

ABSTRACTS OF PAPERS

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ABSTRACTS

CERTAIN ENZYMATIC ACTIVITIES OF FUSARIUM STRAINS ON PLANT MATERIAL. Antonios A. Antonopoulos and Edward G. Wene; Argonne National Laboratory, Argonne, Ill. 60439.

More than 1000 Fusarium strains were isolated from various substrates and screened for cellulolytic activity. None of the isolated strains were constitutive cellulase producers, but all produced cellulase and hemicellulase in the presence of insoluble delignified cellulose. F. oxysporum was the most frequently isolated species and consistently produced the highest levels of cellulase and extracellular protein. Over 90% of the cellulase activity was extracellular, i.e., not bound to mycelium or spores. One Fusarium isolate produced 2.45 IU/mL of cellulase at a level of 0.7 mg/mL of extracellular soluble protein in submerged culture. All tested isolates were also capable of fermenting both five- and six-carbon sugars to ethanol. Selected isolates of F. oxysporum produced up to 4.2 mg/mL of ethanol from both 1% glucose and 1% xylose solutions. (P).

A TAXONOMIC EVALUATION OF THREE CANKER-CAUSING FUNGI OF HONEY LOCUST. P.J. Bedker, and M.J. Wingfield, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.

Thyronectria austro-americana (Speg.) Seeler is reported to cause cankers on honey locust (Gleditsia triacanthos L.) over much of its range. Kaskaskia gleditsiae Born and Crane has been reported causing cankers on honey locust in Illinois. Nectria cinnabarina (Tode ex. Fr.) Fr. was recently determined to cause cankers on honey locust in Minnesota. Cankers caused by N. cinnabarina and T. austro-americana may be confused morphologically. In order to determine the causal agent, microscopic analysis of the fungi must be conducted. Taxonomic characters used to separate N. cinnabarina from T. austro-americana were reconfirmed by us. It was further determined that the anamorph of T. austro-americana, Gyrostroma austro-americana Seeler and K. gleditsiae are conspecific based on pycnidial development, conidial ontogeny; conidial size, shape and color. Cultural characteristics are identical. We propose to synonymize K. gleditsiae with G. austro-americana.

SPORULATION OF BIPOLARIS MAYDIS RACE T: EFFECT OF D-XYLOSE ON TRENDS IN pH AND AMMONIUM LEVELS IN CULTURE MEDIA. T. W. Bischoff and M. O. Garraway. Department of Plant Pathology, The Ohio State University, Columbus, OH 43210 and Ohio Agr. Res. and Devel. Cntr., Wooster, OH 44691.

Sporulation of Bipolaris maydis race T (BMT) was 50-100% higher on a glucose (10 g/l)-L-asparagine (4 g/l) medium supplemented with D-xylose (2 g/l) than on a non-supplemented one, after 6 days of incubation in the dark at 28 C. This was accompanied by a 50% reduction in the rate of increase in pH which typically occurred on a non-supplemented medium. A Nessler colorimetric test indicated that the concentration of residual NH_4^+ in culture media with a xylose supplement was $\frac{1}{2}$ of that in the non-supplemented one, while the rate of NH_4^+ generated from L-asparagine by washed homogenates of the fungal mycelia grown on either medium was comparable. Thus levels of residual NH_4^+ may help to explain trends in sporulation and rate of pH increase seen when BMT is grown on a glucose L-asparagine medium supplemented with D-xylose.

EFFECT OF TILLAGE SYSTEMS ON YIELD COMPONENTS AND DISEASES OF SOYBEANS. V. S. Bisht, J. B. Sinclair, J. W. Hummel and R. D. McClary, Depts. of Plant Path. and Agr. Engr., Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801.

Effect of five tillage systems - conventional (C), ridge-subsoil (RS), sweep-plot (SW), disk (D) and no-till (N) and two row spacings 25 cm. and 76 cm. on two soybean cultivars Corsoy

79 (CR) and Cumberland (CM) was studied in 1981. CR matured a week earlier than CM; 25 cm. spaced plants were slow initially but finally plants in both spacings matured together. CR at 76 cm. matured faster than 25 cm. but spacing did not affect maturity in CM. Yield was higher at 76 cm. (42.2 q/ha) than 25 cm. (38.0 q/ha). RS had significantly ($P=0.05$) lower yields than other tillages, which did not differ from one another. Narrow-spaced plants were taller, lodged more than thus reduced yields. Taller plants, in general, had more disease and lower seed weight. RS gave significantly lower seed weight while N had the highest. Seeds from narrow-spaced plants and from CM gave higher recovery of total fungi and bacteria, which affected the % clean seeds ($r=-0.81$ and -0.68 , respectively). (O)

MODELING INTERPLOT INTERFERENCE. K.L. Bowen and P.S. Teng, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.

Simulation modeling provides a method for quantitative analysis of spatial epidemiological phenomena. EPIMUL, developed by Kampmeijer and Zadoks, simulates epidemics in a multiline and permits the study of the effect of host resistance on disease spread. In this model, space is compartmentalized and a separate epidemic is simulated in each compartment. The compartments influence each other through spore transport. We used EPIMUL as a simulator of wheat leaf rust (Puccinia recondita f. sp. tritici) epidemics in a block of field plots to assess interference between plots. The simulation of the epidemic in two adjacent plots with the same susceptible variety resulted in 4% greater disease severity than in a plot of a susceptible variety adjacent to a nonsusceptible one. Model results were validated in the field using wheat plots artificially infected with leaf rust. Terminal rust severity in two susceptible plots was 6% greater than with one non-susceptible.

SUGAR COMPOSITION OF THE LIPOLYDISACCHARIDE (LPS) OF ERWINIA CHRYSANTHEMI. J.J. Bradshaw-Rouse, L. Sequeira and A. Kelman, Dept. of Plant Pathology, Univ. of Wisconsin, Madison WI 53706

The sugar composition of the lipopolysaccharide of 14 strains of E. chrysanthemi obtained from corn (6), chrysanthemum (2) and six other hosts was analyzed by gas chromatography of alditol acetate derivatives. The results indicate that the LPS of E. chrysanthemi is highly variable. There are at least four distinct types of LPS. Group 1 strains (SR297, SR242, SR235, SR228) have a fucose repeating unit, Group 2 strains (SR31 and SR80) a rhamnose repeating unit, and Group 3 strains (SR58 and SR261) a glucose repeating unit. Group 4 strains (SR90, SR172, SR120, SR238, SR239) contain both rhamnose and glucose (1:1) and appear to have an incomplete O-antigen. Heptose, keto-deoxyoctonic acid, glucosamine and two unidentified sugars were present in all the strains examined. Only one strain (SR30) had galactose in the O-antigen portion of LPS. LPS sugar composition was not correlated with host origin of the strains. (O)

A BIOASSAY FOR TOXIC METABOLITES OF HELMINTHOSPORIUM SATIVUM. C. M. DAVIS¹, J. E. CHRIST², S. G. PUEPPKE³, and R. W. STACK⁴. (1, 4) North Dakota State University, Fargo, ND 58105 (2, 3) University of Missouri, St. Louis, Missouri 63121

Toxic metabolites produced by Helminthosporium sativum P.K. & B., the causal agent of common root rot of wheat and barley, have been implicated in the etiology of the disease but their role is not clearly defined. We here report a simple and reliable bioassay of non-host-specific toxic metabolites found in culture filtrates of H. sativum. The effect of the culture filtrates on root growth of lettuce seedlings was determined in replicated experiments under standardized conditions. Root length of seedlings showed a log linear response

to different concentrations of toxic metabolites in a dilution series. Inhibition of root growth by culture filtrates from different isolates of *H. sativum* varied considerably. Among fifteen isolates tested, we observed a range of inhibition from 11% to 83%. The lettuce seedling root growth bioassay is a simple, consistent, and reproducible bioassay for toxic metabolites found in culture filtrates of *H. sativum*. (P).

THE ETIOLOGY OF BASAL TRUNK CANKERS ASSOCIATED WITH WISCONSIN URBAN MAPLE DECLINE. M. J. Drillas, J. E. Kuntz, and G. L. Worf, Dept. Plant Pathology, Univ. Wisconsin, Madison, WI 53706.

