APS Southern Division

Abstracts

January 28–February 1, 1995 New Orleans, LA

Alphabetized by first author's last name

PATHOGENICITY OF RHIZOCTONIA SPP. CAG-2 AND CAG-5 ON COTTON. R. E. Baird[1], T. B. Brenneman[2], and D. K. Bell[2], RDC-Box 1209[1], CPES[2], Plant Pathology Department, University of Georgia,Tifton, GA 31794.

In a field trial evaluating continuous cotton (*Gossypium hirsutum* L.) versus peanut (*Arachis hypogaea* L.)-cotton rotations, the mycobiota was characterized for cotton roots from all treatments. The most common fungi were *Fusarium oxysporum*, *F. solani*, *Trichoderma* spp., and *Cunninghamella* sp. over all treatments and two sampling periods. *Rhizoctonia* anastomosis groups CAG-2 and CAG-5 were isolated primarily from the continuous cotton treatments. *Rhizoctonia solani* AG-4 was isolated, but at a frequency less than 3%. Isolates of CAG-2, CAG-5 and AG-4 were tested for pathogenicity in the greenhouse; discolored brownish lesions were observed on cotton roots. The three fungi could routinely be reisolated from the root lesions completing Koch's postulate.

EVIDENCE FOR THE PRESENCE OF dsRNA IN ASCOSPORES OF *MONOSPORASCUS CANNONBALLUS*. J. S. Batten, B. R. Lovic, R. D. Martyn, and M. E. Miller. Department of Plant Pathology and Microbiology, Texas A&M University, College Station 77843-2132, and Weslaco 78596.

A large proportion of field isolates of *Monosporascus cannonballus* harbor dsRNA. Presence of dsRNA was found to be associated with variability in phenotype and aggressiveness. dsRNA transfer between different strains *via* hyphal anastomosis was demonstrated previously, but the transmission of these elements through sexual reproduction could not be assessed since the ascospores do not germinate. To obtain a sufficient number of ascospores for nucleic acid analysis, two dsRNA-harboring isolates of *M. cannonballus* were grown separately in a mixture of sand and wheat hulls for one month. Pure ascospores were obtained after passing each culture mixture through a series of sieves followed by centrifugation in 60% sucrose. Ascospores were homogenized in liquid nitrogen and the nucleic acids extracted by standard CTAB protocols and visualized in ethidium bromide-stained gels. Low-molecular-size fragments were observed in each isolate. The dsRNA nature of these fragments was established by digesting with RNase, CF11 chromatography, and staining with acridine orange. The number and sizes of the dsRNA fragments in ascospores were similar to those observed in nucleic acid preparations from parent mycelia.

MPG1 HYDROPHOBIN AND DEVELOPMENT. J.L. Beckerman and D.J. Ebbole. Dept. Plant Pathology and Microbiology, Texas A&M University 77843.

Upon germination, conidia of the rice blast fungus (*Magnaporthe grisea*) are able to form infection structures called appressoria that allow direct penetration of plant cells. Substrate hydrophobicity is a key determinant in the developmental fate of germinating conidia of *M. grisea*. We are examining the pattern of expression of a fungal hydrophobin of *M. grisea* named MPG1 (Magnaporthe Pathogenicity Gene 1). We believe this gene plays a role in the recognition of surface hydrophobicity. The gene was so named because mutant strains are no longer able to efficiently form appressoria and are therefore less pathogenic than wild-type. Expression of this gene is observed during the early stages of infection of rice plants, aerial hyphae and conidiophores, and in media lacking complex nutrient sources. Although it has been reported that MPG1 expression is regulated by nutrient levels, nutrients are not thought to influence appressorium formation on hydrophobic surfaces. However, cAMP has been shown to induce appressorium formation on non-inductive surfaces. Understanding the interplay of nutrients, MPG1 expression and cAMP levels with respect to development is crucial to our understanding of host-pathogen recognition in the rice/blast system.

IMPACT OF SOYBEAN (*GLYCINE MAX*) HERBICIDES ON GROWTH AND DEVELOPMENT OF *RHIZOCTONIA SOLANI* AG-1 *IN VITRO* AND IN FIELD. B. David Black, J. S. Russin, J. L. Griffin and J. P. Snow. Louisiana State University Ag. Center, Dept. of Plant Path. & Crop Phys. Baton Rouge, 70803.

In vitro and field experiments were conducted in 1993 and 1994 to determine the response of *Rhizoctonia solani* AG-1 IA and IB, causal agents of aerial blight and web blight of soybean, to herbicides used in soybean production. Both isolates of *R. solani* reponded similarly to herbicides with respect to mycelial growth and sclerotia production. Acifluorfen, glyphosate, pendimethalin, glufosinate, alachlor, and paraquat amended to PDA at 0.5X - 2X field use rates reduced mycelial growth *in vitro*. Sclerotia production was reduced by glufosinate but inhibited by paraquat, and sclerotia morphology was altered by pendimethalin. In the field study, disease severity was reduced relative to control when pendimethalin was applied PRE followed by paraquat POST direct or when paraquat was applied alone.

COMPARISON OF LATE LEAF SPOT ADVISORIES IN GEORGIA IN 1994. T. B. Brenneman[1], N. Lalancette[2], F. M. Shokes[3], G. B. Padgett[1], and A. K. Culbreath[1]. [1]Dept. Plant Path., Univ. GA, Tifton, GA 31793, [2]Neogen Corp., Lansing, MI 48912, and [3]Univ. Florida, North Florida Res. & Educ. Cen., Marianna, FL 32446.

