ISSN 0976 – 3333

Available Online at www.ijpba.info

International Journal of Pharmaceutical & Biological Archives 2014; 5(2): 150 – 153

ORIGINAL RESEARCH ARTICLE

Studies on the Growth and Reproduction of *L. mauritii* during Vermicomposting of Jackfruit Leaf Litter with Bedding Material Mixture in Various Combinations

A. Revathi, G. Manimegala, K. Pugazhendy* and S. Prabakaran

Department of Zoology, Annamalai University, Annamalainagar – 608 002, Tamil Nadu, India

Received 11 Dec 2013; Revised 04 Apr 20143; Accepted 13 Apr 2014

ABSTRACT

The growth and reproduction of *Lampito mauritii* in different mixtures of jackfruit leaf litter (JLl) with bedding material (BM) were studied for a period of 60 days. *Lampito mauritii* during vermicomposting of JLl + BM were studied in five different treatments T1 (JLl 90 + BM 10), T2 (JLl 80 + BM 20), T3 (JLl 70 + BM 30), T4 (JLl 60 + BM 40), T5 (JLl50 + BM 50) and control. In all the experimental trails worms were weighed (15 mg/kg of medium) and inoculated in to the substrate. The treatments and control, the worms recorded significant increased of biomass, cocoon and hatchling production. The growth and reproduction rate of earthworms were higher in C and T4 when compared with other treatments, upto 60% of the JLl showed better growth and reproduction.

Key words: Vermicompost, Jackfruit leaf litter, *Lampito mauritii* and Biomass.

1. INTRODUCTION

Vermicomposting is a process of utilizing earthworms and it is an eco-biotechnological process that transforms energy rich complex organic substances into a stabilized humus – like product [1]. Earthworms are Annelidan Oligochaetes forming the major terrestrial macro fauna. They constitute more than 80% of the invertebrate biomass [2]. Jackfruit (*Artocarpus heterophyllus)* is one of the significant trees in tropical home gardens and perhaps the most widespread and useful tree. It can provide fallen fruit for livestock, shade and long – term timber. In home gardens, the dense jackfruit canopy provides visual screen and is also ornamental. Pressmud (also called as filter cake) is the residue of cake that is released during the sugarcane juice clarification process during the manufacture of raw sugar. The production of pressmud is normally 4-5 % of cane weight and 35 kg of pressmud per ton of cane.

Further through conventional composting of cattle dung, a significant amount of nitrogen (more than 50%) is lost by vitalization and leaching [3] also the accumulation of cattle dung near the living places lead to sanitation hygienic and pollution problems. Degradation of organic wastes by earthworm and recycling them in agriculture in the form of vermicompost are the recent developments in biological sciences [4, 5, 6].

The reproductive potential of earthworms as waste processor has been well established [7, 8, 9, 10]. But, this potentiality depends upon biomass production and reproduction capacity of those species selected for vermiculture. The growth and reproduction of *L. mauritii* during vermicomposting of JLI+BM were studied in five different treatment and control (BM alone). Hence an attempt has been made to investigate the growth and reproduction of *L. mauritii* with various combinations of bedding materials.

2. MATERIALS AND METHODS

L. mauritii were obtained from stock culture maintained in the department of zoology, Annamalai University. Jackfruit leaf litter were collected from different villages surrounding Neyveli, Tamil nadu and stored in jute bags. The dung was collected from dairy yard at the faculty of Agriculture, Annamalai University.

Jackfruit leaf litter and bedding material mixed with various combinations all the mixture were maintained at 65-70% moisture content. For each treatment six replicates were maintained.

*Corresponding Author: K. Pugazhendy, E-mail: pugalendy@gmail.com

Treatment substrates were prepared inn the following proportions on weight basis such as; T1 – JLI + BM (9:1), T2 – JLI + BM (8:2), T3-JJLI + BM (7:3) ,T4 – JLI + BM (6:4) and T5 – JLI + BM (5:5) alone was used as control (C). In the present study the feed substrates were allowed for 20 days of initial natural decomposition.