Many sugar maples with crown decline in Wisconsin also have basal trunk cankers (BTC). Symptoms of BTC are loosening of bark with discoloration and decay of the underlying wood at the root collar and lower trunk. Of 254 sugar maples examined in 1980, 23.3% exhibited crown decline of which 62.7% had BTC. In addition, 5.6% of "healthy" trees (no crown symptoms) had BTC. Root collars of 55 sugar maples with BTC were exposed in 1980. BTC girdled 30 of 43 trees with crown decline and 2 of 12 "healthy" trees. In 1981, 16 of the 55 trees were removed because of severe decline; 14 of the removed trees were girdled by BTC. Of the remaining 39 trees, 35 exhibited crown decline of which 21 were girdled. Only 4 trees still were considered "healthy" and 1 was girdled. *Phytophthora citricola* was isolated from 37 of the 55 trees and was pathogenic, causing progressive lesions when inoculated to sugar maples, 10-15 years of age. *Fusarium solani* and *F. oxysporum* caused annual cankers observed on 15 of the 55 trees. (O).

THE REAPPEARANCE OF FUSARIUM YELLOWS OF CELERY IN MICHIGAN. W. H. Elmer and M. L. Lacy, Department of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824.

During the summer of 1981 a pathogenic isolate of *Fusarium oxysporum* f. sp. *apii* was isolated from diseased celery (*Apium graveolens* var. *dulce*) plants in a field near Muskegon, MI. Symptoms included stunting, yellowing and vascular discoloration on cultivars Florida 2-13 and Tall Utah 52-70 H which were highly resistant to Fusarium yellows race 1. Healthy celery seedlings of Tall Utah 52-70 and Golden Detroit (susceptible to race 1) both exhibited typical symptoms when grown in greenhouse soil amended with *Fusarium*-colonized wheat straw, suggesting that we have obtained race 2 previously reported in New York and California. Several parsley and celery F₂ lines were screened for resistance to Fusarium yellows in the greenhouse. All F₂ lines exhibited some resistance relative to Tall Utah 52-70. This is the first report of Fusarium yellows on the Tall Utah 52-70 and related celery cultivars in Michigan. (O)

PATHOGENIC VARIATION IN POPULATIONS OF HELMINTHOSPORIUM SATIVUM H. M. EL-NASHAAR and R. W. STACK, Plant Pathology Department, North Dakota State University, Fargo, North Dakota, 58105.

Common root rot, caused by *Helminthosporium sativum*, is an important disease of spring wheat and barley in the northern great plains. While the disease has been widely studied, extensive systematic investigation of pathological variation in *H. sativum* has not been reported. Three widely separated North Dakota counties were selected for field sampling. Approximately 300 isolates of *H. sativum* were obtained from wheat and barley plants. Pathogenicity of isolates was assessed according to amount of disease on wheat test plants in randomized, replicated greenhouse trials. Data were analyzed using the UNIVARIATE Procedure of the SAS computer package. Pathogenicity of isolates was a normally distributed continuous variable. Although the range of pathogenicity in populations of *H. sativum* within counties was similar, the means and variances were different. Factors involved in this pathogenic variation among these populations are under investigation. (P).

DECREASED GERMINABILITY OF FUNGAL PROPAGULES IN RESPONSE TO NUTRIENT STRESS. A. B. Filonow and J. L. Lockwood, Dept. of Botany and Plant Pathology, Michigan State Univ., East Lansing, MI 48824

Conidia of *Cochliobolus victoriae* and sclerotia of *Sclerotium cepivorum*, *Macrophomina phaseolina* and *Verticillium dahliae* were exposed to nutrient stress by incubation for several weeks on sand through which a salts solution percolated. All propagules showed decreased germinability on static dilute salts solution after incubation on leached sand. Duration on leached sand required to reduce germinability was greatest for *V. dahliae* > *M. phaseolina* > *S. cepivorum* > *C. victoriae*. Incubation on leached sand also reduced germinability on PDA of *C.*

victoriae and *S. cepivorum* but not that of *M. phaseolina* and *V. dahliae*. Endogenous carbohydrates in conidia of *C. victoriae* were greatly reduced after 9-12 days of incubation on leached sand. *C. victoriae* and *M. phaseolina* also lost germinability on static salts solution after incubation for several weeks on soils. *C. victoriae* conidia with low germinability, absorbed ¹⁴C from labeled soils and showed increased germinability on salts solution. (O)

SEVERITY OF MAIZE STALK ROT AS INFLUENCED BY KERNEL NUMBER AND IRRIGATION. D. C. Foley and C. A. Martinson, Department of Plant Pathology, Seed and Weed Sciences, Iowa State University, Ames, IA 50011

Four irrigation regimes (none, adequate before silking, adequate after silking, and both), 3 levels of kernel number, and 4 topcross hybrids were used in a split-split plot design with 5 replications. Kernel number was regulated by exposing silks for 1, 2, and 3+ days after initial silk emergence, which gave 280, 382, and 455 kernels/plant, respectively. Less stalk rot as measured by parenchyma rot, broken stalks, stalk softness, stalk color, crown rot severity, and tangential compression, and higher values for breaking strength and maximum fiber strength were associated with lower kernel number. Irrigation before silking significantly increased the breaking strength and the flexural strength values for the stalks. Host genotype (A256xB14A, C123xB14A, W64AxB14A, and B37xB14A) affected all traits, but the association among traits was inconsistent. Hybrid B37xB14A was usually the least rotted hybrid. (P)

PARTICLE ASSOCIATION WITH A SCHEFFLERA RINGSPOTTING DISEASE. G. Gaard, G. A. de Zoeten, and M. F. Heimann, Department of Plant Pathology, University of Wisconsin, Madison, WI 53706.

Unusually long virus particles with rounded ends were visualized in a uranyl-formate stained Brandes' dip from Schefflera (*Brassica actinophylla* L.) with chlorotic ringspot symptoms and early senescence. Only approximately 1% of the cells in tissue from chlorotic areas prepared for electron microscopy contained these particles. This virus-like entity appeared as individual particles or as aggregates mainly in the phloem tissue. Mechanical transmission to a range of different host plants was unsuccessful. Because of gelation of Schefflera sap, attempts to purify the virus-like particles were unsuccessful. (O)

NEMATOSPORA CORYLI ON SOYBEAN SEEDS GROWN IN ILLINOIS. D. A. Glawe and E. G. Jordan, Department of Plant Pathology, University of Illinois, and USDA-APHIS, Urbana, IL 61801.

Nematospora coryli, the yeast spot pathogen, was first observed in Illinois in 1979. This fungus was observed on seed of sixteen soybean cultivars grown in Illinois in 1980. Seeds collected from nine locations were surface disinfected and placed on potato dextrose agar for 10 days at 24°C. *N. coryli* colonies were greyish- to creamy-white, smooth-surfaced, yeast-like, and produced elliptical to spherical budding cells, pseudohyphae, hyphae, raquet-shaped cells, asci (57-) 65-86 x 7.8-13 µm, and ascospores 30-48 x 2.6 µm. Incidence of *N. coryli* was greatest (P=0.05) for the cultivar Beeson (av. 7.4%). Incidence was greater (P=0.05) for maturity group II (av. 1.9%) than maturity group IV (av. 0.4%) soybean cultivars. Maturity groups III and V were intermediate. Incidence of *N. coryli* was greatest on seed produced in southern Illinois at Dixon Springs (av. 3.6%), Carbondale (av. 3.4%), and Brownstown (av. 1.1%), with less than 1% or no occurrence at the other locations. (O)

PRE-INFECTION GROWTH OF VAM FUNGI. M. G. Glenn, Department of Plant Pathology, University of Wisconsin-Madison, Madison, WI 53706

Pre-infection growth patterns of *Glomus mosseae* and *Gigaspora gigantea* were observed when resting spores were germinated on minimal salts agar without roots, near elongating roots of compatible hosts *Nicotiana tabacum* and *Allium cepa*, and near elongating roots of non-hosts *Brassica campestris* and *B. napus*. In the absence of roots, germ tubes were sparsely branched. Presence of a host or non-host root tip stimulated many hyphal branches. With hosts, contact and penetration usually followed. Responses to Brassica root tips ranged from stubby branches oriented both toward and away from roots, to contact and penetration. Compared to hyphal branches stimulated by hosts, those due to Brassica arose closer to the root, and often senesced before making contact. Even though young and vigorous

hyphae penetrated Brassica roots there was never any post-penetration flush of hyphal growth, and functional symbioses never developed.