Two spray advisories, AU-Pnuts (AUP) and a late leaf spot (Cercosporidium personatum) model from Neogen (NEO), were compared using chlorothalonil (CHL) or CHL with up to four sprays of tebuconazole (TEB) substituted midseason. Six sprays were applied according to NEO and seven sprays with both AUP and a 14-day schedule, although spray dates differed. Early leaf spot (Cercospora arachidicola) was the primary disease. There were no differences in defoliation or yield between the advisories and the 14-day schedule of CHL, but all were better than the nontreated plots. Programs using TEB had less leaf spot and stem rot (Sclerotium rolfsii) than those with only CHL. Average yields were 4946, 3825 and 2226 lb/A for TEB plus CHL, CHL, and nontreated plots, respectively.

PECTINASE ACTIVITY OF LATENT AND NON-LATENT FUNGI INVOLVED IN POSTHARVEST DECAYS OF CANTALOUPE. B. D. Bruton, USDA-ARS, Lane, OK 74555 and C. L. Biles, East Central Univ., Ada, OK 74820.

Postharvest decays of cantaloupe fruit can be severe. Phomopsis cucurbitae is involved in latent infections that appear after harvest. Fusarium semitectum is a non-latent pathogen capable of causing decay in the field and in storage. Both fungi were grown separately in shake cultures containing autoclaved inner mesocarp, outer mesocarp, exocarp (cantaloupe), apple pectin, and CM-cellulose. Polygalacturonase (PG) and B-galactosidase (BG) activity were measured from 2 to 10 days following inoculation. Both P. cucurbitae and F. semitectum produced PG on apple pectin, inner and outer melon mesocarp, and melon exocarp. For both fungi, the highest levels of PG activity were observed on melon exocarp. P. cucurbitae, but not F. semitectum, exhibited PG activity on CM-cellulose. P. cucurbitae exhibited more BG activity than F. semitectum, especially in the exocarp. BG activity on pectin and CM-cellulose was detected in cultures with P. cucurbitae, but not F. semitectum. BG appears important in cell-wall-degradation in cantaloupe fruit. The high level of PG and BG activity in the cantaloupe exocarp suggests that degradation of the exocarp is an important step in pathogenesis.

IMIDACLOPRID INSECTICIDE SEED TREATMENTS FOR BARLEY YELLOW DWARF VIRUS CONTROL IN WHEAT. A. Y. Chambers and G. L. Lentz, Dept. of Entomology and Plant Pathology, Univ. of Tennessee, West Tennessee Expt. Station, Jackson, TN 38301-3200.

Seed treatments of imidacloprid insecticide (14.2 and 21.3 g ai/45.4 kg seed) and soil treatment with disulfoton insecticide (1.12 kg ai/ha) significantly reduced aphid counts and barley yellow dwarf virus (BYDV) injury in 'Saluda' wheat compared to no treatment in 1992-93. Acephate insecticide seed treatment (204.1 g ai/45.4 kg) was not effective. The 21.3-g rate of imidacloprid was the most effective treatment for reducing disease injury. Yields were increased significantly over no treatment with imidacloprid treatments only (4.4 and 3.7 hl/ha for 21.3- and 14.2-g rates, respectively). In 1993-94, four seed treatments of imidacloprid reduced aphid counts and BYDV injury significantly compared to no treatment in 'FFR 555' wheat. A rate of 28.4 g ai/45.4 kg was more effective than 14.2- and 21.3-g rates or a 1:1 blend of seed treated with 28.4-g rate and untreated seed. The 21.3-g treatment reduced BYDV injury more than the 14.2-g rate and the blend. Only the 14.2-g rate failed to increase yields over the untreated control. Yield increases for 28.4- and 21.3-g rates and the blend were 6.9, 6.5, and 6.0 hl/ha, respectively.

SCREENING OF INDIGENOUS ISOLATED BACTERIA FOR BIOLOGICAL CONTROL OF TAKE-ALL OF WHEAT IN ALABAMA. C. Chen, and D. J. Collins. Dept. of Plant Pathology, Biological Control Institute, Auburn University, Auburn, AL 36849-5409.

Indigenous bacteria isolated from Alabama wheat soils were screened for potential as biological control agents for take-all of wheat, caused by *Gaeumannomyces graminis* (Sacc.) Arx and Olivier var. *tritici* J. Walker (Ggt). A total of 231 *Pseudomonas* and *Bacillus* spp. were screened. Coker 9766 wheat seeds were treated with each of 231 selected bacterial isolates. Seeds were planted in tubes containing a soil-vermiculite mixture infested with Ggt. *Pseudomonas corrugata* and *Bacillus circulans* suppressed take-all significantly. Their ability to control take-all was superior to that with *P. fluorescens* 2-79. *B. circulans* also showed signs of increased plant growth promotion with significantly higher shoot lengths and dry weights. *P. corrugata* had significantly higher populations on wheat roots than did any other pseudomonad both in the presence and absence of Ggt inoculum in vermiculite.

IMPROVING SHELF LIFE OF GRANULES CONTAINING THE MYCOHERBICIDE, *COLLETOTRICHUM TRUNCATUM*. W. J. Connick, Jr., D. J. Daigle, K. S. Williams, C. D. Boyette[1] and M. A. Jackson[2], SRRC, ARS, USDA, PO Box 19687, New Orleans, LA 70179; [1]SWSL, ARS, USDA, PO Box 350, Stoneville, MS 38776; [2]NCAUR, ARS, USDA, 1815 N. University St., Peoria, IL 61604.

Colletotrichum truncatum (Schwein.) Andrus & W. D. Moore (COLTRU), a fungus pathogenic to hemp sesbania [*Sesbania exaltata* (Raf.) Rydb. ex A. W. Hill], was formulated in wheat flour/kaolin granules ("Pesta"). Granules made with COLTRU conidia as inoculum were stored at 25 C at 0, 12, 33, 53, and 75% relative humidity (RH), and fungal viability was determined at 4-week intervals. Shelf life was better at 33% RH or below, rather than at higher humidities. Granules made with COLTRU microsclerotia were stored at 25, 35, and 45 C (about 20% RH). Some samples were 100% viable after 16 weeks at 35 C, but viability dropped significantly at 45 C over this time period.

