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Alphabetized by first author's last name.

LEAFHOPPER CONTROL REDUCED THE INCIDENCE OF CITRUS BLIGHT. W. C. Adlerz[1], deceased, F. W. Bistline[2], L. W. Russo[2], and D. L. Hopkins[1]. Central Florida Research and Education Center[1], University of Florida, Leesburg, FL 32748 and Coca-Cola Foods[2], Plymouth, FL 32768.

When insect trapping indicated that leafhopper populations were increasing, supplemental applications of insecticides were used to control leafhopper vectors of Xylella fastidiosa, a xylem-limited bacterium, in two 11-hectare plots of Valencia oranges. Supplemental insecticide applications significantly reduced leafhopper populations. Linear regression equations, with time expressed in months as the independent variable and percent citrus blight the dependent variable, were fitted to the data for the supplemental insecticide ($y = 0.557x-2.55$, $r = 0.98$) and routine grove plots ($y = 0.825x-2.28$, $r = 0.97$). The slopes of the two equations are significantly different at the 1% level, therefore supplemental insecticides reduced the rate of increase in incidence of blight.

SCLEROTIA PRODUCTION AND VIABILITY ON PEANUT GENOTYPES PLANTED IN SCLEROTINIA MINOR-INFESTED PLOTS. C. N. Akem, H. A. Melouk, and O. D. Smith. USDA-ARS, Dept. of Plant Pathology, Oklahoma State University, Stillwater, OK 74078-0285 and Dept. of Soil and Crop Science, Texas A&M Univ., College Station, TX 77843.

Nineteen peanut genotypes were evaluated in field plots at Stillwater for reaction to S. minor in 1986. After digging, sclerotia were collected from randomly selected stem segments and pods of susceptible lines, and evaluated for viability. Most genotypes that had sclerotia on pods also had sclerotia on stems. Of 10 susceptible genotypes, more sclerotia were formed in/on stems than in/on pods. Sclerotia collected from stems were significantly more viable than those from pods in 8 of the susceptible genotypes. Highest sclerotial viability was 74% from stems and 60% for pods, all from cv. Florunner, and lowest was 29% from stems and 13% from pods on genotypes TX 771174 and TX 835841, respectively. No sclerotia were produced on resistant genotypes.

TEMPERATURE AND WETNESS DURATION REQUIREMENTS FOR APPLE INFECTION BY PHYSALOSPORA OBTUSA. L. F. Arauz and T. B. Sutton, Department of Plant Pathology, North Carolina State University, Raleigh 27695-7616.

The combined effect of temperature and wetness duration on apple leaf and fruit infection by Physalospora obtusa (Schw.) Cooke was studied under controlled conditions. Temperatures tested ranged from 8 to 32 C and wetness periods from 2 to 48 hours. Models describing the effect of temperature (T) on the wetness period required for light (W_L) and severe leaf infection (W_S) were, respectively, $W_L = 3527.7\ T^{-2}$ and $W_S = 116 - 5380.7\ T^{-1} + 70257.5\ T^{-2}$. At 12 C, 24.5 hr were required for light infeciton compared to 24 C where 6 hr were required. For fruit infection (W_F) the relationship $W_F = 14.8 - 265.2\ T^{-1} + 2988.4\ T^{-2}$ was obtained. At 24 C, 9 hr were required to obtain fruit infection, whereas at 12 C, 13.4 hr were required. At 32C, fruit and leaf infection were delayed. The leaf infection models predicted accurately 65% of the infections obtained under field conditions. Most of the incorrect predictions were associated with low inoculum density.

DETECTION AND HOST RANGE OF pXV10A, A COPPER-RESISTANCE PLASMID IN X. CAMPESTRIS PV. VESICATORIA. C. Bender, D. Malvick, S. George, K. Conway, and P. Pratt, Dept. of Plant Pathology, Oklahoma State Univ., Stillwater, OK 74078-0285.

Copper-based sprays are the chief control method for bacterial spot on tomato. In 1987, 'Jet Star' tomatoes received 9 applications of copper (Cu) oleate, Kocide 101, Bravo C/M, or Dithane M-45 plus Kocide 101. The percentage of green fruit with bacterial spot symptoms ranged from 52-67% across all treatments, suggesting that Cu-tolerant strains of Xanthomonas campestris pv. vesicatoria (Xcv) were present. This hypothesis was verified in the lab; the Cu^r genes in Oklahoma strains of Xcv were localized on a 190 kb plasmid designated pXV10A. pXV10A was efficiently transferred to Cu^s strains of pvs. vesicatoria, dieffenbachiae, manihotis, vitians, nigromaculans, phaseoli, campestris, and pelargonii. These studies indicate the potential threat of pXV10A to disease control with copper sprays, especially in nurseries where multiple pvs. of X. campestris may occur.

LOCAL AND SYSTEMIC RESISTANCE IN WATERMELON INDUCED WITH *FUSARIUM OXYSPORUM* FF. SP. C. L. Biles and R. D. Martyn. Department of Plant Pathology and Microbiology, Texas A&M University, College Station, 77843

Previous work reported that preinoculation with the avirulent race 0 of *Fusarium oxysporum* f. sp. *niveum* (FON) protected watermelon cvs. 'Dixielee' and 'Calhoun Gray' from the virulent race 2. Differential phenol-oxidizing isozymes were detected 12 hr after inoculation in leaf and stem tissue. Recent experiments indicate that the avirulent races 0 and 1, as well as *F. o.* f. sp. *cucumerinum* (FOC), provide different levels of protection with race 1 protecting most effectively. To determine if the protection was specific for wilt and/or systemic, roots of a susceptible watermelon cultivar were induced with FOC and the leaves inoculated with *Colletotrichum lagenarium* 24 to 72 hrs after induction. The induced treatments had approximately 50% fewer lesions than the non-induced water controls. Xylem fluid extracts of 'Calhoun Gray' separated by IEF-PAGE and silver stained indicated a differential isozyme at pI 5.3, which appeared to be associated with the induced treatment and may act as an induction trigger or marker.

ISOZYME ANALYSIS OF *FUSARIUM OXYSPORUM* F. SP. *NIVEUM* RACES AND SELECTED *FUSARIUM* SP. C. L. Biles and R. D. Martyn. Department of Plant Pathology and Microbiology, Texas A&M University, College Station 77843.

