

Multiperforate septa in *Geotrichum* and *Dipodascus*

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The presence of multiperforate hyphal septa has been confirmed in the type strains of *Geotrichum capitatum*, *G. eriense*, *G. fermentans*, *G. terrestre*, *Dipodascus aggregatus*, *D. australiensis*, *D. magnusii*, *D. reessii* and *D. tetrasperma* by transmission electron microscopy. Since such structures have also been observed in the type species, *Geotrichum candidum*, this character may be of value for the differentiation of the anamorphic genus *Geotrichum* Link ex Fries.

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Die aanwesigheid van veelvuldig-geperforeerde hifeseptums is in die tipe-stamme van *Geotrichum capitatum*, *G. eriense*, *G. fermentans*, *G. terrestre*, *Dipodascus aggregatus*, *D. australiensis*, *D. magnusii*, *D. reessii* en *D. tetrasperma* deur transmissie-elektronmikroskopie bevestig. Aangesien dergelike strukture reeds in die tipe-soort, *Geotrichum candidum*, waargeneem is, is hierdie eienskap waarskynlik van beslissende waarde vir die differensiasie van die anamorfie genus *Geotrichum* Link ex Fries.

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Introduction

In an effort to rationalize the classification of the anamorphic yeasts along more natural lines, von Arx *et al.* (1977), Weijman (1979) and Guého (1979) remodelled the arthroconidial genera *Geotrichum* Link ex Pers. and *Trichosporon* Behrend. On the basis of conidiation, ultrastructure of the cell wall, carbohydrate composition, deoxyribonucleic acid composition, urease activity and the colour reaction with Diazonium Blue B, *Geotrichum* was restricted to species which, in respect of these characters, related them to the ascogenous taxa and *Trichosporon* to species with obvious basidiomycetous affinities. Von Arx (1977) considered the type species, *Geotrichum candidum* Link ex Fries, to be an anamorph closely related to the ascomycetous genus *Dipodascus* Lagerheim. Because earlier authors (Wilson & Kessel 1965; Bracker 1967; Hashimoto *et al.* 1973) had found *G. candidum* to be characterized by multiperforate hyphal septa, von Arx *et al.* (1977) anticipated that this feature might further be used to differentiate *Geotrichum* from *Trichosporon*. Since this feature of *G. candidum* was not confirmed for other species of the remodelled genus, the type strains of four species, published in *Trichosporon* but subsequently transferred to *Geotrichum* (von Arx 1977; Weijman 1979), were examined for their septal structure by transmission electron microscopy. For comparative purposes, the type strains of five *Dipodascus* species were also included in the study.

Materials and Methods

Strains studied

The following type strains are held by the Centraalbureau voor Schimmelcultures (CBS), Baarn, The Netherlands:

Geotrichum capitatum (Diddens & Lodder) von Arx: CBS 2364

Geotrichum eriense (Hedrick & Dupont) Weijman: CBS 5974

Geotrichum fermentans (Diddens & Lodder) von Arx: CBS 2529

Geotrichum terrestre (van der Walt & Johannsen) Weijman: CBS 6697

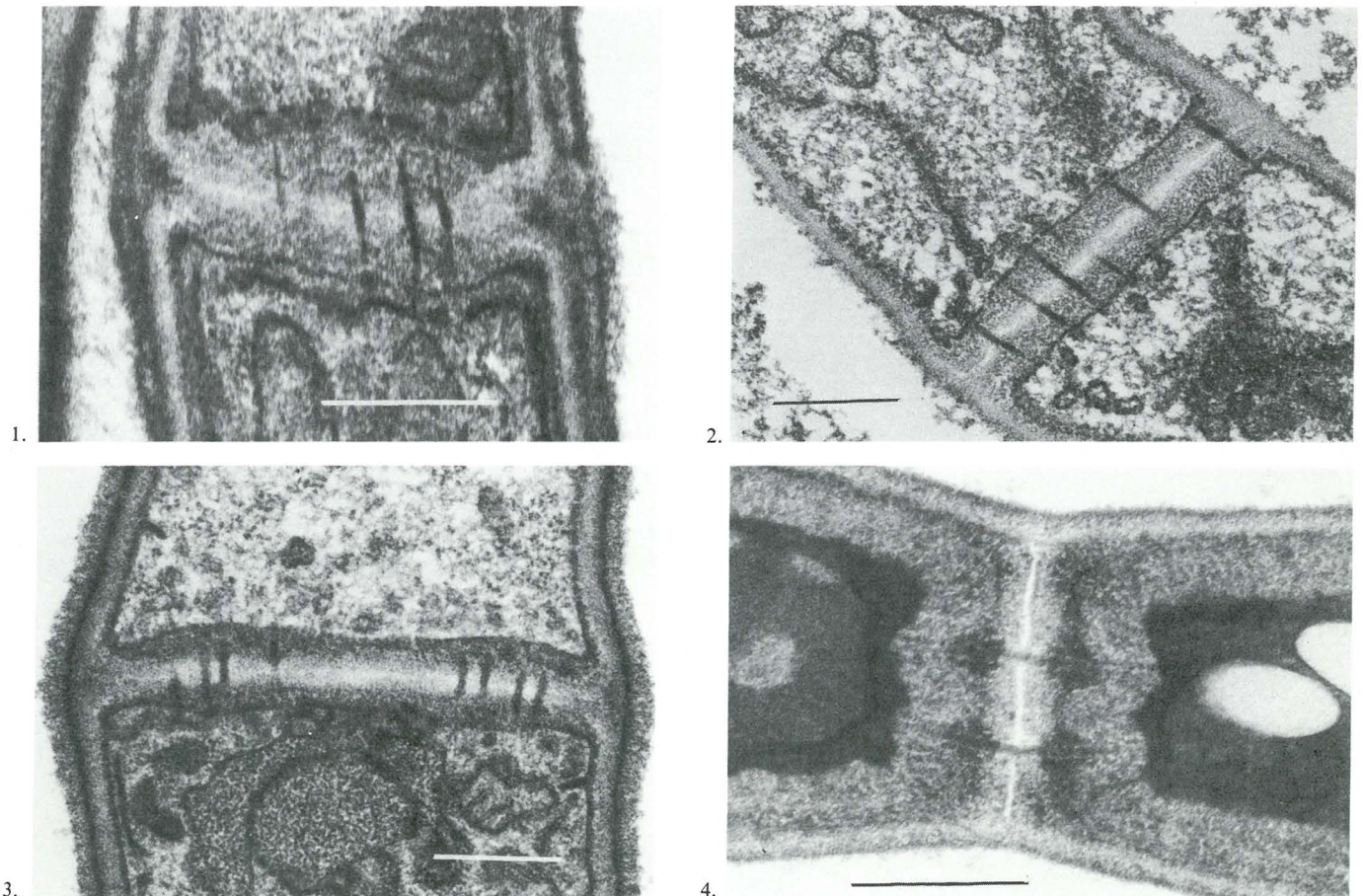
Dipodascus aggregatus Francke-Grossman: CBS 175.53

Dipodascus australiensis von Arx & Barker: CBS 625.74

Dipodascus magnusii (Ludwig) von Arx: CBS 151.30

Dipodascus reessii (van der Walt) von Arx: CBS 179.60

Dipodascus tetrasperma (Macy & Miller) von Arx: CBS 765.70



Figures 1–4 TEM micrographs of longitudinal sections through hyphal septa of 1. *Geotrichum capitatum* 2. *G. eriense* 3. *G. fermentans* 4. *G. terrestre*. The insert bar represents 0,5μm.

