ABSTRACTS OF PAPERS

Presented at Meetings of The American Phytopathological Society

Joint Meeting of
The American Phytopathological Society

SOUTHERN DIVISION

and the Southern Association of Agricultural Scientists
February 3–6, 1980

ABSTRACTS

*Presented in the Graduate Student Award Competition of the Southern Division of The American Phytopathological Society.

PATHOLOGY OF HOPLOLAIMUS COLUMBUS ON SUGARCANE. George E. Astudillo and W. Birchfield, Dept. of Plant Pathology and Crop Physiology and USDA, SEA, Louisiana State Univ., Baton Rouge, 70803

Hoplolaimus columbus Sher was found parasitizing sugarcane in Louisiana. This nematode is known to cause extensive damage to soybeans in other states but sugarcane was not a previously known host plant. It was completely embedded within roots of sugarcane growing in soil where soybeans had grown. Penetration of cortical cells, damaged parenchyma tissue and cell necrosis were observed. It developed in all portions of the sugarcane root and increased in population. Parasitism resulted in a coarse, depleted root system, although top and root wts and leaf lengths were not significantly reduced. Complete embryonic development of the nematode occurred in 10-11 days inside the roots of sugarcane variety L 60-25 at room temperature. Eight soybean varieties were invaded when planted in sugarcane soil naturally infested with this nematode. Distribution and economic importance of H. columbus on sugarcane are unknown.

ETIOLOGY AND CONTROL OF RHODODENDRON DIEBACK CAUSED BY PHYTOPHTHORA SPP. D. M. Benson and R. K. Jones, Dept. of Plant Pathology, N. C. State Univ., Raleigh 27650.

Phytophthora cactorum, P. citricola and P. parasitica were isolated from dieback tissue on hybrid rhododendrons at nine container nurseries across North Carolina. P. cactorum was most commonly isolated (5 of 9 nurseries), although more than one species occurred at some nurseries. Zoospore inoculum of each species infected young leaves and stems of plants incubated under mist for 2 days after inoculation. A dark-brown discoloration of stem and leaf tissue developed that was indistinguishable from symptoms caused by P. heveae (Benson, Phytopathology 69:525). Hybrid rhododendron, Roseum Elegans, sprayed once with captafol (0.6 g/ℓ), captan (1.2 g/ℓ), or mancozeb (0.96 g/ℓ), or drenched with the systemics LS 74-783 (0.96 g/ℓ), or Subdue® (CGA-48988, 0.96 g/ℓ) were protected 1 to 5 days from zoospore infection by P. heveae. Under overhead irrigation (0.8 cm/day), captafol, captan, mancozeb, LS 74-783, and Subdue® prevented zoospore infection of leaf disks from plants up to 70,7,7,21 and 70 days, respectively, after treatment.

RESPONSE OF PRATYLENCHUS PENETRANS-INFECTED TOMATOES TO OZONE AND SULFUR DIOXIDE. B. J. Brewer, R. A. Reinert, and K. R. Barker, Dept. of Plant Pathology, N. C. State Univ., Raleigh 27650.

Tomato plants, Lycopersicon esculentum 'Walter' either non-inoculated or inoculated with Pratylenchus penetrans, were repeatedly exposed 3-4 hr to charcoal-filtered air, ozone (O_3), sulfur dioxide (SO_2), or a mixture of O_3 + SO_2. Ozone at 0.2-0.6 ppm or SO_2 at 0.8 ppm suppressed tomato growth. The gases in mixture at 0.2 ppm O_3 +0.2 ppm SO_2 suppressed tomato growth additively, whereas 0.2 ppm O_3 + 0.8 ppm SO_2 usually caused less than additive growth suppressions. The P. penetrans by 0.2 ppm O_3 + 0.2 ppm SO_2 interaction was less than additive, but the P. penetrans by 0.2 ppm O_3 +0.8 ppm SO_2 interaction was greater than additive. Ozone or SO_2 by P. penetrans interactions were additive. Tomato response to varying O_3 dose was not dependent on the number of P. penetrans (initial population of 0 to 4,000 nematodes) added to plants.

DEVELOPMENT AND CONTROL OF BOT CANKER OF APPLE. E. A. Brown and F. F. Hendrix, Dept. of Plant Pathology and Plant Genetics, Univ. of Georgia, Athens 30602.

Penetration of germinating Botryosphaeria dothidea conidia were observed 4 and 6 hours after inoculation on pruned and punctured stems of greenhouse grown apples, respectively. Evidence of canker formation was observed at 2 weeks. Mycelium was associated with disrupted cortical tissue of cut, cold, and heat treated stems. Rapid vertical canker development resulted from unobstructed growth of mycelium in xylem vessels. Hyperplasia of parenchyma cells restricted initial movement of B. dothidea into the xylem of heat treated trees and resulted in only 56% infection. Bot cankers developed on 100% of cut and cold treated trees and only on 12% of the non-wounded treated trees. Field observations indicated active cankers were associated with pruning wounds 70-100% of the time in four orchards. Five applications at 2-week intervals of benomyl at 1.2 g a.i./liter on cankers reduced recovery of B. dothidea 100% in three orchards and 88% in one orchard.

RHIZOSPHERE EFFECT OF A HERBICIDE-STRESSED PLANT, CASSIA OBTUSIFOLIA, ON FUSARIUM OXYSPORUM f. sp. VASINFECTUM, Steve L. Brown and E.A. Curl, Department of Botany, Plant Pathology, and Microbiology, Auburn University, Auburn, AL 36830

Three-day-old sicklepod plants (Cassia obtusifolia), aseptically cultured in water and foliar treated with the herbicide linuron (3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea), released root exudate representing a 19.8% increase in dry matter over that from healthy plants. Germination of Fusarium oxysporum f. sp. vasinfectum chlamydospores, supported on Millipore filter membranes and buried in nonsterilized rhizosphere soil of herbicide-stressed plants, was significantly reduced below the fungistatic value recorded in a healthy-plant rhizosphere. Chlamydospore production in the rhizosphere was reduced by herbicide stress of sicklepod grown in sterilized soil, but no change occurred in soil with a natural microflora. This study suggests that herbicide-induced alteration of root exudation by a non-crop plant may indirectly affect the pathogen.

INFLUENCE OF TIME AND TEMPERATURE ON INOCULATION AND INFECTION OF ST. AUGUSTINEGRASS BY SCLEROPHTHORA MACROSPORA. B. D. Bruton and R. W. Toler, Dept. of Plant Sciences, Texas A&M Univ. College Station, 77843.

Sporangia of Sclerophthora macrospora, the causal agent of downy mildew of St. Augustinegrass (SA), were produced on infected leaf blades over a temperature range of 5 to 25 C with an optimum at 15C. Optimum temperature range for subsequent zoospore production was determined to be 15 to 20 C with zoospore encystment and germination occurring at 15 to 25 C. Zoospores demonstrated a positive chemotactic response towards the abaxial surface of newly expanding leaves and to a lesser extent to the leaf margins. Infection of leaves by zoospores occurred between 10 and 25 C with an optimum at 15 C. Inoculation techniques involved flooding the grass with tap H_2O and floating naturally infected SA leaves on the surface to allow for sporangia and subsequent zoospore production. The shortest exposure time required for optimum infection was 24 hr at 15 C.

MYCELIAL GROWTH AND CONIDIAL PRODUCTION OF COLLETOTRICHUM DEMATIUM VAR. TRUNCATA IN CULTURE. R.S. Bryant and H.J. Walters, Dept. of Plant Pathology, Univ. of Arkansas, Fayetteville 72701.

Ability of the soybean anthracnose pathogen to grow and sporulate on malt, potato dextrose, potato starch, torula yeast, and V-8 agars was evaluated. Colony diameter was measured every 2 days on cultures incubated in the dark at constant temperatures for 12 days. Mycelial growth and sporulation occurred on all media from 20 to 36 C. Largest colony diameter occurred on V-8 agar at all temperatures, but greatest number of conidia was produced on torula yeast agar at 28 to 32 C. Conidial production in liquid media was evaluated by modifying Richards V-8 medium by substitution of either MOR-REX (Corn Products Corp.), potato starch, or sucrose for the carbon source at six different concentrations. Following incubation for one week in a temperature controlled shaker at 28 C, conidial concentration of each culture was determined. Sporulation occurred on all carbon sources at all concentrations with the largest number of spores produced with MOR-REX at 5 g/l.

PURIFICATION OF RUSSET CRACK STRAINS OF SWEET POTATO FEATHERY MOTTLE VIRUS. B. B. Cali and J. W. Moyer. Dept. of Plant Pathology, N. C. State Univ., Raleigh 27650.

