EFECT OF DIVALENT CATIONS ON GERMINATION OF UREDIOSPores OF UNCOMITRO PHASEOLI. C. Jacob Baker, USDA, Beltsville, MD 20705; Morton Hook, Univ. of Del., Newark 19711; and John Melhuish, Jr., USDA, For. Serv., Berea, KY 40403.

Urediospores of U. phaseoli germinate well in cooled, hot tap water but not in delonized or distilled water. Ion-exchange chromatography and inorganic analysis of this water suggested that divalent cations may be essential for germination. Spores were treated by their self-inhibition by floaing a monolayer of spores on distilled water containing 0.005K Tween 20. The solution beneath the spores was removed after 10 min and replaced by fresh solution four times. The washed spores were then transferred to various test solutions in a microtiter plate and incubated overnight in a dew chamber at 18°C. It was found that calcium (3 mM), magnesium (2 mM), or manganese (0.4 mM) when added to distilled water would stimulate germination. The addition of EDTA to the cation solution prevented germination, until an excess of a divalent cation was added.

RESISTANCE TO PHYTOPHthora CAPSICII IN PEPPER. T. H. Barkdale and G. C. Papavizas, Vegetable Diseases Laboratory, respectively, USDA, Beltsville, MD 20705; and S. A. Johnston, Rutgers Agricultural Research and Development Center, Bridgeton, NJ 08301.

Resistance to foliar blight of pepper (Capsicum annum) caused by Phytophthora capsici was found in several P.I. lines by using a spore suspension as inoculum in a greenhouse test. Two crown-root resistant cultivars, Pyumo from Argentina and 315 from France, were crossed with the susceptible California Wonder and with each other. Resistance to foliar blight from both sources was controlled by a single dominant gene with modifiers. F_2 progeny of each cross generally was as resistant as the resistant parent. Lines selected for resistance to foliar blight in the greenhouse were usually resistant to crown rot in the field. There was an indication that prolonged incubation periods or very high inoculum concentrations could overcome resistance and result in symptoms on some resistant plants.

DIFFERENTIAL INFECTION OF FORTY SOYBEAN CULTIVARS AND LINES BY FIVE PEANUT MOTTLE VIRUS STRAINS. B. C. Bays and S. A. Tolin, Dept. of Plant Pathology & Physiology, Virginia Polytechnic Institute & State University, Blacksburg, Virginia 24061.

Twelve peanut mottle virus (PMV) isolates have been placed in 5 strain groups (I-P5) based on symptom expression in the soybean (Glycine max) cultivars Lee 68, York, and Virginia. The type member of each strain group was inoculated to 40 soybean cvs. and lines to determine the range of response to PMV strains. Five reaction classes resulted. All virus strains infected 26 of the cvs. and lines with differing symptom expression. None of the strains infected cvs. Buffalo, CNS, Davis, Haberland, Kawanoyo, Peking, and Ware. All strains with the exception of V745/19/1 infected cv. Cumberland. Three strains, V745/473, V795/20 and V795/33, infected cv. Virginia. Only one strain, V745/108-1, infected cvs. Arksoy, Dorman, Shreve, V795/183, and York. These strains can be used to identify PMV resistance genes in soybean.

IMPERATIVE OF HOST RANGE STUDIES IN TAXONOMY OF PERONOSCLEROSIUS.

Sensitivity of sclerotinia minor from peanut to dicloran, iprodione and vinclozolin. T. B. Brennan, P. M. Phipps and R. J. Stipes, Dept. of Plant Path. & Physiol., VPI & SU, Blacksburg, VA 24061.

Five isolates of Sclerotinia minor from different peanut fields in Virginia were tested for sensitivity to dicloran, vinclozolin and iprodione. Linear extension of mycelia was measured on glucose-yeast extract agar amended with the fungicides. Levels of inhibition calculated from dosage-response data were plotted on logarithmic-probability paper and regression equations used to determine ED50 values. Although ED50 values for isolates were variable, there was a consistent relationship in sensitivity to the three fungicides. The mean ED50 values for linear extension inhibition in vitro were 0.07, 0.31, and 0.31 mg/ml for vinclozolin, iprodione and dicloran respectively. Nine strains of S. minor with tolerance to one or more dicloronitro-amine fungicides were obtained during in vitro tests. Tolerant strains were capable of growth at fungicide concentrations of 100 μg/ml, and were pathogenic to peanut in growth chamber tests.

WATERMELON MOSAIC VIRUS CAUSES A SERIOUS DISEASE OF PUMPKIN IN SOUTHWESTERN VIRGINIA. F. J. Butterfield, S. A. Tolin and R. C. Lambe. Dept. of Plant Pathology & Physiology, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061.

Pumpkin plants (Cucurbita mixta Pang. [C. angyrosperma Hort.] 'Howden') with severely malformed fruits showing tumour-like protrusions were observed in many fields in Carroll County, Virginia in 1982. Leaves on these plants had a mosaic pattern and were blistered and stunted. A virus was mechanically transmitted from Howden to 'Small Sugar' pumpkin on which it was then maintained. The host range includes several cucurbit species and suggests the virus is watermelon mosaic virus (WMV) 1 or WMV 2. Seeds collected from diseased pumpkin fruits were smaller and showed reduced germination; those seedlings which grew showed no symptoms. Electron microscopy of leaf dips and thin sections of leaf tissue gave evidence of potyvirus-like flexuous rods and pinwheel inclusion bodies respectively. In SDS immunodiffusion tests the pumpkin virus reacted with antisera to WMV 2 but not to WMV 1.
CYTOLOGICAL INVESTIGATIONS OF CHLAMYDOSPORES OF TRICHODERMA.

