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ABSTRACTS

VERIFICATION OF GENETIC CROSSES BETWEEN BASIDIOSPORES OF TILLETIA INDICA BY ISOZYME ANALYSIS. M. R. Bonde, G. L. Peterson, and M. H. Royer. USDA-ARS, Foreign Disease-Weed Science Research, Frederick, MD 21701

Nineteen parent basidiospore (1N) lines of T. indica, the causal agent of Karnal bunt of wheat, were tested by means of starch gel electrophoresis for specific alleles present at each of four polymorphic genetic loci. These loci code for the enzymes glucosephosphate isomerase, glucose-6-phosphate dehydrogenase, malic enzyme, and mannitol dehydrogenase. The glucosephosphate isomerase locus had three alleles, whereas the other loci each had two alleles. The expressed genotypes of the parent basidiospores were compared with those of five single-teliospore (2N) progeny for each of 15 specific crosses. Results confirm Mendelian inheritance at isozyme loci in T. indica. All four loci can be used for genetic markers of this important pathogen. Twelve other polymorphic loci, not examined in this study, may also prove valuable as genetic markers.

EFFECT OF DICLORAN, IPRODIONE, AND VINILOZOLIN ON SCLEROTIAL POPULATIONS AND FUNGICIDE RESISTANCE OF SCLEROTINIA MINOR IN FIELD MICROPLOTS. T. B. Brenneman, P. M. Phipps, and R. J. Stipes, Dept. Plant Path., Physiol., & Weed Sci., VPI & SU, Blacksburg, VA 24061.*

Three applications of dicloran (D), iprodione (I) and vinclozolin (V) were applied to peanut plants in field microplots at cumulative annual rates of 8.41, 3.36, and 2.52 kg/ha, respectively. Soil in each plot was infested with 1800 sclerotia of an in vitro fungicide-sensitive or -resistant strain of Sclerotinia minor. Treatments were applied for 3 yr and consistently suppressed disease in all plots. Mean sclerotial populations were 41.8, 26.0, 21.2, and 7.3/100 g of soil from the check, D, I, and V, respectively. One sclerotium from the sensitive isolate had become resistant and nine sclerotia from resistant isolates had lost their resistance after 3 yr. In microplots infested with equal numbers of fungicide-sensitive and -resistant sclerotia, both fungicide-treated and control plots had more resistant than sensitive sclerotia after 2 yr.

WATER RELATIONS OF GEOTRICHUM CANDIDUM: INTRACELLULAR AND EXTRACELLULAR POLYGALACTURONASE AND CELLULASE PRODUCTION. L.L. Davis and A.B.A.M. Baudoin, Department of Plant Pathology, Physiology & Weed Science, VPI&SU, Blacksburg, VA 24061.

Water potentials at the lower end of the range normally encountered in lemons are associated with greater resistance to sour rot, caused by Geotrichum candidum (Baudoin & Eckert 1982, Phytopathology 72:1592-1597). In liquid cultures of G. candidum, amended with KCl, mannitol, or polyethylene glycol 400 to control osmotic potential (ψ_s), levels of intracellular as well as extracellular polygalacturonase (PG) fell off rapidly with decreasing ψ_s in the range of -5 to -25 bars. Since the ratio of intra- to extracellular PG increased with decreasing ψ_s , it appears that both PG synthesis in the cell and its secretion from the cell are affected by ψ_s . Intracellular and extracellular levels of cellulase also decreased with decreasing ψ_s , though the effect was smaller than with PG. However, the ratio of intra- to extracellular cellulase did not change significantly with changes in ψ_s , suggesting that only enzyme synthesis is affected.

REACTIONS OF SOMACLONAL VARIANTS OF POTATO TO PHYTOPHTHORA INFESTANS. K. L. Deahl and S. L. Sindén, USDA, ARS, Vegetable Laboratory, Beltsville, Maryland 20705.

MYCOFLORA ASSOCIATED WITH SOME OIL CROPS DURING STORAGE AND THEIR CONTROL. Hamdy Y. Aly¹, M.A. Kararah¹ and G.A. Bean² Dept. of Agric. Botany and Plant Pathology, Faculty of Agriculture, University of Cairo, Egypt.¹ Dept. of Botany, Univ. of Maryland, College Park, MD 20742²

Seeds of sesame var. "Giza 25", soybean var. "Calland" and sunflower var. "Miake" were stored at 10 and 30°C and 10 and 20% moisture content (mc) for 6 months. Seeds were assayed before and after storage time for seed mc, fungal population, seed viability and oil content. Sunflower seeds contained maximum mc, followed by sesame and soybean seeds. The highest percent seed containing fungi was sunflower, and the lowest soybean. After storage there was a sharp decline in field fungi and an increase in storage fungi in sesame and sunflower seeds. The percent seed viability decreased with storage as did the oil content. Carbon tetrachloride (2000 ppm) was most effective in reducing the frequency of total fungi recovery, the loss in oil content, and decrease in loss of viability of sesame and soybean seeds; sunflower seed viability was not affected.

IN VITRO PRODUCTION OF OXALIC ACID BY ONE VIRULENT AND FOUR HYPOVIRULENT STRAINS OF ENDOTHIA PARASITICA. R. Bennett and D.F. Hindal, Plant Path. & Agr. Micro., 401 Brooks Hall, West Virginia University, Morgantown, WV 26506-6057.*

One virulent and four hypovirulent strains of Endothia parasitica, with identical genetic backgrounds, were examined for oxalic acid production to determine if Italian or American cytoplasmic agents for hypovirulence affect oxalic acid synthesis. Strains were incubated for 10 da at 25 C in 20 ml of defined liquid media in which carbon and nitrogen sources varied. Mycelial dry weight and oxalate production by all strains was greatest in an asparagine containing medium when pectin was the sole carbon source. Growth and oxalate production decreased progressively when glucose-glyoxylate, glucose, and fructose were used as carbon sources. Minimal growth and oxalate production were detected in the medium containing methionine, and moderate levels occurred in that containing arginine. Oxalate production in all media was independent of the cytoplasmic agents for hypovirulence but appears to be correlated with mycelial growth.