After 15 days 15.0 gram of adult clitellate *L. mauritii* were collected from the stock culture and introduced in control and treatment substrates. Once in 15 days interval up to 60 days weight of the worms (gram), number of cocoon and number of hatchlings were observed and recorded. The statistical significance of the data was tested by one-way ANOVA.

3. RESULTS

The growth and reproduction of *L. maruitii* were observed in different level of organic wastes (JL1, pressmud and cow dung).

(**Table 1-3**) shows the values obtained for different parameters of growth and reproduction of *L. maruitii.* Biomass (gram) of earthworms in general increased in control and T4 and T5 treatments. Over all the difference worm biomass were recorded (23.3± 1.6g), T4 (22.5±1.5g) and T5 (21.4±1.2g) on 60th day.

The capacity of cocoon production by *L. marutii* in leaf litter + bedding material mixture are given table 2 the inoculated adult clitellate worms started to produce cocoon and they were observed on 15th day in C,T1,T2,T3,T4 and T5. Among the all treatment the total number of cocoons were significantly higher in C (14.5±1.26), T4(40.8± 1.65) and T5 (34.9±1.36) than the other treatment it was followed by T3 (23.7±0.51) respectively. From the table significantly (P <0.05) differences were found in the cocoon production.

The numbers of hatchlings produced by the *L.mauritii* in various combinations are presented in Table 3. The hatchlings were observed in all treatments from 30 th day onwards. Among the various treatments the hatchlings were observed in C (total number 47.1±0.29) and T4 (total number 40.2±o.25). Hatchlings in other treatments are in the following order T5 (32.4 ±0.18)> T3 (23.8±0.09)> T2 (23.5±0.19)> T1 (11.2±0.15) respectively.

Table 1: Biomass (g) of *L. mauritii* during vermicomposting of jackfruit leaf litter – bedding material mixture

Substrate Proportions	Vermicomposting days				
	Initial (0)	15	30	45	60
C	15.1± 0.9	17.5 ± 0.6 c (16.2)	18.1 ± 0.9 d (19.8)	20.2 ± 1.2 cd (33.8)	23.3 ± 1.6 d (54.5)
T1	15.0 ± 0.6	15.1 ± 0.9 a (0.5)	15.4 ± 0.7 b (2.9)	16.3 ± 1.3 a (11.1)	17.9 ± 1.7 a (19.0)
T2	15.6 ± 0.9	15.4 ± 0.5 a (2.6)	16.0 ± 0.9 bc (6.4)	17.4 ± 1.0 ab (15.7)	18.2 ± 1.5 ab (20.9)
T3	15.2 ± 0.8	16.5± 0.7 b(10.1)	13.3 ±1.2 a (13.7)	18.2 ± 1.5 b (21.4)	20.6 ± 0.9 b (37.0)
T4	15.8 ± 0.6	17.2 ± 0.3 c (14.2)	18.0 ± 0.8 d (19.4)	19.6 ± 1.9 c (30.0)	22.5 ± 1.5 cd (49.4)
T5	15.7 ± 0.5	16.8 ±0.5 b(11.5)	17.2 ± 0.6 c (14.6)	18.5 ± 1.5 b (22.9)	21.4 ± 1.2 c (42.0)

Mean value followed by different letters is significantly different (ANOVA; Tukey's test, P <0.05); C– Control, T1 (JLI + BM)- 9 : 1, T2 ((JLl + BM) -8 :2, T3 (JLl + BM) -7 :3, T4 (JLl + BM) - 6:4, T5 (JLl + BM) - 5 :5. Initial (0) – Worm unworked initial Substrate, Mean ± SD of six observation. ( ) Percentage increase over the initial

Table 2: Cocoon production (number) of *L. mauritii* during vermicomposting of jackfruit leaf litter – bedding material mixture

