Indian Journal of Weed Science **47**(4): 411–413, 2015

Biological activity of red wriggler earthworm on different ratio of weed and dung as mixtures substrate

Anu Verma and Irvinder Kaur*
Department of Botany, SGN Khalsa P.G. College, Sri Ganganagar, Rajasthan 335 001

Received: 21 July 2015; Revised: 25 October 2015

ABSTRACT

This study identifies the utilization of common weed *Chenopodium murale* as raw material for vermiculturing. Growth and cocoon production in each mixture was recorded weekly for 18 weeks. Significant variations in food preference were observed in worm when the cattle dung was mixed with weed in different combination. The present study revealed that addition of weed in cow dung not only enhanced the growth of the worm but also increased cocoon production thus providing a possible tool towards proper utilization of weed for production of value added product.

Key words: Biological activity, Earthworm, Vermicompost, Weed utilization

Eradication of weeds has been proved to be impossible in spite of the sincere efforts of the scientists and technologists. However; these materials are actually the reservoir of the nutrients that are required for plant growth. The problem lies that these nutrients are in the form of complex, bound organic chemicals with strong bonds. There is a good evidence that organic matter that pass through the gut of earthworm and deposited on or in the soil in the form of casts possessed higher amounts of nutrients than that of the substrates or soil on which the earthworms feed (Reddy *et al.* 1997). Moreover, the nutrients are changed to assimilable forms in the gut, that are more rapidly taken up by plants (Lee 1985).

Chemical substances present in the food attract and elicit feeding responses in many invertebrates. Flavour potentiators or modifiers in food exert gustatory effect not only in man but also in other animal. The existence of such cues in earthworm can be deduced as they show preference to the nature of organic matter (Kale and Krishnanmoorthy 1981).

Considerable work has been carried out on the use of earthworms to recycle various organic wastes. However, there is not much published report available regarding the vermicomposting of weeds. This work presents the dynamics of *E. foetida* earthworm populations during vermicomposting of weed *Chenopodium murale.*

MATERIALS AND METHODS

Fecundity study of earthworm species *Eisenia foetida* during vermicomposting of selected weed and its different parameters was carried out. 300 gm of feed mixture was taken in plastic containers of 500 gm capacity In different ratio of weed *Chenopodium murale* and cow dung (Table 1). All the treatments were kept in triplicate and same setup without earthworm were also maintained which served as control. All the treatment containers were left for 15 days prior to experimentation for thermal stabilization and softening of wastes for easy ingestion by the earthworm. The water was sprinkled over the feed mixture on alternate day to hold moisture content of about 60 to 80%. After 15 days, 10 healthy non-clitellated red wriggler earthworm weighing 150 to 300 mg were selected from stock culture and introduced in each container. To prevent moisture loss, the containers were covered with wet gunny begs. All containers were placed in dark at room temperature. No additional food was added at any stage during the study period.

Table 1. Content of weed with cow dung in initial feed mixture

Treatment	Feed composition	
	Weed %	Cow dung %
C_1	0	100
C_2	20	80
C_3	40	60
C_4	60	40
C_5	80	20

Fresh cow dung was procured from village, The main characteristics of Cow dung were: pH: 7.73, organic carbon Cow dung: 362.31g/kg, total kjeldhal nitrogen (TKN): 6.5 g/kg, total phosphorus (TP): 4.2 g/kg, total potassium: 5.11 g/kg, C:N ratio: 55.65, calcium (Ca): 3.2 g/kg, and C:P ratio: 84.65.

Growth and cocoon production in each mixture was recorded weekly for 18 weeks. The feed in the

***Corresponding author:** ikkocharbot@gmail.com
S.B.D. Govt. P G College, Sardarshahar, Gujarat 331 403

containers was turned out and earthworms and cocoons were separated from the feed by hand sorting, after which they were counted and weighed after washing with water and drying them by paper towels. The worms were weighed without first voiding them, since it has been reported that the gut content would lie around 10% of live weight, where as larger differences are expected in relation to feed (Neuhauser *et al.* 1980). Corrections for gut content were not applied to any of the data in the study. Then all measured earthworm and feed (but not cocoons) were returned to the containers.

At the end of vermicomposting period the earthworms and cocoons were separated and final compost from each reactor was air dried at room temperature. Homogenized samples of final compost were ground in a stainless steel blend, stored in airtight plastic vials for further chemical analysis.

RESULTS AND DISCUSSION

No mortality was observed in any of the feed mixture. Gunadi and Edwards (2003) have reported the death of *Eisenia foetida* after 2 weeks in fresh cattle solids, although physiochemical properties were suitable for the growth of the earthworms. They attributed the deaths of earthworms to the anaerobic conditions which developed after 2 weeks in fresh cattle solids. In our experiments, all the weed feed mixture were pre composted for 2 weeks and during this period all the toxic gases produced might have been eliminated. It is established that pre-composting is essential to avoid the deaths of the worms.

