
Mycological Research News¹

Mycological Research News features: In this issue; Molecules vs morphology; The name *Fusarium moniliforme* should no longer be used; and Differential use of *Termitomyces* by termites.

Molecular methods are used in this issue to investigate the: phylogeography of *Hyphoderma setigerum*, *Mycosphaerellaceae* on *Proteaceae*, *Xerocomus chrysenteron* complex, identification of endophytes from *Pinus tabulaeformis*, root-inhabiting *Cryptosporiopsis* spp., discrimination of *Pisolithus* spp., variation in *Pyrenochaeta lycopersici*, *Penicillium nalgioviense* penicillin production impaired strains, and laccase genes in *Trametes* sp. Sexual reactions in *Zygomycota* are shown to be mediated by trisporoid compounds.

The use of particle filtration to study the diversity of rainforest leaf litter fungi is applied to *Neolitsea dealbata*, an unclamped *Lentinellus* has been rediscovered (and a key to allied European species provided), and the first fossil clavarioid fungus is described from Cretaceous amber.

The following new scientific names are introduced: *Palaeoclavariaceae* fam. nov.; *Palaeoclavaria* gen. nov.; *Cryptosporiopsis rhizophila*, *P. burmitis*, *Xerocomus cisalpinus* spp. nov.; *Lentinellus herbarum* (syn. *Lentinus flabelliformis* var. *herbarum*), *Mycosphaerella concentrica* (syn. *Gibbelina concentrica*), *M. fibrillosa* (syn. *Teratosphaeria fibrillosa*), *M. microspora* (syn. *T. microspora*), *M. proteae-arboreae* (syn. *T. proteae-arboreae*), *X. femicus* (syn. *Boletellus femicus*) combs. nov. A lectotype is designated for the name *Thelephora setigera* (i.e. *Hyphoderma setigerum*), and a neotype for *Lentinus flabelliformis* var. *herbarum* (i.e. *Lentinellus herbarum*).

DOI: 10.1017/S0953756203218207

IN THIS ISSUE

Cryptic species, different species hitherto subsumed under a single scientific name because they are not or scarcely distinguishable morphologically, are proving to be a major component of fungal diversity. Here, based on molecular data, morphological comparisons, and crossing experiments, nine 'preliminary taxa' with different distributions have been recognized in the *Hyphoderma setigerum* complex (pp. 645–652). In the *Xerocomus chrysenteron* complex, which includes some of the most conspicuously coloured bolete mushrooms, however, LSU rDNA sequences confirmed the distinctness of eight species also recognized morphologically and also the monophyly of the group (pp. 659–679).

Plants of the *Proteaceae* have long been known to support unusual fungi whose relationships have been little understood; molecular approaches demonstrate that *Batcheloromyces* belongs in the *Mycosphaerellaceae*, *Teratosphaeria* is a synonym of *Mycosphaerella*, and *Trimmatostroma* a further anamorph of the latter genus (pp. 653–658). Molecular methods have been

used to ascertain the affinities of some white sterile endophytic fungi obtained from *Pinus tabulaeformis*; most could be identified to genus (e.g. *Lophodermium*, *Nemania*, *Rosellinia*) or family (especially *Xylariaceae*) and demonstrate the value of the approach in studies of endophytes (pp. 680–688). An ISSR-PCR system to distinguish sterile mycelia of two mycorrhizal *Pisolithus* species is described (pp. 699–706), and a new species of *Cryptosphaeriopsis* has been obtained in culture from roots of four species of *Ericaceae* and compared with other root-inhabiting species molecularly and morphologically (pp. 689–698).

While molecular data often reveals unexpected heterogeneity in fungi, in the case of *Pyrenochaeta lycopersici*, causal agent of corky root in tomato plants, Italian isolates showed little genetic variability, paving the way for the development of rapid identification methods (pp. 707–716).

