

Microfungal species associated with the gut content and casts of *Drawida assamensis* Gates

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Abstract. Microfungi were isolated from earthworm (*Drawida assamensis*) gut contents and freshly laid worm casts of a pineapple plantation field using Warcup's soil plate method. A total of 17 species of microfungi were isolated, out of which 16 occurred in the anterior region, 12 in the middle region and 10 in the posterior region of the gut and 10 in the worm cast respectively. One species was restricted to posterior region of the gut and the worm cast. The digestion of microfungi in earthworm's digestive tract occurred in a trend anterior > middle > posterior.

Keywords. *Drawida assamensis* Gates; microfungi; pineapple.

1. Introduction

Selective feeding habit of earthworms and the passage of the ingested materials in worm gut influence the properties of worm faeces (Lee 1983). A number of investigators have reported that the casting and excretion of worms may indirectly improve the nutrient supply to plants (Mulongoy 1986; Krishnamoorthy and Vajranabhiiah 1986; Tiwari *et al* 1989). Studies on microflora of the intestinal tract of earthworms have so far received little attention from soil microbiologists (Parle 1963; Dash *et al* 1979; Gorbenko *et al* 1986). For a better understanding of the effect of earthworm ingestion on microbial processes in soils, knowledge of the microbial biomass in digestive tract and casts of earthworm may be useful. Therefore, the present study was undertaken to determine the microfungal population of the gut of earthworm and its cast.

2. Materials and methods

The study was carried out at Pineapple Research Station, Nayabanglow (latitude 25°44'N, longitude 91°53'E, altitude 800 M) in the east Khasi hills of Meghalaya about 30 km north of Shillong. The study soil is a red sandy loam (sand 69%, silt+clay 31%) of laterite origin (oxisol). The pH of the soil was 4.96 and the organic carbon and nitrogen contents were 1.6% and 0.4% respectively. Soil temperature varied between 16°C and 26°C.

In the present investigation the culturing of microfungi of gut content and the worm cast have been used to investigate the fungal communities of the gut and cast of earthworm. *Drawida assamensis* Gates was the dominant earthworm species in the pineapple plantation soils (Tiwari *et al* 1989, 1990). Twenty numbers of intermediate size worms (Martin 1986) were thoroughly cleaned with sterilised water and each worm was cut into 3 parts; anterior (up to 4 cm) middle (from 4–8 cm) and posterior (from 8.0–12.5 cm) using sterilised scissors (Dash *et al* 1979).

The gut content of the different regions of the worms were collected in sterilised petridishes containing about 2 ml of earthworm ringer solution. Freshly produced worm casts were also collected aseptically.

Microfungal populations in earthworm gut contents and casts were estimated by the soil plate method (Warcup 1950) using rose bengal agar medium (Martin 1950). Approximately 0.015 g gut contents and casts were inoculated separately in sterilised petridishes, using a sterilised nichrome spatula. A few drops of sterilised distilled water were poured at the bottom of the petridishes to disperse the inoculum uniformly. Then approximately 15 ml molten and cooled (below 45°C) rose bengal agar, supplemented with streptomycin sulphate, was poured into the petridishes. The dishes (5 replicates) were gently rotated and incubated at a temperature of 25 ± 1°C for 5 days and the fungi were observed under a binocular microscope for identification. The monographs of Raper and Thom (1949), Gilman (1957), Subramanian (1971), Barnett and Hunter (1972), Domsch *et al* (1980) and Ellis and Ellis (1985) were consulted for the identification of fungi.

3. Results and discussion

Nine genera of microfungi comprising 17 species were isolated from the gut contents and casts of the earthworm. The isolates were: *Alternaria alternata*, *Aspergillus nidulans*, *A. niger*, *Curvularia maculans*, *Fusarium moniliforme*, *F. solani*, *Mortierella ramanniana*, *Paecilomyces liliacinus*, *Penicillium chrysogenum*, *P. claviforme*, *P. fellutanum*, *P. funiculosum*, *P. javanicum*, *P. vermiculatum*, *Trichoderma koningii*, *T. viride* and *Torula herbarum* (table 1). Seventeen species were isolated from the gut (anterior 16; middle 12; posterior 10). Ten species comprising 6 *Penicillia*, two *Aspergilli*, one *Curvularia* sp. and one *Paecilomyces* sp. were isolated

Table 1. Percentage frequency of microfungi isolated from the gut contents and casts of *D. assamensis*.

Microfungi	Gut contents			Freshly laid worm casts
	Anterior	Middle	Posterior	
<i>Alternaria alternata</i> (Fr.) Keissler	6	6	—	—
<i>Aspergillus nidulans</i> Van dentatus	14	11	8	15
<i>Aspergillus niger</i> Van. Tieghem	25	19	20	28
<i>Curvularia maculans</i> Boedijn	—	—	8	10
<i>Fusarium moniliforme</i> Sheld	94	87	—	—
<i>Fusarium solani</i> (Mart.) Sacc	51	65	—	—
<i>Mortierella ramanniana</i> (Moller) Linnem.	8	—	—	—
<i>Paecilomyces liliacinus</i> (Thom) Samson	27	29	26	31
<i>Penicillium chrysogenum</i> Thom	83	88	85	90
<i>Penicillium claviforme</i> (Bain)	23	11	13	29
<i>Penicillium fellutanum</i> Biourge	40	44	40	41
<i>Penicillium funiculosum</i> Thom	31	36	14	30
<i>Penicillium javanicum</i> Van Beyma	21	15	13	19
<i>Penicillium vermiculatum</i> Dangeard	54	39	50	52
<i>Trichoderma koningii</i> Oudem	15	—	—	—
<i>Trichoderma viride</i> Pers. ex. Gray	62	—	—	—
<i>Torula herbarum</i> Pers. ex. Gray	4	—	—	—

—, Not isolated.

from freshly laid worm casts. Microfungal species viz., *A. alternata*, *F. moniliforme*, *F. solani*, *M. ramanniana*, *T. koningii*, *T. viride* and *T. herbarum* were present in gut contents and were not recovered from the freshly laid worm casts. *C. maculans* was isolated from the posterior region and earthworm casts. The species of *M. ramanniana*, *T. viride*, *T. koningii* and *T. herbarum* were isolated only from the anterior region of the gut (table 1). This indicates that these microfungi are generally, digested in the middle region of the gut. *F. moniliforme*, *F. solani*, and *A. alternata* were isolated from the anterior and middle regions of the gut indicating that these fungi were digested in the posterior region of the gut of *D. assamensis*.

Present study demonstrated that maximum number of microfungi were digested in the anterior and middle region of the gut of earthworms. Similar fungal flora in posterior region of the gut and casts indicates that little digestion of fungal tissues occurs in the posterior region of the gut. This shows that a gradient exists with regards to the digestive capability of different regions of the gut of *D. assamensis* for utilization of microfungi; anterior > middle > posterior. *D. assamensis* grazed over microfungi and a reduced spectrum of fungal species was found in the casts. Dash *et al* (1979) in a similar study also recorded less number of microfungi in worm casts. In general, it may be concluded that earthworms are able to utilise a large number of soil fungi as food and it has a profound effect on the structure of microfungal communities of the soil.

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