were used to amplify 47 fragments (scored as + or -) from isolates of *Sphaeropsis sapinea*. Three distinct groups were differentiated. Similar procedures have been applied to collections of isolates identified as *B. dothidea* (syn. *B. ribis*), *B. obtusa, B. rhodina*, and *B. stevensii*. Banding patterns displayed by the isolates studied are distinct enough to place other unidentified isolates into groups of highly similar isolates. Collections of isolates identified as *B. dothidea, B. obtusa, B. rhodina*, and *B. stevensii*, however, exhibit even more heterogeneity than *S. sapinea*. Isolates of the *B. dothidea-B. ribis* complex are very diverse, raising questions about both identity of some isolates and validity of this synonymy. Sorting isolates into similar RAPD marker groups may be helpful in preparation for subsequent taxonomic and pathological studies of *Botryosphaeria* species and related anamorphic fungi.

M.R. SMITH1*, I. CHARVAT1 and R.L. JACOBSON2. 1Department of Plant Biology, University of Minnesota, St. Paul, MN 55108, 2Minnesota Department of Transportation, 3485 Hadley Ave. North, Oakdale, MN 55128. The significance of arbuscular mycorrhizae in an early successional tall grass prairie reclamation.

The effect that mycorrhizal inoculum may have on the development of an early successional plant community was investigated in field plots of a recently disturbed area. Mycorrhizal inoculum reproduced from a native prairie was placed below a mix of prairie seed and monitored over a two year period. Percent cover of plants and percentage arbuscular mycorrhizal colonization were measured in order to determine a) if inoculating a disturbed soil with mycorrhizae had any effect on the percent cover of native prairie or ruderal species, b) if inoculated plots had a greater number of prairie grasses that reached reproductive maturity and c) if mycorrhizal inoculation could increase root colonization by AM fungi. Inoculating plots with mycorrhizae significantly increased the percent cover of native prairie grasses, had no effect on the percent cover of ruderal species and significantly increased percentage root colonization by mycorrhizae. The increase in percent cover of native grasses brought about by inoculation may speed up the process of succession by allowing these grasses to outcompete the ruderal species also present at the site. It also may allow for more stability in the system when disturbances such as periodic drought arise. Our findings suggest that the presence of a diverse, viable population of arbuscular mycorrhizae can be essential to the development of early successional tall grass prairie communities.

F.W. SPIEGEL*, T. BARENBERG, G. BRYANT, K. PADILLA, and D.L. MOORE. Department of Biological Sciences, University of Arkansas, Fayetteville, AR 72701 USA. What are all those protostelids doing out there, anyway?

The technique developed by D.L. Moore to evaluate community structure of protostelids can be adapted to help answer a number of different questions about the ecology of the protostelids. In brief, the method consists of placing sterilized wheat straws into habitats in which protostelids occur, then collecting them from the habitats after set periods of time, and enumerating the protostelids which have colonized the straws. A number of studies conducted by undergraduates in our lab have shown how the method can be modified to test certain specific hypotheses. Moore's work shows that certain species occur on aerial dead plants but not in the leaf litter. Other species occur in litter but not on aerial dead plants. This absence of a species from one of these habitats may be a result of the failure of appropriate prey organisms to colonize the straw. A study in which preferred food organisms were introduced into each habitat on the straws shows that presence of appropriate food is not sufficient to stimulate species of protostelids to colonize straws in the nonpreferred habitat. However, presence of a preferred food in the appropriate habitat appears to support greater colonization by the appropriate protostelids. Another study in which straws were fixed in the litter and suspended at different heights above the ground suggests that the boundary between litter and aerial habitats is very narrow. Finally, studies in which straws impregnated with different concentrations of NaCl have been used to approximate the level of salt tolerance of protostelids.

R. J. ST. LEGER* and L. JOSHI. The Boyce Thompson Institute at Cornell University, Tower Road, Ithaca, NY 14853, U.S.A. Protease and carbohydrase strategies of *Aspergillus fumigatus*, phytopathogenic and entomopathogenic Fungi.

