INFLUENCE OF DIFFERENT CULTIVATING AND FOOD SOURCES ON GROWTH OF EARTHWORM, *PERIONYX EXCAVATUS (PERR.)*

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ABSTRACT

Earthworm, Perionyx Excavatus, has been studied and the potential of this epigeic earthworm species for processing organic waste is well known. The substrate and feeding material were considered as effector of the growth, life cycle of earthworms. The current study carried on the evaluation of various cultivating and feeding materials that influenced on growth of earthworms, by calculating biomass, the total number of worms and relative growth rate. As the results, the cow manure fed in cultured and feeding materials showed the suitable in the growth of earthworm, with significant differences from other group which based on worm manure as the substrate and feeding materials. For further study, the adding component, including coir, straw and soil have to be studied to find out the better materials in earthworm cultivation.

Keywords: *Earthworm; Perionyx Excavatus; cow manure; worm manure.*

1. Introduction

Recent years, the problem of efficient disposal and management of organic waste, such as agricultural waste, household waste, sewage sludge, industrial waste, etc. have become significant and important, due to rapidly increasing population, intensive agriculture and industry (Aslok *et al.,* 2009; Prasad, 2011). The disposal of different types of waste has become importance for maintaining environmental health (Senapati and Julka, 1993). In developing countries, including Vietnam, have faced great challenges in organic waste management.

Earthworm *Perionyx Excavatus* (Perr.) is an earthworm found commonly over a large area of tropical Asia, including Vietnam. The potential of *Perionyx Excavatus* have been well established to manage organic waste resources. This is an epigeic species, which lives in organic wastes and high moisture contents and adequate amounts of suitable organic material are required for populations to become fully established and for them to process organic wastes efficiently (Edwards *et al*., 1998; Hasanuzzaman *et al.,* 2014), has been considered as the key organisms in organic matter decomposition (Gómez-Brandón *et al.,* 2012). Notably, different environmental conditions and organic sources are known to affect the growth of earthworms, has been recently reported. In Vietnam, agricultural crop residues comprising of wheat, paddy straw, farm yard manure, etc. which were produced annually in huge amount and quality, which have been considered as the rich nutrients for earthworm raising. Hence, the aims of current study were to establish

whether types of substrate or feeding material effect the growth and biomass pattern of earth worm *Perionyx Excavatus* (Perr.).

2. Materials and methods

Preparation of environmental substrate and feeding material

Different types of major environmental substrates and feeding materials, based on cow manure (Cm) or worm manure (Wm) with adding substrate including coir (Co), straw (St) and soil (So) in various ratios, were used during current study (Table 1).

Table 1. Preparation of substrate and feeding materials for experimentally raising

Substrate	Environmental substrate	Feeding materials
Substrate 1A (Sub1A)	Cm + Co (w/w 3 : 1)	Cm + Co (w/w 3 : 1)
Substrate 1B (Sub1B)	Cm + So (w/w 3 : 1)	Cm + So (w/w 3 : 1)
Substrate 1C (Sub1C)	Cm + St (w/w 3 : 1)	Cm + St (w/w 3 : 1)
Substrate 2A (Sub2A)	Wm + Co (w/w 3 : 1)	Cm + Co (w/w 3 : 1)
Substrate 2B (Sub2B)	Wm + So (w/w 3 : 1)	Cm + So (w/w 3 : 1)
Substrate 2C (Sub2C)	Wm + St (w/w 3 : 1)	Cm + St (w/w 3 : 1)
Control (Cont)	Wm	Cm

Note: w/w: weight/weight

Earthworm raising

Earthworm, *Perionyx cecavatus* (Perr.) were collected in Earthworm farm in Cu Chi, Address: 1A Tran Tu Binh st., Tan Dinh, Tan Thong Hoi, Cu Chi, Ho Chi Minh City. For input criteria, the range of 18 – 20g earthworm fresh weight were enrolled in each experiment. The worms were kept in soil with a pH of 7 and a moisture content of 70 – 80% was maintained by regular watering. Worms were fed with different feeding materials at once per two days. Each experiment was replicated three times. The worms were collected and counted for every 7 days.

Evaluation of relative growth rate (RGR), biomass of maturation

To determine the growth rate, a distinct experiment was conducted for 30 days raising, the average of biomass was calculated at day 0, 10, 20 and 30. Moreover, the relative grow rate was projected by follow formula (1). After cultured experiment, the total number of worms was counted.

Formula (1): $RGR = \frac{\frac{W2}{X2} - \frac{W1}{X1}}{T2 - T1}$ (mg/individual/day)

Note: w: weight; x: sum of individual; t: day experiment.

Statistical analysis

Data were subjected for ANOVA analysis followed by Duncan's multiple-ranged tests to differentiate the statistical difference between results of RGR, biomass and earth worm population in different experiments.

3. Results and discussion

For the growth study, the biomass of every ten days were collected and calculated. The mean value for average weight in Sub1(A, B, C) and control was indicated in Table 2 and the significant difference were shown in p value ($p<0.05$). As the results, during the cultivating periods, the biomass of each experiment were slight increased. At the day 30, biomass was 42.08, 42.52, and 44.31 g for Sub1A, Sub1B and Sub1C, respectively, and significant higher than biomass of control, counting for 38.31 g. Even though,

the Sub1C showed the highest value of biomass at day 30, however, there were no significant difference between Sub1A, Sub1B and Sub1 C.