Examination of cytological and morphological characteristics of resting spores of Trichoderma suggested a similarity to other fungal chlamydospores. All resting spores of isolates of T. viride, T. harzianum, and T. hamatum were 5-10 times larger (6-10 μm) than dehydrated representatives of dormant resting spores on hyphae was observed in solid or liquid media. Resting spores produced thick cell walls (1 μm) in all conditions tested. Large lipid nutrient reserves were observed in chlamydospores and were verified by staining with the lipid dye Sudan Black. Mithramycin, a nuclear dye, stained one nucleus in conidia and two to four nuclei in the resting spores. Features of resting spores of Trichoderma including spore size, thickened cell wall, lipid contents of cytoplasm, multinucleate condition, and process of morphological development indicate their similarity to other fungal chlamydospores.

COMPARATIVE STUDIES OF TWO VECTOR BIOTYPES AND TWO STRAINS OF SOYBEAN DWARF VIRUS.

A California biotype of Acrystaphthon negaloni (foxglove aphid) transmitted both the dwarfing and yellowing strains of soybean dwarf virus, currently not known to be soil-borne as well as seed-borne. However, in comparative studies the Japanese biotype was a more efficient vector than the California biotype, especially of the yellowing strain. The foxglove aphid feeds on soybean while the California biotype will colonize soybean but more readily colonizes leaf lettuce and other hosts. Soybeans exhibit a yellow phytotoxic spotting at the feeding site of the Japanese aphid but not at feeding sites of the endemic aphid. The Japanese biotype generally feeds on the upper epidermis or unfoliared soybean seedlings while the California biotype feeds on the base of the epiplc or the under-surface of the cotyledons. Japanese aphids are more prolific and larger than the endemic biotype. The presence of a vector in the U.S. for soybean dwarf virus increases the potential threat of this pathogen.

ALL BLOTCH EPIDEMICS ON WINTER BARLEY IN THE FALL AS INFLUENCED BY PLANTING DATE.

All barley cultivar Penradd was planted at Rock Springs, PA on 14-20, and 27th Sept. 1982. The earliest date is the recommended planting date for winter barley in central PA. Plants were removed from the field and evaluated in the laboratory for leaf blight symptoms (at harvest scale) on 10 Oct. 1982. This procedure was repeated on 26 Oct. 7th Nov., and 9 Dec. 1982 in order to evaluate disease progress. There was a strong positive correlation between the disease level on the main plant and the first tiller. There was significant disease severity at planting dates on the main plant and the first tiller, as well as a significant increase in disease severity for each planting date over time. These same trends were not evident on the second and third tillers. In general, disease severity was greatest on the earliest planted plots and the oldest leaves.

INFLUENCE OF KLEBSIELLA OXYTCA ON DEVELOPMENT OF SYNENMYTA OF CERATOCYSTIS ULMI ON ELM WOOD.

Antagonism of Ceratocystis ulmi by native elm microflora in vitro stimulated a study to evaluate the influence of a Wildwood bacterium, Klebsiella oxytca, on development of synenmyta on elm wood. Seventy wooden discs were dipped in suspensions of C. ulmi plus K. oxytca. Spore numbers of C. ulmi (50,000 sp/ml) were held constant but numbers of K. oxytca cells were varied (10, 40, 100, 400 sp/ml). Additional discs were used as controls, 10 discs only of C. ulmi and 30 only K. oxytca. Data were obtained on frequency of synenmyta/ mm² for one week. Numbers of synenmyta on the discs exposed to mixed suspensions with K. oxytca were significantly lower (p<0.01) after 24 hours than those exposed to C. ulmi only, but not after one day. The data

suggest that K. oxytca delays but does not prevent development of C. ulmi in elm.

PRODUCTION OF FORMULATION OF TWO BIOLOGICAL CONTROL AGENTS FROM LIQUID FERMENTATION.

S. T. Dunn, N. T. Laxx, and G. C. Papavizas, USDA, ARS, Beltsville, MD 20705.

Large batch production of the biocontrol agent Talaromyces flavus and Trichoderma hamatum was performed by liquid fermentation in 20 L vessels. The system simulated industrial conditions by utilizing commercially available ingredients consisting of molasses plus either dried brewers yeast, cottonseed flour, or corn steep liquor. After 5 days of growth in molasses-rich medium with 12% (dry wt) L1 consisting of hyphae. The air-dried mats were ground and mixed (30% weight with commercially available carrier Pyrax® (pyrophellite). The formulated product contained 10⁶ propagules/g. T. hamatum, grown initially in a 1-2% methanol or contain cell residu yieled a 7-8 g dry wt composed of hyphae and chlamydospores. Mixed with Pyrax® (102 g by wt), the formulation contained 10⁷ propagules/g. Addition of NaCl or CaCl₂ to the various media did not stimulate conidial production. Survival of both organisms in the Pyrax® formulations was monitored over time, with approximately 90% of the propagules remaining viable after one month.

RESISTANCE TO PSEUDOMONAS SYRINGEAE PV. SYRINGEAE, B. J. Fieldhouse, D. A. Burba and N. S. K, Department of Plant Science, University of Delaware, Newark, DE 19711.

Eight isolates of Pseudomonas syringae pv. syringae, the causal organism of bacterial blight of soybean, were obtained from leaves and seeds of the Delaware-introduced cultivar Ware. These isolates were obtained by means of a technique involving the use of a selective medium in Delaware for the identification and quantification of this bacterium. The isolates, similar in host range, do not fit any previously described race designation. The relative pathogenicity of the isolates on 30 selected cultivars clearly shows that a high level of resistance to this possibly new race of Pseudomonas syringae pv. syringae is present among the standard and experimental cultivars grown in and for this area. A cropping schedule to reduce this disease might then include selected resistant cultivars in a rotation with or without other agronomic crops along with the use of seed free from this pathogen.

