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Mycological Research News[1]

This issue of *Mycological Research News* features: Confusion over *Amanita pantherina* in Japan; Foliicolous lichens are benign; A plethora of bryophilous niches; and A longevity gene in *Saccharomyces*.

Fast-tracked for publication in this issue is the description of another new species of pathogenic *Phytophthora*, attacking deciduous trees in Europe. Specific primers for the detection of *Pythium oligandrum* in mushroom beds have been developed and tested. *Puccinia tanaceti* is shown to be more host-restricted than supposed. Transformation systems for *Venturia inaequalis* are compared, and the separation of *Fusarium* species causing crown and head blight of cereals, and also of *Vericillium dahliae* and *V. tricorpus* is described.

The genetic basis of *Aspergillus parasiticus* strains that do not form aflatoxins has been explored, and large insert had been found in an aflatoxin-producing *A. flavus* strain. Two genes involved in the early stage of melanin production in *Colletotrichum lagenarium* are reported, and pairing tests in *Helocobasidium mompa* show it to have a single incompatability factor. Strategies adopted for growth in toxic metal environments have been studied and factors affecting growth determined. Conditions to optimise growth in entomophthoralean fungi have been explored, the coffee berry borer in Mexico has been found to support a wider range of fungi than hitherto expected, and a new *Monacrosporium* able to trap nematodes as well as to parasitize fungal sclerotia has been discovered.

The following new scientific names are introduced in this part: *Monacrosporium janus*, and *Phytophthora pseudosyringiae* spp. nov.

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IN THIS ISSUE

Fast-tracked in this issue is the description of another new species of *Phytophthora* pathogenic to deciduous trees in Europe. This new fungus, *P. pseudosyringae*, is unusual in having semi-papillate caducous sporangia and is aggressive to beech and oak roots, holly leaves and apple fruits; molecularly it is most similar to *P. ilicis* and *P. psychrophila* rather than to *P. syringae*, the name previously but incorrectly applied to this pathogen (pp. 772–789). A diagnostic test based on species-specific primers has been developed for *Pythium oligandrum*, which causes 'black compost' in cultivated *Agaricus bisporus* beds; this will facilitate the rapid diagnosis of this economically important disease (pp. 790–796). The rust *Puccinia tanaceti* is reported from North America for the first time on introduced tansy; cross-inoculation experiments showed that the species was restricted to this host, and that it could not affect species in allied genera (pp. 797–802).

The development of methodologies for genetic transformations is fundamental to advances in many aspects of the control and exploitation of fungi. Two new transformation systems are described and their utility compared with respect to the plant pathogenic *Venturia inaequalis*: one mediated by polyethyelene-glycol and acting on protoplasts, and the other using *Agrobacterium tumifaciens* as a vector into mycelium, the latter being commended for simpilicty and transformation efficiency (pp. 803–810). The precise identification of pathogenic *Fusarium* species has advanced markedly in recent years through the application of molecular methods. Here, rDNA ITS sequences are utilized to improve the diagnosis of species causing crown rot and head blight of cereals, the trichothecene production *tri5* gene proved of particular importance, and the distinction of *F. pseudograminearum* from *F. gramineum* was corroborated (pp. 811–821). The separation of two other plant pathogens, *Verticillium dahliae* and *V. tricorpus*, has often caused difficulties; here their separation is confirmed by cultural characteristics on a semi-selective modified soil extract medium, microsclerotial size, and molecular characters (pp. 822–830).

Four papers are concerned with aspects of fungal genetics, of which two relate to *Aspergillus*. Variants of *A. parasiticus* which do not produce aflatoxins had the same regulator gene *afl*R as ones which did, but expression was 5–10 fold lower; some other factors concerned with fungal development evidently influence the function of this gene (pp. 831–840). The DNA fingerprint patterns of aflatoxin-producing *A. flavus* are polymorphic, and in clone pAF28 a 6355 bp insert has

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been sequenced and found to represent a transposable element of the *gypsy* class named here as *AfRTL-1* (pp. 841–846). The genetics of the violet root rot fungus *Helicobasidium mompa* have been examined by a range of molecular markers in mycelial pairings; these failed to identify nuclear migration to opposite basidiospore isolates in all but one of 92 pairings attempted, suggesting a single mycelial incompatability factor operates in single-spore isolates (pp. 847–853). The melanin synthesis pathway in the plant pathogenic *Colletotrichum lagenarium* has been studied in detail using a constructed double mutant, and two genes have been discovered to be involved in the first reduction step of melanin biosynthesis in this fungus, Thr1p and a deduced 1,3,6,8-tetrahydroxynapthalene-specific reductase (pp. 854–860).

