

# **ABSTRACTS OF PAPERS**

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### ABSTRACTS

EVALUATION OF ANATOMY OF *ULMUS AMERICANA* L. RELATED TO WOUND RESPONSE AFTER CHEMICAL INJECTION. J.L. Andersen, R.J. Campana and A.L. Shigo, Department of Botany & Plant Pathology, University of Maine, Orono, ME 04469.

Since variation in response of elm xylem to wounding and chemical injection may be determined genetically, anatomical features may explain such variation. Evaluation of vessels and parenchymatous tissues of 22 elms was made from tissue sections and photomicrographs. All trees had four treatments: wound plus thiabendazole (TBZ); wound plus TBZ solvent; wound plus water, wound only. To determine internal injury the trees were dissected at 2, 10, or 15 months after injection. Comparisons of internal injury and anatomical characteristics failed to implicate one anatomical feature, but indicated a complex of factors to be responsible for compartmentalization associated with water treatment. Extensive injury associated with TBZ or solvent indicated that normal compartmentalization mechanisms were impaired by chemical injections. The data indicate that repeated injections may limit the ability of a tree to respond after further wounding or infection.

OCCURRENCE OF ANASTOMOSIS GROUP 5 OF *RHIZOCTONIA SOLANI* IN MAINE. B.P. Bandy, D.H. Zanzinger, and S.M. Tavantzis, Dept. of Botany and Plant Pathology, University of Maine, Orono, ME 04469.

Soil samples from potato fields throughout Maine were assayed on a selective medium (Ko and Hora, 1971) to recover isolates of *Rhizoctonia solani*. These isolates will be used in a study aimed at the elucidation of the role of double-stranded ribonucleic acid in cytoplasmically transmitted hypovirulence. The aniline blue (0.5% w/w in lactophenol) nuclear staining method was used to differentiate between multinucleate *R. solani* and binucleate *Rhizoctonia*-like fungi. Fifty out of sixty isolates were multinucleate with mycelial characteristics of *R. solani* and were distributed among anastomosis groups (AG) as follows: AG 1, 10%; AG 2, 16%; AG 3, 22%; AG 4, 26%; AG 5, 18%. Four isolates failed to anastomose with any tester. To our knowledge, this is the first report on the incidence of AG 5 isolates in North America. The biological significance of the frequent occurrence of AG 5 in potato fields remains to be seen.

TRANSFORMATION OF *ERWINIA AMYLOVORA* WITH THE PLASMID pBR322. D. W. Bauer and S. V. Beer, Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

We have developed a transformation (Tf) procedure for *Erwinia amylovora* with pBR322 for eventual use in cloning of pathogenicity genes. *Escherichia coli* Tf procedures served as a starting point. Transformation buffer (50mM CaCl<sub>2</sub>, 10mM RbCl, and 50mM MOPS, pH 6.2) yielded 4-100 times higher numbers of competent cells than more complex buffers or CaCl<sub>2</sub> alone. Holding recipient cells at 4 C for 18 hrs in Tf buffer and including DMSO (35 µl/ml) increased competence ca. 20X and 2X, respectively. A freeze-shock, 30 min after adding pBR322, increased Tf efficiency ca. 6X. After thawing, a heat-shock at 42 C for 1 min, then holding at 0 C for 30-60 min, gave the highest Tf efficiency. With this procedure, *E. amylovora* strains 273 and 345 (both recalcitrant to simpler CaCl<sub>2</sub> procedures) had Tf efficiencies of 10<sup>4</sup> and 10<sup>5</sup> transformants/µg of pBR322, respectively. Other *E. amylovora* strains are being examined for higher Tf efficiencies.

PHYLOPLANE MICROFLORA OF APPLE CULTIVARS IMMUNE AND SUSCEPTIBLE TO *VENTURIA INAEQUALIS*. Christopher M. Becker, and William J. Manning, Department of Plant Pathology, University of Massachusetts, Amherst, MA. 01003.

The phylloplane microflora of two scab-immune (Liberty and Nova Easy-gro) and one scab-susceptible (Imperial McIntosh) apple (*Malus domestica* Borkh.) cultivars were determined in 1981 and 1982. Isolations were made from dormant buds, leaves at half-inch green, and from leaves at monthly intervals until harvest, using leaf print, spore fall and washed leaf disc methods. Phylloplane microflora for all three cultivars were quantitatively and qualitatively similar. Several bacteria were effective in reducing spore germination and germ tube lengths of conidia of *Spilosea pomi*.

THE EFFECT OF *GLOMUS FASCICULATUM* AND *GLOMUS MOSSEAE* ON THE RESISTANCE OF APPLE ROOTS TO SEVERAL ROOT PATHOGENS. M.D. Begin and F.L. Caruso, Department of Botany & Plant Pathology, University of Maine, Orono, ME 04469.

MacIntosh apple seedlings were planted in montmorillonite clay containing spores and hyphae of the vesicular-arbuscular mycorrhizal fungi *Glomus fasciculatum* and *G. mosseae*. Six weeks after planting, roots of mycorrhizal and non-mycorrhizal seedlings were inoculated with the root pathogens *Cylindrocarpum lucidum*, *Phytophthora cactorum*, *P. cambivora*, or *Pythium irregulare*. Other seedlings were inoculated with the parasitic nematode *Pratylenchus penetrans*. Five weeks later, shoot and root growth, root necrosis, and mineral content of the shoots were assessed to determine whether mycorrhizal colonization increased the resistance of the seedlings to any or all of the root pathogens. In another experiment, seedlings were inoculated with the pathogens and incubated for three weeks. Infected and uninfected plants were then inoculated with both endophytes to determine whether mycorrhizal establishment was prevented in diseased roots.

INSERTION OF ANTIBIOTIC-RESISTANT PLASMIDS INTO *ERWINIA CAROTOVORA*. P. M. Berman, M. S. Mount, and G. H. Lacy, Dept. of Plant Path., U. of Mass., Amherst, 01003 & Dept. of Plant Path. & Physiol., Virginia Poly. Inst. & S. U., Blacksburg, 24061.

Plasmid pBR322 was inserted into *Erwinia carotovora* (EC14 thr<sup>-</sup>) by transformation using a freeze-thaw/CaCl<sub>2</sub> technique. Plasmid reisolated from EC14 thr<sup>-</sup> transformants migrated identically to parent pBR322 on gels. Reisolated plasmid did not increase transformation frequency when used with EC14 thr<sup>-</sup> or "cured" EC14 thr<sup>-</sup> (pBR322) recipients. Although the frequency was very low (ca 5 x 10<sup>-9</sup> transformants/recipients/µg DNA), this method is useful for the insertion of specific, pre-characterized plasmids into EC14 thr<sup>-</sup>. Plasmid R68.45 was inserted into EC14 thr<sup>-</sup> via conjugation with *E. coli* (CSH51 [R68.45]). EC14 thr<sup>-</sup> (R68.45) transconjugants were then mated with EC14 auxotrophic mutants and with *E. coli*. Transconjugants/donor frequencies were as high as 2.5 x 10<sup>-2</sup>, but no chromosomal transfer was detected. This technique may be used to introduce transposable elements into EC14 thr<sup>-</sup>, and alterations, i.e. R' formation, may eventually allow chromosomal transfer via conjugation.

EFFECT OF PH ON MEMBRANE POTENTIAL IN LEAF CELLS OF *ULMUS AMERICANA*. R.A. DeScenzo and R.O. Elanchar, Dept. of Botany and Plant Pathology, University of New Hampshire, Durham, N.H. 03824.