Foodstuffs inoculated with *Penicillium nalgioviense* before being allowed to ripen can deter undesirable fungi and bacteria, but strains producing penicillin have to be avoided. Now strains in which the first gene of the penicillin biosynthetic pathway has been disrupted have been obtained and proved efficacious in a smoke-cured meat product (pp. 717–726). An as yet unidentified *Trametes* sp. already established as having bioremediation potential has been shown to have a fourth laccase gene which is an allelic variant of one already known (pp. 727–735).

¹ *Mycological Research News* is compiled by David L. Hawksworth, Executive Editor *Mycological Research*, The Yellow House, Calle Aguila 12, Colonia La Maliciosa, Mataelpino, E-28492 Madrid, Spain. (tel/fax: [+34] 91 857 3640; e-mail: myconova@terra.es), to whom suggestions for inclusion and items for consideration should be sent. Unsigned items are by the Executive Editor.

Particular substances affect developmental stages in fungi. In several species of *Mortierella*, trisporoids proved to induce sexual reactions within that genus and also in species of *Mucor* and *Phycomyces*; a 4-dihydromethyltrisporate dehydrogenase encoding gene has been identified, and the phenomenon may be widespread in zygomycetes (pp. 736–747).

The numbers of fungi that can be isolated from particular plants, especially from tropical rainforest, continue to amaze. Using a particle filtration method, eight fallen leaves of *Neolitsea dealbata* yielded 1365 strains, representing 112–141 morphotaxa according

to different surface treatments, sodium hypochlorite proving the best for biodiversity assessments (pp. 748–756).

Lentinellus herbarum, which does not produce clamp connexions, has been rediscovered on dead *Epilobium angustifolium* stems in France; this is the first time an unclamped species has been found in the genus (pp. 757–762). A fossil clavarioid fungus has been discovered for the first time in Cretaceous amber about 100 Myr old and is described as a new genus and species, *Palaeoclavaria burmitis* in the new family *Palaeoclavariaceae* (pp. 763–768).

DOI: 10.1017/S0953756203228203

MOLECULES VS MORPHOLOGY

During the joint British Society for Medical Mycology and the British Mycological Society meeting at the University of Manchester on 1–3 March 2003, the proposal that ‘This house believes that changes in taxonomy should only be made where there is molecular information’ was vigorously debated in the Victorian grandeur of the Whitworth Hall.

The British Mycological Society’s President, Neil Gow, introduced the protagonists and served as convenor. Cletus Kurtzman (NCAUR, Peoria, IL, USA) kicked off by making a strong case that, for yeasts in particular, the lack of sufficiently differential morphological features and difficulties in using a phenotypic species concept had already led to the need to perform a series of carbohydrate utilization and physiological tests. However, such tests sometimes failed, and molecular approaches were providing satisfactory answers. Molecular studies had shown that, for example, some generic separations based on ascospore differences were unnatural and that these features could vary more within a genus than had previously been assumed. For the yeasts, without molecular methods there would be extreme difficulty in recognizing species and defining genera. Further, molecular approaches had meant that groups with increased predictive value were being recognized. The molecular case was seconded by Austin Burt (Imperial College, University of London, Ascot, UK) who strongly advocated the application of molecular techniques for all fungi before changes are made to their taxonomy. As taxonomy provided the indexing system for all biology it should reflect reality and be stable. It was also often impossible, especially for non-specialists, to make morphological distinctions. Austin provided examples of where molecular data had resolved taxonomic problems, and eloquently described the large numbers of gene sequences becoming available and stressed that many of those of systematic interest were also important in basic functions, such as ones coding for amino acids. Sequencing of much larger portions of genomes was seen

as becoming increasingly important, although the results were not likely to lead to changes being made for perhaps ten years.