INFLUENCE OF TEMPERATURE AND RELATIVE HUMIDITY ON GERMINABILITY OF MUCOR PIRIFORMIS SPORES. Regina B. Bernd and G. A. Bean, Botany Dept., Univ. of Maryland, College Park, MD 20742, and W. S. Conway and H. E. Moline, Horticultural Crops Quality Lab, ARS, U.S.D.A., Beltsville, MD 20705.

Studies were conducted to determine the influence of temperature and relative humidity (RH) on germinability and viability of Mucor piriformis spores. Spores did not survive when stored at 35 C and their survival rate decreased rapidly at 30 C; however, spores remained viable for more than 1 year at 0 C. RH also significantly affected spore viability. Spores held at 26 C and 100% RH no longer germinated after 35 days, while those held at 75 or 90% RH germinated over a 65 day period. At 20 C, RH had little effect on spore germinability. At all temperatures studied, spores had the lowest germination rate when incubated at 100% RH and this germination rate decreased more rapidly with time than it did at 75 or 90% RH. The least favorable temperature-humidity combination, 30 C and 100% RH, decreased spore germination from 100% to less than 1% in 14 days.

* = Student Paper Competition

Thirty protoclones of Kennebec potato (resistant gene R₁) regenerated from mesophyll protoplasts were tested for reaction to a compatible (Race 1) or an incompatible (Race 4) race of *P. infestans*. Detached leaves were inoculated using an atomized spore suspension (3-4 x 10⁶ sporangia/ml), incubated 48 hr in a mist chamber, placed in a controlled environment chamber, and maintained by immersing their petioles in water until symptom expression. Symptoms of the late blight disease in detached leaves were similar to those in intact plants. Although disease reactions for most of the regenerates were similar to those of the single protoplast parent, there was considerable variation in response, which ranged from hypersensitivity and minor necrosis (resistant response) to complete invasion and pathogen sporulation (susceptible response). Protoclone reaction to *P. infestans* was not correlated with chromosomal or morphological variation.

A NEW RACE OF *FUSARIUM OXYSPORUM* F. SP. *MELONIS* CAUSING WILT OF MUSKMELON IN MARYLAND. E. M. Dutky, J. E. Kantzes, A. D. Brooks and J. G. Kantzes, Department of Botany, The University of Maryland, College Park, MD 20742 and Rohm and Haas, 4585 Simonton Road, Dallas, TX 75234.

In 1985 Fusarium wilt of muskmelon was very severe in Maryland. *Fusarium oxysporum* f. sp. *melonis* isolated in 1985 was determined to be Race 1 (Risser et. al. Phytopath. 66:1105-1106, 1976). Muskmelon cultivars 'Saticoy' and 'Early Dawn' which have shown excellent resistance to fusarium wilt in Maryland field tests for more than ten years were susceptible to these 1985 isolates. In 1977 J. E. Kantzes determined that *F. oxysporum* f. sp. *melonis* Race 2 was common in Maryland and that 'Saticoy' and 'Early Dawn' were resistant to Race 2 from Maryland and Michigan. This appearance of Race 1 Fusarium wilt in muskmelons is a potentially serious threat to muskmelon production areas on Maryland's Eastern Shore.

EFFECT OF THE PAV-NY ISOLATE OF BARLEY YELLOW DWARF VIRUS ON YIELD COMPONENTS OF OATS. J. A. Frank and F. E. Gildow, Department of Plant Pathology and USDA-ARS, The Pennsylvania State University, University Park, PA 16802

The oat cultivar Noble was planted in a field trial in central Pennsylvania in 1985. Plants in one meter of row in each plot were infested with viruliferous aphids (*Rhopalosiphum padi*--PAV-NY), and caged for three days, when plants were either four or six weeks old. Once the cages were removed, plants were sprayed with acephate on a 10 day schedule for aphid control. Plants infested at 4 wk had a reduction in number of panicles/m, seed/panicle, seed wt, and yield compared to controls. Plants infested at 6 wk had reductions for all of these components except seed/panicle, and the reductions were significantly less than with the 4 wk infestation.

BIOLOGICAL CONTROL OF VERTICILLIUM WILT OF POTATO IN THE FIELD BY *TALAROMYCES FLAVUS*. D. R. Fravel, J. R. Davis, and L. H. Sorensen. USDA, ARS, Beltsville, MD 20705, and Univ. of Idaho, Aberdeen, ID 83210.

In an Idaho field test main plots were metham and no metham and sub-plots were *Talaromyces flavus* (Tf) in alginate-pyrophyllite pellets and pellets without Tf. Pellets were broadcast (36.2 kg/ha) and rotovated into the soil prior to planting potato cv. Russet Burbank. Verticillium wilt incidence and colonization of potato stem tissue by *V. dahliae* were significantly lower in plots receiving Tf than in non-Tf plots. The following year the same field was planted with two cultivars of potato without additional treatment. Wilt incidence in Norgold was 36.2% and 50.5% for Tf and non-Tf plots, respectively. In Russet Burbank incidence was 22.2% and 31.2% for Tf and non-Tf plots, respectively. At the end of the second growing season soil populations of Tf were 8.9 times greater in plots which had been treated with Tf the previous year than in control plots.

