

ABSTRACTS OF PAPERS

**Presented at Meetings of the
American Phytopathological Society**

POTOMAC DIVISION

Annual Meeting

April 15-17, 1981

ABSTRACTS

DECLINE AND DEATH OF PINUS SPECIES IN DELAWARE. J. C. Adams and A. L. Morehart, Plant Science Dept., Univ. of Delaware, Newark, DE. 19711.

Etiological studies to determine the cause of decline and death of *Pinus* spp. in Delaware were initiated in 1979. The pine wood nematode, *Bursaphelenchus lignicolus* was found to be the major cause of decline and death in Japanese black pine (*Pinus thunbergii*). Ninety-five percent (35/37) of the black pine trees sampled from 5 beach areas were heavily infested with male, female, and larvae of *B. lignicolus*. Nematode presence in the lower branches was positively correlated with emergence holes of the insect vector *Monochamus titillator*. Hundreds of isolation attempts from soil, and root, stem and branch tissue samples were consistently negative for phytopathogens. Two xylophilic fungi, *Rhizoctonia solani* and *Pestalotia funerea* usually accompanied nematode infestations. Leaf analyses of healthy and diseased trees showed no differences in N,P,K,Ca, or Mg levels. *B. lignicolus* infestations also were found on loblolly pine (*Pinus taeda*), Virginia pine (*Pinus virginiana*), scots pine (*Pinus sylvestris*) and eastern white pine (*Pinus strobus*).

BIOLOGICAL CONTROL OF SCLEROTINIA LETTUCE DROP IN THE FIELD BY SPORIDESMIUM SCLEROTIVORUM. P. B. Adams and W. A. Ayers. Soilborne Diseases Laboratory, USDA, Agricultural Research, Beltsville, MD 20705.

Sporidesmium sclerotivorum, a mycoparasite of sclerotia of *Sclerotinia* spp., was evaluated for control of lettuce drop caused by *Sclerotinia minor*. The mycoparasite was applied to field plots in May 1978 at rates of 0, 1, 10, 100, and 1,000 conidia/g of soil. During 1978 *S. sclerotivorum* caused a 75-95% reduction in the numbers of sclerotia of *S. minor* at the rates of 100 and 1,000 conidia/g of soil, respectively. Disease control in the plots for four consecutive crops during 1979 and 1980 varied from 40-83% when compared to the disease incidence in the untreated plots. Disease incidence in the control plots ranged from 24 to 66%. The biological control agent became established in the plots and caused destruction of sclerotia produced on the diseased lettuce. A method of cultivation of *S. sclerotivorum* and its use for the biocontrol of diseases caused by sclerotial fungi has been patented.

USE OF METHAM APPLIED THROUGH SPRINKLER IRRIGATION TO CONTROL LETTUCE DROP CAUSED BY SCLEROTINIA MINOR. P. B. Adams, J. Krikun, S. A. Johnston, and H. E. Carpenter. 1st author, Soilborne Diseases Laboratory, USDA, Agricultural Research, Beltsville, MD 20705; 2nd author, Gilat Experiment Station, Mobile Post, Negev 2, 85-200 Israel; 3rd and 4th authors, Rutgers, Research & Development Center, Bridgeton, NJ 08302.

Fifty ml of metham (sodium methyl dithiocarbamate) (25 µg a.i./ml) applied to 150 g of soil in columns in the laboratory killed nearly 100% of the sclerotia of *Sclerotinia minor* in the soil at depths from 0 to 35 cm. In a lettuce production field in New Jersey metham was applied through sprinkler irrigation over a 4-hr period at the rate of 234 l/ha. Sclerotia of *S. minor* retrieved from these field plots one day after application were dead while approximately 90% of the sclerotia from untreated plots were viable. Lettuce, cv Mesa 659, subsequently planted in this field had 19% drop caused by *S. minor* in the untreated plots and only 2% drop in the metham-treated plots.

DESTRUCTIVE PARASITISM OF SCLEROTIA OF PLANT PATHOGENS BY TERATOSPERMA OLIGOCLADUM. W. A. Ayers and P. B. Adams, Soilborne Diseases Lab., USDA, Agricultural Research, Beltsville, MD 20705.

Sclerotia of *Sclerotinia minor*, *S. sclerotiorum*, *S. trifoliorum*, *Sclerotium cepivorum* and *Botrytis cinerea* were parasitized by *Teratosperma oligocladium*, a recently described dematiaceous hyphomycete. The mycoparasite grew poorly on several common culture media but growth was enhanced by supplements of aqueous extracts of sclerotia. Sclerotia of three *Sclerotinia* spp. were infected within 2 weeks in soil infested with *T. oligocladium*. Sclerotia of *S. minor* were parasitized and completely destroyed in soil by 10 weeks. The morphology, cultural characteristics and parasitic behavior of *T. oligocladium* were similar to those of the mycoparasite *Sporidesmium sclerotivorum*. The specific, destructive activity of *T. oligocladium* indicated that the mycoparasite has the potential to control diseases caused by susceptible, sclerotial plant pathogens.

SEPTORIA LEAF SPOT OF TOMATO CONTROLLED IN THE FIELD BY RESISTANCE.

T. H. Barksdale, USDA, Agricultural Research Center, Beltsville, MD 20705.

Tomato breeding lines deriving resistance to *Septoria* leaf spot (caused by *Septoria lycopersici* Speg.) from P.I. 422397 showed small necrotic flecks in greenhouse screening tests. These lesions contained some conidia-producing pycnidia. To test the ability of this type of resistance to provide disease control in the field, a replicated field study was made. An epiphytotic was induced by inoculating plants growing in the field with a spore suspension. The resistant lines did not defoliate as rapidly as susceptible cultivars, and a functional foliage canopy was maintained until harvest. Susceptible check cultivars were severely defoliated 41 days after inoculation.

EFFECT OF SOIL TYPE AND DINITRAMINE ON CYLINDROCLADIUM BLACK ROT (CBR) OF PEANUT. J. A. Barron and P. M. Phipps, VPI&SU, Blacksburg, VA. 24061.

In the greenhouse, seed of 'Florigiant' peanut were planted in non-sterile Ruston (RU) and Woodstown (WO) loamy fine sands artificially infested with *Cylindrocladium crotalariae* micro-sclerotia (ms) to densities of 0, 5, and 50 ms/g. Symptoms of CBR were significantly (P=0.05) more severe among 8-wk-old plants in RU soil than in WO soil when both were infested to a density of 50 ms/g, but not at 5 ms/g. Treatment with dinitramine at 0.56 kg/ha increased significantly the severity of CBR in RU soil infested to a density of 5 ms/g and in WO soil infested to density of 50 ms/g. Dinitramine had no significant effect on CBR in RU soil at the high inoculum density or in WO soil at the low inoculum density. The tendency of this herbicide to increase the severity of CBR appears to be dependent on interactions between soil types and microsclerotium densities of this fungus in soil.

OCCURRENCE OF PHYTOPHTHORA ROOT ROT OF SOYBEAN IN MARYLAND. Jean E. Beagle, Jane F. Rissler and James G. Kantzes. Department of Botany, University of Maryland, College Park, MD 20742

Soybean root rot caused by *Phytophthora megasperma* f. sp. *glycinea* (Pmg) was found for the first time in Worcester County on Maryland's Eastern Shore in August of 1980. Two isolates obtained from the roots and stems of diseased soybeans ('Essex') in different fields were grown in hemp-seed water culture and tested for pathogenicity by inoculating the hypocotyls of 14-day-old plants with mycelium. A susceptible reaction developed in 95% of the inoculated 'Essex' soybeans. The cultural characteristics of these isolates were similar to those reported for Pmg. The isolates were determined to be race 1 by inoc-

ulating hypocotyls of 14-day-old differential soybean cultivars with mycelium grown in V-8 juice broth. Several soybean cultivars commonly grown in Maryland are highly susceptible to these isolates of *Pmg.*

EFFECTS OF DEW-PERIOD TEMPERATURE ON DEVELOPMENT OF PHILIPPINE DOWNY MILDEW OF MAIZE AND OF TEMPERATURE ON CONIDIAL GERMINATION. M.R. Bonde, USDA-SEA, AR, Plant Disease Research Laboratory, Frederick, MD 21701.

Pioneer 3369A seedlings in the two-leaf stage were sprayed with a conidial suspension of a Philippine isolate of *Peronosclerospora philippinensis*, subjected to dew periods of 4 or 18 hr at specific constant air temperatures from 8 to 35 C, and then transferred to the greenhouse. The optimum temperature ranges during the 4-hr and 18-hr dew periods for subsequent development of systemic infection were 15 to 32 C and 13 to 32 C, respectively. Water-agar plates equilibrated at specific temperatures and then seeded with conidia were incubated for 2 or 5 hr in the dark at a series of temperatures (± 1 C) from 8 to 34 C. The optimum temperature range for germination was 15 to 33 C and 12 to 33 C for 2- and 5-hr incubation periods, respectively. Growth of germ tubes was optimal at 22 to 28 C and 18 to 26 C with 2- and 5-hr incubation periods, respectively. Conditions found favorable for infection of corn by *P. philippinensis* are common during the growing season in much of the U.S. corn belt.

COMPARATIVE SPORE MOVEMENT OF *CERATOCYSTIS ULMI* IN STEMS OF AMERICAN AND SIBERIAN ELMS. Richard J. Campana, Botany and Plant Pathology Dept., University of Maine, Orono, ME 04469.

Resistance to Dutch elm disease is attributed to small vessels and slow movement of the pathogen. The rate of spore movement was compared in *Ulmus americana* (susceptible) and *U. pumila* (resistant) elms. Ten trees, (5-10 m in height, 10-25 cm diam.) of each species were inoculated in June in each of two years. Inoculations were made in xylem of 3-year old twigs of 10 stems per tree. At 24 hours after inoculation, each stem was cut 30 cm below the inoculation point, wrapped in plastic and placed in cold storage. Each stem was cut into 0.6 cm sections; each section was incubated at 22 C on moist paper in plates. Presence of *C. ulmi* was determined by coremia on wood or isolation in culture. Downward movement of *C. ulmi* in *U. americana* reached a maximum of 30 cm; in *U. pumila* the maximum was 10 cm. Average downward movement was 25.5 cm in *U. americana* and 7.2 cm in *U. pumila*. The data show that spores of *C. ulmi* are able to move farther downward in *U. americana* than in *U. pumila* during the same 24 hour period.