We compared saprophytes (*Neurospora crassa, Aspergillus nidulans*), an opportunistic human pathogen (*A. fumigatu>*), an opportunistic insect pathogen (*A. flavus*), plant pathogens (*Verticillium albo-atrum, V. dahliae, Cochliobolus victoriae, Colletotrichum* spp., *Magnaporthe grisea, Nectria haematococca*, a mushroom pathogen *(V fungicola) and entomopathogens (V. lecanii, Nomuraea rileyi, Beauveria bassiana, Metarhizium anisopliae*) in their abilities to degrade and utilize host-derived macromolecules (horse lung polymers, porcine mucin, hyaluronic acid, plant cell walls and insect cuticle).The major class of protease produced by most plant pathogens and *N. rileyi* were broad spectrum basic trypsins; analogous peptidases produced by insect pathogens were specific for Phe-Val-Arg-X. In contrast, subtilisins comprised the major protease component secreted by *Aspergillus* spp., and entomopathogens. This provided them with much greater activity as *cf.* plant pathogens against elastin, mucin and insect cuticle. Plant pathogens and *Aspergillus* spp, but not entomopathogens, also produced high levels of several glycosidic enzymes on mucin and plant cell walls, which contain inductive carbohydrate substrates. Growth of *A. fumigatus* on mucin degraded mucin carbohydrates and mucin proteins by 40% and 75%, respectively. The residual mucin resisted further degradation because the fungus does not produce sialidase. Although they lack hyaluronidase, most of the fungi secreted a range of other enzymes on host-derived macromolecules e.g. phospholipases that are common components of bacteria as well as reptilian and invertebrate venoms. The wide distribution of these enzymes may help explain the pathogenicity of opportunists such as *A. fumigatus*, which are not subject to selection of specific virulence genes.

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G. R. STANOSZ and J. T. BLODGETT. Dept. Plant Pathology, Univ. of Wisconsin, Madison, WI 53706 U.S.A. Confirmation of *Sphaeropsis sapinea* as a latent pathogen of *Pinus resinosa*.

The relationship of the shoot blight and canker pathogen *S. sapinea*

with its host *P. resinosa* was reexamined. To determine the potential for *S. sapinea* to persist on or in asymptomatic red pines, 100 dormant shoots of 2-yr-old seedlings were collected in each of two nurseries. Each shoot was divided into four subsamples: 10 current year's needles; 10 previous year's needles; a current year's stem segment; a previous year's stem segment. Subsamples were surface-disinfested, placed into water agar slants, and incubated for approximately 3 mo. The fungus was confirmed from 27.5% of the seedlings, and with only one exception was associated with previous year's stem segments. Virulence of a subset of these isolates was confirmed by inoculation. The potential for host water stress to release *S. sapinea* from latency and induce collar rot was tested in a greenhouse. Asymptomatic 2-yr-old seedlings were obtained from one of the nurseries mentioned above. Transplanted, noninoculated seedlings were subjected to 6 watering regimes to maintain mean predawn needle water potential above -0.66 MPa (unstressed) or allow it to decrease to -1.1, -1.7, -2.0, -2.5, or -3.2 MPa before rewatering (100 seedlings/regime in each of 2 separate trials). Mortality increased from 7.5% in the unstressed treatment to 50% in the driest treatment ($P<0.001$, data pooled for the 2 trials). Death was associated with girdling cankers in the lower stems/root collars. Asymptomatic persistence and physiologically mediated release from quiescence confirm that *S. sapinea* can be a latent pathogen. These capabilities help explain long-term survival and rapid disease development under conditions that induce host stress.

