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VERMICOMPOSTING EFFICIENCY OF SOME INDIGENOUS EARTHWORM SPECIES FOUND IN EASTERN UTTAR PRADESH

INDRAJEET[1]

Department of Entomology, Sri Durga Ji P.G. College, Chandeshwar, Azamgarh, Uttar Pradesh, India

ABSTRACT

Earthworms are recognized as efficient bioconverters of all types of organic residues. Biodegradation of rural residues, household garbage, sewage sludge and wastes from agro- industries by earthworms is an attractive proposition to regenerate valuable organic manure with minimization of environmental pollution. Attempts were made to culture several species of collected earthworms in plastic trays (50x30x15cm) using cattle manure as bedding material. The indigenous earthworm species, *Amynthus morrisi, Dichogaster bolaui* and *Octochaetona surensis* were identified as potential vermicomposting species. The data on their vermicomposting potential indicated the substantial increase in carbon and nitrogen as well as decrease in the C:N ratio of all the cultures after 150 days of worm inoculation in bedding material. The vermicompost produced by the activities of all the above species of earthworms were very rich in carbon (6.8-8.8%), nitrogen (0.9-1.3%) and having C:N ratios of 6.6-9.0. The C:N ratio below 20 enhances the nutrient mineralization in soil which promotes the availability of plant nutrients.

KEYWORDS: Indigenous Earthworm, Biodegradation, Bioconverter, Vermicompost, Vermitech, Bedding Material

Earthworms are the wonderful zoo beneath our feet known to man ever since he started soiling his hand. Earthworm intake organic waste and discharge valuable product known as vermicast/vermicompost. The process of vermicomposting is many times faster than the best composting system and this was resulted in lower EC, C:N ratio, was significantly lower, N content higher as well as by a more gradual release of P, which made the vermicompost more suitable substrates for agronomic purposes (Lazcano *et al.*, 2008) and product is much superior in quality and the pH of vermicompost is also almost neutral. Vermicomposting is a technique for recycling organic wastes which can be efficiently carried out by the layperson. This is high time to develop low cost vermiculture biotechnology. The low cost technology is very suitable for Indian farmers, housewives and also to the small scale industries for production of organic manure. The system has no environmental impact, low operating and with no maintenance cost. The mass conversion of waste material in to vermicompost would also minimize the environmental pollution by recycling the garbage (Ramnarain *et al.*, 2019). Since our country is very rich in earthworm resources, the common and potential indigenous species may be included in vermiculture programme for an economical and productive manuring. The Indian worms like *Lampito mauritii, Drawida calebi, Amynthus morrisi, Pheretima sp., Perionyx sansibaricus* etc., can be utilized for vermitech system.

MATERIALS AND METHODS

Attempts were made to culture several species of collected earthworms in plastic trays (50x30x15cm) using cattle manure as bedding material. Pilot experiments resulted in better survival of *Amynthus morrisi, Dichogaster bolaui and Octochaetona surensis* as compared to other species. Therefore, these three species were tested for their vermicomposting efficiency in cattle manure for the experiment. One week old cattle manure used for rearing the earthworms. Three replications of each group were arranged randomly. The culture media in plastic trays were prepared one week prior to adding earthworms and sprinkling of water was done on alternate days to induce decomposition. Fifty worms were added in each experimental pot on the top of bedding materials. The culture pots were covered with gunny bags and kept under glass house. The bedding materials were inverted and reshuffled every 15 days to aerate the culture media. The C and N of bedding materials were measured at 0 day and 150 days of the worm inoculation.

RESULTS AND DISCUSSION

The indigenous earthworm species, *Amynthus morrisi, Dichogaster bolaui and Octochaetona surensis* were identified as potential vermicomposting species. The data on their vermicomposting potential is depicted in table 1.The table shows the substantial increase in carbon and nitrogen as well as decrease in the C:N ratio of all the cultures after 150 days of worm inoculation

[1]**Corresponding author**

in bedding material. The vermicompost produced by the activities of all the species of earthworms were very rich in carbon (6.8-8.8%), nitrogen (0.9-1.3%) and having C:N ratios of 6.6-9.0.