Arbocet 20-S, a systemic fungicide used in the treatment of Dutch Elm Disease, has a pH of 2.5. Previous researchers have suggested that necrosis of tissue surrounding injection sites might be due to the low pH of the injected fungicides. We developed an experiment using standard electrophysiological techniques to obtain data on the effects of pH on membrane potentials in elm leaf cells. Test solutions, ranging from pH 2.5 to 10.5, were fluxed through a perfusion chamber containing leaf sections and changes in membrane potential were recorded. Fluxed solutions of pH 2.5 and 3.0 caused a linear depolarization in potential, whereas solutions of pH 3.5 to 10.5 caused varying degrees of hyperpolarization. Deviations in normal membrane potential can result in reduction of cell vigor and ultimately the vigor of the entire tree. Further research is necessary to determine if the low pH of Arbocet 20-S has detrimental effects at or distal to the site of injection.

**RETENTION OF CHLOROTHALONIL ON TOMATO FRUIT SURFACES.** R. J. Freeborn, S. P. Pennypacker, and R. O. Mumma, Department of Plant Pathology and Department of Entomology, The Pennsylvania State University, University Park, PA 16802.

Anthracoze, caused by *Colletotrichum coccodes* (Wallr.) Hughes, is a serious fruit rot of processing tomatoes in Pennsylvania. One recommended control is to spray every 7-10 days with chlorothalonil. Residual levels of chlorothalonil on tomato fruit surfaces sprayed according to the 'FAST' scheduling technique were measured using gas chromatography. During the 1982 growing season, five applications of the fungicide BRAVO 500 (Diamond Shamrock Corp., Painesville, OH) were applied at a rate of 5 l/ha. Fruit with a minimum diameter of 2 cm were collected before and after a spray, before and after rainfall, and at 3-day intervals after each spray. Preliminary results confirm the expected sharp rise in chlorothalonil levels after a spray. A distinct reduction in concentration occurred after each rainfall and within the first 3-day sampling interval. More gradual decreases in concentration occurred as the time after a spray increased.

**PREDICTION OF POTENTIAL ASCOSPORE DOSE OF VENTURIA INAEQUALIS.** David M. Gadoury and William E. MacHardy, Department of Botany and Plant Pathology, University of New Hampshire, Durham, 03824.

The bulk of fungicide sprays applied to control apple scab are directed against the primary inoculum. However, no method exists to predict ascospore dose (ascospores/m<sup>2</sup> orchard floor) and the relationship between ascospore dose and disease development is poorly understood. Therefore, ascospore dose has not been a factor in determining fungicide application rates. We have developed a system to predict ascospore dose of *Venturia inaequalis* in commercial apple orchards. The system couples assessments of density of lesions (lesions/m<sup>2</sup> leaf), pseudothecia (pseudothecia/lesion), leaf litter (proportion of orchard floor covered), and asci (asci/pseudothecium) with two models that predict ascospore maturity. The system can generate predictions of ascospore dose, up to one month in advance, on any date after bud burst.

**EFFECTS OF CULTIVAR RESISTANCE AND INOCULUM PRESSURE ON THE SPREAD OF POTATO LEAFROLL VIRUS (PLRV).** D. J. Gallenberg and T. A. Zitter, Dept. of Plant Pathology, Cornell University, Ithaca, NY 14853.

The field spread of PLRV as influenced by cultivar resistance and inoculum pressure was measured in isolated potato plots. Cultivars used differed in field resistance to PLRV as assessed by other workers using symptom expression: Rosa (very resistant), Katahdin (moderately resistant) and Chippewa (susceptible). Natural aphid populations spread PLRV from source plants placed in plots in varying numbers to simulate different inoculum pressures. Results, as assessed by ELISA on tuber progeny, showed a high incidence of infection in Rosa although few plants had symptoms, indicating tolerance to PLRV. Significantly fewer Katahdin and more Chippewa were infected, but essentially all infected tuber progeny of these 2 cultivars had symptoms. The 3 cultivars had similar increases in PLRV infection with increased inoculum pressure.

**A FUNGAL ENDOPHYTE IN SEEDS OF TURF-TYPE PERENNIAL RYEGRASS.** P. M. Halisky, C. R. Funk and P. C. Vincelli, Cook College, NJAES, Rutgers University, New Brunswick, New Jersey 08903.

Earlier research has demonstrated that plants of *Lolium perenne* can be systemically infected with a fungal endophyte identified

as *Epichloe typhina*. In our studies seeds of 48 cultivars and selections of perennial ryegrass entered in the National Ryegrass Turf Trials were examined microscopically for endophyte infection. Seed lots of each entry were soaked for 16 hours in a 5% NaOH-0.1% trypan blue solution and then boiled gently for 12 minutes in lactophenol-0.1% trypan blue. Individual seeds were mounted in water, crushed, and examined at 200X magnification for the presence of fungal mycelium. Of 48 entries examined, 21 were free of endophyte whereas 27 were infected. Rated on the basis of percent seed infected, 5 entries were 90-100%, 8 were 50-89%, and 14 were below 33% infected seed. The results of ELISA analysis for the presence of endophyte in selected seed samples were consistent with the results of microscopic examination. New Jersey Agric. Expt. Sta. Publ. Nos. K-11130-4-83 and K-15267-2-83.

**POSSIBLE INVOLVEMENT OF FASTIDIOUS PROKARYOTES IN A NEWLY REPORTED DISEASE OF CHRYSANTHEMUM MORIFOLIUM.** R. K. Horst\*, S. O. Kawamoto\*, W. Jessel†, and K. F. Weaber\*. \*Department of Plant Pathology, Cornell University, Ithaca, NY 14853; and †California-Florida Plant Corporation, Fremont, CA 94538.

Viruslike symptoms have been troublesome in the "Marble" and "Comfort" groups of commercially grown cultivars of *Chrysanthemum morifolium* since the early 1960's. Flower symptoms in affected cultivars included variable morphology, shortened internodes and foliar breakdown. Attempts to obtain either viruses or viroids from affected plants or to associate the problem with genetic abnormality were unsuccessful. However, affected cultivars Showoff, Velvet Ridge, Florida Marble and Bonnie Jean bridged with *Cuscuta epithymum* to *Catharanthus roseus* transmitted an organism which induced symptoms typical of a yellows (mycoplasma) disease in *C. roseus* and has been maintained in culture for four months. Moreover, symptoms in 'Florida Marble' were greater at 30°C than at 13°C in controlled environment experiments. These results implicate fastidious prokaryotes in the disease.

**ELECTRON MICROSCOPY OF MYCOPLASMA-LIKE ORGANISMS ASSOCIATED WITH A NEWLY REPORTED DISEASE IN CHRYSANTHEMUM.** H. W. Israel, R. K. Horst, K. F. Weaber, S. O. Kawamoto, and S. J. Buccì. Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

Copious phenolics in both intact and disrupted tissues of *Chrysanthemum morifolium* have prevented visualization by electron microscopy of organisms implicated causally in a new disease in the "Comfort" and "Marble" groups of chrysanthemum cultivars. However, observations of negatively stained maintenance cultures of organisms isolated from diseased Velvet Ridge and Showoff cultivars have revealed mycoplasma-like profiles that varied from spheroid to filamentoid and helicoid. Similar observations were made on sections of *Catharanthus roseus* that showed symptoms of a mycoplasma yellows disease after it had been bridged by *Cuscuta epithymum* to diseased chrysanthemum. Moreover, in veinal tissues of symptomatic *C. roseus* profiles were numerous in phloem cells, some of which were collapsed and darkly stained, were bounded by unit membranes and contained structures resembling ribosomes and DNA fibrils. These findings point to MLO's as agents contributing to this disease.

