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# COMPARISON OF COMPOSTING ABILITY OF *Eiseniafoetida* AND *Eudrilus eugineae*

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**Abstract:**

*In the present study the earthworms namely Eiseniafoetida, Eudriluseugeniae was used in the vermicomposting of organic waste namely Beedi leaf waste Cowdung, and Coconut coirpith.Vermibins prepared using Beedi leaf waste, Coconut coirpith, Cowdung were named as $T_1$,$T_2$,$T_3$, $T_4$, $T_5$, $T_6$, and $T_7$, $T_8$ served as control into pre-decomposed treatments $T_1$, $T_2$, $T_3$, Eiseniafoetida was inoculated and into $T_4$, $T_5$, $T_6$ Eudriluseugeniae was inoculated.Vermicomposting process was carried out for about 90 days, during with us temperature was recorded with intermittent intervals and watered two times perday. After 90 days compost was harvested and sieved weighed and packed.The microbial load was determined in the 45$^{th}$ day of inoculation of earthworms and vermicompost 90$^{th}$ days of inoculation of earthworm from different treatments.The Beedi leaf waste composted by Eudriluseugeniae showed maximum production of earthworms in the treatment $T_6$ when the earthworm feed high and the quantity of vermicompost harvested was also increased in $T_6$ When compared to other treatments.Among all the treatment of Eiseniafoetida Total Heterotrophic Bacterial found to befirstorder and secondly it passes out to Actinomyces and followed by next place to cellulose degraders.Similarly among all the treatments of Eudrilus eugeniaebelong to HetertrophicBacteriaand in second place to cellulose degrading bacterial population and third place found to be Azospirillum sp. The technology that we have applied for the Bio-waste management is Vermicomposting. The best way of disposing Beedi leaf waste accumulated in the southern parts ofThirunelvelidistrict has been identified as the cheap and most economical process called "Vermicomposting". The product of Vermicomposting is a real, natural, biological fertilizer that act as valuable nutrient supplement to the growth of plants.*

**Keywords:-***Vermicompost, Actinomyces, Eiseniafoetida, Eudriluseugeniae, Azospirillum sp and Beedi leaf.*

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## INTRODUCTION:

The agriculture or vegetation depends solely on the fertilizer used for its enriched growth and yield. Bidee rolling is manual in all its stages, with use of only ordinary scissors, winnows and wire nets. The two principal raw materials used for bide making are Bidee tobacco and Bidee leaves (Tendu or kendo leaf). They fit a Bidee in the Bidee industry where no foreign exchange, machinery electric power, skilled labour or any other infrastructure are required. It needs just two ingredients i. e the right type of tobacco and tendu leaves to wrap the tobacco in the blended tobacco and leaves for wrapping are brought from indigenous sources.

Tendu leaves are used to make bidees, an indigenous leaf- rolled cigarette made from coarse uncured tobacco, tied with a coloured string at one end. It is widely smoked in the Indian subcontinent. (Tobacco Board of India, 2010).

Vermicompost is a nutrient rich, organic fertilizer and soil conditioner. The process of producing vermicompost is called vermicomposting. Vermicomposting is an easy and effective way to recycle agriculture waste, city garbage and kitchen waste along with bioconversion of organic waste materials into nutritious compost by earthworm activity. Vermicompost is a potential organic manure rich in plant nutrients compared to farmyard manure (FYM) or other organic manure in respect to supply of N,P and K fertilizer [1].

Composting and vermicomposting are two of the best known – process for the biological stabilization of a great variety of organic waste [2].

Earthworm are well known natural machineries. They can transform organic waste material into vermicompost for agriculture [3]. Earthworms are invertebrates belonging to the phylum Annelida and class oligochateta.The earthworm are long, thread like, elongated, cylindrical, soft bodied animal. They are almost always terrestrial and burrow into moist – rich soil, emerging at night to forage. These body consist of segment arranged in liner series. The worm actually enhance the microbial activity and diversity [4]. Using the vermicompost as a rich compost fertilizer is a great way to grow your own extraordinary health garden without having to purchase chemical or manufacture fertilizers. Vermicompost usually goes twice as far as regular compost. The effect of cow, buffalo, horse, donkey, sheep, goat and camel animalwastes on growth and reproduction of an epigeic earthworm *Eiseniafoetida*was studied by . The effect of various animal agro and kitchen wastes on the growth and development of an epigeic earthworm *Eiseniafoetida*was studied under identical laboratory condition by (Nath,*et al.,*2009) [4].