THE INFLUENCE OF CONCENTRATIONS AND SOURCES OF NITROGEN ON ROOT ROT OF *VIOLA WITTROCKIANA* CAUSED BY *THIELAVIOPSIS BASICOLA*. Warren E. Copes and Floyd F. Hendrix, Department of Plant Pathology, University of Georgia, Athens, GA 30602-7275.

Nitrogen was applied every 2 da as NO_3:NH_4 ratios (100:0, 75:25, 50:50, 25:75) at 52, 105, and 158 mg N·liter^{-1} to sand culture grown pansy plants (*Viola wittrockiana*) both noninoculated and inoculated with *Thielaviopsis basicola*. Disease incidence and severity were lowest at 50:50 and 25:75 ratios at each N concentration. Fresh root weight and length of inoculated plants were highest at the 75:25 and 50:50 ratios. Fresh shoot weight and flower number of inoculated plants were highest at the 75:25 ratio with only shoot weight being positively correlated with total N concentration. Fresh shoot weight, flower number, and fresh root weight of noninoculated plants were highest at the 75:25 ratio and root length longest at the 100:0 ratio with shoot weight and flower number being positively correlated with total N concentration. High NH_4-N reduced plant growth and caused root browning in all plants.

EVALUATION OF ADVANCED PEANUT BREEDING LINES FOR RESISTANCE TO TOMATO SPOTTED WILT VIRUS. A. K. Culbreath, J. W. Todd, W. D. Branch, Univ. of Georgia, Coastal Plain Expt. Station, Tifton, GA 31793-0748, F. M. Shokes and D. W. Gorbet, Univ. of Florida, Marianna, FL.

Randomized complete block field experiments with five-six replications were conducted at Attapulgus, GA in 1993 and 1994, and in Moultrie, GA in 1994. Epidemics of spotted wilt, caused by tomato spotted wilt tospovirus (TSWV) were monitored in six entries: cultivars Florunner, Southern Runner and Georgia Browne, and advanced breeding lines GA T-2846, UF 84x1A-7-2-1-1- and UF 84x9B-1-1-1-. All three advanced lines had lower final incidence of spotted wilt and disease severity ratings than susceptible cultivar Florunner. Across all tests, final cumulative incidence of spotted wilt was 22.0, 12.6, 15.7, 13.9, 15.9, and 12.7% (LSD = 6.0, P = 0.05) for Florunner, Southern Runner, Georgia Browne, GA T-2846, UF 84x1A-7-2-1-1- and UF 84x9B-1-1-1-, respectively. In 1994, final disease severity ratings (percentage of plot row with plants showing severe stunting, general chlorosis, or wilting) immediately prior to digging and inverting were 44.8, 13.3, 20.8, 22.5, 21.3 and 13.8% (LSD = 7.1, P = 0.05) for the respective entries.

DETECTION OF A VIRAL COMPLEX IN TOMATILLO *PHYSALIS IXOCARPA* IN THE CENTRAL HIGH PLATEAU OF MEXICO. R. De La Torre, D. Teliz, B. L. Barron, E. Cardenas, E. Garcia-Latorre, M. Cardenas. Colegio de Postgraduados, Ciencias Biologicas, IPN, Universidad Autonoma Chapingo, Mexico; R. A. Valverde, Dept. of Plant Pathology, Louisiana State University, Baton Rouge, 70803.

Mosaic, leaf deformation, stunting, interveinal yellowing and calico symptoms were observed in tomatillo plants in commercial fields in the Central High Plateau of Mexico. Several viruses were isolated and identified from virus infected tomatillo plants. Techniques used for virus identification included: mechanical, grafting and insect transmissions, electron and light microscopy, serology, and Southern hybridization. The viruses identified were: cucumber mosaic virus, tobacco etch virus, tobacco ringspot virus, tomato spotted wilt virus, impatiens necrotic spot virus, tobacco mosaic virus and two possible geminiviruses. These viruses were found alone and in mixed infections. These viruses were found in tomatillo samples collected from four states in Mexico. Tomatillo yields were not greatly affected by the high incidence of viruses.

PHYSALIS INTERVEINAL YELLOWING AND PHYSALIS CALICO: TWO GEMINIVIRUSES ISOLATED FROM TOMATILLO *PHYSALIS IXOCARPA* IN THE CENTRAL HIGH PLATEAU OF MEXICO. R. De La Torre, D. Teliz, J. A. Garzon, R. Peña, R. A. Valverde, and R. Rivera-Bustamante, Colegio de Postgraduados, CINVESTAV-IPN-Irapuato, Mexico and Dept. of Plant Pathology and Crop Physiology, Louisiana State University, Baton Rouge, 70803.

Two geminiviruses were isolated from tomatillo samples collected from farms in the Central High Plateau of Mexico. Interveinal yellowing and calico (bright yellow, irregular spots with well defined margins) symptoms were observed in all field visited. The viruses were mechanically and graft transmitted to *Physalis ixocarpa, Capsicum annum, Lycopersicon esculentum* and *Datura stramonium*. An agarose gel electrophoresis of nucleic acids extracts from infected plants revealed additional DNA bands not detected in healthy plants. The viral nature of the DNA bands was confirmed by Southern analysis using pepper huasteco virus coat protein gene as probe under low stringency conditions. This is the first report of a geminivirus infecting tomatillo in Mexico. Molecular characterization of these two virus isolates is underway.

WEATHER-BASED SCHEDULES FOR FUNGICIDAL CONTROL OF WATERMELON ANTHRACNOSE. Jim Duthie, Warren Roberts, and Tim Thannisch. Wes Watkins Agricultural Research and Extension Center, Oklahoma State University, Lane, OK 74555.

