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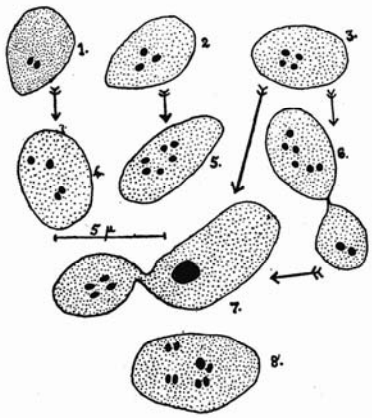
Peculiar Cytological Behaviour of a Distillery Yeast

THE question whether so-called 'pure' strains of yeast are cytologically pure ought to receive the earnest attention of those engaged in the study of the genetics of yeasts. The classification of yeasts is purely arbitrary, and the only reliable method of obtaining any particular species is to get a sample of the original culture. But even if the original culture is available one is not sure that it is cytologically pure, for proportion changes might have occurred in it since isolation. In rapidly growing organisms like the yeasts this is but natural. Investigations on higher plants indicate that polyploids usually mutate to dwarfness as a survival-measure and hence the random size relationships between the diploids and the polyploids offer no morphological criterion for differentiation into types.

It is in this connexion that the peculiar behaviour of an industrially important yeast—isolated last year by Messrs. S. R. A. N. Rao and M. Sreenivasaiya—is interesting. The strain has been kept in an active condition and before cytological investigations it was plated four times to ensure purity. Smears were made at regular intervals after addition of fresh wort to a 24-hour culture, fixed in Carnoy and stained in iron hæmatoxylin. The differentiation was rather tricky and in good preparations the cytoplasm was unstained while the chromosomes appeared lightly glistening. The meta- and ana-phase stages appear in smears made between fifty and fifty-five minutes.



In spite of repeated plating different cells in the smears show different chromosome numbers. Figs. 1, 2 and 3 show cells with two, three and four chromosomes, while Figs. 4, 5 and 8 show what may be considered as the anaphases of the diploid, triploid and the tetraploid. There appears to be 'somatic pairing' especially in the tetraploid (Figs. 3 and 7), indicating that its origin is the result of the failure of the chromosomes to separate in a vegetative division. The variations observed in the behaviour of the chromosomes of the tetraploid during budding are very interesting. In Fig. 7 is shown a mother cell with a reconstituted nucleus and the bud with four chromosomes. In Fig. 6 the mother cell has six chromosomes, while the bud has only two. Chromosome lagging in yeasts was observed by Kater[1] even in 1927. In fact, the lagging of chromosomes was cited by Tischler and Winge[2] as evidence against their being accepted as chromosomes. Needless to say, chromosome lagging has been observed by the senior author (Subramaniam[3]) in a brewery yeast (N.C.T.C. 3,007), and even in the present strain certain appearances indicate that the chromosomes may pass to the bud in pairs. This lagging of the chromosomes in the tetraploid suggests that it is genetically unbalanced and hence produces diploids and triploids with specially high frequency. Is it not possible that an unbalanced chromosome constitution could have been responsible for the peculiar behaviour of the four spores from the same ascus of the press yeast studied by Winge and Laustsen[4]?

In the distillery yeast under investigation it is probable that only mutation and segregation may produce a stable tetraploid.

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