ABSTRACTS OF PAPERS
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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, Heterodera cimbicola, was found to be the major cause of decline and death in Japanese black pine (Pinus thumbergii). Ninety-five percent (35/37) of the black pine trees sampled from 5 sites were heavily infested with male, female, and larvae of B. cimbicola. Nematode presence in the lower branches was positively correlated with emergence holes of the insect vector Monochamus titillator. Hundreds of isolation attempts from soil, root, and branch tissue samples were consistently negative for phytopathogens. Two xylephilic fungi, Heliotrospora solani and Pestalotia funerea usually accompanied nematode infestations. Leaf analysis of healthy and diseased trees showed no differences in N, K, Ca, or Mg levels. B. cimbicola infestations also were found onlobolly pine (Pinus taeda), Virginia pine (Pinus virginiana), Scots pine (Pinus sylvestris) and eastern white pine (Pinus strobus).

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

Spordisemum sclerotivorum, a mycoparasite of scrotalina 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 10 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 86%. The biological control agent became established in the plots and caused destruction of Sclerotinia produced on the diseased lettuce. A method of cultivation of S. sclerotivorum and its use for the biocontrol of diseases caused by sclerotic fungi has been patented.

USE OF METHAM APPLIED THROUGH SPRINKLER IRRIGATION TO CONTROL LETTUCE DROP CAUSED BY SCLEROTINIA MINOR. P. B. Adams, J. Kerkun, 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.

Methyl ethyl (sodium methyl dithiocarbamate) (25 g a.i./l) 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-h 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 SCLEROTINIA OF PLANT PATHOGENS BY TEROSPERMA OLGASOCLEM. W. A. Ayers and P. B. Adams, Soilborne Diseases Laboratory, USDA, Agricultural Research, Beltsville, MD. 20705.

Sclerotia of Sclerotinia minor, S. sclerotiorum, S. trifolii, and Sclerotium cepivorum and Botrytis cinerea were parasitized by Teratosperma oligasoclem, a recently described hyperparasite. The mycoparasite grew poorly on several common cultural 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. oligasoclem. Sclerotia of 5 minor were parasitized and completely destroyed in soil by 10 weeks. The morphology, cultural characteristics and parasitic behavior of T. oligasoclem were similar to those of the mycoparasite Spordisemum sclerotivorum. The specific diagnostic activity of T. oligasoclem ascertained that the mycoparasite has the potential to control diseases caused by susceptible, sclerotial root pathogen.

SEPTORIA LEAF SPOT OF TOMATO CONTROLLED IN THE FIELD BY RESISTANCE. T. L. Burdick, USDA, Agricultural Research Center, Beltsville, MD. 20705.

Tomato breeding lines deriving resistance to Septoria leaf spot (caused by Septoria lycopersici, Sp.) from P. 22482 showed small necrotic flecks in greenhouse screening tests. Some lines contained a new conidium-producing pyridoxine. To test the ability of this type of resistance to provide disease control in the field, a replicated field study was made. Septoria epiphytotics were 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 CYLINDROCLADUS BLACK ROT (CBB) OF PEANUT. J. A. Barron and P. M. Phipps, VPI & SU, Blacksburg, VA. 24061.

In the greenhouse, seed of 'Florigrant' peanut were planted in nonsterile Ruston (RU) and Woodtown (WD) sandy fine sands artificially infested with Cylindrocladium crotalareae microsclerotia (ms) to densities of 0, 5, 50, and 500 ms/g. Symptoms of CBB were significantly (P<0.05) more severe among 8-week-old plants in RU soil than in WD soil when both were infested to a density of 5 ms/g and in WD soil infested to density of 50 ms/g. Treatment with dinitramine at 0.56 kg/ha increased significantly the severity of CBB. In RU soil infested to a density of 5 ms/g, but not 50 ms/g. Treatment with nitramine at 0.56 kg/ha increased significantly the severity of CBB. CBB in RU soil at the high inoculum density or in WD soil at the low inoculum density. The tendency of this herbi9cide to increase the severity of CBB appears to be dependent on interactions between soil types and microsclerotium densities of this fungus in soil.

OCURRENCE OF PHYTOPHTHORA ROOT ROT OF SOYBEAN IN MARYLAND. Joan E. French, Jane F. Eilers, and James C. Kantes. Department of Botany, University of Maryland, College Park, MD. 20742

Soybean root rot caused by Phytophthora megasperma f. sp. glycine (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 hypocotyl 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 inocu-
EFFECTS OF DAY-TO-DAY TEMPERATURE ON DEVELOPMENT OF PHILIPPINE DONNY MILDEW OF MAIZE AND OF TEMPERATURE ON CONIDIAL GERMINATION. H.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 philippinicae, 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 range during the 4- and 18-hr dew periods for subsequent development of systemic infection was 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 5 hr in the dark at a series of temperatures (71°C) from 3°C to 34°C. The optimum temperature range for germination was 15°C to 32°C and 12 to 32°C for 2- and 5-hr incubation periods, respectively. Growth of conidiophores was optimal at 8 to 20°C and 18 to 28°C with 2- and 5-hr incubation periods, respectively. Conditions found favorable for infection of corn by P. philippinicae 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 V. 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 Ulmus pumila (resistant) elms. Ten trees, 5 m high, 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 inoculated 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 32 cm; in U. pumila the max was 10 cm. Average downward movement was 22.5 cm in U. americana and 7.2 cm in U. pumila. The data show that plants of the two species respond differently to the pathogen.


