

# Abstracts of Presentations at the 1989 Annual Meeting

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Alphabetized by first author's last name.

CHANGES IN PINE CELL NUCLEI IN INCOMPATIBLE REACTIONS WITH CRONARTIUM QUERCUUM F. SP. FUSIFORME. Vernon Ammon, and Charles H. Watkinson. Department of Plant Pathology and Weed Science, P. O. Drawer PG, Mississippi State, MS 39762, and So. Forest Exp. Sta., Gulfport, MS 39505.

Cellular changes were detected in rust resistant slash pine seedlings nine days after inoculation with the fusiform rust fungus. Nuclear alterations were observed in cortical parenchyma cells 14 to 21 days after inoculation. Hyphae grew into the outer cortex and then stopped. Haustoria and tannin accumulations were seen only at the site of penetration. Reddish-purple lesions occurred on affected stem tissues, but galls failed to develop. Dying cortical cells were enlarged and many nuclei did not stain like those in unaffected cortical cells. Basophilia of chromatin were faded and stained abnormally. Pyknosis, nuclear vacuolization and swelling of nuclei were common. In dying cells, nuclei and associated nucleoli often could not be observed, necrotic cells stained acidophilic and lacked nuclei, and a variety of pigments were produced.

EVALUATION OF A NEW RAPID IMMUNOASSAY FORMAT FOR THE DETECTION OF PYTHIUM AND RHIZOCTONIA SPECIES IN TURFGRASSES. B. Bernstein and R. A. Haygood. Department of Plant Pathology and Physiology. Clemson University, Clemson, SC 29634.

A rapid, field usable, ELISA format (Agri-Diagnostics Assoc., 2611 Branch Pike, Cinnaminson, NJ 08077) was compared with isolations for the accurate detection of two fungal pathogens of turfgrasses. Soft basal sheaths of St. Augustine-grass and centipedegrass infected with Rhizoctonia solani AG2T2 and blighted leaves of tall fescue infected with Pythium aphanidermatum were tested. An average of 9 minutes was required to conduct immunoassays after plant tissues were collected and ground up. Isolation and identification of these pathogens in pure culture confirmed the accuracy of the rapid ELISA format. No false positives or negatives were obtained in 30 assays.

WHEAT REDUCTIONS DUE TO POWDERY MILDEW AND LEAF RUST ON WINTER WHEAT IN NORTH CAROLINA. K. L. Bowen and S. Leath, USDA-ARS, Department of Plant Pathology, North Carolina State University, Raleigh 27695-7616.

Plots of the winter wheat cvs. Saluda and Coker 983 were established at two locations in the fall of 1987 to determine yield reductions caused by Erysiphe graminis f. sp. tritici (Egt) and Puccinia recondita f. sp. tritici (Prt). Plots were arranged in five randomized complete blocks. Disease levels were established by applications of triadimefon and two inoculations of Prt. At one location, mildew symptoms were observed in February during tillering in Saluda and tillers/m row were reduced 9.6% in untreated plots compared to disease-free plots. No rust developed at this location but kernels/head, 500 kernel weight, and yield were reduced 2.4, 6.4, and 10.5%, respectively, in untreated plots. At the other location, where rust epidemics became severe, only 500

kernel weights and yields were reduced. Effective disease control also was observed in Coker 983 plots, but consistent yield effects were not detected.

EFFECTS OF OILS AND FUNGICIDE FORMULATIONS ON DEPOSITION OF CHLOROTHALONIL APPLIED VIA SPRINKLER IRRIGATION TO PEANUT FOLIAGE. T. B. Brenneman, Plant Pathology Dept., H. R. Sumner, IBPMRL, USDA/ARS, Coastal Plain Station, Tifton, GA 31793, and G. W. Harrison, Fermenta Plant Protection, P.O. Box 70665, Albany, GA 31707.

Chlorothalonil (CTL) was applied at 1.25 kg/ha to peanut foliage via chemigation to compare formulations with and without oil additives (SoyOil or IIN nonemulsifiable oil) with regard to fungicide deposition and retention. Treatments were applied in 25.4 kL/ha of water. Leaf discs were collected before treatment and at 0, 5, 9 and 14 days posttreatment and surface stripped with toluene. Addition of either oil to Bravo 720 resulted in highest initial deposition followed by Bravo 500 and Bravo 720 alone. Rates of CTL dissipation, as found by regression analysis, were highly correlated with initial concentrations ( $r=0.97$ ). By day 14, concentrations of CTL had decreased by more than 93% in all treatments.

A LEAF SPOT AND BLIGHT OF ABELMOSCHUS MOSCHATUS CAUSED BY A PATHOVAR OF PSEUDOMONAS SYRINGAE. C.S. Brown, S.M. McCarter, and J.W. Olive. Dept. Plant Pathology, Univ. of Georgia, Athens, 30602.

A bacterial leaf spot and blight was observed on greenhouse plantings of Abelmoschus moschatus, an ornamental bedding plant recently introduced from India. A fluorescent pseudomonad was consistently isolated from diseased tissue, and Koch's postulates were fulfilled. Optimum temperature for disease development was 20-25 C. The bacterium tested +, -, -, + for levan, oxidase, potato soft rot, arginine dihydrolase, and tobacco hypersensitivity (LOPAT). It utilized erythritol, L(+)-tartrate, and sucrose but not D(-)-tartrate and DL-lactate. In a host range study in the Malvaceae, the bacterium caused foliar lesions on hibiscus, okra, and cotton. Nine strains of P. s. pv. syringae from okra and eight other hosts and a strain of P. s. pv. hibisci were not pathogenic on A. moschatus. The Abelmoschus strain appears to be closely related to but pathologically different from P. s. pv. hibisci. Streptomycin was the best of four bactericides tested for control.

RELATIONSHIPS AMONG VIRUSES DEDUCED FROM OUCHTERLONY SEROLOGICAL REACTIONS. P. M. Burrows and O. W. Barnett, Clemson University, Clemson, SC 29634.

There is a logical connection between various types of precipitin reaction lines, exhibited in an Ouchterlony gel diffusion test, and the presence or absence of presumptive common epitopes on the antigens tested. The minimum number of distinct epitopes necessary to account for observed reactions can be deduced for each antiserum. Minimal epitope compositions of antigens, and the complementary paratope compositions of antisera, are deducible after combining results from several antisera. Epitope compositions can be converted to a pair-wise similarity index for hierarchical clustering of relationships among antigens. This method has been used to investigate relationships among antigens presented by five isolates in the Arabis mosaic virus subgroup of nepoviruses.

Camera-ready abstracts are published as they were submitted by the Division. The abstracts are not edited or typed in the APS headquarters offices.

RESOURCE ALLOCATION FOR DETERMINING PROPAGULE DENSITY OF MACROPHOMINA PHASEOLINA. C. Lee Campbell, Department of Plant Pathology, North Carolina State University, Raleigh 27695-7616.

Estimates of propagule density for soilborne fungi vary due to differences in actual population levels in soil and error associated with assays. Multi-stage sampling was conducted at two sites to optimize allocation of funds for determining propagule density of *Macrophomina phaseolina*. Four subsamples were assayed from each of four samples taken from 12 quadrats per site. Estimates of the variance component for quadrat, sample, and subsample were combined with costs (\$.10/quadrat, \$.25/sample, and \$.89/subsample) to give optimum no. of samples per sampling stage. Variance among quadrats was greater than that among samples within quadrats or subsamples within samples; ratio of variance among samples or subsamples to variance among quadrats was <0.5. Thus, the best means of allocating funds for determining density of *M. phaseolina* would be to assay one subsample from each soil sample per quadrat with the quadrat number determined by the sampling budget.

EVALUATION OF BROCCOLI CULTIVAR REACTIONS TO BACTERIAL SOFT ROT. C. H. Canaday, J. E. Wyatt, and J. A. Mullins, University of Tennessee, West Tennessee Experiment Station, 605 Airways Blvd., Jackson, TN 38301.

