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RESEARCH NOTE

Growth of *Eudrilus eugeniae* in *Pongamia pinnata* leaves mixed with three different animal wastes

C. SURENDAR[1] AND L. VEERAKUMARI[2]

[1]Marine Biology Regional Centre
Zoological Survey of India, Chennai, India
[2]PG & Research Department of Zoology
Pachaiyappa's College, Chennai, India
E-mail: surendar703@gmail.com

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Growth of *Eudrilus eugeniae* cultured in the organic wastes *Pongamia pinnata* leaves mixed with elephant dung, horse dung and cow dung was evaluated in terms of biomass and length of the worm. The control was maintained with *P. Pinnata*. Growth of *E. eugeniae* was observed for a period of 60 days. Measurements were taken once in 15 days interval. The maximum biomass and length was achieved in the worms reared in *P. pinnata* leaves mixed with cow dung. While steady increase in length was observed in all groups, fluctuated growth pattern was observed in biomass of the worms grown in elephant dung and horse dung on 30th and 45th days. After 45 days, the biomass showed upstream in worms reared in elephant dung but declined in worms reared in horse dung. The growth of the worms of all three experimental groups differed significantly from the control at 1% level analysed by students "t" test.

Key words: Cow dung, Elephant dung, Fishmeal

Fishmeal and fish oil are commonly used as a protein supplement and aquafeed. Their usage increased more than threefold from 1992 to 2003 (Tacon *et al.,* 2006). Their overall supply fixed worldwide but the demand has kept on increasing (Anon., 2003). In intensive aquaculture 60-80% of operational cost spent only for feed (Hasan *et al.*, 2007). So an alternative source is needed. Earthworms are good protein source and contain 60-70% of crude protein. Culturing earthworms as live fish food and supplement is advisable. Growth rate and nutritive value of *Labeo rohita* was high when fed with live earthworms than artificial feed (Balasubramanian *et al.,* 2016). A substrate which promotes the growth and reproduction of earthworms is essential for effective culture of the worms (Barik *et al.,* 2010). *Eudrilus eugeniae* (Kingberg, 1876), an epigeic earthworm is commonly found in all tropical and subtropical countries. It is one of the most and highly preferred earthworms in vermiculture for its quick conversion of large quantity of waste into compost, short life span, high reproductive capacity, ability to attain maximum biomass within a short period and high protein content. (Monebi and Ugwumba, 2013).

In the present investigation growth of *E. eugeniae* cultured in the organic wastes *Pongamia pinnata* leaves mixed with elephant dung, horse dung and cow dung was assessed. Active and disease free earthworm species of *E. eugeniae* were collected from Loyola college vermicomposting unit, Chennai, India. They were around 20-25 days old and 2.52±0.08 cm in length and 0.25±0.02 mg in weight. Leaves of *P. pinnata* were collected from Areva industrial ground, Chennai, India. Fresh elephant dung was collected from Sri Kanchi Kamakshi Amman Temple, Kancheepuram, Tamil Nadu, India. Fresh horse dung was collected from Guindy Race Course, Chennai, India. Fresh cow dung was collected from local cowherd's home at Chennai, India.

Freshly collected different dung and *P. pinnata* leaves (chopped) were allowed to mature separately for one month. Four wooden boxes of 50 × 40 × 20 cm size with holes at the bottom for the drainage of excess amount of water were kept in a clean, ventilated and predators free area. Tiny bricks of 2 inches thickness were placed at the bottom. Over the bricks, sand was placed up to a height of 2 inches. Above this red soil was added up to a height of 4 inches.

Matured *P. pinnata* leaves elephant dung, horse dung and cow dung were mixed separately in a ratio of 1kg:1kg as experimental group and the control was maintained without dung. Thirty active and disease free *E. eugeniae* were inoculated into the vermicontainer. The length and weight of the worms were measured before inoculation into the vermibed. Water was sprinkled over the verminbeds every day and maintained in a predators and disease free condition. The set up was maintained for 60 days and the biomass and length were noted once in 15 days as on 1st, 15th, 30th, 45th and 60th days. The growth of worms in terms of biomass and length were analysed by students't' test.