IN VITRO TESTING OF SOYBEANS WITH PHYTOPHthora SPECIES ON PEACH.

D. R. Franco, D. P. Hinkel, and D. P. Hinkel, Dept. of Plant Pathology, West Virginia University, Morgantown, WV 26506.

In a survey conducted to determine whether Phytophthora species were associated with the disease symptoms observed in West Virginia, Phytophthora cactorum and P. cinnamomi were isolated from necrotic root tissue. The pathogenicity of these fungi were tested on peach varieties Redhaven and Glohaven using the coccidium root system. Inoculum of P. cactorum was placed vertically into jars with a lime bean extract and Bencymol (20 mg/l) agar medium, on which P. cactorum and P. cinnamomi had grown for 3-5 days. After 7 days of incubation at 25-30 C, the periderm on the shoots was removed and the length of necrosis determined. Phytophthora cactorum caused larger lesions on Redhaven and Glohaven than P. cinnamomi. This laboratory method may provide a rapid and inexpensive method to test pathogenicity of Phytophthora species on peach varieties.

COMPATIBILITY OF THE ANTIGENIC TALAROMYCES FLAVUS WITH POTATO-PEACE PIECE FUNDICIDES.


Acospora or conidia of a wild-type or a benomyl-resistant isolate of T. flavus, both antagonistic to Verticillium, were suspended in Pyrax® (pyrophellite). Potato seed pieces were treated with the spore preparations and captan, maneb, metalaxyl, thiram, or the recommended rates. Potatoes were planted in the field, recovered after 19, 35, or 54 days and populations of T. flavus were measured by seedling method. The seed pieces were determined using a medium selective for T. flavus. For all sampling dates ascospore preparations of both treatments were generally 95% or greater of the conidial preparations. After 54 days chrysosporium populations in the TB + wild type ascospore treatment were not different from those with the wild type ascospore alone. For the benomyl resistant isolate, after 54 days the polycar-
INFECTION BY SYLVAN SPARRE IN TWO PENNSYLVANIA CONIFER NURSERIES. J. M. Gunu, W. Merrill, and L. C. Schelzin, 211 Buckhout Laboratory, The Pennsylvania State University, University Park, PA 16802.

Infectivity of Sylvan Sparr was tested in two conifer nurseries in Pennsylvania. Shoot inocula, of the ectomycorrhizal fungi, Conoccalis graminifera, Heloloma crustuliforme, Laccaria lactea, and Gymnopilus microcarpus, were incorporated at a rate of 100 ml per 0.3 m² prior to seeding. After 4 months, Laccaria lactea established mycorrhizal relationships with Douglas-fir, red pine and Scotch pine and Heloloma crustuliforme colonized Douglas-fir. Laccaria lactea sp. was isolated from Douglas-fir (30%) recovery, red pine (14%), and Scotch pine (5%) seedlings. The percentage of feeder roots colonized varied from 10 to 80% depending on the host-fungus combination. No mycorrhizal feeder roots were observed on inoculated Colorado blue spruce, Norway spruce, Black Hills white spruce, eastern white pine, southwestern white pine or on trees in any of the check plots.

EFFECTS OF ROOT KNOT NEMATODE ON BACTERIAL WILT OF TOMATO. R.W. Goth, Vegetable Laboratory, ARS, USDA, Beltsville, MD 20705; K.V. Peter, Keral Agricultural University, Vellikkara, Kerala, India; R.N. Sayre, Nematology Laboratory, ARS, USDA, Beltsville, MD 20705; K.V. Peter, Keral Agricultural University, Vellikkara, Kerala, India; R.V. Webb, Chief, Vegetable Laboratory, ARS, USDA, Beltsville, MD 20705.

Eight isolates of Pseudomonas solanacearum (race 1) from different geographic locations were used to study the bacterial wilt resistance of selected tomato, Lycopersicon esculentum, cultivars, and breeding lines. Nine CL-32D-0-1-1968 from AVRDC in Taiwan was resistant to 3 isolates, and the cultivar Virus was resistant to 1 isolate. Bacterial wilt resistance was broken down when root knot nematodes, Meloidogyne incognita, larvae were added at a rate of 100 per 10 cm pot at the time of inoculation with the respective bacterial isolates. These results suggest that M. incognita should be considered as a factor in the development of bacterial wilt resistant tomato germplasm.

EVALUATION OF TOMATO LINES FOR RESISTANCE TO PHYTOPHTHORA INFESTANS. R.W. Goth, Vegetable Laboratory, ARS, USDA, Beltsville, MD 20705; K.V. Peter, Keral Agricultural University, Vellikkara, Kerala, India; R.V. Webb, Chief, Vegetable Laboratory, ARS, USDA, Beltsville, MD 20705.

Eleven tomato (Lycopersicon esculentum) cultivars and breeding lines were evaluated for reactions to tomato race 0, tomato race 1 and potato race 123% of Phytophthora infestans. A isolate to tomato race 0 were Pusa Ruby, WV 36, WV 63, and WV 700. In WV 36, WV 63, and WV 700 had a high infection resistance to tomato race 0. Pusa Ruby was the most resistant to race 1. Lines resistant to potato race 123% were Pusa Ruby, WV 63, WV 106, WV 700. Those tomato entries susceptible to all the P. infestans isolates used were Better Boy VPP, F100 Red, Rutgers, Success, and CL-32D-0-1-1968 from AVRDC in Taiwan. These results suggest that Pusa Ruby is a source of germplasm for additional resistance to P. infestans tomato race 0 and race 1. Potato race 123% is similar to tomato race 0 except that it infects WV 36 which is immune to race 0.

EFFECTS OF AIR POLLUTANT AND SOIL MOISTURE STRESS INTERACTIONS ON SOYBEAN YIELDS. H.E. Neggeus, J.H. Bennett, and T.J. Gish, U.S. Dept. of Agriculture, Beltsville, MD 20705.