EFFECT OF COMPOSTED SEWAGE SLUDGE AND MICROBIAL SEED TREATMENTS ON PYTHIUM DAMPING-OFF OF CUCUMBER. L.E. Garrabrandt, S.A. Johnston and R.D. Lumsden*, Plant Pathology Department, Cook College, Rutgers University, New Brunswick, NJ 08903, and* USDA, ARS, Beltsville, MD 20705.

Field studies were conducted in *Pythium*-infested microplots, half of which were amended with 5% (w/w) composted sewage sludge. In 1983 and 1984, seed were treated with *Trichoderma harzianum* (Th), *Fusarium solani* (Fs) or *Pseudomonas cepacia* (Pc) in gum arabic. In 1984, seed were also germinated and planted in Viterra gel with suspensions of the antagonists.

* = Student Paper Competition

Plant stands were significantly increased with all treatments in 1983 and with gel seeded Th plus and minus compost and Fs plus compost in 1984. Postemergence damping-off was significantly reduced in 1983 with Th, Fs and Pc plus compost and Pc without compost and in 1984 in composted plots with Th, Fs and Pc applied in gum arabic. With all treatments combined, stands were significantly greater with compost than without compost in both years. The effect of the above treatments on plant growth and yield were recorded. NJAES, Publication No. K-11140-2-86.

DETECTION OF *CLAVIBACTER XYLI* SUBSP. *XYLI* IN SUGARCANE LEAVES. A. G. Gillaspie, Jr. USDA, ARS, BARC, Beltsville, MD 20705

C. xyl subsp. *xyl* (C.x.x.), the causal agent of ratoon stunting disease (RSD), was detected in extracts of sugarcane leaves from infected plants from the greenhouse and the field but not from uninfected control plants. The oldest green leaves from field-grown shoots of RSD-infected and control plants were harvested in Louisiana and sent to Beltsville for extraction. The basal part of leaf blades was cut into 2.5 cm sections, vacuum infiltrated with distilled water, and centrifuged at 2,000 g for 5 min in a clinical centrifuge. Leaf sections were supported on a perforated plastic disc above the bottom of the tube. Extracts were also collected by placing 1 cm sections of basal mid-ribs in 1.5 ml conical tubes and centrifuging at 15,000 g for 1 min in an Eppendorf Model 5414 microfuge. Samples were examined for C.x.x. by phase-contrast microscopy. Hurricane-damaged leaves collected in the field in November did not give reliable results. This method provides detection of RSD without destroying the shoot.

SCREENING WORLD EGGPLANT GERMPLASM COLLECTION FOR RESISTANCE TO *PSEUDOMONAS SOLANACEARUM*

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Seedlings of 524 eggplant accessions were screened for resistance to *Pseudomonas solanacearum*, causal agent of bacterial wilt. Plants were grown under 16 hr. light and 32° ± 3°C. Inoculum consisting of 3 isolates of *P. solanacearum* containing 10⁶ cfu/ml was used to inoculate 10, 35 day old seedlings. The 4 assay conditions used are ranked in order of time for maximum symptom development: hypodermic needle injection and 100% RH (4 days), hypodermic needle injection and fluctuating RH (6 days), root dip and 100% RH (10 days), and root dip and fluctuating RH (15 days). Only *Solanum sisymbriifolium* PI 337597 and *S. ciliatum* PI 196300 did not develop wilt symptoms. The *S. melongena* plant introductions 269663 (India), 166996, 176367 and 176761 (Turkey) and 349612 (New Guinea) were highly resistant.

A NONTARGET EFFECT OF CARBOFURAN ON DAMPING-OFF IN ALFALFA.

A. P. Grybauskas, A. M. Decker, L. R. Vough, and K. I. Abdel-Gawad. Depts. of Botany and Agronomy, University of Maryland, College Park, MD 20742.

Results from field experiments over 5 years on alfalfa (*Medicago sativa* L.) with carbofuran, an insecticide-nematicide, showed significant improvement in stand population and yield in 3 of 13 trials. In trials where responses to carbofuran were obtained, insect damage was not apparent and increased stands and yields may have resulted from carbofuran suppressing damping-off. To test the effect of carbofuran on damping-off, growth chamber studies with a *Pythium* sp. showed that the percentage of seedlings exhibiting damping-off symptoms was significantly reduced, but varied with rate of carbofuran application, soil type, and soil moisture. *In vitro* fungal biomass was also significantly suppressed in carbofuran amended media.

A METHOD OF SCREENING GROWTH REGULATORS FOR POTENTIAL USE IN COMMERCIAL MUSHROOM CULTIVATION. Charles R. Halbert and Lee C. Schisler, Dept. of Plant Pathology, The Pennsylvania State University, University Park, PA 16802.

To facilitate rapid screening of growth regulators for use on the commercial mushroom, *Agaricus bisporus*, a method was developed to grow mushrooms in small containers in growth chambers. Two chambers are used for each cropping cycle, one for compost colonization and one for fruiting. Both chambers are equipped with monitors and controls for temperature and humidity. The fruiting chamber is also equipped to provide optimum air volume and carbon dioxide concentration. This growing system shortens the cropping cycle and allows data collection from a large number of replications. Preliminary results indicate that this method is more sensitive for detecting differences in yield (kg/m²) than size (g/mushroom). Fifteen replications of each treatment are required to detect a 15% difference in yield; 38

are required to detect the same difference in size. Improvements in the performance of the system are in progress.