**SPORULATION OF THE FUNGUS HIRSUTELLA RHOSILIENSIS FROM THE NEMATODE CRICONEMELLA XENOPLAX.** B. A. Jaffee and E. I. Zehr, Department of Plant Pathology and Physiology, Clemson University, Clemson, SC 29631.

*H. rhosiliensis* emerged from colonized *C. xenoplax* when incubated for 1 day at 25°C in moist chambers or soil. The emergent hyphae branched infrequently and developed phialides and spores after 2-3 days. With the host nematode as the only substrate, approximately 700 spores per nematode were produced in moist chambers. Sporulation ceased after 21 days. Optimum, maximum, and minimum temperatures for sporulation from colonized nematodes on agarose were approximately 25, 30, and 10°C, respectively. Spore production was generally high between pH 5.5-7.0, the range common in South Carolina peach orchards. Sporulation on agarose was not stimulated by KCl or NaCl. Decreasing the osmotic potential below -5 bars with these salts suppressed spore production until few or no spores were observed at -40 bars.

**UTILIZATION OF MULTIPLE SPORE TRAPS TO STUDY SPORE DISPERSAL WITHIN AN APPLE ORCHARD.** Jonathan D. Kaplan and William E. MacHardy, Dept. of Botany and Plant Pathology, University of New Hampshire, Durham 03824.

Twenty six inexpensive volumetric spore traps were constructed to monitor airborne spore dispersal gradients in an acre of semi-dwarf McIntosh trees. The spore traps, which sample the air at approximately 20 l min<sup>-1</sup>, were interconnected in series with wires distributing DC current throughout the orchard from a central power source. A solid state relay connected to a leaf wetness indicator and the power source activated the traps automatically during periods of leaf wetness. Traps were spaced along four transects radiating from a point source of ascospores of *Venturia inaequalis*, released naturally from infected leaves, or spores of *Lycopodium* sp. released using a mechanical device, to compare the dispersal of a known quantity of *Lycopodium* spores with an unknown quantity of ascospores.

WOUND PREDISPOSITION OF CORN STALKS TO COLLETOTRICHUM GRAMINICOLA. N. J. Keller and G. C. Bergstrom, Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

Anthraxose stalk rot (ASR) of corn in New York has been most severe when *Colletotrichum graminicola* infection occurred in conjunction with injury sites produced by larvae of the European Corn Borer (ECB) in above-ground internodes. Wound sites created in corn stalks by a drill bit, simulating entrance wounds by ECB, were inoculated with *C. graminicola* at various intervals after wounding and at different internode positions on plants at the silking stage. Percentage of pith tissue rotted in each inoculated internode was estimated 10 to 12 days after inoculation. Maximum disease development was observed when there was no interval between wounding and inoculation; with intervals of 2 or more hours, there was a progressive decrease in disease development. Internode position had no effect. These data suggest that wound predisposition to *C. graminicola* in the field may be transitory and that wound-healing mechanisms may be closely related to the vulnerability of corn to stalk rot.

MULBERRY LEAF SCORCH: PATHOGENICITY OF THE ASSOCIATED BACTERIUM. S. J. Kostka, T. A. Tattar, and J. L. Sherald. Dept. of Plant Pathol., Shade Tree Labs, Univ. of Massachusetts, Amherst, MA 01003 and Natl. Park Serv., USDI, Washington, DC 20242.

Bacteria serologically related by indirect immunofluorescent antibody staining to the Pierce's disease (PD) and elm leaf scorch (ES) bacteria were isolated from 9 of 11 leaf scorch-affected mulberries (*Morus alba*) by incubating wood chips in a modified PW medium broth at 28 C. No bacteria were isolated from 8 symptomless trees. Three isolates, subcultured on PD4 medium, were inoculated into mulberry seedlings by attaching a 1 ml pipette of inoculum (10<sup>8</sup> cells/ml phosphate buffered citrate magnesium soln. - pH 7.0) to a severed root and by attaching a latex tubing reservoir (0.2 ml inoculum) to the severed stem of each seedling. Controls were inoculated with sterile buffer. Leaf scorch symptoms characteristic of naturally infected trees developed in 3 of 12 inoculated seedlings after 3 months (Jan.-April) under greenhouse conditions. Bacteria reisolated from symptomatic seedlings were serologically related to the PD and ES bacteria.

CHANGES IN ROOT ROT AND YIELD WITH AGE OF AN ALFALFA STAND. K.T. Leath and R.R. Hill, Jr., USDA Regional Pasture Research Laboratory, University Park, PA 16802

Dry-matter yield and root rot severity were evaluated on 'Vanguard,' 'Arc,' 'WL-311,' 'Saranac-AR' and 'Saranac' alfalfa (*Medicago sativa* L.) over three harvest seasons. Yield was taken three times per season, and root rot was rated at the beginning and end of each season. Cultivars did not differ significantly for root rot severity, which increased gradually during the experiment. A significant year X cultivar interaction was present because cultivar yields differed significantly only during the third harvest year. Vanguard, WL-311 and Arc had greater first, second and total season yields than did Saranac-AR and Saranac in the third year of the trial. Observed differences in yield were not caused by root rots but may have resulted from the interaction of other disease resistances.

OCCURRENCE IN PENNSYLVANIA OF PSEUDOMONAS CORRUGATA-INDUCED STEM NECROSIS ON GREENHOUSE-GROWN TOMATOES. F. L. Lukezic, A. A. MacNab, R. G. Levine, and J. Peplinski. Department of Plant Pathology, The Pennsylvania State University, University Park, PA 16802

Wilting of mature tomato plants, grown in a hydroponics system under glass, suggested presence of a vascular wilt pathogen. Closer examination revealed the presence of brown stem lesions associated with pith degradation. Isolations from tissue at the margin produced bacteria identical in colony morphology to known strains of *Pseudomonas corrugata*. The identity of these strains as *P. corrugata* was confirmed by biochemical and physiological tests. Pathogenicity was confirmed when the test strains caused pith necrosis in 4 wk old tomato plants (cv. Rutgers). Investigation of the original seeds as a possible source of inoculum were negative, suggesting the possibility of an indigenous source of the pathogen.

RESIDUE ANALYSIS SPRAYING: A NEW APPROACH FOR DETERMINING THE CONCENTRATION OF PESTICIDES APPLIED. W.E. MacHardy, Dept. of Botany and Plant Pathology, Univ. of New Hampshire, Durham, NH 03824.

Residue analysis spraying differs from conventional spraying in that the concentration of pesticide prepared in the spray tank is calculated as the concentration necessary to obtain an acceptable density on the target surface, e.g. 6-8 ug/cm<sup>2</sup>, rather than as a predetermined recommended concentration, e.g. 2 lb/100 gal. Pesticides applied at recommended concentrations usually control pests if the sprayer is calibrated accurately and the product is applied correctly, but application errors are common. Correcting calibration and application problems provides no guarantee of adequate protection, because crop canopy characteristics and plant spacing also influence pesticide deposition. Residue analysis spraying overcomes these problems by relating pesticide deposition to an acceptable density of pesticide. A yeast bioassay has been developed that allows growers to quickly and easily make accurate determinations of deposition of selected fungicides.