Since, India is very rich in earthworm resources; the common indigenous species may be identified for their vermicomposting potential and can be used in organic waste management programme. Vermicomposting, the conversion of organic waste in to vermicompost is mediated by the combined action of earthworms and microorganisms. It is the process of generating compost by using earthworms to turn the organic waste in to superior quality compost that consists mainly of wormcast in addition to decayed organic matter (Das *et al.*, 2020) (Devi and Prakash, 2015). Vermicompost, an organic fertilizer rich in N P K, micronutrients and beneficial soil microbes (nitrogen fixing and phosphate solubilizing bacteria and actinomycetes), is a sustainable alternative to chemical fertilizer, which is an excellent growth promoter and protector for crop plants (Ramnarain *et al.*, 2019). Several species have been evaluated for their potential use in vermicomposting, including *Eisenia andrei, E. fetida, Dendrobaena veneta, D. hortensis, Eudrilus eugeniae and Perionyx excavates* (Dominguez, 2018). At Pune, *Polypheretima elongata*, locally available species, is used for vermicomposting (Bhawalkar U.S., 1994). *Lampito mauritii, Octochaetona serrata, O. thrustoni and Perionyx excavatus* were successfully used in vermicomposting programme (Ismail S.A., 1986). Some indigenous species of earthworms were reported in eastern part of Uttar Pradesh and among them *Lampito mauritii, Drawida willsi, D. calebi, Amynthus morrisi, Dichogaster bolaui and Perionyx sansibaricus* were identified as vermicomposting species (Singh and Rai, 2000). The role of some tropical earthworms *Lampito mauritii, Pheretima elongata, Pontoscolex corethrurus and Perionyx excavatus* were recognized in leaf litter breakdown (Krishnamoorthy, 1986). In the present investigation the earthworms, *Amynthus morrisi, Dichogaster bolaui and Octochaetona surensis* were identified for vermicomposting with the help of literature cited and were tested for their vermicomposting efficiency.

Table 1 showed the vermicomposting efficiency of some earthworm species which were found in the locality of eastern Uttar Pradesh. The culture of *Amynthus morrisi, Dichogaster bolaui and Octochaetona surensis* in the cattle manure showed moderate decomposition (decrease in C:N ratio) and nitrogen mineralization. Thus the *A. morrisi*, *D. bolaui* and *O. surensis* were recognized as potential species for vermicomposting but were slow vermicomposter. It was emphasized that *Perionyx excavatus* as the most suitable earthworm species for laboratory culture (Kale and Bano, 1985) whereas, it was also reported that *Drawida willsi* was better for vermicomposting than *Lampito mauritii* and *Octochaetona surensis* (Dash and Senapati, 1985).

Table 1: Vermicomposting efficiency of indigenous earthworm species, found in eastern Uttar Pradesh

Species/Bedding material	No. of worm inoculated	Days after inoculation	Chemical composition of bedding materials		
			C	N	C/N ratio
Amynthus morrisi (cattle manure)	50	0	1.67 (0.17)	0.12 (0.01)	13.92
		150	8.10 (1.13)	0.93 (0.05)	8.71
Dichogaster bolaui (cattle manure)	50	0	1.67 (0.17)	0.12 (0.01)	13.92
		150	8.80 (1.18)	0.95 (0.07)	9.26
Octochaetona surensis (cattle manure)	50	0	1.67 (0.17)	0.12 (0.01)	13.92
		150	7.95 (1.10)	0.87 (0.04)	9.13

Note: The data in parenthesis represents the mean ± SEM of three replications.

The present findings are also in agreement with the reports of various workers (Ansari *et al.*, 2016) (Das *et al.*, 2012) (Devi and Prakash, 2015) (Reineck *et al.*, 1992) (Singh, 1997) who demonstrated more or less similar changes in the chemical composition of earthworms bedding material as a results of eating activity. The earthworms culture showed a decrease in the C:N ratio (Dash and Senapati, 1985). This have also been documented an increase in C, N and decrease in the C:N ratio of culture soil after worm inoculation (Julka and Mukherjee, 1986). The vermicompost contains essential micronutrients and promotes the availability of plant nutrients like N P K (Ansari *et al.*, 2016) (Das *et al.*, 2012).