Isozyme analysis was conducted on the three known races of *Fusarium oxysporum* f. sp. *niveum* (races 0, 1, and 2), *F. o.* f. sp. *cucumerinum*, *F. o.* f. sp. *vasinfectum*, and *F. solani* to detect phenotypic and putative genetic similarities. Both IEF-PAGE and Native-PAGE were used and four enzymes (glucose-6-phosphate dehydrogenase, shikimate dehydrogenase, esterase, and phosphoglucose isomerase) were studied. IEF-PAGE detected greater differences among the *F. o.* f. sp. *niveum* races than did Native-PAGE, although genetic interpretation was easier with Native-PAGE. Eight putative loci were resolved for the enzymes using Native-PAGE. Two of the eight loci were polymorphic for the three races of *F. o.* f. sp. *niveum*. Four of the eight loci were polymorphic when compared to other *F. oxysporum*. ff. sp. All *F. solani* loci were polymorphic when compared to *F. oxysporum* ff. sp.

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

INFECTION OF PEACH BUDS BY BOTRYOSPHAERIA OBTUSA. Kerry O. Britton and Floyd F. Hendrix, Department of Plant Pathology, University of Georgia, Athens, GA 30602.

The three species of Botryosphaeria which cause peach tree fungal gummosis (B. obtusa, B. dothidea, and B. rhodina) were isolated from dormant peach buds in central Georgia each year 1980-87 but only B. obtusa and B. rhodina killed inoculated buds. Only B. obtusa was present in buds in significant numbers, with populations peaking in January and February. Captafol applied in early January each year since planting (1984) reduced incidence of B. obtusa in buds and in subtending twigs of trees in their third leaf by 50% but in the fourth year, there was no reduction in infection of subtending twigs. In severely-infected trees, systemic growth of the fungi progressed as frequently from older infected wood into budwood as from infected floral organs into subtending twigs. Histological examination showed intracellular hyphal growth in parenchyma progressed from bud scales to vascular bundles and into twigs.

ISOLATION AND EVALUATION OF ENDOPHYTIC BACTERIA FROM LIVE OAKS FOR IN VITRO INHIBITION TO CERATOCYSTIS FAGACEARUM AND COLONIZATION OF OAK TREES. D. S. Brooks, C. F. Gonzalez, and D. N. Appel, Texas A&M Univ., College Station, 77843; T. H. Filer, USDA-Forest Service, Stoneville, MS 38776.

Endophytic bacteria isolated from live oaks (Quercus fusiformis) representing three Texas oak wilt centers were evaluated for in vitro inhibition of the oak wilt pathogen, C. fagacearum. Bacterial samples were obtained from healthy trees representing "escapes" and infected trees in disease remission. Isolates were evaluated using three media which allow for the preliminary identification of the inhibitory compound(s). Of the 889 isolates tested, 190 showed some level of in vitro inhibition. Of those, 97 produced a growth-inhibiting siderophore, 84 produced an antibiotic(s), and 9 exhibited chitinase activity. A group of six isolates representing both Gram-negative and Gram-positive strains were evaluated for their ability to colonize both Spanish oaks (Q. texana) and live oaks. Bacillus spp. and Pseudomonas spp. were better able to colonize Spanish oaks and live oaks, respectively.

IMPACT OF LEAFSPOT DISEASES ON YIELD AND QUALITY OF ALFALFA. C. Lee Campbell and J. A. Duthie, Dept. of Plant Pathology, North Carolina State University, Raleigh, 27695-7616

The effects of leafspot diseases on dry-matter yield and quality [adjusted crude protein (ACP), acid detergent fiber (ADF), and total digestible nutrients (TDN)] of alfalfa were examined in plots with or without weekly sprays of chlorothalonil. Effects of leafspots on dry-matter yield were large with reductions of 18.6% (1.7 mt/ha) and 25% (2.7 mt/ha) in unsprayed plots in 1986 and 1987, respectively. In each year, hay quality varied among the five harvests; however, effects due to fungicide treatment were small. In 1986, mean ACP, ADF, and TDN were 19.0, 31.2, and 65.6% and 19.0, 30.1, and 64.8% in unsprayed and sprayed plots, respectively. In 1987, mean ACP, ADF, and TDN were 22.1, 31.1, and 66.7% and 20.6, 29.4, and 64.9% in unsprayed and sprayed plots, respectively. Premature abscission of older leaves due to disease may account for the slightly higher hay quality in unsprayed plots. The impact of leafspot diseases on yield appears to be greater than the effect on quality.

ROOT ROT, A NEW DISEASE OF MUSKMELON IN SOUTH TEXAS. E. R. Champaco, R. D. Martyn, and L. W. Barnes, Texas A&M University, College Station, 77843, and M. E. Miller, J. M. Amador, and A. Perez, Texas A&M University, Weslaco, 78596.

A root rot disease of unknown etiology was observed on muskmelons (*Cucumis melo*) in south Texas. Symptoms include a darkening and sloughing of the cortical root tissue that typically does not extend to the crown area of the vine. Generally, complete deterioration of the tap root and many secondary roots occurs. Pink to purplish bands are often observed on diseased roots. Leaf yellowing, wilting and plant death generally occur when heavy rains follow irrigations or just before harvest. Root rot appears to be more prevalent in heavier soils. Differences in disease severity were observed among 12 cultivars planted in replicated field plots. *Fusarium solani* is consistently associated with diseased roots and, symptomatically, the disease resembles foot and crown rot of squash, caused by *F. solani* f. sp. *cucurbitae*; however, to date, pathogenicity of the *F. solani* isolates has not been established. This is the first known report of this disease on muskmelons.

INFLUENCE OF CLIPPINGS MANAGEMENT PROGRAMS ON DISEASE AND WEED INCIDENCE IN RALEIGH ST. AUGUSTINEGRASS. P. F. Colbaugh and W. E. Knoop. Texas Agric. Expt. Sta., Texas A&M Univ. Res. and Ext. Ctr., Dallas, TX 75252.

