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Short Communication

Vermicompost potential of various local earthworm species of Jammu (India) on kitchen waste

Deepshikha Sharma
Department of Environmental Science, Govt. Degree College, Kathua, J&K-184101, India
deepshiusa@gmail.com

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Abstract

Human society is producing a huge quantity of solid waste with major portion of kitchen waste, which needs to be managed to keep the environment clean. Although a large number of waste management technologies are available, their applications are limited due to high cost of erection and power requirement. To deal with the overgrowing menace of kitchen waste pollution, bioconversion of kitchen waste was carried out in controlled conditions using local earthworm species. The present study was conducted to calculate the vermitechnological potential of three local earthworm species of Jammu on kitchen waste. The study reported Octolasion tyrtaeum to be highly efficient for the production of vermicompost from kitchen waste as well as maximum increase in earthworm biomass.

Keywords: Kitchen waste, vermicomposting, earthworms, potential.

Introduction

Kitchen waste generation is one of the important type of environmental pollution. As villages grew into towns and then cities it became common practice to throw waste into the access ways, water ways and vacant plots. Unsafe disposal of kitchen waste is posing a serious threat to the mankind as it becomes reserves of large number of pathogens to cause epidemics. Vermitechnology is the process by which biological degradation of organic waste takes place in controlled conditions due to earthworm feeding on the materials. Degradation of organic waste into compost under natural conditions normally takes about six months whereas the bio conversion of organic waste materials through earthwormic consumption enhances decomposition by 25% with 25% reduction in time for compositing[1]. Earthworms such as Eudrilus eugeniae, Eisenia fetida and Perionyx excavatus are considered most suitable for vermicomposting. Unfortunately, little is known about the suitability of other earthworm species for vermicomposting.

In the present study the vermicomposting production potential of various local species of earthworms of Jammu on the kitchen waste has been studied. Kitchen waste was mainly composed of biodegradable wastes like cooked food wastes, leftover pulses, rice, pickle and vegetables, fruit peelings, tea leaves, ash, paper etc.

Kale et al[2] suggested possible use of Perionyx excavatus for organic matter degradation and vermicompost production. Kale and Bano[3] reported that under prevailing climatic conditions Eudrilus eugeniae serves as the most suitable for degradation of organic waste and production of vermicompost in southern India. Appelhof et al[4] suggested the use worms at all levels in Australia and Newzealand from home worm bins to large scale composting of municipal biosolids and yard trimmings.

Materials and methods

Three epigeic species of earthworms Amynthus Diffringens, Metaphire houlleti and Octolasion tyrtaeum were collected form moist soils at the depth of 3 to 10 cm from the different locations of Jammu. Then, these specimens were got identified from Zological Survey of India (ZSI), Calcutta. For specific earthworm species, specific vermibeds were prepared in the wooden boxes of size 0.40m x 0.30m x 0.26m. Vermibeds were prepared by placing a layer of paddy straw and saw dust at the base followed by a layer of sand and garden soil. Each vermibed was inoculated with 50 gms of medium size earthworms of specific species. Then, the kitchen waste was chopped into small pieces and was transferred to each vermibed in a period of two to three days. After transferring the kitchen waste, boxes were covered with gunny bags and sprinkling of water was done at regular intervals to maintain desired moisture in the wooden boxes till the vermicompost formation takes place. Also the temperature was monitored regularly in the vermibeds.

When the vermicomposting process was complete the sprinkling of water was stopped so that the earthworms migrate to the deeper layers of the vermibed. Then, the vermicompost along with vermicasts was collected from the topmost layer of each vermibed separately dried, crushed, sieved and weighed. Each vermibed was again inoculated with 1.5kg of kitchen waste. After the end of each season the earthworm biomass was also calculated by separating and weighing the total earthworms present in the each vermibed. This process was repeated during different seasons of the year i.e August to October, November to January, Feb to Apr and May to July. The data of vermicompost production and biomass generated for each species during different seasons of the year was compiled and tabulated.

Results and discussion

The epigeic earthworms used in the present study were identified as Amynthus diffringens (Baird 1869), Metaphire houlleti (Perrier) and Octolasion tyrtaeum (Savigny, 1826). The vermicompost production (in gms) and the earthworm biomass generated (in percentage) of each vermibed is tabulated in the Table-1.