CYLINDROCLADIUM SCOPARIUM AND FUSARIUM SPP. IN SOIL AND SEEDLINGS IN TWO PENNSYLVANIA NURSERIES. B. B. Hunter, Wang Chengguo, and B. Towers. Department of Biological Sciences, California University of Pennsylvania, California, PA 15419 and Pennsylvania Bureau of Forestry, Middletown, PA 17057.

Geranium and carnation baitings were utilized to qualitatively assay soils for species of Cylindrocladium and Fusarium at two Pennsylvania Forestry nurseries. Chlorotic red and white pine, white spruce seedlings, and woody materials in the soil were also tested to determine the presence of pathogenic fungi. All plant tissues were plated onto a selective medium (glucose-lima bean agar, 100:23:15 g/l) containing antibiotics and rose bengal. The medium was modified with yeast extract (2.0 g/l), when isolating the fusaria. Most soils possessed cylindrocladia and fusaria; however, soils not in cultivation were devoid of C. scoparium, but Fusarium spp. were present. Approximately one year after these soils were cultivated and seeds were planted, the cylindrocladia were recovered. Seedling parts and wood chips possessed both types of pathogenic fungi.

Further Characterization of Pelargonium Flowerbreak Virus (PFBV). S. S. Hurtt, USDA, ARS, Florist and Nursery Crops Laboratory, Beltsville, MD 20705

PFBV was purified from Chenopodium quinoa in sodium acetate buffer, pH 5.5, by ammonium sulfate precipitation and differential centrifugation. The buoyant density in CsCl at pH 5.5 was 1.34 g/cc; virus was degraded by CsCl in phosphate buffer, pH 7. In SDS-PAGE, PFBV coat protein was larger than that of hibiscus chlorotic ringspot virus but smaller than that of Saguaro cactus virus and was ca 36 kilodaltons. Double-stranded RNAs detected in infected C. quinoa by selective CF-11 binding and polyacrylamide gel electrophoresis were 2.7, 1.2 and 1.0 X 10⁶ daltons and were similar in size and number to those associated with carnation mottle virus (CarMV) infection. PFBV was differentiated from several CarMV-like viruses by electrophoresis in agarose mini-slab gels in 0.075 MES, pH 6.5. Rabbit antisera against PFBV was specific for the virus and detected PFBV-infected geraniums (Pelargonium x hortorum) in direct ELISA.

EARLY LEAFSPOT INCIDENCE FOLLOWING WEEKLY FIELD INOCULATIONS OF PEANUT IN 1985. E. L. Jewell, P. M. Phipps, and J. L. Steele, Tidewater Res. Ctr., VPI&SU and USDA-ARS, Suffolk, VA 23437.*

Floriant peanut in 27-cm-dia. plots was inoculated weekly from Jul 3 to Aug 28 with 20,000 conidia of Cercospora arachidicola. Inoculation dates were replicated in five randomized complete blocks. Three main stems were tagged at the internode beneath the second fully expanded leaf in each plot just prior to inoculation. Lesion counts and abscised leaflets for the two leaves above tags were determined at 0, 1, 2, and 3 wk after inoculation. Greatest levels of disease developed after inoculation on Jul 24; 39.1 and 47.6 lesions/leaf by 2 and 3 wk after inoculation, respectively. Disease after other inoculation dates ranged from 0.5 to 8.7, and 1.8 to 13.9 lesions/leaf at 2 and 3 wk, respectively. The VA peanut leafspot advisory program predicted heavy infection only after the Jul 24 inoculation, based on hrs of RH \geq 95% and minimum temperatures during high RH periods in the 5 days after inoculation. Correlating infection with these factors may better explain the epidemiology of early leafspot in peanut fields.

SUCCESSION OF BIODETERIORATION FUNGI IN RED OAKS KILLED FOLLOWING GYPSY MOTH DEFOLIATION IN PA. D. Karasevich and W. Merrill, Dept. of Plant Pathology, The Pennsylvania State University, University Park, PA 16802

Biodeterioration of red oaks (subgenus Erythrobalanus) following defoliation by the gypsy moth (Lymantria dispar) in PA involves a complex succession of fungi. Armillaria mellea initially invaded the defoliation-weakened trees and aided in killing them. By 1 growing season after death, Hypoxylon spp. and numerous staining fungi had colonized the sapwood. Hypoxylon spp., Stereum complicatum, and Schizophyllum commune fruited on trees dead 2 growing seasons. By 3 growing seasons after death, Merulius tremellosus, Polyporus pargamenus, P. tulipiferae, and P. gilvus had also fruited on the trees; white rot and stain had begun in the outer heartwood. Fruiting bodies of P. pargamenus and P. gilvus were again found on trees dead 6

growing seasons. By 7 growing seasons after death, 43% of the 100 trees surveyed had been windthrown due to root and butt rot; fruiting bodies and/or rhizomorphs of A. mellea were visible on the lower boles of 48% of these trees.

FUNGICIDAL CONTROL OF MYROTHECIUM RORIDUM TO DE EX. FRIES ON MUSKMELON (CUCUMIS MELO. L.). Joseph O. Kutl, Timothy J. Ng and George A. Bean, Departments of Horticulture and Botany, University of Maryland, College Park, MD 20742.*

The efficacy of six fungicides; (benomyl, captan, chlorothalonil, cupric hydroxide, thiophanate methyl and zineb) in controlling Myrothecium roridum (ATCC# 52485) on inoculated muskmelon leaves and fruits was evaluated under laboratory conditions. Of the fungicides tested, captan (2.08g/L), chlorothalonil (5.7ml/L) and thiophanate methyl (1.49g/L) were the most effective. Pre-infection foliar application of fungicides gave statistically significant control of disease symptoms while post-infection application gave marginal or no control.