Over one hundred dying ornamental pines representing seven species from 10 idly scattered counties and cities in Virginia were sampled for detection of the pine wood nematode (Bursaphelenchus lignicolus) in 1980. Seventy-two percent (76/72 or 100%) of the Japanese black pine (P. thumberiana) and the group tested, contained pine wood nematode. B. lignicolus was isolated from Japanese red (P. densiflora) 100%, mugo (P. mugo) 100%, lobolly (P. taeda) 100%, Virginia (P. virginiana) 100%, eastern white (P. strobus) 27% and Scotch (P. sylvestris) 75%. B. lignicolus was not found in sampled Christmas and forest trees.


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 927). 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 (100 x 105 Pa). Twenty-four hour after the treated peaches were washed 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 decay area compared to the control, a 4% CaCl2 solution pressure infiltration into the fruit produced the optimum effect, resulting in 50% less decay than observed on the untreated fruit.


Trials were conducted to determine the relative effectiveness of Ridomyl (RL) and Previcur N (PN). Systemic fungicides with known toxicity to Pythecymetes, and the Pythium-active contact fungicides Koban (KD) and Tersan SP (TSP) for the control of Pythium blight (P. anathemata) of creeping bentgrass. Also, the non Pythecymetes-active systemic fungicides Baytex N (BN) and Baycur (BC) 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/l. One application of RL at 150 g a.i./l and 2 applications of PN at 612 g a.i./l each, through 3 applications, failed to provide any disease control. Three applications of BN at 310 g a.i./l and BR at 612 g a.i. did not increase the severity of the disease.


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 Plasmodiophora brassicae. Sixty percent of the 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 spores-like structures were found in 3 of 18 water samples. In 3 of 4 ponds, P. brassicae was demonstrated to be present by observing clubrooted roots on seedlings 30 days after planting in pond sediments.

REDUCTION OF CLUBROOT BY CHLORINATION OF PLASMODIOPHORA 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 Plasmodiophora 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, 105 RS/ml were exposed in the dark for 24 hr to NaOCl at concentrations of 0, 0.2, 2.2, and 200 mg Cl/l. Each RS was exposed for 24 hr to NaOCl at concentrations of 0, 0.2, 2.2, and 200 mg Cl/l. Each RS was exposed for 24 hr to NaOCl at concentrations of 0, 0.2, 2.2, and 200 mg Cl/l. Roots of cabbage seedlings were immersed in suspensions of chlorinated RS at the dark for 35 hr, potted and placed in the greenhouse. After 30 days, plants were rated for club root. Chlorine concentrations of 0, 0.2, 2.2, and 200 mg Cl/l inhibited germination of clubrooted roots were sporadic since no symptoms occurred on plants exposed to RS treated with these concentrations. Phototoxicity was observed on plants exposed to 20 and 200 mg Cl/l.
OCCURRENCE OF OPHIOBOLUS PATCH DISEASE IN MARYLAND. P. B. Dernoeden and W. B. O'Neill, Department of Agronomy, University of Maryland, College Park, MD 20742, and Field Crop Laboratory, USDA, Beltsville, MD 20705

Ophiobolus patch of turfgrasses (incitant: Gaecunomonas pyrenoidosa var. avenue (E. M. Turner) Dennis) was observed for the first time in Maryland on 'Pennrose' creeping bentgrass turf at Beltsville in 1979. Recently the pathogen has been isolated from various turfgrass species and problems caused by Ophiobolus were associated with golf courses less than 5 years old in Eastern, Oakland, and Upper Marlboro, Maryland. Affected turf exhibited light yellow, bronze, red-brown or bleached tan patches 15 cm to 50 cm in diameter. Typical symptoms of dark brown pycnidia and hypheal slime were also observed. Aspores lengths from Beltsville, Oakland, and Upper Marlboro isolates were 96.4 µm, 95.8 µm, and 108.9 µm, 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.