LEAF ROLL-NECROSIS: A RESPONSE OF LILAC TO LOW CONCENTRATIONS OF OZONE. William J. Manning, Department of Plant Pathology, University of Massachusetts, Amherst, MA, 01003, William A. Feder, Suburban Experiment Station, University of Massachusetts, Waltham, MA, 02154, and John H. Alexander, The Arnold Arboretum, Harvard University, Jamaica Plain, MA, 02130.

One-year-old plants of lilac (*Syringa vulgaris* L.) cultivars Congo, Marie Legraye, Miss Ellen Willmot, and Primrose were either exposed to ozone (O<sub>3</sub>) at 6-8 ppm for 6 hrs/day, 5 days/week, or grown in carbon-filtered air, for 12 weeks, beginning in January. After 12 weeks, older leaves on Congo were only slightly bronzed. Typical leaf roll-necrosis symptoms, consisting of chlorosis and interveinal and marginal necrosis, developed on the other cultivars, being most severe on Primrose. Individual plants within cultivars varied in the rate and severity of symptom expression.

IMPORTANCE OF PYTHIUM ULTIMUM, RHIZOCTONIA SOLANI, AND PHOMA BETAE IN THE ETIOLOGY OF DISEASES OF TABLE BEET SEEDLINGS. S. B. Martin, G. S. Abawi, and H. C. Hoch, New York State Agricultural Experiment Station, Geneva, NY 14456

Table beet seeds naturally infested with *Phoma betae* (PB) were planted in natural or steam-pasteurized beet field soils. Natural soils contained *Pythium ultimum* (PU) (ca. 250 propagules/g) and *Rhizoctonia solani* (RS) (<4 propagules/100 g). In addition, infested seeds were pretreated with either hot water (59 C, 8 min, 2X) to eliminate PB, or with metalaxyl (12.5 mg ai/g seed) to control *Pythium ultimum* (PU). Natural and pasteurized soils were amended (5%, v/v) or left nonamended with the antagonist *Laetisaria arvalis* (LA), to control all three organisms. Planted soils were maintained for 4 wk in a greenhouse at 18-25 C. PB was isolated only from seedlings in pasteurized soils, whereas ca. 80% and 20% of the isolations from natural soils yielded PU and RS, respectively. Diseased seedlings from metalaxyl-treated seed was due only to RS. Disease incidence attributed to all three pathogens was significantly reduced in LA-amended soils.

COMPARISON OF METHODS TO ISOLATE AND ENUMERATE LAETISARIA ARVALIS FROM SOIL. S. B. Martin, H. C. Hoch, and G. S. Abawi, New York State Agricultural Experiment Station, Cornell University, Geneva, NY 14456.

Recovery of *Laetisaria arvalis* (LA), a basidiomycete antagonistic to many fungi, was compared using two techniques: direct recovery by wet sieving sclerotia (WS), and estimation based on growth from soil pellets using the multiple pellet

soil sampler (MPSS). Two isolation media were used: a modified Ko and Hora medium (KHP) (Phytopathology 61: 707-), and a selective medium developed by Papavizas et al (PLA) (Phytopathology 73: 220-). Natural field soils were artificially amended with ca. 0, 5, 10, 15, 20, and 25 LA sclerotia/g soil. The amended soils were assayed (4 replicates, 5 g each) using the two recovery techniques and media. Mean recovery on KHP using WS was 0, 5.4, 10.4, 16.9, 20.8, and 28.9 sclerotia/g; estimates using the MPSS were 0, 5.5, 6.5, 9.1, 13.1, and 17.1 propagules/g. Recovery on PLA was lower than on KHP for both the WS and MPSS methods, but PLA prevented growth of *Rhizoctonia* spp., which somewhat resemble LA in gross morphology.

THE EFFECT OF PLANT NUTRITION ON THE SUSCEPTIBILITY OF CHRYSANTHEMUM MORIFOLIUM TO ERWINIA CHRYSANTHEMI. R. J. McGovern, R. K. Horst, R. S. Dickey. Cornell University, Ithaca, NY 14853.

Susceptibility of the *Chrysanthemum morifolium* cv. Bonnie Jean to *Erwinia chrysanthemi* was affected by rate of complete fertilizer (Peter's 20-10-20) and by form of nitrogen (N). Test plants were maintained in a greenhouse at ca. 29 C with a 16-hour photoperiod and given equal volumes of appropriate nutrient solutions daily for five weeks. The rate of complete fertilizer was varied from 0 to a concentration containing ca. 473, 105, and 413 ppm nitrogen, phosphorus, and potassium, respectively. In a separate experiment, three forms of N were varied from 0 to 400 ppm. Susceptibility was based on the amount of pith maceration in cuttings four days after dip-inoculation in a bacterial suspension containing ca.  $10^8$  colony-forming units/ml. Susceptibility increased with increasing rates of complete fertilizer, and N in the form of  $(\text{NH}_4)_2\text{SO}_4$ . However, susceptibility was maximal at moderate levels of  $\text{Ca}(\text{NO}_3)_2$  and  $\text{NH}_4\text{NO}_3$  (100-200 ppm N) and decreased between 200 and 400 ppm N of both forms.

INCREASED INCIDENCE OF PYTHIUM ROOT ROT IN POINSETTIA ASSOCIATED WITH HIGH FERTILIZATION RATES. G. W. Moorman, The Pennsylvania State University, Department of Plant Pathology, University Park, PA 16802

Rooted poinsettia (*Euphorbia pulcherrima* Willd.) cuttings were potted in equal parts peat and perlite. Plants were fertilized with soluble 15N-15P-15K fertilizer at rates of 100, 200, 400, and 600 ppm N each time moisture was required. Fifty plants were fertilized at each rate to establish average saturated paste extract conductivity readings of 119, 158, 274, and 468 X  $10^{-5}$  mohs/cm respectively. Twenty five plants at each rate were inoculated with *Pythium ultimum* Trow. (ATCC No. 32231). One week after inoculation 0, 2, 5, and 20 *Pythium*-inoculated plants were dead and 4 weeks after inoculation 0, 13, 21, and 25 *Pythium*-inoculated plants were dead at the 100, 200, 400, and 600 ppm N rates respectively. Four weeks after inoculation 1, 0, 1, and 4 noninoculated plants were dead at the respective fertilization rates.

THE RESPONSE OF CUCUMBER CALLUS TO INOCULATION BY COLLETOTRICHUM LAGENARIUM. P.A. Morgan and F.L. Caruso, Department of Botany and Plant Pathology, University of Maine, Orono, ME 04469.

The purpose of this study was to describe the response of callus derived from two nearly isogenic lines of cucumber, SMR-18 (susceptible) and GY-14 (resistant) to inoculation by *Colletotrichum lagenarium* race 1. Callus was grown in the dark or with a 12 hr photoperiod on media containing different levels of naphthalene acetic acid and benzylaminopurine. Each callus piece was inoculated with one-10 ul drop of inoculum containing  $10^3$ ,  $5 \times 10^3$ ,  $10^4$ , or  $10^5$  conidia/ml on the surface, and incubated at 24°, 27°, or 30°C in the light or dark. Growth of the anthracnose pathogen was monitored daily by a visual rating system. Pieces were also fixed, embedded in paraffin, sectioned, and stained for histological and histochemical examination. Preliminary data showed much greater growth of the fungus on dark-grown than on light-grown callus. After six days, hyphae had ramified eight cells deep and produced acervuli on dark-grown callus from both cultivars, whereas conidial germination and hyphal growth were limited on light-grown callus.