PINE WOOD NEMATODE DISEASE IN ORNAMENTAL PINES IN VIRGINIA. D. E. Carling, R. C. Lambe, S. A. Alexander and A. Elliott. Virginia Truck & Ornamentals Research Station, Virginia Beach, VA 23455 and Dept. of Plant Path. & Physiol., VPI & SU, Blacksburg, VA 24061.

Over one hundred dying ornamental pines representing seven species from 10 widely scattered counties and cities in Virginia were sampled for detection of the pine wood nematode (*Bursaphelenchus lignicolus*) in 1980. Seventy-two percent (56 of 72) of the Japanese black pine (*Pinus thunbergiana*), the largest group tested, contained pine wood nematode. *B. lignicolus* was extracted from Japanese red (*P. densiformis*) 100%, mugo (*P. mugo*) 100%, loblolly (*P. taeda*) 31%, Virginia (*P. virginiana*) 67%, eastern white (*P. strobus*) 27% and scotch (*P. sylvestris*) 7%. *B. lignicolus* was not found in sampled Christmas and forest trees.

COMPARISON BETWEEN PATHOGENICITY, TOXIN PRODUCTION, AND PLASMID PRESENCE IN *PSEUDOMONAS TABACI* AND *PSEUDOMONAS ANGULATA*. Mary Lou Casadevall-Keller and Myron Sasser Dept. Plant Science, University of Delaware, Newark, DE 19711

Eleven isolates of *Pseudomonas tabaci* and *Pseudomonas angulata* were screened for degree of virulence by inoculation into wildfire susceptible and resistant tobacco plants (*Nicotiana tabacum* L. var. MD 201 and MD 872). Each isolate was also tested for toxin production, minimal inhibitory concentrations of numerous antibiotics, induction of hypersensitive reaction, substrate utilization, and presence of plasmid DNA. Presumptive elimination of plasmid from *P. tabaci* was attempted by exposure to acridine compounds, ethidium bromide, sodium dodecyl sulfate, heat, ultraviolet irradiation, and various antibiotics known to inhibit DNA synthesis. No elimination

of plasmid DNA was observed using the above treatments. However, both *P. tabaci* and *P. angulata* isolates were found to contain plasmid DNA. With the exception of toxin production, no appreciable differences in phenotypic properties were found.

THE EFFECT OF POSTHARVEST CALCIUM CHLORIDE TREATMENTS ON BROWN ROT OF PEACHES. William S. Conway, U.S. Department of Agriculture, SEA-AR, Horticultural Crops Quality Laboratory, BARC-West, Beltsville, Maryland 20705.

'Redhaven' peaches, harvested from a commercial orchard in Maryland, were treated with a 0, 2, 4, or 6% calcium chloride solution either by dipping, vacuum infiltration (250 mm Hg) or pressure infiltration (1.03 x 10⁵ Pa.). Twenty-four hours later, the treated peaches were wounded on two sides and inoculated with a conidial suspension of *Monilinia fructicola*. After storage at 20 C for 5 days, the peaches were rated for decay severity by measuring the diameter of decayed area at the inoculation sites. When calculated on the basis of decayed area compared to the control, a 4% CaCl₂ solution pressure infiltrated into the fruit produced the optimum effect, resulting in 50% less decay than observed on the nontreated fruit.

COMPARATIVE EFFECTIVENESS OF SYSTEMIC AND NON-SYSTEMIC FUNGICIDES IN THE CONTROL OF *PYTHIUM* BLIGHT OF BENTGRASS. H.B. Couch Dept. of Plant Path. & Physiol. VPI & SU, Blacksburg, VA 24061.

Trials were conducted to determine the relative effectiveness of Ridomyl (RL) and Previcur N (PN), systemic fungicides with known toxicity to Phycomycetes, and the Pythium-active contact fungicides Koban (KO) and Tersan SP (TSP) for the control of Pythium blight (*P. aphanidermatum*) of creeping bentgrass. Also, the non Phycomycete-active systemic fungicides Bayleton (BN) and Baycor (BR) were tested for their potential for increasing the severity of the disease. Pythium blight was high in incidence and severity on the test site throughout the trials. All fungicides were applied in 163 ml water/m². One application of RL at 153 mg a.i./m² and 2 applications of PN at 612 mg a.i./m², respectively, gave 100% control of Pythium blight for 21 days. KO applied at 367 mg a.i./m² and TSP applied at 794 mg a.i./m² each, through 3 applications, failed to provide any disease control. Three applications of BN at 310 mg a.i./m² and BR at 612 mg a.i. did not increase the severity of the disease.

DETECTION OF *PLASMIDIOPHORA BRASSICAE* IN THE SEDIMENT OF IRRIGATION WATER SOURCES. L. E. Datnoff, T. K. Kroll and G. H. Lacy. Dept. of Plant Path. and Physiol., VPI & SU, Blacksburg, VA 24061.

In 1979, 55 of 103 cabbage fields surveyed in Carroll and Patrick Counties in southwestern Virginia had plants with symptoms of clubroot and were, therefore, infected with *Plasmiodiophora brassicae*. Furthermore, plants with symptoms of clubroot were found in seedbeds with no previous history of cabbage production. These beds had been irrigated from ponds receiving run-off water from *P. brassicae*-infested fields. By microscopic observations, *P. brassicae* resting spore-like structures were found in 3 of 18 water samples. In 3 of 4 ponds, *P. brassicae* was demonstrated to be present by observing clubbed roots on seedlings 30 days after planting in pond sediments.

REDUCTION OF CLUBROOT BY CHLORINATION OF *PLASMIDIOPHORA BRASSICAE* RESTING SPORES. L. E. Datnoff, G. H. Lacy and G. D. Boardman*, Departments of Plant Path. & Physiol. and Civil Engineering*, VPI & SU, Blacksburg, VA 24061.

Resting spores (RS) of *Plasmiodiophora brassicae*, causal agent of clubroot of cabbage, were found in ponds used to irrigate cabbage seedbeds in southwestern Virginia. In an attempt to disinfect irrigation water, 10⁶ RS/ml were exposed in the dark at 25 C for up to 24 hr to NaOCl at concentrations of 0, 0.2, 2, 20 and 200 mg Cl/liter. Roots of cabbage seedlings were immersed in suspensions of chlorinated RS in the dark at 25 C for 36 hr, potted and placed in the greenhouse. After 30 days, plants were rated for root clubbing. Chlorine concentrations of 2, 20 and 200 mg/liter either inhibited germination or were sporidicidal since no symptoms occurred on plants exposed to RS treated with these concentrations. Phytotoxicity was observed on plants exposed to 20 and 200 mg Cl/liter.

OCCURRENCE OF OPHIOBOLUS PATCH DISEASE IN MARYLAND. P. H. Dernoeden and N. R. O'Neill, Department of Agronomy, University of Maryland, College Park, MD 20742, and Field Crops Laboratory, USDA, Beltsville, MD 20705

Ophiobolus patch of turfgrass (incitant Gaeumannomyces graminis var. avenae (E. M. Turner) Dennis) was observed for the first time in Maryland on 'Penncross' creeping bentgrass turf at Beltsville in 1979. Recently the pathogen has been isolated from bentgrass exhibiting typical disease symptoms from golf courses less than 5 years old in Easton, Oakland, and Upper Marlboro, Maryland. Affected turf exhibited light yellow, bronze, red-brown or bleached tan patches 15 cm to 60 cm in diameter. Typical dark brown runner hyphae and simple hyphopodia occurred on roots, crowns, and basal sheath tissue. Ascospore lengths from Beltsville, Oakland, and Upper Marlboro isolates were 96.4 μ m, 95.8 μ m, and 108.9 μ m, respectively. Soil pH at the four sites ranged from 5.2-7.4, and soil texture was a sandy or a silty loam. This constitutes the second report of the disease in the eastern U.S. and the first report of its occurrence in the mid-Atlantic states.

EFFECT OF THINNING ON SCLEROTINIA BLIGHT OF PEANUT. R. L. Dow, D. M. Porter, and N. L. Powell. Dept. of Plant Pathol. and Physiol., and FR, SEA, USDA, Suffolk, VA 23437, and Dept. of Agron., VPI & SU, Blacksburg, VA 24061.

Sclerotinia blight (Sclerotinia minor) development was assessed weekly in artificially infested peanut plots that were unthinned with plants spaced approximately 10 cm apart (UT), or thinned with plants no closer than 20 cm (T). Thinning was done when the plants were mature to prevent compensation in the rows. The average disease severity index (DSI), based on the proportion of symptomatic tissue in a 61-cm length of row was least throughout the season in the T-plots. On the last day of the season, the mean DSI was 1.4 and 0.3 for the UT- and T-plots. Although there were 60% fewer plants in the T-plots, there was an 80% lower average DSI. The mean DSI per plant was 0.2 and 0.1 in the UT- and T-plots. At the end of the season, the mean lengths of the longest lesion in 160, 61-cm row sections were 4.6 and 2.6 cm for the UT- and T-plots. Yield was 31% less in the T-plots.