Broccoli cultivars with different maturities were evaluated in field studies for their reactions to bacterial soft rot caused by *Pseudomonas marginalis* pv. *marginalis* and *Erwinia carotovora*. Transplanting dates of cultivars were staggered to obtain simultaneous maturity. Overhead irrigation was used to briefly wet plants 3-5 times/day during heading to create disease conducive conditions. Only border rows were inoculated. A quantitative 0-5 scale (0=no rot; 5=100% rotted) was used to rate each head for soft rot severity at harvest. Six cultivars were evaluated in 1986, 10 in 1987, and 25 in 1988. There were significant inverse correlations between soft rot severity and days to maturity in all studies. Disease incidence and severity were consistently lowest with cv. 'Shogun' and 'Green Defender'. These two cultivars appear highly tolerant to bacterial soft rot.

EFFECTS OF CULTIVAR AND TILLAGE ON SEVERITY OF ANTHRACNOSE OF GRAIN SORGHUM. Albert Y. Chambers, Department of Entomology and Plant Pathology, University of Tennessee, Jackson, 38301.

Severity of anthracnose caused by the fungus *Colletotrichum graminicola* was greatly reduced in grain sorghum grown at Milan under no-tillage conditions compared to conventional tillage in 1985-87. Anthracnose injury was also much lower in plots of 'DeKalb DK64' than in those of 'Funk's G-522DR'. In 1988, four cultivars were evaluated in no-tillage and conventional-tillage plantings. Results were similar to the first three years. Anthracnose severity was greatly decreased in no-tillage plots, and cultivars varied in reaction to the disease. Funk's G-522DR and 'Paymaster R1090' had high levels of injury while DeKalb DK64 and 'Paymaster 1022' had low levels. In two other experiments in 1988, disease severity was again much lower in no-tillage plots of Funk's G-522DR than in conventional-tillage plots. However, yield increases did not result from reduced anthracnose injury in all four years, and moisture content of grain from plots with less disease was 1-2 percent higher.

A HIGHLY SELECTIVE MEDIUM FOR ISOLATING XANTHOMONAS CAMPESTRIS PV CAMPESTRIS FROM CRUCIFER SEEDS. C. J. Chang<sup>1</sup>, R. Donaldson<sup>1</sup>, M. Crowley<sup>2</sup>, and D. Pinnow<sup>2</sup>. <sup>1</sup>Dept. Plant Pathology, University of Georgia and <sup>2</sup>Seed Laboratory, Georgia Department of Agriculture, Griffin, GA 30223-1797.

CS20ABN medium, containing soy peptone, tryptone, glutamine, histidine, dextrose, starch, (NH<sub>4</sub>)<sub>2</sub>HPO<sub>4</sub>, KH<sub>2</sub>PO<sub>4</sub>, MgSO<sub>4</sub>·7H<sub>2</sub>O, bacitracin, and neomycin, was developed for isolating *Xanthomonas campestris* pv. *campestris* (Xcc) from crucifer seeds. Samples of 50,000 seeds per lot were washed for 2 hours, the washings centrifuged, and the resuspended pellets were diluted to 10<sup>-2</sup>, and 0.1 ml was pipetted onto NSCA, NSCAA, BSCAA (Phytopath. 74:268-272) and CS20ABN. Saprophytic bacteria were too numerous to count and overgrew Xcc on all media except CS20ABN where CFU's ranged from 66-97 per plate at 10<sup>-1</sup> and 37-259 at 10<sup>-2</sup>. Moreover, 59 to 100% of recovered colonies on CS20ABN were Xcc and colony size was 4-6 and 5-10 times that on NSCAA and NSCA, respectively.

INFLUENCE OF CALCIUM IN THE FRUITING ZONE ON THE ELEMENTAL COMPOSITION OF PEANUT PERICARPS UNDER GNOTOBIOTIC CONDITIONS. T. E. Clemente and A. B. Filonow. Department of Plant Pathology, Oklahoma State University, Stillwater, OK. 74078.

Four plants of peanut cv. 'Early Bunch' in 2000 cc pots were grown in a plastic isolator under gnotobiotic conditions. Pegs from each plant were randomly placed in 100 cc cups filled with an acid-washed vermiculite/sand (1:1;v/v) mix containing calcium sulfate equivalent to 0, 280, 560, or 1120 kg gypsum/ha. At harvest, 2 of 20 pericarps at 0 kg/ha, and 1 of 24 pericarps at 280 kg/ha had surface discoloration of 20-75%. All other pericarps were not discolored. Mean calcium content in pericarps was 0.09-0.39%. Pericarp calcium was positively correlated (0.71) with the amount of calcium sulfate added. A significant (P=0.05) difference among calcium in pericarps was only found between 0 and 1120 kg/ha. Magnesium content in pericarps was positively correlated (0.79) with pericarp calcium. Variation occurred in magnesium and potassium contents in pericarps across treatments, but no significant differences were found.

PROCEDURES FOR HISTOCHEMICAL LOCALIZATION OF PHENOLICS IN PECAN LEAVES. S. V. Diehl, C. H. Graves, Jr. and P. A. Hedin. Dept. of Plant Path. & Weed Sci. and Crop Sci. Res. Lab, USDA, MS State, MS 39762.

Localization and quantification of juglone, isoquercitrin and condensed tannins from pecan can be accomplished with use of two separate stains and a microspectrophotometer. Condensed tannins were detected with butanol-HCl (95:5) heated to near 100 C over boiling water. Juglone and isoquercitrin were detected by the Hoepfner-Vorstatz test. Standard curves of each compound were generated using a light path of either 0.02, 0.1 or 1 mm. In palisade parenchyma leaf tissue of greenhouse grown seedling pecan, the concentrations of juglone, isoquercitrin, and condensed tannins were 26.6 µg/µl, 11.0 µg/µl and 40.6 µg/µl, respectively. Previous studies have shown that juglone, isoquercitrin and condensed tannins inhibit growth of *Cladosporium caryigenum* in vitro at 0.05 µg/µl, 4 µg/µl and 4 µg/µl, respectively. Thus, in situ concentrations of these phenolics should be sufficient for fungal inhibition.

BIOLOGICAL AND CHEMICAL CONTROL OF OAK WILT. T. H. Filer, Jr., Southern Hardwoods Laboratory, USDA Forest Service, P. O. Box 227, Stoneville, MS 38776

Replicated field plots established in 1985 at Yoakum, Texas contained 375 live oak trees. Treatments were made bi-monthly with 5 replicated plots per date. Treatments consisted of injection of *Pseudomonas cichorii* into the oak or application of propiconazol to soil under tree dripline. In 1986 treated and check trees were challenged by inoculating all trees with *Ceratocystis fagacearum*, causal organism of oak wilt. Treated trees showed significantly less disease in 1987 than checks. Trees treated with propiconazol had significantly less disease than bacteria treated trees and bacteria treated trees had less disease than check in 1988. Bioassay of tree samples verified uptake and distribution of propiconazol and bacteria in healthy trees. Data suggest that the bacteria was not taken up and distributed in all trees and method of introducing *P. cichorii* into the tree needs improvement.

EFFECT OF *GLOMUS INTRARADICES* AND *MELOIDOGYNE ARENARIA* ON GROWTH OF PEANUT CULTIVAR FLORUNNER. R. K. Garber, J. L. Starr, and R. A. Taber. Department of Plant Pathology and Microbiology, Texas Agricultural Experiment Station, Texas A&M University, College Station 77843.

