

The Expanding Realm of Yeast-like Fungi

Proceedings of an International Symposium
on the Perspectives of Taxonomy, Ecology and
Phylogeny of Yeasts and Yeast-like Fungi

Amersfoort, The Netherlands, 3-7 August 1987

Edited by

G.S. de Hoog, M.Th. Smith
and
A.C.M. Weijman

CBS Symposia Series No.1



Centraalbureau voor Schimmelcultures
Baarn and Delft



Elsevier Science Publishers
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CBS Symposia Series No. 1; also published as Studies in Mycology No. 30,
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ELSEVIER SCIENCE PUBLISHERS B.V.
Sara Burgerhartstraat 25
P.O. Box 211, 1000 AE Amsterdam, The Netherlands

Distributors for the United States and Canada:

ELSEVIER SCIENCE PUBLISHING COMPANY INC.
52, Vanderbilt Avenue
New York, NY 10017, U.S.A.

ISBN 0-444-42900-X

Studies in Mycology No. 30

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Printed in The Netherlands.

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Preface & introduction

FUNGI, HOW I SEE THEM

R. KOKKE

Director, Centraalbureau voor Schimmelcultures, P.O. Box 273, 3740 AG Baarn, The Netherlands

Succeeding as director of the CBS such an eminent systematicist as Dr. von Arx rises expectations. I realize that a biochemist usurping the function of a systematicist, is provoking. It is, however, a property of man to name living and non-living things around him. An unabashed urge seems to drive some species of mankind, commonly designated taxonomists, to bring order in the abundance of forms of life. I must confess that I also yielded to this intellectual impulse.

Let me immediately take away your worries. My system was hitherto rather uncomplicated and simple. The kingdom of fungi was divided in toadstools, moulds and yeasts. It was, therefore, with some astonishment that I noticed that according to the title of this symposium, the yeasts and their likes are expanding their realm. Some of my friends, also would-be taxonomists, told me, that it is a misnomer to call the realm of yeasts a kingdom, despite its importance to the newly crowned queen of science: Biotechnology.

The confusion about yeasts may of course be dated back all the way to the 19th century, when Anton de Bary (1882) and Oscar Brefeld (1888) reported that yeast-like states are an integral part of the life-cycle of a great variety of fungi. Another confusing element may be derived from the name of the CBS itself. The name Centraal Bureau voor Schimmelcultures can be translated as Central Bureau for Mould Cultures. Since its very beginning in 1904, the CBS also hosted, however, a collection of yeasts. Among the strains dating back to the 19th century and still available from the CBS, are Lindner's *Sachsia suaveolens* (now *Moniliella*) and Ludwig's *Endomyces magnusii* (now *Dipodascus*). Also Beyerinck's *Cryptococcus pulverulentus* (now *Sporobolomyces roseus*) is still available, like other strains of *Sporobolomyces* used by Kluyver and van Niel.

When A.J. Kluyver in 1921 succeeded Beyerinck in the chair of applied microbiology at the Delft University of Technology, he expanded the realm of the CBS by transferring the yeast collection — comprising 60 strains at the time — to Delft. Because of its economical interest the yeast collection increased rapidly and today comprises almost 5,000 strains. Kluyver, who's main reputation is in the field of biochemistry, introduced the concept of the Dutch School of yeast taxonomy (Fig. 1) at the Congress of the International Union of Biological Sciences held at Brussels in 1931. He stated that the classification of these strains could only be done by making extensive