Effects of ozone (O₃), sulfur dioxide (SO₂) and soil moisture stress on the yields of two soybean (Glycine max) cultivars, 'Williams' and 'Forest', were studied in open-top field chambers. The plants were exposed to combinations of these stresses on 79 days between July 8 and Oct. 1, 1982. Treatments were: charcoal-filtered (CF) and nonfiltered (NF) air; NF + 0.03, 0.06, and 0.09 ppm O₃; and NF + 0.03, and 0.1 ppm H₂O (a 2.5x factorial). Ozone was added 7 hrs/day (0900-1600 EST) and SO₂ added for 4 hrs/day (0900-1300 EST) except on days with rain. Each pollutant treatment was conducted at two soil moisture potential levels (Ψw = -0.5 and -2.6 bars). A negative linear regression on soybean yields was conducted with increasing O₃ concentration for plots with low soil moisture stress, Ψw = -0.5 bars. No yield reduction was noted at the more negative Ψw for plants in CF chambers. In NF chambers, soil water stress interacted with ambient O₃ to reduce yields about 30%. SO₂ in combination with O₃ increased yield losses.

DETECTION OF DOUBLE-STRANDED RNA IN AGGRESSIVE AND NONAGGRESSIVE STRAINS OF CERATOCYSTIS ULMI. J.G. Hoch, R.J. Campana, and S.M. Tavantzis, Department of Botany and Plant Pathology, University of Maine, Orono, ME 04469.

Induced virulence in Endothia parasitica is attributed to presence of dsRNA. Association by others of dsRNA in strains of C. ulmi with low pathogenicity suggested a similar role in reduced virulence, but this has not been confirmed. A study was initiated to elucidate further the role of dsRNA species in aggressive (A) and nonaggressive (NA) isolates of C. ulmi. Thirty isolates were tested for dsRNA using phenol extraction and cellulose CF-11 chromatography. Treatments with DNase and RNase (0.3 M NaCl) were followed by polyacrylamide gel electrophoresis. A and NA isolates of C. ulmi contained 1 to 3 dsRNA species per isolate. Molecular weights of individual species varied from 1.4-3.0 x 10⁶ daltons. Preliminary results suggest a possible correlation of specific dsRNA segments with nonaggressiveness, but more data are needed for the establishment of a positive relationship.


Symptoms and patterns of disease development observed on Pinus sylvestris were found to differ from those associated with P. sylvestris. Eight trees showing foliage symptoms were compared with eight symptomless trees. Length of shoot elongation was measured and isolations made for Verticillidiella prodere. Trees showing foliage symptoms had significantly reduced shoot elongation. Y. prodere was isolated from 1 of 8 trees including the symptomless trees. Longitudinal sections at groundline, revealed that colonized stems were girdled, apparently by Y. prodere. Unlike P. sylvestris, Y. prodere produces symptoms shortly after infection. P. sylvestris may be infected for months or years before showing any foliage symptoms.


Barley stripe mosaic virus (BSMV) strains CV 52 (ND 18) and CV 42 (ND 159) are closely related serologically and cross-protect in reciprocal tests on barley, but differ in severity of symptoms on barley. Ability to infect Chlamydomonas reinhardtii and in electrophoretic RNA profile. Inocula of the two strains were mixed, mechanically inoculated to and passed successively in Black husles barley in two separate trials. A property of cv CV 52 was lost after the 4th passage while cv CV 42 RNA. Lesions on C. reinhardtii, a property of CV 52. were produced by CV 42 RNA. At none of the trials RNA from virus purified at the 6th passage had a profile similar to CV 42 RNA. Since no lesions on C. reinhardtii, a property of CV 52, were produced after the 4th passage in one trial but persisted in the other. Severe mosaic symptoms in barley, characteristic of CV 52, persisted through the 6th and 8th passage, respectively. Virus from the mixtures reacted with antisera to both strains. Results suggest that a variant of BSMV arose from one or both of the parental strains.


Seventy-five rooted cuttings of azalea cv. Hershey Red were planted in: pine bark (PB); PB plus 10% peat (PM); PB; PM and expanded shale (JM); and PM plus topsoil (TS). In 475 cc pots. Fifteen plants in each medium received Truban®, Subdue® or Allert®, drenched at recommended rates, or the fungal antagonist Myces®. Eight gilpin (M. gilpin) was added as a 25% mycelial suspension of 10 day old, 8:8 broth culture per pot. Each pot was inoculated with a single Phytophthora cinamomi (PC)-colonized oat grain 5 cm below the media surface. After four months results were rated for rot and plated for PC. No significant control was obtained with MA, and PC was recovered from all plants treated with MA and from the controls. Subdue and Allert gave almost
complete control in all media. Control with Truban was comparable to that with Allette and Subdue in PB and TS, but much less in media containing peat. Reduction in inoculum of PC showed a pattern similar to root rot ratings.


Models were developed for predicting colonization levels of Heterobasidion annuus in the root systems of Pinus taeda. Above-ground tree measurements and 0.35 m soil core samples (660) were taken from four plots in each of two thinned plantations. Eighty-six plot trees were excavated and root system colonization levels were determined. Using multiple regression analysis, two and three variable models were developed which predicted root system colonization levels. Measures of stem diameter, radial growth over the last 5 y were used for the two variable models. The 0.35 m soil-root sample was increased with diameter growth to build a three variable model. Both models were significant at P<0.001, with R² values of 0.93 and 0.95, respectively.


