Notes on Southern African Tuberales

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ABSTRACT

Three species of Tuberales have been found in Southern Africa. Terfezia pfeilii Henning occurs in the Kalahari Desert and adjacent areas of the Cape Province, Botswana and South-West Africa. The other two, Terfezia austroafricana sp. nov. and Choiromyces echinulatus sp. nov., are known only from the Cape. C. echinulatus is the first representative of that genus to be collected in Africa or the Southern Hemisphere.

INTRODUCTION

The first record of Tuberales from Southern Africa is Henning's (1897) description of Terfezia pfeilii Henning. from Damaraland, South-West Africa. The occurrence of this species in Damaraland was later noted by Pole Evans (1918); the cracks in the Kalahari sand resulting from growth of its hypogeous ascocarps were illustrated by Leistner (1967).

Two other species, Terfezia boudieri Chat., and T. claveryi Chat., were reported from the Kalahari and Windhoek (Marloth, 1913; Pole Evans, 1918). The "Terfezia claveryi" that they examined as well as all others so labelled in the Mycological Herbarium of the National Herbarium, Pretoria (PRE), were subsequently redetermined as T. pfeilii by Dr P. H. B. Talbot (unpublished). Marloth did not describe his "Terfezia boudieri" and Pole Evans apparently did not see any specimens. We have been unable to locate any collections that were labelled "Terfezia boudieri" by either. Accordingly, until now the only member of the Tuberales authenticated for Southern Africa is T. pfeilii. The closest record of a different species is that of Terfezia decaryi Heim in Madagascar (Heim, 1934).

While noting that three species of Terfezia have been reported from South Africa and South-West Africa, Story (1958) stated that "some records are vague and incomplete and cannot be checked." In view of the confusion about these species, we restudied the Tuberales at PRE. Trappe's earlier studies of the types and supplementary collections of the entire order of Tuberales, including the Terfeziaceae (Trappe, 1971) provided interpretive background. Collections of Southern African Tuberales were also kindly provided by the Herbaria of the Botanical Institute of the University of Turin (TO), Oregon State University (OSC), and the U.S. National Fungus Collections (BPI). This paper should be regarded as a preliminary contribution, since further collecting in Southern Africa will almost certainly produce additional hypogeous fungi.

The collections examined were either dried or, in the case of some at PRE, preserved in ethanol-formalin-glycerine-water solutions. Tissues and spores were examined in these mounting media: (1) 5% KOH, (2) cotton blue-lactic acid, (3) Melzer's reagent, and (4) lactophenol, the mount being heated gently over a gas flame. Spores were drawn from the cotton blue mounts. Spores measured the same in all mounting media.

Key to the Tuberales of Southern Africa

<table>
<thead>
<tr>
<th>Asci mostly cylindric, borne in crowded hymenial layers; spores mostly uniseriate, prominently echinulate, 12-18μ broad (including spines)</th>
<th>1. Choiromyces echinulatus</th>
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<tr>
<td>Asci subglobose, ellipsoid, reniform, or asymmetric; spores mostly biseriate to irregularly arranged, mostly broader than 18μ (including ornamentation):</td>
<td>2. Terfezia pfeilii</td>
</tr>
<tr>
<td>Spores minutely echinulate, mostly 18-23μ broad (including spines)</td>
<td>3. Terfezia austroafricana</td>
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1. Choiromyces echinulatus Trappe & Marasas, sp. nov.

Ascocarps viva eburnea, in statu sicco nigrescens. Gleba solida, marmorata, hymeniis inclusis. Asci cylindrici, 140 × 12-17μ, octospori, in hymenis mutue compressis. Sporae globoseae, 12-18μ latae (cum ornamentis), echinulatae, bactulis et conis 1-2 × 0,5-1 (-1,5)μ. Peridium cellulis inflatis multis.

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TYPE: Cape, Gordonia near Upington, in red sand dune, June 1, 1961, Leistner 2612 (PRE 42202, holotype).

Ascocarp pale cream-colored and subglobose when fresh, as dried with a black peridium and a solid gleba marbled by dark brown veins embedding hymenial palisades; opposing hymenial palisades deformed from pressing against each other.