Attempts to purify two russet crack strains of sweet potato feathery mottle virus (SPFMV) by procedures used for the common strain of SPFMV resulted in severe aggregation. Repeated trials demonstrated these two and the common strain could be purified by homogenizing systemically infected Ipomoea nil leaves in 3 ml/g of 0.1 M sodium borate buffer, pH 8, containing 0.5 M urea and clarifying with chloroform (3 ml extract/ml $CHCl_3$). The extract was given 2 cycles of differential centrifugation, using an 8 ml, 20% sucrose cushion in the first and a discontinuous 18 ml, 20-50% sucrose cushion in the second. Pellets were resuspended in 0.05 M sodium borate, pH 8, containing 0.5 M urea and 1% triton X-100. Centrifugation (160,000 g [avg], 16 h) in 38% CsCl yielded a discrete band of virus with a 260/280 absorption ratio of 1.15. Purified preparations transferred through a local lesion host provided single strain sources. Graft transmission experiments to Jersey sweet potatoes confirmed initial findings that these two strains of SPFMV cause russet crack.

HISTOPATHOLOGY OF CURVULARIA LUNATA INFECTION OF SORGHUM KERNELS. L. L. Castor and R. A. Frederiksen, Dept. of Plant Sciences, Texas A & M Univ., College Station 77843.

Sorghum grain molds are defined as prematurity diseases resulting from infection of florets or developing kernels as early as anthesis by parasitic field fungi. Worldwide, Curvularia lunata (CL) is one of the principal grain mold fungi. Sorghum lines were inoculated at anthesis with CL to determine when and how infection occurs. Observations of diseased and healthy kernels indicated that infection occurred in glumes, lemma, palea, and lodicules by 5 days after anthesis. Colonization of pedicel tissues resulted in kernel abortion or in reduced kernel filling. Although CL hyphae entered the endosperm directly, subsequent colonization was restricted by the peripheral endosperm. Extensive colonization of the endosperm and germ tissues resulted when hyphae entered via the placental void and endosperm transfer cells. This study provides histological evidence that CL colonizes sorghum kernels parasitically prior to maturity.

INITIAL CONTROL OF BARREN STALK OF CORN IN NORTH CAROLINA. S. I. Cohen[1], J. P. Lilly[2] and J. W. Van Duyn[3]. Depts. of Plant Pathology[1], Soil Science[2] and Entomology[3], N. C. State University, Raleigh 27650.

This yield decline of corn in highly organic soils can be controlled by methyl bromide but fumigation is too costly. In greenhouse tests maneb, diazoben, chlorothalonil, benomyl, carboxin, thiophanate and thiram applied preplanting to soil at 56 kg a.i./ha reduced mortality, increased growth and counteracted delay of flowering, reduction of tassel size and number of silks. Selected chemicals and 1 combination of them were tested in field microplots. In 1977 a 1:1:1 maneb-benomyl-PCNB equalled methyl bromide in growth and increased earweight in plots flooded 4 times during the 14th to 44th days after planting. In 1978 this combination reduced root rot and increased growth by midseason. Again it equalled methyl bromide in earweight and reduced barrenness from 15 to 7%. Diazoben, maneb and benomyl also increased earweight but did not reduce barrenness. In 1979, when disease was low, reducing the rates from 56 to 14 kg/ha had no significant effect on performance.

EFFECTIVENESS OF BACTERICIDES AND BACTERICIDE-FUNGICIDE COMBINATIONS IN INHIBITING PSEUDOMONAS TOMATO AND CONTROLLING BACTERIAL SPECK. K. C. Conlin and S. M. McCarter, Dept. of Plant Pathology, Univ. of Georgia, Athens 30602.*

Cupric hydroxide (Kocide 101) and streptomycin (Agri-mycin 17) added to 4-hr shake cultures of Pseudomonas tomato at rates equivalent to those recommended for field application rapidly killed all cells, whereas oxytetracycline (Terramycin) required 8 hr. Cupric hydroxide and streptomycin used alone or in combination with either chlorothalonil (Bravo) or maneb (Manzate 200) at recommended rates reduced foliar lesions when applied as a protective spray in the greenhouse. These chemicals also reduced epiphytic populations of P. tomato on field plants but were only moderately effective for reducing incidence of speck on fruits. Terramycin used in combination with fungicides was least effective for controlling speck in the field. A cupric hydroxide-maneb combination treatment appears to be the best choice for the field control of bacterial speck but complete control was not achieved.

CONTROL OF RICE BLAST WITH MONOGENIC RESISTANCE AND RACE PREDICTION. Pat Crill and Y. S. Ham, The International Rice Research Institute, Los Banos, Laguna, Philippines and Ministry of Agriculture and Fisheries, ORD, Crop Experiment Station, Suweon, Korea.

Blast, caused by Pyricularia oryzae, is the most important disease of rice in the world. Despite numerous attempts to control blast in different countries, significant economic losses occur annually. In 1977 the Republic of Korea averaged 4.94 metric tons of milled rice per ha on 1.2 million ha with slight blast losses. In 1978 rice blast losses were severe when a new race was dispersed throughout the country by two typhoons, reducing the yield to 4.7 T/ha. In November 1978, a comprehensive integrated rice blast control program was implemented through cooperative efforts of research and extension personnel. The control program combined the use of resistant varieties, cultural practices, pesticides, utilization of specific monogenes for resistance, and development of race prediction procedures. Loss to blast in the 1979 crop was negligible.

ATTACHMENT TO GLASS OF THE BACTERIUM ASSOCIATED WITH RATOON STUNTING DISEASE OF SUGARCANE. K. E. Damann, Jr., Dept. of Plant Pathology & Crop Physiology, Louisiana Agricultural Experiment Station, Baton Rouge, 70803.

The ratoon stunting disease-associated bacterium became attached to the upper and lower surfaces of a rectangular glass microcapillary in a characteristic pattern. The pattern was a disc of bacterial cells around a small fragment of sugarcane tissue carried along with the preparation of the bacterium from the plant. The disc diameters were roughly proportional to the size of the tissue fragments. The appearance of the disc pattern required approximately 1 month to develop, and the margins became progressively more defined with time. Frequently, the upper surface of the microcapillary had a disc directly above the disc on the lower surface. The space between discs was free of bacteria. These observations support the hypothesis that material diffusing from the sugarcane tissue fragments attracts and stimulates attachment of the bacterial cells to the glass. The attachment phenomenon may have application for culture of the bacterium.

FUNGICIDAL CONTROL OF STRAWBERRY ANTHRACNOSE. Bryan R. Delp and R. D. Milholland, Dept. of Plant Pathology, N. C. State University, Raleigh, NC 27650.

Strawberry anthracnose caused by Colletotrichum fragariae has caused severe losses in strawberry nurseries throughout the southeastern USA, despite the use of the recommended fungicide, benomyl. In vitro tests determined fungitoxic concentrations of captafol, captan, maneb, and benomyl on C. fragariae to be 1.0, 100, 100, and >500 µg a.i./ml, respectively. Captafol applied every 7 days controlled the disease under field conditions but was ineffective if applied every 14 days. Benomyl, maneb and captan were ineffective in 7- and 14-day spray schedules. In 1978 and 1979 there were no significant differences (P = .05) in yield among the captafol treatments when applied every 7 days at 1.2, 2.4, 3.6, and 4.8 g a.i./l. However, in 1979 disease ratings were higher at the two lower rates.

FACTORS AFFECTING DISEASE DEVELOPMENT OF STRAWBERRIES INFECTED WITH COLLETOTRICHUM FRAGARIAE. Bryan R. Delp and R. D. Milholland, Dept. of Plant Pathology, N.C. State Univ., Raleigh, NC 27650.

Optimum conditions were defined for evaluating resistance in strawberry (Fragaria chiloensis var. ananassa) to Colletotrichum

fragariae. A disease index was developed based on petiole reactions where flecking was considered resistant and girdling to petiole death susceptible. Crown reaction was not used because all plants inoculated in the crown died. The age of inoculum (4-38 days) did not affect the amount of infection. Optimum inoculum density for resistance evaluation was 10^6 conidia/ml. Optimum length of time in the moist chamber was 48 hr with all plants becoming susceptible after 72 hr. Infection occurred at 15C but disease development was retarded. Optimum temperature was 25C with resistant varieties becoming susceptible at 30C. This was related to in vitro optimum temperatures (24-28C) for fungal growth, sporulation and germination.

INTERACTION BETWEEN MELOIDOGYNE ARENARIA (RACE 2) AND CYLINDROCLADIUM CROTALARIAE ON A PEANUT CULTIVAR RESISTANT TO BOTH PATHOGENS. M. Diomande, M. C. Black, N. E. Harris and M. K. Beute, Dept. of Plant Pathology, N. C. State Univ., Raleigh 27650.

