Mycological Research News[1]

This month *Mycological Research News* features the naming of a rust hybrid as a nothospecies, presents a synopsis of a revised ascomycete system, and the identity of British cramp balls. The 20 research papers in this issue include ones reporting a natural hybrid between two species of *Melampsora* rust fungi, the molecular detection of *Rhizoctonia solani* subgroups, variation in *Alternaria alternata* on tomato, genes coding for proteins involved in VA mycorrhizal formation, pycniospore cap production in rusts, *Phakopsora* cuticle penetration, variation in *Dothiostroma pini*, *Aspergillus* evolutionary rates in a chemostat, and metal tolerance in *Oidiodendron* ericoid mycorrhizas. Three papers concern *Agaricus bisporus*, one on oxalate decarboxylase production, and two on its pathogens. The following new scientific names are introduced: *Cornuvesica* and *Halorosellinia* gens. nov.; *Melampsora* x*columbina* nothosp. nov.; *Helicodendron microsporum* sp. nov.; *Cornuvesica falcata* (syn. *Ceraotocystis falcata*), *H. oceanicum* (syn. *Hypoxylon oceanicum*), and *Sporisorium andropogonis-finitimi* (syn. *Ustilago andropogonis-finitimi*) combs. nov.

IN THIS ISSUE

This issue includes the description of a natural hybrid between two rusts on poplar (pp. 261–274) whose significance is discussed further below. Molecular and morphological data is presented on the variation of *Daldinia* in northern Europe (pp. 275–280), which is also featured below. Primers for the detection of *Rhizoctonia solani* subgroups and other genotypes have been designed which will enable these to be identified with increased confidence (pp. 281–285). *Alternaria alternata* isolates from tomato fruits, which cause sunken black lesions, have been found to be represented by two major phenetic groups in California; the two groups were only 50% similar in RAPD markers (pp. 286–292). Three genes coding for proteins have been found to be expressed by *Glomus intraradices* in the formation of VA mycorrhizal mutualisms; these had similarities with ones interacting with the thyroid receptor in humans, an *N*-acetylglucosamine transferase in vertebrates, and a putative leucine zipper that might act as a transcriptional regulator (pp. 293–300). Sequencing of the ITS region of five strains of *Epicoccum nigrum* and four of *Phoma epicoccina*, revealed only 10 variable positions in 457, confirming that these belong to a single species (pp. 301–303).

Two types of somatic incompatibility reactions have been distinguished in *Collybia fusipes*, lightly and heavily pigmented, and at least four loci control these reactions, one causing the heavy pigmentation (pp. 304–310). New light is shed on pycniospore cap induction in rust fungi; this extends beyond species boundaries, the pycnial nectar of different species being able to induce caps in a single species (pp. 313–316). Penetration pegs from appressoria formed by the rust *Phakopsora apoda* are able to penetrate the cuticle directly and when inside grow into hyphae and spread amongst the leaf tissues (pp. 317–324)[2]. Studies of material of *Dothistroma pini* from a wide range of countries using molecular, morphological, growth, and toxin production approaches concluded that the species should not be split and the justification of varieties in it was not justified; strains from Germany particularly produced very high levels of the toxin dothistromin (pp. 325–332). The frequency of mutant production in *Aspergillus niger* and *A. nidulans* in chemostat cultures has been determined and serves as an indicator of the rate of evolution in the system (pp. 333–337). *Oidiodendron* isolates from *Vaccinium myrtillus* mycorrhizal roots in metal contaminated soils grew better in cultures with increasing zinc salt levels than isolates from uncontaminated soils (pp. 338–344).

Three articles concern *Agaricus bisporus*. Oxalate decarboxylase produced in liquid culture and the mycelium has been partially purified and found to consist of two isozymes (pp. 345–352). Discolourations by four species of *Pseudomonas*, *Trichoderma harzianum* and *Verticillium fungicola* infections can be distinguished by chromametric measurements; all but *P. rectans* degraded tyrosinase to varying extents (pp. 351–356). *Cladobotyrum* isolates, causal agents of cobweb disease, were assayed for resistance to three fungicides; the extent of resistance varied according to the species or groups involved, and was a factor in the severity of the 1994/95 cobweb epidemic (pp. 354–364).

Two new ascomycete genera are described: *Cornuvesica* (family not indicated) for *Ceratocystiopsis falcata* (pp. 365–367), and *Halorosellinia* in *Xylariaceae* for *Hypoxylon oceanicum* (pp.

[1] *Mycological Research News* is compiled by David L. Hawksworth, Executive Editor *Mycological Research*, MycoNova, 114 Finchley Lane, Hendon, London NW4 1DG, UK (tel./fax: [+44] (0) 20 8203 4282; e-mail: myconova@btinternet.com), to whom suggestions for inclusion and short items for consideration should be submitted. Unsigned items are by the Executive Editor.