The change in biomass and cocoon production differed depending on the substrates. at deferent all the feed mixtures (Table 2). The maximum biomass (1049 ± 4.15 mg) after 120 days was observed in 20:80 ratio (20:80 ratio) treatment and minimum biomass (993 ± 5.19 mg) in 100% cow dung. All the compositions showed increase in biomass with respect to control. The increase was linear up to 12 months but after that it showed a decline trend.

The maximum weight by earthworm was attained in 11th - 14th week in all the treatments. The fastest growth rate was observed in 40:60 ratio treatment (11 ± 0.10 mg/worm/day) whereas 60:40 ratio treatment supported the least growth (8 ± 0.05 mg/worm/day). The maximum growth rate of *Eisenia foetida* was registered between the range of 8 ± 0.05/earthworm/day (in 60:40 ratio treatment) to 11 ± 0.10/earthworm/day (in 40:60 ratio treatment). The net weight gain by worm was highest in 60:40 ratio treatment (834 ± 6.29 mg/worm) and lowest in 0:100 ratio treatment (777 ± 7.21 mg/worm) (fig. 1). Increasing proportion of weed in the feed mixture promoted a decrease in biomass of *Eisenia foetida.* The loss in worm biomass can be attributed to the exhaustion of food. When *Eisenia foetida* received food below a maintained level it lost weight at a rate which depended upon quantity and nature of

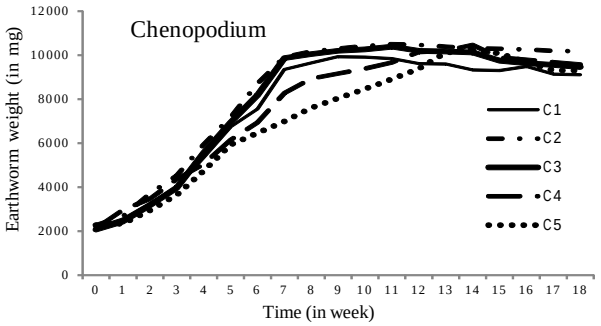

Fig. 1. Growth pattern of earthworm in different feed mixtures

Table 2. Earthworm growth in different feed mixtures of cow dung with *Chenopodium murale* weed

Feed no.	Mean initial wt./worm (mg)	Maximum wt. achieved/worm (mg)	Maximum wt. achieved in	Net wt. gain/worm (mg)	Growth rate/worm/day (mg)
C_1	216 ± 3.96	993 ± 5.19	12th Week	777 ± 7.21	9 ± 0.08
C_2	226 ± 3.96	1049 ± 4.15	11th Week	823 ± 7.67	10 ± 0.09
C_3	207 ± 3.46	1038 ± 5.27	11th Week	831 ±8.60	11 ± 0.10
C_4	212 ± 3.22	1046 ± 3.10	14th Week	834 ± 6.29	8 ± 0.05
C_5	227 ± 2.94	1021 ± 4.38	14th Week	794 ± 7.22	8 ± 0.06

Table 3. Cocoon production in different feed mixtures of *Chenopodium murale*

Feed no.	Cocoon production started in	Total nos. of cocoons after 11 weeks	Nos. of cocoons produced/earthworm	Nos. of cocoons produced/earthworm/day
C_1	6th Week	143 ± 1.40	14.3 ± 0.13	0.34 ± 0.004
C_2	5th Week	137 ± 0.94	13.7 ± 0.09	3.91 ± 0.02
C_3	5th Week	170 ± 0.46	17.0 ± 0.05	4.86 ± 0.005
C_4	5th Week	159 ± 0.46	15.9 ± 0.05	4.54 ± 0.002
C_5	6th Week	120 ± 1.40	12.0 ± 0.13	2.85 ± 0.02

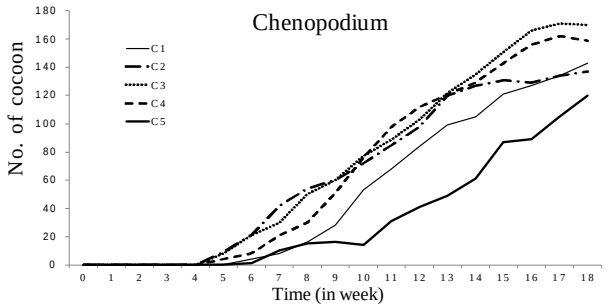

Fig. 2 Cocoon production in feed mixture of *Chenopodium murale* with cow dung

ingestible substrates Neuhauser *et al.* (1980). However, Dominguez *et al.* (1997) reported a decrease in worm biomass even when additional food was added to the experiment every week.