Collections of turfgrass clippings in metropolitan areas account for a signficant manpower and equipment cost as well as increased burden on local landfill sites. A turfgrass clippings management program called the Waste Saver Lawn Care Plan was initiated to eliminate the need for clippings disposal. Raleigh St. Augustinegrass plots receiving 48.9 kg N/ha at 4 or 6 wk intervals were subjected to three types of mowing to determine their influence on weeds and common diseases during Jun to Oct 1984 and 1985. Plots were mowed once or twice weekly at 3.5 cm using a mulching power or standard rotary mower with clipings either bagged or left standing. Broadleaf weed populations were lower on plots with clippings removed; however damaging disease activity was not observed with any of the clippings management programs. A mulching lawnmower was most effective for recycling clippings without weed or disease problems.

DETECCION OF CUCURBIT VIRUSES IN MEXICO. F. Delgadillo, J.A. Garzón and A. Vega. INIFAP-CIFAP-GTO-CEBAJ. Apdo. Postal 112. Celaya, Guanajuato, México.

The viral diseases of cucurbits caused crop losses up to 100% in some production areas in Mexico. In 1985, cucumber mosaic virus (CMV), watermelon mosaic virus 2 (WMV-2) and tobacco ringspot virus (TRSV) were detected by ELISA method in 66.8, 41.6 and 5.4% respectively, of 202 samples of cantaloupe (Cucumis melo L.), watermelon (Citrullus lanatus (Thunb) M. & N.), squash (Cucurbita spp) and cucumber (Cucumis sativus L.) from field in many states of Mexico. In 1986, CMV, WMV-2, TRSV and squash mosaic virus (SwMV) were detected in 44.5, 48.6, 12.8 and 17.9%; respectively, of 319 samples. Finally in 1987, CMV, WMV-2, TRSV, SqMV, papaya ringspot virus-watermelon (PRSV-W) and zucchini yellow mosaic virus (ZYMV) were detected in 28.9, 13.8, 21.8, 7.9, 5.0 and 19.2%, respectively, of 239 samples. Many samples had a mixture of two or more of these viruses. This work is the first report of ZYMV in Mexico (This work was supported by INIFAP-UNPH-CONACYT).

DEVELOPMENT OF HISTOCHEMICAL STAINS TO IDENTIFY PECAN PHENOLICS. S. V. Diehl, C. H. Graves, Jr. and P. A. Hedin. Depts. of Plant Path. & Weed Sci. and Crop Science Res. Lab., USDA., MS State, MS 39762.

Selective indicators for condensed tannins and isoquercitrin, fungitoxic phenolics of pecan were evaluated. This is a first step in efforts to quantitate specific phenolics at sites of infection of the scab fungus Cladosporium caryigenum. Two molecular forms of condensed tannins and an unidentified aglycone have been isolated from pecan leaves. The Hoepfner-Vorstatz (HV) test, previously described for juglone, provides a distinctive color with an absorption maxima at 529 nm with no interference by other phenolics. There is, however, a broad overlap among flavonoids in the 300-330 nm range. Absorption maxima with HV for tannins, quercetin and isoquercitrin occur at 321, 316, 309 and 330 nm respectively. Therefore, other staining procedures must be considered.

QUANTIFICATION OF FLUORESCENT PSEUDOMONAS POPULATIONS USING AN ELISA READER. H.M. El-Nashaar and F.J. Gough, USDA-ARS, Plant Science & Water Conservation Lab., P.O. Box 1029, Stillwater, OK 74076.

Pseudomonas syringae pvs. syringae and tomato, and P. fluorescens were grown at 28 C for 48-72 hr on King's medium B (KMB). For each culture, the number of colony-forming units (cfu) was determined by serial dilution, and absorbance values (ABS) of pigment produced were determined using an ELISA reader (405 nm). Microplate wells (96) were loaded with KMB broth (100 µl/well). A 100-µl aliquant of each dilution (DI) of each strain was added to each well to produce 12 wells/DI and 7 DI/strain. The cultures were incubated on a shaker at 28 C. The ABS were measured at 24-hr intervals for 5 days. The correlation coefficient between cfu and ABS was greater than 0.95 for each strain and greater than 0.88 between ABS and time. These data indicate that an ELISA reader is a reliable instrument for estimating population densities and growth rates of fluorescent pseudomonads.

TEMPERATURE EFFECT ON THE SYMPTOM DEVELOPMENT OF STRAWBERRY LEAVES AND RUNNERS INFECTED BY PHOMOPSIS OBSCURANS. B. C. Eshenaur and R. D. Milholland, Department of Plant Pathology, North Carolina State University, Raleigh 27695-7616.

Blight diseases of strawberry, caused by Phomopsis obscurans (Ell. & Ev.) Sutton exhibit a lengthy incubation period (often > 80 days for full symptom expression) under greenhouse conditions. Thus, controlled environmental chambers were used to determine if temperature has an effect on the incubation period and development of symptoms on leaves and runners. A conidial suspension was sprayed on tagged leaves and runners, and plants were incubated in growth chambers at 15, 20, 25, and 30 C. Abundant symptoms first appeared after 30 days on plants at 30 C. Disease development and severity of leaf symptoms increased from none at 15 C to a maximum at 30 C. Length of runner lesions progressed similarly from no lesions at 15 C to a maximum length of 63 mm at 30 C 45 days after inoculation.

DNA CHARACTERIZATION OF MYCOSPHAERELLA GRAMINICOLA (FUCKEL) SCHROETER ISOLATES. Celsa Garcia, A. Livore, C. Magill, and D. Marshall. Department of Plant Pathology and Microbiology, Texas A&M University, College Station, TX 77843.

Five isolates of Mycosphaerella graminicola were collected from different wheat-growing regions in Texas. Ten single spore cultures from each isolate were grown in yeast-malt agar. Total DNA of conidia or mycelium was extracted by a rapid method developed in this laboratory. The DNA was digested with 14 restriction enzymes for restriction fragment length polymorphism and DNA methylation studies. Digestion with methylation sensitive enzymes seems to indicate differences of DNA methylation in at least two of the isolates at two physiological stages. Studies of restriction fragment length polymorphism are being conducted to determine variation in the population of the pathogen in Texas.