A 2 x 2 factorial experiment was conducted to determine the interaction effect of *Glomus intraradices* (Gi) and *Meloidogyne arenaria* (Ma) on growth of peanut cultivar Florunner. Appropriate 25cm pots received 450cm<sup>3</sup> of Gi inoculum at planting and/or 10,000 Ma eggs 3 days after seedling emergence. Plants were harvested at 24 and 54 days after Ma introduction. At twenty-four days seedlings inoculated with Gi possessed greater shoot weights and leaf areas than seedlings inoculated with Ma or the controls. Inoculation with Ma resulted in suppression of growth compared to controls and dual inoculation with Gi and Ma was ineffective in overcoming growth suppression. By 54 days after nematode introduction leaf areas and shoot weights were over 3 times greater in seedlings receiving either Gi or both Gi and Ma. Mycorrhizal colonization did not inhibit nematode penetration of roots, but did inhibit development of pre-parasitic larvae into adults.

EPIDEMIOLOGY OF PEANUT STRIPE VIRUS (PStV) ON SOYBEAN AND LIMA BEAN. A. G. Gillaspie, Jr., J. M. Wright and M. S. Hopkins, USDA, ARS, Plant Introduction Station, Griffin, GA 30223.

Yield effects and seed transmission of PStV on *Glycine max* (soybean cvs. Bragg, Braxton, Centennial, Ransom, Tracy M, Wright) and *Phaseolus limensis* (lima bean cvs. Henderson bush, Fordhook bush) and spread of the virus from peanut to soybean were tested in a field plot at Byron, GA. Plants for the tests were air-brush inoculated 10 days after planting.

Infection was determined by symptoms and by indirect ELISA. Symptoms were observed 10 days after inoculation, and the first symptoms were observed in the spread-test soybeans 38 days later. After another 26 days, spread was observed up to 80 ft. from infected peanut and secondary spread had occurred. Significant yield reduction was observed in Henderson bush lima bean, but no reduction was observed in Fordhook lima bean or soybeans in preliminary tests. No seed transmission was observed in preliminary tests of seeds from infected lima bean or soybean.

#### GAS-LIQUID CHROMATOGRAPHY OF FATTY ACIDS FROM TOMATO STEMS USED FOR EARLY DIAGNOSIS OF BACTERIAL CANKER OF TOMATO.

R.D. Gitaitis and R.W. Beaver. Dept. of Plant Pathology, Coastal Plain Experiment Station, University of Georgia, Tifton, GA 31793

Fatty acids of tomato (H-722) stems that had terminal ends clipped with a blade contaminated with Clavibacter michiganensis subsp. michiganensis (CMM) were analyzed by gas-liquid chromatography. Anteioseptadecanoic, anteioseptadecenoic, and anteioheptadecanoic, fatty acids commonly found in CMM but not tomato stem tissue, were evident in 33.3 % and 66.7% of inoculated tomato stems after 1, 3, and 7 days, respectively. However, first signs of bacterial canker were not evident until 13-15 days after inoculation. Variability of fatty acid content during early stages of infection could be related to CMM populations which varied initially but after 7 days averaged  $1.4 \times 10^8$  colony-forming-units of bacteria/ml/cm of tomato stem tissue.

RESTRICTED TRANSLOCATION OF COWPEA CHLOROTIC MOTTLE VIRUS IN NONHYPERSENSITIVE RESISTANT SOYBEAN. B.J. Goodrick, C.W. Kuhn, and H.R. Boerma, Dept. of Plant Pathology and Agronomy, University of Georgia, Athens 30602.

Resistance in soybean plant introduction 346304 (PI) to cowpea chlorotic mottle virus (soybean strain) is related to restricted translocation of the virus. When unifoliolate leaves on 10-day-old seedlings are mechanically inoculated and incubated at 24 or 32 C, both PI and susceptible cultivar Davis develop local chlorosis and accumulate similar quantities of virions in inoculated tissue. Virus translocation to and subsequent replication in roots and new uninoculated leaves is greatly restricted in PI (0-10% as much as in Davis). When uninoculated leaves of infected PI plants are inoculated, virus accumulates to quantities similar to initially inoculated unifoliolate leaves, thus indicating no induction of resistance. Host genetic studies indicate that resistance in PI is controlled by two recessive genes. Classification of the  $F_2$  population was based on symptomatology and virus concentration.

POTENTIAL FOR BACILLUS SUBTILIS AS A BIOPROTECTANT OF COTTON SEEDLINGS IN SOIL INFESTED WITH RHIZOCTONIA SOLANI. D. R. Greenough and W. E. Batson, Dept. of Plant Pathology and Weed Science, Mississippi State University, Starkville, 39762.

Cotton seeds coated with an experimental preparation of Bacillus subtilis were planted into three soil regimes (autoclaved soil, soil from a cotton field, and autoclaved soil artificially infested with Rhizoctonia solani) and kept in controlled environment root zone chambers at 20C and 24C for 20 days. Seedlings from seed treated with B. subtilis planted in the pathogen-infested soils had better stands, showed no visible stunting, and had healthy well-developed root systems with very few lesions as contrasted with seedlings from untreated seeds planted into the same soil regimes. These findings suggest that B. subtilis may protect seedlings from R. solani.

SEASONAL VARIATION OF SYSTEMIC AGROBACTERIUM SPP. IN VITIS ROTUNDIFOLIA. D. E. Griffin and C. H. Graves, Jr., Dept. of Plant Pathology and Weed Science, Miss. State, MS 39762, and C. P. Hegwood, Jr., Truck Crops Branch Expt. Sta., Crystal Springs, MS 39059.

Surveys among symptomless muscadines (Vitis rotundifolia) suggest a widespread systemic presence of Agrobacterium spp., although the level of pathogenic forms among these is yet to be determined. A. tumefaciens has been previously demonstrated in muscadine, and new occurrences of crown gall were noted in 1988. To determine dynamics of Agrobacterium presence, 23 mature vines were sampled from the same 12 relative positions per plant five times over two growing seasons. Agrobacterium, although isolated from all plants in

the study at some time, was not consistently found in all plants at every reading nor in all positions within plants. Overall incidence, at its highest level during 1987, decreased in the fall, and continued to be comparatively low during the 1988 summer sampling periods.

STRAINS OF SUGARCANE MOSAIC VIRUS (SCMV) IN LOUISIANA SUGARCANE. Michael P. Grisham, USDA-ARS, Sugarcane Research Unit, Houma, Louisiana 70361.

The strains of SCMV found in Louisiana sugarcane during the past 10 years have been H, I, and M. Based on all samples during the period, the distribution of the strains within the sugarcane belt was as follows: eastern region H=96%, I=2% and M=2%; central region H=98%, I=1% and M=1%; and western region H=82%, I=14%, and M=4%. Strains were identified annually by inoculating differential host plants (sugarcane cvs. CP 31-294 and CP 31-588, sweet sorghum cv. Rio, and johnson-grass) with sap from diseased sugarcane plants. The highest incidence of strain I (12-13%) occurred in the western region during 1978-1982. The subsequent decline in incidence of strain I in this region corresponded with phasing-out cv. NCo 310. Strain M appeared intermittently at low levels in all areas; but in 1987 and 1988 in the western region, strain M appeared in 17 and 13%, respectively, of the samples - most often among samples of the recently released cv. CP 79-318.

INFLUENCE OF CROP ROTATION ON THE POPULATION DYNAMICS OF ROTYLENCHULUS RENIFORMIS, K.C. Hadden, and E. C. McGawley, Dept. of Plant Pathology and Crop Physiology, La. State University, Baton Rouge, LA. 70803

Population development of the reniform nematode (RN) on continuous soybean (S-S) was compared with soybean alternated on 60 d rotations with corn (S-C), grain sorghum (S-G), or wheat (S-W). Reproductive values at 300 d for the S-S, S-C, S-G, and S-W rotations were 361, 106, 75 and 94, respectively. Nematode numbers for all life stages in soil and roots were reduced significantly in the S-C, S-W and S-G rotations when compared to those in the S-S rotation. At 300 d, fresh shoot and root weights and root volume (260, 109 g and 134 ml, respectively) of soybean in the S-W rotation were significantly greater than those in the S-S rotation (165, 59 g and 80 ml, respectively). Allelopathic influences on RN were evaluated by incubating eggs in root exudates concentrated by rotary evaporation. After 12 d, 1% of eggs in corn root exudates hatched compared to those hatched in a distilled water control, suggesting a role for exudates in the population reductions observed in the S-C rotation.