EVALUATION OF PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) FOR CONTROL OF THE RHIZOCTONIA DISEASE COMPLEX AND PLANT GROWTH PROMOTION IN WHITE POTATO. C.W. Murdoch, and S.S. Leach, N.E. Plant, Soil and Water Lab., Orono, ME 04469.

Several strains of *Pseudomonas fluorescens*, alone or in combination with captan or thiabendazole, were evaluated for their

effect on yield and quality of potato tubers, and control of *Rhizoctonia solani* in two separate field tests. 'Kennebec' seed tubers were treated immediately prior to hand planting with PGPR dusts (454 or 227 gm/45.4 kg cut seed) or by 2 min dips in 0.1 M  $\text{MgSO}_4$  cell suspensions ( $10^9$  cfu/ml). Tubers were evaluated for total yield, U.S. Grade #1, and damage caused by *R. solani*. Results showed no significant increases in total yield or quality associated with PGPR use. Disease incidence and severity ratings were equal to or lower than standard chemical treatments, and PGPR-chemical combination treatments resulted in the best disease control. Results indicate that PGPR's may be effective as biological control agents.

MICROFLORA ASSOCIATED WITH GRAPE ROOTS GROWN IN GRAPE NURSERY REPLANT AND NON-REPLANT SOILS. B. D. Olson and T. J. Burr, Department of Plant Pathology, New York State Agricultural Experiment Station, Cornell University, Geneva, NY 14456.

The cause of this replant problem remains unknown, therefore the microflora associated with grape roots in replant soils was studied. Grape nursery replant and non-replant soils were collected from one location in Hanover, New York. One- and 2-week old concord grape seedlings were planted in the soils and grown in a greenhouse. Four single seedling replications were planted per soil treatment per experiment. Soil and root samples were collected after 1, 2, and 3 weeks. From each replication 1-g sifted soil was placed in 9-ml 0.1-M phosphate buffer (PB) for 15 min and four 1-cm root segments, each removed from the region 2 cm behind the root tip, were ground in 9-ml PB, before serial dilutions were plated on selective media for fungi, bacteria, fluorescent pseudomonads, and actinomycetes. More actinomycetes and fluorescent pseudomonads were found in replant than non-replant soils and no differences were detected for total fungi or bacteria.

CHARACTERISTICS OF BARK AND XYLEM FROM CANKERED REGIONS OF BIRCH TREES INFECTED WITH INONOTUS OBLIQUUS. W. D. Ostrofsky, CFRU, College of Forest Resources, and A. Ostrofsky, Dept. of Botany and Plant Pathology, Univ. of Maine, Orono, ME 04469.

Birch (*Betula* spp.) trees infected with the canker-rot fungus *Inonotus obliquus* develop swollen boles at the site of cankers, but the nature of bark and xylem near infected tissue has not been fully characterized. One gray (*B. populifolia*) and four paper birch (*B. papyrifera*) naturally infected with the fungus were dissected longitudinally through the cankers. Bark was thickest at the vertical extent of bark necrosis. In four of five trees the bark was thicker, by as much as three times, on the cankered side than on the opposite side of the stem. On the cankered side bark tapered to a thickness equal to that on the opposite side within an average of 13 cm from the thickest point. Mean xylem growth during the past ten years was greater on the cankered side of the stem in three of five trees. Observations support the hypothesis that *I. obliquus* has a regulatory effect on the vascular cambium.

DESCRIPTION AND QUANTIFICATION OF DENSITY STRESS RESPONSE OF TWO ISOLATES OF ERYSIPIHE GRAMINIS F. SP. TRITICI (EGT) ON FOUR WINTER WHEAT CULTIVARS. J. R. Pelletier and R. D. Schein, Dept. of Plant Pathology, The Pennsylvania State University, University Park, PA 16802

The influence of cultivar and isolate of EGT on the relationship between sporulation/colony and colony density (colonies/leaf) was investigated with primary leaves of 16-day-old seedlings of Chancellor, Hart, Knox and Titan winter wheats whose adaxial surfaces had been inoculated with isolate 13 or 244 of EGT. Conidia were collected and counted daily for the duration of the infectious period. A negative asymptotic relationship between cumulative sporulation/colony and colony density, detectable by the 4th day, was revealed over a range of 1 to 50 colonies/leaf. This density stress response was best described by the equation  $y = ax^{-b}$ , followed by  $y = ae^{-bx}$  and  $y^{-1} = ax + b$ , where  $y$  = cumulative sporulation/colony and  $x$  = colony density. The regression lines of the density stress response were significantly different at the 0.05 level between cultivars and cultivar-isolate combinations, but not between these isolates.

EFFECTS OF WHITE CLOVER MOSAIC VIRUS INFECTION ON NODULATION AND NODULE FUNCTION OF RED CLOVER. A.H. Khadhair, R.C. Sinha, and J.F. Peterson. Dept. of Plant Science, Macdonald Campus of McGill University, 21,111 Lakeshore Road, Ste. Anne de Bellevue, Quebec, H9X 1C0.

Infection of red clover plants with an eastern Ontario isolate

of white clover mosaic virus (WCMV) significantly affected processes relevant to symbiotic nitrogen fixation. Plant growth nodulation pattern, nitrogenase activity (C<sub>2</sub>H<sub>2</sub> reduction) leghemoglobin content, and *Rhizobium* population were reduced in infected plants, but nitrate reductase and acid phosphatase specific infectivities were increased. A cytochemical method using diaminobenzidine indicated that the leghemoglobin was located in the peribacteroidal space. Infectivity assays, immunosorbent electron microscopy, and an ultrastructural examination showed the presence of virus in the nodular tissues.

WEEDS AS HOSTS FOR *COLLETOTRICHUM COCCODES*. R. N. Raid and S. P. Pennypacker, Department of Plant Pathology, The Pennsylvania State University, University Park, PA 16802.

*Colletotrichum coccodes* (Wallr.) Hughes is generally considered to be the primary causal agent of tomato anthracnose. Weeds have been suggested as inoculum sources by a number of investigators. A host range study was conducted under greenhouse conditions to examine 17 weed species commonly occurring in tomato fields, or between tomato rotations, for possible susceptibility to *C. coccodes*. Using a conidial suspension, foliar inoculations were performed at the seedling, expanding leaf, and senescent growth stages. Susceptibility appeared to be related to plant vigor, with 14 of 17 weed species exhibiting successful infection at the senescent stage. In the majority of cases, infected weeds appeared symptomless. The ability of *C. coccodes* to colonize this wide range of weed hosts may help to explain the survival of the fungus over long rotations.

PATHOGENICITY OF *LEPTOGRAPHIUM* SP. ASSOCIATED WITH *DENDROCTONUS TEREBRANS*. K. K. Rane, T. A. Tattar, Shade Tree Lab, Dept. of Plant Pathology, Univ. of Massachusetts, Amherst, 01003.

The black turpentine beetle, *Dendroctonus terebrans*, and an associated bluestain fungus, *Leptographium* sp., have been related to mortality of Japanese black (JB) pines (*Pinus thunbergii*) on Cape Cod, MA. Trees often die with only limited insect activity. The role of *Leptographium* sp. alone was investigated through pathogenicity tests. Two 1 cm vertical wounds were made on the lower stem of 4-year-old JB seedlings. Sterile 2% malt agar blocks (control), or agar blocks containing mycelium of a *Leptographium* sp. isolate were applied to the wounds. No symptoms were observed in control seedlings, while all seedlings inoculated with *Leptographium* sp. isolates died within 2 months of inoculation. Symptom progression in seedlings was similar to that seen in naturally infected mature trees. Xylem of infected seedlings was bluestained; hyphae were present in both ray parenchyma and xylem tracheids. *Leptographium* sp. was reisolated from all inoculated seedlings.