Vermiwash is a liquid that is collected after the passage of water through a column of worm action.It is mixture of excretory products and mucus secretion of earthworms along with micronutrient from the soil organic molecules. It is very useful as a foliar spray. These are transported to the leaf, shoots and other parts of the plants in the natural ecosystem. Vermiwash contains various enzymes and microbes [5].

Vermiwash would have enzymes, secretions of earthworms which would stimulate the growth and yield of crops and even develop resistance in crops through foliar spray. Zambare *et al*. (2008) [5] reported that vermiwash contains enzymes namely proteases, amylases, ureases and phosphatase besides nitrogen fixing bacteria like *Azotobacter*sp,*Agrobacterium*sp, and *Rhizobium*sp, and some phosphate solubilizing bacteria which influences significantly the growth of plant. Foliar application of such nutrients through humic sources increases the uptake and availability of nutrients and its further assimilation for biosynthesis of proteins.
During this process, important plant nutrients such as nitrogen, potassium, phosphorus and calcium present in the waste material are convertedthrough microbial action into such chemical forms which are much more soluble and available to the plants than those in the parent substrate [6].

The present study is on the effect of vermicompost and vermiwash on plant growth and determination of the microbiological characters of vermicompost and Vermiwash usedin the study.

## MATERIAL AND METHODS:

### Collection of earthworm

The specimen selected for the present investigation were the adult clitellate earthworm namely *Eiseniafoetida*andEudrilus*eugeniae.* The worms were collected from Vivekananda center, located at Kanyakumari. Species identity was confirmed using the general characters of earthworm.

### Collection of organic waste

The Beedi leaf waste was collected from southern parts of Thirunelveli district, where small scale (cottage based) Beedi industries are

prevalent.

**Vermibin preparation**

The plastic bin of size 120cm X 24cm were selected and hole of size 0.3cm were drilled along the sides and bottom of the bins. The beedileafwaste, cowdung, coconutcoirpith were mixed in varying proportion in treatments namely $T_1$, $T_2$, $T_3$, $T_4$, $T_5$, $T_6$ and placed in shadow borne areas with intermitted watering at regular intervals (2times day) and allowed to decompose for about 30 days prior to inoculation of earthworm.

**Process of Vermicomposting of Beedileaf waste using *Eiseniafoetida*and*Eudriluseugeniae***

About 30 earthworm of two types were inoculated into each of the prepared vermibins namely $T_1$, $T_2$, $T_3$, $T_4$, $T_5$, $T_6$ and $T_7$, $T_8$ act as control, where no worms were inoculated. All the treatments were placed in shadow borne areas with intermitted watering at regular intervals (1 time/ day) and allowed the worms to compost for about 45-60 days and temperature was recorded every day before watering the bins.

**Enumeration of Heterotrophic Bacteria**

Samples (1gm) from all treatments ($T_1$ to $T_6$)on $45^{th}$ and $90^{th}$day of inoculation of the earthworms were collected separately. They were serially diluted and plated by pour plating technique. 1.0ml each of the dilutions namely $10^{-3}$ $10^{-4}$ ,$10^{-5}$ were plated on Nutrient agar medium and one plate served as control. For each dilution original and duplicate plates were maintained. All the plates were incubated at$37^0$c for 24 hours.

**Enumeration of Fungi**

Sample (1gm) from all treatments ($T_1$ to $T_6$) on $45^{th}$ and $90^{th}$ day of inoculation of the eartworms were collected seperately. They were serially diluted and plated by pour plating technique. 1.0ml of each of the dilutions namely $10^{-3}$ , $10^{-4}$ $10^{-5}$ were plated on Rose Bengal agar medium and plate served as control. For each dilution original and duplicate plates were maintained. All the plates were incubated at$28^0$c for 3 days.

**Enumeration ofActinomycetes**

Sample (1gm) from all treatments ($T_1$ to $T_2$) on $45^{th}$ day and $90^{th}$ day of inoculation of the earthworms were collected seperately. They were serially diluted and plated by pour plating technique. 1.0ml of the dilution namely $10^{-3}$ , $10^{-4}$ , $10^{-5}$ were plated on Kenknight's agar medium and one plate served as control. For each dilution original and duplicate plates were maintained. All the plates were incubated at $28^0$c for 7 days.

