J. Phytol. Res 4(2), 1991

MICROFLORA IN THE GUT CONTENTS OF THE EARTHWORM *(AMYNTHAS DIFFRINGENS* BAIRD.)

MAMTAJ S. DKHAR and R. R. MISHRA
Department of Botany, School of Life Sciences, North-Eastern Hill University, Shillong - 793 014, India

Microbial populations in the gut contents of the earthworm *Amynthas diffringens* Baird. collected from a maize field was estimated at ten days intervals. Results showed that the fungal population was maximum in the fore-gut and minimum towards the hind-gut whereas the populations of bacteria and actinomycetes showed an increasing trend towards the hind-gut. Qualitatively there was no difference between the microflora of the gut contents and of the surrounding soil.

Keywords : Earthworm; Gut contents; Microbial population.

Introduction

Earthworms exert a beneficial influence on the soil. They improve aeration, water-retaining capacity and nutrient status and also enhance decomposition of the litter by mechanical breakdown. They are the chief agents responsible for the crumb structure and mull formation, typical of fertile soilsc Edwards and Lofty, 1972). There are also several references in the literature stating that the earthworms influence the soil microflora. Usually, however, such reports are confined to the enumeration of microflora of soils in which earthworms were present or absent, without establishing any mutual causal relationship. Fungal mycelium and other microbial tissue associated with decaying materials are ingested and they form an important constituent of the diet for earthworms. The present study deals with the comparative account of the microbial populations in the gut contents of the earthworm.

Material and Methods

The present study was carried out in a maize field. The common earthworm found in the field was *Amynthas diffringens* Baird belonging to family Megascolecidae. Samplings were done at ten days intervals.

Large worms (7.0 cm approximately) were cleaned thoroughly with sterilized distilled water and cut into three parts - anterior (1.0-3.0 cm), middle (2.0-5.0 cm), and posterior (5.0-7.0 cm) using sterilized scissors.

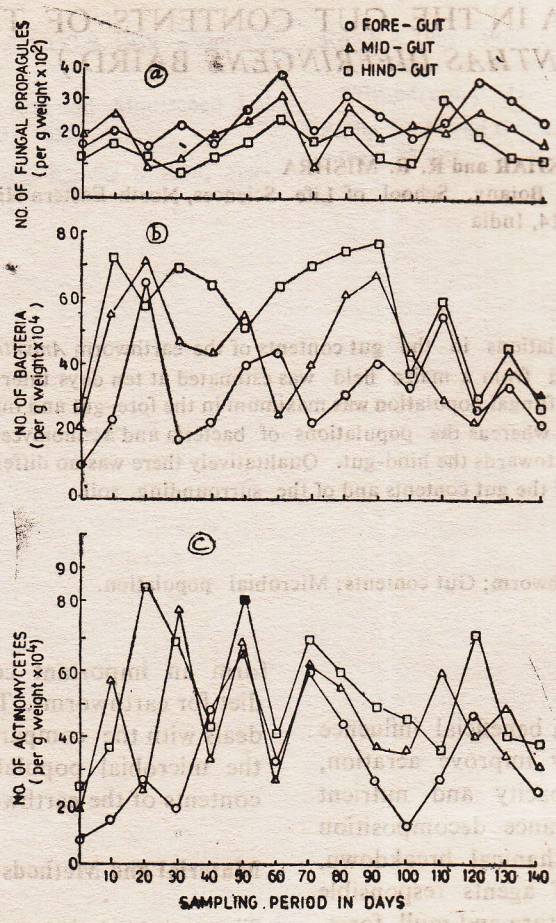

Fig. 1 Microfloral population in the gut contents of earthworm.

The gut contents of different regions were inoculated in sterilized Petri dishes. The soil plate was used to estimate number of fungal propagules. Inoculated Petri dishes were incubated at 25°C for five days. Number of bacteria and actinomycetes was estimated by the dilution plate method (Waksman, 1922) using nutrient agar medium and starch-casein agar medium (Kuster and Williams, 1964) respectively. The culture plates for bacteria and actinomycetes were incubated at 30°C for 24 hours and 7 days respectively. Soil samples were also collected for the study of microflora from the study site where the earthworms were collected.

Results and Discussion

The populations of bacteria and actinomycetes were found to be maximum in the hind-gut, whereas, the population of fungi was found to be maximum in

Table 1 List of fungi isolated from soil and the gut contents of earthworm *Amynthas diffringens*