Spontaneous mutants of E. amylovora resistant to oxytetracycline (OTC) were obtained on media containing 1.6 but not 12.7 μg OTC/ml at frequencies of < 6 x 10¹⁰/ml. Selection from these mutants yielded second-step mutants at 25.4 but not 102 μg OTC/ml at a frequency of < 4 x 10¹⁰/ml. Erwinia herbicola and Pseudomonas syringae pv. Syringae donors (O) and recipient RFI (Amp †, Km †, Tc †) formed transconjugants (T) with E. amylovora in Pyrus communis 'Bartlett' blossoms at 1 x 10⁸ to 3 x 10⁹ TBA. The T strains were resistant to > 100 μg OTC/ml. During pathogene- sis, RFI was lost from > 99.9% of the bacteria recovered. The possibility that resistance may interfere with OTC chemotherapy of fire blight is considered.

CONTROL OF SNAPBEAN DISEASES CAUSED BY PITHYUM AND RHIZOCTONIA WITH AN INTEGRATED APPROACH. J. A. Lewis, W. D. Lamoureux, G. C. Papavizas, USDA, ARS, Beltsville, MD 20705 and J. G. Kantzer, Univ. of Maryland, College Park, MD 20742.

An integrated control approach incorporating cultural, chemi- cal, and biological components was developed over a 4-yr period to reduce damping-off, blight, and root rot of snapbeans in a Salisbury, MD field. The major control component was cultural and consisted of plowing (20-25 cm) infested soil rather than disking (5-7 cm) before planting. Plowing alone generally increased disease but plant rot was reduced when the increases were not as great as that achieved with plowing. In 3 out of 4 yr, use of plowing in association with soil treatment gave a greater yield than that attained when each component was used individually. Prepara- tions of biocontrol agents (species of Trichoderma, Laetissaria, Parawoodia, Fusarium, Stilbumyces, Pseudonomas) added in-pot or to seed did not reduce disease when used individually or in combination with the other methods.

A NEW APPROACH TO INDUCE PROLIFERATION OF INTRODUCED TRICHODERMA SPP. IN SOIL. J. A. Lewis and G. C. Papavizas. USDA, ARS, Beltsville, MD 20705.

The inability to stimulate the production of large numbers of an antagonist in a natural ecosystem is a major factor inhibiting the exploitation of effective Trichoderma spp. for prac- tical control of soilborne plant pathogens. In this study, a sand-brain medium inoculated with T. viride isolate (T-44) to provide 1 x 10⁵ MFU/mg of bean was added to nonsterile field soils after 1, 3, 8, and 16 days of incubation. Amend- ment with a 3-day old preparation to provide 0.1% bran and 1 x 10⁶ CFU/mg of Trichoderma spp. (T-44) increased in a population of 4 x 10⁷ and 2 x 10⁸ CFU/g of soil after 1 and 3 weeks, respectively (40,000 and 200,000-fold increase). The magnitude of proliferation declined using older preparations of inoculum. Trichoderma populations did not increase with any combination of nutrients, including bran, when nonsterilized conidia were used. The results suggest that the use of Trichoderma spp. as an antagonist in soils.

EFFECT ON RESPIRATION OF ADDITION OF FUNGAL SPORES TO SOIL. J. J. Marais and D. R. Pravel, Soilborne Diseases Laboratory, USDA, ARS, Beltsville, MD 20705 and Dept. of Botany, Univ. of Maryland College Park, MD 20702.

Spores from isolates of Trichoderma viride, T. harzianum, Fusarium oxysporum, Penicillium funiculosum, Aspergillus ochraceus, and Verticillium dahliae were suspended in distilled water and added to soil at 10⁷ spores/g of soil dry weight. Soil respiration rates were measured by an alkali trap after addition of spore. Soil respiration rates were maintained at 10% moisture. T. flavus was the only species that consistently increased soil respiration in natural soils, from 5-20% depending on the type and condition of the soil. T. flavus was also the only species that increased (from 5 to 70% in population) when 12-16 h of dew was provided. Spores were air dried for 2 days and then rehydrated to 10% moisture, the T. flavus-infested soils had the highest respiration rates. Most of the species tested increased soil respiration rates and their population densities increased when added to methyl bromide-chloropicrin or steam treated soils.

EFFECT OF DEW TEMPERATURE, DURATION, AND FREQUENCY ON LEPTON DEVELOPMENT ON 'MANTY' SOYBEAN INFECTED WITH PHAKOPHORA PACHYHELI. THE CAUSE OF SOYBEAN RUST. J. S. Melching, USDA-ARS, Plant Dis. Res. Lab., P. O. Box 1209, Frederick, MD 21701.

Soybeans ('Wayne') inoculated with uredospores of Phakopora pachyheii, then immediately provided a single dew period, required a minimum of 6-7 h of dew at the most favorable temperatures (17-21 C) for subsequent lesion development. Temperatures of 9 and 26 C were the limits below which no lesions developed. A dew period of 12-16 h, 12-18 C was sufficient, disease development required 12 h or more of dew, and the number of lesions produced were 0.1% as many as at 17-21 C. Spores on leaves kept under normal field conditions at 18-22 C, followed by drying for 1-4 days before a second dew period of 16 h, produced 20-50% as many lesions as spores given only the 15-hr period. Dry spores on leaves for one week in the greenhouse caused lesions when 12-16 h of dew were provided, but their infectiousness was only 0.5%, or less, of that of spores provided with dew 1 h after inoculation.

EFFECT OF INOCULUM DENSITY ON LESION DEVELOPMENT IN 'WAYNE' SOYBEAN INFECTED WITH PHAKOPHORA PACHYHELI, THE CAUSE OF SOYBEAN RUST. J. S. Melching, USDA-ARS, Plant Disease Research Laboratory, P. O. Box 1209, Frederick, MD 21701.