INFLUENCE OF SOIL COMPACTION OF THE SEVERITY OF PHYTOPHTHORA ROOT ROT OF SOYBEANS. L. E. Gray and R. A. Pope, Departments of Plant Pathology and Agronomy, respectively, University of Illinois, Urbana, IL 61801.

The severity of *Phytophthora* root rot on Corsoy soybeans was increased in 1981 by subsurface soil compaction at Urbana, IL. On 7/1/81 there was an average of 34 plants per 6.1 m row killed by *Phytophthora* in control plots, compared to 52 plants per 6.1 m row in compacted plots. Plant dry matter production in compacted plots averaged 15.6 g/1.5 m² plot area on 6/17/81, and 119.6 g/1.5 m² plot area on 7/13/81, while control plots averaged 27.8 g/1.5 m² and 298 g/1.5 m² area, respectively. There was a significant difference in final stands for Corsoy in compacted (76 plants/6.1 m row) and non-compacted plots (96 plants/6.1 m row). Yields of Corsoy in compacted plots were 1850 kg/ha compared to 3222 kg/ha in control plots. (0)

CONTROL OF A MOLDING-ROOT ROT COMPLEX OF BLACK WALNUT SEEDLINGS IN STORAGE. R. J. Green, Jr., Department of Botany & Plant Pathology, Purdue University, W. Lafayette, IN 47907.

Black walnut seedlings are lifted in the Fall and stored overwinter either in heeling-in beds or cold storage. Losses of 30% or more often occur from a molding-root rot complex involving species of *Fusarium*, *Pythium*, *Trichoderma*, *Gliocladiopsis*, *Penicillium*, *Zygorhynchus* and other fungi. Only *Fusarium* spp and *Pythium* spp were isolated from the internal root tissues. All other fungi were superficial and when infected seedlings were outplanted survival rates were high. This problem is distinct from the seedling root rot caused by *Phytophthora citricola* in the seedbed. The molding-root rot complex was effectively controlled by a captafol root dip (Difolatan 4F 2qt/100 gal H₂O) before heeling-in overwinter or a root dip plus packing in laminated, plastic lined bags rather than wet packing for cold storage.

GROWTH AND INFECTIVITY TITRATION OF *XANTHOMONAS PHASEOLI* VAR. *SOJENSIS* IN RESISTANT AND SUSCEPTIBLE SOYBEAN LEAVES. D. E. Groth and E. J. Braun, Dept. of Plant Pathology, Seed and Weed Sciences, Iowa State University, Ames, IA 50011.

The first trifoliolate leaves of resistant and susceptible soybean plants were inoculated with *Xanthomonas phaseoli* var. *sojensis* (Xps) using an airbrush. Inoculum concentrations were varied to produce initial Xps populations within the leaves ranging from 0.6 to 400 CFU/cm². Pathogen populations were assessed over a nine day period using standard dilution plating techniques. Number of pustules/cm² was determined 10 days after inoculation. At all inoculum concentrations, Xps populations increased at similar rates in both resistant and susceptible leaves. In susceptible leaves, the ratio between the initial pathogen population (CFU/cm²) and the number of pustules 10 days after inoculation (pustules/cm²) was approximately 1:1. In resistant leaves this ratio was approximately 10:1. Resistance was expressed as a reduction in the number of pustules formed but not as a decrease in pathogen growth within the leaves. (0).

RACE 3 SUNFLOWER DOWNY MILDEW: DISTRIBUTION AND SOURCES OF RESISTANCE. T. J. Gulya, U.S. Department of Agriculture, Agricultural Research Service, and Department of Plant Pathology, North Dakota State University, Fargo, 58105; M. L. Carson, Department of Plant Science, South Dakota State University, Brookings, 57007; and R. URS, Dahlgren & Co., Crookston, MN 56716.

Race 3 of sunflower downy mildew (*Plasmopara halstedii*) was found scattered throughout 26 of 40 counties in North Dakota, South Dakota, and Minnesota in a 1981 survey. Overall, 73 out of 303 fields had confirmed race 3 infestation, with the incidence in most fields between 1-5%. None of the USDA inbred or commercial hybrid cultivars tested showed any resistance, including those with the Pl₁, Pl₂, or Pl₄ resistance genes. Out of 695 sunflower plant introductions, six open-pollinated cultivars were identified with high proportions of resistant plants. Three had resistance to mixed inoculum of races 2 and 3. In greenhouse trials, metalaxyl, prothiocard, and DPX-3217 (Curzate) seed treatment controlled race 3 infection.

BIOLOGICAL CONTROL OF THE APPLE SCAB PATHOGEN, *VENTURIA INAEQUALIS*, UNDER FIELD CONDITIONS. C. C. Heye and J. H. Andrews, Dept. of Plant Pathology, Univ. of Wisconsin-Madison, Madison WI 53706

Ascospore production (AP) of *V. inaequalis* was prevented or reduced substantially by treating scab-infected leaves with microbial antagonists to the pathogen. *Athelia bombacina* (A) and *Chaetomium* sp. (C), each grown on milled wheat bran and on PDA, were applied to green McIntosh leaves detached in autumn when trees were 50% naturally defoliated. Leaves were sprayed with A or C at ca. 10² or 10³ propagules/cm², respectively, each as the bran cultures in water, and as fungal propagules in water with carboxymethylcellulose plus malt- and yeast-extracts (CMY). The leaves were overwintered in an orchard in nylon mesh bags, and AP was determined in the spring. AP was prevented on A-treated leaves and reduced ca. 30% (p<.001) on C-treated leaves compared to water and substrates only as controls. There was no difference in effect of bran and CMY substrates on AP (p=.7), nor were there any substrate-antagonist interactions (p=.06). Dry weights of A-treated leaves were lower and these leaves had less strength than all other treatments (p<.01). (P)

LIGHT AND ELECTRON MICROSCOPY OF CELLULOSE DEGRADATION BY BROWN-ROT WOOD-DECAY FUNGI. T. L. Highley, L. Murmanis, and J. G. Palmer, Forest Products Laboratory, P.O. Box 5130, Madison, Wis. 53705.

Eleven brown-rot fungi were grown on cellulose fibers and the degradation was observed by light (LM) and electron microscopy [scanning (SEM) and transmission (TEM)]. LM and SEM showed that hyphae of all the fungi grew randomly on and among fibers with little disruption of the fiber surface; penetration of hyphae into fibers was not apparent. However, when viewed by TEM, hyphae of some brown-rot fungi were present in fiber walls and lumina. Hyphae of all fungi were encased in extracellular material or a hyphal sheath. Sheaths associated with hyphae that touched cotton fibers spread away from the hyphae and sometimes encircled the fibers. Autolyzed intracellular products had diffused into sheaths and fibers. All fungi degraded fibers at a considerable distance from hyphae indicating that the initial dissolution of cellulose is accomplished by a small diffusible depolymerizing agent. (P)

RESISTANCE TO STEM CANKER OF SOYBEANS. P. M. Higley and H. Tachibana. Dept. of Plant Pathology, Seed and Weed Sciences, Iowa State University, Ames, IA 50011.

Stem canker of soybeans, caused by *Diaporthe phaseolorum* var. *caulivora* (Dpc) was a major disease problem when the cultivars Blackhawk and Hawkeye were widely grown in Iowa in the 1950s. Subsequently, the disease has been reported only sporadically. Studies were made to determine whether the change in incidence of stem canker can be related to increased Dpc resistance in recent cultivars. Thirty-four cultivars and experimental lines were tested for resistance using Crall's toothpick tip inoculation method. By this assay method, 70-100% of the plants in most cultivars developed cankers. Moderate resistance, expressed as delayed disease development, was observed in only one of the current cultivars, Pike, and the experimental line A79-331022. The cultivar Midwest, which was not grown in Iowa, displayed the highest resistance. Only 19% of the plants developed cankers and infection was delayed. Although some cultivars are resistant, the recent low disease incidence may not be due to resistance alone.

INCIDENCE OF SEEDBORNE FUNGI ON SOYBEAN CULTIVARS GROWN IN ILLINOIS. E. G. Jordan, P. N. Thapliyal and J. B. Sinclair. Department of Plant Pathology, University of Illinois, USDA-APHIS, Urbana, IL 61801.

