APS North Central Division

Abstracts

June 22-22, 1995 Brookings, SD

Alphabetized by first author's last name

SPHAEROPSIS SAPINEA AND HOST WATER STRESS IN A RED PINE PLANTATION IN CENTRAL WISCONSIN. L.T. Blodgett and G.R. Stanosz, Dept. of Plant Path., Univ. of Wisconsin-Madison, 53706.

Sphaeropsis sapinea causes a shoot blight and canker disease of various conifers. Severe losses of pines due to *S. sapinea* are reported throughout the world, on trees predisposed by stresses, including drought. A field experiment was conducted to determine if water stress affects disease development of *S. sapinea* in red pine plantations. Study plots were established in a nine-year-old red pine plantation in central WI. Removal of vegetation around the study trees and supplemental watering were used to influence the water potential of the pines. The experiment was repeated in two separate plots approximately 1/4 mile apart in two consecutive years (1992, 93). In 1994 the experiment was repeated at a third location, in the same plantation. Shoot tips were inoculated by placing a colonized water agar plug on a wound made by removing a needle fascicle. Results showed that "A" isolates were aggressive and "B" isolates were less aggressive. Non-watered trees with competing vegetation (untreated condition) had significantly lower xylem water potentials (more water stressed) than water or herbicide treatments. Water stress, caused in part by competing vegetation, resulted in increased disease development of trees by *S. sapinea* "A" isolates. The proper identification of the *S. sapinea* morphotype(s) may help estimate risk of damage from disease. Competing vegetation affects water status and disease development, even in relatively moist years, on trees previously considered well-established.

FORMATION OF PRESUMED ADHESIVE MATERIAL BY PRIMARY GERM TUBES AND APPRESSORIA OF BARLEY POWDERY MILDEW. H.H. Edwards. Dept. Biol. Sci., Western Illinois University, Macomb, IL 61455.

Both the primary germ tubes (PGT) and appressoria form a substance sticking to the host cuticle. This presumed adhesive material (PAM) is preserved in ethanol:chloroform (75:25,v/v) fixative containing 0.15% TCA but not in FAA or ethanol:acetic acid. The peak time for PAM in PGTs is 3 h and 10 h for appressoria but disappears 4 h later in both. In LM the PAM stains with trypan blue in hot lactophenol and has a flattened disk-shape. PAM is not preserved in routine SEM processing but is preserved in the ethanol:chloroform fixative, then critical point drying. SEM shows a PAM disk not flat but more doughnut-shaped with appressorium pushed into the middle. Besides adhesion, the PAM may provide a milieu for localizing fungus enzymes.

CONIDIATION OF *PYRENOPHORA TRITICI-REPENTIS* ON WHEAT LEAVES. L. J. Francl, J. G. Jordahl, and E. D. DeWolf. Dept. Plant Pathology, North Dakota State University, Fargo, ND 58105.

Pyrenophora tritici-repentis, the cause of wheat tan spot, conidiates in culture under alternating light and dark cycles with conidiophores formed in light and conidia in dark. The effects of dew and interrupted wet periods on sporulation in nature are not clear. Adult plants of the susceptible spring wheat line ND495 were inoculated with isolate Pti2 after measuring flag and flag-1 leaf areas of three tillers. After a 24-h wet period, plants were held in 21 C growth chambers and subirrigated for 10 days. One flag leaf then was removed to assess conidation and plants were returned to 21 C growth chambers for various light and wetness regimes lasting from 12 to 96 h. Percent disease severity was estimated at the end of each treatment and conidia per mm^2 diseased area were estimated from a sample of leaves blended in 15 ml water (Riaz *et al.* Phytopathology 81:1298-1302). Conidia failed to form prior to treatment or after 24 to 96 h in a continuous light, continuous wet environment. However, unlike the diurnal requirement for conidiation *in vitro*, conidia formed after 12 h in a wet environment in the dark. After 96 h of alternating 8 h dark, wet and 16 h light, dry cycles, 1.7 conidia mm^{-2} were produced. Conidiophores thus are initiated on wheat leaves in a nonsaturated atmosphere in the light and a wet period during darkness is sufficient for conidiogenesis *in planta*.

