of flood debris, ephemeral flows, sandy substrates and shallower stream gradients. Older hosts are more likely to show symptoms. Water stress and increased wounding, due to flood damage and aging, may predispose *P. fremontii* to wetwood symptoms.

* **900A Differences in response of *Sphaeropsis sapinea* morphotypes to a phenolic and monoterpenes of *Pinus resinosa*.** *J. T. Blodgett* and G. R. Stanosz, Dept. of Plant Pathology, University of Wisconsin–Madison, Madison, WI 53706.

In vitro effects of phenolics and monoterpenes on spore germination and mycelial growth were quantified for isolates of the two morphotypes of the red pine shoot blight and canker pathogen *S. sapinea*. We used two A (more aggressive) and two B (less aggressive) morphotype isolates, the major red pine phenolic (pinosylvin), a phenolic common in deciduous trees (tannic acid), and major red pine monoterpenes (α-pinene, β-pinene, and δ-3-carene). Phenolic solutions of 0.2 and 0.02 mg/ml, in 80% acetone, were dried on water agar to give 88 and 8.8 μg/mm^2. At 8.8 μg/mm^2 pinosylvin inhibited conidial germination of B isolates more than A isolates (73 vs. 30%). Pinosylvin inhibited mycelial growth of B isolates more than A isolates (84 vs. 13% and 40 vs. 11% at 88 and 8.8 μg/mm^2, respectively). Tannic acid stimulated or had little affect on germination, and had little effect on mycelial growth of either morphotype. For monoterpenes, saturated atmospheres and vapor concentrations below saturation were used. At saturation, β-pinene inhibited conidial germination of B isolates more than A isolates (79 vs. 37%). Below saturation, δ-3-carene inhibited conidial germination of B isolates and stimulated A isolates (49 vs. –7%). All monoterpenes inhibited mycelial growth of B isolates more than A isolates at saturation. Below saturation, only β-pinene differentially inhibited morphotypes. Examinations of the effects of biologically active host compounds provide means for differentiating morphotypes and offers further evidence for their ecological specialization.

901A Arsenic, chromium, and copper toxicity in four species of brown-rot fungi. *B. Doyle* and J. Jellison, Department of Plant Biology and Pathology, University of Maine, Orono, ME 04469-5722.

The elements arsenic, chromium, and copper are common components of commercial wood preservatives. Physiological sensitivity to these biocides varies among species and isolates within species, and may range from toxicity to tolerance. Toxicity can be influenced by environmental parameters. Using stationary liquid cultures and *in vivo* soil block assays, the effects of pH alteration and the addition of exogenous iron were investigated to determine their effects on the physiology and biodegradation potential of *Gloeophyllum trabeum, Postia placenta, Leucogyrophana pinastri,* and *Serpula lacrimans*. This work is part of a larger project examining the potential use of wood-decay fungi in the bioremediation of preservative-treated wood.

902A Leaf maturity influences development of necrosis on excised hybrid poplar leaf disks used in bioassay for susceptibility to *Septoria musiva*. *D. L. Maxwell,* E. Boehm, and G. R. Stanosz, Univ. Wisconsin, Madison, WI 53706, USA.

The amount of necrosis developed after inoculation of excised hybrid poplar leaf disks has been proposed to reflect relative susceptibility to the leafspot and canker pathogen *Septoria musiva* (teleomorph *Mycosphaerella populorum*). To determine if host factors such as leaf maturity influence bioassay results, we conducted a study of clones NM-6 (*nigra* × *maximowiczii*) and NE-308 (*nigra* var. *charkowiensis* × *berolinensis*) grown in a greenhouse. We cut two 15mm diameter disks from the third or fourth and tenth or eleventh fully-expanded leaves (from the shoot apex). Disks were placed in 24-well tissue culture plates with 1 ml water agar per well, inoculated with 0.1 ml of either sterile water (control) or a suspension of 10^4 conidia per ml, and incubated in the light at 20°C. Periodically after inoculation, we acquired an saved digital color images of disks and later analyzed these images to quantify symptom development. After 30 and 48 days, inoculated disks from each clone were more necrotic than control disks ($p < 0.01$). However, both inoculated and control disks from upper leaves of each clone were less necrotic than corresponding disks from lower leaves ($p < 0.01$). Thus, leaf maturity can influence the response of plant material using in this bioassay. Morphological, biochemical, and physiological characteristics of the leaf tissue, developed while on the intact plant or after excision and incubation, as well as responses of leaf-associated microorganisms, may be responsible for the observed effects.