Soybeans ('Wayne') were quantitatively inoculated with airborne uredospores of Phakopora pachyheii, inoculated at 20 C for 16 h in dew chambers, and then held in the greenhouse until lesion development. A range of 12-16 h was provided at inoculum densities of 200 to 2400 spores/cm² of leaf tissue required to produce one lesion varied from 11 to 113; the average value was 42. Increasing numbers of lesions per leaf increased with increased inoculum density increased from 200 to 2400 spores/cm², but a directly proportional relationship was found at densities of 15-200 spores/cm². No interaction between spore concentration and germinability was noted on agar or on leaf surfaces over the range 5-2400 spores/cm². These studies of uredospore 'infection efficiency' and its variation under defined conditions provide quantitative data required for the development of reliable mathematical models of soybean rust epidemics.

OCCURRENCE OF WHITE PINE ROOT DECLINE IN WEST VIRGINIA. G. J. Meyer, Jr., D. F. Hindal, and D. O. Quinn, West Virginia University, Morgantown, WV 26506.

White pine root decline, caused by Verticillium leucosporum, was first reported on white pines in West Virginia in 1967. By 1980 it had been reported in 15 widely scattered counties. A statewide survey was conducted in 1980 and 1990, to determine the current distribution of the disease. To facilitate the survey, a slide-cassette of 10-projector dissolve process was produced and shown to County Extension Agents, Christmas tree growers, Golf Course Super., Deps. of Agriculture, Natural Resource C, and Landscapers. A questionnaire was used to produce a population of 15-200 spores/cm², which is the maximum number of lesions of the disease per lesion. As a result the disease was positively identified on white pine in seven new counties and from additional sites in six previously affected counties. The disease has now been found in natural sites, Christmas tree plantations, and landscape and soil conservation white pine plantings in 22 counties. It has not been determined whether this disease is an endemic problem for which a greater awareness has developed, or in posing a new threat to white pine in West Virginia.

Six different colony morphologies of Endothoiun parasitica were recovered from corn on American chestnut (Castanea dentata) induced by hypovirulent and virulent strains of the fungus. The soluble mycelial proteins of isolates representing these different morphological groups were compared by polyacrylamide gel electrophoresis (PAGE) in a nondissociating, discontinuous system. Protein patterns varied among the different colony types, but did not exceed intraspecific variation associated with isolates of the same morphotype recovered from naturally occurring corn macroconidia. PAGE can not be used reliably to distinguish or to identify these different morphological types.

A DIALLEL ANALYSIS OF THE INHERITANCE OF RESISTANCE TO TOMATO ANTHRACNOSE CAUSED BY COLLETOTRICHUM GLOeosporium. Anita N. Miller and Timothy Ng, Department of Horticulture, University of Maryland, College Park, MD, 20742, and T. N. Barkdale, Vegetable Laboratory, USDA, Beltsville, MD, 20705.

Six parents were used in a half diallel analysis to determine the inheritance of resistance to tomato anthracnose caused by Colletotrichum gloeosporioides. There were significant differences between selected reciprocal crosses. All possible crosses, excluding reciprocals, were planted in 1982 at two locations, Beltsville and Salisbury, MD, in a randomized complete block design. A total of 21 F1 plants per plot was placed in a shaded greenhouse and punctured inoculated with a spore suspension containing 9.6 x 10^6 spores/mL. Lesion diameters were measured 6 days later. Combined data over locations indicated significant general and specific combining abilities. Narrow sense heritability was 70%. Variances and covariances plotted by Hayman's graphic analysis indicated incomplete dominance.

CROSS PROTECTION STUDIES WITH TOMATO ASPERMY VIRUS. H. E. Nollie and Joseph Kutu, USDA, ARS, Beltsville, MD.

Crown protection studies showed that a mild strain of Tomato Aspermy Virus (TAV) has the potential to protect inoculated tomato seedlings against infection by a severe TAV strain. Inoculation of 10 tomato selections with this mild strain produced only mild symptoms that were marked by the time infected plants began fruiting. Rutgers seedlings inoculated with the mild strain were challenged with the type strain of TAV (ATCC P1572) at seven days after inoculation, fourteen days after inoculation, and twenty-one days after inoculation exhibited symptoms varying from severe to mild. Complete protection was achieved when twenty-five days elapsed between the initial inoculation with the mild strain and the challenge inoculation with the severe strain. Yield trials conducted in field plots showed that plants inoculated with the mild TAV strain had total yields comparable to un inoculated plants; however, ripening of inoculated plants appeared to be delayed slightly.

SUPPRESSION OF DAMPING-OFF AND BLIGHT OF SNAPBEAN CAUSED BY SCLEROTIUM ROLFSEI USING TRICHOSTERMA SUPP. AND GLIOCLADIUM VIRÆNS. C. C. Papavizas and J. A. Lewis, USDA, ARS, Beltsville, MD, 20705.

Two hundred fifty wild strains of Trichoderma hamatum, T. harzianum, T. viride and Gliocladium virens and 34 mutants of T. harzianum and T. viride were screened for their ability to suppress damping-off and blight of snapbean caused by Sclerotium rolfsii. Conidia of the antagonists produced on VR-agar were added to germinating seedlings at the seedling conidial per g of soil without a food base. Seeds of snapbeans (cv. Blue Lake) were planted 1 wk after addition of the antagonists to soil. Plants were evaluated for damping-off and blight 6 wk after planting. Five strains of T. harzianum, two strains of T. hamatum, and one strain of T. viride reduced the disease 40% to 70% depending on the strain of the antagonist and pathogen used. The extent of biological control also depended on the inoculum density of the pathogen and antagonists. Chlamydospores and mycellial fragments containing chlamydospores of T. hamatum were as effective in suppressing S. rolfsii as conidial preparations.