SURVIVAL OF BACILLUS SUBTILIS IN ACER SACCHARUM AND A. SACCHARINUM LINER STOCK. T. J. Hall and Wm. E. Davis, School of Agriculture, Tennessee Technological University, Cookeville, TN 38505.

A serum cap technique was used to inoculate potted bare root liners (30-45 cm tall) of Acer saccharum and A. saccharinum at the full leaf stage with an isolate of Bacillus subtilis, marked with resistance to the antibiotic Rifampicin (Rf). Plants were grown in a lathe house at ambient temperature and watered as needed. After one and two complete growth periods, stems were harvested, debarked, cut serially into sections, and frozen. Each section was dipped in boiling water (1-2 sec), halved, and cultured at 24 C on media amended with Rf. Rf resistant, gram positive, spore forming bacteria having the same cultural morphology as the introduced bacterial isolate were recovered from xylem tissue above the initial wound site after one and two growth periods. B. subtilis colonized new stem tissue in both tree species. Noninoculated trees were sampled and did not contain Rf resistant, gram positive, spore forming bacteria.

INFLUENCE OF PH AND WATER STRESS ON THE SUSCEPTIBILITY OF CENTIPEDE GRASS TO RHIZOCTONIA SOLANI. R. A. Haygood, R. M. Lippert, A. R. Mazur, and L. C. Miller, Department of Plant Pathology and Physiology, Department of Agricultural Chemical Services, and Department of Horticulture, respectively. Clemson University, Clemson, SC 29634.

Centipede grass (Eremochloa ophiuroides) was grown at pH levels of 4, 5, 6, 7 and 8 on a Cecil sandy loam soil in a greenhouse. One-half of the plants were stressed by applying water only after the leaves wilted. Average soil moisture of well watered plants and stressed plants prior to each irrigation were 19% and 4%, respectively. After 3 months, all plants were watered well and inoculated with a Rhizoctonia solani AG2T2 isolate. The pH had no significant effect on disease severity at either moisture level. Disease severity ratings of water stressed grass at all pH levels were

significantly lower (ave. 16% on a 1-100 scale based on percent sheath rot) than grass grown at higher moisture levels (ave. 73%).

EFFECTS OF CULTURE FILTRATES OF TRICHODERMA SPP. ON GROWTH AND REPRODUCTION OF PYTHIUM NUNN AND PYTHIUM ULTIMUM. D. Hensley and M. Windham. Department of Entomology and Plant Pathology, Univ. of Tennessee, P.O. Box 1071, Knoxville, TN 37901-1071.

Isolates of Trichoderma koningii, T. harzianum, T. viride, and T. pseudokoningii were tested for their abilities to inhibit growth and/or stimulate reproduction of Pythium nunn (N3) and P. ultimum (N1). Culture filtrates of the isolates, sterilized by cold filtration or autoclaving, were seeded with agar plugs of N1 or N3. All filtrates tested inhibited growth of N1 and N3. Two isolates of T. viride inhibited growth and oospore formation of N1 to a greater extent than did the other Trichoderma spp. There was no difference in inhibition of growth and oospore formation with autoclaved or cold filtrates. Stimulation of reproductive structures in N1 and N3 by filtrates of Trichoderma species was not observed. Inhibition of growth of N3 in filtrates of Trichoderma reduces the possibility of integrating P. nunn with Trichoderma as an effective biocontrol management system.

PROTEIN A-GOLD LABELLING OF TWO BEAN YELLOW MOSAIC VIRUS - SUBGROUP POTYVIRUSES. H. A. Hobbs and M. R. McLaughlin, USDA-ARS, Crop Sci. Res. Lab., Forage Res. Unit, Mississippi State, MS 39762.

Protein A-gold (5 nm) labelling of two BYMV-subgroup potyviruses, clover yellow vein virus-Pratt (CYVV-Pratt) and pea mosaic virus-204-1 (PMV-204-1), was conducted with a monoclonal antibody produced to CYVV-Pratt. Virus particles in various buffers were allowed to attach to parlodion membranes on nickel grids. Virus particles appeared intact when suspended in 0.03 M sodium phosphate buffer, pH 7.35 or 0.3 M NaCl, but disassociated when in 0.05 M sodium carbonate buffer pH 9.6 or 0.1 M glycine, pH 10. With buffers in which the virus particles remained intact, heavy gold labelling of CYVV-Pratt particles occurred, but there was no specific labelling of PMV-204-1 particles. Outlines of labelled CYVV particles were irregular, while outlines of unlabelled PMV-204-1 particles were clearly delimited.

EFFECT OF WATERMELON CULTIVAR MONOCULTURE ON AGGRESSIVENESS OF FUSARIUM OXYSPORUM F. SP. NIVEUM. D. L. Hopkins, R. P. Larkin, and R. J. Lobinske, Central Florida Research and Education Center, University of Florida, Leesburg, FL 32748.

After a long-term monoculture of watermelon cultivars, most of the highly wilt-resistant cultivars had Fusarium wilt incidence levels that were similar to susceptible cultivars. When pathogen isolates were obtained from wilted plants and tested in the greenhouse, 75% of the isolates from highly resistant Calhoun Gray were highly aggressive toward all watermelon cultivars tested; whereas, only 20-25% of the isolates from moderately resistant Charleston Gray and susceptible Florida Giant were highly aggressive. Total populations of Fusarium oxysporum f. sp. niveum were similar in plots of resistant and susceptible cultivars. Monoculture of the highly resistant cultivars apparently resulted in selection for the highly aggressive race 2 of the pathogen.

REPRODUCTION OF SELECTED NEMATODE SPECIES ON ENDOPHYTE-INFECTED TALL FESCUE. C. A. Kimmons, K. D. Gwinn, and E. C. Bernard. Department of Entomology and Plant Pathology, University of Tennessee, Knoxville, TN 37901-1071.

Tall fescue (Festuca arundinacea) plants, infected (E+) or not infected (E-) with the endophytic fungus, Acremonium coenophialum, were evaluated for resistance to Pratylenchus scribneri (a lesion nematode) and Meloidogyne graminis (grass root-knot nematode) in greenhouse experiments. Presence or absence of endophyte in plants was determined with PAS-ELISA. In separate experiments, plants were inoculated with 1,200 P. scribneri adults and juveniles or 3,400 M. graminis eggs. After 15 weeks, P. scribneri were extracted from roots and soil. P. scribneri populations increased or maintained themselves on E- fescue but disappeared from E+ roots and their rhizospheres. After 8 weeks, numbers of M. graminis egg masses and eggs were significantly higher on E- fescue than on E+ fescue.

EPIDEMIOLOGICAL STUDIES OF ERYSIPIHE GRAMINIS F. SP. TRITICI IN SOUTH CAROLINA. Graydon Kingsland, Department of Plant

Pathology and Physiology, Clemson University, Clemson, SC 29634-0377.

Infection of wheat (Triticum aestivum var. Blueboy) by E. graminis f. sp. tritici (Egt) on or about 24 Feb. in the field was attributable to conidial inoculum from Egt-infected, glasshouse-grown seedlings in pots placed in field plots in 6 replicates on 2 Jan. New lesions (avg of 4, 2 and 10 per 14.1 m<sup>2</sup> on 2, 8 and 21 Mar, respectively) identified through 21 Mar were limited to a 14.1 m<sup>2</sup> semi-circle with a radius of 3 m described by the SE to NW compass points from the source of inoculum. Five lesions were detected in one control plot on 21 Mar, but none earlier. On 30 Mar disease incidence of about 8% was recorded on the plants in 28.3 m<sup>2</sup> plots around the original inoculum sources, in all control plots and in wheat 27 m downwind from the nearest known source of inoculum. These data support the hypothesis that fall and winter infection by Egt in South Carolina may supply primary inoculum in the spring.

