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Physico-chemical and nutritional analysis of vermiwash produced from leaf litters of *Pongamia pinnata* using an Earthworm *Eudrillus eugineae* (Kinb.)

Chandran Sundaravadivelan[1*], Mahalingam Lena[2], Palanisamy Sumathi[3*]
[*1]Department of Zoology, Muthayammal Memorial College of Arts and Science, Rasipuram 637 408, Tamil Nadu, India
[2]Department of Zoology, Sri Sarada College for Women (Autonomous), Salem 636 016, Tamil Nadu, India
[*3]Department of Zoology, L.R.G. Govt. Arts College for Women, Tirupur 641 604, Tamil Nadu, India

ABSTRACT: Vermiwash production has become an innovative discipline of vermitechnology that is aimed basically at the culture of earthworms for waste recycling and the use of its castings for sustainable agriculture. This experiment was carried out to assess the physic-chemical and nutrient status of the vermiwash obtained using the popular composting earthworm species, *Eudrillus eugineae* (Kinb.) from leaf litters of *Pongamia pinnata*. The results showed substantial increase in the nutrient quality of the vermiwash produced with time in all the cases. However, the vermiwash produced from *P. pinnata* leaf litter showed more content of phosphorus, magnesium, calcium and other parameters compared with the vermiwash produced in without leaf litters considered as control. Such variations observed in the nutrient quality of the vermiwash produced from leaf litters indicate that the nutrient quality of the vermiwash produced could be largely influenced by the nature of the composting material thereby providing scope for further investigations in this field.

KEYWORDS: Analysis, *Eudrillus eugineae*, Physico-chemical, Vermiwash.

INTRODUCTION

In the recent scenario, the chemical fertilizers are widely used to obtain high yield on crop production. The day-to-day massive application of chemical fertilizers resulted in poor soil health and turns to unfertile condition which leads to poor cultivation practices. Naturally, Earthworms seems to promote soil fertility and known being as farmer's friend. Earthworms play a major role in improving growth and yield of different field crops, vegetables, flower and fruit crops and the biology of earthworm species suitable for vermicomposting has been described (Sundaravadivelan et al., 2011). Earthworms consume dead organic matter found in soil, which they then ingest together with the undigested food to form worm castings upon completion. One kg earthworms can consume one kg of organic materials in a day and excrete them as casting that are rich in nitrate, available phosphorus, potassium, calcium and magnesium (Curry & Olaf, 2007).

Vermicomposting is a technology of using earthworms as versatile natural bioreactor for effective recycling of organic wastes back to the soil in an environmentally acceptable means of converting waste into nutritious composts for crop production (Kumar& Sekaran, 2004). Waste biomass management, the production of animal protein and the reduction of organic pollution, waste land conservation, land reclamation, the creation of worm-worked manure, soil fertility, and enhancement in plant production (Padmavathiamma et al., 2007). Vermiwash is the wash of earthworm's coelomic fluid and calcareous layer and the watery extract of the bedding materials, which is known to contain ample amount of soluble macro and micronutrients, natural growth hormones, beneficial microbes, vitamins and amino acids etc. and nematicidal properties (Sumathi & Isaiarasu, 2009). Vermiwash is a nutrient rich liquid fertilizer. It is a collection of excretory and secretory products of earthworms and it seems to possess an inherent property of acting not only as a fertilizer but also as a mild biocide (Datta et al., 2016). Hence, this study was taken up to determine the nutrient status of vermiwash produced from different types of leaf litters using the earthworm species, *Eudrillus eugineae*.

MATERIALS AND METHODS

The experiment was carried out by the mud pot method (Sundaravadivelan et al., 2011) developed in our lab. The leaf litters of *Pongamia pinnata* along with bedding materials (sieved soil and cow dung) were inoculated with the earthworms *Eudrillus eugineae*. Water was sprinkled with regular intervals in all the pots to maintain the moisture content of 75-85 % RH and a temperature at 25^0C. The water after percolation through the compost and burrows of the earthworms get collected amidst gravel

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bed. The vermiwash was collected at the base due to gravitational force. The roller is the blood transfusion tube was adjusted and the vermiwash was collected once in fifteen days intervals respectively.

The collections were thus made on the initial day (0 day) and on the 15th, 30th and 45th days, respectively. The vermiwash collected were collected were analysed for the nutrient composition. The extract of the compost in the pot without earthworms and leaf litter was also collected simultaneously and considered as control. The physico-chemical and nutritional analysis of all the samples was carried out to get idea about their nutrient status. For this, the various parameters such as pH, Electrical conductivity (EC), Total hardness (TH), Magnesium, Calcium, Chloride, Salinity, Alkalinity, Organic carbon (OC) and Phosphorus were studied in the samples for the present study following standard procedures of APHA (1975).

RESULTS AND DISCUSSION

Earthworms along with the other soil microflora bring about the decomposition of organic matter and thereby improve the nutrient forms and maintain the physic-chemical and biological properties of soil (Tharmaraj et al., 2011). The physic-chemical parameters of the vermiwash produced from *P. pinnata* leaf litters by a composting earthworm experimented in the present study form and index of the quality of vermiwash produced, enabling the analysis of the nutrient status. The physic-chemical parameters observed in the present study include pH, Electrical conductivity, Total hardness, Magnesium, Calcium, Chloride, Salinity, Alkalinity, Organic carbon and Phosphorus in the vermiwash produced from three types of leaf litter by the desired species of earthworm during a period of 45 days (Table 1). The pH of the vermiwash produced from *P. pinnata* leaf litters in the present study was in the alkaline range from 7.35 to 7.75. This pH range is suited for the growth, survival and normal activity of the earthworm. Soil pH has no effect of toxicity to earthworms but at extremely low pH (~4.0) it may become important to earthworm's survival (Deepthi et al., 2021).