Transmission electron microscopy

For TEM, material from three day-old cultures grown on YM agar (Wickerham 1951) at 28°C was fixed in 1,5% aqueous potassium permanganate for 20 min at room temperature, washed with 0,34 mol dm⁻³ acetate-veronal buffer (pH 7,2), dehydrated with ethanol and embedded in an Araldite-Epon mixture. Ultra-thin sections were stained with 5% aqueous uranyl acetate and lead citrate according to Reynolds (1963). TEM micrographs of sections of the hyphal septa are shown in Figures 1–10.

Observations and Discussion

As shown in Figures 1–5, multiperforate hyphal septa with plasmodesmatal canals appearing as electron-opaque bands across the septa, are characteristic of all four of the *Geotrichum* species studied. In *G. terrestre* with its narrower hyphae, the number of micropores and plasmodesmatal canals per septum appears to be reduced (Figure 4) so that some longitudinal septal sections may occasionally suggest the presence of a single, centrally located micropore. The multiperforate nature of its septa is nevertheless apparent from transverse sections through a septum (Figure 5).

Figures 6–10 likewise confirm the presence of multiperforate hyphal septa in *Dipodascus aggregatus*, *D. australiensis*, *D. magnusii*, *D. reessii* and *D. tetrasperma*. In the strain of *D. magnusii*, however, multiperforate septa were only scantily present with the plasmodesmatal canals appearing at the periphery of the septa (Figure 8).

Although the presence of multiperforate hyphal septa provides further evidence to regard the type species, *G. candidum* as an anamorph related to *Dipodascus*, the genus

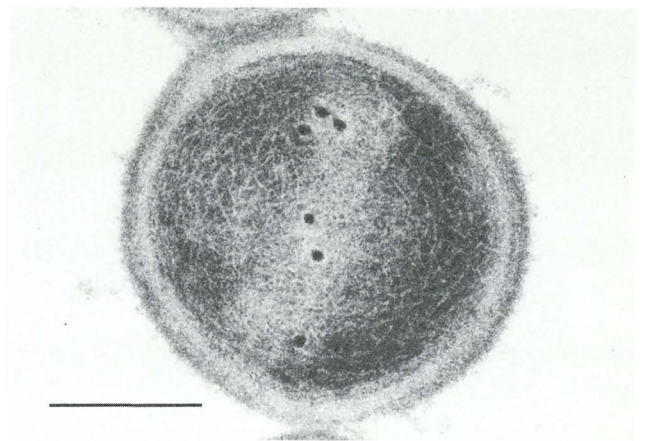


Figure 5 *Geotrichum terrestre* TEM micrograph of a transverse section through a hyphal septum. The insert bar represents 0,5μm.

Geotrichum as demarcated by von Arx (1977), von Arx *et al.* (1977), Weijman (1979) and Guého (1979), is probably still heterogeneous. While *Geotrichum* includes anamorphic states obviously related to *Dipodascus*, it could, none the less, also include arthroconidial anamorphs akin to the Endomycetaceae, since Kreger-van Rij & Veenhuis (1973) reported multiperforate hyphal septa in *Endomyces fibuliger* Lindner, *Botryoaescus synnaedendus* (van der Walt & Scott) von Arx, *Endomycopsella vini* (van Rij) von Arx, *Saccharomycopsis capsularis* Schiønning and *Guilliermondella selenospora* Nadson & Krassilnikov. In this respect it should be noted that Guého (1979) stressed that *G. capitatum* differs from other *Geotrichum* species not only by its slower