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., VP & SU, Blacksburg, VA 24061

The effect of ambient ozone (O₃) on biomass production and height growth of vegetation native to the Shennandoah Nat'l Park was evaluated in two 10-foot diameter plots. In 1979, two collections of total above-ground biomass yielded 9633, 6330, 40670 for the filtered, non-filtered, and open plots, respectively. In 1983, two collections yielded 19,998, 16,083, 14,1250 for the filtered, non-filtered, and open plots, respectively. Height growth of forest trees 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 0.035 and 0.100 ppm, respectively, for the 1979-1980 study period. In 1990, these values were 0.058 and 0.100 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 Shennandoah Nat'l Park.

STUDIES ON SAMPLING TECHNIQUES FOR DETECTION OF THE PINE HOOD NEWMOTO (Bursaphelenchus lignicola) IN PINE TREES. A. D. Elliott, R. C. Lambe, S. Alexander and D. Carling. Dept. of Plant Path., Physiol., VP & 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 lignicola in pine trees. Samples were taken at sites along the forest and branches of B. lignicola were 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 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. Therefore the average density detected at the stem was higher than for branch samples, we concluded that detection of B. lignicola may be more probable from stem than branch samples.


The soil mobility of dichloran (Botran 50WP), Ipridione (Novartal 50WP), and vinclozolin (Ronilan 50WP) was studied in Lodio loam (LL) and Woodstown loamy sand (WLS). Two hundred mg a.i. in each formulation were treated with 400 ml H2O through a 35 cm vertical, segmented polyvinylchloride column packed with air-dried soil. Twelve to 16 hr after leaching ceased, the columns were disassembled into five sections of 5 cm each. A center core sample was analyzed. Residues were extracted with MeCO, 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 fungi died 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 FUSSARUM WILT RESISTANCE AND SOIL MOISTURE TO YIELD AND PERSISTENCE OF ALFALFA. Gary Emerber and R. E. Welsy, N. C. State University, Raleigh 27695.

Five alfalfa populations were inoculated with a mixture of 4 virulent single-spore isolates of Fussarum oxysporum f. sp. medicaginis and transplanted into the field. Stand counts were made at 2-wk intervals and dry matter yields were recorded over the harvest period. A planting of 'Pacific' was planted as a control. All treatments were analyzed for their interaction rating at the final harvest. Time required for Apalachicola (highly susceptible), Narragansett (susceptible), and Liberty (resistant) to reach 50% mortality was 72, 130, and 190 days, respectively. Dry matter yields decreased as disease increased. When Maapa (highly resistant) and Narragansett (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 ISOFLAVONOID GLYCEOLIN AND COOMESTROL. William F. Fett and Stanley F. Oman, Eastern Regional Research Center, 500 E. Mermaid Lane, Philadelphia, PA 19110.

The soybean isoflavonoids glyceolin and coomestrol 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 glyceolin and two for coomestrol. Of the nine pv. glycinea strains tested, seven of the nine known pathogenic races were inhibited by glyceolin and coomestrol. The bioassays. However, glyceolin did inhibit growth of several other bacteria and was shown to be bactericidal towards strains of Bacillus subtilis, B. licheniformis, Staphylococcus aureus, and Corynebacterium luteum. Coomestrol 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 Sarcina lutea. The results of this work have demonstrated that glyceolin and coomestrol are effective in root-active 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, VPISU, 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 strain designated V-1 was present in the non-inoculated trifoliate leaves a week later. 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 on the latter and stunted plants. The mixture of strains was maintained in York for several generations. 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.

XETHINEMA RIVESI ASSOCIATED WITH TOMATO RINGSTROPE VIRUS-INDUCED DISEASES IN PENNSYLVANIA. Lyle B. Rorer. Pennsylvania Department of Agriculture, 2301 N. Cameron Street, Harrisburg, Pennsylvania 17110 and Richard F. Stouffer, Department of Plant Pathology, Fruit Research Laboratory, Biglerville, Pennsylvania 17397.

Soil samples were collected from tomato ringstrobe virus (TRSV)-infected plots in the Tripoli, Oregon, and Pennsylvania counties in seven Pennsylvania counties. Xethinema spp. were recovered from 62 of 66 (94%) samples: 17 (11%) contained only X. americana, 33 (50%) contained only X. rivesi, 12 (18%) contained both species, and 6 (9%) contained species of Xethinema that could not be determined due to insufficient specimen. Xethinema rivesi was present in 21 (70%) and X. americana in 17 (57%) of the 30 samples collected from Adams County that contained Xethinema spp. The 26 samples from outside Adams County, 24 (92%) contained X. rivesi and only 6 (23%) contained X. americana. On the basis of these data, we concluded that X. rivesi is prevalent in TRSV-affected fruit plantings in Pennsylvania.