Six weather-based, fungicide schedules (S1 to S6) were compared for control of watermelon anthracnose (caused by *Colletotrichum orbiculare*). Average relative humidity (RH) and air temperature (AT) were sampled every 15 min., at a height of 10 m above ground, at a distance of 200 m from plots. Duration of disease favorable weather (DFW) was the number of hours per day during which two conditions were satisfied, (RH > 80% and 20C<AT<30C). Single-row plots (10 m x 4 m) of watermelon were infested when plants first flowered by spreading oat kernels colonized by *C. orbiculare* over the surface of soil at the base of plants. In replicated plots, a mixture of benomyl and maneb was applied never (S1), once each week (S2), when a 5-day weighted moving average of DFW exceeded 10 h/day (S3) or 12 h/day (S4), or whenever 60 h (S5) or 100 h (S6) of DFW had accumulated from the time of previous application. Disease (percentage of leaves with lesions) and defoliation (percentage of leaves abscised) were recorded weekly in each plot. For schedules S1 to S6, respectively, total numbers of applications of fungicides were 0, 5, 3, 2, 2, and 1, final disease was 100, 32, 64, 48, 58, and 96% and final defoliation was 99, 8, 37, 38, 39, and 84%. Moving average and cumulative models of DFW for scheduling fungicides will be discussed.

ULTRASTRUCTURE OF EARLY INFECTION STAGES OF *PHYTOPHTHORA SOJAE* ON RESISTANT AND SUSCEPTIBLE SOYBEAN PLANTS. Katalin Enkerli, University of Georgia, Department of Plant Pathology, Athens GA 30602

Host-parasite interfaces in roots of susceptible and resistant soybean plants inoculated with *P. sojae* were studied using transmission electron microscopy. Early events were similar in both compatible and incompatible interactions. Zoospore encystment, germination and penetration of the epidermis occurred within 30 min. Appressorium-like structures were observed in a few cases. Penetration was usually between cells, and hyphae progressed intercellularly. Major cytoplasmic changes occurred at infection sites. Wall appositions and electron-opaque material were laid down in host cell walls adjacent to or opposite penetrating hyphae. Haustoria-like bodies encased by an electron dense layer were found several hours later. Differences between compatible and incompatible interactions were evident 11 h after inoculation. Hyphae invaded the vascular tissue of the susceptible but not the resistant plant.

RESISTANCE OF CITRULLUS LANATUS GERM PLASM TO WATERMELON MOSAIC VIRUS 2 STRAINS. A. G. Gillaspie, Jr. and J. M. Wright, USDA, ARS, Plant Genetic Resources Conservation Unit, Griffin, GA 30223-1797.

Four resistant lines of watermelon (PI 189316, PI 189317, PI 248178, and Egun) were selected after greenhouse and field screening against Florida strain FC-1656 of watermelon mosaic virus 2 (WMV2). Resistant plants from these lines were selfed (Plant Dis. 77:352-354) and screened in a greenhouse test against WMV2 strains/isolates from Arizona, California, and New York (2). Test plants were inoculated by air brush at 3-4 day intervals for a total of 11 inoculations and the plants were observed for symptoms and tested by a double-sandwich ELISA 14 days after the final inoculation. The resistance found against these four strains/isolates was as good as or better than that observed against the Florida strain. These lines may provide useful resistance to WMV2. Another test is in progress with these and other strains/isolates of the virus to more fully assess the usefulness of these lines.

ITS SEQUENCE DIVERGENCE WITHIN *ACREMONIUM*. A. E. Glenn and C. W. Bacon. Dept. of Plant Pathology, University of Georgia, Athens, GA 30602 and USDA/ARS, Russell Research Center, Athens, GA 30613.

Acremonium contains grass endophytes as well as non-endophytic species such as the type of the genus, *A. alternatum*. To determine if a monophyletic relationship exists between the endophytes and the non-endopytic species, comparisons of rDNA intergenic spacer (ITS) sequences were made. The endophytic isolates examined were *A. typhinum*, *A. typhinum* var. *typhinum*, *A. typhinum* var. *bulliforme*, and *A. coenophialum*. In addition to *A. alternatum*, the non-endophytes included *A. strictum*, *A. chrysogenum*, and *A. butyri*. The sequences of the endophytes were very similar, thereby supporting their monophyletic relationship. However, the ITS sequences of the non-endophytes were so divergent from those of the endophytes that no significant alignment could be obtained. This lack of sequence similarity and the intrinsic habitat differences suggest the absence of a monophyletic relationship between the non-endophytes and the grass endophytes. Reclassification of the endophytes may need consideration.

A SEMI-SELECTIVE MEDIUM FOR QUANTIFICATION OF ASCOSPORES OF *SCLEROTINIA SCLEROTIORUM*. W. A. Gutierrez and H. D. Shew. Plant Pathology Department. North Carolina State University. Box 7616, Raleigh, North Carolina 27695-7616

A semi-selective medium was developed for trapping and quantifying ascospores of *S. sclerotiorum*. The medium contains potato dextrose agar, streptomycin sulfate, penicillin-G, calcium chloride, pentachloronitrobenzene, etridiazole, and bromophenol blue. Colonies of *S. sclerotiorum* change the color of the medium by the production of oxalic acid. Calcium oxalate precipitate also can be observed arround the colonies after three days. Sclerotia production occured within eight days. Evaluation of the medium was conducted in greenhouses used for tobacco transplant production.