Table 2. The mean value for the maturation of *Perionyx Excavatus* in Sub1A, B, C and control

	Day 0	Day 10	Day 20	Day 30
Sub1A	20.02±0.07	29.12±0.16	35.50±0.02	42.08±1.05a
Sub1B	20.12±1.05	27.51±0.41	36.14±0.11	42.52±0.88a
Sub1C	19.98±0.02	26.89±0.56	37.12±0.07	44.31±0.62a
Cont	19.87±0.43	21.31±0.23	29.6±0.45	38.31±0.84b

Figure 1. Cultivating *Perionyx Excavatus* in Sub1.

Regarding Sub2A, Sub2B, Sub2C, the mean of weight (biomass) were showed in Table 3. According to Table 2, the mean of biomass was slight increased during days of cultivating. At the day 30, biomass was 33.46, 33.20, and 34.94 g for Sub2A, Sub2B and Sub2C, respectively. Comparing to control, even though the biomass was increased in Sub2A, Sub2B and Sub2C, but there were significant lower than control cultivating.

Table 3. The mean value for the maturation of *Perionyx Excavatus* in Sub2A, B, C and control

	Day 0	Day 10	Day 20	Day 30
Sub2A	21.47±0.43	22.21±0.34	27.69±0.78	33.46±1.47c
Sub2B	21.00±0.15	23.14±0.41	26.03±0.56	33.20±0.95c
Sub2C	20.47±1.14	24.69±1.02	31.26±1.06	34.94±0.82c
Cont	19.87±0.43	21.31±0.23	29.6±0.45	38.31±0.84b

Moreover, making comparison between Sub1 (A, B, C), Sub2 (A, B, C) and control, Sub1, which was the suspension of cow manure that helped to markedly increase biomass than the use of worm manure in culturing.

For the evaluation of reproductive patterns in different culture and feeding materials, at the end of cultivating period, day 30, the total of worms were collected and counted, showed in Table 3.

Figure 2. **The collection of worms for evaluation of total number of worms (arrow indicated cluster of worms).**

Table 3. The mean value for the total of *Perionyx Excavatus* in Sub1A, B, C, Sub2A, B, C and control

	Day 0	Day 30
Sub1A	154,67±6,60	164,00±9,42
Sub1B	155,33±4,78	170,33±9,67
Sub1C	139,00±5,10	161,00±11,52
Sub2A	156,33±13,27	170,33±13,77
Sub2B	153,33±4,11	169,00±10,71
Sub2C	152,67±3,68	162,33±1,25
Cont	142,67±11,09	156,33±7,93ns

Note: ns: none-sense

According to Table 3, at day 30, the number of worms in different culture and feeding materials were increased. However, there were no differences in number of worms in each experiment. It indicated that the weight of individual worm would be increased, this characteristic was evaluated via of relative growth rate (RGR) and showed in Table 4.

Table 4. The mean value for relative growth rate of *Perionyx Excavatus* in Sub1A, B, C, Sub2A, B, C and control

	relative growth rate (mg/individual/day)
Sub1A	4.58±0.55a
Sub1B	4.35±0.53a
Sub1C	4.74±0.65a
Sub2A	2.48±0.51c
Sub2B	2.39±0.55c
Sub2C	3.00±0.27bc
Cont	3.75±0.25b

The RGR in Sub1A, Sub1B, Sub1 C were higher than Sub2A, Sub2B, Sub2C and Cont. The significant differences were observed between Sub1 (A, B, C), Sub2 (A, B, C) and Control ($p<0.05$). The suspension of cow manure materials for Sub1 (A, B, C) was better than worm cultured materials for Sub2 (A, B, C) and control. Markedly, RGR in Sub2A, Sub2B and Sub2C were showed in the lower value than control. In other ways, the rate for growth of *Perionyx Excavatus* in Sub1A, Sub1B and Sub2B were higher than others, thus, it indicated that cow manure was facilities ingestion of earthworms. Due to no differences was determined between Sub1A, Sub1B and Sub1C, the more experiments have to be carried out by calculating the different ration between cow manure and adding substrate coir (Co), straw (St) and soil (So). Based on the results of calculating biomass, total number of worms, and RGR, it indicated that the culture materials as cow manure was the better, in current study, in *Perionyx Excavatus* raising.

4. Conclusion

In conclusion, the cow manure fed in cultured and feeding materials showed the good effect on the growth of earthworm via calculating biomass, amount of worms and relative growth rate, with significant differences from other group which based on worm manure as the substrate and feeding materials. In further study, the various ratio of adding substrate, including coir, straw or soil, have to be studied to found out the better ratio in culturing.

REFERENCES

Aslok, A., Soni, P., Tripathi, A. K. (2009). Role of Earthworms in breakdown of different organic wastes into manure: a review. *Dynamic Soil, Dynamic Plant.*, 3(2), 13-20.

Edwards, C. A., Dominguez, J., Neuhauser, E. F. (1998). Growth and reproduction of *Perionyx excavatus* (Perr.) (Megascolecidae) as factors in organic waste management. *Biol Fertil Soils*, 27, 155-161.

Gómez-Brandón, M., Lores, M., Domínguez, J. (2012). Species-Specific Effects of Epigeic Earthworms on Microbial Community Structure during First Stages of Decomposition of Organic Matter. *PLoS One.*, 7(2), e31895.

Hasanuzzaman, A. F. Md., Das, M., Rahman, G. M. Z., Huq, K. A. (2014). Production performance and nutritional composition of *Perionyx excavatus* (Perrier, 1872) Fed different composite organic food. *Molecular soil Biology*. 5(1), 1-8.

Prasad, M., (2011). Towards a green economy: Waste investing in energy and resource efficiency. Available on http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_8_Waste.pdf.

Senapati, B. K., Julka, J. M. (1993). Selection of suitable vermicomposting species under indian conditions. In: Ghost AK (Ed) *Earthworm Resources and Vermiculture*, Zoological Survey of India, Calcutta, 113-115.