TIMING OF APOTHECIAL PRODUCTION BY SCLEROTINIA SCLEROTIORUM IN KENTUCKY. D. E. Hershman. Department of Plant Pathology, University of Kentucky Research and Education Center, Princeton, KY 42445.

Sclerotia harvested in early June (1990-92) from canola (*Brassica napus* var. *oleifera*) with Sclerotinia stem rot were overwintered and subsequently monitored in replicated microplots for the production of apothecia during spring, 1991-93. Each year, apothecial production commenced in late March, peaked during mid- to late April, and ceased in early, mid-, or late May, depending on the year. Apothecial production coincided with canola flowering each year. Data indicating the consistency of both the onset of apothecial production and it's relationship to canola flowering will be useful in the development of stem rot management programs using foliar fungicides. In addition, data on the timing of apothecial production may help to explain the absence of *Sclerotinia sclerotiorum* as a pathogen of soybean in Kentucky, as well as the prominence of *S. sclerotiorum* in tobacco and tomato seedlings produced in newly developed, hydroponic, production systems.

PATHOGENIC VARIATION AMONG ISOLATES OF TUBERCULARIA CAUSING CANKERS OF WOODY PLANTS. M. B. Jackson and R. W. Stack. Dept. of Plant Pathology, North Dakota State Univ. Fargo 58105

Tubercularia ulmea, anamorph of Nectria cinnabarina, causes branch and stem cankers on several kinds of trees and shrubs in the northern plains states. In this region the most common hosts have been Siberian elm, Russian olive, and, more recently, honeylocust. Tubercularia has been variously regarded as a primary pathogen, an opportunistic invader, or a saprophyte, depending on the host studied and the location where the work was done. We collected 11 isolates of T. ulmea from five hosts. They were individually inoculated into wounded stems of Siberian elm and Russian olive plants growing in the greenhouse in a replicated trial. After five weeks, the length of bark necrosis beyond the wound was measured as an index of pathogenicity for each isolate. Extent of cankering ranged from 7 mm to 90 mm and differed significantly between isolates. Pathogenicity of isolates was similar on both hosts although cankers were generally larger on Siberian elm. There was no apparent relationship between the source of the isolates and pathogenicity to either host.

DEVELOPMENT OF A PCR-BASED TECHNIQUE FOR THE DETECTION OF GENETIC VARIATION AMONG *MACROPHOMINA PHASEOLINA* ISOLATES. Y. Jiang and T. E. Chase. Plant Science Department, South Dakota State University, Brookings, SD 57007.

Charcoal rot disease is one of the major soybean diseases in the North Central region. The causal agent, *M. phaseolina*, is recognized as a highly variable fungal pathogen, and is responsible for economically significant damage to a wide variety of crops worldwide. The genetic variation among *M. phaseolina* isolates has recently been revealed by a PCR-based technique. The results of PCR-amplified regions of the internal transcribed spacer (ITS) 1 and 4 region of the nuclear rDNA gene analysis, indicated that the ITS1/ITS4 region is highly conserved and no polymorphism was found. In contrast, the random amplified polymorphic DNA (RAPD) assay revealed a very high degree of genetic variability of *M. phaseolina*. Although RAPD clusters generally did not match the phenotype clusters, the influence of host preference among *M. phaseolina* isolates was indicated by the *Zea mays* cluster and soil clusters.

IDENTIFICATION AND MAPPING OF A LEAF RUST RESISTANCE GENE IN BARLEY LINE Q21861. Y. Jin[1], I.G. Borovkova[1], B.J. Steffenson[1], J.B. Rasmussen[1], A. Kilian[2], and A. Kleinhofs[2], Dept. Plant Pathology[1], North Dakota State Univ., Fargo, ND 58105; Dept. Crop and Soil Sci.[2], Washington State Univ., Pullman, WA 99164.