PHYSIOLOGICAL EFFECTS OF A BARK BEETLE-BLUESTAIN FUNGUS COMPLEX ON JAPANESE BLACK AND SCOTS PINES. K. K. Rane and T. A. Tattar, Shade Tree Labs, Dept. of Plant Pathology, University of Massachusetts, Amherst, MA 01003.

Cambial electrical resistance and oleoresin flow rate were measured in mature Japanese black (JB) and Scots pines. Trees were naturally attacked by *Dendroctonus terebrans* and an associated bluestain fungus, *Leptographium* sp. Cambial electrical resistance increased after insect attack and before visual symptoms. Oleoresin flow rate was less in Scots pines, and greater in JB pines, attacked by *D. terebrans* than in healthy control trees. Several mature trees inoculated with *Leptographium* sp. developed symptoms and exhibited changes in cambial electrical resistance and oleoresin flow rate similar to naturally infected trees. Inoculated asymptomatic trees developed resin-soaked, discolored zones around inoculation points. In 4-year-old JB seedlings inoculated with the fungus under greenhouse conditions, xylem water potential became more negative and leaf diffusive resistance increased prior to visual symptoms.

GROWTH INHIBITION BY CHLORAMPHENICOL ISOMERS IN THE PYTHIACEAE. C. Rawn, Biology Dept., Seton Hall Univ., S. Orange, NJ 07079; R. Fawl and J.L. Van Etten, Dept. of Plant Pathology, Univ. of Nebraska, Lincoln, NE 68583.

The basis of the atypical sensitivity of pythiaceae fungi to chloramphenicol (CAM) was investigated by comparison of effects of the active isomer, D(-)threo CAM, and a bacteriostatically

inactive isomer, L(+)-threo CAM. The isomers inhibited *Pythium ultimum* growth similarly in short (5 hour) shake culture tests. Both isomers also reduced leucine uptake within 30 minutes. With prolonged treatment in shake culture growth inhibition by L-CAM, but not D-CAM, decreased. In stationary liquid culture and on solid medium D-CAM inhibited growth, but L-CAM did not. Similar results were obtained with a *Phytophthora palmivora* isolate. Given the known binding specificity of D-CAM for 70S ribosomes the results suggest that in these fungi both isomers inhibit growth initially via an effect (permeability perhaps) other than on mitochondrial ribosomes and that D-CAM inhibits growth later by blocking mitochondrial ribosome activity.

USE OF DIPHENYLAMINE WITH BENZIMIDAZOLE FUNGICIDES IMPROVES CONTROL OF BENOMYL-RESISTANT *PENICILLIUM EXPANSUM* IN STORED APPLES. D.A. Rosenberger and F.W. Meyer, N. Y. State Agric. Exp. Station, Hudson Valley Laboratory, Highland, NY 12528.

Combinations of postharvest fungicides and apple storage-scald inhibitors were tested in postharvest treatments to determine if the scald inhibitors affected fungicide efficacy. Wounded apples were inoculated by dipping in a conidial suspension containing 80% benomyl-susceptible (BS) and 20% benomyl-resistant (BR) spores of *P. expansum* and were rated for decay after 73-117 days storage at 2.2°C. Diphenylamine (DPA) at 1000 ppm, ethoxyquin at 2700 ppm, benomyl at 300 mg/l, and thiabendazole at 569 mg/l did not reduce decay compared to inoculated-untreated controls. Either fungicide combined with DPA provided effective decay control, but no beneficial effect was obtained by adding ethoxyquin or the formulated DPA carrier alone (without DPA) to the fungicides. None of 50 cultures of *P. expansum* recovered from DPA-treated fruit but 26 of 50 cultures from untreated fruit were benomyl-resistant. In vitro tests showed BR isolates are more sensitive to DPA than BS isolates.

A SIMPLE ALGORITHM TO EVALUATE THE RELATIVE CONTRIBUTION OF PARASITIC FITNESS ATTRIBUTES TO DISEASE INCREASE. M. H. Royer, Department of Plant Pathology, The Pennsylvania State University, University Park, PA 16802

A computer algorithm was designed to use daily sporulation per colony, latent period, infection efficiency, and virulence frequency as input variables to evaluate the relative contribution of these fitness attributes to a computed disease severity and apparent infection rate. Data from powdery mildew of wheat are used to illustrate the usefulness of the model to evaluate relative differences among six near-isogenic lines of Chancellor winter wheat differing in single powdery mildew resistance genes. The disease severities computed with the algorithm are compared to severities predicted by regression models and field data. The regression model predicting severity on flag leaves by using growth chamber determinations of parasitic fitness together with virulence frequencies had an R<sup>2</sup> = .99. The simulated disease severities closely approximated the field data (regression slope not significantly different from one) and demonstrated the usefulness of the algorithm in the avoidance of extrapolation of regression models.

SUPPRESSION OF *ERWINIA AMYLOVORA* BY *ERWINIA HERBICOLA* IN IMMATURE PEAR FRUITS. S. V. Beer and J. R. Rundle, Department of Plant Pathology, Cornell University, Ithaca, NY 14853

The ability of 16 strains of *E. herbicola* to suppress development of fire blight in immature pear fruits was significantly correlated with their ability to suppress development of apple blossom blight in a research orchard. Fruits 2-3 cm in diameter of *Pyrus communis* cv. Bartlett were surface disinfested and bisected longitudinally. A well was cut in the cheek of each pear half and 50 µl of bacterial suspension (10<sup>7</sup> cfu/ml) was placed in the well. Two hours after treatment with *E. herbicola* the same dose of *E. amylovora* was added. Fruits treated with water became infected in two days, but in fruits treated with *E. herbicola* infection was delayed by one or more days, or in some cases completely prevented. The degree of disease suppression was strongly affected by the treatment dose, interval between treatment and inoculation, and *E. herbicola* strain used. This test is being used as a primary screen for potential biological control agents for fire blight.

USE OF AERIAL INFRARED PHOTOGRAPHY TO EVALUATE A DISEASE CONTROL PROGRAM ON GOLF COURSE FAIRWAYS. P. L. Sanders and W. J. Houser, Department of Plant Pathology, The Pennsylvania State University, University Park, PA 16802.

Aerial infrared records provide the advantages of simultaneous acquisition over large areas, accurate permanent records, and analysis at the convenience of the investigator. This research technique was used to evaluate the efficacy of a disease control program on golf course fairways. Four fairways were sprayed with Daconil 2787 4F at 1.5 fl oz/1000 ft<sup>2</sup>. The remainder of the fairways on the course were not treated, and 12 ft wide non-treated strips were left on each treated fairway. Turf loss to dollarspot (*Sclerotinia homoeocarpa*) was heavy in August, 1982. Aerial IR photographs taken August 26 showed clearly the effect of treatment on disease incidence. The non-treated check strips were clearly visible. Aerial IR photography, though expensive, can provide accurate, permanent records for evaluating disease control programs on large turf areas.