**Enumeration of Phosphate solubilizing Microbes**

Samples (1gm)from all treatments ($T_1$ to $T_6$) on $45^{th}$ day and $90^{th}$ day inoculation of the earthworms were collected separately. They were serially diluted and plated by pour plating technique. 1.0ml of the dilution namely $10^{-3}$ , $10^{-4}$ , $10^{-5}$ were plated on Pikovskaya's agar medium and plate served as control. For each dilution original and duplicate plates were maintained. All the plates were incubated at $37^0$c for 24 hours.

**Enumeration of Nitrogen fixing Bacteria**

Samples (1gm) from all treatments ($T_1$ to $T_6$) on $45^{th}$ day and $90^{th}$ day inoculation of the earthworms were collected seperately. They were serially diluted and plated by pour plating technique. 1.0ml of the dilution namely $10^{-3}$ , $10^{-4}$, $10^{-5}$ were plated on Yeast Extract Manitol agar (YEMA) medium (for *Rhisobium*sp.) Malate medium (for *Azosprillum*sp.) and Ashby's Mannitol agarmedium (for *Azotobacter*sp.). and one plate served as control .For each dilution original and duplicate plates were maintained. All the plates were incubated at $28^0$c for 24 -96 hours.

## RESULTS:

**Microbiological analysis of vermicompost of *Eiseniafoetida, Eudrilus eugeniae***

**Enumeration of Total Heterotrophic Bacteria**

The bacterial count was determined from the vermicompost of *Eiseniafoetida*by serial dilution and agar pour plating technique in Nutrient Agar medium. After overnight incubation colonies were observed. The colony count was determined both manually and also with a colony counter and the colony count (cfu/gm).

**Enumeration of Fungi**

The fungal colony count was determined from the vermicompost of *Eiseniafoetida,*by serial dilution and agar pour plating technique in Rose Bengal Agar medium. After $28^0$c for 3-5 days, colonies were observed. The colony count was determined by microscopic observation.

**Enumeration of Actinomycetes**

The Actinomycetes count was determined from the vermicompostwas*Eiseniafoetida* by serial dilution and agar pour plating technique. In over night$28^0$c colony was observed in powdery form. The colony count was determined by manual counting or by colony counter.

**Enumeration of phosphate solubilizing Microbes**
The phosphate solubilizing Microbial count was determined from the vermicompostof*Eiseniafoetida* by serial dilution and pour plating technique. After incubation clear zones were observed around the colonies. The colony count was determined by manual counting or by colony counter.

**Enumeration of Total Heterotrophic Bacteria**
The bacterial count was determined from the vermicompost of *Eiseniafoetida*by serial dilution and agar pour plating technique in Nutrient Agar medium. After overnight incubation colonies were observed. The colony count was determined both manually and also with a colony counter and the colony count (cfu/gm).

**Enumeration of Fungi**
The fungal colony count was determined from the vermicompost of *Eiseniafoetida,* by serial dilution and agar pour plating technique in Rose Bengal Agar medium. After $28^0$c incubation at for 3-5 days, colonies were observed. The colony count was determined by microscopic observation.

**Enumeration of phosphate solubilizing Microbes**
The phosphate solubilizing Microbial count was determined from the vermicompostof*Eiseniafoetida* by serial dilution and pour plating technique.InPikovciya agar medium.After incubation clear zones were observed around the colonies. The colony count was determined by manual counting or by colony counter.

**Enumeration of Nitrogen Fixing Bacteria**
The nitrogen fixing bacterial colony count was determined from the vermicompost of *Eiseniafoetida* by serial dilution and agar pour plating technique. In pour plating technique. Yeast Extract mannitol agar(YEMA) medium(for *Rhizobium*sp.) Malate medium (for *Azospirillum* sp.) and Ashby's mannital agar medium(for Azotobactersp.) was used. After incubation at $37^0$c for the colonies were observed. The colony was counted manually.