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 (AMV) 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. A 1:50 dilution of the sap was used. Of the sap samples, 1-2 hr at 4°C, Ag 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 provided more vigorous infections of NRSV. ELISA occasionally led to high background Ags. Virus was detected as accurately in ELISA plates coated with both AMV and NRSV antisera as in plates coated with either antisera alone. Purified AMV 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 BACTERIOSPHERES. W. J. Hazel, E. L. Rivero (USDA, SESA, HS1, Beltsville, MD 20705) and G. A. Bean (Univ. Md., Bot. Dept., College Park, MD 20742).

Xanthomonas fragariae phages FPL and FP2 were isolated from soil and naturally-infected leaves. Both viruses have non- contractile tails, 150 and 135 nm long for FPL and FP2, respectively. FPL particles have heads 65 nm across and FP2 particles have heads 58 nm across. There are no known type-specific immunity in FPL strain was susceptible to lysis by FP2. The adsorption rate of FPL to strain XE6 was 2.8 x 10^11 m/min. Adsorption is specific for XE6. Both FPL and FP2 were irreversibly adsorbed to XE6 after 1 hr at 28°C. For FP2, the latent period was 2 hr, the rise period was 2-3 hr, and the eclipse period was 0.5 hr, and the burst size was 175 PFU/infected cell. FPL is also capable of lyophilizing XE6, but not X. pruni or X. vesicatoria. FPL and FP2 mucleic acids are RNA-susceptible, RNA-resistant, and alkali-susceptible.

DETECTION OF VIRUSES IN ULTRASTRUCTURAL STUDIES OF NATURALLY INFECTED KALANCHOE BLOSSFELDIANA S. H. Harston, USDA, SEAR, AR Florist & Nursery Crops Lab., Beltsville, MD 20705.

Kalanchoe commonly exhibit virus-like 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. Viral particles were found in leaf tip preparations and/or ultrathin sections of nine varieties. In a symptomless variety, only a 600-650 nm fluorescent rod was found and mechanically transmitted to Chenopodium amplus. In K. blossfeldiana, viral rod forming in infected tissues resembled calloskaryus inclusion. A second fluorescent rod particle measuring 700-800 nm was found in plants with a mild mosaic. It was associated with pinwheel inclusions, characteristic of virus-like particles. A virus particle with a bacilliform shape was consistently found in sections of plants with leaf spotting, but it has not been mechanically transmitted. Kalanchoe often contained a mixture of these three particle types and inclusion associations, that may represent more than one calm-1, poty-, or bacilliform virus.

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., VPISU, Blacksburg, VA 24061 and TR & EC, 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. Seedlings 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 infected with the organisms 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. 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.


In 1980 'Jet Star' a garden tomato cultivar was exposed to 0.06, 0.06, 0.12, 0.24 and 0.48/1 SO2, in open-top field chambers with nonfiltered (NF) air and to 0.12 and 0.48/1 SO2, in chambers with carbon-filtered (CF) air. Exposures were for 5 hr/5 days/week for 10 weeks. Total of 12 soil samples were collected from 4 different areas in each treatment. Soil levels were relatively high; i.e., in July, Aug. and Sept. about 30 hr > 0.10/1/2. Yields were reduced 17% by oxidants, 180% by the highest dose of SO2, and 32% by the combination of oxidants. Yield reduction in NF air due to 0.06, 0.12, 0.24 and 0.48/1 SO2 were 6, 10, 20 and 18% respectively. Yield reductions in CF air due to 0.12 and 0.48/1 SO2 were 5% and 18% respectively. The correlation between pollutant exposure dose to fruit yield was r = -0.90 for NF and r = -0.99 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 ALFAFA FOR RESISTANCE TO PHYTOPHTHORA MEGASPERMA

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A rapid technique was developed for evaluating alfalfa seedlings for resistance to Phytophthora megasperma. Twelve-month-old seedlings were grown in a mixture of Pro-Mix and Pelle overlying 3 cm of gravel in a 40-cm-tube 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 14 days, resistant plants had long, white roots and succulent, green shoots while susceptible plants had short, brown, or red shoots. Three experiments previously rated as susceptible, intermediate and resistant in an infected 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 GIBRASIS CENICULA


Several Trinidadian bean plants (C. cenicula 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 C. cuniculata and T. multiflora. Symptoms and specific antigen were developed on Chenopodium quinoa, Quinoa sativum 'Alaska' and Vince faba. Local lesions were produced on Nicotiana spp. but the virus failed to infect P. sativum 'Little Marvel' and Phaseolus vulgaris L. 'Mammoth'. Large aggregates and crystalline inclusions were seen in thin sections of infected tissue. Positive serological reactions occurred with bean yellow mosaic virus (BYMV) antisera but not with other potyviruses. Electron microscopy and SDS gel diffusion tests. This bridtal virus isolate may be a new strain of NVMV that differs markedly in host range and symptomatology.