GREENHOUSE EVALUATION OF THE CURATIVE AND PREVENTIVE ACTION OF STEROL-INHIBITING FUNGICIDES AGAINST APPLE SCAB. W.F.S. Schwabe, A.L. Jones and J.P. Jonker, NYS Agr. Exp. Sta., Geneva, NY 14456, Bot. and Pl. Path. Dept., M.S.U., E. Lansing, MI 48824, and FFTRI, Stellenbosch, S. Africa, respectively.

Etaconazole at 15 µg/ml, etilon at 25 µg/ml, fenarimol at 37.5 µg/ml and bitertanol at 125 µg/ml in combination with the adjuvant Agri-Dex at 1 ml/L were highly effective in preventing the formation of apple scab lesions on apple leaves when applied up to 72 hr after the onset of infection periods at 15 C. Applications 120 hr after inoculation resulted in the formation of many chlorotic lesions. With bitertanol at 125 and 250 µg/ml and triforine at 234 µg/ml, chlorotic lesions developed if applications were delayed 24 hr or more after inoculation. Production of conidia was almost completely inhibited by all of the sterol-inhibiting fungicides. Inadequate control was obtained with postinfection applications of dithianon. The protective activity of triforine, etaconazole, bitertanol+Agri-Dex, fenarimol and etilon was found to decrease faster between application and inoculation than that of captan and mancozeb.

EFFECTS OF ACUTE STRESS ON FIR AND SPRUCE TREES VARY AS GROWTH POTENTIAL DETERMINED ELECTRICALLY. W.C. Shortle, USDA Forest Service, P.O. Box 640, Durham, New Hampshire 03824.

Cambial electrical resistance, CER, was determined for 20 balsam fir (*Abies balsamea* L.) and 20 red spruce (*Picea rubens* Sarg.) trees. Trees were indexed for growth potential - high, CER < 10 kΩ; low, CER > 12 kΩ - and half of each class subjected to acute stress by girdling. CER and stem and foliar conditions were observed every 2-4 wk during the growing season. CER increased in trees indexed as low before those indexed as high; in fir before spruce. Bark beetle infestations followed the rise in CER. Decreased CER followed the infestations. Foliar symptoms lagged behind changing CER and infestations. Thus, CER indices of growth potential appeared to predict the sequence of damage due to stress. Fir of low potential succumbed first, followed by fir of high potential, and spruce of low potential, and finally by spruce of high potential.

VISUALIZATION OF ACTIN IN SITU BY RHODAMINE-CONJUGATED PHALLOIN IN UREDOSPORE GERMLINGS OF THE BEAN RUST FUNGUS. R. C. Staples and H. C. Hoch, Boyce Thompson Institute, Ithaca, NY 14853; NY State Agricultural Experiment Station, Cornell University, Geneva, NY 14456.

Rhodamine-conjugated phalloin, a derivative of phalloidin which binds to F-actin, was associated with three types of structures in *Uromyces phaseoli* uredospore germlings. The structures were filaments, peripheral plaques and intranuclear inclusions. The filaments, located throughout the germ tube but especially in the more basipetal regions, were observed as either fine, barely perceivable elements or as coarser easily detectable structures. The plaques, which we suggest to be equivalent to filosomes, occurred near the periphery of the cell's cytoplasm. They were most numerous in the hyphal tip regions. Nuclear inclusions occurred within the nucleoplasm subjacent to the spindle pole body. Treatments with KI and phalloidin substantiated that the fluorescently labeled sites were F-actin. Treatment with cytochalasin E led to disappearance of the cytoplasmic filaments.

TRANSPOSON MUTAGENESIS OF ERWINIA AMYLOVORA WITH TN5. E. M. Steinberger and S. V. Beer, Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

We have established a system for transposon mutagenesis of

*Erwinia amylovora* for production of single-site nonpathogenic mutants that can be used for transformation using cloned genes for pathogenicity. Tn5 was transferred to *E. amylovora* by conjugation with *Escherichia coli* strain 1830 pro- met- that harbors the plasmid pJB4JI:Tn5. Donor and recipient strains were grown to mid-log phase, mixed together in a 1:1 ratio, deposited on 0.45 µm millipore filters and incubated on nutrient agar for 6 hours. Transconjugants that had acquired the kanamycin<sup>r</sup> and neomycin<sup>r</sup> markers of Tn5 were recovered on minimal medium amended with 50 ppm kanamycin and 50 ppm neomycin. Mutagenesis was carried out with 15 strains of *E. amylovora*. Prototrophic colonies carrying Tn5 markers were recovered from two strains at frequencies of 10<sup>-8</sup> and 10<sup>-7</sup> per recipient cell, respectively. Pathogenicity of the transconjugants is being tested by wound inoculation of apple seedlings.

THE EFFECT OF TEMPERATURE ON THE RATE OF SPORE GERMINATION AND APPRESSORIUM FORMATION BY *VENTURIA INAEQUALIS*. M.L. Turner and W.E. MacHardy, Dept. of Botany and Plant Pathology, Univ. of New Hampshire, Durham, 03824.

The rates of germ tube and appressorium formation by conidia and ascospores of *Venturia inaequalis* were determined at 5, 10, 15, and 20 C. Spores on apple seedling leaves were examined at two-hour intervals and categorized as ungerminated, having formed a germ tube but no appressorium, or having formed an appressorium. Mathematical models were developed to estimate the percentage of spores in each germination category at given times and temperatures. The largest percentage of spores were predicted to form germ tubes at the following hours: 8, 12, 7, and 7 for conidia, and 17, 10, 8, and 4 for ascospores, at 5, 10, 15, and 20 C, respectively. Minimum duration of leaf wetness necessary for foliar infection at specified temperatures under laboratory conditions was also determined. The significance of these data in predicting scab infection-periods for wet-dry-wet intervals is discussed.

EMERGENCE OF DRY BEANS AS AFFECTED BY RHIZOCTONIA SOLANI, SOIL MOISTURE AND TEMPERATURE. (A.H.C. van Bruggen, P. A. Arneson, and C. H. Whalen, Cornell University, Ithaca, NY 14853)

*Rhizoctonia solani* delays emergence and development in the field (Phytopathology 73:376,1983). We have determined the influence of soil moisture and temperature on these effects in a factorial experiment involving eight levels of each factor. Sclerotia of *R. solani*, produced on autoclaved green beans, were incorporated into field soil (500/liter). Twelve bean seeds cv. 'Redkloud' were sown in infested or non-infested soil in plastic trays, which were kept in incubators and observed daily for emergence. When four plants in a tray showed their first leaves, wet and dry weights of the seedlings were determined and growth rates were calculated. The numbers of infected plants were maximal at 25C and minimal at 12 and 33 C. Soil moisture did not influence infection. Although emergence and initial development through the "loop" stage were not delayed by *R. solani*, further growth was retarded by the pathogen. In general, temperature and moisture influenced growth and development of the seedlings more than *R. solani* did.

OCCURRENCE OF ERWINIAS AND PSEUDOMONADS IN BACTERIAL SOFT ROT OF BELL PEPPERS. Vincelli, P. C., R. A. Cappellini and M. J. Ceponis\*. Department of Plant Pathology, Rutgers University, New Brunswick, New Jersey 08903 and \*USDA Urban Food Marketing Center, New Brunswick, New Jersey 08903.