Soybean seeds of sixteen cultivars grown at various locations in Illinois from 1978 to 1981 were assayed for fungi. Surface disinfected seeds (4 min in 0.5% NaOCl and 1 min in sterile distilled water) were incubated for 10 days at 24°C on potato-dextrose agar. Incidence of *Phomopsis* spp. was significantly greater (P=0.05) for Wells (av. 22.2%) and less for Elf (av. 3.3%). Incidence of *Cercospora* spp. ranged from 1.0 and 1.1% for Essex and Elf to 8.1 and 8.3% for Amsoy and Amsoy 71, respectively. Incidence of *Alternaria* spp. was significantly greater (P=0.05) for Essex (av. 9.8%) and lower for Elf (av. 2.9%). Seed contaminated with *Cladosporium* spp. ranged from 1.6% for Clark 63 to 4.3% for Essex. For any cultivar, the incidence of *Aspergillus*, *Chaetomium*, *Colletotrichum*, *Fusarium*, *Macrophomina*, or *Penicillium* spp. was less than 2.2%. (0)

COMPARATIVE VIRULENCE OF MONOKARYOTIC AND DIKARYOTIC STAGES OF FOUR ISOLATES OF *Uromyces phaseoli* var. *typica*. J.A. Kolmer and J.V. Groth, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.

The virulence of monokaryotic basidiospores and dikaryotic aeciospores and urediospores were compared in isolates KW8-1, P10-1, P14-1, and S1-5 of *Uromyces phaseoli* var. *typica*, on five bean cultivars: 814, Bush Blue Lake, Montcalm, Early Gallatin, and Roma. Virulence of basidiospores of each isolate was determined by placing germinating teliospores over the five bean cultivars. Segregating cultures produced both pycnia and flecks; homozygous cultures had only flecks or pycnia. The four isolates were selfed and the five cultivars were inoculated with S_1 aecia to detect heterozygosity and dominance in the dikaryotic virulence. Segregating aecial cultures gave rise to both flecks and uredia; homozygous cultures had only flecks or uredia. Isolates with heterozygous basidiospores also segregated as S_1 aeciospores; cultures with homozygous basidiospores did not segregate as S_1 aeciospores.

AN *ALTERNARIA* SP. ON LEAFY SPURGE. J. M. Krupinsky, Plant Pathologist, USDA, Agricultural Research Service, Northern Great Plains Research Center, P.O. Box 459, Mandan, ND 58554.

In 1979 through 1981 isolates of an *Alternaria* sp. were obtained from diseased leafy spurge plants, *Euphorbia esula* L., growing in LaMoure and Morton counties in ND. The pathogenicity of this *Alternaria* sp. has been demonstrated on leafy spurge with glasshouse and preliminary field studies. In the glasshouse studies symptoms were produced with spore concentrations as low as 2.8×10^4 spores/ml, a large number of plant tops were killed with spore concentrations above 1.0×10^5 spores per ml, and leafy spurge plants were killed back to ground level with high spore concentrations above 1.0×10^6 spores per ml. Seed production by leafy spurge was inhibited with preliminary field inoculations. This pathogen could be a potential biological control agent for leafy spurge in areas where herbicide spraying is not desirable. Dr. Emory Simmons, Univ. of Massachusetts, Amherst, identified the pathogen as a member of the *Alternaria tenuissima* group, possibly an aberrant strain of *A. tenuissima* itself. (P)

CHANGES IN VIRULENCE OF *SEPTORIA NODORUM* ISOLATED FROM AGROPYRON SPECIES AND *HORDEUM JUBATUM* AFTER PASSAGE THROUGH WHEAT. J. M. Krupinsky, USDA, Agricultural Research Service, Northern Great Plains Research Center, PO Box 459, Mandan, ND 58554.

Isolates of *Septoria nodorum* from *Agropyron cristatum*, *A. desertorum*, a hybrid of *A. repens* x *A. desertorum*, *A. intermedium*, *A. smithii*, and *Hordeum jubatum* were used to inoculate *Triticum aestivum* in a glasshouse. After six cycles of inoculation and reisolation from wheat, the sixth reisolates (RE-6) were compared with the original isolates (RE-0) and an isolate from *T. aestivum*. Four of the RE-6 isolates had disease ratings similar to their RE-0 isolates. The RE-6 isolates from *A. cristatum* and *H. jubatum* were more virulent than their original RE-0 isolates. The disease symptoms caused by these two RE-6 isolates were comparable to those caused by an isolate from *T. aestivum*. The wide distribution of *H. jubatum* and its association with small grains make it a good alternative host. (P)

THE ROLE OF HYPHAL PEGS IN SPORE DISSEMINATION BY *SIROCOCCUS CLAVIGIGNENTI-JUGLANDACEARUM*. J. E. Kuntz, and V.M.G. Nair, Department of Plant Pathology, University of Wisconsin-Madison, 53706 and School of Science and Environmental Change, University of Wisconsin-Green Bay, 54302, respectively.

Butternut canker, incited by the fungal pathogen *Sirococcus clavignenti-juglandacearum*, has caused widespread dying of butternut, *Juglans cinerea*, in Wisconsin and throughout its range in eastern U.S.A. Under the outer bark of a branch or stem canker, the fungus forms a mycelial stroma from which arise thick, vertical, closely spaced "hyphal pegs" (1500-1900 x 450-510 μ). Pycnidia also develop on the stroma among the bases of the pegs. From the pycnidia, conidia are extruded in sticky masses or as cirri. The spores are dispersed by rainsplash and disseminated by wind during rainfall. Hyphal pegs not only loosen, raise, and crack the outer bark, exposing the pycnidia, but also bear sporulating pycnidia at their tips, facilitating even greater spore dispersal. (D).

COLLECTION, STORAGE, AND GERMINATION OF EASTERN DWARF MISTLETOE (*ARCEUTHOBIUM PUSILLUM*) SEED. W.H. Livingston and R.A. Blanchette, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.

Arceuthobium pusillum seed was collected in September from naturally infected black spruce by wrapping cheese cloth around the brooms. Seed caught by the cheesecloth were removed, sterilized in 3% hydrogen peroxide, and suspended on discs in jars over a saturated NaCl solution. Jars were stored at -10°C and $+4^\circ\text{C}$. Starting two weeks after collection and continuing at biweekly and monthly intervals, 100 seeds were removed from jars at each storage temperature and placed in a growth chamber at 15°C , 18 hr light period. Seeds were moistened three times a week. Maximum germination (the appearance of the red radicle) was ca. 60% and did not differ between storage periods but was slightly larger for seeds stored at -10°C . However, radicle growth did not exceed 1 mm unless seeds received at least 10 weeks of cold storage. *Arceuthobium pusillum* seeds treated as described above successfully infected black spruce seedlings in the greenhouse.

SUSCEPTIBILITY OF POTATO TUBER TISSUE TO MACERATION BY PECTIC ENZYMES UNDER LOW OXYGEN LEVELS. E. A. Maher and A. Kelman, Dept. of Plant Pathology, University of Wisconsin, Madison, WI 53706.

Sterile culture filtrate (SCF) from *Erwinia carotovora* (EC) injected in surface-sterilized potato tubers induces decay lesions indistinguishable from lesions at sites injected with EC culture suspensions when tubers are incubated anaerobically. Under aerobic conditions, no decay is observed. Pectic depolymerase (PD I) with pectic lyase (PL) and polygalacturonase (PG) activity induced maceration under low but not ambient oxygen levels. Heat-treated SCF with proteolytic but not pectolytic activity did not macerate tissue under aerobic or anaerobic incubation. SCF added to 4-day-old injection site wounds prior to anaerobic incubation did not macerate tissue. In contrast, new injections with SCF in the same potato tubers immediately prior to anaerobic incubation induced tissue maceration. Local wound responses may inhibit or restrict pectolytic enzyme activity in soft rot infections under aerobic conditions. (O)

HORIZONTAL MIGRATION OF PLANT-PARASITIC NEMATODES IN SOIL. R. D. McClary and R. B. Malek, Dept. Plant Pathology, Univ. Illinois at Urbana-Champaign, 1102 S. Goodwin Ave., Urbana, Ill., 61801.