Substrate Proportions	Vermicomposting days					
	Initial (0)	15	30	45	60	Total
C	ND	4.1± 0.14 cd	8.2 ± 0.21 e	13.1 ± 0.27 de	18.9 ± 0.36 de	44.5 ± 1.26 de
T1	ND	1.6 ± 0.27 a	2.1 ± 0.28 a	2.3 ± 0.28 a	7.6 ± 0.52 a	13.6 ± 0.51 a
T2	ND	2.6 ± 0.13 b	3.5 ± 0.16 b	6.9 ± 0.25 b	8.8 ± 0.81 ab	21.8 ± 1.28 b
T3	ND	2.1 ± 0.16 ab	4.9 ± 0.21 c	7.6 ± 0.21 bc	9.1 ± 0.61 b	23.7± 1.12 b
T4	ND	3.2 ± 0.19 bc	7.7 ± 0.17 de	12.3 ± 0.19 d	17. 6 ± 0.29 d	40.8 ± 1.65 d
T5	ND	3.8 ± 0.15 c	6.1 ± 0.16 d	10.4 ± 0.16 c	14.5 ±0.18 c	34.9 ± 1.36 c

Mean value followed by different letters is significantly different (ANOVA; Tukey's test, P <0.05); C– Control, T1 (JLI + BM) - 9 : 1, T2 ((JLl + BM) - 8 :2, T3 (JLl + BM) - 7 :3, T4 (JLl + BM) - 6:4, T5 (JLl + BM) - 5 :5; Initial (0) – Worm unworked initial Substrate, ND ; Not determine Mean ± SD of six observations

Table 3: Hatchlings production (number) of *L. mauritii* during vermicomposting of jackfruit leaf litter – bedding material mixture

Substrate Proportions	Vermicomposting days					
	Initial (0)	15	30	45	60	Total
C	ND	ND	6.4 ± 0.15 cd	14.3 ± 0.09 ef	23.4 ± 0.12 cd	47. 1 ± 0.29 ef
T1	ND	ND	1.3 ±0.09 a	4.9 ± 0.06 a	5.0 ± 0.09 a	11.2 ±0.15 a
T2	ND	ND	3.6 ± 0.15 b	6.1 ± 0.09 b	13. 8 ± 0.11 b	23. 5± 0.19 b
T3	ND	ND	4.2 ± 0.14 bc	8.5 ± 0.12 c	14. 1 ± 0.17 b	26. 8± 0.09 c
T4	ND	ND	5.3 ± 0.17 c	13. 2 ± 0.13 e	20. 3± 0.15 c	40. 2± 0. 25 e
T5	ND	ND	5.1 ± 0.09 c	11. 7 ± 0.16 d	15.6 ± 0.13 bc	32. 4 ± 0.18 d

Mean value followed by different letters is significantly different (ANOVA; Tukey's test, P <0.05); C– Control, T1 (JLI + BM) -9 : 1, T2 ((JLl + BM) -8 :2, T3 (JLl + BM) -7 :3, T4 (JLl + BM) -6:4, T5 (JLl + BM) (-) 5 :5. Initial (0) – Worm unworked Substrate, ND – Not determine; Mean ± SD of six observation

DISCUSSION

The enhanced growth (biomass) and reproduction (cocoon production and hatchlings) of *Lampito*

mauritii were observed in all the treatments and control. The higher biomass, cocoon and hatchlings number of earthworms were observed in C, (BM alone) and T4 (60% JL1 + 40% BM) than the other treatments T1, T2, T3 and T5. Kale *et al.* [11] found the growth of earthworms is depend, on the quality of the available food. *L. mauritii* on cow dung [12], *E. eugeniae* on sugar factory refuse [13].

