Original Article

Indian Journal of Biology
Volume 1 Number 2, July - December 2014

Impact of Probiotic in Enhancement of Heterotrophic Bacterial Population in Two Different Cattle Wastes Added Vermicomposts

Ramesh T.*, Jayanthi J.*, Ragunathan M.G.*, Alagurajan R., Devakumar D.***

Abstract

Vermibiotechnology is a boon for sustainable agriculture. In this study the animal wastes (Red Sindhi variety cow and Ellichpuri variety buffalo) composted with leaf litter of *Ficus benghalensis*. The probiotic was used at two concentrations (10%, 20% and 30%) to enhance the composting process. For each waste, *viz*., cow and buffalo were inoculated with 1kg earthworms (*Eudrilus eugeniae*) of similar size per 800 g of waste. The total heterotrophic bacterial (THB) populations were screened at regular interval (0, 15, 30 and 60 days) under identical laboratory conditions during the composting process. Total heterotrophic bacterial population was found to be high in the vermicompost processed with the wastes of Red Sindhi cow variety at 10% probiotic concentration.

Keywords: Vermicompost; *Eudrilus eugeniae*; Probiotic; Heterotrophic bacteria; Sustainable agriculture.

Introduction

Organic farming is a form of agriculture that relies on techniques such as crop rotation, composting, green manuring, and biological pest control. Compost is organic matter that has been decomposed and recycled as a fertilizer and soil amendment. Compost is a key ingredient in organic farming. Composting is categorized into various types such as: municipal solid waste composting, domestic waste composting, vermicomposting, etc.

Vermi composting is a non-thermophilic biological oxidation process in which organic materials are converted into vermicompost (Ghosh, 1993). Vermicompost have large particulate surface areas that provide many micro sites for microbial activity and for strong retention of nutrients (Nighawan and Kanwar, 1952; Lunt and Jacobson, 1994). Vermicomposts consistently promote biological activity which can help plants to germinate, flower and grow and yield better than in commercial container media, independent of nutrient availability (Arancon, *et al*, 2005; Atiyeh, *et al*, 2002). *Eudrilus euginiae* and *Eisenia foetida* (Kinberg, 1867) have been used in converting organic wastes into Vermicompost (Hartenstein, *et al*, 1989; Kale, *et al*, 1988; Prakash *et al*, 2008).

As heterotrophic bacteria are unable to synthesize its own organic carbon-based compounds from inorganic sources, it utilizes carbon from other organic sources. Heterotrophic bacteria are involved in biogeochemical cycles during which they release essential elements such as Nitrogen and Carbon. It enhances the fertility of the soil by nitrogen fixation and thereby the nutritive value of the soil. This work was designed to study the microbiological aspect of vermicompost produced using *Eudrilus euginae*

Author's Affiliation: *Dept. of Advanced Zoology and Biotechnology, Guru Nanak College, Chennai, **Dept. of Botany, Scott Christian College (Autonomous), Nagercoil, Tamil Nadu, India.

Reprint's request: Ramesh T., Research Scholar, Dept. of Advanced Zoology and Biotechnology, Guru Nanak College, Chennai, Tamil Nadu, India.

E-mail: ramesht82@gmail.com

from *Ficus bengalensis* leaf litter added with Red Sindhi-cow and Ellichpuri-buffalo wastes in the presence of selected concentration of a commercially available probiotic.

Materials and Methods

Collection and Processing of Leaf Litter

The leaf litter of *Ficus bengalensis* were collected and cut into small pieces and taken for vermicomposting.

Collection of Animal Wastes

Animal wastes such as Cow (Red Sindhi Variety) dung and Buffalo (Ellichpuri Variety) dung were collected in fresh polythene bags and brought to the composting site.

Experimental Set Up

800 g of each of the animal waste was taken in plastic trough and 8 kg of processed leaf litter waste was added to it. This mixture was mixed well with the required amount of water. In each plastic trough 1kg uniform sized *Eudrilus eugeniae* (Kinberg, 1867) earthworms were added and turned well for uniform distribution. Duplicates (replica 1 and 2) were maintained for each experimentation. This set up was kept under shadow condition for 60 days. The physical parameters such as pH, temperature and moisture content were monitored with utmost care.

Studying the Effect of Probiotics in Vermicomposting with Different Wastes

To study the effect of probiotics in vermicomposting – commercially available EM (Effective Microorganisms) solution was used. The EM should be activated prior to use as per manufacturer (Maple Org Tech, India (P) Ltd) guidelines. The effectiveness of EM in the vermicomposting was checked at 10%, 20% and 30% concentrations. EM was added at 10%, 20% and 30% in cow dung and buffalo dung added vermicomposts. The four different combination taken for analysis were: CDV-I (combination of leaf litter, cow dung, earth worms and EM); BDV-I (combination of leaf litter, buffalo dung, earth worms and EM); CDV-II (combination of leaf litter, cow dung and earth worms); and BDV-II (combination of leaf litter, buffalo dung and earth worms).

