concentrations of the profenofos insecticide and determine the effect of various concentrations of profenofos insecticides on the physiological response of the consumption rate and assimilation efficiency of cow-dung by earthworms *Pontoscolex corethrurus* Fr.Mull.

2. Materials and Methods

2.1. Earthworm Collection *Pontoscolex corethrurus* Fr.Mull.

The collection of earthworms will be carried out by hand sorting [6]. In the designated areas in Inderalaya Ogan Ilir and Palembang, digging is carried out to a depth of 10-15 cm. The hoed soil was separated by hand and the *Pontoscolex corethrurus* Fr.Mull earthworm found was put into a plastic bucket filled with biotope soil from the collected *Pontoscolex corethrurus* earthworm, then kept in a plastic tub measuring 20 x 30 x 10 cm. Soil in plastic tubs is the original biotope soil [7].

The reared *Pheretima javanica* earthworm was fed with cow feces ad libitum on the trough surface. The condition of the soil water content in the plastic tub is maintained in the range of 30-40% by watering, if the soil water content decreases from this value, then watering is done every 3 or 4 days.

2.2. Provision of Cow Feces as Earthworm Feed *P.corethruruss*

Cow feces are taken from cattle breeders' pens in Palembang and Ogan Ilir. The cow feces is dried in the sun to dry, then pounded and blended. After blending, sieve with a sieve (200 mesh size) until the cow feces powder is homogeneous. After sifting, it is put into clear plastic and stored in an excicator before being used for the experiment.

2.3. Research design

This study used a completely randomized design (CRD), with carbofuran insecticide treatment mixed with earthworm feed, carbofuran insecticide with a concentration of 0%; 0.1%; 0.2%; 0.3%; 0.4% and 0.5%. Each treatment

was carried out 5 times. These treatments, referring to the design carried out by Nofyan [9], are:

- A0 = 0% insecticide profenofos + 100 mg cow feces
- A1 = 0.1% profenofos insecticide + 100 mg cow feces
- A2 = 0.2% profenofos insecticide + 100 mg cow feces
- A3 = 0.3% profenofos insecticide + 100 mg cow feces
- A4 = 0.4% profenofos insecticide + 100 mg cow feces
- A5 = 0.5% profenofos insecticide + 100 mg cow feces

The method used refers to the method used by Dickschen and Topp [8], namely into each petri dish (diameter = d = 15 cm), given a filter paper that has been cut according to the diameter of the petri dish used and moistened with sufficient distilled water. After that, 200 mg of cow feces are added, stirred with a carbofuran insecticide that has been determined for the concentration. Water. The criteria for earthworms weighed 1.26-1.38g and body length 12-15 cm and aged 14-18 weeks. Before the experiment, the consumption rate and assimilation efficiency of the earthworms were fasted for 24 hours, then their body weight was weighed.

The consumption rate and assimilation efficiency experiments were carried out for 3 days, each day the earthworms were controlled. On the third day of earthworms, the remaining feed and feces of earthworms are weighed, so the dry weight of feces and dry weight of feed eaten are obtained. To determine the value of consumption rate and digestibility of earthworms using the formula proposed by Dickschen and Topp [8], as the following:

a) Consumption Rate

$$CI = \frac{C}{(T \times A)}$$

Note:

- CI = consumption rate
- C = dry weight of feed eaten (mg)
- T = time (day)
- A = earthworm body weight (g)

b) Assimilation Efficiency

$$AD = \frac{(C - F)}{C} \times 100\%$$

Note:

- AD = Digestibility (%)
- C = Dry weight of feed eaten (mg)
- F = Earthworm faeces dry weight (mg)

2.4. Parameters of observed

The parameters observed in this study were the rate of consumption and digestibility of earthworms *Pontoscolex corethrurus* Fr. Mull

2.5. Presentation of Data

Data are presented in tabular form for each observation

parameter.

2.6. Data analysis

The data obtained from the observations were carried out by Variance Analysis. If there is a significant difference, continue with the Duncan New Multiple Range Test (DNMRT) further test at the level of $\alpha = 5\%$.

3. Results and Discussion

3.1. Earthworms Consumption Rate Experiment *Pontoscolex corethrurus* Fr.Mullat various concentrations of the Insecticide Profenofos

The rate of feed consumption of earth worms *P. corethrurus* in the feed of cow feces given various concentrations of the insecticide profenofos in the form of averages. The average feed consumption rate for P worms, corethrurus was the highest at a concentration of 0% insecticide profenofos + cow feces, namely 0.099 ± 0.001 g / g per day and the average feed consumption rate for *P. corethrurus* earthworms was the lowest at a concentration of 0.5% profenofos insecticide + feces cattle, namely 0.022 ± 0.001 g / g.day, are listed in Table 1.