RICE SEED AND PLANT CHARACTERS ASSOCIATED WITH CULTIVAR REACTION TO BLAST. F. M. Latterell, Bai-chai Wu, and A. E. Rossi, USDA-ARS, Foreign Dis.-Weed Sci. Res., Frederick, MD 21701

Investigations of pathogenic variability in Pyricularia oryzae have led to conflicting results among rice blast pathologists. Impurity or heterozygosity of seed stocks of international differential cultivars is evident in some of the data reported. Under standardized conditions, we are testing many single-spore isolates from single lesions from successive generations of the pathogen to determine frequency of variation as expressed by changes in pathogenicity to one or more of these cultivars. In tests of Raminad III, Kanto 51, and Sha Tiao Tsao showing mixed reactions to certain races of P. oryzae, we have observed a consistent association of seed apiculus color, apical adaxial bending of the lemma, and leaf auricle color with susceptibility or resistance. Host reaction to Races IB-1, IB-54, ID-13, and ID-14 can be predicted on the basis of one or more of these characters. Our findings suggest that genetic impurity of differential cultivars may be one source of conflicting results reported by rice blast pathologists.

MONOCLONAL ANTIBODIES SPECIFIC TO ERWINIA AMYLOVORA.

C. P. Lin, T. A. Chen, J. M. Wells, and T. van der Zwet, Department of Plant Pathology, & USDA, ARS, Rutgers Univ., New Brunswick, NJ 08903, and USDA, ARS, Appalachian Fruit Research Station, Kearneysville, WV 25430.

Forty-eight hybridoma clones secreting monoclonal antibodies against the fire blight bacterium, Erwinia amylovora, were produced by fusing NS-1 myeloma cells with splenic cells from mice immunized with E. amylovora (WV 55). The monoclonal antibodies were tested against 51 E. amylovora isolates from different countries using indirect ELISA. Most of the antibodies reacted with all of the isolates. Six of the monoclonal antibodies did not react to one or two isolates. Thirty-seven out of 48 monoclonal antibodies were used to test the serological specificity against 24 strains of bacteria in 6 genera. Ten clones reacted specifically only with E. amylovora. Sixteen hybridoma clones reacted to one or more Erwinia species besides E. amylovora. The other clones cross-reacted weakly with one or more xanthomonads or pseudomonads.

THE EFFECTS OF AMBIENT OZONE ON FIELD-GROWN BLACK CHERRY (PRUNUS SEROTINA EHRL.) SEEDLINGS: RESULTS AFTER THREE YEARS.

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The effects of ambient ozone on diameter and height growth of black cherry seedlings were investigated using foliar applications of the anti-oxidant ethylenediurea (EDU). Six replications with 44 trees per replication were established in May 1983. Trees received one of three treatments: 1000 ppm EDU+ surfactant+water, surfactant+water, or water. Six sprays were applied at 10-day intervals from late June to early September in 1983, 1984, and 1985. Evaluation of 212 trees in October 1985 showed a significant treatment effect on both diameter and height growth (P=0.0177, and P=0.0351, respectively). Diameter growth was 14% less and height growth was 10% less on non-EDU treated trees compared to those receiving the anti-oxidant EDU treatment.

THE EFFECT OF VARIOUS FUNGICIDE SCHEDULES ON EARLY BLIGHT EPIDEMICS AND YIELD OF POTATO. S. A. Maczuga and B. J. Christ, Department of Plant Pathology, The Pennsylvania State University, University Park, PA 16802*

* = Student Paper Competition

A field experiment was conducted in 1985 at the Rock Springs research farm using the cultivar 'Norchip' to evaluate fungicide application schedules. The fungicide mancozeb (1.8 kg/ha a.i.) was applied at weekly intervals, initiated at either one week before flowering, at flowering, one week after flowering, or two weeks after flowering. Also, treatments recommended by FAST and BLITECAST were included in the test along with any unsprayed check. Disease assessments (lesion number) were made on the 199, 210, and 228 day of the year. Area under the disease progress curve (AUDPC) and yield were calculated for each treatment. Treatment effects were best correlated with AUDPC. AUDPC was most highly correlated with lesion number at day 228. While fungicide treatment had a significant effect on yield, the relationship between lesion number and yield was not highly correlated.

EFFECT OF PLANT AGE ON SUSCEPTIBILITY OF SOYBEAN TO SOYBEAN RUST. J. S. Melching, W. M. Dowler, D. L. Koogle, and M. H. Royer, USDA-ARS, Frederick, MD 21701

Soybeans (cv. Wayne) were grown in the glasshouse and inoculated simultaneously at different ages (15, 20, 25, 32, 37, and 42 days) with a uniform suspension of urediniospores of *Phakopsora pachyrhizi* (isolate Taiwan-72-1). Latent period (50% or more uredinia sporulating) was 8 days for the 15- and 20-day-old plants, 9 for the 25- and 32-day-old plants, and 10 for the 37- and 42-day-old plants. Mean numbers of lesions/cm² decreased with increasing age at any one leaf position among plants of different ages or among leaf positions on plants of the same age, e.g., 20.3 and 0.4 for the first (oldest) leaf position on plants 15 and 42 days old, respectively. An average of 19 and 183 spores were required to cause one lesion on the 15- and 42-day-old plants, respectively. At 14 days after inoculation, 316 and 51 spores/lesion were harvested from the 15- and 42-day-old plants, respectively.