THE IMPACT OF PHOTOCHEMICAL OXIDANT AIR POLLUTION ON VEGETATION NATIVE TO THE BLUE RIDGE MOUNTAINS. S. F. Duchelle, J. M. Skelly and B. I. Chevone. Dept. of Plant Path. & Physiol., VPI & SU, Blacksburg, VA 24061

The effect of ambient ozone (O₃) on biomass production and height growth of vegetation native to the Shenandoah Nat'l Park was examined in twelve 10-foot diameter plots. In 1979, two collections of total above-ground biomass yielded 9633, 6330, 4086g for the filtered, non-filtered, and open plots, respectively. In 1980, two collections, yielded 19,995, 16,083, 14, 120g for the filtered, non-filtered, and open plots, respectively. Height growth of 7 forest tree species planted within these plots was suppressed in open and non-filtered chambers compared to filtered chambers. The highest monthly average and the peak 1 hr conc. of O₃ were .051 and .095 ppm, respectively for the 1979 5-month study period. In 1980, the highest monthly average and the peak 1 hr conc. of O₃ were 0.056, and .100 ppm, respectively. We concluded that chronic ozone doses may have reduced height growth of selected forest trees and biomass production of vegetation native to the Shenandoah Nat'l Park.

FUNGI ASSOCIATED WITH SCLEROTIA OF SCLEROTINIA MINOR BURIED IN VARIOUS SOILS. M. T. Dunn and R. D. Lumsden. 1st author, Dept. of Botany, University of Maryland, College Park, MD 20742. 2nd author, Soilborne Diseases Laboratory, USDA, Agricultural Research, Beltsville, MD 20705.

Survival of sclerotia of Sclerotinia minor buried in one forest soil and six agricultural soils was assessed at monthly intervals. Fungi that developed from surface-disinfested sclerotia were isolated and identified. Numbers of sclerotia in four agricultural soils declined rapidly and the sclerotia were colonized by species of Fusarium, Trichoderma, Gliocladium, Talaromyces, Chaetomium, Codinaea and Paecilomyces. In a clay loam soil a sterile dark mycelial species was associated with decline of sclerotia. Survival of sclerotia was less in compost amended soil than in nonamended soil; however, fungi isolated from these sclerotia were similar. Rapid decline in numbers of sclerotia began in September, 3 mo. after burial, and then leveled off during the winter. One isolate each of Paecilomyces elegans and Chaetomium fusiforme significantly decreased S. minor disease of lettuce in preliminary greenhouse tests.

STUDIES ON SAMPLING TECHNIQUES FOR DETECTION OF THE PINE WOOD NEMATODE (BURSAPHELENCHUS LIGNICOLUS) IN PINE TREES. A. P. Elliott, R. C. Lambe, S. Alexander and D. Carling. Dept. of Plant Path. & Physiol., VPI & SU, Blacksburg, VA 24061 and Virginia Truck & Ornamentals Research Station, Virginia Beach, VA 23455.

A study was conducted to examine the relationship between choice of sampling sites and population densities of Bursaphelenchus lignicolus in pine trees. Samples were taken at sites along the stem and branches of three pine trees. B. lignicolus was detected in all samples. The sampling technique along the stem of the trees indicated that population densities were highest in the middle sections of the trees. Results of the sampling technique were variable among the branch samples. Population densities were highest in the uppermost section of one tree while in another tree, densities were highest in the branches from the middle section. Because the average density detected along the stem was higher than for branch samples, we concluded that detection of B. lignicolus may be more probable from stem than branch samples.

THE MOBILITY OF DICHLORAN, IPRIDIONE, AND VINCLOZOLIN IN LODI LOAM AND WOODSTOWN LOAMY SAND. W.H. Elmer and R.J. Stipes, Dept. Plant Path. and Phys., Va. Tech, Blacksburg, VA 24061

The soil mobility of dichloran (Botran 50WP), Ipridione (Rovral 50WP), and vinclozolin (Ronilan 50WP) was studied in Lodi loam (LL) and Woodstown loamy sand (WLS). Two hundred mg a.i. in each formulated product were leached with 400 ml H₂O through a 35 cm vertical, segmented polyvinylchloride column packed with air-dried soil. Twelve to 18 hr after leaching ceased, the columns were disassembled into seven 5 cm sections, and a center core sample was analyzed. Residues were extracted with Me₂CO, dried, and detected by bioassay procedures utilizing radial growth measurements of Sclerotinia minor across extract-amended agar plates. Each treatment was replicated three times, with untreated columns serving as controls. All fungicides moved past the first section, with dichloran becoming immobile at the 2nd section in the LL and at the 3rd section in the WLS. Ipridione was detected in all sections of both soils, exhibiting the highest degree of mobility. Vinclozolin became immobile in the LL at the 5th section, but detected in all WLS sections.

RELATIONSHIP OF FUSARIUM WILT RESISTANCE AND SOIL MOISTURE TO YIELD AND PERSISTENCE OF ALFALFA. Gary Emberger and R. E. Welty, N. C. State University, Raleigh 27650.

Five alfalfa populations were inoculated with a mixture of 4 virulent single-spore isolates of Fusarium oxysporum f. sp. medicaginis and transplanted into the field. Stand counts were made at 2-wk intervals and dry matter yields were recorded over 5 harvests. Plants were given a root xylem discoloration rating at the final harvest. Time required for Apalachee (highly susceptible), Narrangansett (susceptible), and Liberty (resistant) to reach 50% mortality was 72, 130, and 190 days, respectively. Dry matter yields decreased as disease increased. When Moapa (highly resistant) and Narrangansett (susceptible) were inoculated and grown in the greenhouse and outdoors at several soil moisture contents, disease severity was not related to soil moisture.

ANTIBACTERIAL ACTIVITY OF THE SOYBEAN ISOFLAVANOLIDS GLYCEOLLIN AND COUMESTROL. William F. Fett and Stanley F. Osman, Eastern Regional Research Center, 600 E. Mermaid Lane, Phila. PA 19118.

The soybean isoflavanoids glyceollin and coumestrol were tested for inhibitory activity against numerous strains of the bacterial leaf pathogen Pseudomonas syringae pv. glycinea and other bacteria. Six different bioassays were used to test for effects of glyceollin and two for coumestrol. Of the nine pv. glycinea strains tested, representing seven of the nine known physiologic races, none was inhibited by glyceollin in any of the bioassays. However, glyceollin did inhibit growth of several other bacteria and was shown to be bactericidal towards strains of Bacillus subtilis, B. licheniformis, Staphylococcus aureus, and Corynebacterium flaccumfaciens pv. flaccumfaciens. Coumestrol did not inhibit growth of the five pv. glycinea strains tested but was bactericidal towards strains of B. subtilis, B. licheniformis, S. aureus, Streptococcus thermophilus, and Xanthomonas campestris pv. glycines. The results cast doubt on the purported role of glyceollin and coumestrol in race-specific resistance of soybean to pv. glycinea.

INTERACTION BETWEEN TWO STRAINS OF PEANUT STUNT VIRUS IN SOYBEAN. Rosemary H. Ford and Sue A. Tolin. Dept. of Plant Pathology and Physiology, VPI&SU, Blacksburg, VA 24061.

Two similar strains of peanut stunt virus, V-1 and V-2, have been distinguished by serotype and pathogenicity on soybean (*Glycine max* (L.) Merr 'York'). When the primary leaves of soybean were inoculated with a mixture of the two strains, only the pathogenic strain, V-2, was present in the non-inoculated trifoliolate leaves as indicated by serological tests. However, after transfer of the mixed infection to pea (*Pisum sativum* L. 'Little Marvel'), serotypes of both strains were identified. Symptoms on soybean with the mixed infection were often more severe than the mottle and stunting caused by V-2 alone. The mixture of strains was maintained in York for several passages. Replication of V-1 in York soybean depended on the presence of V-2 and proceeded at a lower level than V-2. Thus, V-2 acted as a helper to permit replication of V-1 in a V-1 resistant host.

XIPHINEMA RIVESI ASSOCIATED WITH TOMATO RINGSPOT VIRUS-INCITED DISEASES IN PENNSYLVANIA. Lyle B. Forer, Pennsylvania Department of Agriculture, 2301 N. Cameron Street, Harrisburg, Pennsylvania 17110 and Richard F. Stouffer, Department of Plant Pathology, Fruit Research Laboratory, Biglerville, Pennsylvania 17307.

Soil samples were collected from tomato ringspot virus (TmRSV)-infected apple, blueberry, grape, peach or raspberry plantings in seven Pennsylvania counties. *Xiphinema* spp. were recovered from 62 of 66 (94%) samples; 11 (17%) contained only *X. americanum*, 33 (50%) contained only *X. rivesi*, 12 (18%) contained both species and 6 (9%) contained species of *Xiphinema* that could not be determined due to insufficient specimen. *Xiphinema rivesi* was present in 21 (70%) and *X. americanum* in 17 (57%) of the 30 samples collected from Adams County that contained *Xiphinema*. In the 26 samples from outside Adams County, 24 (92%) contained *X. rivesi* and only 6 (23%) contained *X. americanum*. On the basis of these data, we concluded that *X. rivesi* is prevalent in TmRSV-affected fruit plantings in Pennsylvania.

EFFECT OF CARBOFURAN ON STEWART'S BACTERIAL DISEASE OF SWEET CORN IN FIELD PLOTS
R.W. Goth and J. Steinke, USDA, Beltsville Agricultural Center, Beltsville, MD 20705, and Department of Horticulture, Cook College, Rutgers University, New Brunswick, NJ 08903

Field plot experiments were designed to test the effect of carbofuran, a broad spectrum systemic insecticide, on the reactions of sweet corn hybrids inoculated with *Erwinia stewartii*, which causes Stewart's bacterial wilt disease of sweet corn. Tolerant sweet corn cultivars selected for this study were Bellingranger, Merit, and Sweet Sue; susceptible ones were Epic and Gold Winner. Inoculated seedlings of all cultivars developed characteristic foliar symptoms with varying degrees of severity. The carbofuran effect was measured by yield of marketable top ears. Carbofuran treated inoculated plots produced slightly more marketable ears than non-carbofuran treated inoculated plots. This increase was 4% for both wilt susceptible Epic and wilt tolerant Merit.

ETIOLOGY OF A DAMPING-OFF DISEASE OF SOYBEANS IN VIRGINIA.
C. E. Grant, P. M. Phipps and C. W. Roane. Dept. of Plant Path. and Physiol., VPI & SU, Blacksburg, VA 24061 and TR & CEC, Holland Station, Suffolk, VA 23437.