Two populations of M. arenaria (race 2) which do not reproduce on peanut enhanced Cylindrocladium black rot (CBR) on CBR-resistant peanut cultivar 'NC 3033' in greenhouse experiments. Nematode populations were from Colombia, South America (256) and North Carolina (486). Root damage tended to increase synergistically (nonsignificant at P=0.05) when nematode populations 256 or 486 (0, 10^3, 10^4 eggs/15-cm pot) were mixed with C. crotalariae (0, 0.5, 5, 50 microsclerotia/cm^3). Disease severity (foliar) increased synergistically in the first test and in a 2^3 factorial experiment with 256, 486 (0, 5 X 10^3 eggs/15-cm pot) and C. crotalariae (0, 50 microsclerotia/cm^3). Although neither nematode population reproduced on 'NC 3033', larvae of both 256 and 486 penetrated roots (5 days), and males with two gonads were observed at 8 wks. Morphological changes in roots were observed histologically.

COMPARISON OF HYDRAULIC PRESS AND PSYCHROMETRIC METHODS FOR ESTIMATING TISSUE WATER STRESS. Deborah R. Fravel[1], D. M. Benson[1] and R. P. Patterson[2], Depts. of Plant Pathology[1] and Crop Science[2], North Carolina State University, Raleigh 27650.*

Hydraulic press and double-junction, isopiestic psychrometer methods of measuring tissue water potential were compared for well-watered and water-stressed tissues. Paired leaves of shore juniper and paired half leaves of corn, soybean, tobacco and azalea were compared. A linear relationship was observed between the two methods for corn, juniper and soybean, but not for azalea and tobacco. This relationship was constant for a plant species down to about -35 bars. A bar reading on the psychrometer was not equivalent to a bar reading on the press. The press underestimated water potential by 0.5, 0.6 and 0.7 fold for corn, juniper and soybean, respectively. The press is portable, relatively inexpensive and durable, and permits rapid estimation of water potential. Relative differences in water potential could be determined by the press for a plant species but absolute values should be determined by calibration with a psychrometer.

EFFECTS OF ALFALFA MOSAIC, CLOVER YELLOW VEIN, AND PEANUT STUNT VIRUSES ON GROWTH AND NODULATION OF WHITE CLOVER. P. B. Gibson, O. W. Barnett, and H. D. Skipper, SEA, USDA and College of Agricultural Sciences, Clemson Univ., Clemson, SC 29631.

Effects of alfalfa mosaic (AMV), clover yellow vein (CYVV), and peanut stunt (PSV) viruses on components of growth and nodulation of 10 white clover clones were studied. Separate plants of the same clone were kept virus-free or inoculated with either AMV, CYVV, or PSV. A rooted stolon tip from each plant was established separately at one end of a small flat and grown for 1 month in a controlled environment chamber at 25 C and 12/12 hr light/dark. All three viruses reduced leaf dry weight, stolon dry weight, neutral detergent fiber per plant (above-ground parts), primary stolon length, secondary stolon length, nodes in secondary stolons, rooting nodes in secondary stolons and nodulation. Two viruses, AMV and PSV, reduced rooting nodes in primary stolon, secondary stolons, and leaves per plant. One virus, PSV, reduced nodes per primary stolon, petiole length, root length and total nitrogen per plant (above-ground parts). Need for virus control is clearly indicated.

THE EFFECT OF RELATIVE HUMIDITY ON THE DISCHARGE AND VIABILITY OF PYCNIDIOSPORES OF SEPTORIA TRITICI. F. J. Gough and T. S. Lee, USDA, SEA-AR, Dept. of Plant Pathology, Oklahoma State Univ., Stillwater, 74074, and Dept. of Botany and Plant Pathology, Purdue Univ., West Lafayette, IN 47907.

The effect of different relative humidity (RH) values on expulsion and longevity of Septoria tritici pycnidiospores was tested by suspending pycnidia in leaf lesions above water and solutions of NaCl and NaOH in sealed tubes maintained at 25± 0.2C. Pycnidia held at about 100% RH for 48 hr expelled more than 2x as many spores as those held at 98% RH, and 11-23x as many as those held at 86% RH. Expelled spores in globules and cirri atop pycnidia remained 100% viable for 15 days in atmospheres of 35-85% RH. But after 15 days at 65% RH and above, viability dropped to 5-10% at 20 days, to less than 2% at 30 days, and to 0% at 50 days. At 55% RH, 50-60% of the spores were viable after 60 days; and at 45 and 35% RH, 60-90% were viable. Spores within pycnidia held at 35% RH and 25C were 100% viable after 132 days.

BENOMYL-RESISTANT BOTRYTIS STRAINS FOUND IN GREENHOUSE TOMATOES IN ARKANSAS. Dot E. Griffin[1], M. J. Goode[1] and T. E. Morelock[2], Depts. of Plant Pathology[1] and Horticulture and Forestry[2], University of Arkansas, Fayetteville 72701.

In 1978 application of benomyl [methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate] to tomatoes failed to control gray mold in several Arkansas greenhouses. Five isolates of Botrytis cinerea from three greenhouses were tested for growth on potato-dextrose agar amended with 0, 0.6, 2.5, 12.5, 25, or 500 µg/ml benomyl. A control strawberry isolate from a garden where benomyl had never been used was also tested. The strawberry isolate and one tomato isolate did not grow at any concentration of benomyl, but four isolates grew at all concentrations tested. Three months in culture did not appear to alter the tolerance of those isolates to benomyl.

THE EFFECT OF ENVIRONMENT ON THE CHRYSANTHEMUM STUNT VIROID DISEASE. M. K. Handley and R. K. Horst, Dept. of Plant Pathology, Cornell Univ., Ithaca, NY 14853.

Chrysanthemum stunt disease, caused by the chrysanthemum stunt viroid (CSV), was found to be affected by alterations in temperature, light intensity and photoperiod. Symptom severity and progression, as well as viroid titer, were affected. Infectivity indices were used to measure both symptom severity and rate of development. These were summations of alternate day observations of the number of infected plants in each treatment. Symptoms were maximum at temperatures of 26-29 C, while maximum viroid titer was observed at 22-26 C. Rapid drops in both parameters occurred below these temperatures, and viroid titer was also reduced above the optimum temperature. Light intensity had less effect than temperature, with the highest intensities favoring symptom development and lower intensities causing increased viroid titer. Short photoperiods reduced symptom development but not viroid titer.

ENHANCEMENT OF VICTORIN TOXICITY BY FRACTIONAL THAWING. Martha Hawes and S. J. Sheen, Dept. of Plant Pathology, Univ. of Kentucky, Lexington, 40546.

One-ml samples of crude victorin isolated from Helminthosporium victoriae were stored at -18 C. When completely thawed and mixed, the toxin inhibited root growth of susceptible oats by 90% at a dilution between 10^4- and 10^5-fold. When successive 0.1-ml fractions were removed as the toxin thawed, the first fraction caused 90% inhibition of growth at a 10^9-fold dilution. The next 9 fractions were progressively less active; the final sample caused 90% inhibition 10^2- and 10^3-fold dilutions. These results suggest that victorin may thaw faster than the surrounding medium so that fractional thawing yields concentrated toxin in the first samples removed. This characteristic may provide a simple method for partial purification of victorin.

CRUCIAL EXPERIMENTS FOR TESTS OF MUTAGENIC NEMATODE THEORY. John P. Hollis, Dept. Plant Pathology & Crop Physiology, La. Agric. Expt. Sta., Baton Rouge, La 70803

There are three crucial experiments, effects of mutagenic nematode theory (MNT), not predicted by current knowledge of variation in organisms based on random mutation, selection and sexual processes: excessive numbers of sweet potato (Ipomoea batatas L.) mutants, some nematode species more mutagenic than others, alteration of chromosome complement in the host. The first effect has long been known but unexplained. The second effect can provide a basis for patents of mutagenic nematode species and new sweet potato varieties. The last crucial experiment is based on MNT's prediction of chromosome changes in the host. Since the nematode effect is on chromosomes, the

formation of new nematode races is mediated by selection pressure derived from the host chromosome complement independent of host. Exposure of root knot species, for example, to sweet potatoes in terms of time and varieties will result in production of chimeric forms of all known and derivable biotypes of these nematodes occurring on all host species throughout the world.

PEST CONTROL STRATEGIES OF MUTAGENIC NEMATODE THEORY. John P. Hollis, Dept. Plant Pathology & Crop Physiology, La. Agric. Expt. Sta., Baton Rouge, La 70803.

Prepest breeding for plant resistance to nematodes is a consequence of mutagenic nematode theory (MNT, Phytopath. 69:528, 1979). Current postpest breeding of resistant varieties to new ecological races (biotypes) after they appear in a crop is based on the concept of biotype formation as a host dependent reaction. According to MNT, biotype formation in a nematode species for all hosts can be derived from reactions to changes in the chromosome complement (gene pool) in one host species alone. The sweet potato (Ipomoea batatas L.) is ideal for production of biotypes because of production of new mutations (root chimeras) from clonally-propagated roots. Development of nematode nurseries utilizing a large potential chromosome complement resulting from continual additions of new sweet potato stocks will lead to a large bank of new nematode biotypes, which can be used to breed resistant varieties of crop plants susceptible to them before they appear in the natural cropping systems.