Table 1. Average feed consumption rate of *P. corethrurus* earthworm at various the concentration of the insecticide profenofos in the laboratory

No	Treatment	Feed Consumption Rate (g/g.day)
A ₀	0% insecticide profenofos + cow feces	0.099 ± 0.001 a
A ₁	0.1% profenofos insecticide + cow feces	0.032 ± 0.002 b
A ₂	0.2% profenofos insecticide + cow feces	0.028 ± 0.001 c
A ₃	0.3% profenofos insecticide + cow feces	0.026 ± 0.002 d
A ₄	0.4% profenofos insecticide + cow feces	0.024 ± 0.003 e
A ₅	0.5% profenofos insecticide + cow feces	0.022 ± 0.001 f

Note: Numbers followed by different lowercase letters indicate significantly different ($\alpha = 0.05$)

From Table 1, it appears that the rate of feed consumption of earthworm *P. corethrurus* Fr.Mull varies depending on the concentration of the insecticide profenofos given to feed in the form of cow feces. Profenofos insecticide is included in the organophosphate insecticide class, inhibiting the activity of the acetylcholinesterase [4] enzyme in the peripheral somatic and autonomic nervous system, causing it to affect the earthworms' sense of taste and smell, so that earthworms do not want to consume feed in the form of cow feces. Mixed with the insecticide concentration profenofos.

Rate of feed consumption of earthworms is influenced by the quantity and quality of feed given [3]. The quality of the feed is related to the taste, smell and chemical composition of the feed. The quality of feed greatly determines the palatability of earthworms, especially *Pontoscolex corethrurus* Fr.Mull. In the above experiment, the feed in the form of cow feces mixed with profenofos insecticide which contains chemical compounds, causes earthworm *P. corethrurus* to dislike consuming the profenofos insecticide, so that affect the rate of feed consumption of *P. corethrurus* Fr.Mull earthworms.

3.2. Efficiency of Assimilation of *P. corethrurus* earthworms at various concentrations of Profenofos insecticide

The digestibility values of *P. corethrurus* earthworms fed with cow feces mixed with various concentrations of the insecticide profenofos are listed in Table 2.

Table 2. Average assimilation efficiency of *P. corethrurus* Fr. Mull on various concentrations of the insecticide profenofos in the Laboratory

No	Treatment	Digestibility (%)
A ₀	0% insecticide profenofos + cow feces	$99,91 \pm 1,06$ a
A ₁	0.1% profenofos insecticide + cow feces	$85,53 \pm 1,32$ b
A ₂	0.2% profenofos insecticide + cow feces	$76,61 \pm 1,41$ c
A ₃	0.3% profenofos insecticide + cow feces	$72,66 \pm 1,61$ d
A ₄	0.4% profenofos insecticide + cow feces	$66,17 \pm 1,58$ e
A ₅	0.5% profenofos insecticide + cow feces	$41,88 \pm 1,83$ f

Note: Numbers followed by different lowercase letters indicate significantly different ($\alpha = 0.05$)

From the above discussion, it can be seen that the amount of feed eaten and what comes out is in the form of feces or changes in feed in the digestive tract greatly affects the digestibility of earthworms. Digestibility of earthworms is influenced by fast or slow change of feed in the digestive tract and the type of earthworm. If the change of feed in the digestive tract of earthworms is fast it will cause the digestibility of earthworms to be low [8];[10]. Time to change feed in the digestive tract of earthworms is different based on the type of earthworm and the type of feed it eats. Examples of the earthworms *Allolobophora rosea* and *Lumbricus rubellus*, each of which require time ranging from 1- 2.5 hours and 36-48 hours.

From the research results listed in Table 2, it turns out that the highest digestibility of *P. corethrurus* earthworms was obtained in the treatment of feed with cow feces + 0% insecticide profenofos. The discharge through the feces is greater because the chemical compound profenofos

insecticide with high concentrations in feed in the form of cow feces can affect the digestive tract of the earthworms, also cause the excretion of the earthworms, *P. corethrurus*, which causes the digestibility value of the earthworm *P. corethrurus* to be very low. The higher the concentration of the insecticide profenofos mixed in cow feces as a feed ingredient for the *P. corethrurus* earthworms, the less feces released by the *P. corethrurus* earthworms, so that the efficiency value of the earthworms assimilation is higher.

this is because in feeding in the form of cow feces the high concentration of profenofos insecticide causes earthworms to dislike the material [11]; [12]. feed in the form of cow faeces + 0.5% insecticide profenofos, so that the process of exchange of feed ingredients is faster causing more feces released by the *P. corethrurus* earthworm, causing the digestibility value of the *P. corethrurus* earthworm to be lower.



Figure 1. a. Weighing of *P. corethrurus* Fr.Mull feed; b. The experiment of consumption rate of *P. corethrurus* Fr.Mull earthworm; c. earthworm *P. corethrurus* Fr.Mull; d. *P. corethrurus* Fr.Mull; e. *Pontoscolex corethrurus* Fr. Mull

4. Conclusion

From the results and discussion above, it can be concluded as follows:

1. The application of various concentrations of the insecticide profenofos on the consumption rate and digestibility of *P. corethrurus* were significantly different.
2. The concentration of profenofos insecticide can affect non-target animals, namely *P. corethrurus*.
3. The higher the concentration of the insecticide profenofos against the *P. corethrurus*, the lower the consumption rate of *P. corethrurus*, and the digestibility of *P. corethrurus* Fr. Mull.

The lowest digestibility value of *P. corethrurus* earthworms was found in the provision of a concentration of 0.5% insecticide + cow feces, namely $41.88 \pm 1.83\%$,

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