The growth pattern of *E. eugeniae* in *P. pinnata* leaves mixed with elephant dung, horse dung and cow dung and control are shown in the table 1, figures 1 and 2. Significant ($P<0.01$) increase in biomass and length was observed in all three experimental groups.

The maximum increase in biomass was observed in cow dung with net gain 1.74 ± 0.01mg followed by elephant dung (0.41±0.02 mg), horse dung (0.40±0.01 mg) and control (0.40±0.01 mg) (Table 1 and figure 1). The linear increase in biomass was observed in worms cultured in cow dung. Growth and reproduction of *Eisenia foetida* is quick in cow dung which is commonly used as the best feed for earthworms (Barik *et al.,* 2010). Suthar (2007) also reported remarkable increase in the biomass of *Perionix excavatus* cultured in cow dung combined with mixed crop residues.

No apparent gain in biomass was observed in *E. eugeniae* reared in elephant dung and horse dung on 30th and 45th day. On 60th day the worms cultured in elephant dung resumed to increase in biomass but decline in biomass was observed in worms cultured in horse dung. Dominguez *et al.* (2000) also reported the stabilization after the initial body weight increment and latter decreased in the culture of *Eisenia andrei* in sewage sludge with different bulking material. This stabilization in biomass may be due to the onset of reproduction utilization of more energy for cocoon production besides growth.

Table 1. Growth of *Eudrilus eugeniae* in *Pongamia pinnata* leaves mixed with elephant dung (ED), horse dung (HD), cow dung (CD) and control (C)

Measurements	Animal wastes	1st day	15th day	30th day	45th day	60th day	Net gain
	ED*	0.24±0.01	0.40±0.02	0.39±0.03	0.39±0.02	0.65±0.03	0.41±0.02
Weight in mg	HD*	0.25±0.02	0.50±0.02	1.19±0.01	1.19±0.03	0.65±0.03	0.40±0.01
	CD*	0.25±0.01	0.50±0.02	1.20±0.02	1.59±0.02	1.99±0.02	1.74±0.01
	C	0.25±0.02	0.30±0.02	0.39±0.02	0.80±0.02	0.65±0.03	0.40±0.01
	ED*	2.52±0.08	4.4±0.01	5.4±0.07	5.68±0.13	6.34±0.09	3.82±0.01
Length in cm	HD*	2.4±0.12	3.76±0.05	4.7±0.1	6.0±0.12	6.32±0.16	3.92±0.04
	CD*	2.44±0.15	3.66±0.17	4.96±0.11	6.86±0.11	7.12±0.08	4.68±0.07
	C	2.52±0.08	3.78±0.08	4.82±0.08	5.82±0.08	6.26±0.05	3.74±0.03

All values are the mean and standard deviation of five replicates

* Denotes significance at 1% level (Students 't' test)

