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Effects of showing rate on the mortality of *Eisenia fetida* in different substrates

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Abstract

Vermicompost is the best and easy remedy for solid waste management. Naturally earthworms play a major role in recycling of wastes. The present research work, attempts to study the mortality of *Eisenia fetida* reared in different substrates. The epigeic earthworm *Eisenia fetida* were selected for the present study. The *Eisenia fetida* was bought from agricultural farm at virudhunagar. The control was filled with either pure cow manure or goat manure or pig manure. The proper moisture content was maintained throughout the experiment. After 15 days, 5 non-clitellate earthworms *Eisenia fetida* (200 to 250 mg) were introduced into each rectangular tray. The triplicates for control and experimental samples were maintained throughout the research period. All trays with earthworms were kept in dark room. Mortality was recorded weekly for 6 weeks. No additional feed was added at any stage of the experiment.

Keywords: *Eisenia fetida*, Mortality, Cow Manure, Goat Manure, Pig Manure

Introduction

All activities of animals including human, result in pollution of natural media namely air, water and land as waste (Wilson 1981). In land, continuous application of synthetic fertilizers minimizes the soil fertility and finally soil becomes sterile. Most household wastes, some commercial and industrial refuse are organic in nature. Nearly 20 million tonnes of city garbage are generated annually in India (Mahdi 1980). This waste forms a valuable source for recovery because of the quantity and easy collection. In industrialized countries, 20-30% of urban waste is organic compared to 40-85% in low-income countries.

Wastes have been classified as solids, liquids and gases. Solid wastes include municipal solid wastes (garbage) animal wastes, agricultural wastes, food processing wastes, industrial wastes and aquatic wastes. These wastes are hazardous to health, pollute the environment and affect the biogeocycle, food chain and food web. Composting is the natural process of biological degradation (Dash and Senapathi 1965). Earthworm is an important animal in decomposer system. Earthworm can be divided into 3 types, epigeic, endogeic and anecies. (Bouches 1977).

The degraded organic matter by earthworm activity is called "vermicompost" which can be used as organic manure in fields to prevent organic carbon deficiency and soil erosion. According to Chu manh thung 2003 the different substrate levels affect reproductive rate of earthworms. Edwards *et al* 1998 stated the growth and reproduction of *Perionyx excavatus* as factors in organic waste management. The earthworm density affects microbial biomass and activity in gut of earthworm. The study of Singh *et al* 2004 stated that optimum moisture required for vermicomposting using *Perionyax excavatus* is 80%.

Several authors have studied the growth and vermicomposting process in earthworm using different substrates. Garg *et al* 2005 studied the growth and reproduction of *Eisenia fetida* in various animal wastes. Among the animal wastes, earthworm growth was maximum in sheep and minimum in camel waste. Jorge Dominguez *et al* 1999 studied the effect of bulking materials on the growth and reproduction of earthworm *Eisenia andrei* using sewage sludge. The lowest growth rate was attained in the mixture of sewage sludge with saw dust. Shagotium *et al* 2004 studied the effect of temperature on growth and reproduction of the epigeic earthworm *Eudrilus eugeniae*.

Vermicomposting of cattle and goat manures by *Eisenia fetida* and their growth and reproduction performance was studied by Loh *et al* 2005. They concluded that cattle manure provided a more nutritious and friendly environment to the earthworms than goat manure. Biradar 2003 studied the influence of organic wastes and seasonal environmental factors on growth and reproduction of *Eisenia fetida*. The present work, attempts to study the mortality of *Eisenia fetida* reared in different substrates.

Materials and Methods

Experimental Animal

The healthy earthworm *Eisenia fetida* were selected as the experimental animal for the present study.

Taxonomic Position

Phylum : Annelida
Class : Oligochaeta
Order : Neooligochaeta
Family : Lumbricidae
Genus : *Eisenia*
Species : *fetida*

Common Name

The common name of *Eisenia fetida* is red worms, red wigglers, tiger worms, manure worms.

