The Genus Saccharomyces (Meyen) Reess

V. Saccharomyces williamus Saccardo, Saccharomyces bayanus Saccardo, Saccharomyces pastorianus Hansen, Saccharomyces heterogenicus Osterwalder, Saccharomyces steineri Lodder et Kreger-van Rij.

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ABSTRACT. The species Saccharomyces heterogenicus Osterwalder, Saccharomyces steineri Lodder et Kreger-van Rij, Saccharomyces pastorianus Hansen, Saccharomyces bayanus Saccardo and Saccharomyces willianus Saccardo were compared. It was found that the biochemical characters used for the definition of these species were variable and the strains of the given species were therefore evaluated together. With reference to the present accepted criteria of species specificity, grouping on the basis of coefficients of similarity was not conclusive. One of the characters (the fermentation and assimilation of galactose) was therefore dispensed with, while a new characteristic (determination) of amylolytic activity was added. It was found that the species Saccharomyces pastorianus, Saccharomyces bayanus and Saccharomyces willianus were so similar that they could be grouped in one species. Saccharomyces heterogenicus retained its species specific characteristics, while Saccharomyces steineri formed a transition between this species and the other three. The coefficients of similarity, S, calculated by the methods of Jaccard and of Sokal and Michener, were compared and some of the more problematical questions of the numerical method are discussed.

The second fermentation type of the genus Saccharomyces (Meyen) Reess includes a group of species characterized by non-fermentation and non-assimilation of galactose. These species are Saccharomyces oviformis Osterwalder (Kocková-Kratochvílová, 1966), Saccharomyces bayanus Saccardo and Saccharomyces pastorianus Hansen. In addition, the species Saccharomyces heterogenicus Osterwalder does not ferment or assimilate raffinose, while Saccharomyces steineri Lodder et Kreger-van Rij ferments galactose, but does not utilize raffinose (Tab. 1).

In the course of long-term cultivation of pure cultures of these species it was found that these properties were variable, leading to change of species specific characteristics. As a result, the views of taxonomists on the classification of these species have often changed, as shown by Stelling-Dekker (1931), Kudryavtsev (1954) and ourselves (Kocková-Kratochvílová, 1966). Windisch (1962) examined 20 strains determined as Saccharomyces pastorianus and found that eight of them completely fermented raffinose, 12 gave one third fermentation of raffinose, five fermented galactose and only two did not assimilate galactose. Kudryavtsev (1954) likewise found that these species assimilated galactose if cultivated in medium containing this sugar. Some of them can also utilize lower dextrins or live in starch and malt substrates.
Fig. 1. Chromatogram of fermented raffinose solution

1 - 21-4-45, *S. cerevisiae* var. *ellipsoideus* (1/3 fermentation)
2 - 21-4-46, *S. cerevisiae* var. *ellipsoideus* (1/3 fermentation)
3 - 21-1-1, *S. logos* (3/3 fermentation)
4 - 21-1-2, *S. logos* (3/3 fermentation)
5 - 21-1-3, *S. logos* (3/3 fermentation)
6 - 21-1-4, originally determined as *S. logos* (but gives only 1/3 fermentation of raffinose)
7 - 21-1-5, *S. logos* (3/3 fermentation)
8 - 21-6-1, *S. kluyveri* (3/3 fermentation)
9 - 21-6-1, *S. pastorianus* (3/3 fermentation ?)
10 - 21-6-2, *S. pastorianus* (2/3 fermentation ?)
11 - 21-6-3, originally determined as *S. pastorianus* (1/3 fermentation)
12 - 21-6-4, originally determined as *S. pastorianus* (1/3 fermentation)
13, 14 - standard raffinoses

X = new oligosaccharide, R = raffinose, M = mellibiose, F = fructose