International Journal of Zoology and Applied Biosciences **ISSN: 2455-9571**
Volume 11, Issue 4, pp: 137-139, 2026
https://doi.org/10.55126/ijzab.2026.v11.i04.018 Crossref IJZAB **http://www.ijzab.com** Rishan Publications

Review Article

EARTHWORMS AND VERMIPRODUCTS: ECO-FRIENDLY APPROACHES TO SUSTAINABLE AGRICULTURE

Bharathi A

PG & Research Department of Advanced Zoology and Biotechnology, Sir Theagaraya College, Chennai - 600 021, Tamil Nadu.

Article History: Received 22nd April 2026; Accepted 24th June 2026; Published 1st July 2026

ABSTRACT

Vermiculture and vermicomposting are sustainable biotechnological processes that utilize earthworms for the conversion of organic wastes into nutrient-rich organic manure. Earthworms function as natural bioreactors by fragmenting, digesting, and biologically transforming agricultural residues, municipal solid wastes, household organic wastes, and other biodegradable materials into stable vermicompost. During this process, earthworms interact synergistically with beneficial microorganisms, enhancing microbial activity, nutrient mineralization, and the production of plant growth-promoting substances. Vermicompost is rich in humus, essential macro- and micronutrients, beneficial enzymes, and microbial populations that improve soil fertility, soil structure, water-holding capacity, and crop productivity while suppressing several soil-borne plant pathogens. Earthworm species used in vermicomposting are classified into epigeic, endogeic, and anecic groups based on their ecological functions, with epigeic species such as *Eisenia fetida* being the most suitable for organic waste decomposition. Vermicomposting has emerged as an eco-friendly and cost-effective waste management technology widely adopted in agriculture, horticulture, and environmental conservation. This review summarizes the biological role of earthworms, the vermicomposting process, earthworm–microbe interactions, classification of earthworms, and the agricultural and environmental significance of vermicompost.

Keywords: Vermiculture, Worms, Compost, Garbage, Farmers.

INTRODUCTION

Vermiculture means the cultivation and artificial rearing of earthworms, while vermicomposting is the scientific process of using earthworms to convert organic wastes into valuable manure for improving soil health and agricultural productivity (Edwards & Bohlen, 1996). Earthworms assimilate farmyard manure and other agricultural wastes through their digestive tract and convert them into nutrient-rich vermicompost (Edwards *et al*., 2011). Similarly, non-toxic municipal solid wastes, industrial organic wastes, and household garbage can also be transformed into vermicompost through earthworm activity (Domínguez, 2004). Earthworms help maintain environmental health by converting organic wastes into valuable manure while reducing waste accumulation. The process of compost formation and earthworm multiplication is simple, economical, and can be easily adopted by farmers (Appelhof, 2011). Vermicompost is the nutrient-rich excreta (casts) of earthworms and serves as an excellent soil conditioner because of its high humus content (Edwards & Bohlen, 1996). The excretory system of earthworms consists of septal, integumentary, and pharyngeal nephridia. Commonly used species for vermicomposting include the redworm (*Lumbricus rubellus*) and the red wiggler (*Eisenia fetida*) (Edwards *et al*., 2011). Earthworms feed on vegetable wastes, compost, and organic bedding materials and produce nutrient-rich casts. Vermicompost contains beneficial microorganisms such as *Bacillus*, *Pseudomonas*, and *Streptomyces*, whose metabolites suppress several phytopathogenic fungi and human pathogenic bacteria (Pathma & Sakthivel, 2012). Earthworms fragment large soil particles and plant litter, increasing the surface area available for microbial decomposition. Through the combined action of aerobic and anaerobic microorganisms, organic wastes are converted into stable vermicompost (Domínguez, 2004).

*Corresponding Author: Bharathi A, Associate Professor and Research Supervisor, PG & Research Department of Advanced Zoology and Biotechnology, Sir Theagaraya College, Chennai - 600 021, Tamil Nadu. Email: bharathia@stcchennai.edu.in.

Vermicomposting is therefore regarded as a nutrient recycling process in which earthworms function as natural bioreactors for the decomposition of organic matter. The resulting vermicompost improves soil fertility, enhances microbial activity, promotes plant growth, and suppresses soil-borne pathogens and pests (Arancon *et al*., 2004).

Vermicomposts

The digestive system of earthworm is a straight tube starting from mouth, muscular pharynx, oesophagus, thin-walled crop, muscular gizzard, foregut, midgut, hindgut, digestive glands, and anus. The digestive system consists of mucus containing protein and polysaccharides, organic and mineral matter, amino acids and microragnisms such as bacteria, protozoa and microfungi. The increased total organic carbon, organic carbon, and nitrogen and moisture content in the earthworm gut provide suitable environment for the activation of microbes and endospores germination. Earthworm's alimentary canal contains the digestive enzymes such as amylase, cellulase, protease, lipase, chitinase and urease. The gut microragnisms were found to be responsible for the mannose and cellulase activities. Earthworms to reduce the small particles (comminutes) the substrate, then increases the surface area for microbial degradation constituting to vermicomposting (active phase). When the crushed organic matter passes through the gut it gets mixed up with the digestive enzymes and gut associated microbes and leaves the gut in incompletely digested form as “casts” after which the microbes start decomposition process contributing to the maturation phase.

