**International Journal of Zoology and Applied Biosciences** **ISSN: 2455-9571**
**Volume 4, Issue 5, pp: 212-214, 2019**
**https://doi.org/10.5281/zenodo.3534150**
**http://www.ijzab.com**

**Research Article**

# VERMICOMPOSTING OF PLANT AND ANIMAL WASTES WITH SPECIAL REFERENCE TO *EUDRILUS EUGENIAE*

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**Article History:** Received 20th September 2019; Accepted 28th October 2019; Published 31st October 2019

## ABSTRACT

The present study reports on the vermicompost obtained from plant and animal wastes using *Eudrilus eugeniae* by bed method. Amongst them, vermicompost raised from animal wastes served as an excellent, nutrient rich organic fertilizer and soil conditioner within a short period of time which could be recommended to the farming community. The vermicompost obtained was rich black in colour and homogenous in nature, improving soil aeration, promoting survival, and dispersal of useful bacteria. In conclusion, earthworms act as mechanical blenders and by commuting the organic matter they modify its physical and chemical status, increasing the surface area exposed to microorganisms and making it much more favourable for microbial activity and further decomposition.

**Keywords:** *Eudrilus eugeniae*, Plant and Animal wastes, Bed method, Vermicompost.

## INTRODUCTION

Due to rapid industrialization and increasing trend in urbanization, hundreds of tons of recyclable organic waste are being generated in cities and towns in the country, creating disposal problems. This waste can be converted into precious compost by applying vermicomposting technology which has the property to retain nutrients for long time (Bano *et al*., 1987; Edwards *et al*., 1985; Graff, 1981). Earthworms can decompose municipal solid waste, household waste, garden waste, animal waste, and urban and industrial sewage sludge (Asgharzadeh *et al*., 2014; Yousefi *et al*., 2012; Omrani & Asgharnia, 2004). Modern agriculture based on chemicals is not sustainable, because of many problems such as loss of soil productivity from excessive nutrient losses, surface and groun d water pollution due to pesticides. An approach towards good soil management, with an emphasis on the role of earthworms, in soil fertility, is very important in maintaining balance in an ecosystem (Asgharzadeh *et al*., 2014). Hence, the present study aims to find the potency of vermicompost using *Eudrilus eugeniae* as it effectively decomposes plant and animal wastes.

## MATERIALS AND METHODS

The "African night crawler" (*Eudrilus eugeniae*), a large earthworm that grows extremely rapidly when cultured under optimum conditions was considered as an ideal species for the present study due to its high reproduction rates (Bano & Kale, 1988; Edwards, 1988), and is capable of decomposing large quantities of organic wastes rapidly and incorporating them into the topsoil (Edwards, 1988; Kale & Bano, 1988; Neuhauser *et al*., 1979).The life cycle of this earthworm ranges from 50-70 days and its life span can be 1-3 years. This species is more productive in terms of rates of growth and would seem to be a suitable candidate for vermicomposting systems, in regions where maintaining its optimal temperature of 25°C is feasible and economic.

*In vitro* studies were carried on *Eudrilus eugeniae* using plant and animal wastes. The raw materials, *viz*., cow dung, plant wastes (carrot and tomato wastes), and animal wastes (fish, crab, and prawn wastes) collected from Palarpatti village of Uthamapalayam, Theni, Tamil Nadu, India were chopped into small pieces (1cm per piece)

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before feeding on the vermibed. Two sets of experiments were conducted (one with plant and another with animal wastes). The containers were sprinkled with water and observed for reproduction and growth of *Eudrilus eugeniae* on a daily basis. The samples were examined for their pH and water holding capacity at an interval of fortnight and thereafter at the end of 30 days, the vermicompost was analyzed for nutrients.

