Naumovozyma baii sp. nov., an ascomycetous yeast species isolated from rotten wood in a tropical forest

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Two strains isolated from rotten wood were included in the Saccharomyces group based on morphological characteristics. However, rRNA gene sequence analyses (including the 18S rRNA gene, 26S rRNA gene D1/D2 domain and internal transcribed spacer region) indicated that these two strains represent a novel species of Naumovozyma, for which the name Naumovozyma baii sp. nov. is proposed (type strain: BW 22T = CGMCC 2.04520T = CBS 12642T). The MycoBank number of the new species is MB800484.

Based on a multigene phylogenetic analysis of the Saccharomycetaeae (Kurtzman & Robnett, 2003), the genus Naumovia Kurtzman (2003) was described to accommodate two yeast species previously classified in Saccharomyces sensu lato. The generic name Naumovozyma was proposed to replace Naumovia because the latter is a younger homonym of Naumovia Dobrocz (1928) (Dothideomycetes), and is therefore illegitimate (Kurtzman, 2008). Naumovozyma is closely related to the genera Saccharomyces and Kazachstania and, at the time of writing, comprised only two species: Naumovozyma castellii and Naumovozyma dairenensis (Vaughan-Martini et al., 2011).

During our survey on the ecological distribution of Saccharomyces species in nature performed in recent years, two strains representing a novel species of Naumovozyma were identified by sequence analyses of the 18S rRNA gene, 26S rRNA gene D1/D2 domain and internal transcribed spacer region, for which the name Naumovozyma baii sp. nov. was proposed.

Strains BW 21 and BW 22T were isolated from two rotten wood samples collected in the Bawangling National Nature Reserve (coordinates: 18°50′–19°05′ N 109°05′–109°25′ E), Hainan Province, southern China, in July 2007 by using the enrichment method. The enrichment medium contained (w/v) 1 % yeast extract, 1 % peptone, 1 % glucose, 8 % (v/v) ethanol and 200 μg chloramphenicol ml⁻¹. The morphological, physiological and biochemical characteristics were examined by standard methods described by Kurtzman et al. (2011). Nuclear DNA was extracted using the method of Wang & Bai (2008). The ITS region and 26S rRNA gene D1/D2 domain sequences were determined using the D1/D2 tree (see Fig. S1 available in IJSEM Online), which included strains of all known species of Naumovozyma, for which the name Naumovozyma baii sp. nov. is proposed (type strain: BW 22T = CGMCC 2.04520T = CBS 12642T). The MycoBank number of the new species is MB800484.

Abbreviation: ITS, internal transcribed spacer.

The GenBank/EMBL/DDBJ accession numbers for the rRNA gene sequences from this study are JX087438 and JX087439.

A supplementary figure is available with the online version of this paper.

The MycoBank number of the novel species is MB800484.
The two strains of \textit{N. baii} were isolated from rotten wood collected in tropical forests with a mean annual temperature of 23.6 °C and mean annual rainfall of 1500–2000 mm, which indicated that this novel species has a different ecological distribution to the other members of the genus \textit{Naumovozyma}. \textit{N. castelli} is widely distributed and has been found in Africa, Finland, The Netherlands and the USA; strains have been isolated from various substrates, such as soil, fermenting cucumbers, buttermilk, ensiled maize and baboon caecum contents (Vaughan-Martini et al., 2011). \textit{N. dairenensis} has been found associated with dried fruit, probably in Japan, and ensiled crops in The Netherlands (Middelhoven et al., 1990; Vaughan-Martini et al., 2011).

**Description of \textit{Naumovozyma baii}** Q.-M. Wang, W.-Q. Liu, P.-J. Han & J.-Z. Qiu sp. nov.

\textit{Naumovozyma baii} (bai'i. N.L. gen. masc. n. baii of bai, named in honour of Feng-Yan Bai, professor at the Institute of Microbiology, Chinese Academy of Sciences, for his contributions to the taxonomy of yeasts in China).

In YM broth, after 3 days at 25 °C, cells are ellipsoid (Fig. 2a), 3.0–4.5 × 5.0–7.5 μm, and occur singly or in pairs. Budding and 2–4 indels) in the D1/D2 domain. There were 176–210 nt mismatches shown between the isolates and the type strains of the two known species in the ITS region sequence alignment. Therefore, the two isolates represent a novel \textit{Naumovozyma} species, for which the name \textit{Naumovozyma baii} sp. nov. is proposed.

**Fig. 1.** Phylogenetic tree drawn from neighbour-joining analysis based on sequences of the 18S rRNA, 26S rRNA gene D1/D2 domain and 5.8S rRNA gene, depicting the relationships of the species \textit{Naumovozyma baii} sp. nov. with all known species of \textit{Naumovozyma} and \textit{Saccharomyces} and most species of \textit{Kazachstania}. The type strain of \textit{Hanseniaspora guilliermondii} was used as the outgroup. Bootstrap percentages over 50 % from 1000 bootstrap replicates are shown. Reference sequences were retrieved from GenBank under the accession numbers indicated. Bar, 1 % sequence divergence.
occurs singly. After 1 month at 25 °C, sediment is present. After 1 month at 25 °C, the streak culture is butyrous and cream-coloured. The surface is smooth and the margin is entire. Pseudohyphae are not observed in cultures grown on cornmeal agar. Sporulation is observed on McClary acetate agar after 7 days at 25 °C; vegetative cells transform directly into persistent asci each containing one to four globose ascospores (Fig. 2b). Glucose and galactose are fermented; sucrose, maltose, lactose and raffinose are not fermented. Glucose, galactose and trehalose are assimilated; L-sorbose, sucrose, maltose, cellobiose, lactose, melibiose, melezitose, raffinose, inulin, soluble starch, D-xylose, L-arabinose, D-arabinose, D-ribose, L-rhamnose, D-glucosamine, methanol, ethanol, glycerol, erythritol, ribitol, galactitol, D-mannitol, methyl z-D-glucoside, salicin, DL-lactic acid, succinic acid, citric acid, inositol and hexadecane are not assimilated. Ammonium sulfate is assimilated; potassium nitrate, sodium nitrite, L-lysine, ethylamine hydrochloride and cadaverine hydrochloride are not assimilated. Growth in vitamin-free medium is negative. Starch-like compounds are not produced.

The type strain, BW 22^T (=CGMCC 2.04520^T=CBS 12642^T), was isolated from rotten wood, Bawangling, Hainan province, in July 2007. Strain BW 21 (=CGMCC 2.04519=CBS 12641) is a reference strain of this species. The MycoBank number of _Naumovozyma baii_ sp. nov. is MB800484.

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**References**