RESISTANCE IN A CAPSICUM ANNUUM (PEPPER) LINE TO GEOGRAPHICALLY DIVERSE CUCUMBER MOSAIC VIRUS ISOLATES. H. A. Hobbs, L. L. Black, D. J. Dufresne, and R. A. Valverde. Dept. Plant Path. and Crop Physiol., Louisiana Agric. Expt. Sta., La. State Univ. Agric. Ctr., Baton Rouge 70803

Cucumber mosaic virus (CMV) affects pepper (Capsicum spp.) worldwide. Greenhouse screening of pepper lines for reaction to CMV resulted in the identification of a CMV-resistant line. The C. annuum line "IR", originally from the Lembang Horticultural Research Institute in Indonesia, with the Asian Vegetable Research and Development Center (AVRDC) designation PBC 535, showed resistance to CMV isolates from different geographic locations. The pepper line was mechanically inoculated with seven isolates originating from Louisiana, California, the Dominican Republic, and Taiwan. Symptom development in PBC 535 varied with the virus isolate and ranged from none to moderate. All virus isolates induced severe symptoms in the CMV-susceptible controls Yolo Wonder and VR-2.

EFFECTS OF HOST RESISTANCE ON LESION DEVELOPMENT BY *THIELAVIOPSIS BASICOLA*. M.E. Hood and H.D. Shew. Department of Plant Pathology, North Carolina State University. Box 7616, Raleigh, North Carolina, 27695-7616.

Effects of resistance on important stages of pathogenesis and lesion development by *Thielaviopsis basicola* were studied on Burley tobacco cultivars: B21xKY10, low resistance; KY14, moderate resistance; TN90, complete resistance. TN90 carries the single gene for resistance to black root rot from *Nicotiana debneyi*. Lesion number and size were quantified with video image analysis system. Penetration and colonization of each cultivar were examined histologically. Lesions developed and expanded on all cultivars, but there was little or no secondary inoculum production on TN90. Ectotrophic growth also was significantly less on TN90.

COPPER-CONTAINING FUNGICIDES REDUCE THE SPREAD OF BACTERIAL FRUIT BLOTCH OF WATERMELON IN THE GREENHOUSE. D. L. Hopkins, Central Florida Research and Education Center, University of Florida, Leesburg, FL 34748.

The effects of streptomycin sulfate and cupric hydroxide on the rate of spread of bacterial fruit blotch of watermelon in a greenhouse with overhead watering were evaluated in 4-week tests. A single 2.5-cm square plastic cell was planted with infected Charleston Gray seed in the center of 600 cells planted with healthy seed. Two days after seedling emergence (7-8 days after planting) and 7-10 days later, the plants were sprayed with either streptomycin at 200 or 800 ppm or cupric hydroxide at 1.2 g/L of water. Applications of cupric hydroxide and the 800 ppm rate of streptomycin resulted in a 70-97% reduction in the spread of bacterial fruit blotch. In one test, symptoms developed on 201 seedlings in the control treatment versus only seven seedlings in the cupric hydroxide treatment. The lower rate (200 ppm) of steptomycin was not as effective as the higher rate, but there was some phytotoxicity with the high rate.

ELIMINATION OF VIRUS FROM ARACHIS AND VIGNA GERMPLASM VIA SHOOT TIP CULTURE OF THE EMBRYO AXIS. M. S. Hopkins and D. L. Pinnow, USDA, ARS, Plant Genetic Resources Conservation Unit, Griffin, GA 30223-1797.

Individual seeds were tested by DAS-ELISA to detect the presence of peanut mottle potyvirus (PMV) or peanut stripe potyvirus (PStV) in peanut and blackeye cowpea mosaic potyvirus (BlCMV) in cowpea. The epicotyl of the embryonic axis was excised and placed onto MS-salts medium + Gamborg's B-5 vitamins. After one month, the resulting explant was tested again by ELISA for the presence of virus. Thirty out of 33 PMV infected peanut explants tested negative for the presence of virus. However, only two out of seven BlCMV

infected cowpea explants were found to be free of virus. This procedure will be useful in eliminating certain seedborne viruses from these crops and in conservation of valuable germplasm. Furthermore, this procedure should be adaptable for a variety of other legumes.

EFFECT OF FERTILIZERS AND THEIR RATES OF APPLICATION ON THE INCIDENCE OF SOYBEAN DISEASES AND CROP PRODUCTIVITY. R. P. Pacumbaba, Department of Plant and Soil Science, Alabama A&M University, Normal, AL 35762.

The incidence of soybean stem canker (SSC), phytophthora root rot (PRR), bacterial blight of soybean (BBS), soybean mosaic virus disease (SMV), and soybean cyst nematode disease (SCN) were compared under different fertilizer and rate regimes with the unfertilized controls. Fertilization with NPK did not affect the incidence of PRR, BBS, and SCN; N-fertilizer had no effect on incidence of PRR, SMV, and SCN; P-fertilizer also had no effect on incidence of PRR, BBS, and SCN; and nor did K-fertilizer have an effect on incidence of BBS, SMV, and SCN. The nodules were smaller at 200 kg/ha (N) and plants were taller at 100 and 200 kg/ha (P) and at 150 kg/ha (K). All four fertilizers (NPK, N, P, and K) greatly reduced the incidence of SSC but the yield increased when soybean were fertilized with NPK at 150 kg/ha and with N at 200 kg/ha.

THE EFFECT OF SPRAY INITIATION ON LEAF SPOT SEVERITY AND PEANUT YIELD. G.B. Padgett and A.K. Culbreath, University of Georgia, Department of Plant Pathology. P.O. Box 1209, Tifton, Ga, 31794.