**Table 1.Enumeration of Total Heterotrophic Bacteria from vermicompost of *Eiseniafoetida* [45$^{th}$day]**

| S. No | Dilution | CFU/gm | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 100 | 95 | 97.5 |
| 2 | $10^{-4}$ | 95 | 92 | 93.0 |
| 3 | $10^{-5}$ | 85 | 80 | 82.5 |

**Table 2. Enumeration of Fungi from vermicompost of *Eiseniafoetida*[45$^{th}$ day]**

| S. No | Dilution | CFU/gm | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 90 | 88 | 89 |
| 2 | $10^{-4}$ | 84 | 80 | 82 |
| 3 | $10^{-5}$ | 75 | 70 | 72.5 |

**Table 3.EnumerationofActinomycetes from vermicompost of *Eiseniafoetida* [45$^{th}$day]**

| S.No | Dilution | CFU/gm | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 98 | 95 | 96.5 |
| 2 | $10^{-4}$ | 82 | 80 | 81 |
| 3 | $10^{-5}$ | 77 | 72 | 74.5 |

**Table 4.Enumerationof Phosphate solubilizing microbes from vermicompost of *Eiseniafoetida* [45th day]**

| S.No | Dilution | CFU/gm | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 54 | 50 | 52 |
| 2 | $10^{-4}$ | 43 | 39 | 41 |
| 3 | $10^{-5}$ | 23 | 20 | 21.5 |

**Table 5.Enumerationof CelluloseDegrading Bacteria from vermicompost of *Eiseniafoetida* [45th day]**

| S.No | Dilution | CFU/gm | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 58 | 55 | 56.5 |
| 2 | $10^{-4}$ | 43 | 39 | 41 |
| 3 | $10^{-5}$ | 32 | 27 | 29.5 |

**Table 6. Enumeration of Total Heterotrophic Bacteria from vermicompost of *Eudriluseugeniae* [45th day]**

| S.No | Dilution | CFU/gm | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 58 | 53 | 55.5 |
| 2 | $10^{-4}$ | 46 | 42 | 44 |
| 3 | $10^{-5}$ | 34 | 29 | 31.5 |

**Table 7. Enumeration of Fungi from vermicompost of *Eiseniafoetida* [90th day]**

| S.No | Dilution | CFU/gm | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 66 | 62 | 64 |
| 2 | $10^{-4}$ | 52 | 49 | 50.5 |
| 3 | $10^{-5}$ | 48 | 36 | 42 |

**Table 8. Enumeration of Phosphate solubilizing microbes from vermicompost of *Eiseniafoetida* [90th day)**

| S.No | Dilution | CFU/ml | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 123 | 118 | 120.5 |
| 2 | $10^{-4}$ | 99 | 89 | 94 |
| 3 | $10^{-5}$ | 66 | 58 | 62 |

**Table 9. Enumeration of Total Cellulose Degrading Bacteria from vermicompost of *Eiseniafoetida* [90$^{th}$day]**

| S.No | Dilution | CFU/gm | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 223 | 218 | 220.5 |
| 2 | $10^{-4}$ | 91 | 87 | 89 |
| 3 | $10^{-5}$ | 88 | 84 | 86 |

**Table 10.Enumeration of Total Heterotrophic Bacteria from vermicompost of *Eudriluseugeniae* [90$^{th}$day]**

| S.No | Dilution | CFU/gm | | |
|---|---|---|---|---|
| | | Original | Duplicate | Average |
| 1 | $10^{-3}$ | 226 | 220 | 223 |
| 2 | $10^{-4}$ | 106 | 100 | 103 |
| 3 | $10^{-5}$ | 96 | 92 | 94 |