Barley line Q21861 possesses an incomplete dominant gene for resistance to *Puccinia hordei*, tentatively designated as *Rph*Q. To investigate the allelic relation between *Rph*Q and other known *Rph* genes, F_2 populations from crosses between Q21861 and donors of *Rph*1 to *Rph*12 were evaluated for leaf rust reaction at the seedling stage. Results indicated that *Rph*Q in Q21861 is likely allelic to *Rph*2. Bulked segregant analysis was used to identify RAPD and RFLP markers linked to *Rph*Q using a doubled haploid population derived from the cross between Q21861 and SM89010 (susceptible parent). Among 600 decamer primers screened, 14 markers were found to be linked to *Rph*Q in the range of 3.4 to 16 cM. *Rph*Q was mapped to the centromeric region of chromosome 7 with a cluster of markers located 10 cM distal. This location was further confirmed by a linkage with the RFLP marker CDO749. The orientation of these markers were determined using STS markers BG123 and PR168.

ENHANCED PEROXIDASE ACTIVITY IN A NONHOST *POPULUS* FOLLOWING INOCULATION WITH *MELAMPSORA MEDUSAE*. P. A. Mason, J. B. Rasmussen, and R. W. Stack. Dept. of Plant Pathology, North Dakota State University, Fargo, ND 58105.

Throughout North America, *Populus* species and their hybrids are affected by *Melampsora* leaf rust. All of the 15 native *Populus* spp. are host to one or more of the four indigenous *Melampsora* species. A total peroxidase activity (TPA) assay was performed on black cottonwood (*P. trichocarpa*) leaf disks inoculated with a compatible (*M. occidentalis*), and an incompatible (*M. medusae*) rust. Spectrophotometric assays indicated an increase in TPA in the incompatible interaction beginning 72 hr post-inoculation. Native isoelectric focusing gels showed three peroxidase bands with isoelectric points of 3.6, 3.8, and 4.2. Native polyacrylamide gel electrophoresis resolved the three bands into seven isozymes of differing apparent molecular weights. Although both gels exhibited similarities between the incompatible and compatible isozyme patterns, the intensity of the bands was enhanced in the incompatible interaction. These data show enhanced peroxidase activity in the nonhost rust interaction; however no new isozymes are activated.

***FUSARIUM* HEAD BLIGHT AND *SEPTORIA* DISEASES OF WHEAT SEVERE IN NORTH DAKOTA, 1994.** M. P. McMullen and D. R. Nelson. Plant Pathology Dept., North Dakota State University and ND Dept. of Agriculture, Fargo, ND 58105

A survey of incidence (% symptomatic tillers) and severity (% leaf or head area infected) of leaf and head diseases of wheat was conducted in 361 fields in North Dakota in 1994. Leaf blotch, caused by *Septoria nodorum*, was the most frequently observed leaf disease in the eastern two-thirds of the state. Leaf rust was the most frequently observed disease in the southwest (SW) and west central districts, with wheat streak mosaic the second in incidence in the SW district. *Fusarium* head blight (scab) was the most common and severe head disease in the 161 fields that were surveyed following anthesis. Wheat fields in the northeast (NE) district had the most severe *Fusarium* head blight, and when surveyed at early dough stage or beyond, incidence of infection averaged 60%, but a few fields had 100% incidence and severities of 70-76%. *Septoria* glume blotch was the second most common and severe head disease observed across districts.

OCCURRENCE OF PINK ROT ON BOTH IRRIGATED AND NON-IRRIGATED POTATOES IN 1994. C. L. Merkens, R. W. Stack, N. C. Gudmestad, and G.A. Secor. Plant Pathology Dept., North Dakota State Univ., Fargo 58105.

