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RESEARCH ARTICLE

MICROORGANISMS IN THE GUT OF EARTHWORM *Eudrilus eugeniae*

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Abstract

Large quantities of organic waste is being generated in agriculture, horticulture, rural industries including sericulture and household sectors and creating environmental problems. If these wastes are converted into wealth in the form of valued manure, not only crop production would be enhanced, environmental pollution will be mitigated. Composting is a microbiological decomposition of organic wastes. Earthworm's gut is a reactor to provide proper environment for the microbes and are playing important part in waste decomposition. Earthworms derive their nutrition from organic matter in the form of plant material, living protozoa, rotifers, nematode, bacteria, fungi and other microorganisms and decomposing remains of large and small animals. The earthworm castings are rich in plant nutrients and also contain certain enzymes namely amylase, proteases, lipase, cellulase, chitinase and invertase. The plant growth hormones secreted by earthworms are known to promote the growth of certain beneficial microbes besides enhancing plant growth. Microorganisms provide a primary source of food for earthworms. Hence, the present study was aimed to isolate and identify the various types of bacteria and fungi present in the gut of *Eudrilus eugeniae.* The bacteria identified in the gut of the selected earthworm were *Proteus mirabilis, Staphylococcus aureus, E.coli* and *Klebsiella* sp. The fungi identified in the gut of *Eudrilus eugeniae* were *Aspergillus flavus*,. *A. niger, A. ternus, Alternaria* sp. and *Pencillium* sp.

Keywords: Earthworm, Microflora, Bacteria, Fungi, *Eudrilus eugeniae.*

Introduction

In modern times due to industrialization and simultaneous population explosion, new problems have plagued humanity. Pollution has suddenly come to the forefront. Waste is a misplaced resource and it is not possible to wastes in toto and actually there is no waste in the natural world. Every possible substance we use and throw away comes back as new and different material. Materials discarded after use may come only through two possible ends. One is discharge into the environment and the other is reuse or reclamation or recycling (Sajnanth and Sushama, 2004).

Earthworms can be use to dispose off all sorts of organic wastes including sewage, animal manure, waste paper pulp and mushroom compost. Organic wastes can be composted to produce manure rich in soil nutrients. Earthworm alone processes more than 20 per cent of the total energy input into the system, stimulate composting activity by decreasing 25 percent of the composting period. Earthworm is not only the biofertilizing agent and composting element but also aerator, moisture retainer, crusher, biological agent, nature's best soil chemist and agriculturist and provide an excellent medium for the growth of microorganisms (Sharma and Agarwal, 2004).

Earthworms fragment the organic waste substrates, accelerate microbial activity greatly and increase

rates of mineralization, rapidly converting the wastes into humus like substances with a finer structure than compost but possessing a greater and more diverse microbial activity (Arancon *et al*., 2003).

Earthworms are wonderful creatures that do much for land and organisms that inhabit it. The earthworms gut is a natural bioreactor and the gizzard is novel colloidal mill in which the feed is ground into particles smaller than 1 micron giving enhanced surface area for the microbial processing. Bacteria and fungi which are important in wastes degradation increase exponentially along the length of tubular bioreactor, reaching densities about 1000 times greater than in surrounding soil. By manipulating the composition and activity of earthworm communities, they may be used to manipulate populations of soil microorganisms to reduce the severity of plant disease and to increase plant productivity in the field (Doube, 1994).

The microflora in the earthworm gut may bring about the breakdown of organic matter and thus make their casts richer in plant nutrients. Earthworm intestines may be the site for lignin oxidation and humus formation. The intestinal bacteria of earthworms produce gums which cement the casts into water stable aggregates. The interactions between earthworms and microorganisms are of major importance in the degradation of organic matter and the release of mineral nutrients into the soil. Hence, the present work was aimed to study the microflora namely bacteria and fungi present in the gut of *Eudrilus eugeniae.*

Materials and Methods

Collection and culturing of earthworms

The exotic earthworm *Eudrilus eugeniae* was collected from Aarthi farms, Kondegoundampalayam village, Pollachi Taluk, Coimbatore, Tamilnadu, India. The species were cultured at Kongunadu Arts and Science College premises, Coimbatore, Tamilnadu, India for six months and were used for the study.

Isolation and identification of bacteria and fungi Preparation of culture media

Petriplates of 12 x 45 mm capacity, test tubes of 25 x 125 mm and boiling tubes 25 x 250 mm were used, as culture vessels. Nutrient agar medium (Mukherjee, 1988) and potato dextrose agar (Mukherjee, 1988), were used as culture media for bacteria and fungi respectively.