**PLATE-1:- ENUMERATION OF TOTAL HETERTROPHIC BACTERIA FROM VERMICOMPOST OF EARTHWORM 45$^{th}$DAY and 90$^{th}$DAY**

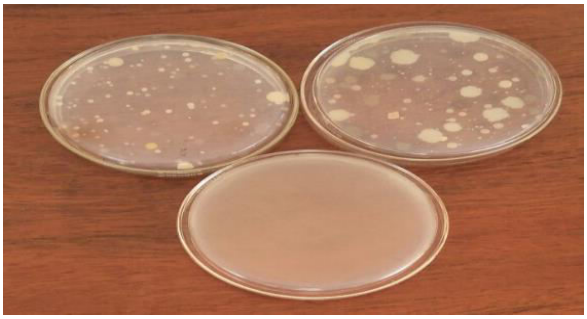


**PLATE-2:- ENUMERATION OF FUNGI FROM VERMICOMPOST OF EARTHWORM 45$^{th}$DAY and 90$^{th}$DAY**

**PLATE-3:- ENUMERATION OF ACTINOMYCETES FROM VERMICOMPOST OF EARTHWORM 45th DAY and 90th DAY**

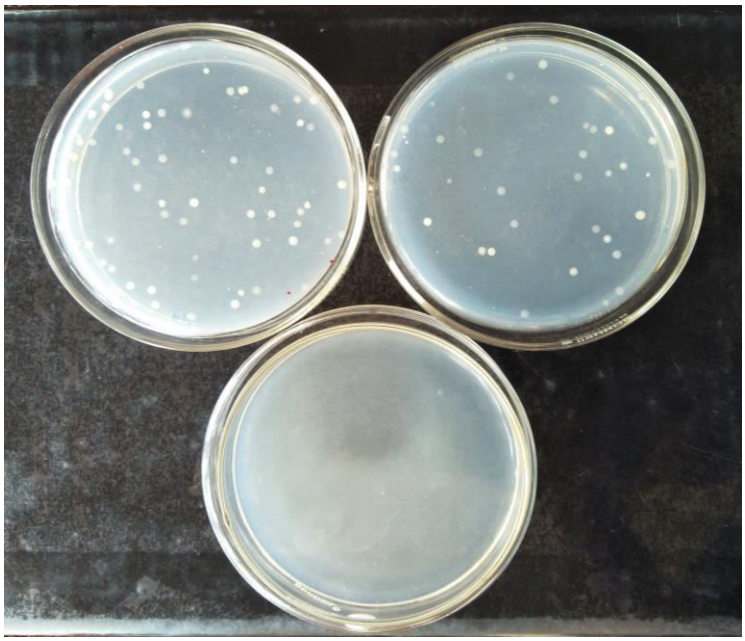


**PLATE-4:- ENUMERATION OF PHOSPHATE SOLUBILIZING MICROBES FROM VERMICOMPOST OF EARTHWORM 45th DAY and 90th DAY**

**PLATE-5:- ENUMERATION OF *Rhizobium* sp. FROM VERMICOMPOST OF EARTHWORM 45th DAY and 90th DAY**

**PLATE-6:- ENUMERATION OF *Azotobacter* sp. FROM VERMICOMPOST OF EARTHWORM 45th DAY and 90th DAY**

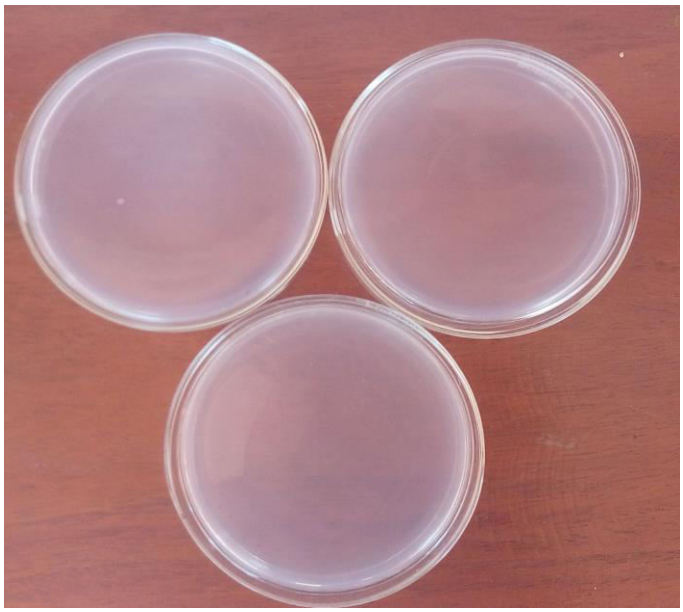
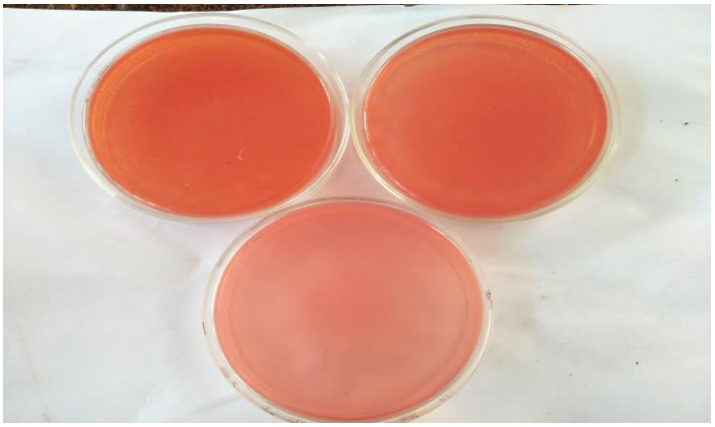