Laboratory and greenhouse studies were conducted to determine the cause of a damping-off disease affecting 'Essex', 'Lee 68' and 'McNair 500' soybeans in King and Queen County, VA. Two species of *Fusarium* were isolated consistently and tested for pathogenicity on the three cultivars. Bioassays for the organisms pathogenic on soybeans were performed by planting seeds of the three cultivars in soil from a problem field. The pathogenicity of the fungi isolated from diseased seedlings was determined by observing the behavior of soybeans planted in pasteurized field soil infested with the organism that were originally isolated. In both pathogenicity and bioassay tests *Fusarium oxysporum* colonized Essex and McNair 500 and *F. solani* colonized McNair 500 and Lee 68. Since only *F. oxysporum* was found on Essex, only *F. solani* on Lee 68 and both *F. oxysporum* and *F. solani* were found on McNair 500, the *Fusarium* species appeared to have selectively colonized the three cultivars.

DETECTION OF APPLE MOSAIC AND PRUNUS NECROTIC RINGSPOT VIRUSES IN ROSE BY THE ENZYME-LINKED IMMUNOSORBENT ASSAY (ELISA). E.L. Halk, American Type Culture Collection, Rockville, MD 20852

The ELISA test is a reliable method for detecting apple mosaic (APMV) and Prunus necrotic ringspot (NRSV) viruses in rose. Sap extracted with a roller press rinsed with PBS-Tween containing 0.1% ovalbumin and 1% PVP-40 allowed rapid sampling and produced results equivalent to grinding tissue in a mortar and pestle at 1:50 W/V in the same buffer. When samples, conjugate, and substrate were incubated for 1-2 hr at 4 C, A₄₀₅ values were less than 0.1 for control samples and 0.2-2.0 for infected petals and young leaves. Extracts of infected mature leaves produced low A₄₀₅ values. Overnight incubation of sap extracts occasionally led to high background A₄₀₅. Virus was detected as accurately in ELISA plates coated with both APMV and NRSV antisera as in plates coated with either antisera alone. Purified APMV and NRSV were detected to an end point of 37 ng/ml on plates coated with homologous antisera, but neither virus was detectable with heterologous antisera.

PARTIAL CHARACTERIZATION OF TWO *XANTHOMONAS FRAGARIAE* BACTERIOPHAGES. W. J. Hazel, E. L. Civerolo (USDA, SEA, HSI, Beltsville, MD 20705), and G. A. Bean (Univ. MD, Bot. Dept., College Park, MD 20742)

Xanthomonas fragariae phages FP1 and FP2 were isolated from soil and naturally-infected leaves. Both viruses have non-contractile tails, 150 and 135 nm long for FP1 and FP2, respectively. FP1 particles have heads 65 nm across and FP2 particles have elongated heads 58 x 88 nm. Eleven *X. fragariae* strains were susceptible to lysis by FP1 while only four strains were susceptible to lysis by FP2. The adsorption rate constant of FP2 to strain Xf4 was 2.88×10^{-11} ml/min. At a multiplicity of infection of 0.01, 96% of FP2 PFU were irreversibly adsorbed to Xf4 after 1 hr at 28C. For FP2, the latent period was 2 hr, the rise period was 2-3 hr, the eclipse period was 0.5 hr, and the burst size was 176 PFU/infected cell. FP2 is also capable of lysing *X. phaseoli*, but not *X. pruni* or *X. vesicatoria*. FP1 and FP2 nucleic acids are DNase-susceptible, RNase-resistant, and alkali-susceptible.

DETECTION OF VIRUSES IN ULTRASTRUCTURAL STUDIES OF NATURALLY INFECTED *KALANCHOE BLOSSFLEDIANA* S. S. Hearon, USDA, SEA, AR Florist & Nursery Crops Lab., Beltsville, MD 20705.

Kalanchoes commonly exhibit viruslike symptoms, but no virus has been identified. An ultrastructural study and transmission tests were initiated to find the cause of a seasonal leaf spotting on *Kalanchoe blossfeldiana*. Viruslike particles were found in leaf dip preparations and/or ultrathin sections of nine varieties. In a symptomless Rotkappchen, only a 600-650 nm flexuous rod was found and mechanically transmitted to *Chenopodium quinoa*. The virus formed fusiform aggregates *in situ* that resembled carlaviruses inclusions. A second flexuous rod particle measuring 700-800 nm was found in plants with a mild mosaic. It was associated with pinwheel inclusions, characteristic of potyvirus infections. A third type of particle with a bacilliform shape was consistently found in sections of plants with leaf spotting, but it has not been mechanically transmitted. Kalanchoes often contained a mixture of these three particle types and inclusions, that may represent more than one carla-, poty-, or bacilliform virus.

EFFECTS OF SULFUR DIOXIDE AND AMBIENT OXIDANTS ON THE YIELD AND QUALITY OF TOMATO. H. E. Heggstad, J. H. Bennett, and E. H. Lee, Plant Stress Laboratory, PPHI, U.S. Dept. of Agriculture, Beltsville, Maryland 20705.

In 1980 'Jet Star' a garden tomato cultivar was exposed to 0, 0.06, 0.12, 0.24 and 0.48 $\mu\text{l/l}$ SO₂ in open-top field chambers with nonfiltered (NF) air and to 0, 0.12 and 0.48 $\mu\text{l/l}$ SO₂ in chambers with carbon-filtered (CF) air. Exposures were for 5 hr/day, 5 days/week, for a total of 57 days. Ambient ozone levels were relatively high; i.e., in July, Aug. and Sept. about 30 hr \geq 0.10 $\mu\text{l/l}$. Yields were reduced 17% by oxidants, 18% by the highest dose of SO₂, and 32% by the combination of oxidants plus SO₂. Both fruit size and number were reduced. Yield reduction in NF air due to 0.06, 0.12, 0.24 and 0.48 $\mu\text{l/l}$ SO₂ were 6, 10, 20 and 18% respectively. Yield reductions in CF air due to 0.12 and 0.48 $\mu\text{l/l}$ SO₂ were 5 and 18% respectively. The correlation between pollutant exposure dose and fruit yield was $r = -.90$ in NF and $r = -.99$ in CF air. The quality of fruits was not changed based upon taste, color, texture, total acidity, pH and ascorbic acid content.

A RAPID METHOD FOR SCREENING ALFALFA FOR RESISTANCE TO PHYTOPHTHORA MEGASPERMA. B. A. Hohrein, Univ. of Md., Botany Dept., College Park, Md. 20742/W-L Research Inc., 7625 Brown Bridge Rd., Highland, MD. 20777; G. A. Bean, Univ. of Md., Botany Dept.; and J. H. Graham, W-L Research, Inc.

A rapid technique was developed for evaluating alfalfa seedlings for resistance to Phytophthora megasperma Drech. Twelve-day old seedlings were grown in a mixture of Pro-Mix and Palite overlying 3 cm of gravel in a 45x60-cm tub. A suspension of mycelium was poured into furrows between every other row. Water was added through a tube until free water reached the surface of the growing medium. Water was drained after 3 days. After 18 days, resistant plants had long, white roots and susceptible plants had short, brown or rotted roots. Three experimental lines previously rated as susceptible, intermediate and resistant in an infested field nursery, and the resistant and susceptible check varieties were inoculated in 4 tests to determine reliability of the technique. The correlation between the greenhouse and field tests ranged from $r = +0.83$ to $+0.99$.

ISOLATION OF A BEAN YELLOW MOSAIC-RELATED POTYVIRUS FROM GIBASIS GENICULATA. P.L. Hunst, S.A. Tolin and R.C. Lambe, Dept. Plant Pathol. & Physiol., VPI&SU, Blacksburg, VA 24061.

Several Tahitian bridal veil plants (G. geniculata (syn.) Tradescantia multiflora) from an ornamental nursery in Virginia, exhibiting severe stunting and leaf distortion, were infected with a potyvirus. This virus was readily sap transmissible to T. fluminensis and T. albiflora. Severe systemic symptoms developed on Chenopodium quinoa, Pisum sativum 'Alaska' and Vicia faba. Local lesions were produced on Nicotiana spp. but the virus failed to infect P. sativum 'Little Marvel' and Phaseolus vulgaris 'Top Crop' and 'Bountiful'. Laminated aggregates and crystalline inclusions were seen in thin sections of infected tissue. Positive serological reactions occurred with bean yellow mosaic virus (BYMV) antiserum but not with other potyvirus antisera in serologically specific electron microscopy and SDS gel diffusion tests. This bridal veil virus isolate may be a new strain of BYMV that differs markedly in host range and symptomatology.

RESPONSE OF AMERICAN ELM SEEDLINGS TO CULTURE FILTRATES OF ISOLATES OF CERATOCYSTIS ULMI. Mohammed Jalloh and Lafayette Frederick, Department of Botany, Howard University, Washington, D.C. 20059.

Two to three-week-old American elm seedlings were treated with culture filtrates from aggressive and nonaggressive strains of Ceratocystis ulmi by submerging root systems in the filtrate. The extent to which typical Dutch elm disease wilt symptoms were induced was assessed at 12, 24, and 48 hours. Aggressive strains induced moderate to severe wilting in seedlings within 48 hours. Nonaggressive strains induced slight to no wilting within the experimental period. Filtrates from two newly isolated strains induced severe wilting within 48 hours and were considered to be aggressive. Results obtained suggest that (1) C. ulmi phytotoxin is capable of entering the intact root system of an elm seedling and induce wilting, (2) germinated elm seeds may be useful for the bioassay of aggressive and nonaggressive strains of the pathogen, and (3) wilting associated with Dutch elm disease may be induced in the host by the phytotoxin independently of the physical presence of the pathogen in the host's tissues.

EFFECT OF SOIL MOISTURE AND ORGANIC AMENDMENTS ON THE SURVIVAL OF FUSARIUM OXYSPORUM F. SP. MELONIS. M. M. Kao and G. A. Bean, University of Maryland, Department of Botany, College Park, MD. 20742. J. J. Marois and J. A. Lewis. Soilborne Diseases Lab, Beltsville, MD. 20705.