LABORATORY AND GREENHOUSE EVALUATION OF SELECTED FUNGICIDES FOR CONTROL OF BOTRYOSPHAERIA DOTHIDEA ON GOLDEN WEEPING WILLOW. S. George and K. Conway, Dept. of Plant Pathology, Oklahoma State Univ., Stillwater, OK 74078-0285

Penconazole (Award) and tridemorph (Calixin) were highly effective in inhibiting growth of Botryosphaeria dothidea isolates in vitro. Complete inhibition usually occurred at 50-100 µg/ml. Benomyl (Benlate) reduced in vitro fungal growth at rates as low as 1 µg/ml but higher concentrations were not negatively correlated with growth. In greenhouse studies on naturally infected willows, a trunk spray of penconazole, soil drenches (1x and 2x rate) of tridemorph, and a commercially prepared tridemorph paint applied to the trunk surface restricted canker elongation. Only the tridemorph paint was able to inactivate B. dothidea in established cankers.

CHARACTERIZATION OF A POLYHEDRAL VIRUS CAUSING SORGHUM YELLOW BANDING IN TEXAS. L. M. Giorda, R. W. Toler, and A. Livore, Department of Plant Pathology and Microbiology, Texas Agricultural Experiment Station, College Station, 77843.

Purified particles of sorghum yellow banding virus (SYBV) and tobacco mosaic virus were layered (1mg/ml) onto continuous-density gradients of CsCl in 0.02 M PPB, pH 7.0. The UV absorvance profiles displayed a peak for each virus corresponding to one band in the gradient. Virions of SYBV had a buoyant density of 1.386 g/cm^3, while TMV was 1.316. SDS-PAGE (gradient 8-25) analysis of the viral protein was done using the PhastSystem (Pharmacia Inc., N.Y.). A single protein band with a molecular weight of 29 Kd was identified using MW standards and TMV. The RNA from purified SYBV (non-denaturing conditions) migrated as 5 bands in 1.3% agarose gel with 10 mM sodium phosphate buffer pH 7.0 or 0.02 m Hepes buffer, pH 7.0 and 0.02% SDS. These 5 bands were resolved when virus RNA was extracted from SYBV purified from different hosts. The major RNA band was approximately 1.8 Kb when compared to RNA ladder markers and lambda DNA/Hind III fragments.

HOST RANGE STUDIES OF SORGHUM YELLOW BANDING, A NEWLY RECOGNIZED VIRUS DISEASE OF GRAIN SORGHUM AND SORGHUMxSUDANGRASS HYBRIDS IN TEXAS. L. M. Giorda, R. W. Toler, and J. D. Alexander, Dept. Plant Pathology & Microbiol., Texas Agricultural Experiment Station, College Station, 77843.

A new virus disease was observed on commercial grain sorghum and sorghum x sudangrass hybrids in 1985 in Texas (Phytopathology 77:641), and again in 1987. The host range of the virus was increased by using an air gun inoculation technique with 6.3 Kg/cm^2 pressure. The extended new hosts include Setaria italica, ten cultivars of Sorghum bicolor, six of S. sudanense, and four of Zea mays. Local lesions were observed on johnsongrass, sudan 'Cumberland' and grain sorghum BTx623. The sorghum cultivar QL3-India is immune to all strains of SCMV and MDMV. QL3-India was susceptible to the new virus displaying chlorotic streaking, bands, and severe necrosis. A positive serological reaction occurred with a sudan virus found in California (B. Falk, personal communication) and with a virus from a similar disease found in Venezuela (M. J. Garrido).

SEASONAL DISTRIBUTION OF AGROBACTERIUM SPP. IN VITIS ROTUNDIFOLIA VINES. D.E. Griffin and C.H. Graves, Jr., Dept. of Plant Pathology and Weed Science, Miss. State, MS 39762

Agrobacterium tumefaciens was extracted from vascular systems of symptomless muscadines (Vitis rotundifolia). Previous sampling of dormant wood has indicated a high incidence of systemic Agrobacterium infestation in Mississippi muscadine vineyards. Muscadine is propagated primarily by softwood cuttings. Twelve plants previously sampled in late 1986 and early 1987 were selected for a multiple sampling study to determine bacterial incidence in new growth in early season and at propagation time. Basal and near-tip portions of new shoots from six locations per plant were sampled in late May and late June by extracting vascular juices and plating on NKS and RS medium. Incidence of Agrobacterium spp. was greater at the second date. Results suggest that propagation by cuttings made as near to the tip and as early in the season as possible may reduce the incidence of Agrobacterium infestation.

INCREASED SECOND CROP RICE YIELD BY APPLICATION OF FUNGICIDES TO THE FIRST CROP. D.E. Groth, Rice Research Station, La. Agri. Exp. Stn., L.S.U. Agricultural Center, P.O. Box 1429, Crowley, LA 70527-1429

Rice (Oryza sativa) plots in Crowley, Louisiana were inoculated with Rhizoctonia solani. Propiconazol, benomyl, iprodione, thiabendazole, SN84364, and NTN19701 fungicides were applied with a CO_2 backpack sprayer delivering 190 l/ha at the panicle differentiation, booting, and/or 70 percent heading in the first crop. Plots were rated for disease development at maturity and harvested for first and second crop yields.

Fungicides reduced sheath blight levels and increased yields in the first crop, as well as ratoon stand counts and yields in the second crop. Sheath blight levels did not differ significantly among treatments in the second crop. Yields in the second crop ranged from -86 kg/ha to 1057 kg/ha over the inoculated control.

TOMATO SPOTTED WILT VIRUS INFECTION OF CULTIVATED MALVACEOUS SP. AND OTHER CROP PLANTS IN SOUTH TEXAS. R. S. Halliwell, Plant Pathology & Microbiology, TAMU, College Station, 77843

Tomato spotted wilt virus (TSWV) diseases have become economic problems of numerous crop plants and epiphytotic in peanuts in the winter garden area of Texas. This report identifies TSWV susceptible crop plants (potato, tomato, pepper, spinach, beet, and bean) and previously unreported Malvaceous spp. as TSWV hosts. All crop plants tested were infected mechanically and TSWV subsequently transmitted to an indicator host. In addition, TSWV infection was confirmed by ELISA and EM of tissue sections. Gossypium barbadense L. and G. hirusutum L. inoculated cotyledons or leaves produced small necrotic lesions (2-3mm), systemic necrotic lesions, chlorotic feathering of the veins and mild vein clearing. Symptoms decreased in new growth until visual evidence of infection becomes subliminal. Hibiscus esculentus L. (okra) and H. tiliaceus, (native ornamental) were naturally and experimentally infected.