Sterilization of media and culture vessels

After the addition of agar, the media were heated gently with constant stirring and poured into conical flasks. The mouth of the conical flasks were closed with non-absorbent cotton plugs and covered with cloth. The media and glassware were sterilized by autoclaving for 20 minutes. The autoclaved media were poured into culture vessels under aseptic conditions.

Samples Extraction

100 mg of the gut content was taken from the two selected earthworm species namely *Eudrilus eugeniae* by dissection and dispersed in 10ml of sterile distilled water and stirred well. The gut sample was diluted serially upto 10^{-4} dilutions 0.5 ml. of the gut sample was taken and transferred to sterile petriplates containing various media like nutrient agar and potato dextrose agar medium for growth of bacteria and fungi respectively.

Identification of bacteria

The isolates of bacteria were identified based on their morphological, cultural and biochemical characteristics following the procedures of Mukherjee (1988).

Identification of fungi

Fungal hyphae, spores and fruiting structures were mounted on a clean glass slide with lactophenol cotton blue on a clean glass slide with lactophenol cotton blue and a cover slip was placed on the mountant. Thus the preparation was observed under the microscope and the isolates of fungi were identified (Mukherjee 1988).

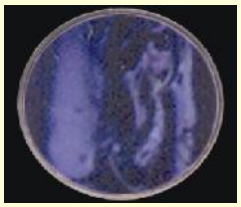
Results and Discussion

Soil is an abiotic factor, which inhabits varieties of microflora and macroflora. The microorganisms and macroorganisms are interdependent and the nutrient cycling in the soil is highly influenced by the activity of these organisms, to exploit the organic resources available in the wastes and soil, the microorganisms generally mutually associate with macroorganisms like earthworms and vice versa.

Plate 1.

BACTERIAL SPECIES FROM THE GUT OF *Eudrilus eugeniae*

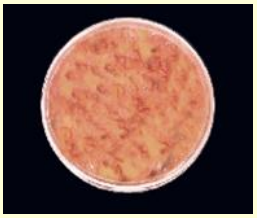
Bacterial growth on nutrient agar



Klebsiella sp.

Proteus mirabilis

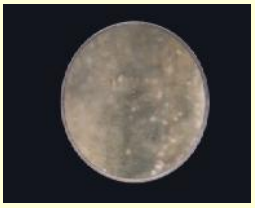
E-coli



Staphylococcus aureus

Plate 2.

FUNGAL SPECIES ISOLATED FROM THE GUT OF *Eudrilus eugeniae*



Aspergillus flavus

Alternaria species

Aspergillus terrus

Penicillium sp.

Earthworms feed on large quantities of organic matter and produces cast, a finely fragmented and processed organic waste. The passage of organic waste through the gut of worms leads to the acceleration of humification process by the gut microflora and the establishment of microflora in their egesta. Earthworm and their casts stimulated soil fertility by increasing soil aggregate stability via bacterial polysaccharides and by enhancing the rate of organic matter breakdown via microflora. Microbial metabolites particularly growth regulatory substances are involved in the biological effects of worm casts.

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Microorganisms on one hand mineralize complex substances, releasing into soil available nutrients for plants and on the other hand, synthesize as a consequence of their secondary metabolism, a whole series of substances, many of which are biologically active. Earthworm ingest oxygen together with food particles and that the oxygen concentration decreases from the anterior gut to the posterior gut due to microbial respiration during passage through the gut. A second oxygen gradient might also occur from gut wall to inner gut sites. These considerations might be correlated to the increased culturable aerobic population of earthworm gut.

Facultative anaerobic bacteria’s such as *E.coli, Proteus mirabilis*, *Klebsiella* and *Staphylococcus aureus* were identified in the gut of *Eudrilus eugeniae* by the changes that occur in the biochemical characteristic exhibited by the bacteria. Fungi namely *Penicillium species, Aspergillus flavus, Aspergillus terrus* and *Alternaria* species present in the gut of *Eudrilus eugeniae* were identified morphologically. Plate 1 is represents the presence of the bacteria *Klebsiella*, *Proteus mirabilis, Staphylococcus aureus* and *E.coli*. Plate 2 represents the presence of the fungi *Aspergillus flavus*, *Aspergillus niger*, *A.terrus* and *Alternaria* sp. Bacteria and fungi in the gut flora increased greatly in number in the two selected earthworm species namely *Eudrilus eugeniae.* The microorganisms present in the gut of the earthworm takes a major part in cellulose and chitin breakdown, their increase may come partly from sugars released by enzymatic degradation of organic material and partly from the mechanical action of the worm’s oesophagus and gizzard in breaking down the organic matter into a finely divided state in which it is more readily susceptible to microbial attack. Edwards and Fletcher (1988) reported that the interactions between earthworms and microorganisms are of major importance in the degradation of organic matter and the release of mineral nutrients into soil.

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