Soil, naturally or artificially infested with F. oxysporum f. sp. melonis spores was amended with plant or animal residues and maintained in sealed plastic containers at various soil moisture levels at 25 ± 1°C. After 7 wk, pathogen population density was quantified by soil dilution plate method. In general, the organic amendments alone did not affect pathogen population. Combined treatment of flooding with the addition of an organic amendment reduced the pathogen population to an undetectable level (below 50 propagules/g of dry soil). A nylon fabric technique was used to determine chlamydospore germination in soil. The combination of flooding plus organic

amendment suppressed chlamydospore germination and reduced severity of muskmelon wilt in greenhouse pathogenicity experiments.

QUANTIFYING EXPRESSION OF RESISTANCE TO UROMYCES PHASEOLI IN PHASEOLUS VULGARIS. B.A. Kidney and R.D. Berger, Dept. of Plant Pathology, The Pennsylvania State University, University Park, PA 16802, and Plant Pathology Dept., University of Florida, Gainesville, FL 32611.

Five cultivars of Phaseolus vulgaris were evaluated for rust resistance at two field locations and in the greenhouse (GH). Eight breeding lines were included in GH tests. Measured resistance components were latent period, number of uredinia (NU), uredinal size, disease severity, and rate of disease progress (r). Three lines were immune and five were highly resistant, with latent periods from 10-19 days, NU less than 1 per cm², and r near 0. Based on NU and r, resistance of cultivars varied with GH test and sometimes field location, though Gator Green was resistant at both locations and Bountiful and Sprite were susceptible at both. Latent periods ranged from 8-12 days in the GH; r ranged from 0 (Gator Green) to 0.22 (Sprite) in the field. Uredinal size was always ≥ 500 μm.

CULTIVATION OF THE ELM LEAF SCORCH-ASSOCIATED BACTERIUM (ESB), S. J. Kostka, J. L. Sherald, S. S. Heaton, and J. F. Rissler. ESL, NCR, NPS, USDI, Wash., DC 20242; FNCL, USDA, ARS, Beltsville, MD 20742.

A Gram-negative, catalase-positive bacterium was cultivated from seven of ten American elms showing leaf scorch symptoms, but not from five symptomless trees. The ESB was ultrastructurally similar to the xylem-limited bacterium associated with elm leaf scorch. Wood chips from debarked, surface-sterilized stems were incubated at 30°C in S-8 (medium for the ratoon stunt bacterium). Turbidity was evident after 21 days. ESB, subcultured on solid PD-2 [medium for the Pierce's disease bacterium (PDB)], developed white, convex colonies, 0.1-0.6 mm in diameter, after 10-14 days incubation at 30°C. Indirect immunofluorescent antibody staining using antiserum to an isolate of the ESB or PDB demonstrated relatedness between the ESB (from xylem extracts of cultures) and the PDB. Similar results were obtained using PDB antiserum provided by M. J. Davis. Cultivation of the ESB will permit pathogenicity testing and taxonomic comparison to other xylem-limited bacteria.

CESSATION OF SPORULATION BY PHOMOPSIS SOJAE ON SOYBEAN STEMS WITH THE APPROACH OF AUTUMN AND ITS POSSIBLE SIGNIFICANCE. Martin M. Kulik, Seed Research Laboratory, PGGI, SEA-USDA, Bldg. 006, BARC-W, Beltsville, MD 20705.

Soybean stems collected periodically during the summer of 1979 and placed in moist chambers, exhibited sporulating pycnidia of Phomopsis sojae within 14 days. Senescing or dead stems collected during the late summer and early autumn and treated similarly, remained devoid of sporulation by this fungus after 8 wk. Stems were collected monthly from a nonharvested plot, beginning in October, 1979. No sporulation was observed in the laboratory until the May 1, 1980 collection was examined. Stems were then collected weekly and sporulation peaked on June 18 and declined to zero by August 6. The effect of delayed sporulation by P. sojae on its dissemination is discussed.

INFECTION OF LEGUME SEEDLINGS BY PHOMOPSIS BATATAE, P. PHASEOLI, AND P. SOJAE. Martin M. Kulik, Seed Research Laboratory, PGGI, SEA-USDA, Bldg. 006, BARC-W, Beltsville, MD 20705.

Seedlings of adzuki bean, birdsfoot trefoil, broadbean, cowpea, garden pea, greenbean, jackbean, lima bean, mung bean, scarlet runner bean, and soybean with their first true leaves expanded, were inoculated with conidia from mass isolates of Phomopsis batatae, P. phaseoli, and P. sojae. Plants were collected 17 and 28 days after inoculation, rinsed for 1 min in NaOCl (1% available Cl) and placed on moist blotters in plastic containers. After 7 days, pycnidia of P. sojae were observed on all plants. Pycnidia of P. phaseoli were observed on all plants except birdsfoot trefoil. Pycnidia of P. batatae were observed only on mung bean in the first collection but were present on all plants in the second collection. Implications of these results are discussed.

A STRAIN OF TOMATO ASPERMITY ISOLATED FROM TOMATO IN MARYLAND. Joseph Kuti and Harold Moline, Dept. of Botany, Howard University, Washington, D.C. 20059 and Horticultural Crops Quality Lab., HSI, USDA, SEA-AR, Beltsville, MD 20705

A mechanically transmissible agent was recovered from tomato plants (Lycopersicon esculentum) in Prince Georges Co., Maryland. A virus, 30 nm in diameter, and serologically related to the tomato aspermy virus (TAV) type strain was isolated. Spinacia oleracea ('Bounty' spinach) is a suitable propagative host yielding 1-5 mg of virus per 100 g leaf tissue 12-14 days after inoculation. The virus is most stable in phosphate buffer (0.1M) pH7.6 amended with 0.1% thyoglycolate. Chenopodium quinoa is a reliable assay host producing necrotic local lesions 6-9 days after inoculation. Its longevity *in vitro* is between 30 and 48 hours, thermal inactivation point between 60-65°C and dilution end point between 10⁴ and 10⁵ in Bounty spinach. The virus does not produce enations typical of TAV or fruit aspermy in any of more than 30 tomato lines tested in the greenhouse but causes dwarfing and leaf mottling of inoculated tomato seedlings.

ASSOCIATION OF ROOT DISEASE AND INSECT INFESTATIONS WITH EASTERN WHITE PINES EXPRESSING SENSITIVITY TO AIR POLLUTION. A.L. Lackner and S.A. Alexander. Dept of Plant Pathology and Physiology, VPI & SU, Blacksburg, VA 24061.

A survey was conducted along the Blue Ridge Parkway in Virginia to determine if there is an association between eastern white pines expressing symptoms of air pollution sensitivity and the presence of root disease and insect infestations. The 25 sensitive trees sampled possessed only current-year needles which were short and chlorotic to brown. Two lateral roots were excavated from each tree and brought to the laboratory for fungal isolation. Two pathogenic fungi, Verticilladiella procera and Heterobasidion annosum, were isolated from 28% of the trees and two blue-stain fungi, V. serpens and a Graphium sp., were isolated from 12% of the trees. Infected roots exhibited either resin-soaking, dark staining or a stringy, rotted appearance. Two species of weevils, Pissoides approximatus and a Hylobius sp., were found in 20% of the trees sampled.

FUNGICIDE TESTING IN RELATION TO DISEASE PROGRESS OF APPLE POWDERY MILDEW. Lalancette, N. and K.D. Hickey, The Pennsylvania State University Fruit Research Lab, Biglerville, Pennsylvania 17307

Bitertanol (Baycor 50W) was applied to semi-dwarf Rome Beauty, Stayman Winesap, and Delicious trees at varying rates and spray intervals. The proportion of leaves per terminal infected by Podosphaera leucotricha was determined seven times during 1980. The number of treatment means that were different at a given time varied considerably during the 8 weeks that the seven assessments were made. On Rome the number of significant differences were 13, 14, 12, 24, 31, 19, and 14 for counts 1 through 7, respectively. The number of differences on Stayman and Delicious varied from 15 to 28 (2nd and 1st counts) and 5 to 25 (7th and 1st counts), respectively. These data indicate that results of single time assessments may be time dependent.

SCREENING SOYBEANS FOR RESISTANCE TO FUSARIUM OXYSPORUM. S. Leath and R. B. Carroll, Univ. of Delaware, Newark, DE 19711

Fusarium blight of soybean has increased in the Delmarva area. Tests were initiated in the field, greenhouse and growth chamber to screen varieties for resistance to Fusarium oxysporum and to develop a rapid, reliable screening method. Varieties included Bedford, Emerald, Essex, Forrest, Miles, Union, Verde, Ware, Williams and York. Field trials indicate useful levels of resistance occurs in Miles, Ware, Williams and York. Miles and York also had the highest degree of resistance in greenhouse tests. Resistant varieties had the highest yield in paired field trials. Rapid screening was accomplished by growing soybeans in test tubes in a 29 C growth chamber. Seedlings were wound-inoculated when 6 da old and rated for disease 10 da later. Results, compared to greenhouse and field tests at 2 locations, indicate this method can be used to predict resistance under field conditions. Resistant seedlings thus identified can be transplanted to the greenhouse for use in a breeding program.

THE EFFECT OF INOCULUM DENSITY ON UREDOSPORE GERMINATION AND INFECTION OF CORN BY Puccinia polysora, THE CAUSE OF SOUTHERN CORN RUST. J. S. Melching, Plant Disease Research Laboratory, AR, SEA, USDA, P.O. Box 1209, Frederick, MD 21701.

Uredospores of Puccinia polysora Underw. were deposited by gravitational settling on the upper surface of 2 X 2-cm leaf pieces of field corn (Pioneer 3369A), which were immediately given a dark 16-hr dew period at 25 C and then were floated on 21 mg/l kinetin in sterile tap water at 27 C. At spore densities of 530, 3,800, 11,200, and 16,000/cm², germination percentages on leaves were 51, 43, 7, and 4 (respectively) and pustules/cm² were 23, 57, 82, and 65 (respectively). Single spore inoculations (one spore/leaf piece) resulted in 13-19 pustules/100 inoculations. Appressorium and substomatal vesicle formation, calculated as percentages of germinated spores, did not differ significantly at the various inoculum densities. These data indicate that inhibition of germination is the primary factor that reduces infection efficiency of inoculum at higher densities.