Pink rot of potato, caused by Phytophthora erythroseptica, was severe in several northern potato growing regions in 1994, including the Red River Valley of North Dakota and Minnesota. Previously (1989-91), this disease was severe in potatoes grown under irrigation on lighter soils in central Minnesota and in Idaho, but was rare in non-irrigated potatoes grown on the heavier soils of the Red River Valley. In 1994, however, P. erythroseptica was commonly isolated from rotted potatoes grown in the Red River Valley as well as from potatoes grown under irrigation in central Minnesota and in Idaho. This change in disease distribution may well be associated with two successive years (1993, 1994) of high summer rainfall. Potatoes showing dual infections of pink rot and late blight were not uncommon in some crops. Potato farmers reported postharvest losses due to pink rot of up to 50%. Soil inoculum levels may now be high enough in this area for the disease to recur even in the absence of unusually wet conditions.

EFFECT OF WHEAT STREAK MOSAIC VIRUS ON YIELD OF SELECTED SPRING AND WINTER WHEAT CULTIVARS S. Muratoti[1], A. D. Hewings, [1,2], L. L. Domier[1,2], Department of Plant Pathology[1], and USDA ARS Crop Protection Research Unit[2], University of Illinois, Urbana, IL 61801

In a two year study the effect of an Illinois isolate of wheat streak mosaic virus (WSMV) on yield of selected hard red spring wheat and soft red winter wheat cultivars was evaluated. In spring 1993 and 1994, twenty hard red spring wheat cultivars were planted in yield plots (2.4m x 1.4m) with 3 replications in a RCB design. Virus inoculum was prepared by grinding WSMV-infected leaves in 0.01 M, K_2HPO_4 pH 7 (1:2, w/v). Seedlings at Feeke's growth stage 2 were mechanically inoculated using an air brush. Controls were non-inoculated plots. Symptoms were rated every 7-8 days beginning one week after inoculation using an 0-5 scale, where 0 was no symptoms and 5 was severe stunting and chlorosis. The grain yield, 1,000 kernel weight and plant height were analyzed. There were significant differences among some cultivars for all the traits. Average percent reduction of yield varied from 40% to no decrease in yield. Yield reductions in 1993 were greater than in 1994 and had a range of three-fold to eighteen-fold for all of the cultivars except Krona where it was the same.

ULTRARAPID FREEZING AND FREEZE-SUBSTITUTION OF BYDV-MAV INFECTED OATS. P. H. Nass and C. J. D'Arcy, University of Illinois at Urbana-Champaign, Department of Plant Pathology, 1102 South Goodwin Avenue, Urbana, IL 61801.

An ultrarapid freezing protocol was developed to preserve viral inclusions in infected cells for subsequent observation and to permit localization of barley yellow dwarf virus (BYDV) RNA and coat protein *in situ*. Oat seedlings were inoculated with BYDV-MAV-NY. Samples were taken at 5 and 10 days post inoculation and prefixed over night in 4% buffered paraformaldeyde. Two hours prior to freezing samples were incubated in 1.8 M buffered sucrose as a cryoprotectant. Tissue pieces were then placed on copper grids, plunged rapidly into liquid propane and were subsequently transferred into liquid nitrogen. Samples were freeze-substituted for 72 hours with methanol and fixed with 1% OsO_4. Tissue pieces were embedded at room temperature in a Medcast/Spurr mixture. This procedure resulted in the preservation of tissue structure throughout the phloem with low ice crystal damage. The plasmalemma was not detached from the cell wall and appeared smooth. Other membranes, such as tonoplast and nuclear membrane, were similarly preserved. Viral inclusions could be identified. Viral particles were found adhering to remnants of degenerated plant tissue and condensed filamentous material. Virus-induced vesicles appeared often as folded strings of filamentous material. Viral coat protein and RNA could be localized intracellularly.