Occurrence of Panicum Mosaic Virus on St. Augustine Grass and Centipede Grass in South Carolina. R.A. Haygood and O. W. Barnett, Department of Plant Pathology and Physiology, Clemson University, Clemson 29634-0377.

St. Augustine decline (SAD), caused by a strain of panicum mosaic virus (PMV), was observed in 2 lawns, one in Charleston and one in Columbia in September, 1987. Chlorotic spots and blotches similar to those associated with SAD were detected on centipede grass in the same home lawns. Similar symptoms were

detected in other centipede lawns ranging in age from 1 to 15 years old in Charleston, Columbia, Conway and Clemson. Enzyme linked immunosorbent assays revealed that the PMV isolates detected in the symptomatic centipede and St. Augustine grass blades in South Carolina were serologically related to the strain which causes SAD in Texas. Preliminary indications are that PMV isolates cause mosaic symptoms on centipede grass, but do not significantly impair its growth.

FASTIDIOUS, XYLEM-INHABITING BACTERIA ASSOCIATED WITH SCORCH OF PIN OAK AND SOUTHERN RED OAK TREES IN THE CAROLINAS. R. A. Haygood, Department of Plant Pathology and Physiology, Clemson University, Clemson 29634, R. K. Jones and Pi-Yu Huang, Department of Plant Pathology, North Carolina State University, Raleigh, 27695.

Fastidious, xylem-inhabiting bacteria (FXIB) serologically related to the Pierce's disease bacterium were consistently detected by ELISA from September through December, 1987 in the petioles or buds of 4 pin oak (Quercus palustris) trees in Raleigh, N. C. and 10 Southern red oak (Quercus falcata) trees in Clemson, S.C. having leaf scorch symptoms. All scorched trees developed early fall coloration. Severe crown decline was observed on 3 trees of each species. No FXIB antigens were detected in petioles of 3 symptomless pin oak and 9 symptomless Southern red oak trees. Electron microscopy revealed the presence of bacteria resembling FXIB in xylem vessels of veins in pin oak leaves with marginal and interveinal necrosis, but not in leaves from trees without scorch symptoms.

PATHOGENICITY OF RHIZOCTONIA ZEAE AND RHIZOCTONIA ORYZAE on CENTIPEDE GRASS AND ST. AUGUSTINE GRASS. R. A. Haygood, Department of Plant Pathology and Physiology, Clemson University, Clemson, SC 29634-0377 and S.B. Martin, Horry-Georgetown Technical College, Conway, SC 29526.

One Rhizoctonia zeae isolate and two R. oryzae isolates were cultured from rotted sheaths of centipede grass (Eremochloa ophiuroides) in 1987. Centipede grass and St. Augustine grass (Stenotaphrum secondatum) were inoculated with the three isolates collected from centipede grass, a R. zeae isolate collected from bermudagrass (Cynodon dactylon) roots and a R. solani anastomosis group 2 type 2 isolate collected from centipede grass. All five isolates caused sheath rot of both grasses within 10 days after inoculation at 18 to 30 C. R. zeae and R. oryzae isolates also induced some foliar blight of centipede grass. The respective isolates were cultured from the infected grasses thus fulfilling Koch's postulates.

HISTOPATHOLOGICAL STUDY OF SORGHUM HEAD BLIGHT Fusarium moniliforme (Sheld.) S. & H., AT El BAJIO, MEXICO. M. Hernández, E. Cárdenas, S. Osada y L. E. Mendoza. INIFAP-C.P. Apdo. Postal #112, Celaya, Gto., México.

Head blight (F. moniliforme) reduces grain yield in sorghum at El Bajio, Mexico. The purpose of this study was to compare the characteristics of the vascular tissue, at the peduncle level, of inoculated plants of two genotypes: a moderately resistant (MR,RTx430) and a susceptible (S. R28B). Twenty plants per genotype were inoculated at anthesis in the peduncle, by tooth-pick technique. At physiological maturity, five inoculated plants of each genotype were obtained. Both cross and longitudinal sections were observed at microscope. Results indicated that: a) Vascular bundles of the MR had more lignine than in the S; b) S showed more tissue damage in the peduncle (29 vs. 16 cm) and more pith damage (78 vs. 42%) than the MR; c) were located at the periphery in the MR the 82% of the total vascular bundles and only 74% in S; d) parenchymal cells and vascular bundles tissue were invaded by the pathogen.

SURVIVAL OF PSEUDOMONAS SOLANACEARUM IN SELECTED GEORGIA SOILS. M.S. Hopkins and S.M. McCarter. Dept. Plant Pathology, University of Georgia, Athens, GA 30602.

When five field soils were infested at 1.8×10^7 cfu/g with P. solanacearum and held in the greenhouse at 24-32 C, relatively high populations (6.0×10^4 to 3.3×10^2 cfu/g) were still present in four of the soils after 6 mo. Disease incidence in tomato transplanted into the four soils ranged from 17 to 100% after 6 mo. In the fifth soil, a Greenville sandy loam, the organism was not detected after 2 mo. A variety of soil bacteria isolated from 24 Georgia soils were antagonistic to P. solanacearum in vitro. In greenhouse and field tests some of these bacteria slowed disease development but did not provide long-term control. When three selective media were evaluated for their selectivity and efficiency in recovering P. solanacearum from various natural soils, the medium of Granada and Sequeira (Plant Dis. 67:1084-1088) was superior. We concluded that P. solanacearum survives longer in some soils than recent studies have suggested and that suppressiveness in some soils may be related to either biological or physical factors.

EFFECTS OF TRICHODERMA HARZIANUM AND GLIOCLADIUM VIRENS ON MYCOPHAGOUS COLLEMBOLA (INSECTA), PROISOTOMA MINUTA AND ONYCHIURUS ENCARPATUS. R. T. Lartey, E. A. Curl, and C. M. Peterson, Dept. of Plant Pathology and Dept. of Botany and Microbiology, Ala. Agric. Expt. Sta., Auburn Univ., AL 36849.