Distinguishing Characters

Eisenia fetida are utilized throughout India for vermicomposting process. So it is called as manure worm. They consume high organic matter and release casting highly valued as soil conditioners. The conversion efficiency of *Eisenia fetida* is upto 7 mg/worm/day. They are quite hardy and tolerate wide fluctuation of temperature and humidity. The dorsal side of body is recognized by its darker colour and a ventral side is pale colour with genital apertures. The body of *Eisenia fetida* is divided into 100-120 segments. The segments are extended into the inner side of body and certain internal organ system. Each body segment possesses a row of annular about 80-120 minute S shaped and yellow chitinous structures called setae. They are not visible to naked eye, half of them embedded on the body wall. *Eisenia fetida* are hermaphrodites. They attain a body weight of 1.5 g and are capable of producing cocoons. The cocoons are produced from clitellum region. The clitellum in mature worms has 7-9 segments .The clittellar region is highly vascularised. The life cycle is completed in 120days. *Eisenia fetida* attain sexual maturity in about 50days. The adult worm size is 3-4 cm in length. A mature worm on an average can produce one cocoon every third day from the day of maturity. From each cocoon 1 to 3 individuals emerge with in 16 days of incubation period. The live individuals do not come out of the feed substrate. Humidity ideal for survival of young one is 40%. The hatchlings reach non-clitellates stage in 30 days and the non-clitellate stage requires 13 days to reach clitellate.

Collection of Earthworm

The epigeic earthworm *Eisenia fetida* were selected for the present study. The *Eisenia fetida* was bought from agricultural farm at Virudhunagar. The worms were kept in the laboratory under room temperature and provided food and maintained as a stock mother culture. The cocoons collected from mother culture were reintroduced into the same bed. The vermibed was kept moist by sprinkling water once in two days.

Experimental Design

Plastic trays (26 cm, 12 cm and 5 cm) were filled with 100 g (DW) of manure like cow manure, goat manure and pig manure. The cow manure, goat manure and pig manure were mixed (C: G: P) in different proportion like 2:1:1, 1:2:1, 1:1:2 and 1:1:1 in the present experiment. The control tray was filled with either pure cow manure or goat manure or pig manure. The proper moisture was maintained throughout the experiment by sprinkling distilled water whenever necessary. The samples were turned out manually everyday for 15 days in order to eliminate volatile toxic gases. After 15 days, 5 non-clitellate earthworms *Eisenia fetida* (200 to 250 mg) were introduced into each rectangular tray. The triplicates for control and experimental samples were maintained. All trays with earthworms were kept in dark room. Mortality was recorded weekly for 6 weeks. No additional feed was added at any stage of the experiment.

Result

Table 1: Mortality of *Eisenia fetida* reared in different substrates. Each value (%) represents an average of 3 observations.

Substrates	Mortality (%)
Cow Manure (100%)	Nil
Goat Manure (100%)	6.6
Pig Manure (100%)	13.2
C: G: P (2:1:1)	Nil
C: G: P (1:2:1)	19.6
C: G: P (1: 1: 2)	33.3
C: G: P (1:1:1)	Nil

C: G: P - Cow Manure: Goat Manure: Pig Manure

Discussion

In the present work, earthworm like *E. fetida* were reared in different substrates like cow, goat and pig manure and mixed manures. Mortality of earthworm varied in different animal wastes. Gunadi and Edwards 2003 reported death of *E. fetida* after two weeks in fresh cattle solids. The death of earthworm was due to anaerobic condition in fresh cattle Solids. In the present experiment, manures were precomposted fifteen days to remove volatile gases before introducing earthworm. No mortality was observed in 100% cow manure and manure mixture of 2:1:1 and 1:2:1. However, in *E. fetida* a maximum mortality of 33.3% was observed in those reared in 1:1:2 manure mixture. No mortality was observed in 100% cow manure, 2:1:1 and 1:1:1 mixed manure. Above observations show *E. fetida* is capable of tolerating a wide variety of animal waste. It was also found that increased concentration of pig manure was not suitable. Chang and Griffith 1988 reported that worms fed with untreated pig manure died within a few hours. In the present study, the results clearly show that the cow manure is the best for earthworm culture to compare with sheep manure and pig manure.

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