THE USE OF CYCLOHEXIMIDE TO DIFFERENTIATE ENDOTHIA PARASITICA FROM E. GYROSA. J.A. Micales, and R.J. Stipes, Dept. Plant Pathol. & Physiol., Va. Tech, Blacksburg, VA 24061

Selective sensitivity to cycloheximide (Acti-dione®) was used to differentiate Endothia parasitica from E. gyrosa. Radial growth of ten specimen-vouchered isolates of each taxon was assayed on cycloheximide-amended glucose (0.5%) yeast extract (0.1%) agar (1.5%). At 1 µg/ml cycloheximide, the growth of E. parasitica was slightly depressed (6-25%), while that of E. gyrosa was greatly inhibited (80-95%). Endothia gyrosa did not grow at concentrations above 2 µg/ml, while E. parasitica showed traces of growth at 50 µg/ml. A similar response was observed on cycloheximide-amended potato-dextrose agar. Data from studies using cycloheximide-amended glucose-yeast extract broth culture, inoculated with spores of the two species, indicated a comparable trend.

USE OF TWO-DIMENSIONAL POLYACRYLAMIDE GEL ELECTROPHORESIS FOR THE IDENTIFICATION OF PATHOGENIC SOFT ROTTING BACTERIA. H.E. Moline, K.S. Johnson, and J.D. Anderson, Horticultural Science Institute, USDA, SEA-AR, Beltsville, MD 20705

The O'Farrell two-dimensional electrophoretic separation of proteins is a potential tool for identifying bacteria isolated from diseased plant tissues. Three strains of Erwinia carotovora, 2 of E. atroseptica, 2 of E. chrysanthemi and 1 of Pseudomonas fluorescens were used in the study. A profile, which contains at least 100 silver stained proteins, may be equivalent to 50 or more conventional biochemical tests used for identifying these bacteria. However, these soluble protein profiles are very complex, whereas ribosomal protein profiles, containing 5-10 major proteins, are less complex and are easier to analyze. Either the soluble or the ribosomal protein profiles could be used to distinguish the four species. Differences could also be detected between some strains. Most significant differences in the protein profile of Erwinia spp. occurred in the 20-50 Kd molecular weight range acidic proteins.

MICROFLORA ASSOCIATED WITH BACTERIAL WETWOOD IN AMERICAN ELM. C.W. Murdoch and R.J. Campana, Dept. of Botany and Plant Pathology, University of Maine, Orono, ME 04469.

Enterobacter cloacae (= Erwinia nimipressuralis), considered the single causal agent of bacterial wetwood of elm, has been associated with other microflora in elm. To elucidate the etiology of wetwood in elm, an attempt was made to isolate all microflora possible from capillary liquid, wetwood tissues and unaffected sapwood, involving 1300 wood samples from 62 elms. Enrichment broth cultures, incubated under aerobic or anaerobic conditions were followed by repeated streaking on agar plates to obtain pure cultures. Cultures were identified by standard bacteriological methods. A total of 16 species of microflora were obtained; 14 species of bacteria and 2 of yeasts. Based on frequency, Enterobacter and Klebsiella species were most often isolated from wetwood tissues. E. cloacae was always a component of mixed bacterial populations, including two other species of Enterobacter. The data suggest that wetwood may be attributed to mixed populations of bacteria, rather than to one species.

SCREENING WHITE PINE FOR OZONE SENSITIVITY. James E. Nellesen and John M. Skelly. Dept. of Plant Path. and Physiol., VPI & SU, Blacksburg, VA 24061.

Superior stocks of 3 - 6 week old *Pinus strobus* L. seedlings were screened for ozone (O₃) sensitivity. Fumigations were performed in Continuous Stirred Tank Reactors (CSTRs) at 0.0, 0.12, and 0.25 ppm O₃ for 6 hrs/day for 14 days. Twenty-seven full sib families at 16 seedlings per treatment and twenty-three half sib families at 8 seedlings per treatment were used in the fumigations. Symptom development was noted and height increases were measured at the end of the 7th and 14th days of fumigation. No visible symptoms were observed and no significant differences in height growth were noted at any of the treatments. The seed orchards from which the seed had been obtained thus seem to contain ozone tolerant stock.

INFLUENCE OF CULTURE AGE AND TEMPERATURE ON PRE-PENETRATION EVENTS OF *DRECHSLERA DICTYOIDES* AND COLONIZATION OF TALL FESCUE LEAVES. N. R. O'Neill, USDA, SEA, Field Crops Laboratory, Beltsville, MD 20705

Pots of tall fescue plants 8 weeks old were inoculated at temperatures of 10 to 30 C with a suspension of 30,000 *Drechslera dictyoides* conidia/ml taken from cultures incubated for 9, 16, 30, and 46 days. Leaves were examined at 12, 24 and 48 hours for pre-penetration events and leaf colonization. Spore germination, germtube elongation, and appressorium formation were complete within 24 hours and were inhibited with increasing spore age. Formation of sub-epidermal vesicles, primary and secondary hyphae, and cellular necrosis occurred within 48 hours and was greatest from 16-day-old cultures. The optimum spore age and incubation temperature for rapid and severe infection by artificial inoculation was 16 days and 20 to 25 C. In *in vitro* studies, germination and germtube lengths of spores were greatest with cultures 7 to 16 days old and were inhibited as spore age increased and as incubation temperatures decreased from 30 to 10 C.

PROTECTION AGAINST RACE 2 OF *COLLETOTRICHUM TRIFOLII* IN ALFALFA HYPODERMICALLY INOCULATED WITH MIXTURES OF RACE 1 AND RACE 2 CONIDIA. S. A. OSTAZESKI AND J. H. ELGIN, JR., Field Crops Laboratory, SEA, USDA, Beltsville, MD 20705.

Our use of hypodermic inoculations of alfalfa with *C. trifolii* has been previously described. We used a mixture of equal concentrations of race 1 and race 2 inoculum to hypodermically inoculate stems of clones known to be resistant to race 1 of *C. trifolii* but susceptible to race 2 (RS), and stems of clones known to be susceptible to both races (SS). Conidial concentrations used were a 1:1 mix at 0.5×10^6 , 1×10^6 , or 2×10^6 conidia of each race/ml. All inoculated stems of the SS clones were killed at all concentrations. No reaction occurred, or only a small nonlethal lesion was produced, on inoculated stems of RS clones. RS stems reacted as expected when hypodermically inoculated individually with race 1 or race 2. We propose that possibly a phytoalexin-like system is operative in RS clones, and is induced by race 1, but not by race 2 infections.

SENSITIVE AND RAPID DIAGNOSIS OF POTATO SPINDLE TUBER VIROID DISEASE BY NUCLEIC ACID HYBRIDIZATION. Robert A. Owens and T.O. Diener, Plant Virology Laboratory, Beltsville Agricultural Research Center, USDA-SEA-AR, Beltsville, MD 20705.

Potato spindle tuber disease is a serious problem for seed potato producers and potato breeding programs. Detection of potato spindle tuber viroid (PSTV) by bioassay is slow and often unreliable. Polyacrylamide gel electrophoresis methods are reliable, but multiple assays are laborious. Hybridization of highly radioactive recombinant DNA to PSTV previously bound to a nitrocellulose membrane is more sensitive and less laborious. Aliquots of crude sap are spotted on a nitrocellulose membrane and are baked for 2-3 hr at 80 C *in vacuo*. Labelled recombinant DNA is then added and allowed to hybridize with bound PSTV. DNA-PSTV hybrids are detected by autoradiography after extensive washing to remove unhybridized DNA. The entire indexing procedure requires 4 days and can detect 80-250 pg PSTV, equivalent to a PSTV concentration of 0.04-0.125 µg/g epidermis, eyes, or sprouts.

CONTROL OF *CYLINDROCLADIUM* BLACK ROT (CBR) OF PEANUT BY SOIL FUMIGATION. P. M. Phipps and J. A. Barron, Tidewater Research and Continuing Education Center, VPI&SU, Suffolk, Va. 23437.

Terr-o-cide 72-27(19 lb/ha), Terr-o-cide 54-45(23,47,94 lb/ha) and Terr-o-gel 67(79,158 lb/ha) were used to evaluate chloropicrin (CP) at rates of 10, 20, 40 and 80 kg/ha for control of CBR in a naturally infested peanut field. Soilbrom 90(14,26,51 lb/ha) was used to assess effects of the ethylene dibromide component of CP compounds. Soil treatments were applied 20-m deep with two chisels per row, spaced 20-cm apart. Plots were four rows (0.9-m apart, 12.2-m long), replicated in four randomized complete blocks, and planted to Florigiant peanut 18 days after treatment. Only CP at 20, 40 and 80 kg/ha reduced significantly ($P = .05$) populations of *C. rotalariae microsclerotia* (ms) in soil. Significant negative correlations ($P = .01$ and $.05$, respectively) were found between CP rates and ms populations 66 days ($r = -0.53$) and 168 days ($r = -0.46$) after treatment. CBR incidence was low in all plots, probably due to prolonged drought conditions. Peanut yields were increased by all CP treatments and significantly ($P = .05$) by Terr-o-cide 54-45, 94 lb/ha (CP=80 kg/ha).

OZONE SENSITIVITY IN SWEET CORN (*ZEA MAYS*, L.) AND POTENTIAL FOR A BIOCHEMICAL MARKER. E. V. Podleckis and C. R. Curtis, University of Delaware, Newark, Delaware 19711.