PIERCE'S DISEASE BACTERIUM CAUSES A DISEASE OF ROUGH LEMON CITRUS. D. L. Hopkins and W. C. Adlerz, Univ. of Florida, Agricultural Research Center, Leesburg 32748.

The Pierce's disease bacterium caused dieback-type symptoms in five of seven rough lemon citrus plants (Citrus jambhiri) in the greenhouse. The plants were inoculated in December 1977 and symptoms were observed first in August 1978. Symptoms included a dieback of young shoots from the tip, curling and tipburn of younger leaves, and leaf drop. Plants continued to produce new shoots which died back, resulting in a bushy-type growth. Water flow-rate through the diseased stems was reduced when compared with healthy rough lemon. Immunofluorescence techniques revealed the bacterium in the diseased tissue. Earlier, the Pierce's disease bacterium was recovered from citrus with blight, and citrus with rough lemon rootstock is very susceptible to blight.

SURVIVAL OF RHIZOBIUM JAPONICUM IN THREE SOILS. M. M. Joshi, S. N. Hillebrenner, and G. R. Goss. Kalo Laboratories, Inc., 525 Kentucky Street, Quincy, IL 62301.

Rhizobium japonicum (RJ) strains 6, 110, 122, and 138 containing antibiotic-resistance markers were added to autoclaved (AC) and non-autoclaved (NAC) Seaton-Urban silt loam (SSL), Port-Byron silt loam (PSL), and Wakeland sand (WS) from West-central Illinois. The soils were incubated at 35 C and survival of RJ was monitored over a 120-day period. In general, AC soils, if kept free of contaminants (e.g., Penicillium spp., Trichoderma spp., and gram-negative bacteria), supported RJ longer than NAC soils. In both AC and NAC soils, survival of RJ was as follows: PSL > SSL > WS. The length of survival in NAC soils was longest for strain 138 followed by 122, 110, and 6. These data suggest that effectiveness of a strain (e.g., 110) does not correlate with its saprophytic survival in soil. Soil characteristics may influence persistence of RJ under field conditions.

CELL WALL COMPOSITION, PERCENT GC IN THE DNA, AND SEROTYPING OF THE BACTERIUM ASSOCIATED WITH RATOON STUNTING DISEASE OF SUGARCANE. J. Kao[1], E. W. Blakeney[2], M. A. Gerencser[3], and K. E. Damann, Jr.[1], Depts. of Plant Pathology and Crop Physiology[1], and Biochemistry[2], LA Agri. Exp. Sta., Baton Rouge 70803, and Dept. of Microbiology, WV Univ. Medical Center, Morgantown 26506[3]. *

The ratoon stunting disease-associated bacterium was extracted from diseased sugarcane and purified by differential and density gradient centrifugation. Cells were sonicated, DNA was extracted, and walls were prepared by enzymatic digestion. After cell wall hydrolysis, sugars and amino acids were analyzed. Fucose and rhamnose were the major sugar components. Lycine, ornithine, alanine, glutamic acid, and glycine were presumed to make up the peptidoglycan tetrapeptide and linkage. The Tm was determined and the % GC calculated at 60%. These results are characteristic of the family Actinomycetaceae and more specifically the genus Actinomyces. However, serotyping with fluorescent antibodies specific to recognized Actinomyces spp. as well as to related genera were negative. It appears that the bacterium has taxonomic affinity to the family Actinomycetaceae but not to recognized genera within the family.

ULTRASTRUCTURAL STUDIES OF BLUEBERRY (VACCINIUM CORYMBOSUM L.) RED RINGSPOT: PARTICLES AND INCLUSIONS SUGGESTIVE OF A CAULIMOVIRUS. K.S. KIM, B.J. Moore, and E.M. Martin, Dept. of Plant Pathology, Univ. of Arkansas, Fayetteville 72701.

Blueberry red ringspot, long assumed to be caused by a virus, occurred in blueberry in northwestern Arkansas. During August and September red rings with green or chlorotic centers appeared on the lower leaves and red circular lesions were present on stems. EM observations of diseased leaves of three varieties showed isometric particles, 50-55 nm in diameter, in both the cytoplasm and nucleus. In the nucleus, particles were sometimes associated with lipid globules. In the cytoplasm, there were circular inclusions composed of particles embedded in an electron dense matrix with electron-lucent areas within the inclusion. The inclusions are strikingly similar to those that are a recognized diagnostic feature of the caulimoviruses. The size and morphology of the particles, the similarity of the inclusion bodies, and the consistent occurrence of the particles within the inclusions suggest that blueberry red ringspot is caused by a virus in the caulimovirus group.

RELATIONSHIPS BETWEEN TILLAGE PRACTICES AND SEED TREATMENTS, AND GROWTH AND YIELD OF BARLEY IN HELMINTHOSPORIUM SOROKINIANUM-INFESTED SOIL. G. C. Kingsland, Dept. of Plant Pathology and Physiology, Clemson Univ., Clemson, SC 29631.

Field plots infested with H. sorokinianum were rototilled once, twice, and four times prior to planting seeds of barley (Hordeum vulgare 'Keowee'). H. sorokinianum-infested seeds treated with Ceresan M or Vitavax 75 were planted in once-tilled plots. Emergence and plant heights were greater in plots tilled 4 times (332 plants and 79 cm, respectively) than in once-tilled plots (238 plants and 62 cm, respectively). Yields also were greater (2688 and 1949 kg/ha, respectively), but the difference was not statistically significant. An average of 18 seedlings per row were diseased in all tillage plots. Seed treatments reduced seedling blight (5 plants per row) when compared with the checks (21 plants per row) improved stand (92% and 64%, respectively), and resulted in a significant increase in yield (2016 and 1344 kg/ha, respectively).

DETECTION AND DISTRIBUTION OF TWO CORN VIRUSES IN SOUTH CAROLINA. G. C. Kingsland[1], E. B. Eskew[2], and O. W. Barnett[1], Depts. of Plant Pathology and Physiology[1] and Agronomy and Soils[2], Clemson Univ., Clemson, SC 29631.

Maize dwarf mosaic virus (MDMV) was reported several years ago in South Carolina. Maize chlorotic dwarf virus (MCDV) was reported more recently from only one county. We used ELISA techniques to survey for MDMV-A and -B, MCDV, and maize chlorotic mottle virus (MCMV). MDMV-A and MCDV were detected serologically from all regions of the state. MDMV-A and MCDV were detected, respectively, in 12 and 2 of 18 fields in the northeast, 2 and 2 of 18 fields in the south central, 3 and 1 of 5 fields in the central, and in 12 and 11 of 18 samples from 1 field in the western (W) region. MCMV was not detected. MDMV-B was detected in only 1 sample. MCDV was detected in Johnson grass from 3 regions. Ten samples of 59 were doubly infected. MDMV was detected more often by serology than by indexing on DeKalb BR64 sorghum, when both methods were used.

THE INFLUENCE OF SUGAR CONTENT ON THE DEVELOPMENT OF WHITE ROT OF APPLE. Frank C. Kohn, Jr., and F. F. Hendrix, Jr., Dept. of Plant Pathology and Plant Genetics, Univ. of Georgia, Athens 30602.*

Apples were collected at weekly intervals from an orchard in Georgia beginning 3 weeks after petal fall and continuing until harvest. At each sampling date apples were puncture wounded and spray inoculated with Botryosphaeria dothidea conidia at a concentration of approximately 10^5/ml. The inoculated fruit were incubated in damp chambers at 30 C, and the percentage that developed rot was recorded after 7 days. The sugar content in a subsample of fruit was measured by determining percent soluble solids with a refractometer. No le-

sions developed until sugar content reached approximately 10.5%. Lesion formation continued to increase with increasing sugar content until at harvest, when sugar content reached 13.8%, rot incidence was 100%. A regression analysis indicated a significant association (r^2 = 72.3) between sugar content and rot incidence.

INOCULUM SOURCES OF MONILINIA FRUCTICOLA IN SOUTH CAROLINA PEACH ORCHARDS. F. A. Landgraf and E. I. Zehr, Dept. of Plant Pathology and Physiology, Clemson Univ., Clemson, SC 29631.*

Sources of inoculum for Monilinia fructicola (Wint.) Honey in South Carolina peach orchards were studied during 1979. Conidial numbers on sporulating blighted blossoms decreased to zero when fruits were mature. However, nonabscised aborted fruits in the tree and thinned fruits on the orchard floor were important conidial sources when normal fruit was mature. Fruits thinned before pit hardening decomposed quickly, and less than 2% were observed sporulating. Fruits thinned from unsprayed trees after pit hardening were infected and up to 38% were sporulating. When thinned fruits from trees receiving varying numbers of cover sprays were examined those fruits without early season sprays had more sporulation. Results indicate that infected blossoms are not important sources of inoculum for ripe peach fruits in South Carolina, but nonabscised aborted fruits or thinned fruits on the ground are important sources of inoculum.