FORECASTING PYTHIUM BLIGHT ON TURFGRASS IN IOWA, 1991-1994. F.W. Nutter, Jr., M.L. Gleason, and J. Newton. Department of Plant Pathology (351 Bessey Hall) and Superintendent, Veenker Golf Course, Iowa State University, Ames, IA 50011.

Pythium aphanidermatum causes a disease of turfgrass that can quickly kill extensive areas of turfgrass if fungicide applications are not properly timed to coincide with environmental conditions that favor disease development. A model to forecast the occurrence of Pythium blight of turfgrass, based on daily min temp, max temp, and hours RH $\geq$ 90% (Plant Disease 67:1126-1128), was evaluated in Ames, IA from mid-May through mid-Sept during 1991-1994. The model was modified slightly by lowering the minimum temperature requirement from 20 to 18 C. The modified model correctly predicted the occurrence of Pythium blight for two out of two episodes in 1991. Pythium blight occurred only once per season in 1991-1994 (three outbreaks), and the model correctly predicted all three episodes. Thus, out of a total of approximately 470 forecasting days, the model correctly predicted all five episodes in which pythium blight occurred. Moreover, the model correctly indicated that there was no risk for pythium blight to occur on the days that forecasting criteria were not met. A total of six fungicide sprays would have been saved during these four years if the pythium model had been used to schedule fungicide applications.

DETECTION AND POPULATION DYNAMICS OF *XANTHOMONAS PHASEOLI* IN POST-HARVEST ASSAYS OF *PHASEOLUS* BEAN SEED. Chris Onstad and Jim Venette. Department of Plant Pathology, North Dakota State University, Fargo 58105-5012

The seedborne bacterial pathogen of dry edible bean, *X. phaseoli*, is managed by planting seed with little contamination. Several postharvest tests use bioassay to detect the pathogen in commercial seed. Bioassays include leaf spray, stem injection or vacuum infiltration of seedlings. In this study, bioassays of seedlings inoculated with graded doses of bacteria were compared for symptom expression and for pathogen detection using IFAS. Symptoms on vacuum-infiltrated seedlings developed after 10 days from inoculations with concns from 10^7 to 10^2 cfu ml^{-1}, but assay sensitivity of >80% occurred from inoculation with 10^3. In other bioassays, symptoms did not develop from inoculum concns $< 10^4$ and assay sensitivity of 80% was exceeded at concns $> 10^5$. IFAS detected bacteria in seedlings vacuum-infiltrated at a bacterial concn of 10^1 or greater with 80% sensitivity associated with concns $> 10^1$. In other bioassays, 80% assay sensitivity was achieved at concns $\geq 10^4$ and 10^5 for injection and spray, respectively. In another study, IFAS detected bacteria from seedlings vacuum infiltrated with 10^1 only after 10 days with populations increasing to 10^6 after 12 days. From vacuum inoculations with 10^1, IFAS detected bacteria after three days, and populations increased to 10^8 after eight days.

PATHOTYPES OF *PSEUDOMONAS SYRINGAE* PV. *GLYCINEA* IN EASTERN NORTH DAKOTA.

Prom, L. K., and Venette, J. 1995. Dept. of Plant Pathology, North Dakota State University, Fargo, North Dakota 58102.

One hundred and sixty four strains of *Pseudomonas syringae* pv. *glycinea* were isolated from diseased plants in 170 commercial soybean (*Glycine max*) fields in eastern North Dakota during the 1991-1993 growing seasons. Pathotypes were determined on standard differential soybean cultivars in greenhouse tests. Of the eight known pathotypes in the United States, five were detected. Pathotype 4, which constituted 63% of the total isolates, was most prevalent. Pathotypes 6, 2, and 5 represented 22%, 7%, and 5% of the total isolates, respectively. Pathotype 4 was reported as the predominant type in Minnesota, Wisconsin, and Iowa. Supplemental evaluation in the growth chamber confirmed pathotype identity. Five strains were different from the pathotypes previously found in the United States suggesting additional pathotypes may be present.