RESPONSE OF AMERICAN ELM SEEDLINGS TO CULTURE FILTRATES OF ISOLATES OF CERATOCSYSTEUS ULMI

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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 did not result in wilt symptoms 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 inducing wilt, (2) germinated elm seedlings may be useful for the bioassay of aggressive and nonaggressive strains of the pathogen, and (3) wilt 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 PHYTOPHthora oxyosporm F. sp. melonis

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Soil, naturally or artificially infested with F. oxyosporm F. sp. melonis spores was amended with plant or animal residues and maintained in sealed plastic containers at various soil moisture levels. After 6 weeks, pathogen population density was quantified by soil dilution plate method. In general, 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 UNOMYCTUS PHASROLLII IN PHASEOLUS VULGARIS


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 uredina (NU), uredinal size, disease severity, and rate of disease progress (RD). These 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 timesome field location, though 'Gator Green' was resistant in both locations and 'Black Gold' and 'Green Giant' susceptible. Line progression over 8-12 days in the GH; r ranged from 0 (Gator Green) to 0.22 (Sprite) in the field. Uredinal size was always 2500 µm.


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 'seedling-like' bacteria associated with elm leaf scorch. Wood chips from debarked, surface-sterilized stems were incubated at 30°C in S-8 medium (medium for the racket stunt bacterium). Turbidness was evident after 21 days. ESB, subcultured on solid PD-2 (medium for the Pierce's disease bacterium) developed white, convex colonies, 0.1-0.6 mm in diameter, after 10-14 days incubation at 30°C. Indirect immunofluorescent antibody staining using antisera 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 antisera provided by N. J. Davis. Cultivation of the ESB will permit pathogenicity testing and taxonomic comparison to other xylem-limited bacteria.

CESSATION OF SPORULATION BY PHOMOPSIS SOJAEE ON SOYBEAN STEMS WITH THE APPROACH OF AUTUMN AND ITS POSSIBLE SIGNIFICANCE

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Soybean stems collected periodically during the summer of 1979 and placed in moist soil were stored for 7 days. Sporulation of Phomopsis sojaee within 14 days. Sporulation of P. sojaee 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. sojaee on its dissemination is discussed.

INFECTION OF LEGUME SEEDLINGS BY PHONOPSIS BATAEEAE, P. PHASROLLII, AND P. SOJAEE

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Seedlings of adzuki bean, birdfoot trefoil, breadbean, cowpea, gordon pea, pigeon pea, 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 bataeae, P. phasrollii, and P. sojaee. Plants were collected 1 and 16 days after inoculation, rinsed for 1 min in tap water (10 available), and placed in plastic containers. After 7 days, pycnidia of P. sojaee were observed on all plants. Pycnidia of P. phasrollii were observed on all plants except birdfoot trefoil. Pycnidia of P. bataeae 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 ASPERMY ISOLATED FROM TOMATO IN MARYLAND. Joseph E.ui 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 George's 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 for TAV. Infecting 1-2 DAY OLD SEEDLINGS with 5 ml of virus produced 75% lesions 9 days after inoculation. The virus is most stable in phosphate buffer (0.1M) pH7.6 amended with 0.1% thymolglycolate. Cheno-podium quinoa is a reliable assay host producing necrotic local lesions in about 15 days after inoculation. That was different from TAV in lesion size between 30 and 48 hours, thermal inactivation point between 60-65°C and dilution end point between 10^6 and 10^5 in Bounty spinach. The virus does not produce lesions typical of TAV or 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.D. 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 rotted and checkered in appearance, and lateral roots were excavated from each tree and brought to the laboratory for fungal isolation. Two pathogenic fungi, Clitocybeiladiella procera and Heterobasidion annosum, were isolated from 25% of the trees and two blue-stain fungi, Piptostrstriction and a Guibourtia 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, Pinnatoten approximatus and a Hylobius sp., were found in 20% of the trees sampled.

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

Betanal (Becky 50W) was applied to semi-dwarf Rome Beauty, Stayman Winsap, and Delicious trees at varying rates and spray intervals. The proportion of leaves per terminal infected by Podosphaera leucotricha was determined seven times during 1987. The number of leaves per terminal was different at a given time varied considerably during the eight weeks that the seven assessments were made. On the 6th week of the experiment, the number of significant differences were 13, 14, 12, 24, 31, 15, 14, and 14, respectively. The number of differences on Stayman and Delicious varied from 15 to 20 (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 OXYSPOREUM. S. Leeth and R. B. Carroll, Univ. of Delaware, Newark, DE 19711

Fusarium infection of soybeans 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 useable level 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 wounding soybeans in test tubes in a 29 C growth chamber. Seedling were wound-inoculated when 6 da old and rated for disease 10 da later. Results, compared to greenhouse and field tests at 2 locations, indicated 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 ERODOSPORA GERMINATION AND INFECTION OF CORN BY FUCCINIA POLYPODIA, THE CAUSE OF SOUTHERN CORN RUST. J. S. Melchinger, Plant Disease Research Laboratory, AR, SEA, USDA, F.O. Box 1209, Frederick, MD 21701.