**PLATE-7:- ENUMERATION OF *Azospirillum* sp. FROM VERMICOMPOST OF EARTHWORM 45th DAY and 90th DAY**

**PLATE-8:- ENUMERATION OF *Azospirillum* sp. FROM VERMICOMPOST OF EARTHWORM 45th DAY and 90th DAY**

**PLATE-9:- ENUMERATION OF CELLULOSEDEGRADING BACTERIA FROM VERMICOMPOST OF EARTHWORM 45th DAY and 90th DAY**



## DISCUSSION:

In the present study epigeic earthworms namely *Eiseniafoetida*and*Eudriluseugeniae* were of control used for the management ofBeedi leaf waste and production of vermicompost. Three treatments were prepared for each earthworm, whereas control was maintained for each category. After 90$^{th}$ day of inoculation, black vermicompost was obtained from each treatment.

Vermicomposting has been recently universally accepted as eco-friendly technology for sustainable development and abatement of pollution caused by municipal; garbage, sewage, sludge, agricultural wastes. The vermicomposts prepared from organic wastes such as Beedi leaf waste by earthworms, *Eiseniafoetida* and *Eudriluseugeniae*can be used as the best organic fertilizer in terms of nutritional quality and the impact on the growth of the vegetable plants are highly fruitful and recommended for Agricultural use. The earthworm activity accelerated the process of waste products decomposition and stabilization [8].

When the used substrate is a rich source of complex macromolecules, which can be easily broken down by secretory enzymes of earthworms and the castings contained most of the consitituentsfavourable for the growth of plants as a biofertilizers

The present study revealed that the castings of earthworms are rich source of microbes namely Total Hetertrophic Bacteria, Fungi, Actinomycetes, Nitrogen Fixing Bacteria (*Rhizobium*sp.*Azotobacter*sp.*Azospirillum*sp.) Phosphate Solubilizing Microbes, Cellulose Degrading Bacteria,whose enzymes and their products degrades and decomposes the complex organic matter into simpler ones and makes the nutrients available to the plant roots and increases in the plant growth and there by their yield.

In the process of composting different types of organic substrates (i.e. textile sludge, textile fibre, Institutional waste, kitchen waste and agro- residues) and the microbial load and worm count was maximum with that of agro- residues.

In the present study maximum growth of the earthworm *Eiseniafoetida* was obtained with Treatment ($T_3$) Composted for 90 days. The maximum yield of vermin compostedof*Eiseniafoetida* was obtained in Treatment ($T_3$).

Kadam *et al*. (2008) [7] have studied the decomposition of Tenduleaf*(Diospyrosmelanoxylon)* leaf residues by *Eudriluseugeniae*the maximum growth of the worm was obtained with Treatment composted for 45 days.

In the present study the Beedi leaf waste composted by *Eudriluseugeniae*showed maximum production of earthworms in the treatment $T_6$, where the earthworm feed was high and the quantity of vermicompost harvested was also high in $T_6$ when compared to other Treatments. Among all the treatmentsof*Eiseniafoetida*.Total Hetertrophic Bacteria rank first second place goes to Actinomyces and third place goes to Cellulose degraders.Similarly among the all treatments of *Eudriluseugeniae*.TotalHetertrophic Bacteria rank first rank first second place goes to Cellulose degrading bacteria and third place goes to *Azospirillum* sp.

The vermicomposting is the cheap technology that can be used for degradation of waste into simple molecules the biofertilizer that can be used a source of obtaining high yield from all fields of agricated production.

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