E. eugeniae and *L. mauritii* on pressmud. Karmegam and Daniel [14] have reported elevated biomass and increased number of cocoons in *E. fetida* when they fed with *G. maculate* leaf litter litter + CD mixture. Chaudhuri *et al.* [15] have compared epigeic species of earthworms (*E. fetida, E. eugeniae, P. excavatus)* in vermiculture in north – east India reveals that fast growth and reproduction rate. Manivannan *et al.* [16] observed greater growth of the earthworms *E. eugeniae, P. excavatus, E. fetida* and *L. mauritii* in pressmud, trash, bagasse (PTB) in the mixture of 8 : 1 : 1 than the other proportions 9: 5 : 5, 7 : 2 : 1 , 7 : 1 : 2, 6: 2: 2: 6 , 1 : 3, 6 : 1 : 3. They added the enhanced growth and reproduction. Similarly, the present investigation was supported by the findings of Banu *et al.* [17] and Loh *et al.* [18] in which they have stated that the better growth of earthworms are due to more nutrients and friendly environment to earthworms.

Suthar [19] has emphasized that in addition to the estimation of biochemical properties of wastes, the microbial biomass and decomposition activities during vermicomposting, determining the worm biomass and cocoon production is also important. Recently Manimegala *et al.* [20] in *E. fetida* observed higher growth rate and they added in leguminous leaf litter it could be due to the higher N content. Manimegala *et al.* [21] stated the highest growth and reproduction of *Lampito mauritii* were observed in T_2 (FA 3: CLl 3.5 :L CD 3.5) fly ash mixed with cashew leaf litter and cow dung than the other mixture. Dharani *et al.* [22] stated the *E. eugeniae* showed superior growth in T4 (FA + HD (3: 7) than the other proportions. Falling in line with the present study Sorojini *et al.* [23] have indicated that the highest growth and reproduction of *E. fetida* in BM alone and 10% FA mixture with bedding material seems to be the better combinations than 20, 30, 40 and 50% FA. In the present study, it has been observed that JLl mixtures effectively supported the growth and reproduction of *Lampito mauritii* . From various treatments and control, the C and T4 mixture showed highest growth and reproduction.

ACKNOWLEDGEMENT

Authors are thankful to the authorities of Annamalai University and Head of the Department of zoology for providing necessary facilities to conduct the research.

REFERENCES

1. Benitez, E., Nogales, R., Masiandro, G., Ceccanti, B. 2000. Isolation by isoelectric focusing of humic – urease complexes form earthworm (*Eisenia fetida*) processed sewage sludges. *Biol. Fert. Soils.* 31: 489 – 493.
2. Senapati, B.K., Dash M.C. 1981. Effect of grazing on the elements of production in the vegetation and Oligochaeta components of a tropical pasture land. Rev Ecol. *Biol. Sol*. 18 : 487 – 505
3. Chinnasamy, K. 1994. Water hyacinth for production of biogas – a case study, M.E., Thesis, Annamalai University, India.
4. Graff, O. 1981 Preliminary experiments of vermicomposting of different waste materials using *Eudrilus eugeniae* (kinberg), In ; workshop on the role of earthworms in stabilization of organic residues (Appelhof, M., ed.). Malmazoo Michigan, PP. 179 – 191.
5. Edwards, C.A., Bohlen, P. 1995. Biology and ecology of earthworms. Chapman and Hall, New York.
6. Edwards, V.A., Burrows, I., Flectcher, E.K., Jones, B.A. 1985. The use of earthworms farm wastes. In: composting of agricultural and other wastes (Gasser, J.K. R., ed.) PP. 229 – 242.
7. Edwards. C.A. 1988. Breakdown of animal, vegetable and industrial organic wastes by earthworms. In: Earthworms in waste and Environmental management (Edwards, C.A., and E.F neuhauser, eds.) SPB Academic, The Hague, PP. 21 – 31.
8. Ramalingam, R. 1997. Studies on the life cycle, growth and population dynamics of *Lampito mauritii* (Kinberg) and *Eudrilus eugeniae* (Kinberg) cultured in different organic wastes and analysis of nutrients and microbes of vermicompost. Ph.D. Thesis, Annamalai University, India.
9. Sangwan, P., Koushik, C.P., Garg, V.K. 2008. Feasibility of utilization of horse