[2] See also 'Punching appressoria' in February's Mycological Research News (*Mycological Research* **104**(2): 131–132, 2000).

368–374). The new aeroquatic species *Helicodendron microsporum* is described from Mallorca (pp. 375–377), the hypogeous *Picoa lefebvrei* and *Tirmania nivea* have been discovered in Spain for the first time (pp. 378–381), and *Ustilago andropogonis-finitimi* is found to be a species of *Sporisorium* (pp. 382–383).

NATURAL RUST HYBRID NAMED

Newcombe *et al*. (2000) provide evidence for the occurrence of hybrids in nature between two species of rust fungi occurring on poplars in the Pacific Northwest of the USA, *Melampsora medusae* and *M. occidentalis*. The hybrid has been given a formal scientific name, *M.* ×*columbiana*. The new hybrid is intermediate in morphology, ITS sequences, and geography as it occurs where host hybrids abound.

Hybrids have previously been reported between related species of several plant pathogens, notably *Melampsora larici-populina* × *M. medusae* (Spiers & Hopcroft 1994), *Ophiostoma ulmi* × *O. novo-ulmi*, *Phytophthora* (three examples), *Tilletia caries* × *T. foetida*, as reviewed by Brasier (1995; see also Brasier, Cooke & Duncan 1999). Hybridization has also been postulated as a step in the speciation process of *Allomyces javanicus* (Emerson & Wilson 1954), the evolution of some parmelioid lichens (Culberson & Hale 1973), and to explain some chemical variation found in aberrant specimens of alectorioid lichens (Brodo 1978). However, this may be the first time a hybrid name has been deliberately introduced and validly published in the fungi. Spiers & Hopcroft (1994) described '*M. medusae-populina*' as a new species for their hybrid, but did not avail themselves of the possibilities of using formal hybrid names. Under the provisions of the International Code of Botanical Nomenclature, the names of hybrids can be indicated either by a 'hybrid formula' (i.e. *Melampsora medusae* × *M. occidentalis*) or a single 'nothospecific' epithet preceded by a '×' (i.e. *M.* × *columbiana*). In the case of species names not originally introduced with an '×' but which are or are later found to be hybrids (nothospecies), the '×' should then be added. Spier & Hopcroft's epithet should therefore be corrected to *M.* ×*medusae-populina* (note this was not done in the entry for that name in the *Index of Fungi* **6**: 495, 1995). The practice of naming hybrids is routine in flowering plants, and has been commended for use between lichen-forming fungi (Hawksworth 1988), following evidence for gene-flow between species of *Cladonia* (Culberson, Culberson & Johnson 1988).

The emergence of hybrids is of major significance in plant pathology, as these may be more pathogenic or attack different hosts from their parents. In the case of *Melampsora* × *columbiana*, this attacks intersectional *Populus* hybrids, but also occurs on the hosts of the parent rusts. *M. medusae* occurs predominantly on *P. deltoides*, and *M. occidentalis* on *P. trachycarpa*.

The optimal conditions for the development of hybrids in nature able to attack new hosts will be where hosts become sympatric in parts of their ranges; when one fungus is introduced or spreads into a zone where the putative partner fungus is already established. As global warming gradually takes effect, particular fungi will be brought into contact with closely allied species with which they might hybridize. Cases of fungal hybrids able to attack new hosts or which are more virulent than either parent on the same hosts can thus be expected to arise in future.

Systematists in all groups of fungi need to be increasingly alert to possible hybrid occurrences when examining material that appears to be intermediate between two known species. However, confirmation by molecular methods, such as those employed by Newcombe *et al*. (2000), will be needed to substantiate putative hybrids. As is the practice with flowering plants, separate nothospecific names would only be justified where the hybrids were well-established in nature, and there was a need for pathologists or ecologists to communicate about them – as is the case with *M.* × *columbiana*; in other more occasional occurrences, a hybrid formula giving the parents would suffice.

Brasier, C. M. (1995) Episodic selection as a force in fungal microevolution, with special reference to clonal speciation and hybrid introgression. *Canadian Journal of Botany* **73**(Suppl. 1): S1213–S1221.

Brasier, C. M., Cooke, D. & Duncan, J. M. (1999) Origin of a new *Phytophthora* pathogen through interspecific hybridization. *Proceedings of the National Academy of Sciences, USA* **96**: 5878–5883.

Brasier, C. M., Kirk, S. A., Pipe, N. & Buck, K. W. (1998) Rare hybrids in natural populations of the Dutch elm disease pathogens *Ophiostoma ulmi* and *O. novo-ulmi*. *Mycological Research* **102**: 45–57.

