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A RECORD OF ARTHROBOTRYS TORTOR *JAROWAJA* AND ENGYODONTIUM ALBUM *(LIMBER) DE HOOG* FROM ANTARCTICA.

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Key words: ***Arthrobotrys tortor, Engyodontium album,*** antarctic soils.

SUMMARY

We report for the first time isolates of ***Arthrobotrys tortor*** and ***Engyodontium album*** from Mid Victoria Land (Antarctica). These fungi are discussed with notes on their ecology.

RESUMEN

[Primeros aislamientos Antarticos de Arthrobotrys tortor Jarowaja y Engyodontium album (Limber) De Hoog.]

Se reporta por primera vez el aislamiento de ***Arthrobotrys tortor*** y ***Engyodontium album*** desde Mid Victoria Land (Antártica). Se discuten ambos taxa con algunos comentarios ecológicos.

INTRODUCTION

In a survey of microfungi in soil, mosses and ornithogenic material collected in Victoria Land (Antarctica) during the Italian expeditions 1988-89, 1989-90 and 1990-91, 269 isolates representative of 18 genera have been isolated. A preliminary listing was compiled in a previous paper (Del Frate and Caretta, 1990). Furthermore, a number of additional species of difficult identification was isolated, and from these entomogenous and nematophagous fungi; microscopic examination led to their attribution to the genus ***Engyodontium*** as ***E. album*** (Limber) de Hoog, and ***Arthrobotrys*** as ***A. tortor*** Jarowaja, respectively. This is the first report of the observation of these two fungi from Antarctica.

We consider these records of particular taxonomical and ecological interest.

MATERIAL AND METHODS

Collections of material (212 samples) were made during the Italian expeditions 1988-91 at 7 locations of the Mid Victoria Land (Terra Nova), Ross Sector (160-170° E). The localities, the methods used for fungal isolation and identification have been described previously (Del Frate and Caretta, 1990). A good cultural medium suitable for isolation of some filamentous fungi, particularly the entomogenous and nematophagous ones, was the "moss plate culture". The moss used was ***Brachythecium rutabulum*** *(Hedw.) Bruch et al.*, collected in the Pavia Botanical Garden; it was sterilized, placed in petri dishes and moistened with sterile water. The antarctic material was distributed on the surface of the moss plates, which were then incubated at various temperatures (8, 15, 25 and 40° C) for up to 12 weeks. This natural substrate has been found also to be suitable for the culture of Antarctic members of the keratinophilic fungi. Most of these fungi grow and sporulate in culture at temperatures in the range of 10-15°C.

RESULTS AND DISCUSSION

Over 269 strains of fungi have been isolated from 212 samples of soil, mosses and ornithogenic material collected in 7 localities of the Mid Victoria Land.

In general the highest occurrences of fungi were recorded from mosses and soil when mosses were present.

The nematophagous ***Arthrobotrys tortor*** and the entomogenous ***Engyodontium album, Acremonium strictum, Beauveria bassiana*** and ***Paecilomyces farinosus*** were isolated only or mainly from moss and soil-moss. Also the cellulolytic ***Chrysosporium verrucosum*** and ***Geomyces pannorum*** var. ***pannorum*** were isolated from mosses and ornithogenic material (feathers). ***Thelebolus microsporus,*** a minute 8-spore ascomycete (Montemartini Corte et al., 1993, ***Phoma herbarum,*** ascomycetous yeast of the genus ***Torulopsis*** and basidiomycetous yeast of the genera ***Cryptococcus*** and ***Sporobolomyces*** were frequently isolated from bird dung.

NEW RECORDS

Arthrobotrys tortor Jarowaja

During investigations of hyphomycetes on mosses from Antarctica at Edmonson Point, Cape King, Mount Melbourne, numerous isolates were obtained in culture and found to possess conidiogenous structures and conidial morphology similar to *A. tortor*. Morphological investigations were carried out on moss plate cultures and on other agar plate formulations (OA, Sabouraud's agar, Emerson's agar medium); moss plate cultures proved to be particularly useful for the growth of this fungus. According to the original description and classification of *A. tortor* by Jarowaja (1968; 1970) our strains were identified as this species.

According to Jarowaja (1968), *A. tortor* has a varied structure of the spore bearing part of the conidiophores. Conidiophores in *A. tortor* can be of the intermediate type between candelabrelloid and arthrobotryoid or genicularioid, with the apical part covered with short denticles. Heads of conidia rather elongated, somewhat irregular; conidia 20-26 long and (9) 11-14 µm wide, hyaline, obovoidal to clavate, 2-celle, with one median septum, slightly constricted at the septum. Sometimes the fungus forms small additional conidiophores bearing a loose apical verticillate head of 2-11 drop-like microconidia with one septum. Chlamydospores are often present, intercalary, solitary or arranged in short chains. Optimal growth was observed at 24° C and no development was found to occur at 6 or 30° C.