dung spiked filter cake in vermicomposters using exotic earthworm *Eisenia fetida Bioresour. Techo*. 99: 2442 – 2448.
10. Suthar, S. 2009. Vermicompostabilization of municipal sewage sludge amended with sugarcane trash using epigeic *Eisenia fetida* (Oligochaeta). J. Hazard. Mater. 163: 199 – 206.
11. Kale, R.D., Bano, K. 1992. Niche divergence – a limiting factor for recommendation of earthworms for biotechnology. Proc. Nat. Sem. Org. Fmg., Bangalore, pp. 42-44.
12. Kale, R.D., Mallesh, B.G., Bano, K., Bagyaraj, D.J. 1992. Influence of vermicompost application on the available macronutrients and selected microbial populations in a paddy field. *Soil Biol. Biochem*. 24 (12): 1317 – 1320.
13. Kale, R.D. 1994. Consolidated technical report of the ADHOC Scheme on promotion of vermicomposting for production of organic fertilizer. U.A.S., G.K.V.K. Bangalore, India.
14. Karmegam, N., Daniel. T. 2000. Decomposition of leaf litters using the compost worm, *Eisenia fetida*. Indian *J. Environ. Ecoplan.* 3(1): 111-116.
15. Chaudhuri, P.S., Pal. T.K., Bhattacharjee, G., Dey, S.K. 2003. Rubber Leaf litter (*Hevea brasiliensis.* Var RRM 600) as vermiculture substrate for epigeic earthworms. *Perionyx excavatus, Eudrilus eugeniae and Eisenia fetida, Pedobiol*. 47: 796-800.
16. Manivannan, S., Ramamoorthy, P.S., Parthasarathi, K., Ranganathan, L.S. 2004. Effect of sugar industrial wastes on the growth and reproduction of earthworms. *J. Exp. Zool.* India. 7: 29-37.
17. Banu, J., Esakkiraj, S., Nalndran, R., Logakanthi, S. 2005. Bio management of petrochemical sludge using an exotic earthworm *Eudrilus eugenia.* J Environ. *Biol.* 26 (1): 43 – 47.
18. Loh, T.C., Lee Y.C, Liang, L.B., Tan, D. 2005. Vermicomposting of cattle and goat manures by *Eisenia fetida* and their growth and reproduction preference. *Biores. Techno*l. 9: 111- 114.
19. Suthar, S. 2006. Potential utilization of guar gum industrial waste in vermicompost production. *Biores. Technol*. 97: 2474-2477.
20. Manimagala, G., Sarojini, S., Gunasakaran, G., Prakash, M., Parthasarathi, K., Ananthakrishnasamy, S. 2008. Role of *Leucaena glauca* leaf litter on the growth and reproduction of earthworms *Eisenia fetida*, Savigny. C.M.U. J. Nat. Sci. 7(2): 295-306.
21. Manimegala, G. Kavitha, V., Sarojini, S., Gunasekaran, G., Ravichandran, R.2009 Toxic effects of Lignite Fly ash During vermicomposting on the growth and Reproduction of Earthworm *Lampito mauritii. The inter. J. of Toxicol.* 7 (1) : PP.1-12.
22. Dharani, S., Manimegala, G., Gunasekaran, G., Ananthakrishnaswamy, S., Sarojini, S. 2010. "Vermicomposting of fly ash: a potential hazardous waste converted into nutritive compost by earthworm (*Eudrilus eugeniae*): *Int. J. Global Environmental Issues*. Vol, No.1 (375). PP 384 - 397.
23. Sarojini, S., Ananthakrishnasamy, S., Manimegala, G., Prakash, M., Gunasekaran, G. 2009. Effect of lignite fly ash on the growth and reproduction of earthworm *Eisenia fetida*. E. J. Chem. 6(2): 511-517.