Brodo, I. M. (1978) Changing concepts regarding chemical diversity in lichens. *Lichenologist* **10**: 1–11.

Culberson, C. F., Culberson, W. L. & Johnson, A.(1988) Gene-flow in lichens. *American Journal of Botany* **75**: 1135–1139.

Culberson, W. L. & Hale, M. E. (1973) Chemical and morphological evolution in *Parmelia* sect. *Hypotrachyna*: product of ancient hybridization ? *Bryologist* **25**: 162–173.

Emerson, R. & Wilson, C. M. (1954) Interspecific hybrids and the cytogenetics and cytotaxonomy of *Allomyces*. *Mycologia* **46** 393–434.

Hawksworth, D. L. (1988) Naming mechanical and sexual hybrids in lichen-forming fungi. *International Lichenological Newsletter* **21**(3):59–61

Newcombe, G., Stirling, B., McDonald, S. & Bradshaw, H. D. jr (2000) *Melampsora* × *columbiana*, a natural hybrid of *M. medusae* and *M. occidentalis*. *Mycological Research* **104**: 261–274.

Spiers, A. G. & Hopcroft, D. H. (1994) Comparative studies of the poplar rusts *Melampsora medusae*, *M. laricis-populina*, and their interspecific hybrid *M. medusae-populina*. *Mycological Research* **98** 889–903.

A REVISED ASCOMYCETE SYSTEM

Through successive editions of the *Outline of the Ascomycetes*, Eriksson & Hawksworth (e.g. 1986, 1998) refrained from recognizing any rank between phylum and order. Many workers found a system of 44 orders without any hierarchy difficult to use and to teach. Some workers were keen to start to accept classes for some groups of orders as justification

https://doi.org/10.1017/S0953756200009618 Published online by Cambridge University Press

Table 1. Outline of the *Ascomycota* for 1999 down to the rank of tribe (abstracted from Eriksson 1999).

Taphrinomycotina
Neolectomycetes
Neolectales
Pneumocystidomycetes
Pneumocystidales
Schizosaccharomycetes
Schizosaccharomycetales
Taphrinomycetes
Taphrinales
Saccharomycotina
Saccharomycetes
Saccharomycetales
Pezizomycotina
Arthoniomycetes
Arthoniales
Chaetothyriomycetes
Chaetothyriales
Dothideomycetes
Dothideales
Patellariales
Pleosporales
Eurotiomycetes
Eurotiales
Onygenales
Lecanoromycetes
Gyalectales
Lecanorales
Acarosporineae
Agyriineae
Lecanorineae
Lichinineae
Peltigerineae
Teloschistineae
Pertusariales
Leotiomycetes
Cyttariales
Erysiphales
Helotiales
Rhytismatales
Pezizomycetes
Pezizales
Sordariomycetes
Hypocreomycetidae
Halosphaeriales
Hypocreales
Microascales
Sordariomycetidae
Diaporthales
Ophiostomatales
Sordariales
Xylariomycetidae
Xylariales
Uncertain
Calosphaeriales
Meliolales
Phyllachorales
Trichosphaeriales
Uncertain
Coryneliales
Laboulbeniales
Lahmiales
Medeolariales
Ostropales
Pyrenulales
Spathulosporales
Triblidiales
Trichotheliales
Verrucariales

from molecular data started to accumulate (e.g. Berbee & Taylor 1992, Nishida & Sugiyama 1994). After an accelerated period of sequence generation, Eriksson & Winka (1997) then proposed a system including 21 new supraordinal taxa as a basis for discussion, but these authors considered it premature to adopt that immediately in the *Outline* (Eriksson & Hawksworth 1998), in view of the instability and confusion caused by conflicting systems in the past. After two more explosive years of sequencing, and a revised arrangement of higher taxa (Eriksson & Winka 1998), confidence has increased and Eriksson (1999) has now proposed a system for general use. This new *Outline* recognizes 3 subphyla, 13 classes, 2 subclasses, and 6 tribes to accommodate 41 orders. A considerable number of families and some of the orders remain unassigned to higher categories as representatives have not yet been sequenced. In common with earlier *Outlines*, lists of all accepted families and genera are also provided, but not synonyms.

The system down to the level of order is summarised in Table 1. Revisions are to be expected, but for the first time there is a system underpinned by molecular data covering all ascomycetes, including those that are lichen-forming, and that can be commended for general use.

Many of the names will be unfamiliar to many mycologists, but because of the predictive value of classifications with respect to the biology, ecology, physiology, pathology, metabolites, enzymes and other properties of organisms grouped together, the scheme will be of immediate interest to mycologists active in diverse fields.