Twenty sweet corn lines, including 13 inbreds and 7 hybrids were evaluated for seedling sensitivity to a single, acute ozone exposure. Seedlings at the 3-4 leaf stage were exposed to $492 \mu\text{g}/\text{m}^3$ O₃ for 3 hours in a controlled environment chamber. Plants were visually rated for sensitivity to ozone using a nine-point scale. Statistical analysis of the ratings suggested a ranking of the 20 lines according to sensitivity. Three lines, including the commercially important hybrid 'Silver Queen' were relatively sensitive. Four lines were ranked highly tolerant and the remaining 13 rated as intermediate. Polyacrylamide gel isoelectric focusing was used to compare banding patterns of sensitive, tolerant and intermediate types. Esterase and peroxidase enzyme systems as well as general proteins were visualized. Regression analysis will evaluate the correlation of the various banding patterns with ozone tolerance to determine which bands might prove useful as markers.

A NEMATODE (*APHELENCHOIDES*) ASSOCIATED WITH *CYTOSPORA* CANKER OF PEACH. P. L. Pusey and L. J. Slana, USDA Appalachian Fruit Research Station, Kearneysville, WV 25430.

Bark samples were collected from the trunk and scaffold limbs of peach trees at two orchards (5 miles apart) near Romney, WV, in August 1980. Both cankered and non-cankered areas of the trees were examined. Nematodes bearing stylets were found at the margin of cankers and associated with pycnidia of *Cytospora leucostoma* Sacc. The nematodes were increased on cultures of *C. leucostoma* grown on potato dextrose agar, and were observed feeding on hyphae. The nematode populations from the two locations are similar and appear to be an undescribed species of *Aphelenchoides*.

INFLUENCE OF SELECTED HERBICIDES ON OZONE WEATHER FLECK INJURY IN TOBACCO (*NICOTIANA TABACUM*). J. J. Reilly and L. D. Moore. SPR & CEC, Blackstone, VA 23824 and Dept. of Plant Path. & Physiol., VPI & SU, Blacksburg, VA 24061.

Field experiments were conducted over a 4 year period to determine the influence of selected herbicides on ozone weather fleck injury in tobacco. Isopropalin, pebulate, and diphenamid were applied at the recommended rates of 1.7, 4.5, and 4.5 kg ai/ha, respectively, every year. Isopropalin treated plants had significantly less weather fleck injury for 2 to 4 weeks after transplanting, but not later. Isopropalin treatment did not affect the number of stomates, their open or closed state, stomatal conductance or any of the other physical characteristics measured, in a manner significant enough to account for the observed protection. Benzimidazole compounds, shown to reduce ozone injury in other systems and known to be released on decomposition of isopropalin, were not detected in leaves of treated plants. Pebulate and diphenamid treatments had no effect on the sensitivity of tobacco to ozone.

STUDIES ON THE INTERACTION OF *PRATYLENCHUS PENETRANS* AND *VERTICILLIUM ALBO-ATRUM* ON YELLOW POPLAR ROOTS. F. J. Schultz and A. L. Morehart, University of Delaware, Newark, DE 19711.

Field and greenhouse studies were initiated to assess the influence of *Pratylenchus penetrans* on *Verticillium wilt* of 1-year-old yellow poplars (*Liriodendron tulipifera* L.). A factorial design utilizing 4 levels of *P. penetrans* (0, 40, 400,

and 4000 nemas/tree) interacting with 4 levels of *Verticillium albo-atrum* ($0, 1 \times 10^4, 1 \times 10^6,$ and 1×10^8 conidia/tree) was replicated 6 times in the field and 4 times in the greenhouse. Soil was characterized with regard to nematodes and nutrients present. Climatic conditions and soil temperature were noted. *Verticillium* was not reisolated from live petiole tissue sampled periodically, nor from tissues sampled following dormancy. Growth (height and trunk diameter) was slightly depressed in the field at highest inoculum levels.

COTTON SEEDLING RADICLE EXUDATES IN RELATION TO SUSCEPTIBILITY TO *VERTICILLIUM* WILT AND *RHIZOCTONIA* ROOT ROT. F. M. Shao and M. N. Christiansen, Plant Stress Laboratory, Plant Physiology Institute, U.S. Department of Agriculture, SEA-AR, Beltsville, Maryland 20705.

Seedlings of *Verticillium* wilt tolerant cotton (*Gossypium hirsutum* L.) Acala 4852 were subjected to chilling stress at 10 C. Root exudates were collected after 2, 3, 4, and 5 days exposure. After chilling, the plants were tested for susceptibility to *Verticillium* wilt and to *Rhizoctonia* root rot. Exudates were analyzed for amino nitrogen compounds and reducing sugars by fluorometric and colorimetric methods respectively. Positive correlations between disease severity and quantity of exudates and negative correlations between top dry weight and quantity of exudates were established. This may explain the observation that wilt tolerant cotton cultivars are susceptible to this disease and possibly to *Rhizoctonia* root rot at low temperatures but are tolerant at temperatures more suitable for cotton growth.

A FACTORIAL ANALYSIS OF THE EFFECTS OF TEMPERATURE, MOISTURE AND INOCULUM DENSITY ON BEAN ROOT ROT CAUSED BY *PHYTHIUM* AND *FUSARIUM*. D.W. Sippell and R. Hall, Dept. of Environmental Biology, University of Guelph, Guelph, Ontario, N1G 2W1.

Effects of soil temperature (14, 21 and 28 C), soil moisture (-50 and -170 mbars), and inoculum density (0, 10, 100, 1000 propagules per gram (p/g)) on severity of bean root rot caused by *Pythium ultimum* (P) and/or *Fusarium solani* f. sp. *phaseoli* (F) were examined. Plants (cv. Seafarer) 5 days old were placed in infested soil and harvested 10 days later. Each fungus and the combination caused more disease in the wetter soil. Most disease (rot of hypocotyl, tap root and adventitious roots) occurred at 21 C in the presence of F at 1000 p/g, closely followed by F + P at 1000 p/g at 14 C and P alone at 1000 p/g at 14 C. Root and shoot dry weights were reduced more by P than F. In the presence of F, moisture, temperature and inoculum density explained 0.1, <14.0 and 22.5% of variability in disease. Corresponding figures for P were 1.4, 4.1 and 25.4% and for F + P were 2.3, 2.5 and 6.1%. Density of inoculum of F, P and F + P accounted for 0.1, 3.9 and 1.6% of variation in plant weight.

REACTION OF *NICOTIANA* SPECIES TO *MELOIDOGYNE* HAPLA. L. J. Slana, USDA - SEA/AR, Appalachian Fruit Research Station, Route 2 Box 45, Kearneysville, West Virginia 25430.

Reactions to *Meloidogyne hapla* of 58 *Nicotiana* species, 8 subspecies and 2 *N. tabacum* cultivars were determined 8 weeks after inoculation of greenhouse-grown plants with approximately 790 freshly hatched larvae. Each accession was tested in a minimum of 9 replicated pots. Washed roots were indexed for root-galling on a scale of 0-5 (0=no galling; 5=severe galling), and the results analyzed statistically. The eight most resistant species and their indices were *N. nudicaulis* (2.0), *N. repanda* (2.5), *N. benavidesii* (2.6), *N. tabacum* cv. NC95 (2.7), *N. longiflora* (2.7), *N. knightiana* (2.7), *N. hesperis* (2.8), and *N. nesophila* (2.8). The remaining 50 species and cultivars had root-galling indices ranging from 2.9 to 4.5. Susceptibility of 33 untested species was also determined. The data confirm the high degree of resistance in *N. nudicaulis* as reported by Chapman (Phytopathology, 1957), the moderate degree of resistance inherent in *N. tabacum* cv NC95, and the wide variability in response of *Nicotiana* species to *M. hapla*.

GREENHOUSE CONTROL OF BEAN RUST WITH *BACILLUS SUBTILIS*. J. R. Staveland, C. A. Thomas, C. J. Baker, and J. S. MacFall. USDA, SEA-AR, Applied Plant Path. Laboratory, Beltsville, MD 20705.

An up to twentyfold reduction in number of rust pustules occurred on primary leaves of *Phaseolus vulgaris* cv. 'Lake Shasta' sprayed with *B. subtilis* and then inoculated with

collection 16 of *Uromyces phaseoli*. *B. subtilis* was cultured on Eugonbroth at 30 C. This medium did not affect rust development. *B. subtilis* in Eugonbroth was equally effective in reducing rust severity when applied 0-3 days before inoculation with *U. phaseoli*. However, weekly application of this crude preparation did not give field control. In the greenhouse the cell-free culture filtrate significantly reduced the number of pustules. Dead *B. subtilis* cells were as effective as the live cells and more effective than the filtrate. A methylene chloride extract from *B. subtilis* cells gave the same effect as *B. subtilis* in Eugonbroth, but neither ethanol nor trichloroacetic acid precipitates were active.

SUSCEPTIBILITY OF SAFFLOWER CULTIVARS TO COTTON STRAINS OF *VERTICILLIUM DAHLIAE*. C. A. THOMAS. USDA, SEA-AR, Beltsville, MD 20705

Field tests were conducted from 1970-80 to determine the wilt reaction of safflower cultivars to strains of *Verticillium dahliae* pathogenic to cotton. Safflower cultivars were evaluated in Texas, Arizona, and California in soils heavily infested with cotton strains. The reactions of the cultivars ranged from highly resistant to highly susceptible. None was highly resistant at all locations. Isolates of *V. dahliae* cultured from infected safflower grown in the field were evaluated for virulence to several safflower cultivars and to Paymaster 111 cotton grown in the greenhouse. Both the mild and the cotton-defoliating strains of *V. dahliae* were isolated from safflowers. Several safflower cultivars were susceptible to both strains. None of the cultivars tested was resistant to both strains. VFR-1 and LMVFP-1 were highly resistant to the defoliating strain. P.I. 249081 was resistant to the mild strain.

INFECTION RATES AND INOCULUM DENSITY-INFECTION RELATIONSHIPS OF *CYLINDROCLADIUM CROTALARIAE* ON PEANUT. G. S. Tomimatsu and G. J. Griffin. Dept. of Plant Pathol. & Physiol., VPI & SU, Blacksburg, VA 24061.