The Electrical conductivity values of the vermiwash produced from *P. pinnata* leaf litters were more or less same from 1.09 to 1.71 µmhos/cm^3. The Electrical conductivity is used as a measure of total ions in the soil solution (Elbanna et al., 2021). The alkalinity of the vermiwash produced from *P. pinnata* leaf litters in the present study ranged from 8.38 to 9.02 in the experimental pots. Vermiwash produced by earthworms has an alkalinity of about 70 ppm due to ammonia produced during the breakdown of nitrogenous substrate (Sugapriya & Mahalingam, 2016). The organic carbon content of the vermiwash produced in the control in this study ranged from 6.83 to 6.23 % while in the experimental sets with *P. pinnata* leaf litters it ranges from 6.76 to 4.46 on 45th day. Organic matter plays a key role in agricultural production as it improves many desirable properties such as water holding, ion exchange and so on in the compost (Sundararasu & Jeyasankar, 2014). The reduction in organic carbon is an indication of the composting effected by the earthworms.

The amounts of magnesium, calcium and chloride observed in the vermiwash obtained in the present study can be considered to indicate the status of micro nutrients in the vermiwash which in turn determine the uptake of nutrients by the plants. Hence, presence of high amount of calcium 2.40 and 4.90 in treatment has been recorded in the vermiwash produced by the earthworm. The phosphorus content of the vermiwash produced in the present study ranged from 0.38 to 0.50 % in the experimental pots. The enhancement of phosphatase activity and the physical breakdown of materials result in greater mineralization. The increased phosphorus availability due to the vermicomposting application has been reported already (Nath & Singh, 2016).

Earthworms assimilated nutrients and energy from a wide range of ingested materials with variable efficiency, depending on the species and the nature of the ingested materials. In the present study also the quality of vermiwash produced, improved and the nature of the leaf litter influenced the quality of the compost produced. Presently, vermicomposting is being carried out only by using the exotic species of earthworms such as *Eudrillus eugineae* and *Eisenia fetida* (Lakshmi Prabha et al., 2007). The present study reveals that the physic-chemical and nutritional status of vermiwash produced from *P. pinnata* leaf litters has potential application in sustainable agricultural development with cost effectiveness, availability, eco-friendly, reliability, and reproducibility by the earthworm species, *Eudrillus eugineae*.

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Table 1. Physico-chemical and nutritional composition of vermiwash produced from *Pongamia pinnata* leaf litters by earthworm *Eudrillus eugineae*.

Parameters	Control				Leaf litters of *P. pinnata*			
	0 day	15th day	30th day	45th day	0 day	15th day	30th day	45th day
pH	7.85± 0.05	7.83± 0.05	7.79± 0.01	7.75± 0.05	7.88± 0.05	7.58± 0.05	7.47± 0.05	7.35± 0.05
EC (µmhos/cm^3)	0.90± 0.01	0.95± 0.05	1.05± 0.05	1.09± 0.01	0.89± 0.01	1.32± 0.08	1.42± 0.08	1.71± 0.01
Total hardness (mg/L)	2.45± 0.05	2.94± 0.05	3.30± 0.05	3.95± 0.01	2.30± 0.05	4.75± 0.05	6.10± 0.05	9.15± 0.01
Magnesium (mg/L)	1.05± 0.05	1.28± 0.05	1.35± 0.08	1.55± 0.01	1.09± 0.05	2.65± 0.05	3.40± 0.08	4.20± 0.01
Calcium (mg/L)	1.42± 0.01	1.65± 0.05	2.05± 0.05	2.42± 0.01	1.40± 0.01	2.70± 0.05	3.30± 0.08	4.80± 0.05
Chloride (mg/L)	5.20± 0.05	4.80± 0.05	4.70± 0.05	4.50± 0.01	5.18± 0.01	4.68± 0.05	4.12± 0.05	3.65± 0.05
Salinity (g/L)	7.91± 0.01	7.50± 0.05	7.24± 0.05	6.92± 0.05	7.87± 0.05	7.02± 0.05	6.18± 0.05	5.21± 0.08
Alkalinity (mg/L)	7.78± 0.01	8.02± 0.05	8.15± 0.05	8.38± 0.01	7.80± 0.01	8.37± 0.05	8.72± 0.05	9.02± 0.01
OC (%)	6.81± 0.05	6.68± 0.05	6.48± 0.05	6.25± 0.05	6.75± 0.05	5.92± 0.05	5.15± 0.05	4.52± 0.05
Phosphorus (%)	0.28± 0.01	0.34± 0.01	0.37± 0.01	0.39± 0.01	0.24± 0.01	0.33± 0.01	0.42± 0.01	0.51± 0.01

EC- Electrical conductivity, TH- Total Hardness, OC- Organic Carbon.
Each value is the average of three estimations ± SD.

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