Fungi	Soil	Gut contents		
		Fore-gut	Mid-gut	Hind-gut
PHYCOMYCETES				
Absidia sp.	+	−	−	−
Mucor hiemalis	+	+	+	+
M. plumbeus	+	+	+	+
M. racemosus	+	+	+	−
Pythium sp.	+	+	−	−
Rhizopus nigricans	+	+	+	−
FUNGI IMPERFECTI				
Alternaria alternata	+	−	−	−
Aspergillus candidus	−	+	+	+
A. flavus	+	+	+	+
A. niger	+	+	+	+
Cephalosporium sp.	+	+	+	−
Cladosporium cladosporioides	+	+	+	+
Fusarium moniliforme	+	+	+	+
Geotrichum candidum	+	+	+	+
Penicillium ehrysogenum	+	+	+	+
P. humicola	+	+	+	+
Penicillium sp.	+	+	+	−
Trichoderma viride	+	+	+	−
Trichoderma sp.	+	+	−	−
Verticillium sp.	+	+	−	−
MYCELIA STERILIA				
Black sterile mycelia	+	−	−	−
White sterile mycelia	+	+	−	+
Yellow sterile mycelia	+	+	+	−

+ = Present, − = Absent.

the fore-gut and exhibited a decreasing trend down the canal of the earthworm (Fig. 1)

Altogether 23 fungal species were isolated (Table 1). Qualitatively there was no differences in the microflora of soil and the gut contents. Most of the fungal species which were obtained from the soil were also isolated from all the regions of the earthworm gut. From the Table 1, it is evident that the soil contained higher number of fungal species than the gut of the earthworm. The genus *Alternaria alternata* was restricted to soil. *Mucor hiemalis*, *Penicillium chrysogenum*, *Trichoderma viride*, *Geotrichum* sp. were of frequent occurence in the soil. *Aspergillus niger*, *Fusarium moniliforme*, *Geotrichum* sp., *Mucor hiemalis* and *Penicillium chrysogenum* were found to be present throughout gut contents of the earthworm.

Bacteria and actinomycetes in the gut flora increased greatly in number. Conditions were less suitable for fungi which usually did not increase in the gut. These results suggest that increases were by bacterial growth and not by the selecting food materials with high bacterial count by the worm. Similar findings have also been reported by Parle (1953). Rushchmann (1953) and Schultz and Felber (1956) reported that actinomycetes are capable of rapid growth in the digestive canal of earthworm forming thereby an important co-dominant fraction in the gut microflora of the animals. However, these results are contrary to Dawson (1947) who observed that the number of bacteria was reduced by passage through the canal while the number of fungi was unaffected. The limited number of fungal species isolated from the gut contents may be on account of selective effect of the passage through the canal on the viability of spores ingested. The small size of the sample and selective effect of the culture medium may also be responsible for lesser fungal species in the gut content. Many of the fungal species were common to all the three regions of the gut of earthworm. This indicates there was no complete killing of such species as they pass down the canal, however, this does not give any information regarding the possibility of quantitative selective killing which might have occurred. Most of the gut fungi were also found in the soil from where the worms were collected. Parle (1963) and Lofty (1974) also reported the similar findings and they concluded that the earthworms are unlikely to pass an indigenous microflora population to their guts.

Earthworms are not capable of digesting all the fungal species they ingest (Nielson, 1962). There is evidence that some of the microorganisms which are taken with the soil by the earthworm are digested during their passage through the earthworm gut (Dash *et al.* 1979). It was observed that *Pythium* sp and *Verticillium* sp were found to be present in the fore-gut and did not occur in the mid-gut and hind-gut of the earthworm, thereby indicating that these species are digested in the mid-gut of the earthworm. *Rhizopus nigricans*, *Trichoderma* spp. and *Cephalosporium*

sp. could be isolated from fore-gut and mid-gut which indicates that they might be digested in the hind-gut of the earthworm. *Fusarium moniliforme*, *Geotrichum candidum*, *Cladosporium cladosporioides*, *Aspergillus* spp and *Penicillium* spp were found to be present throughout the gut canal suggesting that these species were not digested by the earthworm.

From the present study it has been observed that there exists an interaction between earthworm and the soil micro-organisms which form a source of food for the earthworm. The activity of earthworm may have a very significant effect on the distribution of the soil fungi. No evidence was obtained that the worms had a specialized gut flora, qualitatively different from that of the soil they feed on.

One of the authors, Mamtaj S. Dkhar is thankful to Council of Scientific and Industrial Research (CSIR) New Delhi for providing financial assistance.

References

Dash MC, Mishra PC and Dehera N 1979, *Trop. Ecol* 20 9

Dawson RC 1947, *Soil Sci. Soc. Ame. Proc.* 12 512

Edwards CA and Lofty JR 1972, *Biology of Earthworm*, Chapman and Hall, London, p 283

John LF and Curl EA 1972, *Method for the Research on Ecology of Soil Borne Plant Pathogens* Minneapolis Burges Publication Co. p 247

Kuster R and Williams ST 1964, *Nature* (London) 202 928

Lofty JR 1974, *Biology of plant litter decomposition* 2 467

Martin JP 1950, 69 215

Nielson CO 1962, *Oikos* 13 200

Parle J N 1963, *J. Gen. Microbiol.* 31 1

Ruschmann G 1953, *Z. Acker-u Pflbau*, 96 201

Schultz W and Felber E 1956, *Z. Acker-u pflbau* 101 471

Waksman J H 1922, A method of counting of the numbers of fungi in the soil. *J. Bot* 7 339