CONTROL OF SEEDBORNE ASCOCHYTA BLIGHT IN FIELD PEA BY SEED TREATMENT. K. Y. Rashid and T. D. Warkentin, Agriculture and Agri-Food Canada, Agri-Food Diversification Research Centre, Unit 100 - 101 Route 100, Morden, Manitoba, Canada R6M 1Y5.

Ascochyta blight in field pea (Pisum sativum L.) is caused by Mycosphaerella pinodes. Seed-to-seedling transmission of seedborne infections may cause foot rot and kill the seedling. Field studies were conducted to investigate the efficacy of seed treatment fungicides for the control of this disease. Infected seed from the cultivars AC Tamor and Radley were used. Thiram alone or in combination with iprodione (Rovral 4F) improved emergence by 85% and reduced foot rot severity by 50%. Fosetyl-Al (Aliette) alone or in combination with iprodione improved emergence by 58% and reduced foot rot severity by 38%. Carbathiin/thiabendazole (Crown) improved emergence by 41% and reduced foot rot severity by 20%. All treatments except iprodione significantly increased seed yield by a range of 16-22%. Iprodione/thiram and iprodione/fosetyl-Al were the most effective treatments.

RESISTANCE OF SPRING WHEAT CULTIVARS/LINES TO *FUSARIUM* HEAD BLIGHT (SCAB) IN GREENHOUSE TESTS. S.S.A. Rizvi, L. Fischer, Jackie Rudd, and D. Gallenberg. Department of Plant Science, South Dakota State University, Brookings, South Dakota 57007.

Eight spring wheat, *Triticum aestivum* L.em.Thell. cultivars, and 21 'Sumai #3' derived advanced breeding lines were evaluated for resistance to scab. They were inoculated with the causal pathogen *Fusarium gramineum* Schwabe. adjusted to 20 x 10^3 conidia ml^{-1}. Inoculation techniques used were (I) placing a drop of inoculum in the central floret of each spike; (ii) hypodermically injecting the inoculum suspension into wheat stems before heading; and (iii) spraying the entire row of each entry at anthesis. A row of each entry sprayed with water only served as control. The development of scab and its spread along the rachis were measured at intervals of 7, 10, 13 and 17 days after inoculation. The Disease Severity Index (DSI) of each cultivar/ line was calculated and the Area Under the Disease Progress Curve (AUDPC) determined. Although wheat cultivars/ lines differed in the amount of scab induced depending on inoculation technique, the DSI and AUDPC values were higher in susceptible than in resistant cultivars. Cultivar Sumai #3 remained resistant irrespective of inoculation technique.

DEVELOPMENT OF SUDDEN DEATH SYNDROME OF SOYBEAN IN RELATION TO SOIL WATER POTENTIAL. H. Scherm, X. B. Yang, and P. Lundeen, Department of Plant Pathology, Iowa State University, Ames 50011

The influence of soil water potential (Ψ) on the development of sudden death syndrome (SDS) of soybean was studied on potted plants in a growth chamber at 20 C. Pasteurized soil was amended with macroconidia of *Fusarium solani* form A (causal agent of SDS) at planting. After seed germination, the pots were subjected to different soil moisture treatments by withholding water until Ψ reached values of -0.003, -0.02, -0.05, -0.10, -0.20, -0.40, or -0.80 MPa. Foliar disease intensity (incidence and severity) was recorded at 3-day intervals, and root disease intensity was determined 4 wk after planting. The study was replicated three times and repeated twice, with two isolates of *F. solani* (from Iowa and Arkansas). Foliar symptoms decreased with decreasing values of Ψ. For both isolates, the decrease followed a power-law relationship when disease intensity was plotted against Ψ ($0.56 \leq |r| \leq 0.86$; $0.036 \leq P \leq 0.0001$), the decrease was linear when disease intensity was plotted against the number of days on which Ψ was less than -0.01 MPa ($0.69 \leq |r| \leq 0.86$; $0.006 \leq P \leq 0.0001$). There were no clear relationships between root symptoms and Ψ, or between foliar symptoms and root symptoms.