Horizontal migration of the plant-parasitic nematodes *Helicotylenchus dihystrera*, *H. pseudorobustus*, *Heterodera glycines*, *Hoplolaimus galeatus*, *Longidorus brevipannulatus*, *Paratrichodorus christiei*, *Pratylenchus hexincisus*, *P. penetrans*, *Tylenchorynchus agri*, *T. martini* and *Xiphinema americanum* in 10 x 1 cm tubes of Plainfield sand was investigated. Mean distance migrated ranged from 5.4 cm for *T. martini* to 1.2 cm for *X. americanum*. Percent migrating the full tube length was 10.4 for *P. christiei*, 7.4 for *T. martini*, and less than 4 for all others. Percent migrating less than 1 cm ranged from 30 for *P. christiei* and *T. martini* to 93 for *X. americanum*. Among 5 species compared in flats of Plainfield sand, migration was greatest in *P. christiei*, which moved 40 cm to clover plants in 5 wk. Degree of migration was low in *H. pseudorobustus* and intermediate in *T. martini*, *H. galeatus* and *P. hexincisus*. In flats of Drummer silty clay loam, little migration of any species occurred. (O)

ANALYSIS OF THE GENOMIC RNAS OF THE AM STRAIN OF BARLEY STRIPE MOSAIC VIRUS. J.E. McFarland, G.D. Gustafson and A.O. Jackson, Purdue University, West Lafayette, IN 47907.

RNAs extracted from barley stripe mosaic virus (BSMV) may be resolved by gel electrophoresis into 3 classes exemplified by the Type, North Dakota 18 (ND18), and Argentina mild (AM) strains, which have 2, 3, and 4 RNA components, respectively. Recombinant DNA clones derived from ND18 RNAs have been used to analyze the AM RNA components. pBSM 1 clones hybridized to RNA 1 of the ND18, Type and AM strains. pBSM 2 clones hybridized to RNA 2 of all three strains. pBSM 3 clones hybridized to RNA 3 of the ND18 strain, to RNA 2 of the Type strain, and to RNAs 3 and 4 of the AM strain. AM isolates obtained after inoculating the host with high dilutions of the virus were also investigated. All AM isolates contained RNA sequences which hybridized to each of the three clones. These results provide further evidence to support the theory that BSMV is actually a tripartite genome. *In vitro* translation data supplement the analysis of the AM genomic RNAs. (O).

RELATIONSHIP BETWEEN CALCIUM LEVELS IN POTATO TUBERS AND ERWINIA SOFT ROT. R. G. McGuire and A. Kelman, Department of Plant Pathology, and P. Fixen, Department of Soil Science, University of Wisconsin, Madison, WI 53706.

An inverse linear relationship between the severity of bacterial soft rot of potato tubers, caused by *Erwinia carotovora* pv. *atroseptica* (Eca), and the level of tuber calcium has been demonstrated in laboratory and field trials. Vacuum infiltration of potato tubers with solutions of $\text{Ca}(\text{NO}_3)_2$ increased calcium levels in tuber periderm and cortex tissue and reduced bacterial soft rot when tubers inoculated with Eca were incubated in a mist chamber at 20 C for 96 h. A field trial was designed to establish a group of subplots with a wide range of available calcium. The tubers obtained from these plots had calcium contents ranging from 0.06 to 0.28% in the periderm and from 0.01 to 0.06% in the cortex as determined by inductively coupled plasma-optical emission spectrometry. As the tuber calcium increased, percent surface area of tubers decayed by Eca was reduced from 42 to 19%. (0)

FUSARIUM SPECIES ASSOCIATED WITH NORTH DAKOTA GRASSLAND SOILS. MARCIA P. McMULLEN and R. W. STACK. Department of Plant Pathology, North Dakota State Univ., Fargo, ND 58105.

Soils from four grassland sites in North Dakota were sampled during the growing seasons of 1979-1981 and analyzed for the presence of *Fusarium* species. Sites ranged from undisturbed tall grass prairie to a cultivated field. Nineteen *Fusarium* taxa were identified in 2469 isolates. The five species which accounted for 87.2% of all isolates were *F. oxysporum* (50.1%), *F. equiseti* (15.1%), *F. acuminatum* (10.8%), *F. avenaceum* (7.3%) and *F. solani* (3.9%). *F. graminearum* and *F. culmorum*, causal agents of *Fusarium* root rots of Gramineae, accounted for only 1.3% of all isolates. Numbers of *F. oxysporum* and *F. oxysporum* var. *redolens* were significantly less when sites were disturbed by grazing or cultivation, while *F. equiseti* was significantly more abundant in cultivated soil. Recovery of certain *Fusarium* species was associated with the types of dominant vegetation of the individual sites. Levels of *F. acuminatum* and *F. avenaceum* were particularly influenced by plant species present. (0)

INHERITANCE OF GENETIC RESISTANCE TO MDMV IN SUGARY x DENT MAIZE CROSSES. M.A. Mikel, Cleora J. D'Arcy, A.M. Rhodes, and R.E. Ford. Department of Plant Pathology, University of Illinois, 1102 S. Goodwin, Urbana, 61801.

Two maize dwarf mosaic virus (MDMV) resistant dent corn inbreds, Pa405 and B68, were crossed with susceptible sugary corn genotypes (su) and 95% of the F1's of su x Pa405 were resistant while 72% of su x B68 were resistant. In 2 years of evaluation of su x Pa405 crosses, the F2's fit a 45 resistant:19 susceptible ratio and the testcrosses to su (su¹ x Pa405) fit a 3 resistant:5 susceptible ratio. The F2 and testcross segregates fit a 3 gene model for MDMV resistance in which one gene must be present with either of the other two. In both F2's and testcrosses, MDMV resistance segregated independently of the sugary gene. Following inbreeding and selection, some crosses of su x Pa405 have resulted in homozygous resistant sugary lines. (0)

SEED TRANSMISSION OF MDMV IN SWEET CORN. M.A. Mikel, Cleora J. D'Arcy, A.M. Rhodes, and R.E. Ford. Department of Plant Pathology, University of Illinois, 1102 S. Goodwin, Urbana, 61801.

Seed from several field grown maize dwarf mosaic virus (MDMV)-infected sweet corn hybrids was examined for MDMV seed transmission. Seed sampled during the summers of 1979, 1980, and 1981 was germinated in the greenhouse the following winters. Only 1 seedling of 19,239 tested was found to be MDMV-infected. During the latter 2 years, seeds were dissected at different maturities and components were tested for MDMV by both infectivity and enzyme-linked immunosorbent assay (ELISA). MDMV was not detected in pollen, but was detected in glumes and whole anthers. MDMV was detected in unfertilized kernels (68 positive/96 assayed), and silks (49/61). At 21 days postpollination MDMV was detected in the pericarp (61/91), but rarely in the endosperm (13/91) or embryo (2/91). No MDMV was detected in the embryo of mature kernels (0/109), but occasionally in the endosperm (7/109) and pericarp (2/109). Detectable MDMV in seeds appears to decrease as kernels mature. (0)

EFFECT OF THREE SOILBORNE FUNGI ON APOTHECIAL PRODUCTION OF SCLEROTINIA SCLEROTIUM. J. D. Mueller, Molly Niedbalski Cline,

J. B. Sinclair, and B. J. Jacobsen. Dept. Plant Pathology, Univ. Illinois at Urbana-Champaign, 1102 S. Goodwin Ave., Urbana, IL 61801.

Sclerotinia sclerotiorum sclerotia from a soybean (*Glycine max*) isolate were incubated in either 14 g of sterile vermiculite or vermiculite infested with a 40 ml suspension (1.4×10^7 conidia per ml) of either *Gliocladium roseum*, *Gliocladium virens*, or *Trichoderma viride*. Each combination was incubated first at either 0, 1, or 2 wks in the dark at 21 C, then for 4 wks at 0 C, and lastly at 15 C with 21,520 lx and a 14 hr photoperiod to induce apothecial production. Incubation of sclerotia with *G. virens* for 1 or 2 wks at 21 C significantly ($P=0.05$) reduced apothecial production compared to the control. *Trichoderma viride* significantly ($P=0.05$) reduced apothecial production compared to the control after one week incubation. *Gliocladium roseum* had no significant effect. *Gliocladium virens* and *Trichoderma viride* were reisolated from apothecia and sclerotia more frequently than *Gliocladium roseum*. (0)

EFFECT OF LEAF WETNESS DURATION AND HOST NUTRITION ON RELATIVE DISEASE EFFICIENCY AND LESION SIZE OF NET BLOTCH ON BARLEY. Forrest W. Nutter, Jr. and V. D. Pederson, Plant Pathology Dept., North Dakota State Univ., Fargo, 58105

The effect of leaf wetness duration and host nutrition on two resistance components of barley to *Pyrenophora teres* were studied on 5 barley cultivars. Genotypes that limited the size of *P. teres* lesions did not necessarily reduce lesion number (disease efficiency). Lesion size was not affected by the duration of leaf wetness following inoculation with *P. teres*, however, disease efficiency increased as the duration of leaf wetness was increased. The linear model $Y = b_0 + b_1X$ adequately described the relationship between the duration of leaf wetness (X) and the increase in disease efficiency (Y). Either the rate parameter (b_1) or relative disease efficiency can be used to quantify genotypes that reduce lesion number. As host nutrition was increased disease efficiency of *P. teres* decreased. These experiments suggest that environmental effects must be considered when making selections to combine both resistance components. (0)

CHARACTERIZATION OF TWO ISOLATES OF SOYBEAN MOSAIC VIRUS (SMV) AND THEIR TRANSMISSION BY APHIDS. P.O'Connell-Ziegler, J.H. Hill and H.I. Benner. Dept. of Plant Pathology, Seed and Weed Science, Iowa State University, Ames, IA 50011.