The opposing view was advocated by Richard Summerbell (CBS, Utrecht, The Netherlands) who responded by agreeing that molecular techniques offered powerful tools to assist in making taxonomic decisions. However, molecular approaches could be compared to a powerful car whilst the traditional ones were more like the horse and cart. They both reached the same destination, although one was faster than the other. He supported the application of molecular methodology, but not at the expense of sound traditional investigations. It was not ‘the only way to travel’, but a ‘powerful tool’ rapidly adopted in a fashion-following ‘trendium’ (such as a university). Breadth of understanding could not be achieved by technology alone, and examples were given of elegant results obtained by traditional methods. David Hawksworth (Universidad Complutense de Madrid, Spain) followed, pointing out that a main focus of his current research was the use of molecular approaches to examine generic concepts and infraspecific variation in parmelioid lichens. While the lack of morphological characters was a difficulty in yeast systematics, most fungi had a wide range of morphological features and so molecular studies of them were not essential for satisfactory placements. Further, DNA analyses cannot, or cannot easily, be carried out on the historical type material of a very large number of fungal taxa; were these to be ignored in molecularly driven taxonomies? He had no complaint about the application of molecular data to re-inforce information and test hypotheses on relationships obtained by more traditional approaches, stressing that in many cases molecular data corroborated existing classifications. It was necessary to be pragmatic, and to support the proposal would mean fossilizing the science, especially with respect to the documentation of the world’s yet undescribed fungal diversity. Bearing in mind that each scientific name is a hypothesis as to status and

relationships, the only scientifically defensible approach was to make hypotheses on the basis of all the data available, which may or may not be molecular.

Neil Gow summarised the main points and invited questions from the audience. Amongst these, one that received considerable agreement concerned the need to move away from the dual naming system of anamorphs and teleomorphs, a particular problem in medical mycology. David Hawksworth provided the answer most wanted to hear, that the system was archaic and unnecessary and the sooner mechanisms for it being

discontinued could be put into place the better. On this rare note of complete agreement, Neil Gow closed the debate: the motion before the house was then overwhelmingly defeated.

Anthony J. S. Whalley

School of Biomolecular Sciences, Liverpool John Moores University
Byrom Street, Liverpool L3 3AF, UK.
E-mail: a.j.whalley@livjm.ac.uk

DOI: 10.1017/S095375620323820X

THE NAME *FUSARIUM MONILIFORME* SHOULD NO LONGER BE USED

This letter, signed by the members of the International Society for Plant Pathology and International Committee on the Taxonomy of Fungi (ISPP/ICTF) Subcommittee on *Fusarium* Systematics, is intended to bring an important name change to the attention of the mycology and plant pathology communities. The subcommittee has unanimously recommended that the common fumonisin-producing fungus on maize be referred to as *Fusarium verticillioides*, rather than *F. moniliforme*. This is based on the facts that: (1) that the name *F. moniliforme* represents an unacceptably broad species concept; and (2) *F. verticillioides* is undisputably the older name for the species now commonly referred to as *F. moniliforme*.

It is well-known that species concepts in *Fusarium* have been controversial. The name *F. moniliforme* has been used for at least six, and probably more, reproductively isolated mating populations (i.e. biological species), and possibly more phylogenetic species, for the past 40 years; at least three of these species are common on maize. This means that much literature using the name *F. moniliforme* cannot be reliably linked to modern species concepts that even the most conservative *Fusarium* taxonomists of today would recognize. The modern usage of the name *F. verticillioides* to designate what is now known as mating population A of the *Gibberella fujikuroi* complex, the main fumonisin producing species, was proposed by Nirenberg (1976) to emphasize this more precise species concept.

The species formerly included in *F. moniliforme sensu* Snyder, Hansen & Oswald (1957) are presently referred to by: (1) several anamorphic species names (e.g. *Fusarium proliferatum*, *F. subglutinans*, *F. verticillioides* and several recently described biological and/or phylogenetic species; O'Donnell *et al.* 1998); or (2) mating population letters A-H in the *G. fujikuroi* complex, also known as section *Liseola* (Leslie 1995). Because of the broad application of the name *F. moniliforme* in the past, we emphasize that users should not assume any equivalency between this name and *F. verticillioides*, particularly when dealing with older literature.

These species should be unequivocally identified using multiple approaches, including micromorphology from structures developing on low nutrient agar (e.g. carnation leaf agar CLA, Synthetischer Nährstoffarmer Agar SNA; incubated in the light and in the dark), mating tests with standard tester strains and molecular techniques such as DNA sequencing or AFLP. Now that it is practical to precisely identify the species formerly lumped under the name *F. moniliforme*, future scientific communication will be expedited by divorcing new knowledge on these species from the less precise concepts of the past.