The ability of *Clonostachys rosea* and *Trichoderma virens* to grow in sites contaminated with the toxic metals cadmium and copper has been studied experimentally, and toxicity found to be ameliorated by an increased carbon source; the mycelia exhibited both 'phalanx' and 'guerilla' growth strategies to exploit such an adverse environment (pp. 861–871).

Finally, three papers are concerned with entomogenous or nematophagous fungi. Problems of bulk culture *in vitro* have limited the application of entomophthoralean fungi in biocontrol, but now enhanced growth of representatives of three genera has been achieved through the addition of vitamins, amino acids, and glucose (pp. 872–878). In a search for potential biocontrol agents, studies of the fungi associated with the coffee berry borer *Hypothnemus hampei* in Mexico revealed 40 species, most of which were obtained from the cuticle; this is a major contribution to understanding the mycobiota of this pest, and yielded three undescribed species (pp. 879–887). A new nematode-trapping *Monacrosporium* species has been discovered parasitizing *Sclerotinia sclerotiorum* in China; it is an active predator of *Panagrellus redivivus* (pp. 888–894).

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CONFUSION OVER *AMANITA PANTHERINA* IN JAPAN

In the review of *Amanita muscaria* and its toxins published in the February issue of this journal (Michelot & Melendez-Howell 2003), information on the allied *A. pantherina* and its products was included. New molecular and chemical studies on specimens identified as *A. pantherina* in Japan, however, have revealed that material from that country named as this species is a mixture of two fungi, *A. pantherina* and a second species newly described as *A. ibotengutake* (Oda *et al.* 2002). *A. ibotengutake* is the fungus known as 'ibotengutake' in Japanese but not previously given a scientific name, and after which ibotentic acid was named. The new species contains both ibotenic acid and muscinol and can be separated morphologically from other species in the *A. muscaria* complex. It differs from *A. pantherina* in the larger fruit bodies, ascending volval rings, a deciduous anunulus, and also the presence of clamp connexions on hyphae and basidia. *A. muscaria* differs from the new species in the yellowish to reddish pileus, but *A. regalis* is similar to *A. ibotengutake* in having a brownish pileus but occurs in high mountain forests. All four species are clearly separated by ITS sequences. Mycologists need to be aware that chemical and other studies reported to have been conducted on *A. pantherina* from Japan could be based on either that species or *A. ibotengutake*. Where voucher material has been preserved, the identity of the fungus studied can be confirmed by checking for clamp connexions. At present *A. ibotengutake* is only known from mixed forests of *Fagaceae* or *Pinaceae* in Japan, but it would be prudent also to check the basis of reports from other regions.

Michelot, D. & Melendez-Howell, L. M. (2003) *Amanita muscaria*: chemistry, biology, toxicology and ethnomycology. *Mycological Research* **107**: 131–146.

Oda, T., Yamazaki, T., Tanaka, C., Terashita, T., Taniguchi, N. & Tsuda, M. (2002) *Amanita ibotengutake* sp. nov., a poisonous fugus from Japan. *Mycological Progress* **1**: 355–365.

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FOLIICOLOUS LICHENS ARE BENIGN

It has generally been assumed that lichens growing on tropical leaves, which can form mosaics over up to 100% of the surface area, adversely affect the hosts by reducing the photosynthetic activity (Rogers & Barnes 1986). However, no experimental data were available, although it has been suggested that lichen colonies are less harmful to tropical leaves than ones of the same algae in the non-lichenized state (Hawksworth 1988). Now, Anthony, Holtum & Jackes (2002) have studied the daily carbon gain in leaves of the palm *Calamus australis* and of the dicotyledonous tree *Lindsayomytrus racemoides* in a tropical rainforest in Queensland. They examined the gaseous exchange and analyzed chlorophyll contents of fronds and leaves of different ages in relation to the occurrence of 11 lichenized fungi grouped into four categories on the basis of colour and morphology; the transmittance and reflectance of the lichens was also measured using a quantum sensor.

Studies were carried out in both the wet and dry seasons, on understorey leaves and ones in well-lit forest gaps, and when conditions were overcast and sunny. While the lichens showed mean light interceptance of 50%, with some reducing the photosynthetically usable light to 70%, this was fully compensated for by the leaves developing higher concentrations of chlorophyll under the lichens as compared to uncolonized areas of the leaves. No lichen thalli developed a thickness at which all light was stopped entering the leaf tissues. Moore (2003) speculates that the lichens not utilizing more of the incident light might be a trade-off between increasing lichen productivity and destroying the leaf that provides its habitat.