In laboratory tests, two species of mycophagous collembolan insects, Proisotoma minuta and Onychiurus encarpatus, died when exposed to sporulating cultures of plant-disease biocontrol agents, Trichoderma harzianum and Gliocladium virens. The insects grazed the mycelia of young cultures, but began to die when cultures started to sporulate. When exposed to conidial exudate (spore washings), along with washed spores of each fungus, the Collembola avoided the exudate extracts but fed on the washed spores. When exposed to conidia coated with spore extracts, the insects were repelled by the spores. The two fungi also were lethal to the fall army worm, Spodoptera frugiperda, suggesting a broad-spectrum potential. These results suggest that the Collembola, which are known to suppress Rhizoctonia solani on cotton seedlings, may avoid toxic biocontrol agents T. harzianum and G. virens.

PATTERNS OF SPORULATION BY SEPTORIA NODORUM ON WHEAT LEAVES IN RELATION TO COMPONENTS OF QUANTITATIVE RESISTANCE. K. J. Leonard, USDA-ARS, N. C. State Univ., Raleigh, NC 27695.

Starting 7 days after inoculation, adult wheat plants infected with Septoria nodorum in the greenhouse were placed in a mist chamber each night to induce sporulation. Conidia were washed from leaves of intact plants each day with 10% ethanol and collected for counting. Conidial production per day followed a generally triangular pattern over the infectious period. Sporulation patterns on 4 cultivars were similar, but the times of onset and peak sporulation varied among 3 experiments. Leaves with 5-15% infection produced up to 10^6 conidia per leaf during the infectious period. Parameters of the sporulation curve were used in the model of Leonard & Mundt (TAG 67:219-230) to predict the effects of components of resistance on rates of disease increase (r). According to the model, with a susceptible host and high values of r, extending the latent period will reduce r more than equivalent reductions in infection efficiency or sporulation. For low r values, the reverse is true.

EFFECT OF CULTIVAR MIXTURES ON LEAF RUST SEVERITY IN WHEAT. T. Mahmood and D. Marshall, Department of Plant Pathology and Microbiology, Texas A&M University, College Station, 77843; and Texas Agricultural Experiment Station, Dallas, 75252.

Three mixtures of susceptible and resistant wheats in two- and three-way combinations and the respective purelines were evaluated for disease severity and yield parameters. Leaf rust (Puccinia recondita) severity was decreased and the rate of rust spread was slowed in the mixtures compared to the susceptible purelines. The rate of rust increased faster in the three-way mixtures containing two-thirds susceptible plants than in those containing one-third susceptible plants. In the two-way mixture, rust severity was decreased when only 10 percent of the mixture was resistant. There were no differences in yield between the purelines and the mixtures in the three-way combinations. However, in the two-way combination, several mixtures had higher yields than the purelines. Thousand kernel weight was increased in certain mixtures above the component purelines. Generally, different cultivar combinations had variable effects on the performance of the mixtures.

EFFECT OF INOCULUM TYPE AND SOURCE ON FUSARIUM WILT OF COTTON. J. P. McEntee and R. D. Martyn, Department of Plant Pathology and Microbiology, Texas A&M University, College Station, 77843.

Fusarium oxysporum f. sp. *vasinfectum* (FOV) survives in the soil as chlamydospores and saprophytically in infected plant tissue. Greenhouse and field microplot experiments were used to evaluate the efficacy of several types of inocula. Inoculum potential (IP) of overwintered-soil infested with FOV was compared to soil infested with laboratory-grown inoculum immediately prior to planting. Secondly, the IP of three FOV spore types (microconidia,

macroconidia, and chlamydospores) were compared. Lastly, the IP of different infected plant organs (stems, taproots, lateral roots and crowns) were compared. Inoculum in overwintered soil was more effective at causing disease in cotton than artificially infested soil as determined by vascular browning and pathogen isolation. All spore types demonstrated a high IP; however, 200 chlamydospores /g of soil was as effective as 1 x 10^5 microconidia /g of soil at causing disease. Of the plant organs tested, lateral roots were the most effective source of inoculum while the crowns were the least effective.

EARLY STAGES OF INFECTION OF PEANUT BY SCLEROTINIA MINOR. H. A. Melouk, S. S. Aboshosha, and C. N. Akem. USDA-ARS, Dept. of Plant Pathology, Oklahoma State Univ., Stillwater, OK 74078-0285.

Detached basal stems of peanut were inoculated with S. minor by placing a mycelial plug (4mm dia) on stem surface, and incubated on moist Whatman #1 filter paper in petri plates at 30±1C in darkness. Samples (5mm long) of inoculated stems were taken from the leading edge of infection, fixed in 2% glutaraldehyde, post fixed with 2% osmium tetroxide, and processed for scanning electron microscope. At 3 hr post inoculation (PI), hyphal growth was more abundant on surfaces of susceptible cv. Tamnut 74 (TAM) than on resistant cv. Toalson (TL). However, by the sixth hour, hyphal growth on TL was evident with a characteristic twining appearance. Infection cushions (IC) were well formed on TAM and TL at 12 and 24 hr PI, respectively. More IC were formed on TAM than TL, and successful hyphal penetrations were more common on TAM than on TL at 12 hr PI.

VARIATIONS IN STRUCTURE, GROWTH, AND PATHOGENICITY OF STEM CANKER PATHOGEN FROM THE SOUTHEASTERN UNITED STATES. R. P. Pacumbaba. Department of Plant and Soil Science, Alabama A&M University, Normal, AL 35762.

Eleven isolates of Diaporthe phaseolorum var. caulivora (Dpc), the causal organism of soybean stem canker (SSC) from 3 states of the southeastern United States were grown on PDA plates at different pH and temperatures in either continuous fluorescent light or in the dark. Variation in the culture morphology of each isolate including growth rate, number of stroma produced, color and consistency of the culture colony was noted. The maximum growth rate of the 11 Dpc isolates was obtained at pH 4.5 at 20 C in continuous fluorescent light or at 30 C in the dark after 54 hr of incubation. The maximum number of stroma produced was obtained at pH 5.5 at 15 C both in continuous fluorescent light and in the dark and at pH 6.5 at 25 C in continuous fluorescent light after 96 hr of incubation. Inoculation of these isolates to seedlings of Arksoy, Essex, Forrest, Ransom, Bragg, and Horosoy 63 produced 11 tentative Dps biological strains. All 11 Dpc isolates induced typical symptoms of SSC on susceptible soybean cultivar, RA 701.