## RESULTS AND DISCUSSION

The vermicompost raised from two different wastes were estimated and the fecundity rates investigated are presented in Table 1. The population of *Eudrilus euginae* was found to be more in the animal waste rather than plant waste. It was also interesting to note that animal waste degraded more efficiently than plant waste with higher macronutrient content. Biological parameters such as cocoons numbers, hatchling numbers and number of matured earthworms were recorded maximum in the animal waste than its counterpart Edwards & Lofty (1977) reported that many species of earthworm produce cocoons throughout the year, when the temperature, soil moisture, food supplies and other environmental factors are suitable. A similar result was observed in the present study in animal wastes wherein maximum number of cocoons were recorded by receiving suitable environmental factors. The nitrogen, phosphorous and potassium content of the control, and plant, and animal wastes compost when analysed was significantly higher in animal waste. Kale *et al*. (1992) reported that *Eudrilus eugeniae* has shown prolonged period of breeding that follows a harmonic function. The cocoon laying continued throughout the life except for a few days before they died. An optimum temperature range of 20-30ºC for vermibeds using *Eudrilus eugeniae* is required since cocoons hatch sooner at higher temperatures (Edwards & Lofty, 1977). Evans & Guild (1948) reported that the activity, metabolism, growth, respiration, reproduction, fecundity and growth period from hatching to sexual maturity of earthworms are greatly influenced by temperature.

**Table 1.** Vermicompost obtained using *Eudrilus eugeniae*

| Parameters | Control | Plant waste | Animal waste |
|---|---|---|---|
| Cocoon | -NA- | 197.60 ±5.50 (45%) | 238.60 ±8.21 (55%) |
| Hatchling number | -NA- | 206.00 ±9.41 (47%) | 241.00 ±2.80 (53%) |
| Numbers of matured earthworms | -NA- | 8.60 ±1.20 (38%) | 14.30 ±0.90 (62%) |
| Water holding capacity (g/L) (15 days) | 0.73 ±0.30 | 2.00 ±0.81 | 3.00 ±0.81 |
| Water holding capacity (g/L) (30 days) | 1.83 ±0.23 | 2.46 ±0.26 | 3.16 ±0.12 |
| pH (15 days) | 7.10 ±0.32 | 7.20 ±0.21 | 7.10 ±0.37 |
| pH (30 days) | 6.90 ±0.14 | 7.20 ±0.47 | 7.10 ±0.32 |
| Nitrogen (mg/L) | 1.30 ±0.07 | 1.77 ±0.20 | 2.80 ±0.64 |
| Phosphorous (mg/L) | 1.24 ±0.07 | 1.20 ±0.10 | 1.62 ±0.04 |
| Potassium (mg/L) | 1.07 ±0.08 | 2.02 ±0.10 | 2.70 ±0.16 |

NA: Not applicable

On the other hand, the water holding capacity in control and two different experimental vermicompost were analyzed, and the maximum amount of water holding capacity were obtained from animal wastes composts. Likewise, the pH also varied, with the maximum amount recorded from plant wastes. Earthworm population is fairly high in soils with neutral pH. Saranraj & Stella (2012) reported that fluctuations of pH occurs due to the organic acids released during the decomposition of wastes which was is in accordance to the present investigation. Earthworms for their maximum productivity require a wide pH range (5.0-9.0) and are very sensitive to pH, thus pH of soil or waste is sometimes a factor that limits the distribution, numbers and species of earthworms. Many reports are available regarding the change in the pH of cast towards neutrality from that of the surrounding soil. The secretions of the calciferous glands neutralize the soil that passes through their gut. *Eudrilus eugeniae* reduced the pH from 6.7 to 6.0 in a study conducted by Munnoli & Bhosle (2009). The decrease in pH values when pressmud was treated with *Eudrilus eugeniae* showed decreasing trend in pH from 8.6 to 6.7 during vermicomposting over a period of 60 days (Munnoli, 2007). To conclude, the present study reports that plant and animal wastes which degraded efficiently through vermicomposting using *Eudrilus eugeniae*, was rich black in colour and homogenous in nature, improving soil aeration, promoting survival, and dispersal of useful bacteria within such systems. Earthworms act as mechanical blenders and by commuting the organic matter they modify its physical and chemical status, increasing the surface area exposed to microorganisms and making it much more favourable for microbial activity and further decomposition (Pandit *et al*., 2012).

## CONCLUSION

Although microorganisms are responsible for the biochemical degradation of organic matter, earthworms are crucial drivers of the process, by fragmenting and conditioning the substrate and dramatically altering its biological activity.

**ACKNOWLEDGMENT**

The authors express sincere thanks to the Head of the Department of Zoology, Hajee Karutha Rowther Howdia College, Uthamapalayam, Theni, Tamil Nadu, India for the facilities provided to carry out this research work.

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