Erodospora of Fucumia polyplodia Under 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 period of 10 min before exposure to a light of 1000 foot candles for 6-16 hours. The influence of 500, 1000, and 1500 ppm of the synergistic growth factor in the plant leaf piece resulted in 13-19 percent 100 inoculations. Pressor fusarium 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.


Selective sensitivity to cycloheximide (Anti-dione) was used to differentiate Endothia parasitica from E. cyruss. Endothia parasitica had no growth on 21 ml/100 inoculations. 8 ml/ml cycloheximide, the growth of E. cyrus was slightly depressed (25-35%), while that of E. cyrus was greatly inhibited (80-95%). Endothia cyrus did not grow at concentrations above 2 mg/ml, while E. parasitica showed traces of growth at 50 mg/ml. A similar response was observed on cycloheximide-amended glucose-yeast extract broth culture, inoculated with spores of the two species, indicating a comparable trend.

USE OF TWO-DIMENSIONAL POLYACRYLAMIDE GEL ELECTROPHORESIS FOR THE IDENTIFICATION OF PATHOGENIC SOFT BOTTING 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 in 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 protein profile, which consists of proteins at different concentrations, 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 minor protein bands, are easier to analyze. 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.N. Murdock and R.B. Campagna, Dept. of Botany and Plant Pathology, University of Maine, Orono, ME 04469.

Enterobacter cloacae ("Erwinia minipressuralis") considered the single causal agent of bacterial wetwood in 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 present from capillary liquid, wetwood tissues and unaffected sapwood. 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 7 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 a single species.

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-five three-hit sib families at 8 seedlings per treatment were used in the fumigations. 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 DRECHSLERIA DICTYOIDEA AND COLONIZATION OF TALL FESCUE LEAVES. N. A. 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 dictyoidea conidia/ml taken from cultures incubated for 5, 10, 15, 20, and 25 days. Leaves were examined at 12, 24, and 48 hours for primary hyphal elongation and conidium formation. Spore germination, germ tube 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 appressorium development occurred within 48 hours and was greatest from 15-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 germ tube length of spores at 25 °C were greater than at 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. Ostaszewski and J. H. Elgin, Jr., Field Crops Laboratory, USDA, SEA, 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 hydropthernically inoculate stems of clover known to be resistant to race 1 of C. trifolii but susceptible to race 2 (80), and stems of clover known to be susceptible to both races (82). Conidial concentrations were used as 1:1:1:1 mix of 10⁻⁵, 10⁻⁶, or 2 x 10⁻⁶ conidia of each race/ml. All inoculated stems of the 55 clover plants were inoculated at all concentrations tested. No reaction occurred on only a small non-lethal lesion was produced, on inoculated stems of 83 clover. 83 stems reacted as expected when hydropthernically inoculated individually with race 1 or race 2. We propose that possibly a phytalexin-like system is operative in race 1, and is induced by race 1, but not by race 2 infections.

SENSITIVE AND RAPID DIAGNOSIS OF POTATO SPINDEL TUBER VIRUS DISEASE BY NUCLEIC ACID HYBRIDIZATION. Robert A. Ovens 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 virus (PSTV) by microscopy 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 an nitrocellulose membrane is more sensitive and less laborious. All of the crude sap of spotted on nitrocellulose membrane and are baked for 2-3 hr at 80 °C in vacuo. Labelled recombinant 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 90-250 pg PSTV, equivalent to a PSTV concentration of 0.04-0.125 μg/g epidermis, eyes, or sprouts.

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

Torr-o-cide 22-27(19 Z% ha), Torr-o-cide 54-45(23.47,94 ᵋ ha) and Terr-o-gel 57(29.158 ᵋ ha) were used to evaluate chloropirifor (CP) at rates of 10, 20, and 80 kg/ha for control of CBR in a naturally infested peanut field. Soilbrom 40(14.18, 51 ᵋ ha) was used to assess effects of the ethylene dibromide compound of CP compounds. Soil treatments were applied in 20-mp wide with 2, 000 chisels per row, spaced 20 cm apart. Plants were five rows (0.9- m apart, 12-2 m long), replicated in four randomized complete blocks, and planted to 40 inches per plant 18 days after treatment. Mean CP at 200 kg/ha in 20-mp wide applied at 0.10 (P = .05) populations of C. sotarellae microclera (ms) in soil. Significant negative correlations (P = .01 and .05, respectively) were found between CP rates and ms populations 66 days (r = .53) and 168 days (r = .64) 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 Torr-o-cide 54-45, 94 ᵋ 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. Seedings at the 3-4 leaf stage were exposed to 492 μg/m³ for 3 hours in a controlled environment chamber. Plants were rated after 6-7 days for ozone using a nine point scale. The critical 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 patterns were visualized using silver stains, and the correlation of the various banding patterns with ozone tolerance to determine which bands might prove useful as markers.