COMPUTER ENHANCED IMAGE ANALYSIS OF BACTERIAL POLYPEPTIDE PATTERNS ON TWO-DIMENSIONAL POLYACRYLAMIDE GELS. H. E. Moline and W. R. Hruschka, Horticultural Crops Quality and Instrumentation Research Laboratories, U.S. Department of Agriculture, Agricultural Research Service, Beltsville, MD 20705.

Comparisons of two-dimensional polyacrylamide gel electrophoresis (2-D PAGE) profiles of *Erwinia carotovora* pv. *carotovora*, *E. c.* pv. *atroseptica*, *E. chrysanthemi*, *E. rhapontici*, *E. herbicola*, and *E. amylovora* were made by transferring gel images to a Hewlett-Packard HP. 1000 minicomputer with a television camera. Computer assisted image analysis allowed us to develop gel maps that revealed polypeptides common to all species as well as polypeptides that were characteristic of the different species. Although all bacterial strains studied shared some common protein patterns, significant differences were observed between *E. c. carotovora*, *E. c. atroseptica*, and other species analyzed to allow differentiation.

IN VITRO EFFECT OF THE FUNGICIDE THIABENDAZOLE ON THE FINE STRUCTURE OF CERATOCYSTIS ULMI. Santford V. Overton and R. Jay Stipes, Dept. Plant Pathol., Physiol. & Weed Sci., VPI & SU, Blacksburg, VA 24061.*

The effect of the fungicide thiabendazole on cultures of *Ceratocystis ulmi* grown on PDA was examined at the fine structural level and compared to non-fungicide-amended cultures. Septa appeared to be swollen and irregular, and the membranous structures thought to function in cell wall synthesis (Jeng et al., Eur. J. For. Path. 10:16-27. 1980) had degenerated. The disappearance of these mesosome-like structures may be a factor in fungal growth inhibition which is caused by this fungicide. There was an increase in vacuole formation in the hyphae of the treated cultures, in addition to the aggregation of ribosomes within the diminished cytoplasm. Swollen golgi cisternae and nuclear envelopes were observed, while mitochondria and nuclei appeared to be washed out. An increase in the number of lipid bodies was also noted. These modifications in the ultrastructure of *C. ulmi* appear to be the result of the stressed environment induced by this fungicide.

DETECTION OF GRAPEVINE VIRUSES BY IMMUNOSORBENT ELECTRON MICROSCOPY. E. V. Podleckis and M. K. Corbett, Botany Dept., Univ. Maryland, College Park, MD 20742.

Extracts from grapevines in buffered 2.5% nicotine were applied to carbon-coated Parlodion-covered grids sensitized with antisera. Preparations were treated with homologous and heterologous antisera, stained with 2% ammonium molybdate and

examined in the electron microscope. Extracts from Chardonnay with decline symptoms and Vidal 256 with "little grape" symptoms contained spherical virus-like particles that were trapped and decorated with tobacco and tomato ringspot virus antisera, respectively. The particles did not decorate with normal serum or with grapevine fanleaf virus antiserum. Extracts from Vidal 256 also contained closterovirus-like particles that did not react with antisera to grapevine Virus A (GVA) or a Swiss closterovirus from leafroll infected grapevines. GVA antiserum trapped and decorated closterovirus-like particles in extracts from leafroll diseased Waltham Cross and Emperor grapevines but did not decorate closterovirus-like particles in Mission grapevines with leafroll symptoms.

A TECHNIQUE FOR STUDYING THE RELATIONSHIP OF VARIOUS BULB FUNGI TO BULB MITES, RHIZOGLYPHUS SPP. (ACARI:ASTIGMATA:ACARIDAE). M. H. Rhoades, S. L. Poe (Dept. Entomology) and R. J. Stipes (Dept. Plant Path., Physiol. Weed Sci.), VPI & SU, Blacksburg, VA 24061.

A technique for studying the response of *Rhizoglyphus* spp. to bulb tissue infested with fungi is described. Uniform disks were cut from daffodil bulb scales and placed on potato-dextrose agar cultures of *Fusarium oxysporum* for 48 hr. Infested and uninfested (control) disks were placed in shell vials, and the vials were placed in a petri dish with all stages of *R. robini*. After 24 hr, the food preference of the mites was recorded. Results were compared based on the number of mites which made a choice, i.e., the percentage of mites on each disk. After an arc sine transformation of data, significant differences were determined using the Normal Approximation to the Binomial Distribution for One Sample Test. In two separate trials, mites preferred infested disks to control disks (p=0.01). This method could be used to study various interactions among bulb mites, their hosts and various fungi.

EFFECT OF STORAGE CONDITIONS AND DURATION ON VIRULENCE AND VIABILITY OF PYRENOPHORA AVENAE. E. R. Seip and J. A. Frank, Dept. of Plant Pathology and USDA-ARS, The Pennsylvania State University, University Park, PA 16802

Pyrenophora avenae, a major oat leaf pathogen in Pennsylvania, does not sporulate well and loses virulence rapidly in culture. A study was conducted to evaluate the viability and virulence of *P. avenae* stored on oat leaves. Field-infected leaves of the cultivar Noble were stored in paper bags at room temperature or 4C, and tested 2-6 months after storage. Viability, based on the number of lesions producing spores, was greatest on leaves stored at 4C. Sporulation decreased from 69 to 24 percent over a four month period. Based on inoculation of Noble oats in the greenhouse, spores collected from leaves stored 6 months at room temperature were more virulent than spores produced in vitro.

OBSERVATIONS ON THE DECLINE OF NORWAY SPRUCE IN CENTRAL PENNSYLVANIA. J. M. Skelly, Department of Plant Pathology, The Pennsylvania State University, University Park, PA 16802.

