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**CHARACTERISATION OF MALATE-DEPENDENT  
MUTANTS OF THE YEAST *SCHIZOSACCHAROMYCES*  
*MALIDEVORANS***

Department of Microbiology and Genetics  
Massey University

A thesis presented in partial fulfilment of the requirements for the degree  
of Masters in Science in Genetics at Massey University

**Nicolette Olivia Hansen  
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## ABSTRACT

The phenotypes of several UV induced malate-dependent mutants of *Schizosaccharomyces malidevorans* were characterised and compared to the previously characterised malate-dependent strain, *S. malidevorans* #11. This strain uses less glucose than the wild type, has an extended life in liquid media, does not sporulate readily and turns indicator medium blue.

The malate-dependent mutant strains were analysed for their fermentation characteristics, their complementation groups and their chromosomal patterns on a transverse alternating field electrophoresis apparatus (TAFE). The fermentation patterns of all of the strains were similar to #11. There appear to be three complementation groups involved in the malate-dependent phenotype.

The TAFE patterns and subsequent Southern Hybridisation showed that the malate-dependent mutants had a decreased mobility of chromosome II, while chromosomes I and III were not altered. The chromosome II alteration varied between the different malate-dependent mutants but fell into a small number of discrete patterns.

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## ABBREVIATIONS

Abbreviations are as described in the text. Those not described are "accepted" abbreviations (*Biochem. J.* 1983 **209** :1-27).

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## 1. INTRODUCTION

### 1.1. SCHIZOSACCHAROMYCES

#### 1.1.1. The Genus

*Schizosaccharomyces* was first isolated by Lindner in 1893 from an African beer made from millet and four species have subsequently been described, *S. japonicus*, *S. octosporus*, *S. malidevorans*, and *S. pombe*. They are distinguished on the basis of morphology, such as the number of spores in an ascus (four to eight), and their differing abilities to use the sugars maltose, melibiose and raffinose (Slooff, 1970).

*Schizosaccharomyces* are ascosporegenous yeasts which, uniquely among such yeasts, reproduce vegetatively by binary fission rather than by budding. They have a predominantly haploid life cycle with conjugation being immediately followed by meiosis and the haploid spores are formed within an ascus (Slooff, 1970). Zygotes can occasionally germinate into diploid colonies but these are unstable (Leupold, 1970).

Sipiczki *et al* (1982) proposed that *S. malidevorans* is a variety of *S. pombe* because the two species are interfertile and Bridge and May (1984) suggested that there was insufficient distinction based on numerical classification between the two to justify them as different species.

#### 1.1.2. *Schizosaccharomyces pombe*

*S. pombe* is the type species for the *Schizosaccharomyces* genus. Cells are either homothallic or heterothallic with homothallic strains being self-fertile. Heterothallic strains can mate with homothallics or strains of opposite mating type. After conjugation zygotes sporulate to give four ascospores (Gutz *et al*, 1974).

#### 1.1.3. *Schizosaccharomyces malidevorans*

*S. malidevorans* was first isolated from Listan grapes grown in Spain in 1964. It is a homothallic yeast which produces four ascospores. While closely related to *S. pombe*, it differs in both its inability to ferment maltose and in the rough outer membrane on its spores (Rankine and Fornachon, 1964). It is a high malate-metabolising yeast, degrading close to 100% of L-malate (Rodriguez and Thornton, 1988).