STUDIES ON CONTROL OF ERYSIPIHE GRAMINIS F. SP. TRITICI BY TRIADIMENOL. Graydon Kingsland, Department of Plant Pathology and Physiology, Clemson University, Clemson, SC 29634-0377.

The systemic fungicide Baytan 30FL {B-(4-chlorophenoxy)-a-(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol} (triadimenol) at 21.1, 26.4 and 31.2 g (a.i.) per 100 kg of seed provided control of powdery mildew (pm) on wheat (Triticum aestivum var. 'Blueboy') seedlings in the greenhouse for 68 days, as estimated by disease severity (< 1%) and compared with severity (11%) on leaves of plants from untreated seeds. The symptoms on seedlings from treated seeds were chlorotic lesions without sporulation. Plants with high pm severity ratings produced fewer tillers than plants with low ratings (2.6 and 4.1, respectively). Severity of infection in the field was lower on plants from treated seeds (2, 28 and 10% for three years) than on plants from untreated seeds (40, 38 and 41%) through April. Grain yields (3158, 2890 and 5040 kg/ha for three years) from the plots planted with treated seeds were not significantly greater than yields (3024, 2621 and 4906 kg/ha) from the plots seeded with untreated seeds.

EFFECTS OF RIDOMIL 2E (METALAXYL) ON DISEASES CAUSED BY RHIZOCTONIA SOLANI AND ON GROWTH OF R. SOLANI AND SCLEROTIUM ROLFSSII IN VITRO. T.A. Kucharek and R.E. Cullen, Plant Pathology Dept., University of Florida, Gainesville, FL 32611.

In field tests, labeled rates (1.2-2.3 l/ha) of Ridomil applied once to the soil surface reduced the number of plants with R. solani-induced lesions (RIL). For beans and soybeans, a post-seeding, preemergent spray was made as a .3-m band (74 l/ha) along the row. For cucumber, a 1.2-m band (187 l/ha) was sprayed at first true leaf formation. In two field tests, Ridomil reduced RIL in soybean stems by 36 and 2.4% and when combined with flutolanil reductions were 48 and 27%, respectively. In beans, these reductions, respectively were 8 and 35%. Cucumber fruit with RIL (belly rot) were reduced by 52, 80, and 89%, respectively by Ridomil, flutolanil, and Ridomil plus flutolanil, respectively. In vitro, Ridomil significantly reduced the growth of two isolates of R. solani and one of S. rolfsii at 68 hr by 30, 27 and 14%, respectively, at 500 ug/ml: a dilution rate which is 16.7 and 13.2% of that used in the field for the legume and cucumber crops, respectively. Sclerotial development of S. rolfsii at 116 hr was reduced 100%.

REACTION OF PEANUT CULTIVARS TO POD ROT AND THEIR INFLUENCE ON PYTHIUM POPULATIONS IN SOIL. P. I. Lewis and A. B. Filonow, Department of Plant Pathology, Oklahoma State University, Stillwater, OK. 74078.

Peanut cvs. Pronto, Spanco, Okrun, Langley, GK-7, Florunner, Florigiant, and NC-7 were grown in two locations in Oklahoma in 1988. Pods were sampled 3 times during the season and rated for pod rot severity. Populations of Pythium spp. in field soils were estimated monthly from planting to harvest. 'Florigiant' or 'NC-7' sometimes had significantly (P=0.05) more pod rot; however, the other cultivars at both locations did not differ in pod rot. Similar results were obtained in 1987. Averaged over the season, Pythium populations in soil planted to each cultivar were not significantly different. At Ft. Cobb, Pythium populations peaked in August; however, in 1987, they peaked in July. Based on isolations, no cultivar maintained a greater population of Pythium spp. in roots. P. myriotylum was frequently isolated from rotted pods. Results suggest that 'Florigiant' and 'NC-7' may not be the choice for planting in Pythium infested soils in OK.

EFFECT OF PHOSPHORUS ON ROOT COLONIZATION AND SPORULATION BY GLOMUS ETUNICATUM ON FOUR HOST SPECIES IN SAND VERMICULITE CULTURE. H. D. Liyanage and N. C. Schenck, Department of Plant Pathology, University of Florida, Gainesville, FL 32611

Alfalfa, bahiagrass, onion and wheat were inoculated with the VA mycorrhizal fungus *Glomus etunicatum* (isolate LETC 329) and grown in acid-washed sterile sand:vermiculite (3:1, v/v) mixture. Plants were irrigated with eight P levels, 0.05, 0.1, 0.5, 1, 2, 4, 10, and 20 ppm in modified 0.1 strength Long Ashton II nitrate type solution. After 12 weeks the sporulation over P levels was bimodal with a high peak (39500-43400 spores per plant) at 0.5 ppm P and a low peak (7500-10500) at 20 ppm P in all hosts except wheat. Bahiagrass supported good sporulation in a wide range of applied P levels. Sporulation was significantly and positively correlated with colonized root length and percent colonization. Percent shoot tissue P was significantly and negatively correlated with spore production. This method provided excellent colonization and sporulation on 3 of 4 hosts evaluated and would be good for rapid multiplication of VA mycorrhizal fungi.

EFFECT OF CHEMICAL TREATMENTS ON YIELDS OF PEPPER GENOTYPES WITH DIFFERENT LEVELS OF RESISTANCE TO BACTERIAL SPOT AND POPULATIONS OF CERTAIN INSECTS. S.M. McCarter, Dept. Plant Pathology, Univ. of Georgia, Athens 30602.

Bacterial spot caused by *Xanthomonas campestris* pv. *vesicatoria* causes serious defoliation of pepper in the mountainous areas of Georgia but is less damaging in the Piedmont. At Blairsville (mountain area) weekly applications of mancozeb (1.8 g/L) + cupric hydroxide (3.0 g/L) increased yields of the highly susceptible cultivar Yolo Wonder B by 94% and the moderately resistant genotype C44-V22 by 13% but had no effect on the yield of the highly resistant genotype C44-GC. Similar results were obtained with streptomycin (1.2 g/L). At Athens (Piedmont) yields of Yolo B, C44-V22, and C44-GC were reduced 15, 30, and 31% by the mancozeb + cupric hydroxide treatment. Streptomycin increased yield of Yolo B by 12% but had no effect on yields of C44-V22 and C44-GC. The mancozeb + cupric hydroxide treatment markedly increased populations of the green peach aphid at Blairsville and fall armyworm at Athens whereas mancozeb or streptomycin alone had no effect.

RESISTANCE TO SHEATH BLIGHT IN U.S. LONG-GRAIN RICE CULTIVARS. M.A. Marchetti and C.N. Bollich, USDA-ARS, Route 7, Box 999, Beaumont, TX 77713.

Replicated yield trials were conducted on 7 rice cultivars, including 3 semi-dwarfs (SD), during 1984-1988 to quantify (1) impact of sheath blight caused by *Rhizoctonia solani* on yield and (2) varietal differences in resistance. Percent yield loss (YL) for inoculated plots was based on yields of adjacent noninoculated plots. Disease index (DI) was calculated from percentages of harvested area rated 5 (40-60% of plant height from base diseased), 7 (61-90%) and 9 (>90%)(0-9 scale). A direct correlation ( $r^2=0.744$ ) between DI and YL was described by  $YL=13.22-.95DI+.52DI^2$ . 'Rexmont' (SD) averaged a 44% yield loss, greater ( $P<0.05$ ) than yield losses in 'Gulfmont' (SD), 'Skybonnet' and 'Lemont' (SD) (31-34%). 'Leah,' 'Tebonnet' and 'Newbonnet' sustained losses of 15-22%. An  $F_6$  line (R08703196) from a cross of Leah and a Lemont sister line combined superior resistance with SD plant type and improved yield potential; it will be registered as elite germplasm.