New information and suggested modifications to the new *Outline* will be accessible through the Myconet home page: http://www.umu.se/myconet/Myconet.html.

Berbee, M. L. & Taylor, J. W. (1992) Two ascomycete classes based on fruiting-body character and ribosomal DNA sequences. *Molecular Biology and Evolution* **9**: 278–284.

Eriksson, O. E. (ed.) (1999) Outline of *Ascomycota* – 1999. *Myconet* **3**: 1–88.

Eriksson, O. E. & Hawksworth, D. L. (1986) Outline of the ascomycetes – 1986. *Systema Ascomycetum* **5**: 185–324.

Eriksson, O. E. & Hawksworth, D. L. (1998) Outline of the ascomycetes – 1998. *Systema Ascomycetum* **16**: 83–296.

Eriksson, O. E. & Winka, K. (1997) Supraordinal taxa of *Ascomycota*. *Myconet* **1**: 1–16.

Eriksson, O. E. & Winka, K. (1998) Families and higher taxa of *Ascomycota*. *Myconet* **1**: 17–24.

Nishida, H. & Sugiyama, J. (1994) *Archiascomycetes*: detection of a major new lineage within the *Ascomycota*. *Mycoscience* **35**: 361–366.

BRITISH CRAMP BALLS

Ju *et al*. (1997) applied the name *Daldinia concentrica* (Bolton) Ces. & De Not. 1863 to a species with a pigment turning yellow in potassium hydroxide and not purple. The name had been used in many parts of the world for this yellow pigment-producing species, but in the British Isles the name had always been applied to one providing a purple and not a yellow reaction with the same reagent. No yellow pigmented specimens have ever been found in the British Isles. In the absence of any Bolton material, Ju *et al*. had felt justified in applying the name to the more widespread yellow pigment-producing species, and used Bolton's (1790) illustration as type.

However, as a result of detective work by Roy Watling and Alan Legg, a specimen sent to Bolton to be identified by an Edward Robson of Darlington was discovered in 1998 in the Sunderland Museum. This specimen was of the purple-reacting species, but regrettably lacked ascospores. As a result of this new information, Rogers *et al*. (1999) reinstated the use of the name for the purple-reacting species by designating a specimen collected on *Fraxinus* in Co. Durham as the interpretative type (epitype) for Bolton's illustration. The new species name *Daldinia childiae* J. D. Rogers & Y.-M. Ju 1999 was introduced for the yellow-pigmented species, which also has a much wider host as well as geographical range.

The name of the familiar cramp balls on *Fraxinus* has thus been safeguarded in the sense of its usage in the British Isles, although workers in many other parts of the world will now have to get used to calling their similar cramp balls *D. childiae*. A revised key to the 21 species of the genus now known world-wide was also provided.

A paper included in this issue of *Mycological Research* has examined the northern European representatives of the genus by a combination of ITS sequence and morphological approaches (Johannesson, Læssøe & Stenlid 2000). Five entities were recognized, three of which occurred exclusively on burnt wood. The species on burnt wood did not form a monophyletic group, but the authors argue that the ancestor of the genus was pyrophilous and that the preference for burnt substrates has been lost more than once. In their most parsimonious tree, *D. concentrica* comes close to *D. grandis* and *D. loculata*, both species of burnt wood. The species now called *D. childiae* does not appear to have been represented in their study.

For further information on James Bolton (1750–99), producer of the first British book devoted entirely to fungi, see Ainsworth (1996), Edmondson (1995), and Watling & Seaward (1981).

Ainsworth, G. C. (1996) *Brief Biographies of British Mycologists*. British Mycological Society, Stourbridge.

Bolton, J. (1790) ['1789'] *An History of the Fungusses growing about Halifax*. Vol. 3. B. White & Son, Huddersfield.

Edmondson, J. (1995) *James Bolton of Halifax*. National Museums & Galleries on Merseyside, Liverpool.

Johannesson, H., Læssøe, T. & Stenlid, J. (2000) Molecular and morphological investigation of *Daldinia* in northern Europe. *Mycological Research* **104**: 277–282.

Ju, Y.-M., Rogers, J. D. & San Martin, F. (1997) A revision of the genus *Daldinia*. *Mycotaxon* **61**: 243–293.

Rogers, J. D., Ju, Y.-M., Watling, R. & Whalley, A. J. S. (1999) A reinterpretation of *Daldinia concentrica* based upon a recently discovered specimen. *Mycotaxon* **72**: 507–519.

Watling, R. & Seaward, M. R. D. (1981) James Bolton: mycological pioneer. *Archives of Natural History* **10**: 89–110.