E.C.SWANN*,E.M.FRIEDERS, R.W.HANSON and D.J.MCLAUGHLIN Department of Plant Biology, University of Minnesota, St. Paul, MN 55108 U.S.A. Divide and conquer: the rise and fall of a yeast division paradigm

For about twenty years it has been assumed that a fundamental difference between basidiomycetes and ascomycetes lies in the behavior of nuclei and cytoskeletal elements during yeast cell division. In the basidiomycete pattern the nucleus moves into the bud before division, while in ascomycetes, the dividing nucleus remains in the parent cell. This paradigm was based on the study of only a few species, but was assumed to be a general characteristic of each group. A third pattern of division was reported in the basidiomycete *Agaricostilbum pulcherrimum* (Agaricostilbaceae: Agaricostilbales) in which the nucleus divides in the parent cell. An ongoing study of yeast division in a second species of *Agaricostilbum* has yielded results consistent with the *A. pulcherrimum* pattern. Phylogenetic analysis of rDNA sequences indicate that the *Chionosphaeraceae* bears a sister relationship to the Agaricostilbaceae. In order to assess the phylogenetic significance of the *Agaricostilbum* pattern of yeast division, *Stilbum vulgare* (Chionosphaeraceae) was examined using immunofluorescence microscopy. The unusual dikaryotic yeast phase of *Stilbum vulgare* shows the basic *Agaricostilbum* pattern of division. These results suggest that yeast division patterns are probably good characters for phylogenetic inference, and that there is a greater diversity of division patterns than was thought previously. We propose that the Chionosphaeraceae be placed in the Agaricostilbales based on nucleotide sequence and yeast division pattern characters.

A.R. SWANSON* and J.C. CAVENDER. Department of Natural Science, Manatee Community College, Venice, FL 34293 and Department of Environmental and Plant Biology, Ohio University, Athens, OH 45701 U.S.A. Global distribution of forest soil dictyostelids.

The goal of this project was to compile, organize and present the known distributional data on the dictyostelid cellular slime molds (CSM) found in forest soils worldwide. The question of what factors influence CSM distribution patterns was also addressed. CSM have been recovered from soils of temperate deciduous forest, tropical deciduous and seasonal evergreen rainforest, boreal coniferous forest, and tundra by various investigators. Within each of these biomes, specific patterns of distribution were recognized. Worldwide, sixty-five species of CSM were found to fall into one of four categories: cosmopolitan, disjunct, restricted, and pantropical. Global CSM distribution patterns are influenced by a variety of factors other than the biota (including but not restricted to climate, latitude, altitude, soil pH, and soil-forming parent materials). The current study supports the thesis that organic inputs from specific plant associations and animal vectors have an important role as well.

J. E. TALLAKSEN*, I. CHARVAT, and D. L. STENLUND. Department of Plant Biology,
University of Minnesota, St. Paul, MN, 55108 U.S.A. Greenhouse production of
mycorrhizal inoculum.

The demand for site specific native mycorrhizal inoculum has increased greatly with the recent interest in site restoration. The effects of different parameters on the production of native arbuscular mycorrhizal inoculum were investigated, including inoculum type and nutrient levels. The inoculum used was from a pot culture of material made from soil obtained adjacent to a remnant prairie site. Three inoculation treatments were tested, including untreated soil, AMF spores isolated from the soil, and a mixture of the soil inoculum and isolated spores. Using *Andropogon gerardii Vitman* (big bluestem) as a host, the mycorrhizal cultures were grown for 16 weeks in sand. They were watered with a system modified from that developed in Beltsville, MD (P.D. Millner and D.G. Kitt, 1992. *Mycorrhiza* 2: 9-15). Plant growth and health were monitored as indicators of plant nutrient stress. After 16 weeks, shoots were removed and analyzed for biomass. Roots were also sampled for biomass. Plant biomass data indicates that treatments inoculated with soil had less shoot biomass than those inoculated with isolated spores. However, pots treated with soil also exhibited less phosphorus stress under low phosphorus conditions. The pots not sampled for root biomass were dried for use as AM inoculum in a roadside prairie restoration project to test its efficacy in promoting native prairie plant growth.

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