The overall analysis of vermicompost production by different species of earthworms on kitchen waste revealed that Octolasion tyrtaeum produced maximum (1137.2 ± 23.5, 1118.1 ± 20.2, 1008.9 ± 4.3 and 1215.7 ± 34.9) gms of vermicompost during Aug – Oct, Nov – Jan, Feb – Apr and May – Jul with maximum percentage of earthworm biomass increase i.e 82.76%, 50.00%, 27.20% and 99.70% respectively followed by Amynthus diffringens which produced (1120.8 ± 20.3, 1072.5 ± 15.5, 846.9 ± 1.6 and 1163.8 ± 38.4) gms with earthworm biomass increase of 70.72%, 40.06%, 17.34% and 92.12% during Aug – Oct, Nov – Jan, Feb – Apr and May – Jul respectively. While minimum vermicompost was produced by Metaphire houlleti which produced 984.8 ± 19.2, 933.3 ± 1.3, 884.9 ± 0.3 and 1165.0 ± 1.5 during Aug – Oct, Nov – Jan, feb – Apr and May – Jul with earthworm biomass increase of 60.86%, 29.16%, 3.94% and 77.26% respectively.

From the analysis of the data, it can be concluded that all the three species of earthworms can carry out vermicomposting during all the seasons of the year, though the vermicompost production potential of earthworm species varied with type of species used and also during different seasons of the year. Reinecke et al[5], 1992 also reported that Perionyx excavatus could not survive the low temperatures while Eisenia foetida can tolerate wide range of temperatures. The critical analysis of the data revealed that Octolasion tyrtaeum exhibits highest value of vermicompost production and earthworm biomass in least number of days as compared to Amynthus diffringens and Metaphire houlleti. Thus it was observed that Octolasion tyrtaeum exhibits higher feeding and biodegradation capacity as compared to rest of the earthworm species. Sinha and Sinha[6] 2000 also vermicomposted kitchen waste and garden waste along with cattle dung using Eudrilus eugeniae, Eisenia foetida and Perionyx excavatus and observed that worms acted faster during summer days (Jun – Aug) than in winter days (Jan – Mar).

Table-1: Vermicompost production potential of different species of earthworm on kitchen waste during different seasons of the year.

Season	Parameter for Vermicompost Production Potential	Name of Earthworm Species		
		Amynthus diffringens	Metaphire houlleti	Octolasion tyrtaeum
Aug - Oct	Average Vermicompost production in gms	1120.8 ± 20.3 (1047-1188)	984.8 ± 19.2 (907-1070)	1137.2 ± 23.5 (1055-1227)
	Average no. of days for harvesting	32.0 ± 1.6 (30-34)	37.0 ± 1.0 (36-38)	29.0 ± 0.8 (28-30)
	Average percentage increase in earthworm biomass	70.72	60.86	82.76
Nov - Jan	Average Vermicompost production in gms	1072.5 ± 15.5 (907-1204)	933.3 ± 1.3 (861-982)	1118.1 ± 20.2 (1041-1152)
	Average no. of days for harvesting	45.5 ± 1.5 (44-47)	55.5 ± 0.5 (55-56)	42.5 ± 0.5 (42-43)
	Average percentage increase in earthworm biomass	40.06	29.16	50.00
Feb - Apr	Average Vermicompost production in gms	846.9 ± 1.6 (724-920)	884.9 ± 0.3 (803-989)	1008.9 ± 4.3 (897-1095)
	Average no. of days for harvesting	45.5 ± 2.5 (43-48)	49.5 ± 0.5 (49-50)	34.0 ± 2.0 (32-36)
	Average percentage increase in earthworm biomass	17.34	3.94	27.20
May - Jul	Average Vermicompost production in gms	1163.8 ± 38.4 (1021-1228)	1165.0 ± 1.5 (1117-1252)	1215.7 ± 34.9 (1036-1351)
	Average no. of days for harvesting	27.6 ± 1.2 (26-29)	33.0 ± 0.8 (32-34)	24.6 ± 1.2 (23-26)
	Average percentage increase in earthworm biomass	92.12	77.26	99.70

Conclusion

In the light of the above results, it was concluded that vermicomposting of kitchen waste using local species of earthworms should be encouraged in every household with integrated approach by earthworms as producers, processors and consumers. The use of local species of earthworms in vermicomposting of kitchen waste helps in the management of waste at the source and generation of organic fertilizers. Since the local species are readily available and quickly get acclimatized in the prevailing conditions.

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