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

Bark samples were collected from the trunk and scaffold limbs of peach trees at four 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 pyendia of Cytoprosa leucostoma Sacc. The nematodes were increased on cultures of peach tissue grown in the laboratory, and an associated feeding on hyphae. The nematode populations from the two locations are similar and appear to be an undescribed species of Aphelenchoides.


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 dinophenid were applied at the recommended rates of 1.7, 4.5, and 4.5 kg al/ha, respectively, every year. Isopropalin treated plants had significantly less weather fleck injury for 2 to 4 weeks after transplanting, but not later. Isopropalin treated plants did not differ from the other treatments in terms of number of days to first floreting, 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 dinophenid treatments had no effect on the sensitivity of tobacco to ozone.

STUDIES ON THE INTERACTION OF PRATYLENCHUS PENETRANS AND VERTICILLIUM ALBO-ATRUM ON YELLOW POPULAR 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 penetran 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 x 10^6, 1 x 10^7, and 1 x 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 temperatures at 1 cm and 5 cm 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 SEEDEEDE 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 Division, U.S. Department of Agriculture, SEA-AR, Beltsville, Maryland 20705.

Seedlings of Verticillium wilt tolerant cotton (Gossypium hirsutum L.) Acala 4652 were subjected to chilling stress at 10 C. for 3 weeks, and then exposed at 21 C. for 5 days. After chilling, the plants were tested for susceptibility to Verticillium wilt and to Rhizoctonia root rot. Exudates were analyzed for amino acid composition 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 help explain the observed variation in cotton cultivars to susceptible to this disease and possibly to Rhizoctonia root rot at low temperatures but are tolerant at temperatures more suitable for cotton growth.

A FACTIORIAL ANALYSIS OF THE EFFECTS OF TEMPERATURE, MOISTURE AND INOCULUM DENSITY ON BEAN ROOT ROT CAUSED BY PYTHIUM AND FUNARIUM. D. W. Sippel and R. Hall, Dept. of Environmental Biology, University of Guelph, Guelph, Ontario, N1G 2V1.

Effects of soil temperature (14, 21 and 28 C), moisture (50% and 170% nba), and inoculum density (0, 10, 100, 1000 propagules per gram (ppg)) on severity of bean root rot caused by Pythium ultimum (P.) and/or Funarium solani (F. sp. phaseoli) (F.) were examined. Plants (cv. Seafarer) 5 days old were placed in infested soil and harvested 10 days later. Each fungicide 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 ppg, followed by F + P at 1000 ppg at 14 C and P alone at 1000 ppg at 14 C. Root and shoot dry weights were reduced more by F than P. In the presence of moisture, temperature, and inoculum density explained 0.1, 14.0 and 22.5% of the 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 MELIOIDOGY HAPLA. L. J. Slama, USDA - SEA-AR, Appalachian Fruit Research Station, Reulee 2 Box 45, Kearneysville. West Virginia 25430.

Reactions to Meloidogyne hapla of 58 Nicotiana species, 8 sub-species and 2 Nicotiana tabacum cultivars were determined 8 weeks after inoculation of greenhouse-grown plants with approximately 750 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 were N. glutinosa (2.5), N. benedixii (2.6), N. tabacum cv. NC95 (2.7), N. longiflora (2.7), N. kniphtiana (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 38 untested species was also determined. The data confirm the high degree of resistance in N. nactiellus as reported by Chapman (Phytophathology, 1957), the moderate degree of resistance inherent in N. tabacum cv NC95, and the wide variability in response of Nicotiana species to M. hapla.


An up to 20-fold 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 of brown spot phaseoli. B. subtilis was cultivate on Eugonoth at 30 C. This medium did not affect rust development. B. subtilis in Eugonoth was equal to effective in reducing rust severity when applied 0-3 days before inoculation of beans with the rust. 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 blue extract from B. subtilis cells gave the same effect as B. subtilis in Eugonoth, but not ethanol nor trichloroacetate acid precipitates were active.

SUSCEPTIBILITY OF SAFFLOWER CULTIVARS TO COTTON STRAINS OF VERTICILLIUM DIAEAE. G. 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 to slightly. Tuber was highly resistant at all locations. Isolates of V. dahliae cultured from infested safflowers grown in the field were found to be virulent to several safflower cultivars to the cultivars that were inoculated from safflower. Several safflower cultivars were susceptible to both strains. None of the cultivars tested was resistant to both strains. VFR-1 and DMVP-1 were highly resistant to the deflecting strain. P.I. 264931 was resistant to the wild strain.