Hymenium of thin-walled, mostly collapsed paraphyses 4μ broad growing among hyaline thin-walled asci. Asci mostly 8-spored; in youth cylindric to ellipsoid or saccate and with spores irregularly arranged; by maturity mostly cylindric, 140 × 12-17μ,
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hyaline, thin-walled, with stems long tapered below the basal spores to narrow bases and spores uniseriate or occasionally biseriate.

Spores globose, 12–18 µ broad with ornamentation, 10–14 µ excluding ornamentation, light yellow to light brownish yellow. Walls 1 µ thick, light blue in cotton blue. Ornamentation of round-tipped rods and cones 1–2 × 0,5–1(–1,5) µ, pale yellow in KOH and light blue in cotton blue, ca 20–25 around the spore circumference, unconnected except for some spores on which barely perceptible lines on the spore surface join occasional ornaments.

_Global veins_ of subparallel-interwoven, hyaline, thin-walled hyphae 3–6 µ broad at septa, the cells frequently inflated. _Peridium_ of hyphae with light yellow, thin walls, 4–5 µ broad at septa but with many cells greatly inflated (15–50 µ broad).

CAPE.—Gordonia near Upington, in red sand dune, June 1, 1961, Leistner 2612 (PRE 42202, holotype).

This species has the solid gleba marbled with veins and embedded hyphalia with elongate asci that typify the genus _Choiromyces_. It differs from previously described _Choiromyces_ spp. in having echinulate spores. _C. venosus_ (Fr.) Th. Fr., the most common species of Europe, has larger spores prominently ornamented with irregular tubes and rods. The other _Choiromyces_ species have either ridged or pitted spores. _C. echinitus_ is the first member of the genus found in Africa or, for that matter, in the Southern Hemisphere.


Ascocarps 2,5–6,5 × 2,5–5,8 cm, subglobose to obpyriform or turbinate, lacking a basal mycelial tuft but with a basal attachment scar. _Peridium_ c. 1 mm thick, prominently wrinkled (particularly on the upper surface), blackish brown with the wrinkles yellowish white, fleshy, solid, marbled with white veins. Odour rather strongly fungoid.

_Asci_ randomly arranged in fertile pockets, (5–) 8- spored at maturity, typically subglobose but sometimes ellipsoid or obovoid, 70–100 × 50–80 µ, hyaline, thin-walled, sessile to subapplanate, readily separable from the global hyphae, spores loosely arranged within.

_Spores_ globose, (16–)18–23(–26) µ with ornamentation, at first hyaline, by maturity pale brown. Walls 1,5 µ thick, 2-layered, blue in cotton blue. Ornamentation appearing as a minutely papillose, mucilaginous-granulose epispore in KOH or lactophenol but clearly seen as densely crowded, minute, deeply staining spines 1–1,5(–2(–6)) µ tall in cotton blue.

_Global fertile pockets_ separated by sterile but otherwise undifferentiated veins, the hyphal hyaline, thin-walled, 5–12 µ broad at septa but the cells generally inflated (up to 20 µ) to appear pseudoparenchymatous. _Peridium_ with an outer layer of large hyphae 4–12 µ broad at septa but with cells inflated to 15–30 µ to give a cellular appearance; inner peridial layer of generally circumferentially aligned hyphae 4–10 µ broad at septa, the cells often slightly inflated.

Fruiting from April to June in sand dunes of the Kalahari Desert and adjacent areas of the Cape, South-West Africa and Botswana.


BOTSWANA.—_Ghanzi:_ _Scholtz_ (PRE 41869).

Kalamar desert.— _Bottomley_ (PRE 44310); _Nash_ (PRE 44254); _Weintraub_ (PRE 33294). _Askham:_ _Steydom_ (PRE 44245). _Kalahari Gemsbok National Park:_ _Story_ 5616 (PRE 41602); _Le Riche_ (PRE 41870).


_Terfezia pfeilii_ has been suggested as a synonym of several other _Terfezia_ species by various European authors. Our examinations of the types of all _Terfezia_ species have established beyond doubt that _T. pfeilii_ is distinct and confirm Mattirolo’s (1922) illustrations that clearly show the differences in spore ornamentation between _T. pfeilii_ and the other species. The earlier confusion about _T. pfeilii_ stems in part from the paucity of good specimens available for study by earlier authors and in part from the nature of the spore ornamentation of _T. pfeilii_. The spines are so crowded and minute that they cannot readily be seen even with an oil immersion objective unless stained.