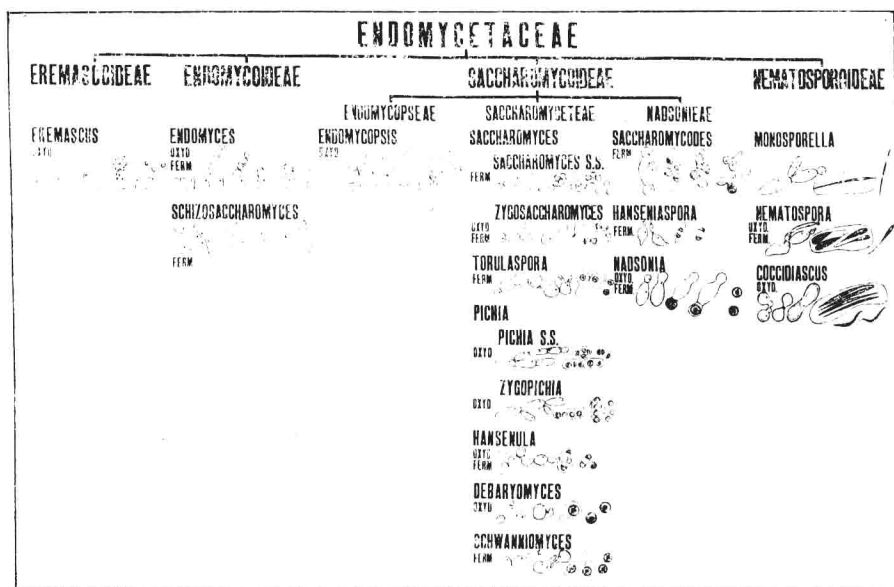


Fig. 1. Kluyver's realm of yeasts and yeast-like fungi. (Reprinted from *Annls Zymol.*, Ser. 2, 1: 48, 1921).

use of their physiological characteristics. On this basis, Stelling-Dekker, Lodder, Diddens and Kreger-van Rij published the various editions of 'The Yeasts'. Other scientists, educated in the Netherlands, like van der Walt, van Uden and Phaff went all over the world preaching these concepts.

Bringing order in the yeasts seems, however, not all that easy. Phaff (1986) stated in his article 'my life with yeasts': 'During the identification of numerous yeast isolates from various natural habitats, it became increasingly clear that in spite of significant improvements in the older taxonomic systems (here he refers to the work of Lodder and others, R.K.) species delimitations were often arbitrary and were sometimes based only on one or a few genes coding for hydrolytic enzymes that enabled the yeast to utilize certain di- and tri-saccharides'. At this stage we see the need for the biochemist to enter again the field of fungal systematics with molar G+C percentages of nuclear DNA, DNA/DNA reassociation percentages, cell-wall compositions, serology and coenzymes Q. All these are now accepted additional characteristics for classification. Barnett, Payne and Yarrow (1983) incorporated some of these in their book: 'Yeasts: Characteristics and identification'.

Whereas the yeast taxonomists were forced to abandon a classification based on morphology only, the rest of the fungal world is still classified by mainly morphological characteristics. Some influences are derived from the ecological behaviour of the organisms. In this context we note studies on the Taphrinales to be based on their phytopathological properties, those on the dermatophytes to depend on their medical importance and those on yeasts, to rely on their industrial importance. Terms such as osmophilic and ther-

mophilic have also a taxonomic connotation. Matsushima's (1971, 1975) books on microfungi, von Arx's (1981) 'The genera of fungi sporulating in pure culture' and 'Genera of Hyphomycetes' by Carmichael *et al.* (1980) are attempts to come to grasp with the taxonomy of these respective organisms, using a more integral but still mainly morphological approach. The morphological school has also been extended to the submicroscopical level, e.g. allowing revealing details of conidiogenesis to become part of the characteristics of classification.

It is evident that neither morphology nor physiology alone can deal satisfactorily with the pleomorph lower fungi. Moreover, properties are found to be changing gradually from one group to another, and there are often no sharp borderlines between neighbouring taxa. Properties are continuously mixed in sexual and asexual reproduction. With computers the correlation between strains and taxa can now be expressed in percentages. But these methods have not yielded significant new insights or clearer differentiation in the existing taxa, which were devised on the basis of morphology and much intuition. The diversity in methods of research has certainly enriched us and promoted a better understanding of the individual mycological groups and their relationship. The objective of this symposium is to bring together researchers using these different methods and schools of thought. We hope that this interaction will prove to be a fertile one, similar to the process that allows the yeast-like anamorph to grow into a beautiful teleomorph.

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