EPIDEMIOLOGY AND CONTROL OF CLADOSPORIUM CARPOPHILUM ON PEACH E. G. Lawrence and E. I. Zehr, Department of Plant Pathology and Physiology, Clemson Univ., Clemson, SC 29631.

Cladosporium carpophilum germinates and grows best at 15-30 C. Conidia placed on dry cover slips reached 11% germination when stored at 94-100% RH, but germination was 50% in free water and near 100% on water agar. Lesions on peach twigs sporulated at 80-100% RH, but 98-100% was optimal. Lesions exposed to 100% RH produced conidia for 21-30 hr, after which conidia were released. Conidia are disseminated in the air and in rain water runoff. Maximum numbers of airborne conidia were present 3-4 weeks after the calyx-split stage of development. The period 2-6 weeks after calyx-split appeared to be critical for fungicide protection against peach scab in the field.

HISTOPATHOLOGY OF MONILOCHAETES INFUSCANS, THE CAUSAL AGENT OF SCURF OF SWEET POTATOES. G. W. Lawrence and J. W. Moyer, Dept. Plant Pathology & Crop Physiology, Louisiana State Univ. Agric. Expt. Sta., Baton Rouge, 70803 and Dept. Plant Pathology, N.C. State Univ., Raleigh, 27607.

Conidia of Monilochaetes infuscans placed on the fibrous roots of sweet potato germinated in 6 hours in moist chambers held at 24C. Germ tubes produced a bulbous swelling which had the appearance of an appressorium after 11 hours. Penetration of epidermal cells of the fibrous root was accomplished via formation of the appressorium and a penetration peg. Infection hyphae grew intracellularly until a cell wall was encountered at which time an intracellular appressorium and penetration peg were formed. Appressoria were found in all cases where a cell wall was penetrated. Penetrating hyphae were produced from appressoria from which further development within the host cells ensued. Conidiophores producing conidia were observed on the surface of the rootlets one week after inoculation.

EFFECT OF ANTAGONISTIC SOIL FUNGI ON THE RELATIONSHIP OF INOCULUM DENSITY TO INFECTION IN FUSARIUM CROWN ROT OF TOMATO. J. J. Marois and D. J. Mitchell, Department of Plant Pathology, Univ. of Florida, Gainesville, FL 32611.*

Methyl bromide-chloropicrin treated soil was infested with chlamydospores of Fusarium oxysporum f. sp. radicis-lycopersici or with chlamydospores of the pathogen plus conidia of five isolates of antagonistic species of Trichoderma, Aspergillus, and Penicillium. The isolates of the antagonists were selected for their ability to increase rapidly in numbers in freshly fumigated soil and for their close association with the plant roots. Bonnie Best tomato seeds were planted in soils with a series of inoculum densities (ID) of the pathogen plus the mixture of antagonists at a constant 5000 conidia/g of soil per isolate. The ID of the pathogen required for 50% infection after 2 wk at 20 C were 6500 or 300 chlamydospores/g of soil with and without antagonists added, respectively. After 2 wk at 20 C, the ID of the pathogen at 500 chlamydospores/g of soil increased to 4000 propagules/g of soil without antagonists added and decreased to 50 propagules/g of soil with antagonists added.

HISTOLOGICAL ASPECTS OF INFECTION OF RICE BY RHIZOCTONIA SOLANI AND RHIZOCTONIA ORYZAE. D.S.Marshall and M.C.Rush, Dept. of Botany and Plant Pathology, Purdue Univ., West Lafayette, IN. 47907 and Dept. Plant Pathology, Louisiana State Univ., Baton Rouge, LA. 70803.*

Mechanisms of infection by Rhizoctonia solani and R. oryzae on rice cultivars differing in resistance levels were found to be identical in most aspects. Both pathogens produced two prepenetration structures, infection cushions and lobate appressoria. A highly significant correlation existed between infection cushion formation and lobate appressorium formation (r=0.977). Penetration pegs produced from these structures penetrated the plant surface directly. Stomatal penetration was infrequent. Initial penetration occurred on the outer epidermis of the sheath. There were highly significant correlations between disease severity ratings of the cultivars and both infection cushion formation (r=0.970) and culm invasion (r=0.935). The fungi failed to penetrate past the outermost sheaths and thus did not colonize the culms of cultivars having low disease ratings.

ROD-SHAPED PARTICLES AND ASSOCIATED INCLUSION BODIES IN LEAF CELLS OF MIMOSA SHOWING VIRUS-LIKE SYMPTOMS. E.M. Martin and K.S. Kim, Dept. of Plant Pathology, Univ. of Arkansas, Fayetteville 72701.

Mimosa, Albizzia julibrissin Durazzini, showed severe symptoms suggestive of virus infection. Leaves showed chlorotic mottling and vein clearing, and the tree had several dead twigs and branches. EM examination of leaf tissue from the chlorotic regions showed rod-shaped particles 35 X 95 nm. The particles, occurring only in the cytoplasm, were associated with viroplasm like structures consisting of circular bodies of electron-dense granules and/or amorphous fibrillar regions. Many cells containing "viroplasm" exhibited cell wall protuberances into the cytoplasm where the particles were located. The particles were observed in various types of parenchyma cells but not in the sieve elements or xylem vessels. Depending upon the plane of sectioning, the particles appeared as stacks of rectangular rods, circular spheres in a zig-zag pattern, or in paracrystalline arrays. Seedlings grown from seeds from the diseased tree had similar symptoms and contained particles and cytopathological structures as described above.

EFFECT OF PLICTRAN (CYHEXATIN) ON THE SPORULATING POTENTIAL OF CERCOSPORA ARACHIDICOLA ON PEANUT LEAVES. H. A. Melouk, USDA-SEA, AR, Dept. of Plant Pathology, Oklahoma State Univ., Stillwater 74074.

Cercospora arachidicola causes necrotic lesions on peanut, Arachis hypogaea, leaves. Sporulating potential of C. arachidicola is defined as the number of conidia/cm^2 of necrotic area produced at 27±1 C, 100% relative humidity, and 800 lux. Leaflets of cv. Tamnut that had obvious necrotic lesions were misted with an aqueous preparation of Plictran (tricyclohexyl hydroxystannane) on the adaxial, on the abaxial, and on both surfaces using a DeVilbiss No. 15 atomizer. Leaflets were then incubated at the stated conditions for 3 days. Conidia were washed from the surface of the leaflets with distilled water containing Amway surfactant (1 ml/l). Conidia in the suspension were counted using a hemacytometer. Necrotic lesions on the leaflets were excised and surface area determined with a Lambda area meter. Plictran at 17, 985, and 1970 µg/ml when applied on either the adaxial or both surfaces was most effective in reducing sporulation.

AMINO ACID CONTENT IN LEAVES OF MYCORRHIZAL AND NONMYCORRHIZAL CITRUS ROOTSTOCKS. S. Nemec and F. I. Meredith, USDA, SEA, Orlando, FL 32803; and USDA, SEA, Athens, GA 30601.

The effect of mycorrhiza on total nitrogen, and 17 amino acids, was studied in leaves of two citrus rootstocks. They were grown in a low-phosphorus Astatula fine sand control, in soil amended with Glomus etunicatus (G.E.), and in soil amended with 2240 kg/ha phosphate (S.P.). All treatments were fertilized with a liquid 12-0-6. Sour orange was 3.1- and 3.5-fold taller and rough lemon was 1.8- and 2.0-fold taller than the controls in the G.E. and S.P. treatments, respectively. In the control, leaf N was significantly higher than in the other treatments. Most amino acids in the control were lower than in the other treatments, with the exceptions of arginine (up to 12-fold

increase), proline (up to 1.8-fold increase), lysine, and free ammonia. In rough lemon, levels of most amino acids were similar between the G.E. and S.P. treatments; but in sour orange 12 amino acids were slightly lower in the S.P. treatment.

