Mycological Research News

This issue of Mycological Research News features: CBS centenary: collect, study and preserve; In this issue; The origins of Saccharomyces cerevisiae; and Diversity of fungal laccase gene sequences in salt marshes.

A review of aspects of fungal genetic resource collections and their role in the genomic age precedes papers on relationships within Pythium and the Coronophorales using molecular phylogenetic approaches. Diplodia pinea and D. scrobiculata on pines in North America are reassessed. The polygalacturonase encoding gene of Rhizopus oryzae is characterized, the kinetics of selenite uptake in Saccharomyces cerevisiae are described, viability tests for Rhinosporidium seeberi endospores are assessed, and aspects of the detection of the isoepoxydon dehydrogenase gene involved in patulin biosynthesis are explored. Other papers consider fire and the availability of hypogeous fungi as animal food in Australia, interactions between scarce tooth fungi and others, Termitomyces species consumed in China, red-capped species of Russula sect. Kerampelina, and rapid detection of Mycosphaerella species on Eucalyptus.

The following new scientific names are introduced: Chaetosphaerellaceae and Scortechniaceae fams. nov.; Bertia tropicalis, Lasiobertia portoricensis, Nitschkia meniscoidea, and Termitomyces bulborhizus spp. nov.; and B. multiseptata (syn. B. moriformis var. multiseptata) comb. nov.

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CBS CENTENARY: COLLECT, STUDY AND PRESERVE

The year 2004 witnessed the centenary of the foundation of the Centraalbureau voor Schimmelcultures, The Fungal Diversity Centre, in The Netherlands. Today, CBS occupies a unique position with respect to its collections of fungal cultures. Not only is it claimed to be ‘the oldest collection of living fungi in the world’ (Anon. 1975), its origins were an international initiative, the brainchild of a meeting of the Association Internationale des Botanistes held in Leiden in 1903 (Auger-Barreau 1967, de Hoog 1979). At that time there was no mechanism or organization such as the International Union of Biological Sciences (IUBS; founded 1919) or the United Nations Educational, Scientific and Cultural Organization (UNESCO; founded 1946) that could have funded such a body internationally. Friedrich A. F. C. Went (1863–1935) of Utrecht was given the responsibility of organizing such a collection; he had learned pure culture methods for fungi from H. Anton de Bary (1831–1888) in Germany and made isolations in Indonesia in 1895, some of which are still in the CBS catalogue. The collection was established in 1904 and consequently came to be supported by the government of The Netherlands, from 1907 through the Willie Commelin Schloten Phytopathological Laboratory then in Amsterdam. For the next 50 years it became the passion of Johanna Westerdijk (1883–1961), the newly appointed Director of the Phytopathological Laboratory who was also to become the first woman professor in The Netherlands in 1917. The Laboratory and the CBS collection moved to Baarn in 1922, and in that same year Albert J. Kuyper (1888–1956) in Delft took over the yeasts held by CBS. Funding and the survival of the collections was precarious through the war years. Indeed, the War Office in London instructed one of its REME (Royal Electrical and Mechanical Engineers) in 21 Army Group to travel from Brussels to CBS to secure a culture of the vitamin B group producer Eremothecium ashbyii required by Glaxo late in 1944; he found the collection ‘in impeccable state, using all sorts of discarded glassware for culture vessels and extracting an agar substitute from coastal red algae’ and met Westerdijk who informed him that he was a little
late – an American had arrived to request the same fungus two days earlier2, but she had several subcultures and one was secured for Glaxo. The Baarn and Delft units remained on different sites until the relocation to Utrecht on 1 December 2000. In 1968 CBS was made an institute of the Royal Netherlands Academy of Arts and Sciences (KNAW) which has supported its activities ever since.

Today the collection holds about 55,000 strains of fungi (including yeasts) which represent around 13,000 different species, that is about 25% of all fungi known to be culturable (Crous, Samson & Summerbell 2004). These holdings make CBS the world’s major custodian of ex situ fungal diversity. At the end of 2003, it had 95 people on site, of which 19 were scientists and nine were PhD students.

To mark the centenary, a symposium 100 Years of Fungal Biodiversity and Ecology was held in the KNAW premises in Amsterdam on 13–14 May 2004. This was attended by 170 people from 27 countries, including many distinguished mycologists participating as Guests of Honour at the invitation of CBS. Authoritative and stimulating reviews were presented in areas where CBS is active: Comparative genomics and bioinformatics; Biodiversity and ecology; Indoor air, food and applied mycology; Evolutionary phytopathology; Origins of pathogenicity in clinical fungi; and Collection, preservation and digitalisation. A barbeque and ‘fungal hyphal party’ was held in Utrecht in a marquee on the lawns outside the institute’s new premises on the evening of the 13th.

