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Short communication

Arxula gen. nov. (Candidaceae), a new anamorphic, arthroconidial yeast genus

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Abstract

The new genus *Arxula* is proposed for the classification of xerotolerant, ascomycetous, anamorphic, arthroconidial yeasts. The genus is considered to be of endomycetaceous affinity.

Although the classification of the anamorphic, arthroconidial yeasts along natural lines has largely been resolved (De Hoog et al. 1986; Weijman 1979), the position of the soil-borne species, described as *Trichosporon terrestre* Van der Walt & Johannsen (1975), remains unsettled. In their description of this species, Van der Walt & Johannsen (1975) drew attention to its being characterized by an essentially ascomycetous, double-layered cell-wall. The type strain was, moreover, found to have a ploidy of greater than unity, which seems to preclude the possibility of its being representative of a haploid mating type. The species is currently known from two, sexually non-reactive strains.

Von Arx et al. (1977) subsequently re-examined the species, and considered it as a possible representative of a new genus, distinct from *Trichosporon* Behrend based on the basidiomycetous anamorph, *T. beigelii* (Küchenmeister & Rabenhorst) Vuill. Weijman (1979) in his revision of the anamorphic, arthroconidial yeast genera, on the basis of whole-cell monosaccharide composition and conidiation, restricted *Trichosporon* to basidiomycetous anamorphs, and *Geotrichum* Link: Fr. to anamorphs of ascomycetous affinity. Since *T. terrestre* lacked D-xylose and L-fucose, and because of its essentially ascomycetous cell-wall, Weijman (1979) reclassified the species as *Geotrichum terrestre* (Van der Walt & Johannsen) Weijman. Van der Walt et al. (1983) re-examined the species by TEM, and reported it as having multiperforate septa, as observed in *Geotrichum* and its teleomorphs, *Dipodascus* Lagerh. and *Galactomyces* Redhead & Malloch. They, nonetheless, stressed that within *Geotrichum, G. terrestre* took an isolated position, particularly on account of its marked xerotolerance. Middelhoven et al. (1984), in describing a closely related species, *Trichosporon adeninovorans* Middelhoven et al., pointed out that both this species and the type of *G. terrestre,* have the rather uncommon ability of utilizing certain purines (uric acid and adenine) as well as *n*-alkylamines (*n*-butylamine and pentylamine) as sole source of both carbon and nitrogen. De Hoog et al. (1986) in their recent revision of *Geotrichum,* nevertheless excluded *G. terrestre* from this genus, on the grounds of its being extremely yeast-like, and by its scant formation of hyphae.

The exclusion of *G. terrestre* from *Geotrichum*, as demarcated by De Hoog et al. (1986), is, in fact, substantiated by a composite of both morphological and physiological characters. Unlike the type of the genus, *G. candidum* Link and other accepted members of the genus, *G. terrestre* is distinguished morphologically by

- its restricted colonies on solid media and
- the rather scant formation of non-expanding, narrow hyphae (2.0–3.5 μm diam.) which rapidly disarticulate into squat arthroconidia, and physiologically by
- its xerotolerance and
- utilization of nitrate as nitrogen source.

Other discriminating physiological characters include its utilization of a wide range of di- and trisaccharides as carbon sources.

Since the species has been excluded from both *Geotrichum* (De Hoog et al. 1986) and *Trichosporon* (Weijman 1979), the directive of Von Arx et al. (1977) is followed by the proposal of the new genus.

Arxula Van der Walt, M.Th. Smith & Yamada gen. nov. (Candidaceae)

Fermenta arthroconidialia anamorphica xerotolerantia. Coloniae restrictae siccae hebetes albae vel cremeae butyrosae vel friabiles. Parietes cellularum ascomycetoidei distromatici sine D-xyloso vel L-fucoso. Hyphae angustae non dilatantes septatis multiperforatis in arthroconida brevia disarticulantes sed aliquando blastoconidia ferentes. Blastosporae gemmantes holoblastice aliquando in denticulis curtissimis hypharum emergentes. Materia amyloidea extracellulosa non formatur. Nitrato pro fonte nitrogeni utitur. Non color ruber Sale Diazonii Cerulei B formans. Systema Coenzymatis 9 ad est.

Arthroconidial, xerotolerant, anamorphic yeasts. Colonies restricted, dry, dull, white to cream-coloured. Cell-walls ascomycetoid, two-layered, without D-xylose or L-fucose. Hyphae narrow, not spreading, with multiperforate septa, disarticulating into squat arthroconidia, but also forming blastoconidia. Blastoconidia budding holoblastically, occasionally arising on very short denticles of hyphae. Extracellular, amyloid material not formed. Nitrate utilized as source of nitrogen. No red colour produced with Diazonium Blue B Salt. Coenzyme Q9 system present.

Typus *Arxula terrestris* (Van der Walt & Johannsen) Van der Walt, M.Th. Smith & Yamada, nov. comb. (Basionym: *Trichosporon terrestre* Van der Walt & Johannsen in Antonie van Leeuwenhoek 41, 361, 1975).

The genus includes the second species, *Arxula adeninivorans* (Middelhoven, Hoogkamer-Te Niet & Kreger-van Rij) Van der Walt, M.Th. Smith & Yamada, comb. nov. (Basionym: *Trichosporon adeninivorans* (as 'adeninovorans') in Antonie van Leeuwenhoek 50, 373, 1984). This species is currently known from eight, sexually non-reactive strains. These two species may be recognized by the following:

Key to the genus *Arxula*

Melibiose utilized	*A. adeninivorans*
Melibiose not utilized	*A. terrestris*

While not considered to be close to anamorphs of the Dipodascaceae Gäumann, the genus *Arxula*, nevertheless, does share pertinent characters with the conidial states of certain Endomycetaceae J. Schröter. On the basis of its formation of multiperforate, disarticulating hyphae as well as blastoconidia and its xerotolerance, it shows agreement with *Endomyces fibuliger* Lindner. Whereas the utilization of nitrate is not known to occur among the Dipodascaceae (De Hoog et al. 1986), this character is not uncommon among the Endomycetaceae. Likewise, strains of the endomycetaceous species, *Yarrowia lipolytica* (Wickerham et al.) Van der Walt & Von Arx, have been observed to utilize *n*-butylamine as sole source of both carbon and nitrogen. In terms of its xerotolerance and multiperforate septa, the genus *Arxula* also shows agreement with *Stephanoascus ciferrii* Smith et al., which species Middelhoven et al. (1989) recently reported as capable of utilizing adenine and uric acid as sole source of both carbon and nitrogen.

Material examined

The following strains, held by the Yeast Division of the Centraalbureau voor Schimmelcultures (CBS) in Delft (The Netherlands), and the Council for Scientific and Industrial Research (CSIR) in Pretoria (South Africa), were examined:

Arxula terrestris

CBS 6697T	≡	CSIR 803, from soil (South Africa)
CBS 7376	≡	CSIR 914, from soil (South Africa)

Arxula adeninivorans

CBS 8244T	≡	CSIR 577, from soil (The Netherlands)
CBS 7370	≡	CSIR 1117, from soil (South Africa)
CBS 7377	≡	CSIR 1118, from soil (South Africa)
CSIR 1136		from maize silage (The Netherlands)
CSIR 1138		from maize silage (The Netherlands)
CSIR 1147		from soil (South Africa)
CSIR 1148		from soil (South Africa)
CSIR 1149		from soil (South Africa)

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