Isolations were made from 190 decayed peppers from ten separate shipments originating from Florida, California and New Jersey, USA, and the Netherlands. *Erwinia carotovora*, the most common pathogen, was isolated from 60.0% of decayed peppers, and *E. atroseptica* was detected in 3.7%. Although fluorescent pseudomonads were commonly isolated from decayed peppers (83.4%), pectolytic pseudomonads able to cause soft rot were found infrequently (3.2%), and these were usually present in combination with *E. carotovora*. Five of six fluorescent pseudomonads isolates were identified as *Pseudomonas marginalis* by metabolic tests. The predominant cause of bacterial soft rot of bell peppers was *E. carotovora*, but apparently other bacteria can be involved as well.

CROSS-PATHOGENICITY OF FUSARIUM MONILIFORME ISOLATES FROM CORN AND ASPARAGUS. Paul D. Vineis, John P. Damicone, and William J. Manning, Dept. of Plant Pathology, University of Massachusetts, Amherst, MA 01003.

Cross-pathogenicity of isolates of *Fusarium moniliforme* Sheldon from corn stalks (*Zea mays* L.) and asparagus stems and crowns (*Asparagus officinalis* L.) was investigated in laboratory, greenhouse and field experiments. While isolates of *F. moniliforme* differed in pathogenicity to corn and asparagus, several selected isolates were pathogenic to gnotobiotically-grown asparagus seedlings and potted corn seedlings. Cross-pathogenic isolates, one from corn and one from asparagus, reduced emergence of field grown sweet and dent corn and greenhouse grown asparagus when added to the soil as oat-inoculum. In the field both isolates incited stalk rot in inoculated corn plants, while in the greenhouse each isolate incited stem and crown rot in asparagus seedlings grown in amended soil. Corn and asparagus can serve as reservoirs of inoculum for *F. moniliforme* which can be pathogenic to both hosts.

**HYPHAL-SPORE INTERACTIONS IN SCHIZOPHYLLUM COMMUNE. D. A. Voorhees and J. L. Peterson.** Plant Pathology Dept., N.J. Agr. Exp. Sta. Rutgers University, New Brunswick, N.J. 08903

*Schizophyllum commune* was grown on a Schizophyllum complete minimal medium plus yeast extract. Hyphal-spore attractions were observed by placing a dialysis membrane between the fungus colony and basidiospores from selected mating types. An attraction of hyphae to spores was observed and fusions of hyphae and spores was a common occurrence, regardless of mating type. Higher frequencies of fusion were observed in compatible matings. The spore cytoplasm and nuclei were donated to the hyphal cell. Subsequent to monokaryotic hyphal-spore fusions a dikaryon was formed. These fusions were also observed in dikaryotic hyphae. Dikaryotic (clamp forming) hyphae, however, always dedikaryotized just previous to fusion with a spore. The clamp connection-forming dikaryon formed side branches with monokaryotic (non-clamp forming) type cross walls, in response to a spore attractant. After fusion of these "monokaryotic" side branch cells with a spore, a dikaryon was sometimes formed. N.J. Agr. Exp. Sta. K-11410-2-83.

**THE ETIOLOGY OF DECLINE OF PINUS STROBUS ON VIRGINIA LANDSCAPES.** Michael J. Weaver and R. Jay Stipes, Dept. Plant Pathol. & Physiol., VPI & SU, Blacksburg, VA 24061

The decline of *Pinus strobus* in landscapes has been observed in eastern North America for over 80 years, and has been attributed to many causal factors. Declining trees in Virginia were studied. Symptoms included chlorotic, tufted foliage, premature needle loss and needle drooping, bark shriveling, and death of trees. An extensive site-indexing system was developed for evaluating tree and soil parameters on decline (poor) and natural (good) sites. Growth indicators were weighed against site-quality indicators. Declining trees were associated with average soil pH of 7.0, average clay content of 37%, high soil compaction and disturbed soil profiles. Non-declining trees were associated with average soil pH of 5.5, average clay content of 18%, low soil compaction and non-disturbed soil profiles. Certain biotic agents were associated primarily with declining trees. Human-altered landscapes may be a major contributing factor to the decline of Eastern white pine.

**ASSOCIATION OF AN ACTINOMYCETE WITH APPLE REPLANT DISEASE.** S. W. Westcott, III and S. V. Beer. Department of Plant

Pathology, Cornell University, Ithaca, NY 14853

Correlative evidence indicates the involvement of an actinomycete in the etiology of an apple replant disease. In separate experiments soil conducive to apple replant disease, and thus suppressive to formation of first-order lateral roots on young seedlings, was treated with five concentrations of various biocides and then added to steamed soil. Germinating apple seeds were planted and first-order lateral roots counted 2 weeks later. Roots were then cleared with KOH and stained with trypan blue in lactic acid, and the percent of root epidermal area infected by an actinomycete was estimated. Streptomycin sulfate and chlorothalanyl suppressed infection by the actinomycete and enhanced lateral root numbers, whereas metaxyl, prothiocard, and benomyl did not. The involvement of the actinomycete in lateral root generation is suggested by the unusual combination of effective biocides. Surveys of orchard soils indicate that the same actinomycete may be widespread.

**A SEARCH FOR POTENTIAL BIOCONTROL AGENTS FOR MULTIFLORA ROSE.** S. M. Wong, Dept. of Plant Pathology, Cornell University, Ithaca, NY 14853 and D. F. Hindal, Division of Plant and Soil Sciences, West Virginia University, Morgantown, WV 26506.

Based on an extensive literature search, no exotic or native disease agents have been reported to cause serious damage to multiflora rose (MR). In West Virginia disease organisms isolated from MR included 10 fungal pathogens of rose hybrids: *Alternaria*, *Botrytis*, *Cladosporium*, *Fusarium*, *Leptosphaeria*, *Monochaetia*, *Pestalotia*, *Phoma*, *Phomopsis* and *Verticillium*. The crown gall bacterium also was isolated from diseased MR tissues. The nematodes *Criconeoides*, *Dorylaimus*, *Hoplolaimus*, *Meloidogyne*, *Psilenchus* and *Xiphinema* were extracted from soil around MR roots. None of the organisms appeared to cause serious damage. Inoculation of greenhouse- and field-grown MR with isolates of *Phoma* and *Epicoccum*, the two fungi most commonly recovered from cankers on MR, and isolates of *Phytophthora cactorum* and *P. cinnamomi*, two root pathogens with a wide host range, produced no visible damage after 6 mo.

**INCIDENCE OF dsRNA IN SOIL-BORNE ISOLATES OF RHIZOCTONIA SOLANI.** D.H. Zanzinger, B.P. Bandy, and S.M. Tavantzis, Dept. of Botany & Plant Pathology, Univ. of Maine, Orono, ME 04469.

A study was made to determine the occurrence of double-stranded ribonucleic acid (dsRNA) in soil-borne isolates of *Rhizoctonia solani* and to evaluate its role in cytoplasmically transmitted hypovirulence and its potential use in biological control. Forty-six isolates were obtained from potato soils and examined for dsRNA by electrophoresis on 2.4% polyacrylamide gels. Fungal isolates were grown in broth culture and dsRNA was isolated by phenol extraction and CF-11 cellulose column chromatography. Thirty-three of 46 isolates representing all five anastomosis groups showed one to several bands of dsRNA. Criteria used to demonstrate the double-stranded and ribose nature of the nucleic acid were resistance to pancreatic deoxyribonuclease I, ribonuclease A at 2X SSC, sensitivity to alkali treatment, kinetics of melting upon thermal denaturation, and serology. Tests are being conducted with appropriate host crops for each anastomosis group to determine the virulence of all the isolates.