Only two described species of _Terfezia, T. olbiensis_ Tul. & Tul. and _T. leptoderma_ Tul. & Tul., resemble _T. pfeilii_ in having spores ornamented with very small spines. The spores are larger and the spore ornamentation much taller (2–3 µ), coarser, and more openly spaced in _T. olbiensis_ and _T. leptoderma_ than in _T. pfeilii_. Although Mattirolo (1922) correctly illustrated the echinulate nature of spores of _T. pfeilii_, he suspected it to be synonymous with _T. pinoyi_ Maire, which he also correctly illustrated as lacking spines. The two are readily separable by this difference in spore ornamentation as well as by the amyloid reaction of spores of _T. pinoyi_ with Melzer’s reagent and the lack of that reaction by _T. pfeilii_.

Dr Talbot’s redetermination of PRE collections labeled “_Terfezia claveryi_" as _T. pfeilii_, noted earlier in this paper, was confirmed by our studies. Accordingly, _T. claveryi_ is not known to occur in South Africa, notwithstanding the reports of Marloth (1913), Pole Evans (1918), and Doidge (1950).

3. _Terfezia austroafricana_ Marasas & Trappe, sp. nov.


_TYPE:_ Cape, Griqualand West near Barkly West, _E. L. Stephens_ (PRE 35577, holotype).

Dried ascocarps orange brown to brownish black, smooth; dried gleba brown in young specimen, ochraceous in older specimen, solid, marbled with pallid veins.

_Aschi_ randomly arranged in fertile pockets, (4–)8- spored at maturity, ellipsoid to obovoid, subcylindric, reniform or asymmetric, 90–140 × 30–80 µ, hyaline,
thin-walled, astipitate or with a short basal protuberance; spore arrangement occasionally uniseriate but mostly incompletely biseriate to irregular.

Spores globose, 25–30 μ broad with ornamentation, 16–22 μ excluding ornamentation, hyaline in youth and pale yellow at maturity. Walls 1–2 μ thick, light blue in cotton blue. Ornamentation of truncate to round-tipped spines (2–3–5–6) × 1–3 μ, connected by walls to form a partial to complete reticulum of 4–6 sided, irregularly sized alveoli; alveoli 3–7 across the spore diameter; reticular walls 0.5 μ thick, variable in height from very low to as high as the spines. Occasional spores ornamented with rounded warts and no reticulum or with crowded spines only erratically connected by low walls.

Glebal fertile pockets separated by sterile but otherwise undifferentiated veins, the hyphae hyaline, thin-walled, 5–12 μ broad at the septa but the cells generally inflated (up to 22 μ). Peridium of hyphae 10–30 μ broad at septa, the cells mostly inflated (up to 60 μ) to give a cellular appearance.

Cape—Griqualand West: Barkly West, E. L. Stephens (PRE 35577, holotype); Kimberley, April 10, 1918, Wilmot (PRE 11542, paratype).

Terfezia austroafricana belongs to subgenus Matritolomyces (Fischer) Trappe by virtue of its large, elongate asci and uncrowded spores (Trappe, 1971). The other species presently assignable to this subgenus—T. decaryi, T. terfezioides (Matt.) Trappe, and T. spinosa Harkn.—also have prominently reticulate spores. Of these, T. spinosa of North America most closely resembles T. austroafricana in microscopic characters (the fresh ascocarps have not been described for either); T. austroafricana, however, has fewer, larger, and more regular alveolae on the spore surface and larger, more inflated cells in the peridium and gleba. The spores of T. austroafricana are larger than those of T. terfezioides, and the asci are smaller than those of T. decaryi. All of these species are closely related in anatomical characters, but only T. terfezioides is known from a large number of collections. As the others are collected again and become better known, some may prove to merit only varietal status.

ACKNOWLEDGEMENTS

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REFERENCES


FIG. 1–3.—Ascospores. Fig. 1, Choiromyces echinulatus, PRE 42202. Fig. 2, Terfezia pfeilii, PRE 17799. Fig. 3, Terfezia austroafricana, PRE 15542.