Cocoon production started in 6th week in 100% cow dung; in 7th week in other feed mixtures except 80:20 ratio treatment (6th week). After 120 days maximum cocoons (170 ± 0.46) were counted in 40:60 ratio treatment and minimum (120 ± 1.40) in 80:20 ratio treatment (Fig. 2). The mean number of cocoon production was between 12.0 ± 0.13 (in C_5 treatment) and 17.0 ± 0.05 (in C_3 treatment) cocoons earthworm^{-1} for different feed mixtures tested as shown in (Table 3).

Cocoon production fluctuated with time. Initially cocoon production rate was high. The range of mean number of cocoons produced per worm per day was 0.34 ± 0.004 in cow dung to 4.86 ± 0.005 in 40:60 ratio treatment. The difference between the rates of cocoon production could be related to the biochemical quality of the feeds,which is an important factor in determining the time taken to reach sex maturity and onset of maturity (Edwards *et al.* 1998). Feeds which provide earthworms with sufficient amount of easily metabolizable organic matter and non assimilated carbohydrates favour growth and reproduction. Parthasarathi (2007) examined the growth and reproduction of indigenous *Lampito mauritii* in comparison with exotic *Eudrilus eugeniae* cultured on three feed substrates-clay loam soil, cowdung and press mud (filter cake) over a period of 360 days under laboratory conditions. The decrease of worm length and biomass observed slightly on 63-70th days in *Lampito mauritii* and 42-49th days in *Eudrilus eugeniae*. After 270 days both worms in all these fed substrates showed decreasing trends of length and biomass which were due to continued reproduction and aging. It was observed that both weight gain and cocoon production was more when *Chenopodium murale* weed was mixed with pure cowdung. It indicated that *Chenopodium murale* weed is a good biomass and reproduction supporting medium which can be used effectively for culturing *Eisenia foetida* as well as recycling of weed material for production of vermicompost when mixed with pure cowdung. Weed strongly influenced the biology of *Eisenia foetida*. Net biomass gain by earthworm in different feed mixture was in order of $C_4 > C_3 > {}_2 > C_5 > C_1$ and that of cocoon production of $C_3 > C_4 > C_2 > C_1 > C_5$. Therefore, there is a need to divert research activities to expore the potential of different weeds as a raw material for vermicomposting their utilization and to design a national level policy for their proper utilization.

REFERENCES

Chan PLS and Griffiths DA. 1988. Vermicomposting of pretreated pig manure. *Biological wastes* **24**(1): 57-69.

Chaudhary PS, and Bhattacharjee G. 2002. Capacity of various experimental diets to support biomass and reproduction of *Perionyx excavates*. *Bioresource Technology* **82**: 147-150.

Dominguez J and Edwards CA. 1997. Effects of stocking rate and moisture content on the growth and maturation of *Eisenia andrei* (Oligochaeta) in pig manure. Soil Biology and Biochemistry **29**(3&4): 743-746.

Edwards CA and Burrows I. 1989. The potential of earthworm Compost as plant growth media. pp. 211-219. In: *Earthworms in Waste and Environmental Management*. SPB Academic Publishing, The Hague.

Edward CA, Dominguez J, Neuhauser EF. 1998. Growth and reproduction of *Perionyx excavates* (Perr.) (Megascolecidae) as factors in organic waste management. *Biology and Fertility of Soils* **27**: 155-161.

Gunadi B, Edwards CA. 2003. The effect multiple applications of different organic wastes on the growth, fecundity and survival of *Eisenia foetida* (Savigny) (Lumbricidae). *Pedobiologia* **47**(4): 321-330.

Kale RD and Krishnamoorthy RV. 1981. Litter preferences in the earthworm *Lampito maurittii*. *Proceedings of the Indian Academy of Sciences Animal Science* **40**(1): 123-128.

Kale RD, Bano K and Krishnamoorthy RV. 1982. Potential of *Perionyx excavates* for utilizing organic wastes. *Pedobiologia* **23**: 419-425.

Lee KE. 1985. *Earthworms*: *Their Ecology and Relationships with Soils and Land use.* Academic press, Australia, 411.

Loh TC, Lee YC, Liang JB, Tan D. 2004. Vermicomposting of cattle and goat manure by *Eisenia foetida* and their growth and reproduction performance. *Bioresource Technology* **96**: 111-114.

Neuhauser EF, Hartenstein R, Kaplan DL, 1980. Growth of the earthworm *Eisenia foetida* in relation to population density and food rationing. *OIKOS* **35**: 93-98.

Parthasarathi K. 2007. Life cycle of Lampito mauritii (Kinberg) in comparison with *Eudrilus eugeniae* (Kinberg) cultured on different substrates. *Journal of environmental biology* **28**(4): 803-812.

Reddy MV, Balashouri P, Kumar VPK, Cogle AL, Yule DF and Babu M. 1997. Response of earthowrm abundance and production of surface casts and their physico-chemical properities to soil management in relation to those of an undisturbed area in a semi-arid tropical Alfisol. *Soil Biology and Biochemistry* **29**: 617-620.