INCIDENTS OF FUSARIUM BLIGHT OF BLUEGRASS FOLLOWING FUNGICIDE USAGE FOR HELMINTHOSPORIUM BLIGHT. W. C. Nesmith and R. N. Carrow, Depts. of Plant Pathology and Horticulture, Kansas State University, Manhattan, KS 66506

Turf quality frequently decreases markedly in midsummer after Kansas homeowners attempt to control spring Helminthosporium diseases with fungicides. Usually fungicide treatments control Helminthosporium while Fusarium blight develops later in the summer following hot, dry periods. Fusarium blight is usually worse in areas receiving early fungicide treatments than in nearby untreated areas. In 1978 and 1979 several commercial and experimental fungicides for Helminthosporium control were applied at half, full and 2X the manufacture's suggested rate. Plots of 'Park' Kentucky bluegrass (0.9 X 1.8 m) were arranged in a randomized complete block with three replications and sprayed all season at 2-week intervals using a hand sprayer. All materials controlled Helminthosporium but Fusarium blight increased with fungicide rate. The reasons for such changes are not understood, but similar results occurred both years.

POLYPEPTIDE COMPARISONS AMONG STRAINS OF MAIZE DWARF MOSAIC VIRUS AND SUGARCANE MOSAIC VIRUS. J. F. Perryman, M. B. Perryman, R. S. Halliwell, and R. W. Toler. Dept. Plant Sciences, Texas A&M University, College Station 77843.

Polyacrylamide gel electrophoresis (PAGE) and polypeptide mapping were used to determine relationships between strain H of SCMV (S-H) and strains A, B, F, and a local isolate designated ELM of MDMV (M-A, -B, -F, -ELM). Viruses were purified from infected leaves with PEG and proteins were precipitated in cold acetone. PAGE of each virus showed a single type of polypeptide. MW relationships were: M-F < M-A = M-ELM < M-B = S-H. Polypeptide maps of S-H and M-B, resulting from trypsin digestion, electrophoresis, and chromatography, were almost identical. Maps of M-A, M-F, and M-ELM were similar to each other, but distinct from those of S-H and M-B. Other maps, made by limited proteolysis and electrophoresis, showed that M-A, M-F, and M-ELM polypeptides were not identical. Based on polypeptide features, M-B is closely related or identical to S-H, while M-A and M-ELM form a second group, and M-F a third.

OCCURRENCE OF NORTHERN CORN LEAF BLIGHT ON TWO PREVIOUSLY RESISTANT SWEET CORN HYBRIDS IN SOUTH FLORIDA. David J. Pieczarka, Univ. of Florida, Agricultural Research and Education Center, Belle Glade 33430.

In the spring of 1979 susceptible-type lesions caused by Helminthosporium turcicum were observed on the previously resistant sweet corn hybrids Guardian and Florida Staysweet carrying the Ht_1^A and Ht_1^B resistance genes, respectively. Prior to this finding only resistant-type (chlorotic) lesions developed on the hybrids. In a controlled environment, susceptible lesions were reproduced on Guardian, Florida Staysweet and Iobelle (no Ht genes) inoculated with single-spore isolates of H. turcicum recovered from the naturally infected hybrids carrying the Ht_1 gene. Susceptible lesions developed also on the inbreds (provided by A. L. Hooker) Oh 43, Oh 43 Ht_1^A, RB 37 Ht_1^A, RH 55 Ht_1^A, and RH 55 Ht_1^B but not on NN14B Ht_2 or NN14 Ht_1/Ht_1 Ht_2/Ht_2. These findings indicate that a new race of H. turcicum, probably similar to race 2 reported in Hawaii, now exists in south Florida.

EPIDEMIOLOGY AND CONTROL OF CELERY STALK ROT CAUSED BY RHIZOCTONIA SOLANI. David J. Pieczarka, Univ. of Florida, Agricultural Research and Education Center, Belle Glade 33430.

Lesion development was detected on celery petioles within one week after planting healthy seedlings into organic soil. Petiole infections increased steadily during the first 6 weeks and reached 4 to 5 infected petioles/plant. Seven to 12 weeks after planting, petiole infections increased significantly following rains. Infection levels following rains usually did not increase significantly in treatments receiving effective fungicides. The outer petioles infected during weeks 1 to 6 did not influence yields since they normally senesced prior to harvest (week 12). A 4 to 5-day spray schedule (mancozeb + benomyl or chlorothalonil) initiated 6 weeks after planting provided excellent stalk rot control similar to that achieved with a 4 to 5-day schedule started the 1st week. Starting at week 6, fungicide applications based on scouting once weekly for disease progress resulted in 3 to 5 fewer applications compared to the preventative spray program initiated at week 6. Disease control was equivalent in both treatments.

SANITATION MEASURES TO CONTROL FOLIAGE DISEASE NEGATED BY ACCELERATED RATES OF DISEASE INCREASE. J. L. Plaut and R. D. Berger. University of Florida, Gainesville, 32611.*

Progress of three compound interest diseases, caused by Uromyces phaseoli on Phaseolus vulgaris, Cercospora arachidicola on Arachis hypogaea, and Botrytis cinerea on Begonia semperflorens was monitored in epidemics initiated by three levels of inoculum. Polycyclic disease development occurred in replicated greenhouse chambers (with simulated field weather) and in buffered field plots. The 61 disease progress curves were analyzed by logistic, gompertz, and multi-level polynomial transformations. Regardless of the transformation, disease progressed most rapidly from the lowest initial level. Incremental decreases in initial disease corresponded with incremental increases in the rate parameter in 98% of all cases. All disease progress curves approached the same asymptotic line. Low initial disease apparently is compensated for by accelerated rates of disease progress. Thus, sanitation measures are less effective in the management of compound interest diseases than has been previously theorized. To obtain the maximum benefit from sanitation, rate-reducing measures must also be used.

THE EFFECTS OF ANHYDROUS AMMONIA ON TIME OF INFECTION OF COTTON BY PHYMATOTRICHUM OMNIVORUM. C.M. Rush and S.D. Lyda, Dept. of Plant Sciences, Texas A&M Univ. College Station 77843.

Greenhouse studies were conducted in a controlled environment to observe the effects of anhydrous ammonia (NH_3) on phymatotrichum root rot of cotton. In order to establish a more natural situation, soils were inoculated with sclerotia and then planted to cotton. All of these plants succumbed to disease, thus establishing the fungus in the soil. This infested soil was then treated with three rates of NH_3 at the equivalent of 100, 200, and 400 lb/A. Disease first appeared in nonfumigated (ck) soils. There was a 10 day difference between the first observed disease in the ck soils and any of the treated soils. There was a 20 day difference between disease onset in the ck soils and those receiving the highest NH_3 rate. These delays were observed in soils with optimum moisture and temperature for fungal growth. Under field conditions the delay period possibly could be prolonged.

VEIN SPOT DISEASE OF PECAN AND CONTROL WITH FOLIAR FUNGICIDES. R.S. Sanderlin and A.S. Hunt, Louisiana State Univ. Pecan Research and Extension Station, P.O. Box 5519, Shreveport 71105.

Vein spot of pecan is incited by Gnomonia nerviseda. The pathogen attacks veinal tissue including rachises, petioles, midribs, and lateral veins, and causes premature defoliation. Three fungicides registered for pecans were tested for effectiveness in vein spot control. Benomyl, dodine, and fentin hydroxide at 0.11, 0.29, and 0.09 kg a.i./378.5 l, respectively, were applied to limbs of the Success cultivar at two Louisiana locations. Benomyl was used also at 0.34 kg a.i./378.5 l. Benomyl significantly reduced (P=0.05) the number of vein spot lesions compared to unsprayed controls at both locations. The two rates of benomyl did not differ significantly in control. Dodine controlled vein spot at one site but not at the other. Fentin hydroxide failed to reduce lesion numbers at either location.

COTTON BOLL ROT FUNGI ASSOCIATED WITH ANTHONOMUS GRANDIS. M. L. Schroeder and J. P. Snow, Dept. of Plant Pathology and Crop Physiology, Louisiana State Univ. Agric. Exp. Sta., Baton Rouge 70803.

The possible role of the boll weevil (Anthonomus grandis) in movement of inoculum of cotton boll rot fungi was studied. Several fungi responsible for cotton boll rots were identified in cultures from internal and external weevil isolations. Internal isolations were made from excised and mashed head, thorax and abdomen segments. External isolations were obtained from washings of intact insects. Fusarium spp. were found externally on approximately 60% of the weevils collected from cotton fields. Other fungi were found less frequently. Aspergillus sp., Nigrospora sp., Curvularia sp., and Phytophthora sp. were identified in isolations from internal areas.

THICK WALLED CHLAMYDOSPORES OF PHYTOPHTHORA CINNAMOMI PRODUCED IN NATURAL SOIL. H. D. Shew and D. M. Benson, Dept. of Plant Pathology, N. C. State University, Raleigh 27650.