According to Jarowaja (1968), *A. tortor* differs from *A. conoides Drechsler* in the morphology of conidia: the conidia of *A. conoides* are more slender, arise on blunt papillose sterigmata and are collected in regular apical and intercalary clusters. The fungus captures and eats eelworms (Nematoda).

In studies on the occurrence of predaceous fungi of the genus *Arthrobotrys* on various substrates in Poland, seven strains of *A. tortor* were isolated by Jarowaja (1970) from loess soil; two isolates trapped nematodes by means of predaceous bulb organs and haustoria.

Arthrobotrys tortor has not been recorded in other investigations on various substrata. Yet this species was listed by Schenck et al. (1977) among the 48 recognized species of the genus *Arthrobotrys.* Van Oorschot (1985) revised this genus and recognized 27 species and 5 varieties. *Arthrobotrys tortor* was listed by her as a synonym of *A. conoides Drechsler*. As we explained above, *A. tortor* differs sufficiently from *A. conoides* to warrant classification as a separate species. *A. tortor* and *A. conoides* differ mainly in the conidiophores. In *A. tortor* conidiophores of the intermediate type between candelabrelloid and arthrobotryoid or genicularioid are present; conidia are elongate. In *A. conoides* conidiophores proliferate repeatedly, conidia are elongate-obovoidal and much longer 30-46 x 11.5-14 µm.

Nematophagous fungi have been recorded in soil and vegetation samples collected from various sites in Antarctica at 68°S (Gray and Smith, 1984). In 24 species of nematophagous fungi recorded, ***Arthrobotrys robusta*** was reported as the only species of this genus. This species was only isolated from bird-associated sites. Spontaneous trap formation was widely observed in the Antarctic isolates and their distribution is most probably linked to the bird population (Gray, 1985).

A new springtail-predaceous hyphomycete of ***Gressittacantha terranova*** isolated from moss species ***Bryum algens*** and ***Ceratodon purpureus*** in Antarctica was described as ***Arthrobotrys ferox*** by Onofri and Tosi (1992). It produces aerial predaceous organs consisting of ovoidal cells surrounded by an adhesive secretion and supported by 2-cell stalks. Strains of *A. tortor* that we isolated in Antarctica are close to *A. ferox*, but they do not exhibit the peculiarity in culture of *A. ferox* to produce predaceous organs on the aerial hyphae. According to Onofri and Tosi (1992), the production of predaceous organs is very difficult. Further studies are required to fully evaluate this ability from our strains of *Arthrobotrys*. Besides the conidia of *A. ferox* are smaller than those of *A. tortor.*

Engyodontium album (Limber) de Hoog

The genus ***Engyodontium*** was erected by de Hoog (1978) to accommodate species in which some polyblastic conidiogenous cells with narrow denticles are formed.

Seven species were included in this genus by de Hoog, being one of them ***E. album*** *(Limber) de Hoog*. This is a new combination erected by de Hoog for ***Tritirachium album*** *Limber* (basionym) and ***Beauveria alba*** *(Limber) Saccas*. This genus is characterized by hyaline, branched conidiophores, subverticillate to verticillate, polyblastic conidiogenous cells forming holoblastic one-cell-conidia on butt-shaped denticles on elongated rachids. ***Engyodontium*** is closely related to genus ***Tritirachium*** and shows features which link the anamorph genera ***Verticillium*** and ***Aphanocladium*** (Gams et al., 1984). ***Tritirachium*** *Limber* differs in pigmented colonies and regularly geniculate conidiiferous rachids with flat conidial scars. In ***E. album*** branching of conidiophore is strictly verticillate, rachids geniculate with regularly spaced and butt-shaped denticles concentrated in the apical region. The morphological characteristics of our isolates from Victoria Land (Antarctica) were very similar to ***E. album*** as reported by de Hoog. On moss plate culture and PDA our strains produce white colonies with abundant aerial mycelium. Conidiophores are ascendent to suberect, branching verticillate, conidiiferous rachids geniculate producing conidia from short denticles, conidia subulate to ellipsoidal, 2.5-3.5 x 2-3 µm. The sympodial conidiogenous cells, or rachids, of the antarctic strains of ***E. album*** are longer. They are similar to the geniculate rachids of the genera ***Acrodontium*** and ***Tritirachium*** , that develop sympodially.

Engyodontium album is close to ***E. parvisporum*** *(Petch) de Hoog*; the main feature for distinguishing of both species is, according to de Hoog, the rachids, cylindrical, slightly flexuose with extremely thin denticles in ***E. parvisporum,*** with geniculate butt-shaped denticles on the edges in ***E. album.***

The host of ***E. album*** strains isolated in Antarctica is difficult to determine. In this area the presence of collembola and mites has been confirmed. It is interesting to note how the nematophagous ***A. tortor*** and the entomogenous ***E. album,*** as well as ***Acremonium strictum, Beauveria bassiana*** and ***Paecilomyces farinosus*** appear to be a component of the mycota of this glaciated area. Their occurrence was found in Antarctica to be restricted to the mosses or the soil on which the mosses are present. Occurrence of these fungi on this substratum could be linked to collembola and nematode populations, colonists of this potentially favourable habitat, as it is the case with the bryoflora in Victoria Land consisting of sparsely developed communities of turf- and cushion-forming mosses (Broady et al., 1987; Longton, 1973).