Peanut (*Arachis hypogaea* L.) can be devastated by early and late leaf spot (*Cercospora arachidicola* Hori and *Cercosporidium personatum* (Berk. & Curt.), respectively) when epidemics are severe. Field studies were conducted in 1993 and 1994 to assess the impact spray initiation has on leaf spot severity and peanut pod yield. Treatments included sprays applied on 14-day intervals, initiated 35, 49, 63, 77 days after planting (DAP) or a nonsprayed control. Treatments were replicated three or four times, and arranged in a randomized complete block design. Leaf spot was quantified during the growing season using the Florida 1-10 scale (1=no disease and 10=completely defoliated or dead plants). After the final rating, peanuts were dug, allowed to dry, and combined. A drought occurred in 1993; resulting in minimal early leaf spot severity in sprayed peanut. Leaf spot was most severe (5.5) in the nonsprayed peanut, followed by peanut which received the initial spray 77 DAP. Yields did not differ among treatments. In 1994, yield was lowest in nonsprayed peanuts, 67% less than peanuts sprayed beginning 35 DAP. Delaying sprays from 35 to either 63 or 77 DAP resulted in greater early and late leaf spot severity (20 and 24% greater, respectively) and lower yields (29 and 36% less, respectively). Yields and leaf spot severity did not differ among the 35 and 49 DAP treatments. Delaying fungicide sprays can have varying effects on yield and disease severity depending on the environment.

PARTIAL RESISTANCE TO RICE SHEATH BLIGHT MAY BE CONTROLLED BY SINGLE MAJOR GENES. X. B. Pan, X. Y. Sha, Q. J. Xie, S. D. Linscombe, and M. C. Rush, Louisiana State University Agricultural Center, Baton rouge, LA 70802.

All known resistance to the rice sheath blight disease is partial. Sheath blight resistance has been considered to be polygenic. Recent research has suggested that the major portion of resistance from cultivars with high levels of partial resistance may be controlled by single dominant or recessive genes. Sheath blight resistance in germplasm release LSBR-5 (Crop Sci. 32:507) was controlled by a single recessive gene. Evaluation of disease in inoculated F_2 populations from crosses with the resistant cultivars Jasmine 85 and Teqing showed that the major portion of the resistance expressed by each of these cultivars was controlled by a single dominant gene and suggested that these genes were independently inherited. Data from F_2 plants from the cross Teqing x Maybelle (susceptible) suggested that minor genes may also play a role in the resistance of Teqing. In the crosses Teqing x Cypress, Maybelle x Teqing, and Maybelle x Jasmine 85 the F_2 plants segregated 3:1 (resistant : susceptible). F_2 plants from the cross Jasmine 85 x Teqing segregated 15:1 (resistant : susceptible).

EFFICACY OF *MONOSPORASCUS CANNONBALLUS* ASCOSPORE EXTRACTION FROM SOIL. Y. J. Park, R. D. Martyn, and M. E. Miller. Department of Plant Pathology and Microbiology, Texas A&M University, College Station 77843 and Weslaco 78596.

Monosporascus cannonballus is a recently reported ascomycete causing root rot and vine decline of muskmelon and watermelon in several areas around the world. This pathogen is difficult to detect and identify in roots and soil; however, several unique characteristics of the ascospores allow direct extraction from soil and their subsequent identification by either microscopy or a PCR-mediated detection method using *Monosporascus*-specific primers and probes. The usefulness of this detection method would be improved by determining the efficacy of the spore extraction procedure and the minimum number of spores necessary in a sample to allow for their detection by PCR. The spore extraction efficiency of our standard protocol was assessed by adding known numbers of laboratory-grown ascospores of *M. cannonballus* to soil samples. The average spore extraction efficiency of the original method was 26%; however, the extraction efficiency was increased to 69% when a smaller-mesh sieve (25 μm instead of 38 μm) and higher sucrose concentration (60% instead of 50%) were used. The increased efficiency using the 25-μm sieve was due to the smaller size of laboratory-grown ascospores vs those observed in natural field soil. No significant increase in extraction efficiency was observed using the modified protocol with naturally infested field soil.

POST-INFECTIONAL DEVELOPMENT AND REPRODUCTION OF *MELOIDOGYNE ARENARIA* RACES 1 AND 2 ON SUSCEPTIBLE AND RESISTANT SOYBEAN GENOTYPES. E.M.R. Pedrosa, R.S. Hussey, and H.R. Boerma, Dept. Plant Pathology, University of Georgia, Athens, GA 30602-7274.

Post-infectional development, reproduction, and fecundity of *Meloidogyne arenaria* races 1 and 2 were studied on susceptible (CNS), partially resistant (Jackson), and highly resistant (PI200538 and PI230977) soybean genotypes in the greenhouse. At 10 days after inoculation 60% and 99-100% of race 1 second-stage juveniles were vermiform or sexually undifferentiated in CNS and the resistant genotypes, respectively. In contrast, 98, 58, 56, and 38% of race 2 juveniles had developed to sexually differentiated juveniles in CNS, Jackson, PI200538 and PI230977, respectively. By 20 days after inoculation, 88-100% of race 2 nematodes in roots of all genotypes were adult females, whereas less than 25 and 1% of race 1 were adult females in CNS and the resistant genotypes, respectively. Race 1 produced 85-96% fewer eggs per egg mass and 96-98% fewer eggs per root system 45 days after inoculation than race 2 across genotypes. Development of *M. arenaria* race 1 was slower and more variable on susceptible and resistant soybean genotypes than race 2. The effectiveness of resistant soybean cultivars in suppressing development and reproduction of race 1 of *M. arenaria* indicates their use should be an effective management tactic.

STARCH ACCUMULATION IN BYMV-INFECTED ARROWLEAF CLOVER. I. J. Pemberton and G. R. Smith, Texas Agri. Expt. Stn., Overton, TX 75684.