Overall, the chemical composition of the vermicompost produced by the activities of the earthworms tested for their vermicomposting efficiency was somewhat better than the widely acclaimed Cuban worm humus (Lazcano *et al.*, 2008) (Rosset and Benjamin, 1993). Therefore, the composting efficiency of these earthworm species (*Amynthus morrisi, Dichogaster*

bolaui and Octochaetona surensis) may be effectively utilized in vermitechnology as one of the important component of organic farming (Ansari *et al.*, 2016) and sustainable agriculture in India.

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REFERENCES

Ansari A., Jaikishun S., Islam S.K., Kuri K.F. and Nandwani D., 2016. Principles of vermitechnology in sustainable organic farming with special reference to Banladesh. *In*: Nandwani, D.(eds), Organic Farming for Sustainable Agriculture: Sustainable Development and Biodiversity, **9**:213-219.

Bhawalkar U.S., 1994. Converting wastes in to resources. ILEIA Newsletter, **10**(3):20-21.

Das D., Bhattacharya P., Ghosh B.C. and Banik P., 2012. Effect of vermicomposting on calcium, sulphur and some heavy metal content of different biodegradable organic wastes under liming and microbial inoculation. J. Environ. Sci. Health Biol, **47**(3):205-211.

Das S., Goswami L. and Bhattacharya S.S., 2020. Vermicomposting: earthworms as potent bio-resources for biomass conversion. In: Current developments in Biotechnology and Bioengineering: Sustainable Bio-resources for the Emerging Bio-economy (eds: Rupam Kataki, Ashok Pandey, Samir Kumar Khanak and Deepak Kant), pp.79-102.

Dash M.C. and Senapati B.K., 1985. Vermitechnology: Potentiality of Indian earthworms for vermicomposting and vermifeed. In: Soil Biology (eds: M.M. Mishra and K.K. Kapoor), pp.61-69.

Devi J. and Prakash M., 2015. Microbial population dynamics during vermicomposting of three different substrates amended with cow dung. Int. J. Curr. Microbial Appl. Sci, **4**(2):1086-1092.

Dominguez J., 2018. Earthworms and Vermicomposting. Earthworms- The Ecological Engineers of Soil (ed. Sajal Ray), pp. 63-75.

Ismail S.A., 1986. Earthworm resources of Madrash. In: Proc. Nat. Sem. Org. waste Utiliz. Vermicomp. Part B. Verms and Vermicomposting (eds: M.C. Dash, B.K. Senapati and P.C. Mishra, Five star printing press, Burla), pp.8-15.

Julka J.M. and Mukherjee R.N., 1986. Preliminary observation on the effect of *Amynthus diffringens* (Baird) on the C/N ratio of the soil. Proc. Nat. Sem. Org. Waste Utiliz. Vermicomp. Part B: Verms and Vermicomposting, pp. 66-68.

Kale R.D. and Bano K., 1985. Laboratory propagation of some indigenous species of earthworm. Journal of Soil Biology and Ecology, **5**(1): 20-25.

Krishnamoorthy R.V., 1986. Role of some tropical earthworms in nutrient cycling. Proc. Nat. Sem. Org. Waste Utiliz. Vermicomp. Part B: Verms and Vermicomposting, pp.47-65.

Lazcano C., Gomez-Brandon M. and Dominguez J., 2008. Comparison of the effectiveness of composting and vermicomposting for the biological stabilization of cattle manure. Chemosphere, **72**(7):1013-1019.

Ramnarain Y.I., Ansari A.A. and Ori L., 2019. Vermicomposting of different organic materials using the epigeic earthworm *Eisenia foetida*. Int. J. of Recycling Organic Waste in Agriculture, **8**:23-36.

Reineck A.J., Viljoen S.A. and Saayman R.J., 1992. The suitability of *Eudrilus eugeniae*, *Perionyx excavatus* and *Eisenia fetida* (Oligochaeta) for vermicomposting in Southern Africa in terms of their temperature requirements. Soil Biol. Biochem., **24**:1295-1307.

Rosset P. and Benjamin M., 1993. Two steps backwards, one step forwards: Cuba's nationwide experiments with organic agriculture. Global Exchange, San Francisco, pp.67.

Singh J., 1997. Habitat preferences of selected Indian earthworm species and their efficiency in reduction of organic materials. Soil Biol. Biochem, **29**(2/3):585-588.

Singh J. and Rai S.N., 2000. Earthworm farming and vermicomposting: A boon for sustainable agriculture. Journal of Soil Biology and Ecology, **17**(1):65-72.