Using plating methods, infection rates and microsclerotial density-infection relationships of *Cylindrocladium crotalariae* were determined from asymptomatic roots of peanut plants grown in naturally infested soil at 25C. In a time-course experiment, the infection rate for apparent infections, on a per unit-root-length-unit-inoculum basis, increased over three consecutive 21-day periods. The infection rate for estimated infections [based on $\log_e(1/1-y)$, where y is the proportion of symptomatic plants], on a per plant-unit-inoculum basis, also increased over the same three periods. Each plant had about 300 apparent root infections when 50% of the plant population had root necroses, based on the infection-rate curve. Regression line slopes of 0.98 ($R^2=0.94$) and 0.99 ($R^2=0.94$) were obtained for \log_{10} - \log_{10} plots of microsclerotial inoculum density versus the number of apparent infections per plant and per unit root length, respectively.

COMPARATIVE SYSTEMIC DISTRIBUTION OF ARBOTECT 20-S[®], VANGARD[®], LIGNASAN BLP[®], BLOC[®] AND NUARIMOL IN *ULMUS AMERICANA*. P.A. Truax and R.J. Stipes, Dept. Plant Pathol. & Physiol., Va. Tech, Blacksburg, VA 24061

Distribution profiles of selected fungitoxicants were assayed in American elm (*Ulmus americana*) since they may be used as vascular disease control agents. In Study I, Arbotect 20-S[®], Bloc[®] and Lignasan BLP[®] were administered at 8,000 µg/ml by a gravity-flow (infusion) technique to 12-yr-old field trees, which were sacrificed and bioassayed 1 mo. later by over-spraying biopsy disks with *Ceratocystis ulmi* or *Glomerella cingulata*. Percentage values of fungal growth inhibition were estimated from the total area of the disk cross-sections. In Study II, Arbotect 20-S[®], Vanguard[®], Lignasan BLP[®] and nuarimol were administered at 5,000 µg/ml with a Sterrett-Creager mini-injector. Branches were bioassayed 2 mo. after injection as in Study I. Results in both studies demonstrated possible inadequacies associated with vascular disease control due to erratic and unpredictable movement of fungitoxicants.

CROSS-RESISTANCE PATTERNS OF FENARIMOL-RESISTANT ISOLATES OF *USTILAGO MAYDIS*. R. C. WALSH AND H. D. SISLER, DEPT. OF BOTANY, UNIVERSITY OF MARYLAND, COLLEGE PARK, MD 20742.

Fenarimol-resistant isolates of *Ustilago maydis* were obtained by treatment of wild type sporidia with nitroguanidine followed by colony selection from fenarimol-containing media.

Four moderately resistant mutants with rapid growth rates were identified and tested for resistance to other inhibitors of ergosterol biosynthesis. All four isolates were more resistant than the wild type to the sterol C-14 demethylation inhibitors imazalil, miconazole, dodecylimidazole, and triadimefon. One isolate showed increased resistance to the C-14 demethylation inhibitor CGA 64251, whereas three showed decreased resistance. These results are consistent with a mechanism of resistance involving specific changes in sensitivity to the C-14 demethylation system. However, since these mutants also showed changes in sensitivity to azasterol A25822B and tridemorph, which are not C-14 demethylation inhibitors, resistance may involve changes in permeability, modification of a sterol carrier protein, or altered microsomal lipid composition.

CALCIUM NUTRITION OF TOBACCO AFFECTING LIPID CONTENT AND SUSCEPTIBILITY TO BLACK SHANK. W. F. Waterfield and L. D. Moore. Dept. of Plant Path. & Physiol., VPI & SU, Blacksburg, VA 24061.

Three cultivars of flue-cured tobacco were grown in modified Hoagland's solution at 25 or 250 µg/ml Ca. These cultivars varied in resistance to *Phytophthora parasitica* var. *nicotianae*. Two weeks after transplanting into modified nutrient solution the plant roots were inoculated with zoospores. Plant roots were rated for disease severity based on a scale of 1 to 4 (1=healthy, 4=completely macerated) beginning five days after inoculation. McNair 944 was highly resistant to black shank at both Ca levels while Virginia Gold and Coker 319 were significantly more susceptible to the pathogen at 250 µg/ml Ca than at 25 µg/ml Ca. Root tissues from all three cultivars grown at both Ca levels were harvested and analyzed for total lipids, free sterols, steryl glycosides, acylated sterol glycosides and steryl esters. Preliminary results indicate that susceptibility was not related to lipid content although Virginia Gold, the most susceptible cultivar, had the highest free sterol content independent of Ca level.

PINEWOOD NEMATODE FOUND ASSOCIATED WITH LANDSCAPE PINES IN VIRGINIA. M.J. Weaver, J.A. Fox, R.L. Dow and R.J. Stipes. Dept. Plant Pathol. & Physiol., Va. Tech, Blacksburg, VA 24061

The pinewood nematode, *Bursaphelenchus lignicolus*, which causes a wilt of pine, was reported in Japan in 1969, in Missouri (USA) in 1979 and later in other states. We herein report it for the first time in Virginia in February, 1980. The specimen was extracted from the wood of a 17-year-old Eastern white pine (*Pinus strobus*) from a Rockbridge County landscape. Since this initial discovery, the nematode has been identified in *P. sylvestris* from Henrico County and *P. thunbergii* in Southeastern Virginia. In addition, aphelenchoid nematodes in small population densities were observed in the wood of *P. taeda* from Henrico County and in *P. strobus* from Boutetourt County. A water extraction technique was used to separate the nematodes from the wood. Counts for the initial observation ranged from a very low number of nematodes in the bole of the trees to very high counts in the upper branches. Cerambycid beetles, the suspected vectors of the nematodes, were observed in these samples.

FACTORS ASSOCIATED WITH DECLINING EASTERN WHITE PINE (*PINUS STROBUS*) ON VIRGINIA LANDSCAPES. M.J. Weaver, R.J. Stipes, D.F. Amos & H.J. Heikkinen. Depts. Plant Pathol. & Physiol., Agronomy & Entomology, Va. Tech, Blacksburg VA 24061

Factors associated with declining *Pinus strobus* on Virginia landscapes were studied. One hundred test trees, ranging from healthy controls to trees in various stages of decline, were used. A systematic indexing method was developed and followed for each tree in the study. Data were collected on tree growth, chemical and physical soil factors, associated abiotic and biotic agents, and on rhizosphere and root zone indicators. Results implicated the following interacting complex of factors: high soil pH (7.0-8.5), heavy soil texture, high amounts of

competition and shading, root impedance, physically disturbed soil horizons, soil compaction, various secondary biotic agents, and various other abiotic stresses, primarily moisture stress. Thus far, no one factor is suspected as being the primary causal agent contributing to decline. Poor quality growing sites, however, on which this sensitive species is planted, appear to be involved in an overall and primary way.

UROMYCES TRIFOLII-REPENTIS LIRO VAR. TRIFOLII-REPENTIS ON TRIFOLIUM REPENS IN NORTH CAROLINA. R. E. Welty, C.G. Van Dyke, and W. A. Cope. Oxford Research Station, USDA-SEA-AR, Oxford, NC 27565, and Department of Plant Pathology, Botany, and Crop Science, North Carolina Agricultural Research Service, Raleigh, NC 27650.

Rusts of clover (*Trifolium* spp.) are distributed widely in the humid and subhumid climates of the USA. The macrocyclic rust (O,I,II,III) *Uromyces trifolii-repentis* Liro var. *trifolii-repentis* was observed on leaves and petioles of Ladino white clover in North Carolina. Since a detailed description is not always included in reports of these rusts, and they are sometimes reported as *Uromyces* sp. or *U. trifolii* without varietal designation, we examined the spore stages of this rust using whole mounts and paraffin sections with light and scanning electron microscopy. The fungus produces a type 4 pycnium, a cupulate aecium, and uredial and telial pustules lacking peridia. It is not widespread in North Carolina, nor is it presently thought to limit forage production in North Carolina.

SPREAD OF PHYTOPHTHORA CINNAMOMI (PC) AND MORTIERELLA ALPINA (M-7) ON TWO PINE BARK POTTING MEDIA (A & B) IN VITRO. W. H. Wills and R. C. Lambe. Dept. of Plant Path. & Physiol., VPI & SU, Blacksburg, VA 24061

Mortierella spp. have been shown previously to be antagonistic to PC in vitro. The spread of PC and M-7 on autoclaved (S) and non-autoclaved (NS) samples of two commercial pine bark potting media from point sources of infestation was studied in Petri dishes. PC did not spread well on samples of NS bark, but spread readily on SA and irregularly on SB. Conversely, M-7 spread readily on NS samples of barks and very little on samples of S barks. When the two bark media were infested with PC 2 wk following infestation with M-7, no spread of PC occurred on NS B, and very little on NS A; the spread of PC was almost three times as frequent on S A as on S B, but was irregular on both. Although PC has been shown to cause disease in azaleas when artificially infested in non-autoclaved bark in the greenhouse, it is possible that M-7 will protect against low levels of natural infestation.

LYSOSOMAL MODEL FOR BALANCED PARASITISM. Charles L. Wilson, USDA SEA/AR, Appalachian Fruit Research Station, Kearneysville, WV 25430.

A different perspective on balanced parasitism is presented. Plant cells are divided into two distinct spacial compartments: endoplasmic space and ectoplasmic space (after de Duve). Lysosomal components (pinocytic vesicles, vacuoles, golgi vesicles, phagocytic vacuoles) make up the ectoplasmic space which forms an interconnecting network that allows the movement of materials from the outside of the plasmalemma to the vacuole. Single-membrane-bounded vesicles that move in the cell and fuse with one another form this discontinuous pipeline. My thesis is that balanced parasitism in plants is based on the host's ability to confine the pathogen and its cellular degrading enzymes to the ectoplasmic space of the cell. The line between the ecto- and endoplasmic space is delimited by the plasmalemma and lysosomal membranes. Events which destroy or transgress this demarcation result in necrotrophic parasitism. Balanced parasites can extract nutrients from host cells through the ectoplasmic space without being destructive.