Growth rates and starch concentrations were measured in arrowleaf clover (*Trifolium vesiculosum* Savi) plants inoculated with bean yellow mosaic virus (BYMV). Three populations ('Yuchi', 'Meechee', Line 47) of greenhouse-grown plants were inoculated with BYMV-204-1 at one of three different times. Inoculation dates were 16 wk (EARLY), 21 wk (MID), or 26 wk (LATE) after planting. Control plants were not inoculated. All plants were harvested four times, and leaves sampled for starch analysis six times during the study. Plants developed symptoms within 2 to 3 wk post-inoculation. Dry matter production peaked by the third harvest, then declined. Post-inoculation yields were significantly lower for EARLY (33%) and MID (19%) treatments compared to healthy controls at third harvest. By the fourth harvest, yields were 41, 45, and 27% lower than controls for EARLY, MID, and LATE, respectively. Starch concentrations rose over time and peak levels coincided with the rapid growth phase. Starch levels peaked higher in diseased plants than healthy controls. However, inoculated plants were less efficient in starch utilization since greater accumulations of starch did not result in higher yields. We conclude that BYMV infection disrupts normal starch metabolism in arrowleaf clover.

EFFECT OF PLANTING DATE AND CULTIVAR SUSCEPTIBILITY ON PROGRESS OF STEM CANKER IN ARTIFICIALLY INOCULATED SOYBEANS. J.C. Rupe and C.M. Becton. University of Arkansas, Fayetteville.

The effect of planting date on the development of stem canker was determined in four soybean cultivars: Walters, susceptible; Narow M and Asgrow 5979, intermediately susceptible; and Hutcheson, resistant. Two-wk-old greenhouse grown-seedlings were inoculated with 10^6 ascospore/ml and placed in a dew chamber. After three days, 25 plants were transplanted to single row plots 3.5m long, one row per cultivar, on four dates (1 June, 20 June, 30 June, and 14 July 1994) in three replications. Disease incidence and plant growth stage were determined weekly from the end of July until physiological maturity. In all plantings, stem canker first appeared approximately 60 days after inoculation at the R3 growth stage for all cultivars except Hutcheson which had no disease. Subsequently, stem canker progressed fastest in Walters followed by Narow M and Asgrow 5979 and faster with a delay in planting.

PATHOGENIC AGGRESSIVENESS OF PCNB TOLERANT AND SENSITIVE ISOLATES OF *SCLEROTIUM ROLFSII*. M.-Y. Shim[1], J. L. Starr[1], K. E. Woodard[2]. [1]Dept Plant Pathology and Microbiology, Texas A&M University, College Station, Tx 77843; [2]Texas Agricultural Experiment Station, Stephenville, Tx 76401.

Occurrence of fungicide resistance in pathogen populations can cause problems in disease control. Tolerance to PCNB in *Sclerotium rolfsii* (causal agent of southern blight of peanut) was detected in a Texas peanut field in 1985. A survey for PCNB-tolerant isolates was conducted in several Texas peanut fields in 1992 and 1993. Additional PCNB-tolerant isolates were detected; however, tolerant populations are not wide spread. Twenty one fungicide tolerant isolates were detected from a total of 292 isolates examined. Tolerant and sensitive isolates of *S. rolfsii* were examined for pathogenic aggressiveness. Eight isolates of *S. rolfsii* (four PCNB-tolerant and four sensitive isolates) were tested in greenhouse and field microplot experiments. In the greenhouse test, sensitive isolates infected 65.1, 81.5, and 90.2% of the stems of inoculated peanuts at 10, 14, and 21 days after inoculation (DAI) respectively. Tolerant isolates infected 49.0, 63.6 and 77.7% of the stems at 10, 14, and 21 DAI. In the microplot test, PCNB-sensitive isolates infected 33, 43, and 52% of the plants at 14, 21, and 28 DAI whereas tolerant isolates infected 20, 30, and 36% of the plants at 14, 21, and 28 DAI. In general, PCNB-sensitive isolates were significantly aggressive than PCNB-tolerant isolates at $P=0.05$.

MUSCADINE GRAPE (*VITIS ROTUNDIFOLIA*) CULTIVAR SUSCEPTIBILITY TO FUNGAL DISEASES. Barbara J. Smith and C. L. Gupton, USDA-ARS Small Fruit Research Station, Poplarville, MS 39470

Berry rot diseases of 19 muscadine grape cultivars grown in South Mississippi were scored at harvest over a three-year period. Bitter rot (*Greeneria uvicola*) and Macrophoma rot (*Botryosphaeria dothidea*) were the most prevalent berry diseases. 'Cowart', 'Higgins', 'Fry', 'Watergate' and 'Janebell' had the most severely rotted berries. 'Noble', 'Welder', 'Carlos', 'Hunt', 'Doreen' and 'Supreme' had the least. 'Noble' and 'Welder' were most resistant to bitter rot while 'Cowart' and 'Fry' were most susceptible. Foliar diseases were rated just prior to harvest in 1994. Bitter rot leaf spot and black rot leaf spot (*Guignardia bidwellii*) were the most common foliar diseases. 'Summit', 'Noble', 'Southland' and 'Welder' scored lowest for foliar diseases. 'Hunt', 'Fry' and 'Janebell' had the greatest incidence of foliar diseases.

EFFECTS OF TEMPERATURE AND LIGHT ON GERMINATION OF UREDINIOSPORES OF PUCCINIA SUBSTRIATA var. INDICA. H. Tapsoba and J. P. Wilson, Dept. Plant Pathology, UGA, and USDA-ARS Forage and Turf Unit, UGA CPES, Tifton, GA 31793.

Germination of urediniospores of P. substriata var. indica was evaluated after 2,4,6 and 8 hr incubation on 2% water-agar at 10, 16, 20, 25, 30, and 35C in light (1650 lux, fluorescent), dark, alternate light-dark, and alternate dark-light. Less than 1% germination occurred at 35C. At 30C, germination remained constant after 4 hr. At 10C, germination increased with longer incubation. Under all light conditions, optimum germination after 4-8 hr occurred at 20-25C. Continuous light appeared to inhibit germination for 2 hr incubation, but exposure to light during the first hr of incubation was stimulatory when followed by 1 hr dark.

