A new species of Helicocephalum (Zygomycotina) from South Africa

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Helicocephalum africanum sp. nov. is described from rock hyrax dung and is the first representative of this genus to be recovered from the Southern Hemisphere. The morphology is described using scanning electron and optical microscopy. The fungus was grown in culture, together with the bacteria on which it appears to feed. A key to the genus is included.

Keywords: Coprophilous, dung, Helicocephalum africanum, hyrax, Mucorales, Procavia sp.

Introduction

In a survey of dung for the presence of Mucorales, a specimen belonging to the genus Helicocephalum, from dung in latrines of Procavia capensis (Pallas, 1766) ('rock dassie'), was recorded for the first time in South Africa. The genus Helicocephalum was erected by Thaxter (1891), based on H. sarcophilum from carrion in Connecticut as the type species. Although Thaxter placed it in the Hyphomycetaceae, he speculated that it could be a Mucoraceous fungus. Since then, only three other species have been described: H. oligosporum Drechsler (1934) on decaying spinach from Virginia, United States of America, H. diplosporum (Drechsler 1943) from decaying leaves of Poa pratensis, Arlington, Virginia and H. corniculatum Kitz & Embree (1989) from riparian woodlands soil, Solon, Iowa, characterized by the formation of the entire merosporangium before cleaving delimits the individual sporangioles. Arnaud (1952) recorded H. diplosporum from Versailles, France, as well as H. megalosporum sp. nov., which is a nomen nudum because of the lack of a Latin description. Zyche et al. (1969) did not consider this genus in their monograph of the Mucorales. Hawksworth et al. (1983) treated this genus in the Zoopagales, an order they distinguish on the morphological grounds. On the basis of the slight bend to the sporangiophore, the number and size of the sporangioles and the lateral thickened area on the sporangioles, the fungus was placed in a new genus. This article therefore represents the first report of a representative of the genus Helicocephalum from the Southern Hemisphere.

Materials and Methods

The dung was collected in the latrines of rock dassies feeding on indigenous plants on the hills of Pellisier, Bloemfontein, and put into sterile plastic bags. Later it was plated out onto Potato carrot agar (PCA) plus Novobiocin (125 mg per litre). Incubation was at 24°C for two weeks under intermittent, mixed ultraviolet and daylight fluorescent light tubes, for 12 hours per day. The fungus which developed was processed for scanning electron microscopy (SEM) (Roux & Botha 1994). Material for light microscopy was mounted in acid fuchsin lacto-phenol and also in water.

Morphology

The fungus consists of sterile hyphae which are sparingly branched (with septa only in much older parts of the mycelium). The unbranched sporangiophores measure up to 850 μm (Figure 1), developing from a number of poorly branched rhizoids (Figure 2) which develop from what may be termed a trophocyst-like structure or basal hyphal swelling, 25 μm wide at the base. The apex of the sporangiophore swells and darkens (Figures 5 & 6). When it reaches maturity, the sporangiole is delimited by a septum while the next sporangiole is forming from the apex of the sporangiophore. These sporangioles are formed in a false chain and held together in a mucus droplet (Figures 4 & 6) at the apex of the sporangiophore, which is more or less straight (Figure 5). Up to 10 (usually 5) sporangioles, which measure a maximum of 132 (usually 45) × 35 μm, are formed and have scars at both ends (Figure 4). The cell wall of the sporangiole seems to be partly thickened, which may explain the curvature in the long axis (Figures 7 & 8). The first sporangiole may be the longest, with a rounded apex (Figure 5). The apices of the intermediary sporangioles are perforated by a distinct pore where they are connected to the previous and following sporangioles (Figure 6). When broken, the cell-like contents are released.

Description

Helicocephalum africanum Cec. Roux sp. nov.

Sporangiophorus 850 μm alitis, sarsum 15 μm erisasis, basis ad 25 μm erisasis; apex sporangiophoris rectus, 15 μm diam., elliptico-cylindraceus, utrinque obtuse rotundatis, maturitate brunneis. 35-132 (av. 45) × 25-35 (av. 30) μm denique secernendibus et in capitulum subglobosum viscosum cohaerentibus, incrassatus lateralis.

TYPUS: PREM 51900.

Sterile basal hyphae 4 μm in diameter, arising from a swollen base or trophocyst which gives rise to a single sporangiophore or pairs of up to 500 to 850 μm long. Base up to 25 μm and the stipe 15 μm in diameter, ending in a discoured swollen apex which produces sporangioles in linear succession. Tip of the sporangiophore is more or less straight. A maximum of 10 sporangioles, measuring 35–132 (average 45) × 20–35 (average 30) μm and are dark brown in colour when mature. The first sporangiole is the longest, the apex ending in an obverse tip. The intermediary sporangioles have distinct scars, with a single pore at each end. On one side of each sporangiole is a distinct scar which appears to be caused by thicker cell-wall material. (Figures 1–8).