INDUCED RESISTANCE TO FUSARIUM WILT OF WATERMELON UNDER SIMULATED FIELD CONDITIONS. R. D. Martyn and C. L. Biles. Department of Plant Pathology and Microbiology, Texas A&M University, College Station, 77843.

*Fusarium oxysporum* f. sp. *niveum* race 2 (FON-2) is pathogenic to all known watermelon (*Citrullus lanatus*) cultivars. However, greenhouse studies have shown that resistance to FON-2 can be induced by prior inoculation with an avirulent race (FON-1). To determine the efficacy of induced resistance under simulated field conditions, microplots (0.7m x 1.2m) were utilized. Three-wk-old Calhoun Gray watermelons (resistant to FON-1) were induced with *F. o. cucumerinum* (FOC) or FON-1 and transplanted 72 hr later into microplots infested with FON-2. Both induction treatments (FOC and FON-1) delayed the onset of disease symptoms; however, FON-1 provided significantly more protection throughout the season. Non-induced treatments had a disease severity rating (0-4 scale) of 3.2 with 40% dead plants, while the FOC- and FON-1-induced treatments had severity ratings of 3.0 and 2.0, with 30% and 5% dead plants, respectively. Although complete protection was not attained with the induced treatments, significant reductions in time of disease development, incidence, and severity were achieved.

TRANSMISSION OF SCLEROTINIA BLIGHT OF PEANUT FROM INFECTED SEED. H. A. Melouk and C. N. Akem. USDA-ARS, Dept. of Plant Pathology, Oklahoma State Univ., Stillwater, OK 74078-0285.

Four *Sclerotinia minor*-susceptible peanut genotypes were planted in infested plots in 1986. Disease incidence (DI)

values of 98-100% were reported for all genotypes, and *S. minor* was recovered from 12.3, 11.2, 9.6, and 6.4% of seed from cv. Florunner, TX 833841, cv. Okrun, and TX 771174, respectively. Two hundred seeds from each genotype were planted, two seeds/pot (10.5 cm dia), in a mixture of soil, peat and sand (1:2:2) by volume. Pots were placed closely on a greenhouse bench to obtain a thick canopy. Plants were watered daily and fertilized semi-monthly with 0.2%  $NH_4NO_3$  from July 8 to Oct 15, 1988. Temperature and relative humidity were monitored by a recording hygrothermograph. Typical Sclerotinia symptoms, appeared on plants in mid Sept. DI was recorded at five times, with highest DI values of 0.0, 1.0, 3.5, and 4.5% recorded for TX 833841, TX 771174, cv. Okrun, and cv. Florunner, respectively.

THERMAL INACTIVATION IN SOIL OF *MACROPHOMINA PHASEOLINA* AND *PYTHIUM IRREGULARE*. M. N. Miles and K. E. Conway. Dept. of Plant Pathology, Oklahoma State Univ., Stillwater, OK 74078.

Initial densities of *M. phaseolina* (Mp) (280 sclerotia/g soil) and *P. irregulare* (Pi) (260 oospores/g soil) were mixed separately into pasteurized sandy loam soil (pH 6.0, 1.0% organic matter) and placed as 2.0g portions (moistened or dry) into sealed glass vials. Soils were incubated either at constant temperatures of 25 (base), 40, 45, 50, 55, 60 C or were exposed to a daily 2 hr period at each temperature. At specific times, 5 randomly chosen vials were removed from each treatment and assayed for viable populations. Complete inactivation of Pi occurred in wet and dry soil in less than 2 hr at 55 and 60 C in both experiments. Inactivation time/temp for Mp in wet soil were 4 da/50 C, 6 hr/55 C, and 3 hr/60 C. In dry soil, parameters were 16 da/50 C, 8 da/55 C, and 6 hr/60 C. Under recurrent 2 hr temperature cycles, Mp was inactivated in less than 16 and 4 da in dry soil and 4 and 1 da in wet soil at 55 and 60 C, respectively. LD90 values were determined for all temperatures and times.

ONION BULB ROT CAUSED BY *GEOTRICHUM CANDIDUM* IN TEXAS. M. E. Miller, Texas Agricultural Experiment Station, Weslaco 78596, R. A. Taber, and L. M. Pike, Texas A&M University, College Station 77843.

*Geotrichum candidum* Link: Fr. (telemorph *Galactomyces candidum* (Butler and Petersen) Redhead & Mallock) was isolated from rotting bulbs of onion (*Allium cepa* L.) cv. Texas Grano 1015Y (TG 1015) in south Texas. A watery soft rot started on the bulb neck and progressed down the outer scale. TG 1015 bulbs injected with 0.5 ml of a 30,000 conidia ml<sup>-1</sup> aqueous suspension of the isolate developed typical symptoms within 3 days. Taxonomic distinction among *Geotrichum* species is currently based on both morphological characteristics and growth rates on different carbon sources. Although growth of this isolate on L-arabinose, lactose, raffinose, salicin, and sucrose varies from *G. candidum* isolates from citrus, combined characteristics suggest that the onion isolate should be assigned to this species.

EPIDEMIOLOGICAL IMPORTANCE OF SIX SOLANACEOUS WEED HOSTS IN THE TOBACCO ETCH VIRUS/BELL PEPPER PATHOSYSTEM. F.W. Nutter, Jr. and C.W. Kuhn, Department of Plant Pathology, University of Georgia, Athens 30602.

Of the epidemiological components studied in the tobacco etch virus (TEV)/pepper/aphid/weed host pathosystem, factors involving the weed hosts are the least understood. Using ELISA for diagnosis, TEV incidence was monitored in six solanaceous weed species throughout the cropping season. These included: *Datura stramonium* L., *Nicandra physalodes* L., *Physalis angulata* L., *P. virginiana* Mill., *Solanum carolinense* L., and *S. nigrum* L. Important weed component factors were: (i) annual vs perennial life strategy, (ii) time of emergence of the weed populations, (iii) TEV incidence in weed populations at pepper transplant time, (iv) aphid preferences for specific weed species, and (v) the rate of spread of TEV in naturally occurring weed host populations. TEV disease epidemics progressed faster when weeds were planted in the same plot arrangements as experimental pepper plots than in naturally occurring weed populations.

DISEASE SEVERITY AND EPIDEMIC COMPONENTS OF *LEPTOSPHERULINA* LEAFSPOTS ON ALFALFA AND WHITE CLOVER. O. M. Olanya and C. L. Campbell, Dept. of Plant Pathology, North Carolina State University, Raleigh, 27695-7616.

Isolates of *Leptosphaerulina briosiana* from alfalfa and *L. trifolii* from white clover were pathogenic on both alfalfa and white clover. Slightly higher disease severity occurred with both species at 15 and 22 C than at 30 C. Incubation period (3-

4 da) on intact plants and latent period (14-17 da), infectious period (18-21 day), sporulation rate, and date of peak sporulation on detached leaves were similar for all pathogen-host combinations. Temperature during disease development did not affect latent or infectious period. Sporulation did not appear to be related to level of disease severity. Total number of ascospores ejected 2 wk after leaf detachment was slightly higher on alfalfa inoculated with *L. briosiana* than on clover inoculated with *L. trifolii*. Sporulation occurred in a series of peaks over time indicating a possible difference in maturity of pseudothecia on senescent leaves; 80% of all ascospores were ejected within 7 da of leaf detachment.

PRESENCE OF SOYBEAN CYST NEMATODE RACE 5 IN MADISON COUNTY, ALABAMA. R. P. Pacumbaba, Department of Plant and Soil Science, Alabama A&M University, Normal, AL. 35762.