FACTORS ASSOCIATED WITH RESISTANCE TO AFLATOXIN PRODUCTION IN MAIZE. K.M. TUBAJIKA[1], B.Z. GUO[1], J.S. RUSSIN[1],R.L. BROWN[2], T.E. CLEVELAND[2], N.W. WIDSTROM[3]. [1]DEPT. PLANT PATH. & CROP PHYS., LSU AG. CTR.,BATON ROUGE, LA;[2] USDA/ARS/SRRC., NEW ORLEANS, LA; [3] USDA/ARS, INSECT BIOL. & MGT. LAB., TIFTON,GA.

Wax from kernels of maize population MAS:gk, resistant to *Aspergillus flavus* colonization and aflatoxin production, was compared to that from susceptible commercial maize hybrids Pioneer hybrid 3154, DPL G-4666, and Asgrow RX 947. Fifty kernels of uniform size and shape from each genotype were immersed in hot (80° C) chloroform for 30-45 sec to remove wax from pericarp surfaces. Significantly more (F=6.47; P=0.002) wax was recovered from resistant population MAS:gk than from the susceptible hybrids. Thin-layer chromatography of extracted wax was conducted using methylene chloride, benzene:chloroform (7:3; v:v), or chloroform:ethyl acetate (1:1; v:v). Wax components were visualized by spraying chromatograms with H_2SO_4. Chromatograms showed differences in chemical makeup of pericarp wax of selected maize genotypes. Several compounds that were present in MAS:gk were not detected in the susceptible hybrids. There are indications that resistance in MAS:gk is due in part to increased levels of wax on the kernel surface as well as differences in chemical composition of this wax.

EVALUATION OF METHODS TO INCREASE *IN VITRO* SPORE PRODUCTION OF *CLADOSPORIUM CARYIGENUM*. W. W. Turechek and K. L. Reynolds, Department of Plant Pathology, University of Georgia, Athens, GA. 30602.

Methods to increase *in vitro* spore production of *Cladosporium caryigenum*, causal organism of pecan scab, were investigated. Single spore isolates were obtained from scab lesions on pecan leaves. Three inoculum production techniques and three types of agar media were examined in a complete factorial design. Techniques included growing a single colony on agar or blending single five week old colonies and dispensing the homogenate over 10 agar plates with or without a cellophane membrane. Spore counts were made one week after blended homogenate was placed on agar. Media types included oatmeal, V8, and PDA. Total spore production was greater (α = 0.05) in the blended versus the unblended treatments. The addition of a cellophane membrane did not significantly increase spore production. There were no consistent differences in spore production among media types. However, oatmeal agar is preferred because resulting conidial suspensions contained fewer mycelial fragments.

PERIWINKLE GERMINATION AFFECTED BY CRAMBE AND RAPESEED MEAL SOIL AMENDMENTS. J. Walker and J. Melin. Department of Plant Pathology, University of Georgia, Georgia Station, Griffin, GA 30223.

In investigating the potential of crambe and rapeseed meals as soil amendments for root-knot nematode control, we examined the effect of these materials on seed germination of five annuals. The rapeseed meal contained 69μ moles/g glucosinolate. Ground meals were mixed with a soil-less medium (PRO-MIX) at 0, 0.75, and 1.25% (vol/vol). Celosia, dianthus, marigold, periwinkle and salvia were seeded immediately. Percentage germination was determined 8 days later. Germination of periwinkle (*Cantharanthus roseus*) was decreased by 15 and 17% at the 0.75% rate of crambe and rapeseed meal, respectively, and 30% by both meals at a 1.25% rate. Plants which germinated were chlorotic and stunted. Germination of other species was not affected. Periwinkle may be a sensitive bioassay plant for measuring phytotoxicity of soil amendments containing glucosinolates.

NATURAL SHEDDING OF LOBLOLLY PINE ROOT CELLS PROMOTES MICROBIAL GROWTH. C. H. Walkinshaw. USDA Forest Service, 2500 Shreveport Highway, Pineville, LA 71360.

One of the most striking examples of natural cell death occurs in secondary growth of roots. At this time, most cortical cells die and their tissue is shed as a unit. This shedding exposes the remaining living cells to pathogens and environmental stress. Saprophytes colonize the dead cells that have been shed. Mycorrhizal roots are not involved in this shedding process. Non-mycorrhizal roots of loblolly pine (Pinus taeda L.) were selected within 10-40 year old plantations for this research. A total of 2400 roots were fixed, embedded, sectioned, stained and observed with a light microscope. Cellular changes in dying cells included disappearance of starch grains, death of nuclei, and clearing of the cytoplasm. These changes were accompanied by a proliferation of microorganisms in shed cells and invasion of remaining living cortical cells. Protection of exposed root cells occurs over time with the formation of bark cells.

QUANTITATIVE GENETIC ANALYSIS OF PARTIAL RUST RESISTANCE IN PEARL MILLET. J. P. Wilson, USDA-ARS Forage and Turf Unit, UGA Coastal Plain Experiment Station, Tifton, Georgia 31793

The inheritance of partial resistance to Puccinia substriata var. indica of pearl millet inbreds 700481-21-8 and ICMP 501 crossed to Tift 383 was evaluated in the field in 1993. Area under the disease progress curves of individual plants of the parents, F_1, F_2, and backcross F_1s to each parent were determined. Broad-sense heritability for both crosses was 43%. Additive genetic effects were significant in the cross of 700481-21-8 x Tift 383, whereas additive, dominance, and dominance x dominance epistasic effects were significant for ICMP 501 x Tift 383. Number of genes conferring partial resistance was estimated to be 2 for 700481-21-8 and 2.5 for ICMP 501.