

## SHORT NOTE

# Fungi in the gut contents of Namib Desert dune Lepismatidae (Thysanura: Insecta)

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### ABSTRACT

Six fungal species were isolated from the guts of five dune dwelling lepismatid species from the Namib Desert. The abundance of *Penicillium chrysogenum* Thom, which occurred in the guts of all lepismatid species, warrants further investigation.

### INTRODUCTION

Freshly killed Namib lepismatid species of the genus *Ctenolepisma* were found to rapidly develop fungal hyphae from inside the body when left in a moist environment at room temperature. This observation suggested that an unusual association exists between these animals and fungi in their guts.

Namib lepismatids are detritivores, consuming mainly dead plant matter, but occasionally small dead animals. The gut environment of arthropod detritivores in general provides moisture, behaviourally regulated temperature, suitable pH and a constant food source to micro-organisms capable of living there (Crawford & Taylor 1984). Gut micro-organisms, such as found in termites (Cano & Calomé 1986, p.366) may be cellulolytic, and may have a symbiotic relation with their hosts, that use nutrients released by cellulose digestion. Thus, in the Namib Desert sand dunes where microbial populations are low (le Roux 1970) because of extreme temperatures, low soil moisture, and a patchily distributed detrital food source, the guts of arthropods may provide a suitable environment for microbial activity.

In desert ecosystems, arthropod detritivores and their associated gut flora may be relatively more important in energy flow and nutrient cycling processes than the free-living microbial detritivores (Crawford & Taylor 1984) that are responsible for the breaking down of more than 70% of primary production in other ecosystems (Heal & Maclean 1975). Knowledge of the factors affecting these processes is important for understanding the functioning of the desert ecosystem.

Free-living fungi are known to play a major role in decomposition and nutrient cycling in many ecosystems (Cano & Colomé 1986). It is tempting to suggest that fungi may perform this function by existing in detritivore guts in a manner comparable with

other gut micro-organisms, although no known example of filamentous fungi metabolising in the anaerobic gut environment exists. The presence of fungi in the guts of Namib lepismatids does not necessarily mean that any association exists between the two, other than coincidental consumption of the fungi by lepismatids with their food. However, to assess the role of fungi in the Namib dune ecosystem, it is necessary as a first step to determine what, if any, fungi exist in the gut contents of the dune dwelling Namib lepismatids.

### METHODS

The gut contents of 3-5 individuals of each of five species of dune dwelling lepismatids freshly collected from the Namib Desert were aseptically removed. Gut contents were pooled for each species and suspended in 1 ml sterile distilled water. Aliquots of each suspension were plated onto Czapek-Dox (Oxoid), cornmeal (Oxoid) and 1% malt extract (Oxoid) agar in plastic petridishes, respectively. Dishes were incubated for ten days under intermittent near-UV illumination at 25° C before they were inspected for fungal growth. Isolations were made from fungal colonies onto appropriate media for identification of species.

### RESULT AND DISCUSSION

Six fungal species were isolated from the gut contents of the five lepismatid species (Table 1). *Penicillium chrysogenum* Thom occurred most frequently and was present in all five lepismatid species, whereas *P. griseofulvum* Dierckx and *P. crustosum* Thom occurred in only one species respectively (Table 1). The ubiquitous *Penicillium* form-genus occurs commonly in soil, its members are spoilage agents of food products and can grow at low levels of water activity. Although the *Penicillium* species occurred frequently in the lepismatid guts, their association with soil debris suggests that their presence in the gut could be the result of their conidia or mycelia being consumed

TABLE 1: The frequency (total number of colonies counted) of fungi isolated from the gut contents of five lepismatid species that inhabit the Namib Desert sand dunes.

Lepismatid Species	Fungal Species						
	<i>Penicillium chrysogenum</i> (typical) <sup>1</sup>	<i>Penicillium chrysogenum</i> (atypical) <sup>2</sup>	<i>Penicillium griseofulvum</i>	<i>Penicillium crustosum</i>	<i>Aspergillus terreus</i>	<i>Alternaria alternata</i>	<i>Cladosporium cladosporioides</i>
<i>Mormisma wygodzinskyi</i>	100	6	5	0	0	0	0
<i>Namibmormisma muricaudata</i>	15	0	0	0	2	0	0
<i>Nebkahlepisma<sup>3</sup> australis</i>	50	0	0	1	0	0	0
<i>Ctenolepisma terebrans</i>	13	2	0	0	0	1	0
<i>Ctenolepisma pauliani</i>	53	0	0	0	0	0	1

<sup>1</sup> - produces the typical yellow pigment on Czapek Yeast-extract agar (CYA)

<sup>2</sup> - does not produce the typical yellow pigment on CYA

<sup>3</sup> - identified as *Hyperlepisma australis* (Watson & Irish 1988, Watson 1989)

with the detritus. Alternatively, some lepismatids are known to ingest fungi preferentially, so it may be that Namib lepismatids selectively graze on commonly occurring fungal hyphae. Nothing is known however, of the occurrence of fungi in the Namib Desert dune ecosystem. Members of the genus *Penicillium* produce mycotoxins harmful to man and other animals, but little is known of the effect of these mycotoxins on insects. Certain *Penicillium* species however, also produce secondary metabolites that are useful to man, such as penicillin produced by *P. chrysogenum*.

The remaining three fungal species occurred infrequently in three of the lepismatid species (Table 1). *Alternaria alternata* (Fr.) Keissler and *Cladosporium cladosporioides* (Fresen.) de Vries are known to occur commonly on the phylloplane and on senescent plant material. *Aspergillus terreus* Thom, in common with *Penicillium*, is known as a soil fungus, associated with soil debris, and as a food spoilage agent. The comparatively rare occurrence of these fungal species is likely to be from coincidental consumption with detritus.

It is not possible to deduce either the role or effect of the fungi isolated in this study on the survival and biology of the lepismatids. However, the relatively high frequency of *P. chrysogenum* in the gut contents

of all the lepismatid species warrants further investigation.

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