904A Infection of *Eucalyptus marginata* by *Phytophthora cinnamomi*: The role of collar infection. *E. O'Gara,* G. E. St.J. Hardy and J. A. McComb. School of Biological and Environmental Science, Murdoch University, Perth 6150, Western Australia.

Approximately 14% of the *E. marginata* (jarrah) forest of Western Australia is infested with *P. cinnamomi*. Bauxite mining is carried out in the jarrah forest. *P. cinnamomi* can kill up to 38% of jarrah plants on rehabilitated mines. Deaths of seedling jarrah in rehabilitated mines were frequently observed where ponding of rainwater had occurred around the plant collars and *P. cinnamomi* was often isolated from the collar but not the roots of the dead and dying seedling. A glasshouse trial was conducted to determine if it is possible for *P. cinnamomi* to infect the collar of jarrah through the periderm and if wounding is necessary for infection to occur. A watertight cup was constructed around the collar of each experimental tree to simulate localized ponding. The wounded and unwounded plants were exposed to the pathogen by filling the cups with *P. cinnamomi* laden water. The results showed that zoospores of *P. cinnamomi* could successfully penetrate and infect both unwounded and wounded periderm at the collar of *E. marginata*. Successful infection resulted from inoculation with both zoospores and mycelium of *P. cinnamomi*. Lesions resulting from inoculation of wounded plants with motile zoospores were significantly longer than those resulting from inoculated unwounded plants.

905A Use of geographic information systems to study Armillaria root disease distribution in the Black Hills. *M. A. Kallas,* W. R. Jacobi, R. M. Reich, and J. E. Lundquist. Departments of Forest Sciences and Plant Pathology and Weed Science, Colorado State University, USDA, Forest Service, Rocky Mt. Forest and Range Exp. Station, Fort Collins, CO 80523.

The incidence and severity of Armillaria root disease (*Armillaria* sp.) on ponderosa pine (*Pinus ponderosa*) varies spatially in the Black Hills of South Dakota. Armillaria root disease incidence may be related to site productivity, soil characteristics, past management activity, climatic variation or other environmental factors. The purpose of this three-year study is to develop a landscape-scale, hazard-rating system for Armillaria root disease utilizing geographic information systems. Data from three different root disease incidence surveys were used to generate a disease distribution map. Various spatial statistical analyses and geographic information system manipulations will be used to determine if environmental and past management factors are related to disease distribution.

907A Identification of *Armillaria* in South Africa. M. P. A. Coetzee, B. D. Wingfield, M. J. Wingfield and T. A. Coutinho. Tree Pathology Cooperative Programme, Department of Microbiology and Biochemistry, University of the Orange Free State, P.O. Box 339, Bloemfontein 9300.

Armillaria spp. are important pathogens of trees throughout the world. The genus has been well studied in North America and Europe, but has received minimal attention in Africa. *Armillaria mellea* was first reported to occur in South Africa in the early 1900's, associated with root rot of *Pinus* and *Eucalyptus*. The taxonomic disposition of the fungus, however, remains doubtful although the name *A. heimii* has recently been used in some reports. The aim of this study was to examine isolates of *Armillaria* from Southern Africa. Thirty one isolates, originating from different regions in Southern Africa, were obtained using established isolation techniques. These were compared using cultural morphology, basidiomes produced *in vitro* and on the basis of RFLP's. Our preliminary results suggest that at least two species of *Armillaria* occur in South Africa.

908A Evaluation of *Fusarium avenaceum* and other candidate fungi for biological control of invasive *Rubus* spp. C. Oleskevich, *S. F. Shamoun,* and Z. K. Punja, Canadian Forest Service, Pacific Forestry Centre, Victoria B.C. V8Z 1M5.

Three fungi, *Fusarium avenaceum, Colletotrichum dematium,* and a *Phomopsis* sp., were isolated from diseased *Rubus* tissues and investigated individually as potential biocontrol agents for *Rubus parviflorus* and *R. spectabilis*. All three fungi caused ≥50% leaf necrosis when inoculum, produced on agar or liquid media, was applied to detached *Rubus* leaves. On intact *Rubus* plants, similar inoculum did not significantly influence the growth of treated plants, regardless of the incorporation of several adjuvants. Predisposing host plants with low doses (2 mM) of glyphosate, followed by *F. avenaceum* inoculum, resulted in significantly greater % leaf area necrosis on *R. parviflorus* than either fungus or glyphosate applied alone, at 7 days. When grown on rice and applied as a culture filtrate, *F. avenaceum* caused significant foliar necrosis on intact *Rubus* plants. Analysis of culture filtrates revealed