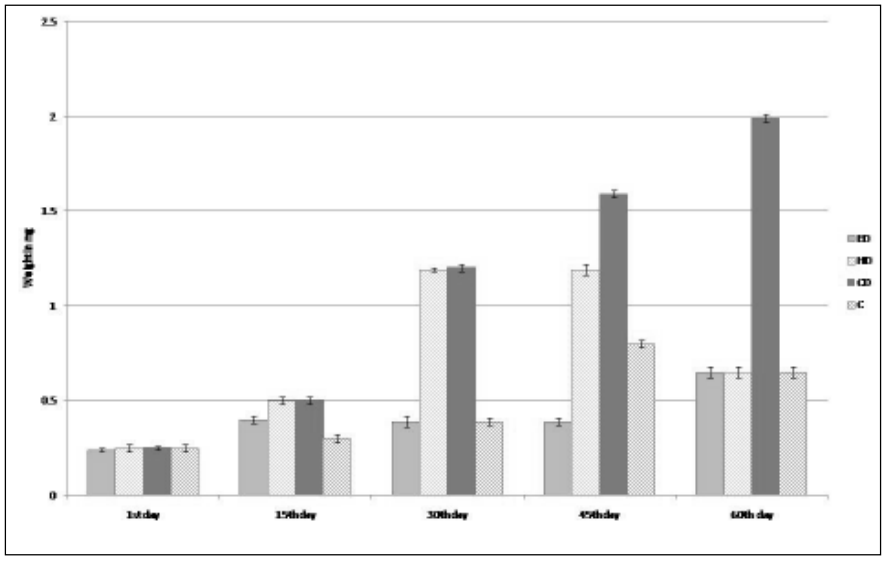

Fig.1. Weight gain in *E. eugeniae* reared in *P. pinnata* leaves combined with elephant dung (ED), horse dung (HD), cow dung (CD) and control (C)

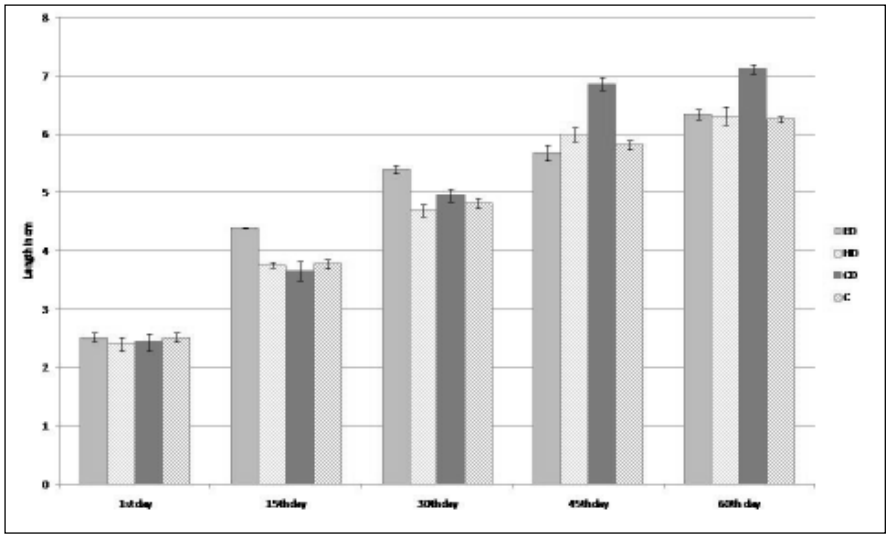

Fig. 2. Length gain in *E. eugeniae* reared in *P. pinnata* leaves mixed with elephant dung (ED), horse dung (HD), cow dung (CD) and control (C)

Nowak (1975) reported steady increase in biomass in juvenile stage, decrease and fluctuated improvement in reproductive stage and slow and decreased biomass in post reproductive stage.

The worms cultured in cow dung showed steady increase in biomass, which clearly indicate its nutritional availability, increased growth pattern even in pre and post reproductive periods. Significant increase in biomass was observed in control (*P. pinnata* alone) which indicates *P. pinnata* supports the growth of *E. eugeniae*. Preference of leaf litter was determined by C: N ratio. *P. pinnata* leaves contains 33: 1 ratio of C: N (Barik *et al.,* 2010).

Steady and linear increase in length was observed in all three experimental group and control irrespective of biomass changes. The mean net gain in length of the worm was high (4.68±0.07 cm) in *P. pinnata* leaves mixed with cow dung followed by horse dung (3.92±0.04 cm), elephant dung (3.82±0.01 cm) and control (3.74±0.03 cm) (Table 1and figure 2).

The growth of worms increase in terms of biomass and length differ significantly from control at 1% level when the data were analysed by students't' test.

From the present study, it could be concluded that cow dung is the most preferable substrate when compared with elephant dung and horse dung to mix with the *P. pinnata* leaves. *P. pinnata* leaves promote growth of *E. eugeniae* and have no harmful effect. *P. pinnata* leaves mixed with cow dung is the best substrate to culture *Eudrilus eugeniae* which could be used as live aquaculture protein supplement.

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