OCCURRENCE OF SCLEROTINIA DISEASES ON POTENTIAL LEGUME COVER CROPS IN THE SOUTHEASTERN USA. R. G. Pratt, USDA, ARS, Mississippi State, MS 39762, S. M. Dabney, Louisiana Agric. Experiment Station, Baton Rouge, LA 70803, and D. A. Mays, Tennessee Valley Authority, Muscle Shoals, AL 35660.

Symptoms of disease and sclerotia of Sclerotinia were observed in stands of Austrian Winter pea (Pisum sativum var. arvense [L.] Poir, caleypea (Lathyrus hirsutus L.), hairy vetch (Vicia villosa Roth), and bigflower vetch (V. grandiflora W. Koch) in Louisiana and Alabama. Cultures from sclerotia from each host corresponded to S. trifoliorum or S. sclerotiorum in anamorphic features and all were pathogenic on plants of the source species. Apothecia from field-collected sclerotia or sclerotia of isolates were identified as S. trifoliorum and S. sclerotiorum. Both species were present on diseased plants at both locations. These results establish new North American records for S. trifoliorum on winter pea and hairy vetch and S. sclerotiorum on hairy vetch. These pathogens may limit productivity of the four legumes as winter cover crops in the Southeastern USA.

UPTAKE AND DISTRIBUTION OF THIABENDAZOLE INJECTED INTO LIVE OAKS. P. E. Roberts and D. N. Appel, Department of Plant Pathology and Microbiology, Texas A&M University, College Station, TX 77843

Thirty-two live oaks (Quercus fusiformis Small) growing in a naturally occurring oak wilt center were injected with 27.9 ml/cm dbh thiabendazole (TBZ) at 15000 ppm a.i. Five healthy and three diseased trees were treated in June, July, September and December, 1986, and reinjected in June 1987. A bioassay of twigs using a fungicide-sensitive Penicillium expansum Link isolate showed maximum distribution (64%) of TBZ occurred in the crowns of trees 1 month after the June treatments and minimum distribution (3%) following the December treatments. The 1987 reinjections greatly increased distribution of the fungicide in tree crowns. Residual activity of TBZ was assayable up to 12 months following June 1986 injections. Environmental variables and tree condition (healthy vs. diseased) were found to have some influence on the rates of fungicide uptake, but not on fungicide distribution in tree crowns.

UTILIZATION OF THE INTERSTATE HIGHWAY SYSTEM IN THE SOUTHEAST FOR DETECTION OF WHEAT RUSTS. John J. Roberts and Howell A. Fowler, Jr., USDA-ARS. Departments of Agronomy and Plant Pathology, University of Georgia, Griffin, GA 30223-1797.

The interstate highway system in Georgia, Florida, Alabama, Mississippi, and Louisiana provided a readily accessible means to plant and monitor trap plots for wheat rusts throughout the southeastern United States during two seasons. Susceptible wheats were planted at 80 sites outside the "mow line" at mile posts every 20 miles - a distance comparable to that used in established cereal rust surveys. The rectangular route included I75, I10, US171, and I20. Peat pots with seedlings and direct seedings were used to provide the best chance for survival. Unfortunately, the two years featured major droughts which limited survival of plants. However, in both years, surviving plants did have rust. This method offers a good way to survey a large area (1500 miles long), in a relatively short time. Planting and sampling each required only a three-day trip.

DETACHED STEM ASSAY TO EVALUATE THE SEVERITY OF STEM BLIGHT OF RABBITEYE BLUEBERRY (VACCINIUM ASHEI). Barbara J. Smith, USDA-ARS, Small Fruit Res., P. O. Box 287, Poplarville, MS 39470.

A detached stem assay (DSA) was compared to greenhouse and field inoculations to evaluate stem blight (Botryosphaeria dothidea) severity on 5 rabbiteye blueberry cultivars. In each test, succulent, partially hardened stems were wounded by scraping away a 2 X 4 mm section of bark 50 mm from the tip of the stem, and inoculated immediately by securing a 2 mm mycelial square against the wound. For the DSA, 150 mm shoots were cut from the plant and all leaves except the top 3 were removed. After inoculation each stem was inserted into moistened, sterilized sand in a 150 X 25 mm tissue culture tube and incubated at 20 C. In each test there were significant differences in lesion length 20 days after inoculation, and relative cultivar susceptiblity was the same with Tifblue being the most susceptible and Climax the least susceptible of the cultivars tested. The DSA could be utilized in a breeding program to efficiently identify resistant genotypes.

ANTAGONISM OF BINUCLEATE RHIZOCTONIA-LIKE FUNGI AND OTHER BASIDIOMYCETES TO RHIZOCTONIA SOLANI AG-4 AND AG-2 TYPE 2. Donald R. Sumner and Durham K. Bell, University of Georgia Coastal Plain Experiment Station, Tifton, GA 31793-0748.

Isolates of Rhizoctonia-like fungi CAG-2 and CAG-4, Laetisaria arvalis (LA) and an orange basidiomycete (OB) indigenous to the Georgia coastal plain were tested for antagonism against Rhizoctonia solani AG-4 and AG-2 type 2. Potential antagonists and pathogens in 3% cornmeal-sand (w/w) were mixed equally in Dothan loamy sand. Soil was incubated 0-6 wk, sampled for colony forming units (CFU) and planted to snap bean or corn. Snap bean was rated for root disease severity and corn for crown/brace root rot (RDS) 2-3 wk after planting. Fifteen of 19 isolates of CAG-2, seven of nine of CAG-4, one of 12 of LA, and one of nine of the OB reduced RDS or increased stands in snap bean or corn. Only three of 19 isolates of CAG-2, one of nine of CAG-4, two of 12 of LA, and one of nine of the OB reduced CFU of AG-4 in soil after 4-6 wk.