FERULIC ACID AS A FACTOR IN RESISTANCE IN WHEAT TO FUSARIUM HEAD BLIGHT. R.W. Stack and J.D. Rasmussen. Plant Pathology Dept., North Dakota State Univ., Fargo 58105.

Ferulic acid, an intermediate of the phenylpropanoid pathway, has strong antifungal properties, and has been implicated in resistance to several diseases including resistance to Fusarium ear rot of corn. During the 1993 and 1994 wheat scab epidemics in the upper midwest, spring wheat cultivars showed different levels of damage in field trials. Since ferulic acid is known to be present in wheat grain, we chose to see if genotype differences in susceptibility to head blight might relate to endogenous levels of ferulic acid in wheat kernels. Grain samples of ten genotypes, representing a range of head blight disease reactions, were analysed for level of ferulic acid using base hydrolysis and HPLC separation. Grain of all genotypes contained substantial levels of ferulic acid, but levels were not consistently higher in resistant lines than in susceptible ones. Presence of ferulic acid alone is unlikely to be the main mechanism of resistance in wheat to Fusarium head blight.

SOYBEAN CYST NEMATODE EFFECT ON SOYBEAN YIELDS IN TEN NORTH CENTRAL STATES IN 1993 AND 1994. W. C. Stienstra,[1] G. L. Tylka,[2] and P. R. Sellers[3] and the North Central Soybean Cyst Nematode Project. [1]Department of Plant Pathology, University of Minnesota, St. Paul MN 55108, [2]Department of Plant Pathology, Iowa State University, Ames IA 55108, and [3]Botany and Plant Pathology Department West Lafayette IN 49707.

Test plot trials were conducted at 27 and 32 locations in 1993 and 1994, respectively by cooperators in IL, IN, IA, KS, MI, MN, MO, NE, OH and WI to determine the yield of susceptible and resistant soybean varieties in soybean cyst nematode(SCN), *Heterodera glycines* infested and noninfested sites. Four replications of soybeans from maturity groups I, II, III and IV were planted at all locations. Soil at planting and at harvest in each variety was collected and SCN egg densities were determined at Iowa State University. Plots were harvested and yield losses from SCN were determined by comparing yields of either resistant and susceptible varieties within a site or yields from noninfested with infested sites. SCN loss in infested soils ranged from a low of $1.48/ha in 1993 to a high of $248.06/ha in 1994.

EFFECT OF GROWTH MEDIUM, SPORE CONCENTRATION, AND LEAF WETNESS DURATION ON INFECTION FREQUENCY OF *COCHLIOBOLUS HETEROSTROPHUS* ON CORN M.R. Terry and F. W. Nutter, Jr., Department of Plant Pathology, 351 Bessey Hall, Iowa State University, Ames, IA 50011

Experiments were conducted to quantify the effects of growth medium, spore concentration (spores per cm^2 of leaf tissue) and duration of leaf wetness (hours) on infection frequency (number of lesions/plant) of *Cochliobolus heterostrophus* on corn. Growth medium (spores obtained from cultures on CMX vs. corn leaf agar) had no significant effect on infection frequency, although radial growth of *C. heterostrophus* in petri dish cultures was significantly faster on corn leaf agar. Following inoculation, corn plants were exposed to leaf wetness periods of 4, 8, 12, 16, 24, and 32 hrs and then transferred to a lighted growth chamber at 24 C. Infection frequency increased in a nonlinear fashion from approximately two lesions per plant after four hours of leaf wetness to more than 50 lesions per plant following a 16 hour leaf wetness period. Continuous leaf wetness periods $\geq$ 24 hours generally resulted in infection frequencies lower than those obtained at 16 hours of wetness. Infection frequency increased in a linear fashion with increasing spore concentrations up to 5 x 10^3 spores per ml when 40 ml of spore suspension was applied to a 64 cm^2 area of leaf tissue.