Two isolates of SMV were readily transmitted by *Myzus persicae* but differed in transmissibility by *Rhopalosiphum maidis*. Infrequently the isolate not transmissible by *R. maidis* became transmissible by *R. maidis* when acquired from a plant coinfecting with both isolates. Sequential acquisition probe experiments made aphid acquisition factor an unlikely explanation for transmission of the nontransmissible isolate by *R. maidis*. The SMV isolates were further studied by enzyme linked immunosorbent assay because the viral capsid may be associated with transmissibility. The isolates could be distinguished from each other by using heterologous antibodies in the ELISA procedure. The specificity of ELISA was mainly caused by the behavior of the conjugated antibodies. (0)

WOOD-DESTROYING FUNGI DEVELOP HYPHAL SHEATHS IN AXENIC CULTURE. J. G. Palmer, L. Murmanis, and T. L. Highley, Forest Products Laboratory, P.O. Box 5130, Madison, Wis. 53705.

Isolates of 12 brown-rot and five white-rot Hymenomycetes produce gel-like sheaths that encapsulate hyphae. Sheaths of aerial hyphae and those on agar surfaces can be visualized by transmission electron (TEM) and transmission light (TLM) microscopies. When a hypha touches a solid substrate, the sheath spreads and is easily discernible in scanning electron (SEM) and reflectance light (RLM) microscopies. Extrusion of cell contents occurs through walls (TEM, SEM) and sheaths often contain cytoplasmic organelles (TEM). Morphologies and histologies of sheaths and contents differ among fungi as well as within a fungus. Empty cells often are seen, sometimes close to hyphal growing points (SEM, RLM, TEM). We hypothesize that sheaths (1) concentrate enzymes, (2) provide a chemical reaction medium, (3) attach hyphae to solid substrates, (4) reduce hyphal desiccation, and (5) protect against harmful environmental agents. (P)

THE EFFECTIVENESS OF CAPTAN AS A SEED TREATMENT FOR CORN. W. L. Pedersen, J. M. Perkins and D. G. White, Department of Plant Pathology, University of Illinois, Urbana, IL 61801.

This study was initiated to provide a data base for the evaluation of Captan as a corn seed treatment. A factorial design involving two locations, six commercial hybrids per location, two planting dates, three plant populations and two seed treatments was used. Seeds were treated with Captan (13.5 ml a.i./4.54 kg of seed) or a control treatment of the dye and carrier but no Captan. Over all factors, Captan treated plots had 9% higher plant populations and 591 kg/ha higher yields than the control plots. The main effects, locations, hybrids, planting dates and seed treatments, were all significant. When individual hybrids were compared, yield differences between the Captan and control plots ranged from 1898 to -803 kg/ha.

STRUCTURAL OBSERVATIONS ON *VERTICILLIUM DAHLIAE* MICROSCLEROTIA WITHIN POTATO ROOTS. James W. Perry and Ray F. Evert, Dept. of Botany, University of Wisconsin, Madison, WI, 53706

Microsclerotia of *Verticillium dahliae* within potato roots were examined, primarily with the transmission electron microscope. These resting structures were found in all tissues except the xylem, even though the tracheary elements of some microsclerotium-containing roots were infected. Occasionally present within nine days of inoculation, they became more numerous with time. Usually, microsclerotia consisted of a peripheral region composed of degenerate hyaline cells, and an inner region of pigmented cells with cytoplasmic contents of varying electron density. Melanin covered cells in both regions but was more prevalent over the pigmented cells. Roots containing large microsclerotia were moribund. Several living roots contained small resting structures which sometimes produced penetration hyphae. Living host cells responded to attempted penetrations by producing lignitubers which ensheathed the penetration hyphae. (0).

Forecasting potato early blight in relation to timing fungicide sprays in Wisconsin. Pscheidt, J.W. and Stevenson, W.R., Dept. of Plant Pathology, Univ. of Wisconsin, Madison, WI 53706

Methods for initiation and spacing of chlorothalonil (0.88 kg/ha) sprays for early blight, *Alternaria solani* (E.M.) Jones, control were evaluated in central Wisconsin on Russet Burbank potatoes during 1980 and 1981. Field plot treatments included initiating weekly sprays 0, 2, 4, and 6 weeks after row close, after accumulating 1000 growing degree days (GDD) from emergence (base 45F), and after a sudden rise in air-borne spores. Additional treatments were initiated and spaced according to BLITECAST, FAST, and a combination of both disease forecasting programs. Best control was generally associated with the most frequent fungicide application. However, disease severity in plots sprayed weekly 0, 2 and 4 weeks after row close was not significantly different (12, 10 and 9 sprays, respectively). Sprays initiated on the basis of spore counts (8 to 9 sprays) or GDD (9 to 10 sprays) gave good control as did the BLITECAST (9 to 13 sprays) and FAST (9 sprays) spray schedules. The combination of FAST and BLITECAST program (9-13 sprays) gave excellent control. Yields tended to reflect the level of disease control. (0).

EFFECT OF CULTIVARS, CULTURAL PRACTICES, AND FOLIAR-APPLIED FUNGICIDES ON SCLEROTINIA STEM ROT OF SOYBEANS. V. Radke and C. R. Grau, Dept. of Plant Pathology, University of Wisconsin Madison, WI 53706

Sclerotinia stem rot of soybean was studied in naturally infested field plots. Cultivars Hodson and Corsoy were less diseased compared to Wells, SRF-200, Steele, and Asgrow 2656. Disease severity indices (DSI) (0 = No disease, 100 = 100% death) were greater for all cultivars planted at 25-38 cm row-widths compared to DSI at 76 cm row-widths for 2 of 3 years. However, lower yields were measured for 25-38 cm row-width plots when compared to 76 cm row-widths for all years. Optimal irrigation throughout the growing season resulted in DSI of 34-39, but minimal irrigation at and after flowering resulted in DSI of 3-13 in 2 years of studies. Yields improved 10-22% by reducing disease severity through irrigation management. Benomyl, CGA-64250, and thiabendazole were applied at the R1 and R2 growth stages. DSI were 7, 51, 53, and 57 for Benomyl, CGA-64250, thiabendazole, and non-treated, respectively. Benomyl improved yield 44% compared to the non-treated plots. (0)

EFFECT OF HERBICIDES ON CARPOGENIC GERMINATION OF SCLEROTIA OF *SCLEROTINIA SCLEROTIORUM*. V. Radke and C. R. Grau, Dept. of Plant Pathology, University of Wisconsin, Madison, WI 53706

The effects of atrazine, simazine, trifluralin, metribuzin, and dinoseb herbicides on carpogenic germination of sclerotia of *Sclerotinia sclerotiorum* were investigated. Each was applied

at rates of 0.5, 1.0, and 2.0 mg/g dry wt. autoclaved soil. Herbicide effects on carpogenic germination were compared to sclerotia incubated in non-treated soil. Sclerotia were incubated in water-saturated soil in glass petri dishes at 15° C and 22-32 μ einsteins of light (16 hr light/8 hr dark) for each treatment. Simazine, trifluralin, metribuzin and atrazine increased sclerotial germination 33, 28, 27, and 19%, respectively; number of stipes/sclerotium was increased 64, 59, 46, and 37% by simazine, atrazine, metribuzin, and trifluralin, respectively. The number of apothecia/sclerotium were reduced 22 and 50% by simazine and atrazine, respectively and increased by metribuzin and trifluralin 50 and 46%, respectively. Simazine and atrazine retarded cap development and maturation. Dinoseb reduced sclerotial germ by 99%. (P)

BACTERIAL SOFT ROT OF WALNUT SEED. Vicki Radke and J. E. Kuntz, Dept. of Plant Pathology, University of Wisconsin-Madison, WI, 53706.