USE OF DNA HYBRIDIZATION TECHNIQUES TO DETECT AGROBACTERIUM TUMEFACIENS T-DNA IN SYMPTOMLESS VITIS ROTUNDIFOLIA VINES. Joe Sun and Dawn Luthe, Dept. of Biochemistry and Clinton H. Graves, Jr., Dept. of Plant Pathology and Weed Science, Miss. State, MS 39762.

Our research indicates that T-DNA (tumor-inducing DNA) hybridization techniques may be used successfully for screening isolates of Agrobacterium from muscadine for infectivity and for screening symptomless muscadine grapes (Vitis rotundifolia) for presence of Agrobacterium tumefaciens. The radioactive probes used contained T-DNA

fragments cloned into E. coli plasmid pBR322. Colony hybridization and slot blot techniques consistently distinguished between virulent and avirulent isolates of Agrobacterium. Positive readings were obtained for the presence of T-DNA in some symptomless plants and negative readings in others. Confirmatory studies, including a Southern blot analysis, are incomplete.

EGG HATCH OF CRICONEMELLA XENOPLAX AT DIFFERENT TEMPERATURES. S. W. Westcott, III, Department of Plant Pathology and Physiology, Clemson University, Clemson, SC 29634.

Eggs were collected from gravid females of Criconemella xenoplax (Raski) Luc and Raski by incubating the females in distilled water at 25 C for 1 day. Females were removed from dishes by hand picking. Dishes containing more than 30 eggs were incubated at constant temperatures in the range of 10-35 C. The hatching date and the percent of eggs that hatched were recorded. At 10 C 150 ± 10 days were required for hatching. Hatch occurred in 8.5 ± 0.5 days at temperatures of 25-32 C. Sixty-six ± 22% of the eggs hatched at temperatures of 13-32 C. Eggs died above 33 C and 42 ± 16% of eggs hatched at 10 C. At 25 C 80% ± 8% of the eggs hatched. In the range of 10-25 C, eggs hatched in 150 degree days (base of 9 C). Above 25 C the number of days required for hatching was relatively constant and did not follow the degree-day model. This information may be useful for interpreting the effects of temperature on nematode reproduction.

INDEPENDENCE OF THE LEAF RUST RESISTANCE AND RYE CHROMOSOMES OF TWO TRITICALES. J. Wilson and G. Shaner, USDA-ARS, Coastal Plain Expt. Sta., Tifton, GA, 31793-0748; and Dept. Botany and Plant Pathology, Purdue Univ., West Lafayette, IN, 47907.

Triticale PIs 429120 and 429215 were selected as potential sources of leaf rust resistance for wheat. Both cultivars exhibit 0;n infection types to culture 7434-1-1T of Puccinia recondita. Ease of transfer of rust resistance from triticale to wheat will be affected by the number and genomic location of the genes for resistance. PI 429120 has two dominant genes that confer a high level of resistance. PI 429215 also has two dominant genes; one confers a high level of resistance and one confers a low level of resistance. The triticales were crossed to the wheat cv. Caldwell, which in the seedling stage is susceptible to P. recondita. The mitotic chromosomes of the parents and interspecific F_2 were C-banded and the plants were inoculated. In both F_2 populations, no rye chromosome was consistently associated with a resistant infection type, indicating that the genes for resistance in the triticales are located on wheat genome chromosomes.

OCCURRENCE OF SCLEROTIA TYPES AND RHIZOCTONIA FOLIAR BLIGHTS OF SOYBEAN IN LOUISIANA. Yang, X.B., G.T. Berggren, and J.P. Snow, Dept. of Plant Path. and Crop Phys., La St. Univ. Agri. Center, Baton Rouge, LA 70803.

The sclerotial form and associated type of soybean foliar blight was determined in 2-3 fields at 11 locations statewide during August, 1987. Both microsclerotia causing web blight and sasakii sclerotia causing aerial blight were observed; however, the web blight type was predominant. Rainfall during the season was above normal. Microsclerotia show a lateral growth type of development, different from the loose type formation of sasakii sclerotia.

DEVELOPMENT OF RHIZOCTONIA AERIAL BLIGHT OF SOYBEAN. X.B. Yang, J.P. Snow, and G.T. Berggren. Dept. of Plant Path. & and Crop Phys. La St. Univ. Agri. Center, Baton Rouge, LA 70803

The time and number of primary infections developing from soilborne inoculum was quantified by counting and removing lesions at 3-5 day intervals during two growing seasons. Numbers of primary infections detected were highest early then fluctuated over time. Fluctuations appearred to be related to rainfall occurrence. Disease establishment from primary infections and enlargement of foci were monitored in different plots inoculated over time. One season, high establishment ratios were obtained only after canopy closure, but in another, heavy rainfall increased ratios in early season. Disease foci expanded more rapidly after canopy closure. Disease development appears to be divided into two periods: before and after canopy closure. The first is important to determine the number of disease foci while the second for expansion of disease foci. Natural disease progress monitored in 35 plots was erratic in two seasons.

RESISTANCE TO FUSARIUM WILT IN MUSKMELON BREEDING LINE MR-1. F. W. Zink and C. E. Thomas, Dept. of Vegetable Crops, Univ. of California, Davis, CA 95616 and USDA, ARS, U. S. Vegetable Laboratory, Charleston, SC 29414.

MR-1 is a muskmelon (Cucumis melo) breeding line that was developed and released to serve as a source of high levels of non-specific resistances to downy and powdery mildews. Fusarium wilt resistance in this line was evaluated by inoculating seedlings of MR-1 and differential muskmelon genotypes with isolates of Fusarium oxysporum f. sp. melonis races 0, 1, and 2. Roots were washed, pruned to about 25 mm, and dipped into suspensions of 2.5×10^5 conidia per ml of a test isolate for one minute. Inoculated seedlings were transplanted into a sterile peat and perlite (1:1) mix and placed in the glasshouse at 20-27 C and observed for at least 28 days for development of wilt symptoms. Resistant plants were observed until maturity. MR-1 was resistant to races 0, 1, and 2. Perlita FR and Doublon were resistant to races 0 and 2 and CM 17-187 was resistant to races 0 and 1. Charentais T and PMR-45 were susceptible to all three races.

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