Race determination of soybean cyst nematode (SCN), *Heterodera glycines*, indicated that race 3 was present in Huntsville (Madison County) and Scottsboro (Jackson County), but absent in the Tallassee (Elmore County) and Marion Junction (Dallas County) areas. Race 5 was identified for the first time in Madison County, Alabama. The size of nodules of soybean cultivars Essex and Lee grown in non-SCN-infested soil was significantly bigger compared with the size of nodules of the same cultivars grown in SCN race 5 infested soil. The number of nodules of the same soybean cultivars grown in SCN race 5 infested soil was significantly more than the number of nodules of the same cultivars grown in non-SCN-infested soil. The yields of Essex and Lee grown in non-SCN-infested soil were significantly higher than the yields of the same soybean cultivars grown in SCN race 5 infested soil. Soybean nodulation seemed to be influenced by soybean cultivars, rhizobium strains, and races of SCN.

PRIMARY INFECTION LOCI OF TWO VIRUSES TRANSMITTED BY LEAF-FEEDING BEETLES. C. Patterson and R. Gergerich, Dept. of Plant Pathology, Univ. of Arkansas, Fayetteville, AR 72701.

Fluorescent-labelled antibodies were used to detect the primary infection loci of two beetle-transmissible viruses, southern bean mosaic (SBMV) and bean pod mottle (BPMV). Transmission of SBMV by *Ceratomyza trifurcata* (Forst) to *Phaseolus vulgaris* L. 'Black Valentine' resulted in detectable fluorescence in veins radiating from the feeding site, but not in portions of the vein adjacent to it. The fluorescence was limited to vein cells even at eight days post-inoculation. When BPMV was transmitted in the same manner, the fluorescence was detected in cells adjacent to the feeding site. Although the initial fluorescence was located in the veins leading from the feeding site, it eventually spread to mesophyll cells surrounding the fluorescing veins. These results suggest that BPMV and SBMV, two beetle-transmissible viruses from different virus groups, differ in the manner in which they establish infection following beetle transmission.

EFFECT OF NITROGEN SOURCE AND LEVEL ON THE SEVERITY OF STRAWBERRY ANTHRACNOSE CROWN ROT. Barbara J. Smith, USDA-ARS, Small Fruit Research, P. O. Box 287, Poplarville, MS 39470

The influence of N source on the severity of anthracnose crown rot (causal fungus=*Colletotrichum fragariae*) on strawberry was investigated by applying N from 7 sources [ $(\text{NH}_4)_2\text{SO}_4$ ,  $\text{NH}_4\text{Cl}$ ,  $(\text{NH}_4)_2\text{HPO}_4$ ,  $\text{NH}_4\text{NO}_3$ ,  $\text{NaNO}_3$ ,  $\text{KNO}_3$ ,  $\text{Ca}(\text{NO}_3)_2$ ] at 3 rates (0, 40, and 160 ppm) to strawberry plants grown in 10 cm pots. The plants were fertilized 3 times weekly for 6 wks with a complete nutrient solution containing the N treatment, and inoculated with  $1.5 \times 10^6$  conidia/ml of *C. fragariae*. Each plant was rated for disease severity (DS) on a scale of 0 to 6. Plants receiving 160 ppm N were more susceptible (DS=4.7) than plants receiving 0 and 40 ppm N (DS=2.4, 2.7). Among plants receiving 160 ppm N, those treated with  $\text{Ca}(\text{NO}_3)_2$  were more resistant (DS=2.9) than all others, and plants treated with a nitrate N source including  $\text{NH}_4\text{NO}_3$  were more resistant than plants receiving N from other ammonium sources. There was no difference in DS due to N source among plants receiving 40 ppm N.

USE OF FATTY ACID PROFILES TO IDENTIFY STRAINS OF *XANTHOMONAS CAMPESTRIS* PV. *CITRI* FROM THE CITRUS CANCKER EPIDEMIC IN FLORIDA. R. E. Stall and N. C. Hodge. Plant Pathology Dept., Univ. of Florida, Gainesville, FL 32611.

Fatty acids from strains of the citrus canker bacterium were separated by gas chromatography and the profiles were compared with those from known bacteria using the Hewlett-Packard Microbial Identification System (MIS). All strains were identified as *Xanthomonas campestris*. Of 77 strains from the Nursery canker, 52% and 22% were identified as pv.

*vignicola* and as pv. *alfalfae*, respectively. Of 25 strains from the Asiatic canker, 48% and 36% were identified as pv. *malvacearum* and as pv. *manihotis*, respectively. Since the similarity indices of the identifications were low (<0.75), the strains isolated in Florida were different from those cataloged in the MIS Library. A new library was generated with the MIS Library Generation Software for the strains from Florida. Each kind of strains had different profiles of fatty acids. Strains from each type of canker were identified correctly (100%, with similarity indices >0.85) when 32 strains were tested with the new library.

BIOLOGICAL CONTROL OF RHIZOCTONIA SOLANI AG-2 TYPE 2 IN A CORN-SNAP BEAN-PEANUT ROTATION IN MICROPLOTS. Donald R. Sumner and D. K. Bell, University of Georgia, Coastal Plain Experiment Station, Tifton, GA 31793-0748.

Field microplots were noninfested or infested separately with *Rhizoctonia solani* anastomosis group (AG) 2 type (T) 2, and AG-2T2 plus *Rhizoctonia*-like binucleate CAG-2, CAG-4, or CAG-5; *Laetisaria arvalis*; or an unidentified orange basidiomycete (OB) 12 April 1985. Microplots were planted to a corn-snap bean double crop in 1985, peanut in 1986, and corn-snap bean in 1987. Crown and brace root rot (CBRR) was decreased and foliage weight increased by CAG-4 in 5-wk-old plants in 1985 in infested soil. There were no differences in grain yield in infested soil, and all corn in infested soil yielded less than corn in noninfested soil. In 1987 there were no differences in CBRR among treatments, but grain yield in CAG-5 and OB treatments was similar to noninfested soil, and greater than in soil infested with AG-2T2. Some of these indigenous soil fungi have the potential of reducing CBRR.

FUNGAL DEVELOPMENT IN SUSCEPTIBLE AND RUST RESISTANT PEARL MILLET. J. Taylor, and C. W. Mims, Department of Plant Pathology, University of Georgia, Athens, GA 30602.

Fungal development in leaves of pearl millet (*Pennisetum americanum*) inoculated with urediniospores of the rust fungus *Puccinia substriata* var. *indica* was monitored using epifluorescence light microscopy and transmission electron microscopy. In a susceptible cultivar (Tift 23DB) the fungus colonized the tissue extensively and produced uredinia by 8 days after inoculation. In a moderately resistant cultivar (86-8770) fungal growth was retarded and accompanied by visible host necrosis by 8 days, with some sites developing uredinia after 14 days. In a highly resistant cultivar (Tift 85DB) fungal growth was confined to the tissue adjacent to the infection site with no macroscopic symptoms evident. Within 4 days host cells in this area became intensely autofluorescent, indicating necrosis; this was confirmed by ultrastructural observations. Thus, the timing and effectiveness of resistance mechanisms in the two cultivars differed substantially.

ULTRASTRUCTURE OF THE INFECTION PROCESS IN PEANUT RUST. J. Taylor, E. A. Richardson, and C. W. Mims, Department of Plant Pathology, University of Georgia, Athens, GA 30602.

Early stages of infection of peanut (*Arachis hypogaea*) leaves by urediniospore germings of *Puccinia arachidis* were examined using electron microscopy. Appressoria that developed over stomata produced penetration pegs that entered the leaf via stomatal pores. A penetration peg was initially small and thin-walled, but became thick-walled and wedge-shaped as it appeared to push its way through the stomatal pore. Once inside the leaf the penetration peg expanded to form a sub-stomatal vesicle that produced an intercellular infection hypha (IH) that grew until its tip contacted a mesophyll cell. A septum developed to delimit a terminal haustorial mother cell (HMC) from the remainder of the IH. The HMC became attached to the host cell by an extracellular matrix material then formed a typical dikaryotic haustorium with a slender neck region and an expanded haustorial body separated from the host cell cytoplasm by an extrahaustorial matrix and membrane.