CBS is publishing its own celebration issue of Studies in Mycology, which includes the first descriptions of 100 or so fungi new to science and which grow in culture (Crous et al. 2004). That the contributions to this publication have been solicited and secured in the last year or so testifies to the world need for an institute like CBS, and our ignorance of so many of the fungi around us.

In order to mark the occasion, Mycological Research publishes an invited review on fungal genetic resource centres and their importance in the molecular era in this issue (Ryan & Smith 2004). Today, the international mycological community needs a network of top-quality collections of fungal cultures more than ever before, and CBS is now preeminent amongst those and primed with the vision to meet the challenges and needs of the 21st century. We wish it and its current Director Pedro W. Crous every success in realizing the CBS’s informal mission: to collect, study and preserve3.

2 The officer was John (‘Jack’) Heslop-Harrison (1920–1998), Director of the Royal Botanic Gardens Kew (1970–1976), and he regarded this as his ‘only contribution to mycology’ (J. Heslop-Harrison, pers. comm.). For further information see his autobiography/biography: www.users.waitrose.com/~genome/jlh/contents.history. The identity of the American is unknown to the Executive Editor.

3 For further information on CBS, its resources, holdings, publications, and services see http://www.cbs.knaw.nl.
The effects of fire on hypogeous fungi are rarely considered, especially in relation to their use as a food source by vertebrates, but new studies show that fire may well increase the availability of fungi for animals such as the northern bettong in Australia (pp. 1438–1446). Interactions between different rare wood decay fungi could contribute to their scarcity; here interactions between three hydnaceous fungi and other wood decay species on agar and in wood are compared and the ecological and conservation implications discussed (pp. 1447–1457).

Not uncommonly, favoured mushroom species eaten locally prove not be formally named. In the case of the genus *Termitomyces*, which includes some of the most sought-after edible mushrooms in Africa and Asia, a new species mainly known from markets in China is described as new here.

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**THE ORIGINS OF SACCHAROMYCES CEREVISIAE**

One approach to determining evolutionary histories of species is to find evidence for major changes in genomes due to ancient duplications and subsequent losses. As more whole-genome data becomes available, this becomes an increasingly possible topic to examine. Kellis, Birren & Lander (2004) have shown through such comparisons that *Saccharomyces cerevisiae* arose from an ancient whole-genome duplication and subsequent massive gene loss and specialization. The ancestor may have been close to *Kluyveromyces waltii*; each region of the genome of that fungus corresponds to two in *S. cerevisiae*. The divergence of duplicated genes is compared by the numbers of substitutions per thousand amino acids, *K. waltii* always coming out as basal to *S. cerevisiae*. In cases where accelerated evolution appeared to have occurred, in 95% of cases this was only in one of the two paralogues in the *S. cerevisiae* genome.

This approach to unravelling the history of the acquisition of genetic relationships clearly has great potential, and now should be used in conjunction with molecular phylogenetic approaches where sufficiently detailed genomic data are available.


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**DIVERSITY OF FUNGAL LACCASE GENE SEQUENCES IN SALT MARSHES**

The issue of functional diversity and species redundancy is a rarely explored but crucial aspect of the role of fungi in ecosystem processes. Lyons *et al.* (2003) surveyed the occurrence of ascomycete laccase gene sequences associated with decaying *Spartina alterniflora* in a salt marsh in the south-eastern USA. Laccases are involved in lignin degradation, and have potential applications in the detoxification of pollutants, prevention of wine discolouration, and paper processing. These researchers designed a primer set targeting the region of fungal laccase between two conserved copper-binding sites, recovering sequences from 24 isolates cultured from decaying blades and also directly from the blades. Overall, 39 distinct sequences and 15 distinct laccase sequence types were retrieved from the *S. alternifolia* decay system demonstrating a high sequence diversity of this functional gene in a natural fungal community for the first time. Two of the types were not found in the fungi isolated, which represented ten ascomycete species, mainly species of *Mycosphaerella* and *Phaeosphaeria*. As well as providing a valuable basis for future studies of these degradative enzymes in nature, this work illustrates that even in such a single plant dominated community a variety of fungi can ensure that there is an ability to maintain crucial ecosystem processes even if all species are not present. Whether this is a question of redundancy or a system evolved to provide resilience to fluctuating environmental factors over the long term remains a matter for further debate and exploration.