In 1980, a newly recognized disease, bacterial soft rot of walnut seed, severely reduced (20% of normal) germination and seedling production in Wisconsin nursery seedbeds. Symptoms ranged from "cheesy" to "mushy" to "soupy" breakdown of the nut "meat" inside the shell. Soft-rotting bacteria in the genera *Pseudomonas* and *Erwinia* have been isolated repeatedly. Inoculations of walnut kernels with certain isolates of both genera, alone and in combination, resulted in mushy rot. In 1980 and 1981, walnuts picked from different trees through August 1 were free of bacteria and sound, whereas many nuts collected in September were infected and rotting. In 1981, nut clusters cloth-bagged at different dates through August 21 remained free of kernel rot as well as of maggots of the walnut husk fly (*Rhagoletis suavis*). Of nuts bagged in September, most husks were infested with maggots and many (32%) kernels were rotting. Continuing research seeks to clarify disease etiology and possible maggot pathogen relationships. (0)

LACK OF INOCULUM DOSAGE EFFECTS IN CEREALS INOCULATED WITH BARLEY YELLOW DWARF VIRUS. M. Skaria, R.M. Lister, J.E. Foster & G.E. Shaner, Purdue Univ. & USDA, ARS, W.Lafayette, IN 47907.

Progressive inoculum dosage effects on symptoms and yields have been reported (e.g. Phytopathology 66:646, 1976) in cereals inoculated with barley yellow dwarf virus (BYDV) by infestation with different numbers of aphids. We have investigated this effect in relation to its possible impact in tests of the comparative susceptibilities of cereals to BYDV. Cultivars of wheat, oats and barley grown at 20 C with a 14 hr photoperiod were inoculated with a "PAV-like" isolate of BYDV by infestation with 2 or 10 aphids (*Rhopalosiphum padi*) per plant. Individual or bulked plants (leaves and stems) were harvested at 4 to 6 day intervals during one month and their virus contents assessed by ELISA. No effects of inoculum dosage were observed. Virus contents peaked about 12 days after inoculation before declining, but were similar at each sampling date whether the plants had been infested with 2 or 10 aphids. Similarly, no significant differences were noted in symptoms or tissue weight during the period. (P)

THE WISCONSIN ELITE FOUNDATION SEED POTATO FARM AS A MEANS TO PRODUCE DISEASE-FREE SEED POTATOES. S. A. Slack, Dept. of Plant Pathology, Univ. of Wisconsin-Madison, Madison, WI 53706

The Wisconsin Elite Foundation Seed Potato Farm (State Farm) was established in 1941 to provide the state potato industry with a continued source of high quality seed potatoes. Subsequently, the seed potato acreage in Wisconsin has increased from a low of 914 acres in 1940 to 10,600 acres in 1981. In 1981, 96% of all certified seed lots originated from the State Farm. The State Farm concept permits intensive testing (e.g., serologic assays for particular bacteria and viruses) of selected nuclear stocks for the presence of specific pathogens and the isolated clonal increase of these stocks under strict sanitary and cultural control for 2-4 generations before sale to private seed growers. All stocks are screened visually several times each year and plants with disease symptoms are rogued. Most seed growers practice a 3-year increase system with new seed lots being purchased annually from the State Farm to replace stocks which have been sold for commercial use. (P)

YIELD LOSSES IN SPRING BARLEY DUE TO COMMON ROOT ROT IN EASTERN NORTH DAKOTA. Robert W. Stack, Department of Plant Pathology, North Dakota State University, Fargo, ND 58105.

Common root and crown rot of spring barley, caused by *Helminthosporium sativum*, is widespread in North Dakota. Surveys of barley root rot losses in adjacent parts of the Canadian prairie provinces place root rot losses at 10.7% for a 3-year period (1970-72) (Piening et al. 1976. Can. Plant Dis. Surv. 56:41-45). We followed the methods used in the Canadian surveys, in which plants are harvested, then sorted into four disease categories: clean, slight, moderate, severe. Heads were allowed to mature and threshed out by hand. Mean weight of grain per plant was determined and this was compared for the four disease categories. The clean plants (or slightly infected plants if no clean plants were found) were used as a standard and the yield per plant of the other categories was compared to the standard. In 1981, barley fields in 9 counties in eastern North Dakota were surveyed by this method. Losses averaged 13% for the fields surveyed in 1981. (P).

REACTIONS OF BARLEY SEEDLINGS TO STEM RUST, *PUCCINIA GRAMINIS*. B. J. Steffenson, R. D. Wilcoxson, and A. P. Roelfs. Dept. of Plant Pathology, University of Minnesota and Cereal Rust Lab., ARS, USDA, St. Paul, MN 55108.

Seedlings of barley cultivars with and without T-gene resistance were tested at 25 C with *Puccinia graminis* f. sp. *tritici* races 113-RTQ, 151-QSH, and 29-HJC; and an isolate of *P. graminis* f. sp. *secalis* (Pgs), obtained from barley in the field. Since the cultivars tested produced mixed infection types to all cultures, their responses were expressed as a weighted mean of the infection types. Race RTQ was the most virulent and differentiated among some barleys with T-gene resistance while races QSH and HJC did not. Race HJC and RTQ responded similarly on non-T-gene barleys, but the T-gene barleys were more resistant to HJC. Thus, HJC was the best culture used for detecting the presence of the T-gene. The isolate of Pgs did not distinguish the cultivars with the T-gene. Black Hulless, Heitpas-5, and Hispont appear to possess resistances different from the T-gene.

RUSTMAN: A PORTABLE, MICROCOMPUTER-BASED ECONOMIC DECISION MODEL FOR SWEET CORN RUST CONTROL. P.S. Teng and P.R. Montgomery, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.

RUSTMAN (Rust Management) estimates the profitability of applying a fungicide spray at any time during the growing season for controlling sweet corn rust (*Puccinia sorghi*). The program uses two types of models: a) disease incidence-severity models and b) disease severity-yield loss models. Type a) models compute mean disease severity from the proportion of rusted plants in a field. Output from type a) models are used as input for type b) models. RUSTMAN uses critical point disease severity-yield loss models to predict yield reduction from severity at a crop growth stage. These algorithms were derived from experiments using plots sprayed with fungicides at different growth stages. Early and late epidemics were regularly monitored on 1000 plants which were harvested for yield. The BASIC program is available on Apple II Plus microcomputers or on TRS-80 Pocket Computers.

CONTROL OF PRICKLY SIDA PLANTS WITH *COLLETOTRICHUM GLEOSPOROIDES* IN ILLINOIS. P. N. Thapliyal, M. A. Cubeta and J. B. Sinclair. Dept. of Plant Path., Univ. Illinois at Urbana-Champaign, Urbana, IL 61801.

Colletotrichum gleosporoides was isolated from prickly side (*Sida spinosa*) growing in soybean plots at the plant pathology research farm, Urbana. Infected prickly sida plants showed severe leaf blighting, defoliation and large dark stem cankers with the characteristic orange acervuli of *C. gleosporoides*. Heavily infected plants wilted and died. In greenhouse and growth chamber studies, soybean and prickly sida plants were spray inoculated with a conidial suspension of the fungus (1×10^6 spores/ml). All inoculated prickly sida plants developed leaf lesions within 5 days, followed by wilting and death of plants within 14 days. No symptoms developed on either of two soybean cultivars. These results show that *C. gleosporoides* can be used for biological control of prickly sida in soybean fields. (O)

A SOURCE OF RESISTANCE TO *HELMINTHOSPORIUM MAYDIS* RACE 0 THAT PROLONGS MONOGENIC CHLOROTIC-LESION RESISTANCE IN CORN. D. L. Thompson, USDA-ARS, Crop Science Dept., N. C. State Univ., Raleigh, NC 27607 and R. R. Bergquist, Pfister Hybrid Corn Co., El Paso, IL 61738.

The corn inbred B73 with the recessive gene *rhm*, which conditions chlorotic-lesion resistance to *Helminthosporium maydis* race 0, showed adequate resistance under epidemic conditions from the seedling stage until shortly after anthesis. Then, large, tan to brown, oval to rectangular lesions developed which were indistinguishable from those of susceptible genotypes lacking the *rhm* gene. An inbred source of resistance derived from a cross between B37 and Nigeria Composite A Rb was identified which had a single recessive gene, allelic or identical to *rhm*, and an additional modifier gene(s). This source retained resistance for an additional period approaching physiological maturity. The prolonged resistance from the combination of *rhm* and modifier gene(s) could be incorporated into commercial inbreds by alternate backcrossing and inbreeding. (O).