Norway spruce [*Picea abies* (L.) Karst] is the principal species involved in the Waldsterben (forest death) occurring throughout the forests of western Europe. Symptoms of decline include discoloration of upper needle surfaces, loss of older needles, thinning of crowns, reduced radial growth, abnormal cone production, root mortality, dieback, and eventual tree death. This report presents the first observations of this decline in Norway spruce in eastern United States. During the fall of 1985 and early winter of 1986 Norway spruce has been observed throughout central and southeastern PA exhibiting symptoms identical to the complex of symptoms reported for this species in Germany. Symptoms were first noted on individual trees on the University Park campus. More advanced stages of foliar symptoms and whole tree decline including top death and severe defoliation have been observed as far to the SE as Embreeville, PA. No cause has yet been determined.

EFFECTS OF SEPTORIA NODORUM LEAF AND GLUME BLOTCH ON YIELD AND YIELD COMPONENTS OF WINTER WHEAT IN PENNSYLVANIA. V. J. Spadafora, H. Cole, Jr., and J. A. Frank, Department of Plant Pathology and USDA-ARS, The Pennsylvania State University, University Park, PA 16802

Field experiments were conducted to determine the effects of *Septoria nodorum* leaf and glume blotch on yield and yield components of two soft red winter wheat cultivars. A range of disease severity was generated in field plots by varying irrigation, artificial inoculation and fungicide treatment. Foliar disease severities ranged from 5-88% at GS 11.1, and yields ranged from 3376-7613 kg/ha. Data obtained from single

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tillers were more variable and distributed less uniformly than data obtained from replicated field plots. Yield losses were correlated with a reduction in kernel weight. In the cultivar Tyler, losses were also associated with a reduction in the number of seed/head, and were more closely predicted by the area under disease progress curves than by critical point models. The optimum time for control measures may be earlier than previously thought.

RELATIONSHIPS AMONG SOIL INOCULUM DENSITIES OF THIELAVIOPSIS BASICOLA, ROOT ROT SEVERITY AND GROWTH OF TOBACCO. Lawrence P. Specht and G. J. Griffin, Dept. Plant Pathology, Physiology and Weed Science, VPI&SU, Blacksburg, VA 24061

Tobacco seedlings were grown in the greenhouse for 30-31 days in soil (pH 7.0) naturally infested with *T. basicola*. Soil temperatures of 20-23 C were maintained with temperature tanks. The inoculum densities of *T. basicola* tested ranged from 0 to 200 propagules per gram of soil. For all three tobacco cultivars tested (B 21, NC 95 & Va Gold) the mean percent of roots with root rot increased significantly ($P=0.001$) with increasing inoculum densities of *T. basicola* (R^2 range 0.97-0.99). Increasing levels of root rot were positively correlated with decreases in shoot and root weight and shoot height. Similar results were obtained in a field study conducted on a commercial tobacco field (cv. B 21-Ky 10) located in southwestern Virginia. However, about three-fold higher inoculum densities of *T. basicola* were required to produce levels of root rot similar to that obtained in the greenhouse. These results were attributed partially to the lower pH (5.5-5.8) of the field soil.

SOME RELATIONSHIPS AMONG RESISTANCE GENES IN BEAN CULTIVARS USED TO DIFFERENTIATE RACES OF UROMYCES APPENDICULATUS. J. R. Stavely, USDA, ARS, BARC, Beltsville, MD 20705.

Bean cultivars used to differentiate races of *U. appendiculatus* (Ann. Rep. Bean Improv. Coop. 26:iv-vi) can be grouped by similarities of their reactions to the 20 races described in 1984 (Plant Dis. 68:95-99) and 11 races found recently. Cultivar grouping provides useful inferences about independence or identity of resistance genes. Ecuador 299, Mexico 235, NEP-2, Aurora, and 51051 develop small hypersensitive, necrotic lesions to the same 11 races. Early Gallatin, Kentucky Wonder 780, and Brown Beauty develop larger necrotic lesions to nine races, only one of which is among the first 11. These and other groupings of cultivars suggest relationships of genes conditioning necrotic, small uredinium, or intermediate uredinium reactions to various clusters of races. Genetic data indicate such groupings are reliable and useful in implementing gene deployment strategies to enhance the potential for developing stable resistance to this pathogen.

VARIABILITY IN SEGREGATION OF F₃ POPULATIONS OF SORGHUM FROM UNINFECTED AND VIRUS-INFECTED PARENT STOCKS. I.E. Stokes, R.G. Mock and A.G. Gillaspie, Jr. USDA, ARS, Beltsville, MD 20705.

Sugarcane mosaic virus strain A (SCMV) in P₁ plants of sorghum cultivars Planter and MN 4611 influenced genotypic variability in 739 F₃ populations. Control crosses, Planter x MN 4611 and the reciprocal, were between P₁ plants not SCMV infected. Treated crosses of the same parent combinations were between P₁ plants not infected and plants, female and male, SCMV infected. The virus was not detected in bioassays of F₁ or F₂ plants from control or treated crosses. Comparisons of control and treated crosses, based on segregation for seedling stem color and ligule presence, show that variability was related to parent combinations and genotypes. Major variability in the cross Planter x MN 4611 was due to a deficiency of plants in the green-ligule genotype of the treated population. In the reciprocal cross, the major variability was due to an excess of plants in the red-liguleless genotype of the treated population; total variability in control and treated populations of this cross was highly significant, $P = 0.01$.