EFFECT OF MAINTENANCE HOST ON VIRULENCE IN *PSEUDOPERONOSPORA CUBENSIS*. C. E. Thomas and E. L. Jourdain, USDA, ARS, U. S. Vegetable Laboratory, Charleston, SC 29414.

A field isolate of *Pseudoperonospora cubensis* pathotype 5 was obtained from squash (*Cucurbita pepo*). Pathotype 5 is virulent to both squash and muskmelon (*Cucumis melo*). Subpopulations of the isolate were maintained on each host for 18 generations. After each generation, each subpopulation was inoculated to both squash and muskmelon and the subsequent sporulation rate (SR) on each host was monitored as an indicator of virulence. The subpopulation maintained on muskmelon showed a marked reduction in virulence against squash, 99.7% decrease in SR, and a marked increase in virulence against muskmelon, 226.1%

increase in SR, from generations five through 18. Virulence against squash in this subpopulation returned to the original level after two generations of continuous culture on that host. This study illustrates the important effects of cucurbit host species in selection of virulence factors in this pathogen.

DEVELOPMENT OF MULTIPLE VIRUS RESISTANT JALAPENO PEPPERS, B. Villalon, Texas Agricultural Experiment Station, 2415 E. Hwy 83, Weslaco, TX. 78596.

Demand for pungent and mildly pungent jalapeno peppers (*Capsicum annuum* L.) for fresh market and processing has increased during the past 15 years. Viruses are the limiting factor in most production areas because all known commercial jalapenos are susceptible to virus diseases. The  $et^a$ ,  $y^a$ ,  $L^1$  and  $p^1$  genes which confer resistance to tobacco etch virus, potato virus Y, tobacco mosaic virus and pepper mottle virus, respectively, were incorporated into commercial types via the pedigree-backcross method. Sources of these genes included: 'Avelar', 'Agronomico', 'Casca Dura', PI 342947, PI 264281 and AC 2120. Over 3,400 breeding lines with varying levels of capsaicin have been developed with multiple virus resistance. Selections for high yielding, early concentrated fruit set on a single stemmed plant for mechanical harvesting are being made.

PATHOGENICITY OF FIVE FUNGI TO ROOTS OF CORN, SORGHUM, PEARL MILLET, ABRUZZI RYE AND FIVE FORAGE BERMUDAGRASSES. H. D. Wells, J. P. Wilson, D. K. Bell and D. R. Sumner. USDA-ARS and University of Georgia, Coastal Plain Experiment Station, Tifton, GA 31793-0748.

Five fungi [a sterile white basidiomycete (SWB), *Rhizoctonia solani* AG-2 type 2, *Bipolaris triseptatum*, *Exserohilum rostratum*, and *Fusarium roseum* var. *equiseti*], from Tifton 44 bermudagrass, from Cordele, GA and a SWB from soil were evaluated for pathogenicity to corn (Pioneer 3369A), sorghum (Pioneer 8330), pearl millet (Tifleaf 2), Abruzzi rye, and bermudagrasses (Coastal, Coastcross 1, Tifton 44, Tifton 78, and Tifton 85). Root disease index ratings showed that both isolates of the SWB and the *R. solani* AG-2 type 2 were highly virulent on all crops. Pearl millet, sorghum and the five bermudagrass hybrids were susceptible to all pathogens whereas corn and abruzzo rye were resistant to *B. triseptatum*, *E. rostratum* and *F. roseum* var. *equiseti*.

REDUCED PATHOGENICITY AFTER SUBCULTURING AND A METHOD FOR PRESERVING CULTURES OF *MOESZIOMYCES PENICILLARIAE*. J. P. Wilson and H. D. Wells, USDA-ARS, Coastal Plain Experiment Station, Tifton, GA 31793-0745.

*Moesziomyces penicillariae* causes smut of pearl millet inflorescences, and is often maintained as sporidial cultures. Bulk sporidial cultures were established from teliospores collected from inoculated heads of cytoplasmic male-sterile inbred B7. Each of eight cultures maintained for 1, 11, 21, or 31 subcultures were used to inoculate 10 heads of field-grown inbred Tift 85DB. Mean smut severities decreased 51% (from 20.4 to 10.0% severity) and seed yields increased 78% (from 12.0 to 21.3 g/10 heads) when inoculations were performed with cultures maintained for 31 subcultures rather than with the newly established cultures. These results indicate the need for developing a method for long-term storage of cultures. Storage of sporidia in 40, 60, 80 and 100% glycerin at 8C,

-7C, and -73C was evaluated. Survival was greatest at -73C for all concentrations and 80% glycerin was the optimum concentration for storage.

A HISTOLOGICAL COMPARISON OF MECHANICALLY WOUNDED TREES AND TREES WITH DOGWOOD CANKER. M. T. Windham and E. Graham, Department of Entomology & Plant Pathology, Univ. of Tennessee, P.O. Box 1071, Knoxville, TN 37901-1071.

Forty 3-year-old dogwood stems with symptoms of dogwood canker, 30 nonsymptomatic stems, and 20 stems wounded with a 3 mm drill bit were examined histologically. Differences in anatomy were noted among sample types. Cambium death was observed in all trees with dogwood canker symptoms and callus formation was not observed. In wounded trees, tree wounds were filled with actively growing callus within one growing season. Cambium death and lack of compartmentalization of diseased tissue associated with dogwood canker could serve as entry points for secondary invading organisms and may account for diverse mycoflora (*Fusarium*, *Curvularia*, *Pestalotia*, and *Botryodiplodia*) that is found in diseased tissue.

DISEASE INCIDENCE AND SEVERITY OF DOGWOOD ANTHRACNOSE IN THE GREAT SMOKEY MOUNTAIN NATIONAL PARK. M. Windham, M. Montgomery, and K. Landon. Dept. of Entomology and Plant Pathology, Univ. of Tennessee, P.O. Box 1071, Knoxville, TN

Eighty-three permanent plots were established in the GSMNP on a 5 km grid pattern. At each plot ten flowering dogwood trees (*Cornus florida*) were tagged and rated for dogwood anthracnose incidence and symptom severity. Tree diameters, elevation of plot, type of trees in the canopy, and proximity of the plot to water (creek or lake) were examined. Ten additional pairs of plots were established in which one plot of each pair was in disturbed areas of GSMNP (campgrounds, visitor centers, etc.) and the other member of each pair was approximately 200 m into the woods that were adjacent to the disturbed plots. Dogwood anthracnose was found in over twenty remote plots in the GSMNP. Symptom severity ranged from few individual lesions to dead trees with large cankers at epicormic shoots. Disease incidence was much lower in the disturbed plots than in plots established 200 m into the woods.

DISTRIBUTION OF PRUNUS NECROTIC RINGSPOT VIRUS IN PEACH TREES AFTER GRAFT INOCULATION OF SHOOTS OR ROOTS. Wuqiao Yuan, O. W. Barnett and Simon Scott, Department of Plant Pathology & Physiology, Clemson University, Clemson, SC 29634.

Two-year-old dormant peach trees, with Red Haven or Loring scions and Lovell or Nemaguard rootstocks, were grafted with twig tissue from healthy or infected sources of 4 Prunus necrotic ringspot virus (PNRSV) isolates. Three trees of each of 4 scion/rootstock combinations were grafted with each source near the top and three on major roots. Trees leafed out after 1-2 wks in a greenhouse and weekly assays were by ELISA. PNRSV was first detected in leaves near the top of shoot-grafted trees 2-3 wks after grafting. PNRSV was systemic in these trees, including roots, at this time or 1-2 wks later although virus was not detected in some branches until 6-14 wks after grafting or not at all in 1/4 of the branches. PNRSV was not detected in any root-grafted trees or in trees grafted with healthy tissue. Few differences were found among virus isolates or cultivars. Thus, soil-borne transmission of PNRSV may not be an important means of natural spread.