INCIDENCE OF SCLEROTIUM BLIGHT OF SOYBEAN. P. M. Phipps, Tidewater Res. Ctr., VPI & SU, Suffolk, VA 23437.

Excess and Forrest soybean were grown in plots (1.8 x 10.7 m) with rows spaced 25 and 76 cm apart. Incidence of Sclerotinia blight, caused by Sclerotium sclerotiorum and S. minor, was determined at harvest. Threshold for 30% percent of visible infections. Aphotheca of only S. sclerotiorum were found in high numbers beneath areas shaded by dense foliage. Stem lesions were from 1 mm up to 0.5 cm deep. The blight line indicating infection by aphotheca, Esses, yielded 2628 and 2191 kg/ha, and Forrest yielded 2830 and 2373 kg/ha in 25 and 76 cm rows, respectively. Lesion centers of Sclerotinia blight plot averaged 2.5 and 1.7 in Esses and 22.1 and 15.9 in Forrest planted to 25 and 76 cm rows, respectively. As planting rates increased from 2 to 6 seed/30 cm in 25 cm rows and from 6 to 12 seed/30 cm in 76 cm rows, disease incidence tended to increase. Results suggest that soybean cultivars with dense foliage (i.e. Forrest) planted in high populations may result in increased incidence of Sclerotinia blight.

GENETICS OF REACTION TO MAIZE DWARF MOSAIC VIRUS STRAIN A IN FOUR RESISTANT CORN INBRED LINES. C. W. Roane, S. A. Tolin and H. S. Aycock, Dept. of Plant Path. & Phyisol., Dept. of Agron., VPI & SU, Blacksburg, VA 24061.

High degrees of resistance to maize dwarf mosaic virus strain A (MDMV-A) occur in corn inbred lines B86, OH175, O.H175, and 86. When B86 inbreds were crossed with the highly susceptible inbred line Va50 and their F1 and F2 progeny were inoculated with MDMV-A, all F1 plants were resistant and F2 progeny segregated into resistant and susceptible classes consistent with the hypothesis that a single dominant gene condition exists in each inbred. When the following crosses were made, no susceptible segregates appeared in the F2: B86 X OH175, B86 X OH175, Va50 X OH175, and Va50 X B86, and OH175 and B86. We conclude that each of the resistant inbred lines has a single dominant gene controlling resistance and that the genes are allelic. This greatly facilitates transfer of MDMV-A resistance in breeding programs.


A study was undertaken to clarify the relations among genes for peanut mottle virus (PMV) resistance present in the three closely related soybeans Glycine max (L.) Merr., cultivars 'Arskoy', 'Dorman' and 'York', and two unrelated cultivars 'CHS' and 'Shore'. Parental and progeny plants at the V2-3 stage were inoculated with the PMV isolate V74S. From the data obtained, it was determined that York and CHS have genes at a common locus. Progenies segregated into dihybrid ratios when CHS was crossed with Dorman, Shore or York. Genes in Dorman and 'Peking' have previously been labeled ym and yu, respectively. It was therefore concluded that ym occurs also in Arskoy, Shore, and York and that the gene in CHS is at a third locus.


Polyphyla graminis Led., a root parasite of barley (Hordeum vulgare L.), oats (Avena sativa L.), rye (Secale cereale L.) and wheat (Tritium aestivum L.), has been found in seven Virginia counties on barley, rye, wheat, corn (Zea mays L.), red fescue (Festuca arundinacea Schreb.) and bromegrass (Bromus ciliatus L. Pers.). The fungus is a vector of wheat spindle streak virus (WSSV) and wheat soil-borne mosaic virus (WSBM) and has been found in roots of oats infected with wheat soil-borne mosaic virus (WSBM). The occurrence of P. graminis in Hanover, Richmond and Westmoreland counties is Important since wheat with WSSV had previously been found there. The significance of corn as a host is emphasized by the occurrence of WSSV in both corn and wheat. This is the first report of P. graminis on corn, bromegrass and red fescue.

EVIDENCE FOR INVOLVEMENT OF ACTIVE OXYGEN IN TOBACCO RESISTANCE TO A BACTERIAL PATHOGEN. M. A. Roy and M. Sasser, University of DE, Newark, DE 19711.

Selected enzymes and compounds known to degrade or 'trap'
superoxide, singlet oxygen, triplet oxygen or hydroxyl radicals were used to determine the possible involvement of active oxygen in plant disease resistance. The compounds were added to inocula of Pseudomonas syringae pv. syringae (10^8 cfu/ml final concentration in CaCl₂ buffer) immediately prior to injection into the non-host plant Nicotiana tabacum 'MD 201'. Bacterial populations were quantitated by respiration. Superoxide dismutase (dismutes superoxide), β-carotene (singlet trap), sodium ascorbate (antioxidant) and sodium linoleate caused increases in bacterial population levels when compared to the control. Control (free radical) did not affect bacterial populations. Results suggest that inhibition of bacterial growth in an incompatible host plant involves some forms of active oxygen.

**RESISTANCE TO BROWN ROT (MONILIA FRUCTICOLA) IN SWEET CHERRY (PRUNUS AVULUS L.)**

Ralph Spurrier and Leonard Gilreath, USDA, Appalachian Fruit Research Station, Kearneysville, WV 25430.

Fruit were collected from 12 cultivars of sweet cherry in an unsprayed orchard. Fruit were exposed to each of 3 treatments: unwashed; washed and inoculated with 10³ spores/ml of *Monilia fructicola*; and washed, wounded and inoculated. Disease severity was rated following 3 days in a moist chamber. Unwounded fruit exhibited a wide range in infection severity varying from 50% of 'Kaiserjen Eugenie' fruit infected and 75% of 'La Belle' berries completely rotted. All wounded fruit were severely infected. While resistance to brown rot is largely dependent upon the integrity of the epidermis, variation in infection of unwounded fruits and berries that show some evidence of the epidermis itself may also be responsible for infection severity. Cultures of *M. fructicola* spores on cherry juice or cherry epidermis agar did not suggest the presence of a water soluble fungal growth inhibitor or promoter in fruit of the cultivars tested. Susceptibility was not associated with brix.

