

The yeast genus *Yarrowia* gen. nov.

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The ascigerous teleomorph of *Candida lipolytica* (Harrison) Diddens et Lodder, previously classified as *Endomycopsis lipolytica* Wickerham et al. and as *Saccharomycopsis lipolytica* (Wickerham et al.) Yarrow, has been assigned to the new genus *Yarrowia*. *Yarrowia lipolytica* (Wickerham et al.) comb. nov. is the type species for the genus.

The remaining species of *Saccharomycopsis* are revised.

INTRODUCTION

Although the sexual stage of *Candida lipolytica* is well documented, its taxonomic position is still unsettled. Wickerham et al. (1970) first discovered that this saprobic, markedly lipolytic species, in fact constituted haploid mating types of a filamentous, heterothallic, ascigerous teleomorph. This teleomorph was reported to form solitary, lateral or terminal, ovoid, clavate, ellipsoidal, spheroidal, rarely cylindrical, sessile or pedunculate, one- to four-spored asci borne on branching, septate hyphae. Blastospores rarely produced asci. As there was no evidence for conjugation immediately preceding ascus formation, it was assumed that the ascigerous hyphae were diploid. Sporulating cultures were reported to become light pink or brown. The ascospores were described as varying in shape, ranging from spherical, spheroidal, angular, hemispheroidal, crateriform to hat-shaped (galeate) with a basal brim. Wickerham et al. (1970) published this teleomorph as *Endomycopsis lipolytica* Wickerham, Kurtzman et Herman.

As the generic name *Endomycopsis* Dekker was subsequently shown to be an obligate synonym of *Saccharomycopsis* Schöningg (van der Walt and Scott, 1971; von Arx, 1972), Yarrow (1972) reclassified this teleomorph as *Saccharomycopsis lipolytica* (Wickerham et al.) Yarrow.

Redhead and Malloch (1977) revised the Endomycetaceae and included in it

the Ascoideaceae. They redescribed *Endomyces decipiens* Reess, the type species of the genus, a mycelial yeast growing on gills of *Armillaria mellea*, and restricted the family to taxa with galeate (hat- or helmet-shaped) ascospores. Some non-filamentous yeast genera, such as *Hansenula*, were also included in the Endomycetaceae. Excluded from the family were taxa with spherical, elongate, oblate or saturn-shaped ascospores.

According to this concept, the genus *Saccharomycopsis* Schiönnig *sensu* von Arx et al. (1977) appears to be heterogeneous. The type species, *S. capsularis* Schiönnig, has bivalvate, oblate or nearly spherical, smooth-walled, rather large ascospores with an indistinct equatorial rim (von Arx, 1974). Such ascospores are unknown in other yeast genera, but have been observed in *Narasimhella hyalinospora* (Küehn et al.) von Arx, an ascomycete classified in the Gymnoascaceae (von Arx, 1971).

Saccharomycopsis fibuligera (Lindner) Kloecker has galeate ascospores, similar in size and shape to those of *Endomyces decipiens*. In both species the asci develop on undifferentiated hyphae and are usually 4-spored. *S. fibuligera* therefore has to be treated as *Endomyces fibuliger* Lindner, as it was originally named.

Saccharomycopsis vini (Kreger-van Rij) van der Walt et Scott and *Saccharomycopsis crataegensis* Kurtzman et Wickerham, on the other hand, are both characterized by spiny, saturn-shaped ascospores which become markedly pigmented during maturation. In this respect and also on the basis of their formation of clavate conidia with a truncate base, these two species show close agreement with *Endomycopsella phaeospora* Boedijn (1960). Consequently, these two species have to be classified in *Endomycopsella* as ***Endomycopsella vini*** (Kreger-van Rij) von Arx comb. nov. (basonym *Endomycopsis vini* Kreger-van Rij, Antonie van Leeuwenhoek 30: 430, 1964) and ***Endomycopsella crataegensis*** (Kurtzman et Wickerham) von Arx comb. nov. (basonym *Saccharomycopsis crataegensis* Kurtzman et Wickerham, Antonie van Leeuwenhoek 39: 83, 1973). These two species show the same carbohydrate pattern of their cell walls as *S. fibuligera*, with mannose and glucose as the main constituents and small amounts of glucosamine (chitin) (A. C. M. Weijman, pers. comm.).

Saturn- or walnut-shaped, pitted or rugose ascospores are also known in non-filamentous yeast genera, e.g. *Schwanniomyces* Kloecker and *Williopsis* Zender containing soil-borne species. Also rather similar are the ascospores in the soil-borne filamentous yeast *Arthroascus javanensis* (Kloecker) von Arx (von Arx, 1972a, 1974). Saturn-shaped, often rugose or spiny ascospores with equatorial rims or rings are also typical for many Trichocomaceae (Eurotiaceae), especially for the teleomorphs of *Aspergillus* species (cf. Raper and Fennell, 1965; Samson, 1979). Redhead and Malloch (1977) therefore suggested a relationship with this group of cleistocarpous ascomycetes.

Saccharomycopsis lipolytica differs from all the above-mentioned genera in the structure of its ascospores which are variable in both size and shape. Free, mature ascospores are usually hemi-ellipsoidal, navicular in side view, with