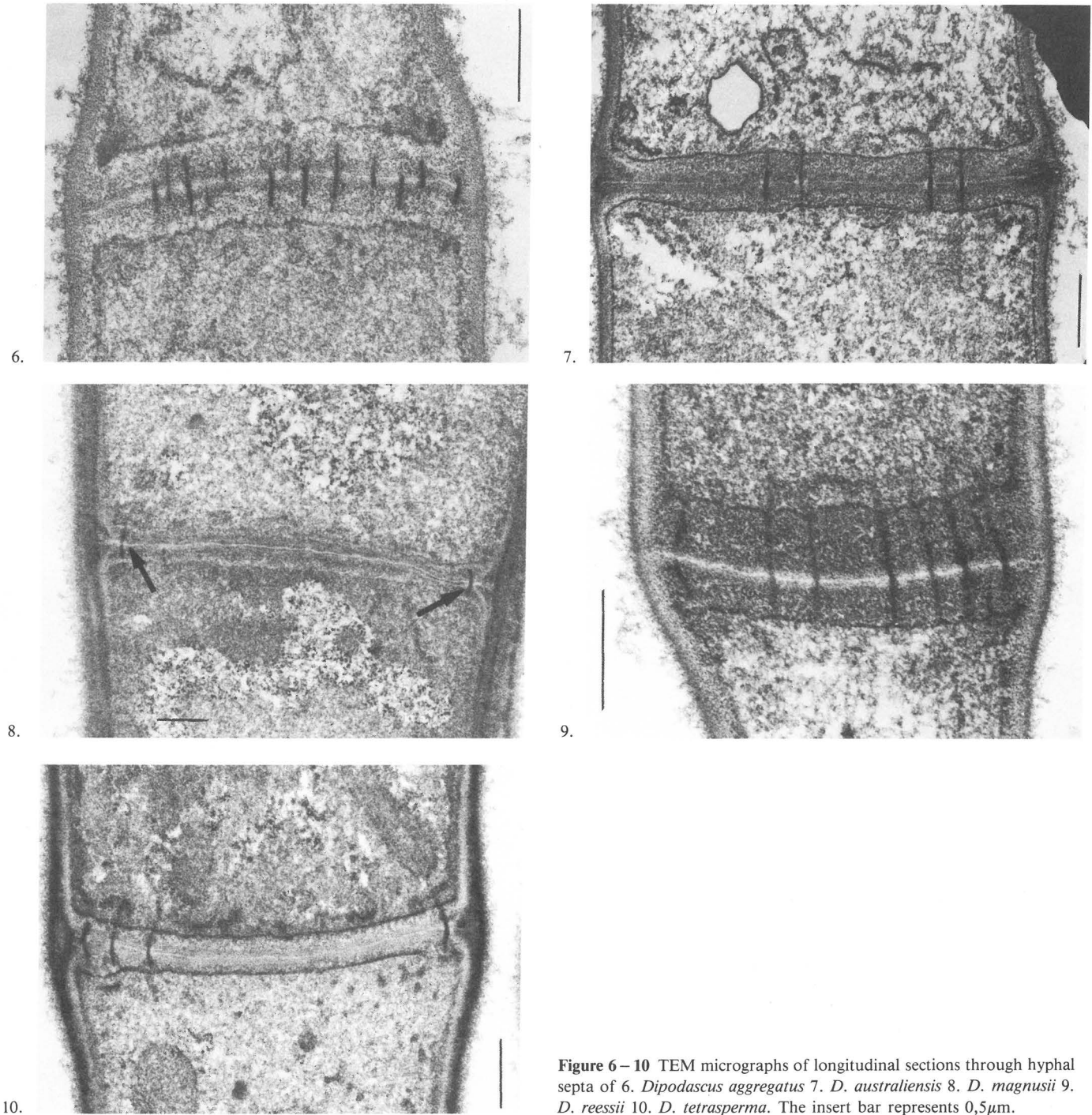


Figure 6–10 TEM micrographs of longitudinal sections through hyphal septa of 6. *Dipodascus aggregatus* 7. *D. australiensis* 8. *D. magnusii* 9. *D. reessii* 10. *D. tetrasperma*. The insert bar represents 0,5 μ m.

growth and thinner hyphae, but also by the lower mean molar percentage of guanine plus cytosine (% G + C) of its DNA. It also differs by the formation of clavate blastoconidia on a sympodially elongating and cicatrized rachis. This state is mainly observed in fresh isolates and often disappears after several transfers. *G. terrestre*, on the basis of its pronounced xerotolerance, likewise takes an isolated position within the genus.

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