**EFFECTS OF SDI-APPLIED CADMIUM ON NEMATODE POPULATIONS WITHIN AN EXPERIMENTAL ORCHARD.**

L. J. Slana and R. F. Kocurak, USDA, Appalachian Fruit Research Station, Kearneysville, WV 25430, and Fruit Research Laboratory, BAH, Beltsville, MD 20705.

In February 1981, a cadmium chloride solution (CdCl₂) was incorporated into the upper 15 cm of a Galtown sandy loam soil at Beltsville, MD, at rates of 0, 5, and 10 ppm. Two months later apple, peach, pear, and plum were planted in this soil using a randomized complete block with 4 replications. In August 1982, 120 soil samples were taken and nematodes extracted, counted, and identified. Correlation coefficients indicated Tylenchus and Paratylenchus populations, which were sporadically found throughout the test site, did not correlate with Cd concentrations. Most uniformly occurring populations of *Aphelenchoides*, *Ditylenchus* species, and *Heterodera* species were associated with Cd corcs.; 5 ppm Cd slightly decreased nematode numbers, while 10 ppm decreased nematode numbers by 25-30%. Results indicated that *Aphelenchoides* and *Heterodera* species were the most frequently found nematodes within the orchard and nematode populations were decreased by application of inorganic cadmium.

**EUROPEAN RUST FUNGI PATHOGENIC TO COLLECTIONS OF LEAFY SPURGE FROM THE UNITED STATES.**


Twenty-one isolates of rust fungi (16 *Melampyrum spp.*, 3 *Urginea spp.*) were collected in 1982 from five species of *Euphorbia* in Switzerland, Austria, Hungary, and Romania. Four of these isolates of *Melampyrum* have been maintained under greenhouse conditions for several generations. One of these isolates caused infection of *E. canum*, a weed species, and *E. canum* leafy spurge from Europe by European pathogens provides a basis for optimism that rust fungi may be used for biocontrol of this noxious weed.

**OCURRENCE OF FIRE BLIGHT IN COMMERCIAL PEAR SEEDLING ROOTSTOCKS FOLLOWING GROOMING WITH SYMPTOMLESS SCIONWOOD.**

T. van der Zwal, USDA, Appalachian Fruit Research Station, Kearneysville, WV 25430.

Approximately 600 seedlings in a commercial nursery were budded in early August with apparently healthy scionwood collected from 'Starkrimson' trees severely affected with fire blight. Budwood was collected from an apparently healthy tree and at distances of 2.5 - 30.0 cm and 1.0 - 3.0 m away from blighted branches on diseased trees. Following surface sterilization in 3% sodium hypochlorite for 3 min., equal parts of the two samples were inoculated by thermotherapy (50°C for 15 min.), the removed bud dipped for 1 min. in 100 ppm streptomycin, or were left untreated. In early December, three seedlings in the nursery with buds from untreated, symptomless scionwood were found seriously blighted. Though rare, the spread of endophytic *E. amylovora* from symptomless, surface sterilized branches to commercial rootstock may have serious implications in the fruit tree nursery trade.
I. van der Zet and R. L. Bell, USDA, Appalachian Fruit Research Station, Kearneysville, WV 25430.

Approximately 400 seedlings from 5 controlled crosses were divided into groups of short (mean 32.4 cm) and tall (mean 50.9 cm) plants. One half of each group was artificially inoculated with a suspension of E. amylovora at 10^3 cell/ml and the other half with 10^6 cell/ml. Each plant was injected by hypodermic needle with approximately 0.05 ml of inoculum. The higher inoculum concentration resulted in almost twice the incidence of blight (7% versus 39% of plants blighted) and a slight but non-significant increase in the absolute length and percent of plant blighted. Absolute length of blighted terminal was not affected by plant height but the same amount of blight (approx. 11 cm) represented significantly more of the smaller plants (34% versus 21%). Absolute length of blighted shoot may be a better measure of plant resistance than percent of plant blighted, at least in pear seedlings more than 25 cm tall.

Errata

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Two abstracts by A. Hagan and P. O. Larsen were inadvertently omitted from the abstracts of papers presented at the 1981 Annual Meeting of The American Phytopathological Society, which were published in the August 1981 issue.

DIURNAL AND SEASONAL PERIODICITY OF AIRBORNE DRECHSLER A POAE CONIDIA OVER KENTUCKY BLUEGRASS. Austin Hagan, Auburn University, AL 36849 and P. O. Larsen, Ohio State University, Columbus, OH 43210

Airborne Drechslera poae conidia were collected over Kentucky bluegrass with a Kramer-Collins intermittent spore trap and a Burkard 7 day continuous spore trap in 1979 and 1980. Relative humidity, rainfall, and leaf wetness were recorded from April to November. Peak concentrations of airborne D. poae were observed in late May and June. Infrequently, moderate releases of conidia were observed in April or early May. Very few conidia were trapped from July to November. The diurnal discharge of D. poae conidia which peaked between 1200 to 1400 hours coincided with abrupt decreases in the moisture levels in the turf microclimate. Few conidia were collected in the late evening or early morning. Negligible releases of conidia were noted during periods of prolonged leaf wetness or high relative humidity.

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On page 580. in the article entitled “Association of Pseudomonas syringae pv. lachrymans and Other Bacterial Pathogens with Roots” by C. Leben, in the right column footnote b of Table 2 should have read:

b“Wet” = -0.1 bar; “moderately wet” = -0.1 bar. See text.