H. africanaum can be separated from the known species on morphological grounds, on the basis of the slight bend to the sporangiophores, the number and size of the sporangioles and the lateral thickened area on the sporangioles.


Discussion

This specimen (PREM 51900) initially grew under artificial conditions without any special media or supplements except the bacterial contaminant, contrary to what is reported in the literature (Ellis 1963). Later attempts to grow it failed. The initial isolation...
was obtained from a culture mixed with Doctylella sp., which is also nematophagous. The nematodes present in the initial culture were representatives of the family Rhabditidae, similar to what was found by Barron (1975) who demonstrated that *H. oligosporum* parasitises eggs of some species of *Rhabditis* nematodes. Later, mites were also observed in the culture, and one mite egg

Figures 1–4  Sporangiphore and sporangiole of *H. africanum* (bright field optics). Bar = 10 μm. 2. Base of sporangiophore of *H. africanum* (bright field optics, water mounted) with possible appressoria on mite egg. Bar = 10 μm. 3. Base of sporangiophore of *H. africanum* with reduced rhizoides (phase contrast optics). Bar = 10 μm. 4. Full complement of sporangioles with apex of first spor-angiole arrowed (bright field optics). (Bar = 10 μm).
was possibly associated with the base of a sporangiophore (Figure 2) where what appear to be appressoria could be distinguished. The thickened material on one side of the sporangiole caused it to take on a specific form when collapsing, enabling the entire complement of sporangioles produced by a sporangiophore to interlink and form a ball held together by mucus. This

thickened area has not been described for any other species of this genus.

The spirally twisted apex of the sporangiophore, described by Drechsler (1934) for *H. oligosporum*, has not been observed in the species studied here. Only a slight twist was seen (Figure 2), similar to *H. corniculatum*, where cleaving of the sporangiolar structure (merosporangium) takes place before they darkened, similar to those illustrated by Barron (1975). He stated that *H. oligosporum* can have up to three heads, produced in clusters. Here only one instance of two adjoining sporangiophores was observed.

**Helicon ovalisporum** Krzem. & Badura [Acta Soc. Bot. Polon. 23, 757–758 (1954)] from rabbit dung in Poland was considered by Goos et al. (1986) to be better placed in *Helicocephalum*. With the present knowledge of this genus it can be synonymized with *H. oligosporum*.

The terminology relating to the spore type of *Helicocephalum* differs between authors. Drechsler (1934, 1943) and Watanabe & Koizumi (1976) used the term 'spore' while O'Donnell (1979) prefers 'sporangium', which is more acceptable for this group. Benjamin (1966), on a treatise of the mero sporangium, stated that sporangiospores formed in linear series are coined merosporangium, according to Martin (1940). Barron (1975) considers these propagules 'arthrospores', which can be argued to be the best interpretation of the nature of the spores. Sutton (1993) proposed the term 'mitosporangium' for anamorph or asexual spores in the Deuteromycotina. This term may also be applicable to asexual spores from other groups, i.e. the Mucorales, although terms relating to the Deuteromycotina has not been used in other groups as the ontogeny is quite distinct. The fact that this genus is extremely poorly known and seldom found is apparent from the literature. The most frequently recorded species is *H. oligosporum*, reported from Belgium (Bruyck 1987), France (Arnaud 1952), Poland (Krzemieniewska & Badura 1954), Japan (Watanabe & Koizumi 1976), Ontario (Barron 1975) and Virginia (Drechsler 1934).

*H. africanaum* has not been demonstrated to be a parasite of any other organism. This represents the first of any species of this genus occurring in the Southern Hemisphere.

**Key to species of Helicocephalum**

1. Sporangio phore more or less straight, sporangioles produced in pairs

2. Sporangio phores coiled or bent, sporangioles not produced in pairs

3. Sporangio phores distinctly terminally helicoid

4. Sporangio phores up to 65 μm long, up to 21 in number

5. Sporangio phores up to 55 μm long, up to 10 in number

6. H. sarco philum

4. Sporangio phores up to 830 μm in length, sporangioles 5 or less, measuring up to 95 μm, no thickened area on sporangioles

7. Sporangio phores up to 850 μm in length, sporangioles more than 5, measuring up to 132 μm, thickened area on sporangioles

**H. africanaum**

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**References**