We have had long discussions at conferences and in the literature on this issue (e.g. Neish & Leggett 1981, Gams 1982). To summarize the debate, the type specimen that is the basis for the name *F. verticillioides* has not been shown to possess sporodochial conidia (i.e. macroconidia), although the identity of the fungus is certain because of micromorphological characters of the mycelial or primary anamorph (i.e. microconidia).

We are aware that name changes to important organisms concern experimental and field pathologists and mycologists. The possibility of conserving the name *F. moniliforme*, a formal procedure allowed by the International Code of Botanical Nomenclature, was discussed but rejected because it did not address the question of the imprecise species concepts noted above.

For these reasons, we are unanimous in our recommendation that authors of articles on mycology, phytopathology or mycotoxicology, and the editors of journals on these topics, refrain from the continued use of the name *F. moniliforme*. The nomenclature recommended is as follows:

Anamorph

Fusarium verticillioides (Sacc.) Nirenberg, *Mitt. Biol. Bundesanst. Land- Forstw. Berlin* **169**: 26 (1976).

Basionym: *Oospora verticillioides* Sacc., *Michelia* **2**: 546 (1882).

Synonym: *Fusarium moniliforme* Sheldon, *Ann. Rep. Nebraska agric. Exp. Sta.* **17**: 30 (1904).

Teleomorph

Gibberella moniliformis Wineland, *J. agric. Res.* **28**: 920 (1924).

Synonym: *Gibberella fujikuroi* mating population A.

For routine use, we recommend the form '*F. verticillioides* (syn. *F. moniliforme*)' until the use of *F. verticillioides* becomes well-established.

Gams, W. (1982) Generic names for synanamorphs? *Mycotaxon* **15**: 459–464.

Leslie, J. F. (1995) *Gibberella fujikuroi*: available populations and variable traits. *Canadian Journal of Botany* **73** (Suppl. 1): S282–S291.

Neish, G. A. & Leggett, M. (1981) *Fusarium moniliforme* var. *intermedium*, a new variety in the *Liseola* section. *Canadian Journal of Botany* **59**: 288–291.

Nirenberg, H. I. (1976) Untersuchungen über die morphologische und biologische Differenzierung in der *Fusarium*-Sektion *Liseola*. *Mitteilungen aus der Biologischen Bundesanstalt für Land- und Forstwirtschaft Berlin-Dahlem* **169**: 1–117.

O'Donnell, K., Cigelnik, E. & Nirenberg, H. I. (1998) Molecular systematics and phylogeography of the *Gibberella fujikuroi* species complex. *Mycologia* **90**: 465–493.

Snyder, W. C., Hansen, H. N. & Oswald, J. W. (1957) Cultivars of the fungus, *Fusarium*, *Journal of Madras University*, *B* **27**: 185–192.

Keith A. Seifert¹ (Past-Chair), Takayuki Aoki², Robert P. Baayen³, David Brayford⁴, Lester W. Burgess⁵, Sofia Chulze⁶, Walter Gams⁷, David Geiser⁸, J. de Gruyter⁹, John F. Leslie¹⁰, Antonio Logrieco¹¹, Walter F. O. Marasas¹², Helgard I. Nirenberg¹³, Kerry O'Donnell¹⁴, J. Rheeder¹⁵, Gary J. Samuels¹⁶, Brett A. Summerell¹⁷, Ulf Thrane¹⁸ and Cees Waalwijk¹⁹

¹ *Biodiversity Theme (Mycology & Botany), Agriculture & Agri-Food Canada, 960 Carling Avenue, Ottawa, Ontario K1A 0C6, Canada.*

² *National Institute of Agrobiological Sciences, 2-1-2 Kamondai, Tsukuba, Ibaraki 305-8602 Japan.*

³ *Plantenziektenkundige Dienst, P.O. Box 9102, 6700 HC Wageningen, The Netherlands.*