INFECTION RATES AND INOCULUM DENSITY-INFECTIONS RELATIONSHIPS OF CYLINDROCLADUM CROVATLAREAE ON PEANUT. G. S. Tommatsu and G. J. Griffin, Dept. of Plant Pathol. & Physiol., VPI & SU, Blacksburg, VA 24061.

Using plate methods, infection rates and microscopical density-infestation relationships of Cylindrocladum crovatalareae were determined from asymptomatic and healthy plants grown in naturally infected soil at 25C. In a time-course experiment, the infection rate for apparent infections, per unit -root-length-unit-inoculum basis, increased over three consecutive 2-day periods. The infection rate for estimated infections [based on log₃ (1/y)], where y is the proportion of symptomatic plants, on a per plant-unit-inoculum basis, also increased over the same three periods. Plant had about 30 apparent root infections when 50% of the plant population had root necroses, based on the infection-rate curve. Regression line slopes of 0.96 (95% and 0.94 (95% were obtained for 1975-1976 data on microscopical inoculum density versus the number of apparent infections per plant and per unit root length, respectively.


Distribution profiles of selected fungitoxins were assayed in American elm (Ulmus americana) since they may be used as vascular disease control agents. In Study I, Arbovert 20-501, BLD and Lignasan BLP were administered at 8,000 µg/ml by a gravity-flow (infusion) technique to 12-year-old field trees, which were sacrificed and bioassayed 1 mo. later by overwound with bisolute drench into xylem drench. Both treatments were significantly different from controls. Percentage values of fungal growth inhibition were estimated from the total area of the disk cross-sections. In Study II, Arbovert 20-501, Vandr, Lignasan BLP, and marinifil were administered at 10,000 µg/ml by overwound with bisolute drench into xylem drench. 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 fungitoxins.

CROSS-RESISTENCE PATTERNS OF FENARIMOL-RESISTANT ISOLATES OF USTILAGNO VIVIDS. R. C. Walsh and H. D. Siler, Dept. of Botany, University of Maryland, College Park, MD 20742.

Fenarimol-resistant isolates of Ustilago vivid 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 following compounds: 14α-methylsterol, 14α-methylsterol imazalil, miconazole, dodecylaminol, and tridemorph. One isolate showed increased resistance to the C-14 demethylation inhibitor GDA 64251, whereas three showed decreased resistance. These results are consistent with a mutational change involving specific changes in sensitivity to the C-14 demethylation system. However, since these mutants also showed changes in sensitivity to asastenol A258228 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.


Three cultivars of matured tobacco were grown in modified Hoagland's solution at 25 or 250 μg/ml Ca. These cultivars varied in resistance to Physallthora parasitica var. nicotianae. Two weeks after transferring to modified nutrient solution the plant roots were inoculated with zoospores. Plant roots were rated for disease severity on a scale of 1 to 4 (1 healthy, 4 completely macerated) beginning five days after inoculation. McFarland 94 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 tissue from all three cultivars grown at both Ca levels were harvested and analyzed for total lipids, free sterols, steryl glycosides, acetylated 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.


The pine needle 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, aphelopedoid nematodes in small, popular white pine can be observed in the wood of *P. taeda* from Henrico County and in *P. strobus* from Botetourt County. A water extraction technique was used to separate the nematodes from the water. Counts for the initial observation ranged from a very low number of nematodes to the amount of the trees to very high counts in the upper branches. Ceramicized beetles, the suspected vectors of the nematodes, were observed in these samples.


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 biotic agents, and on rhizosphere and root zone indicators. Results implicated the following interacting complex of factors: high soil pH (7-8.5), heavy soil texture, high amounts of competition and shading, root impendence, 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.


Rusts of clover (*Trifolium spp.*) are distributed widely in the humid and subhumid climates of the world. *C. trifolii-repensis* LIE var. trifolii-repensis 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 since no time reports were made, 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 acervulus, and additional conidia lacking pericia. 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.** M. H. Willa 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*. Consequently, *M-7* spread readily on *NS* samples of bark and very little on samples of *S* bark. When the two bark media were infested with *PC* 2 wk following infestation with *M-7*, no spread of *PC* occurred on *NS* and very little on *SA*; the spread of *PC* was almost three times as frequent on *SA* as on *SB*, but was irregular on both. Although *PC* has been shown to cause disease in azaleas when artificially infected in non-autoclaved bark in the greenhouse, it is possible that *M-7* will protect against 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 special compartments: ectoplastic space and endoplasmic space (after de Duve). Lysosomal components (pinocytotic vesicles, vacuoles, golgi vesicles, phagocytic vacuoles) make up the ectoplastic space which forms an interconnecting network that allows the movement of materials from the outside of the plasmalemma to the vacuole. Single-membrane-bound 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 endoplastic space of the cell. The line between the ecto- and endoplastic 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 ectoplastic space without being destructive.