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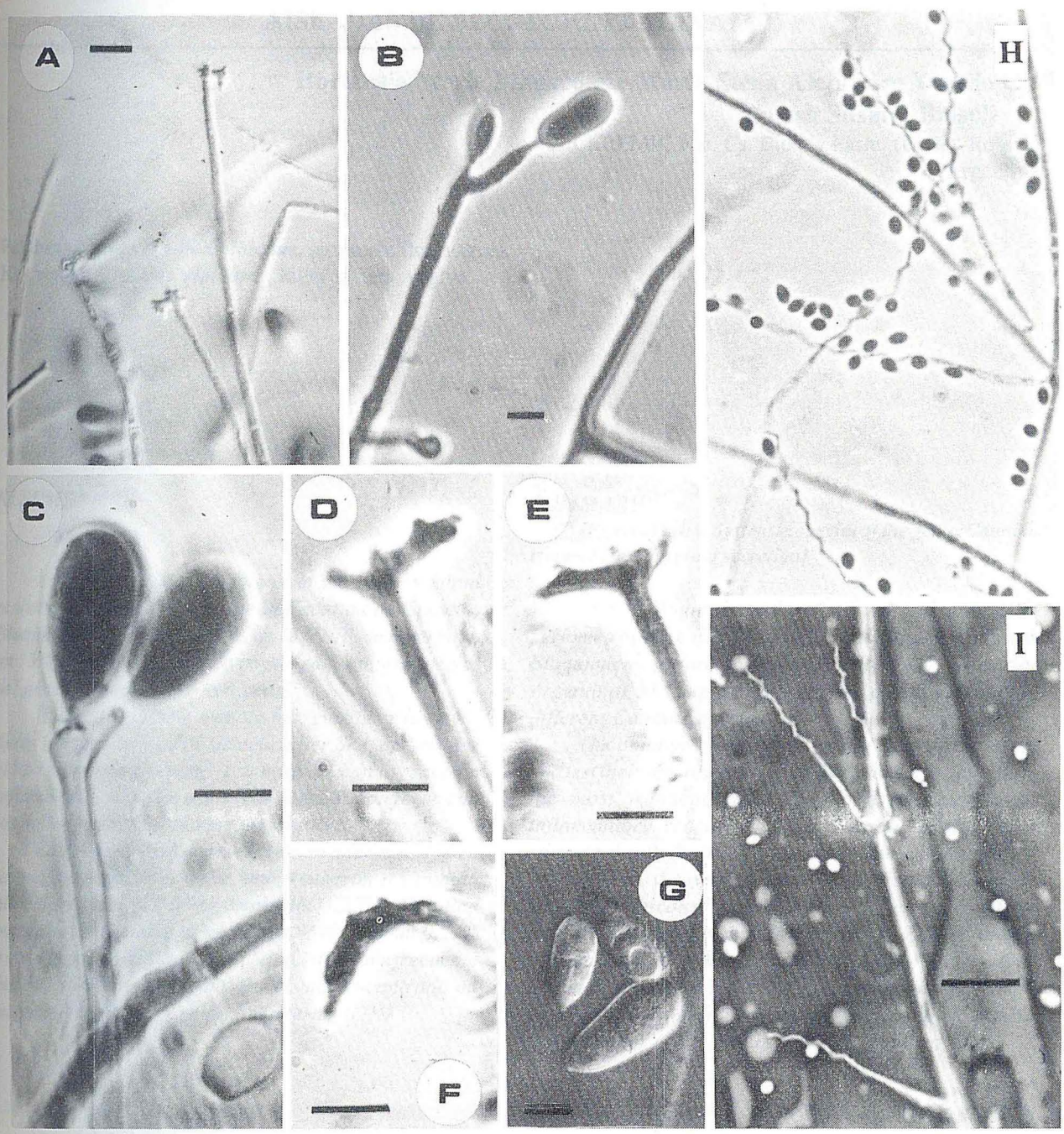

Fig. 1: ***Arthrobotrys tortor***. Tips of conidiophores; **A** arthrobotryoid; **B** genicularioid; **C, D, E** candelabrelloid; **F** extended arthrobotryoid; **G** conidia. **A**, bars = 20 μm; **B-G**, bars = 10 μm.
H-I. ***Engyodontium album;*** mono and biverticillate conidiophores; geniculate rachids with denticles. Bars = 10 μm