PHOMOPSIS SEED INFECTION AND SEED QUALITY IN SOYBEAN ISOLINES DIFFERING IN GROWTH HABIT AND MATURITY. P.R. Thomison and W.J. Kenworthy, Dept. of Agronomy, Univ. of Maryland, College Park, MD 20742

Seed produced from the indeterminate soybean cultivar 'Clark' and its semideterminate and determinate isolines were evaluated for infection by *Phomopsis* sp. and germinability. Effects of growth habit on seed quality in early, late flowering and late maturing Clark isolines were considered. Late maturity was associated with the greatest improvement in germination and reduction in seed infection. Effects of delayed flowering on seed quality were less consistent. Isolines with indeterminate and semideterminate growth habit

exhibited less seed infection and higher germination levels than determinates of similar maturity. Growth habit effects were expressed in early maturing isolines in 1984 and in late maturing isolines in 1985.

EFFECT OF ERYSIPIHE GRAMINIS TRITICI INFECTION ON GRAIN FILLING IN WHEAT. J. R. Tomerlin, USDA, ARS, Beltsville, MD 20705; P. S. Baenziger, Monsanto Agricultural Products, Inc., Chesterfield, MO 63166; and V. W. Small, National Association of Wheat Growers, Washington, D. C. 20002.

Main plots were applications of Benlate and subplots were six soft red winter wheat cultivars which vary in resistance to *Erysiphe graminis tritici*. Plots were established in two locations each in 1983 and 1985. Mildew developed naturally. In 1983 mildew severity was assessed about 3 weeks before harvest. In 1985 mildew severity was assessed weekly from heading until harvest and area under the disease progress curve (AUDPC) was calculated. Mildew severity in 1983 ranged from 10-30% and 20-40% in sprayed and unsprayed plots respectively. In 1985 mildew severity ranged from 10-30% and 30-60% in sprayed and unsprayed plots respectively. The correlation coefficients (r) between mildew severity and plot yield were -0.39 in 1983 and -0.55 in 1985; the r between AUDPC and yield was -0.54. Mildew severity was poorly correlated with the rate of grain filling, with r 's of -0.17 in 1983 and -0.12 in 1985.

THE NUCLEAR DNA CONTENT OF PHYTOPHTHORA INFESTANS. P. W. Tooley, C. D. Therrien, and Abhi Pathak, USDA-ARS, Frederick, MD and Dept. Biology, Penn State Univ., Univ. Park, PA 16802

Zoospores of *P. infestans* were obtained by flooding agar cultures of the fungus with sterile distilled water and incubating at 10 C for 3 hr. After fixation in 4% formalin, followed by post-fixation in 70% ETOH, the Feulgen-DNA content of individual zoospore nuclei was determined by cytophotometry. *P. infestans* isolates from Mexico contain approximately one-half the DNA of isolates from the United States and Britain. The results are consistent with cytological studies by Sansome (J. Gen. Microbiol. 99:311-316), which indicated that British isolates contain approximately twice the chromosome number of Mexican isolates. DNA contents of two isolates, one from the Netherlands and one from California, were similar to those of the Mexican isolates. These isolates may be of recent Mexican origin. A substantial number of U.S. isolates contained DNA levels intermediate between those of other U.S. isolates and Mexican isolates, indicating possible triploidy or aneuploidy resulting from chromosome elimination.

THE EFFECT OF THE ERGOSTEROL BIOSYNTHESIS INHIBITING FUNGICIDE, PENCONAZOLE, ON FATTY ACID COMPOSITION OF USTILAGO MAYDIS AND MONILINIA FRUCTICOLA. W. F. Waterfield and H. D. Sisler, Univ. of MD, Dept. of Botany, College Park, MD 20742. *

In untreated *U. maydis* sporidia, predominance of 18:2 or 18:1 fatty acids in polar lipids varies according to cell density in the culture. Polar lipids of sporidia grown with penconazole contained more 18:2 than 18:1 fatty acids regardless of cell density. Similarly, polar lipids in *M. fructicola* contained more unsaturated fatty acids following treatment with penconazole. Protoplasts and mitochondria from penconazole treated *U. maydis* sporidia were more susceptible to osmotic disruption than were those from control sporidia. Mitochondria from treated sporidia had reduced ADP phosphorylating capacities and altered mitochondrial ATPase kinetics. These studies indicate that changes in sterol content and saturation of the polar lipid fatty acids resulting from fungicide treatment lead to alterations in membrane fluidity and behavior of membrane bound enzymes.

EFFECT OF HELMINTHOSPORIUM SOLANI AND SEED PIECE TREATMENT WITH CGA 449 ON THE OCCURRENCE OF RHIZOCTONIA SCLEROTIA ON POTATO TUBERS. R. J. Young and R. W. Goth. Division Plant and Soil Sciences, 401 Erooms Hall, W.V.U., Morgantown, WV 26506-6057, USDA Veg. Lab. Bldg. 001 HH13, BARC-W, Beltsville, MD 20705.

Potato tubers were examined for sclerotia of *Rhizoctonia solani*, grouped according to sclerotia severity, and then reclassified into similar groupings based on silver scurf (SS) severity. Katahdin tubers infected with *Helminthosporium solani* showed fewer and smaller sclerotia than tubers free of SS. When SS was present, 77% of the tubers were sclerotia-free, when SS was absent 100% of the tubers showed sclerotia. Tubers with heavy sclerotia development were treated with CGA 449 at rates of 5 and 10 g ai/Cwt seed potatoes. The incidence of sclerotia on harvested tubers was reduced 67 and 82%, respectively, while only 5% of the untreated tubers were sclerotia-free.

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