Chlamydospores of Phytophthora cinnamomi were collected from naturally infested azalea and Fraser fir soils using a wet sieving-selective medium procedure. Following germination on the agar medium, measurements of chlamydospore diameter and wall thickness were made. Chlamydospore diameter of azalea isolates averaged 53 µm with a range of 29 to 76 µm. Fir isolates averaged 59 µm with a range of 40 to 70 µm. Waterhouse [CMI Mycological Paper No. 92, 1963] reported an average value of 42 µm and a maximum of 60 µm for P. cinnamomi chlamydospores. Wall thickness of chlamydospores from azalea isolates averaged 1.9 µm; fir isolates averaged 1.6 µm. This compares with a value of 0.5 to 0.6 µm for chlamydospores produced in culture [Hemmes and Wong, Can. J. Bot. 53:2945]. The thicker walls of chlamydospores produced in nature may be important in the survival of P. cinnamomi in soil under adverse conditions. Thick walled chlamydospores of other Phytophthora spp. have been associated with enhanced survival in soil.

AN ALTERNARIA SP. PATHOGENIC ON MARIGOLD IN SOUTH CAROLINA. Elizabeth Smallwood, L. W. Baxter, Jr., and Susan Fagan. Dept. of Plant Pathology and Physiology, Clemson Univ., Clemson, SC 29631.

African marigolds (Tagetes erecta) growing at Clemson, S. C. were found to be naturally infected with an Alternaria sp. When African and French marigolds (Tagetes patula) were inoculated with single-spore isolates of this fungus, infection resulted on leaves, stems, and flowers of both types. Zinnia plants (Zinnia elegans) were not affected by this fungus but under the same environmental conditions they were severely blighted by Alternaria zinniae. Inoculations made with Alternaria zinniae onto marigolds did not result in infection. The marigold fungus sporulated freely when grown under alternating light and dark periods (12 hr each) at 22 C on oxythioquinox-amended (100 ppm ai) carrot juice agar (CJA) and it produced a few spores on amended potato-dextrose agar and non-amended CJA, but not on either amended or non-amended oatmeal agar, cornmeal agar, or lima bean agar. This fungus did not sporulate on amended CJA in either continuous light or in continuous dark.

EVALUATION OF TECHNIQUES FOR SCREENING OF STRAWBERRY SEEDLINGS FOR RESISTANCE TO COLLETOTRICHUM FRAGARIAE. Barbara J. Smith and J. M. Spiers, USDA, SEA, U. S. Small Fruits Research Station, Poplarville, MS 39470.

Anthracnose or crown rot of strawberries caused by Colletotrichum fragariae Brooks has become severe in recent years in the southern U. S. Development of resistant varieties is a practical control, but requires an effective method of screening substantial populations of seedlings. Inoculation procedures were evaluated to determine a method of greenhouse screening. Strawberry seedlings were placed in a humidity chamber before and after inoculation for periods up to 3 days to determine the optimum incubation time for infection. Seven methods of inoculation using conidial suspensions containing 900,000 sp/ml were evaluated. High humidity during the 24 hr immediately after inoculation was necessary for rapid symptom expression. Methods involving wounding resulted in 80 to 100% infection and were considered too severe. Less severe methods, such as spraying or brushing on inoculum, allowed mass screening for field resistance to anthracnose.

PORIA LATEMARGINATA ON PEACH IN TEXAS. D. H. Smith[1], W. A. Taber[2], Ruth A. Taber[2], and J. L. Lowe[3], Texas A&M Univ., Yoakum 77995, Texas A&M Univ., College Station 77843, and College of Forestry, Syracuse Univ., Syracuse, N. Y. 13210.

This is the first report of Poria latemarginata (Dur.&Mont.)Cke. on peach in Texas. We observed this white rot fungus in Atascosa, Brazos, Gaines, Lavaca, Limestone, Robertson, Smith, and Waller Counties. Widely effuse resupinate fruiting structures appeared at the base of peach trees, on the soil surface adjacent to the base of peach trees, in association with pruning wounds, on the main trunk, and on scaffold limbs. Fruiting structures were observed on 64 of 412 (15.5%) Junegold trees in a Waller County orchard during September 1974. Eleven per cent of the trees (45) were dead. A Lavaca County orchard consisting of breeding lines (3257 trees) was examined during June 1974, and fruiting structures were observed on 38 trees (1.16%). Although P. latemarginata is widely distributed in Texas, its importance as a peach tree pathogen is undetermined.

TEMPERATURE INFLUENCE ON THE COLONIZATION OF EGGPLANT AND WATERMELON BY VERTICILLIUM DAHLIAE. Larry D. Smith, Plant and Soil Science Dept., Tennessee Technological University, Cookeville 38501.

To determine if strains of V. dahliae exist in relation to immediate past hosts of the fungus, the capability of nine isolates from different hosts to colonize eggplant (Solanum melongena L.) and watermelon (Citrullus vulgaris Schrad.) was compared in a factorial design at 18, 24, and 30 C. The extent of colonization was quantified on a selective medium by plate counts. Isolates showed varying colonizations of 1.5 - 118.0 propagules/mg fresh wt in eggplant and watermelon at 18 C. At 24 C colonizations were 0.1 - 45.0 propagules/mg fresh wt. All isolates showed little colonization, 0.8 - 5.2 propagules/mg fresh wt, at 30 C. The effect of increased temperature on the extent of colonization was not uniform for each of the nine isolates. A significant interaction between temperature of incubation and the capability of isolates to colonize inoculated plants was observed.

FIELD SPREAD OF PSEUDOMONAS TOMATO AND EFFECT OF ENVIRONMENTAL FACTORS ON DISEASE DEVELOPMENT. D. R. Smitley and S. M. McCarter, Dept. of Plant Pathology, Univ. of Georgia, Athens 30602.*

Chico III tomato plants at 19 C were atomized with 5×10^6 cells/ml of Pseudomonas tomato. Lesion numbers increased as the period of 100% relative humidity increased from 0 to 100 hr. More lesions developed when the bacteria were forcibly applied by close atomization than when atomized gently, particularly at low RH. Lesion numbers were higher at 18 and 25 than at 32 C. Abnormal lesions appeared within 48 hr on plants forcibly inoculated and held at 100% RH at 32 C. When inoculated plants were given a 24-hr, 100% RH period at 19 C and moved to 30 C after an additional 0 to 96 hr, lesion numbers increased as the period at 19 C increased. In field plots established with 1, 10, 30 and 100% infected plants, the bacterium spread rapidly and all plants in the 1% plots showed symptoms within 4 wk. Fruit with speck ranged from 86% in early harvests to 6% in late harvests. Yields were similar regardless of the number of plants infected initially.

EFFECT OF TEMPERATURE-WATER POTENTIAL INTERACTIONS ON GROWTH OF PHYMATOTRICHUM OMNIVORUM. M. Stapper, S.D. Lyda, and W.R. Jordan. Texas Agricultural Experiment Station, College Station, Texas 77843.

Osmotic potential of Difco potato-dextrose agar was adjusted with KCl or sucrose. Plates were seeded with P. omnivorum (4 mm plug) taken from 4-day old cultures, sealed with parafilm and incubated at 20, 28 or 35 C. Colony diameters were measured after three and seven days. On PDA amended with KCl, greatest growth occurred on basal medium (-4.5 bars) and declined with decreasing osmotic potential. Growth at 35 C was stimulated by the addition of KCl and was best between -8.5 and -15 bars. The response of P. omnivorum with sucrose as osmoticum was similar to KCl. Growth at 20 and 28 C was best on basal medium and declined with decreasing osmotic potential; at 35 C it reached a maximum at -15 bars. Growth with sucrose as osmoticum was higher than with KCl. A vapor equilibration technique was used to evaluate P. omnivorum growth on PDA without specific ion or molecular effects. Optimum growth was at -6 bars at 20 and 28C and at -20.5 to -27.5 bars at 35C.

RELATION OF MAIZE DWARF MOSAIC VIRUS INFECTION TO INCREASED SUSCEPTIBILITY OF CORN TO HELMINTHOSPORIUM MAYDIS. C. Stevens and R. T. Gudauskas, Dept. of Botany, Plant Pathology, and Microbiology, Auburn Univ., Auburn, AL 36830.

Lesions produced by *Helminthosporium maydis* race O on corn seedlings infected with maize dwarf mosaic virus (MDMV) were 60-70% greater in number and size and supported two-fold more sporulation than those on virus-free seedlings. Germination rates of *H. maydis* conidia were similar on leaves of MDMV-infected and healthy seedlings; however, conidia on MDMV-infected leaves produced shorter germ tubes and twice the number of appressoria as conidia on virus-free leaves. Analyses of leaf leachates and washings showed significantly greater amounts of electrolytes, total carbohydrates, orcinol- and ninhydrin-positive substances, and total amino acids from MDMV-infected tissues than from virus-free. Results indicate that the increased susceptibility of MDMV-infected corn to *H. maydis* is related to alteration of membranes and increased leakage of metabolites available to the fungus for colonization and sporulation.