⁴ *CABI Bioscience UK Centre (Egham), Bakeham Lane, Egham, Surrey TW20 9TY, UK.*

⁵ *Fusarium Research Laboratory, Faculty of Agriculture A05, University of Sydney, Sydney, NSW 2006, Australia.*

⁶ *Universidad Nacional de Río Cuarto, Dpto. Microbiología e Inmunología, Ruta 8 km. 601, Río Cuarto, Córdoba 5800, Argentina.*

⁷ *Centraalbureau voor Schimmelcultures, Uppsalalaan 8, 3584 CT Utrecht, The Netherlands.*

⁸ *Fusarium Research Center, Department of Plant Pathology, 121 Buckhout Laboratory, The Pennsylvania State University, University Park, PA 16802, USA.*

⁹ *Plantenziektenkundige Dienst, Geertjesweg 15, P.O. Box 9102, 6700 HC Wageningen, The Netherlands.*

¹⁰ *Department of Plant Pathology, 4002 Throckmorton Plant Sciences Center, Kansas State University, Manhattan, Kansas 66506-5502, USA.*

¹¹ *Toxigenic Fungi Unit, Institute of Science of Food Production, CNR, Viale Einaudi 51, 70125 Bari, Italy.*

¹² *Programme on Mycotoxins and Experimental Carcinogenesis Unit (PROMEC), Medical Research Council, P.O. Box 19070, 7505 Tygerberg, South Africa.*

¹³ *Institut für Pflanzenvirologie, Mikrobiologie und biologische Sicherheit der Biologischen Bundesanstalt für Land- und Forstwirtschaft (BBA), Königin-Luise-Strasse 19, 14195 Berlin, Germany.*

¹⁴ *Microbial Properties Research, National Center for Agricultural Utilization Research, USDA Agricultural Research Service, 1815 North University Street, Peoria, IL 61604-3999, USA.*

¹⁵ *Programme on Mycotoxins and Experimental Carcinogenesis Unit (PROMEC), Medical Research Council, P.O. Box 19070, 7505 Tygerberg, South Africa.*

¹⁶ *Systematic Botany and Mycology Laboratory, USDA Agricultural Research Service, B-011A, BARC-W, Beltsville, MD 20705-2350, USA.*

¹⁷ *Plant Disease Diagnostic Unit, Royal Botanic Gardens, Sydney, Mrs Macquaries Road, Sydney, NSW 2000 Australia.*

¹⁸ *Center for Process Biotechnology, BioCentrum-DTU, Technical University of Denmark, Soltofts Plads, Building 221, DK-2800 Kgs. Lyngby, Denmark.*

¹⁹ *Biointeractions and Plant Health, Plant Research International, Wageningen University and Research Centre, P.O. Box 16, 6700 AA Wageningen, The Netherlands. E-mail: seifert@em.agr.ca*

DOI: 10.1017/S0953756203248206

DIFFERENTIAL USE OF *TERMITOMYCES* BY TERMITES

While the mutualistic association between *Termitomyces* spp. and termites is familiar to mycologists, the ecological and physiological basis of the relationship has received only limited experimental attention. Hyodo *et al.* (2003) examined the chemical composition of fungus combs of different ages and the chitinolytic activity in the guts of nine termite species belonging to five different genera of *Macrotermitinae*. They found that while the carbohydrate:lignin ration of the fungus combs increased with comb age in *Macrotermes* spp. colonies, it decreased or remained the same in those of *Ancistrotermes*, *Hypotermes*, *Odontotermes*,

and *Pseudacanthotermes* spp. The contribution of the fungi to termite nutrition was lower in the case of *Macrotermes* spp. than in the species of the other four genera. The authors concluded that while in *Macrotermes* spp. the main role of the *Termitomyces* spp. is to degrade lignin so that the termites can utilize cellulose more efficiently, in the other genera it is to serve directly as a food source.

Hyodo, F., Tayasu, I., Inoue, T., Azuma, J.-I., Kudo, T. & Abe, T. (2003) Differential role of symbiotic fungi in lignin degradation and food provision for fungus-growing termites (*Macrotermitinae*: *Isoptera*). *Functional Ecology* **17**: 186–193.