LATEX SEROLOGICAL TEST FOR BARLEY STRIPE MOSAIC VIRUS: SENSITIVITY AND RELIABILITY. Roland G. Timian USDA ARS, Dept. of Plant Pathology, North Dakota State Univ., Fargo, ND 58105

The serological latex test for barley stripe mosaic virus (BSMV) readily detected the virus in saline buffered plant extracts containing one part infected to 500 parts healthy plant tissue. The virus was also detected in extracts from ground seed samples using a 1:500 ratio of infected to healthy seed. Nonspecific reactions in seed extracts reduced the reliability of results. A more reliable and efficient method was to test extracts from bulked leaf samples of 3-5 cm tall seedlings. Sample preparation time was less than for ground seed extracts and 250 seedlings could be grown in a 15 cm pot. Latex beads sensitized with antibodies from four BSMV strains were equally reliable in detecting the presence of nine strains of the virus. (T).

FIELD CHARACTERIZATION OF RATE-REDUCING RESISTANCE TO *PHYTOPHTHORA MEGASPERMA* F.SP. *GLYCINEA* IN SOYBEAN. P.W. Tooley and C. R. Grau, Dept. Plant Pathology, Univ. Wisconsin, Madison, WI 53706.

Twelve soybean cvs. were planted in a field naturally infested with numerous races of *Phytophthora megasperma* f.sp. *glycinea* (Pmg). Half the rows were treated with the systemic fungicide metalaxyl to simulate disease-free conditions. Disease incidences taken at 1-3 wk intervals throughout the season were used to calculate the simple interest infection rate (R) for each treatment. Values of R for each cv. ranged from .00003 to .00041 per day for treated plots and from .00025 to .00555 per day for nontreated plots. Disease severity ratings based on internal necrosis of tap roots and lower stems correlated well with disease incidence. Cumulative disease incidence for each cv. ranged from 0.3 to 3.9% in the treated plots and from 2.4 to 36.2% in the nontreated plots and was highly correlated with yield reduction due to Pmg. Differences in rate-reducing resistance among cvs. accounted for most of the variability in yield reduction; disease tolerance, defined in terms of differential yielding ability of equally diseased cvs., played a minor role.

EFFECTS OF SOIL MOISTURE AND TEMPERATURE ON THE EMERGENCE AND FUNGAL INFECTION OF SOYBEANS OF VARYING SEED QUALITY. M. T. Wall and D. C. McGee, Dept of Plant Path., Seed & Weed Sci., Iowa State University, Ames, IA 50011.

One part of a Wells soybean seedlot originally with 3% mechanically damaged seed and two parts in which damage was induced on 19% and 28% of the seeds, were planted in plastic boxes containing field soil adjusted to 40, 55, or 70% moisture holding capacity, and held at 15, 20, or 25°C. Emergence rate was measured over the first 6 days after planting. Seedling parts were washed in sterile water and plated on media selective for *Pythium*, *Fusarium*, and *Rhizoctonia* spp. In general, emergence rate declined with increased mechanical damage, lower soil moisture and lower temperature. Reduced emergence rate was significantly correlated ($r=-0.76$ and $r=-0.91$) with seedling infection by *Pythium* and *Fusarium* for the seedlots with induced mechanical damage of 19% and 28%, respectively. There was no such correlation for the original seedlot, however. Very little *Rhizoctonia* infection occurred under any of the soil conditions. (O).

POPULATIONS OF PECTOLYTIC BACTERIA IN SOIL IN RELATION TO DEPTH AND CROPPING HISTORY. J.-S. Wang and A. Kelman, Department of Plant Pathology, University of Wisconsin, Madison, WI 53706.

Soil populations of pectolytic bacteria and fluorescent pseudomonads were determined by direct plating on crystal violet

pectate (CVP) and King's B medium and by enrichment procedures. Populations of total background bacteria, fluorescent pseudomonads and pectolytic fluorescent pseudomonads (PFP) in a given plot remained relatively constant over a one year period. Among the PFP strains detected, *Pseudomonas putida*, *P. cichorii* and biotypes with the characteristics of A, B, C, and G of *P. fluorescens*, were capable of decaying potato tubers and Chinese cabbage tissue. Populations of *Erwinia carotovora* (Ec) usually declined rapidly in the fall period after crop plants were harvested. After November of 1980 Ec strains were usually not detected by direct plating but could be detected by enrichment techniques. Ec populations were usually higher at depths below 15 cm than above. Ec was not detected by direct plating or enrichment in five fields in which non-susceptible crops had been grown for 5 or more years. (P)

VERTICILLADIELLA PROCERA ASSOCIATED WITH ROOT WEEVIL DAMAGE. M.J. Wingfield, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.

Verticilladiella procera was isolated from resin soaked wood associated with pine root collar weevil (*Hylobius radialis*) infestation on *Pinus banksiana*, *P. nigra* and *P. sylvestris* in Minnesota; *P. nigra*, *P. ponderosa*, *P. resinosa*, *P. strobus* and *P. sylvestris* in Wisconsin and *P. resinosa* in Michigan. The fungus was also isolated from lesions associated with early pine root weevil (*Hylobius rhizophagus*) damage on *P. sylvestris* in Minnesota and *P. banksiana* in Wisconsin. Symptoms associated with root collar weevil infestation (basal cankers with resin exudation) are similar to those reported for *V. procera*; the cause of white pine root decline in other parts of the United States. Inoculations of *P. strobus* seedlings resulted only in small local lesions from which *V. procera* was isolated one year after inoculation. *V. procera* appeared of minor importance in causing the mortality of the trees observed and secondary to the activities of root collar and root tip weevils.

THE PINE WOOD NEMATODE ASSOCIATED WITH STRESSED TREES AND CUT TIMBER IN MINNESOTA AND WISCONSIN. M.J. Wingfield and R.A.

Blanchette, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.

The pine wood nematode (*Bursaphelenchus xylophilus*) was found in trees stressed by various forest insects and fungal pathogens in Minnesota and Wisconsin and in dead tops or branches of otherwise healthy trees. Pathogens such as white pine blister rust were the primary cause of mortality in these trees. All dying trees or tree parts that contained *B. xylophilus* were also infested with cerambycids (Coleoptera: Cerambycidae), the vectors of *B. xylophilus*. Four mo after cutting, nematode-free logs in which borers had oviposited contained nematodes. Inoculations of *Pinus banksiana*, *P. resinosa* and *P. nigra* with isolates of *B. xylophilus* able to kill seedlings in the greenhouse did not result in symptoms in the field. These results suggest that *B. xylophilus* is transmitted by cerambycids ovipositing in dying trees, and that *B. xylophilus* is not the primary cause of tree mortality in areas examined in Minnesota and Wisconsin.

EVALUATION OF CUCUMBER SEEDLINGS FOR RESISTANCE TO GUMMY STEM BLIGHT (*DIDYMELLA BRYONIAE*). A. J. Wyszogrodzka, P.H. Williams and C. E. Peterson, Dept. of Plant Pathology and USDA-Dept. of Horticulture, University of Wisconsin-Madison, Madison, WI 53706

Optimal conditions for *D. bryoniae* spore production, inoculum concentration and target tissue selection were studied to develop a method for inoculation of cucumber seedlings. Uniform infection of susceptible cultivars Uniflora D and SMR 18 was obtained following inoculation of 7-day-old seedlings grown in vermiculite at 26°C under 16 hr photoperiod and light intensity of 200 $\mu\text{E}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$. Inoculum was increased on autoclaved potato cubes under continuous light at 22 + 2°C for 6 days. Seven mm^2 of the cotyledon tissue was crushed and inoculated with 5000 spores in 0.01 ml of water followed by 48 hr incubation at 20°C 100% RH in darkness. Necrotic lesions (ca 7 x 14 mm) developed 3 days after inoculation. Lesions extended beyond fungal colonization. Cotyledons of 1-2 day post-emergence seedlings appeared resistant, older ones were susceptible. No seedling resistance to gummy stem blight was found among 725 P.I. accessions and 483 breeding lines and cultivars of cucumbers. (P).