LIGHT QUANTITY AND QUALITY OF THE LIGHT-DELAYING EFFECT IN POWDERY MILDEWED BARLEY AND AUTOFLUORESCENCE IN LIGHT AND DARK. A.M. Tin & H.H. Edwards. Dept. Biol. Sci., Western Illinois University, Macomb, IL 61455.

The light-delaying effect saturates (light quantity) at a photon fluence rate of 30 umol m^{-2} s^{-1} with half-saturation at 2.3 umol m^{-2} s^{-1}. Filters giving peak transmission in near infrared, red, green, blue and near ultraviolet at 8 umol m^{-2} s^{-1} were used to determine light quality (action spectrum) of the light-delaying effect. Infrared, red and green had no delaying effect; whereas, blue and near ultraviolet gave maximal effect. Autofluorescence (AF) correlated with papilla formation. In dark incubation AF was first detected at 12 h and 14 h in light incubation. By 24 h there was greater AF in light than in dark incubation correlating with a greater percentage of papillae in light incubation.

A MOLECULAR GENETIC MARKER LINKED TO PATHOGENICITY IN THE BARLEY PATHOGEN *PYRENOPHORA TERES*.

John I. Weiland[§], Brian J. Steffenson[§], Richard Cartwright[¶] and Robert K. Webster[¶]. Departments of Plant Pathology, North Dakota State University, Fargo, N.D. 58105 [§] and University of California at Davis, Davis, CA. 95616[¶].

Net blotch of barley is caused by the haploid fungal ascomycete *Pyrenophora teres*. Progeny from a genetic cross between *P. teres* isolates 0-1 and 15-A were assessed for pathogenicity on 12 cultivars of barley. On cultivar 'Harbin', the 76 progeny of the 0-1 (pathogenic) and 15A (non-pathogenic) cross segregated at a near 1:1 ratio for pathogenicity. Genomic DNA was prepared from 0-1, 15-A, twenty pathogenic progeny isolates, and twenty non-pathogenic progeny isolates that were cultured on V8 juice agar. The DNA from the pathogenic and non-pathogenic progeny isolates, respectively, were pooled for bulk segregation analysis using the polymerase chain reaction and arbitrary primers. Using one primer pair, a 0.6 kb DNA fragment was amplified from the genomic DNA preparations of isolate 15-A and the bulked non-pathogenic isolates, but not from that of the pathogenic isolates. The future use of this and other markers in the potential cloning of pathogenicity genes from *P. teres* will be discussed.

EFFECTS OF WHEAT STREAK MOSAIC VIRUS INFECTION PERIOD ON WINTER WHEAT CULTIVARS. Z. Wu and M. A. C. Langham. Department of Plant Science, South Dakota State University, Brookings, SD 57007.

The variation of wheat streak mosaic virus (WSMV) titer in shoots and roots during early growth of two winter wheat cultivars, Arapahoe and Rose, and its effects on vegetative growth were investigated in this research. Wheat was grown under greenhouse conditions, and the virus was measured with PA-ELISA. The rates of shoot and root growth in WSMV-infected plants were significantly reduced for both cultivars. WSMV infection reduced root weights for both cultivars more than shoot weights; whereas, the ELISA values from shoots of both cultivars were consistently higher than those of roots. ELISA values from shoots of both cultivars were correlated with shoot weights ($r = 66$-97%) in both experiments and with root weights ($r = 91$-98%) only in the second experiment. This indicated that the growth of shoots and roots was influenced by WSMV concentration in the shoots at an early growth stage. However, ELISA values for root samples were not always correlated with root weights or with shoot ELISA values.