Earthworms and Microbes

The relationship between the earthworms and microbes is found to be complex. Some groups of microbes were found to be a part of earthworm’s diet which is proved by the destruction of some microbes as they pass through the digestive system of earthworms. Certain yeasts, protozoa and few groups of fungi such as *Alternaria solani, Fusarium oxysporum* and microfungi were digested by the earthworms, *Drawida calebi, Eisenia foetida* and *Lumbricus terrestris*. *Bacillus cereus* var *mycoides* were seen to decrease during gut passage while *E. coli* and *Serratia marcessens* were fully eliminated during passage through the gut of earthworm.

The plant growth-promoting rhizospheric bacteria such as *Pseudomonas, Rhizobium, Bacillus, Azosprillium, Azotobacter,* etc. ingested by earthworms along with rhizospheric soil, they might get activated due to the suitable micro-environment of the gut. Then increase of population of plant growth-promoting rhizobacteria (PGPR) by earthworm activity. The gut of Earthworms harbor ‘nitrogen-fixing’ and ‘decomposer microbes’ and eliminate them along with nutrients in their excreta.

Classification of Earthworms

Based on definite ecological and trophic functions earthworms are classified into epigeic, anecic and endogeic species. Epigeic earthworms are smaller in size; they are uniformly pigmented body, high reproduction rate, short life cycle and regeneration. They feed on the surface litter, dwell in superficial soil surface within litters and mineralize them. Epigeic earthworms such as *Eisenia foetida, Dendrodrilus rubidus, Lumbricus rubellus, L. castaneus, L. festivus, Eiseniella tetraedra, Bimastus minusculus, B. eiseni, Dendrobaena veneta, D. octaedra.* Endogeics earthworms are small to large sized, has weakly pigmented body, moderately tolerant to disturbance, forms extensive horizontal burrows, life cycle of medium duration and are geophagous feeding on soil and particulate organic matter. They can efficiently utilize energy from poor soils and produces pronounced changes in soil physical structure hence can be used for soil improvements. Endogeics earthworms include *Aporrectodea caliginosa*, *Allolobophora chlorotica,* A. *trapezoides, A. rosea, Millsonia anomala, Octolasion cyaneum, O. lacteum, Pontoscolex corethrurus,* and *Aminthas* sp. Aneceics are larger, with low reproductive rate, sensitive to disturbance, nocturnal, phytogeophagous, bury the surface litter, forms middens, dorsally pigmented worms and lives inside the extensive, deep, permanent vertical burrows. Vertical burrows Formation enhances the air water relationship helps in efficient mixing of nutrients. Aneceics earthworms *includes Lumbricus terrestris, L. polyphemus* and *Aporrectodea longa.*

CONCLUSION

Vermicomposting is extensively used in North America for on-site institutional processing of food scraps, such as in hospitals, shopping malls, universities, and correctional facilities. It is used for medium-scale on-site institutional organic material recycling, such as for food scraps from shopping malls and universities. It is selected either to decrease the cost of commercial waste removal and as an eco-friendlier choice than conventional disposal.

ACKNOWLEDGMENT

The authors express sincere thanks to the head of the PG & Research Department of Advanced Zoology and Biotechnology, Sir Theagaraya College, Chennai for the facilities provided to carry out this research work.

CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

FUNDING

This study received no specific funding from public, commercial, or not-for-profit funding agencies.

AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

REFERENCES

Appelhof, M. (1997). *The worm book: The complete guide to gardening and composting with worms*. Berkeley, CA: Ten Speed Press.

Suthar, S. (2014). Microbial biodegradation of waste materials for nutrients enrichment. *International Biodeterioration & Biodegradation, 92*, 41-48.

Edwards, C. A., Arancon, N. Q., & Sherman, R. L. (Eds.). (2011). *Vermiculture technology: Earthworms, organic wastes, and environmental management*. Boca Raton, FL: CRC Press.

Huang, K., Li, F., Wei, Y., Fu, X., & Chen, X. (2013). Comparative study on physical and chemical characteristics of sludge vermicomposted by *Eisenia fetida*. *Procedia Environmental Sciences, 16*, 418-423.

Li, Z., Lu, H., Ren, L., & He, L. (2011). A comparative study of synchronous treatment of sewage and sludge by two vermifiltrations using an epigeic earthworm *Eisenia fetida*. *Journal of Hazardous Materials, 185*(2-3), 881-888.

Adi, A. J., & Noor, Z. M. (2010). Production of biofertilizer from vermicomposting processes of municipal sewage sludge. *Journal of Applied Sciences, 10*(7), 580-584.

Ndegwa, P. M., & Thompson, S. A. (2000). Effects of stocking density and feeding rate on vermicomposting of biosolids. *Bioresource Technology, 71*(1), 5-12.