Total Heterotrophic Bacterial Population (THBP) Analysis

Heterotrophic bacterial population was assessed at different periods. On initial (0),

Table 1: Total heterotrophic bacterial population in vermicomposting at different periods

Days	EM Concentration (%)	Total Heterotrophic Bacterial Count (CFU/ml)				
		CDV-I	BDV-I	CDV-II	BDV-II	Control
0	10	9×10^{-3}	8×10^{-3}	8×10^{-3}	6×10^{-3}	-
	20	11×10^{-3}	10×10^{-3}			
	30	13×10^{-3}	13×10^{-3}			
15	10	16×10^{-3}	12×10^{-3}	10×10^{-3}	8×10^{-3}	-
	20	14×10^{-3}	13×10^{-3}			
	30	11×10^{-3}	7×10^{-3}			
30	10	18×10^{-3}	13×10^{-3}	13×10^{-3}	11×10^{-3}	-
	20	11×10^{-3}	9×10^{-3}			
	30	7×10^{-3}	5×10^{-3}			
60	10	21×10^{-3}	15×10^{-3}	15×10^{-3}	11×10^{-3}	-
	20	9×10^{-3}	7×10^{-3}			
	30	-	-			

15th, 30th and 60th days, the samples were collected for bacterial enumeration from replica-1 and replica-2. Sterile nutrient agar plate was used as control. Analysis was carried out based on the work of Caapucino (1992). The bacterial enumeration results are presented in Table 1.

Each value presented in this table is Mean value obtained from 6 individual observations of the replica 1 and 2.

Results

The total heterotrophic bacterial population of the different vermicompost treatments was checked at 0, 15, 30 and 60 days interval during the composting process. Total heterotrophic bacterial count was highest in CDV-II compost than BDV-II compost.

The CDV-I and BDV-I composts showed higher THB populations than CDV-II compost; at the same time CDV-I showsed higher THP populations when compared to BDV-I. The THBP load was found to be declining at 30th and 60th days in CDV-I and BDV-I composts with 20% and 30% concentration of EM, respectively. Interestingly CDV-I and BDV-I composts with 30% EM at 60th day did not shows any colonies. The reduction in the bacterial population may be due to the secretion of antibacterial substances produced by microbes like actinomycetes present in the probiotic (EM) solution (Viswanathan, 2008; Vijaya, 2008).

Discussion

Among the treatments, highest heterotrophic bacterial population was recorded in the CDV-I vermicompost processed with cow dung waste and 10% EM solution, so this probiotic concentration may be considered as the best one as it will enhance the maximum growth of heterotrophic bacteria in vermicompost.

The result suggests that the bacterial load is rich in the vermicompost processed with waste from Red Sindhi-cow than Ellichpuri-buffalo in the presence of 10% probiotic solution. The findings thus pave way for increasing the commercial value of vermitechnology and improving organic agriculture and thereby sustainable agriculture.

References

1. Arancon NQ, Edwards CA, Bierman P, Metzger JD, and Lucht C. Effects of vermicomposts produced from cattle manure, food waste and paper waste on the growth and yield of peppers in the field. *Pedobiologia*. 2005; 49(4): 297-306.
2. Atiyeh RM, Lee S, Edwards CA, Arancon NQ and Metzger JD. The influence of humic acids derived from organic wastes on plant growth. *Bioresource Technologyi.* 2002; 84: 7-14.
3. Cappuccino JG and Sherman N. Microbiology. California: The Benjamin/Cummings Publishing Company Inc.; 1992.
4. Ghosh AH. Earthworm Resources and Vermiculture. Calcutta: Zoological Survey of India; 1993.
5. Hartenstein R and Bisesi MS. Use of Earthworm Biotechnology for the Management of Effluents from Intensively Housed Livestock. *Outlook on Agriculture, USA*. 1989; 18: 72-76.
6. Kale RD, Bano K and Krishnamoorthy RV. Potential of *Perionyx excavates* for utilization of organic wastes. *Pedobiologia.* 1982; 23: 419–425.
7. Lunt HA and Jacobson HG. The chemical composition of earthworm casts. *Soil Science.* 1994; 58: 367-75.
8. Nighawan SD and Kanwar JS. Physico-chemical properties of earthworm castings. *Indian J of Agricultural Sciences*. 1952; 22: 357-375.
9. Prakash M, Jayakumar M and Karmegam N. Physico-chemical characteristics and fungal flora in the casts of the earthworm, *Perionyx ceylanesis* Mich, reared in *Polyathia longifola* leaf litter. *Journal of Applied Sciences Research.* 2008; 4(1): 53-57.

10. Vijaya D, Padmadevi SN, Vasandha S, Meerabhai RS, and Challapandi P. Effect of vermicompostedcoirpith on the growth of *Andrographis paniculata. Jr of Organic System.* 2008; 3(2): 53. ISSN 1177-4258.
11. Viswanathan S. Use and effects of probiotics on selected freshwater fish Channa species. PhD Thesis. Tirunelveli: Manonmaniam Sundaranar University; 2008.