In view of the range of different conditions and number of species examined, and further the very different morphologies of the leaves involved, it seems probable that this is a general phenomenon. I.e. that foliicolous lichens, other superficial fungi, bryophytes, algae, and cyanobacteria that do not penetrate more than leaf cuticles and are thin enough to transmit some light, are benign. This conclusion is likely to be applicable to tropical crops such as coffee, tea, and oil palms as well as native rainforest trees, and suggests that attempts to eliminate superficial foliicolous organisms by plant pathologists in the interests of plant health are unnecessary. This situation would not be expected to apply in cases where fungal hyphae penetrate through the epidermis and disrupt the chlorophyll-containing cell layers within leaves.

Anthony, P. A., Holtum, J. A. M. & Jackes, B. R. (2002) Shade acclimation of rainforest leaves to colonization by lichens. *Functional Ecology* **16**: 808–816.

Hawksworth, D. L. (1988) Effects of algae and lichen-forming fungi on tropical crops. In *Perspectives in Mycopathology* (V. P. Agnihotri, A. K. Sarbhoy & D. Kumar, eds): 76–83. Malhotra Publishing House, New Dehli.

Moore, P. D. (2003) Shady deals with lichens. *Nature* **421**: 591–592.

Rogers, R. & Barnes, A. (1986) Leaf demongraphy of the rainforest shrub *Wilkea amcrophylla* and its implications for the ecology of foliicolous lichens. *Australian Journal of Botany* **11**: 341–345.

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A PLETHORA OF BRYOPHILOUS NICHES

Mosses and liverworts have proved to be a major source of novel fungi, especially minute ascomycetes (Döbbeler 1997). As data has accumulated, it has become clear that many species occur only in particular microsites on their hosts. Examples include leaf nerves, hyaline hair-points on leaves, subterranean rhizoids, perianths, leaf borders or axilis, or individual leaf cells. Familiarity with such microsites and those colonized by different fungi is a major aid to their discovery.

Peter Döbbeler has been studying these fungi for over 25 years, and has now compiled an overview of the microniches inhabitated by bryophilous ascomycetes (Döbbeler 2002). In all, 29 such microhabitats are detailed together with examples of the fungi to be found in them, mostly with illustrations. Perithecioid ascomata seem better-suited to the niches than apothecioid ones.

It is to be hoped that this extensively referenced overview will stimulate mycologists familiar with bryophytes, and bryologists keen to extend their knowledge of bryophyte ecology, to further explore their mycobiota.

Döbbeler, P. (1997) Biodiversity of bryophilous ascomycetes. *Biodiversity and Conservation* **6**: 721–738.

Döbbeler, P. (2002) Microniches occupied by bryophilous ascomycetes. *Nova Hedwigia* **75**: 275–306.

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A LONGEVITY GENE IN *SACCHAROMYCES*

Restrictions of calorie intake are well-recognized to promote longevity in a wide range of organisms, including mammals. In *Saccharomyces cerevisiae*, calorie restriction was found by Lin, Defossez & Guarente (2000) to require the NAD^+-dependent histone deacetylase Sir2. That enzyme is strongly inhibited by the vitamin B_3 precursor nictotimide (Bittermann *et al.* 2002). Now, Anderson *et al.* (2003) have demonstrated that increased expression of the enzyme *PNC1* (pyrazinamidase/nicotinamidase 1) is necessary for lifespan extension by calorie restriction. *PNC1* acts as a longevity gene responsive to various stimuli that extend life-span. Nicotinamide depletion activated Sir2, and this was found to be the mechanism by which *PNC1* regulates longevity. If nicotinamide is shown to have a parallel effect in other organisms, this elegant work could contribute to a greater understanding of the control of the ageing process.

Anderson, R. M., Bittermann, K. J., Wood, J. G., Medvedik, O. & Sinclair, D. A. (2003) Nicotanimide and *PNC1* govern lifespan extension by calorie restriction in *Saccharomyces cerevisiae*. *Nature* **423**: 181–185.

Bittermann, K. J., Anderson, R. M., Cohen, H. Y., Latorre-Esteves, M. & Sinclair, D. (2002) Inhibition of silencing and accelerated aging by nicotinamide, a putative negative regulator of yeast Sir2 and human SIRT1. *Journal of Biological Chemistry* **277**: 45099–45107.

Lin, S. J., Defossez, P. A. & Guarente, L. (2000) Requirement of NAD and *SIR2* for life-span extension by calorie restriction in *Saccharomyces cerevisiae*. *Science* **289**: 2126–2128.