ROOT DISEASES OF CORN CAUSED BY RHIZOCTONIA SOLANI AND RHIZOCTONIA ZEAE. Donald R. Sumner and D. K. Bell, Plant Pathology Dept., Univ. of Georgia Coastal Plain Station, Tifton 31794.

Root diseases are found frequently in irrigated corn on loamy sand or sand soils in the Georgia Coastal Plain. From 1974 to 1978 Rhizoctonia solani was isolated from corn roots in 10 counties, and 4 of 8 isolates caused post-emergence damping-off (PEDO), stunting, or leaf necrosis or chlorosis in corn seedlings. Isolates from lima bean, cowpea, peanut, spinach, sorghum, rhizosphere soil (cucumber and cowpea), and soil were also pathogenic on corn. Symptoms were brown to black lesions on seminal, crown, and brace roots. Frequently roots decayed and disintegrated 2-5 cm from the crown. Some isolates (AG-4) from peanut were avirulent, but other isolates (AG-1 and 2) caused severe root necrosis on corn. In contrast, AG-1 and 2 isolates caused only slight necrosis but AG-4 isolates caused severe necrosis and PEDO on peanut seedlings. Rhizoctonia zeae was less virulent than R. solani and caused buff to tan root lesions with dark brown borders on corn. Rhizoctonia spp. (binucleate) were not pathogenic on corn.

INFECTION DECLINE RATES IN ALTERNATE HOST ERADICATION RUST CONTROL. E. P. Van Arsdel, Dept Plant Sciences, Texas A&M Univ., College Station 77843
Determining the distance required in eradication control of rust presupposes its effectiveness. Ribes eradication had been determined to be effective before white pine blister rust control work was started (Bulls 2, 4, & 6, Am Pl Pest Cont Com, 4 Joy St Boston, Mass 1918-20, and 1924 Jour Ag Res 28:1253-1258). My review of 30 yrs of Lake States tests also showed effective control (Abstr, 1st Intnl Cong Pl Path, London, 1968). Distances necessary for ribes removal were determined from exponential dilution curves; the number of infections/plant declined in proportion to the square root with distance. In a high hazard area a 12 ft tree next to ribes would have 36 cankers; a tree 300 ft away, 6; a tree 600 ft away, 2.54; one 900 ft away, 1.57; and one 1800 ft away, 1.06 cankers. In the northern Lake States infection decline curves were made from incidence data in three areas in which the sq rt distance was 300 ft. In low-hazard Calif. the decline rate sq rt distance was 25 ft (USDA Tech Bull 1251, 1961). Eradication distance should equal twice the sq rt distance along locally made decline curves.

INCREASED CROP VALUE AND DECREASED PEANUT POD ROT WITH GYPSUM AND CULTIVAR. M. E. Walker[1], A. S. Csinos[2] and D. K. Bell[2], Depts. of Agronomy[1] and Plant Pathology[2], Univ. of Georgia, Coastal Plain Station, Tifton 31794.

Five cultivars of peanut, Florunner, Tifrun, Florigiant, Ga. 194 Va. and Early Bunch, were grown on a Stilson loamy sand and top dressed with 0, 560, 1120 and 1680 kg/ha of gypsum. Generally, yields and percent sound mature kernels increased and the amount of pod-rot decreased with all cultivars as the amount of gypsum increased. Significant ($P = 0.05$) differences in yields, sound mature kernels and amount of pod-rot were detected among cultivars. Florunner had significantly higher yields and percent sound mature kernels and less pod-rot than any of the other cultivars at all levels of gypsum. Data indicate that addition of proper amounts of gypsum and choice of peanut cultivar can significantly reduce pod-rot and increase yields, percent sound mature kernels and dollar value per acre.

REDUCTION OF MYCOFLORA AND CONTROL OF INSHELL WEEVILS IN PECANS STORED UNDER HIGH CARBON DIOXIDE ATMOSPHERES. John M. Wells and Jerry A. Payne, USDA, SEA, AR, Southeastern Fruit and Tree Nut Research Laboratory, P. O. Box 87, Byron, GA 31008.

High CO_2 atmospheres reduced the mycoflora and controlled in-shell weevils in pecans stored at 7C and 65% relative humidity. After 5 months in atmospheres of 21% oxygen (O_2) and 30% CO_2, pecan weevil mortality was 100%, total mycoflora isolated from kernels was significantly reduced, and, off-flavors had not yet developed in the kernels. In atmospheres of 3 and 10% CO_2 (plus 21% O_2), or in 1% O_2 (with or without 30% CO_2) weevil mortality was less than 100%. Objectionable off-flavors developed in high CO_2 atmospheres after 6 months. Alternaria spp. were the most frequently isolated fungi in pecans held in air; however, Penicillium replaced Alternaria as the dominant surviving mycoflora in high CO_2 atmospheres after 5 months.

DISTRIBUTION OF RICKETTSIA-LIKE BACTERIA IN PEACH, AND OCCURRENCE IN PLUM, CHERRY AND SOME PERENNIAL WEEDS. John M. Wells and Donald J. Weaver, USDA, SEA, AR, Southeastern Fruit and Tree Nut Research Laboratory, P. O. Box 87, Byron, GA 31008.

Enumeration of rickettsia-like bacteria (RLB) in roots or twigs of peach trees symptomatic for phony peach disease required examination of at least three tissue samples per tree due to variability of distribution. RLB were more numerous in extracts from roots than from twigs, but were the same in terminal twigs from current or the previous year's growth. RLB were present in symptomless trees in peach orchards with moderate (7%) or high (50%) incidence of phony disease, but not in an orchard with low (0.1%) incidence. Symptom expression followed first detection of RLB by 3 to 9 months. Seasonal counts in peach trees were highest in May and lowest in November and February. RLB of similar morphology and antigenicity to phony peach RLB were found in several species of Prunus, including domestic plum and cherry, and in Johnson grass.

BROWN BLOTCH, A NEW DISEASE OF RICE. N. G. Whitney, Texas A&M University Agricultural Research and Extension Center, Beaumont, 77706.

Narrow brown leaf spot is the disease usually attributed to Cercospora oryzae. In Texas and Louisiana another disease symptom has been found that is caused by this same organism. The disease begins as a small irregularly shaped brown blotch on the leaf sheath usually 3 to 4 cm. below the ligule. The blotch spreads so that in advanced stages it may cover the entire leaf sheath. The disease causes premature dessication of the leaves and reduces yield. Cercospora oryzae was isolated from an infected sheath, and under controlled conditions inoculated leaf sheaths exhibited the same symptoms. The organism was reisolated from lesions of inoculated sheaths. In inoculation studies wounding the tissue was found to be necessary for infection. Two applications of benomyl at 0.56 to 1.12 kg/ha is effective in controlling this disease.

CONTROL OF WATERMELON MOSAIC VIRUS ON SUMMER SQUASH WITH OIL SPRAY. Witcher, W., and F. H. Smith, Dept. of Plant Pathology and Physiology, Clemson University, Clemson, SC 29631.

JMS stylet oil was applied in 1977-1979 according to label recommendations to summer squash for control of watermelon mosaic virus (WMV). In 1977, results were not significantly different between sprayed and nonsprayed plots. In 1978 and 1979 significantly greater numbers of fruit with WMV symptoms were harvested from plants in unsprayed plots than from plants sprayed with oil. Significantly more fruits with WMV symptoms were harvested from plants sprayed once than from those sprayed twice per week. In 1979, plants also were examined and there were significantly fewer plants with WMV symptoms in plots sprayed with oil than in nonsprayed plots. The difference between diseased plants in plots sprayed once per week and those sprayed twice per week was not significant.

EFFECTS OF FOLIAR APPLIED FUNGICIDES AND TIMING OF APPLICATION ON FUSARIUM SCAB INCIDENCE IN WHEAT. F. Wright Dept. of Plant Pathology, Univ. of Missouri, Columbia, MO 65211

A four-year study was conducted to determine the effects of timing of fungicide application on spike and seed infection caused by Fusarium graminearum f. sp. cerealis (Cke) Snyd. & Hans. cv. Graminearum. Fungicide treatments used to control scab were benomyl (1.12 kg/ha), mancozeb (2.24 kg/ha), benomyl plus mancozeb (1.12 + 2.24 kg/ha), chlorothalonil (2.34 l/ha), and captafol (4.67 l/ha). These were applied to wheat plants at growth stages 10.0, 10.1, 10.5, and 10.5.4 (Feek's scale). Each plot was sprayed only once with a particular treatment. Significant differences ($P = 0.05$) were found for spike disease incidence when comparing fungicide treated plots with a control. Fusarium-infected seed ranged from 3.6 to 7.6% scab for treated plots to 9.5% for the control. Growth stage 10.0 was the most effective stage at which to apply fungicides to reduce spike and seed infection caused by the scab fungus.