

The American Phytopathological Society

NORTH CENTRAL DIVISION

Annual Meeting
June 25-27, 1984

ABSTRACTS

SIMULATION OF POTATO EARLY DYING DISEASE EPIDEMIOLOGY USING COUPLED MODELS OF HOST AND PATHOGEN DEVELOPMENT. Adams, S. S., Rouse D. I., and Nicot, P. C., Dept. of Plant Pathology, University of Wisconsin, Madison, WI 53706.

A computer simulation model of potato crop growth (Ng, E. and Loomis, R. S. 1984. Simulation of growth and yield of the potato crop. PUDOC) was suitable for Wisconsin based studies of Potato Early Dying. The model was coupled to a simplified epidemiological model of *Verticillium dahliae*. The combined model assumes the number of root infections increases in proportion to soil volume explored by the roots. Each infection is placed into one of 30 sequential cohorts based on infection date. The progress of pathogen colonization is modeled assuming a maximum pathogen growth rate limited by temperature and the healthy fraction of stem xylem volume. Observed relations between percent stem infection at various times after crop emergence and number of propagules per gram of soil in infested fields were comparable to those generated by the combined model.

PHYTOMASS DECOMPOSITION AND FERMENTATION TO ETHANOL BY SELECTED FUNGAL STRAINS. Antonios A. Antonopoulos and Edward G. Wene; Argonne National Laboratory, Argonne, IL 60439.

There has been a renewed interest in the bioconversion of cellulose, hemicellulose and starch to produce fuel and other petroleum derived chemicals. This paper summarizes new developments in biodecomposition and fermentation of these macromolecules by selected fungal strains. Results obtained from research on enzymatic activities of *Fusarium* strains on cellulose degradation and fermentation of glucose and xylose are compared with those obtained by others working with strains from different fungal genera. Studies on ethanol tolerance, mixed cultures and cell immobilization of selected *Fusarium* strains will be presented.

SPORULATION OF BIPOLARIS MAYDIS RACE T IN VITRO IS INCREASED BY LEACHATES FROM CORN LEAVES EXPOSED TO HIGH TEMPERATURE PRIOR TO INOCULATION. E. O. Basse and M. O. Garraway, Dept. of Plant Pathology, OARDC/The Ohio State University, Columbus, OH 43210.

Leaves from susceptible and resistant isolines of corn were incubated in the dark at normal (28 C) or high (41 C) temperature for 6h prior to inoculation with *Bipolaris maydis* race T (BMT), followed by 24h in darkness at 28 C. Electrolyte leakage from infected susceptible leaves was enhanced 2 to 3 fold by the prior 6h exposure to 41 C. Sporulation on agar media supplemented with leachates from infected susceptible leaves exposed to 41 C prior to inoculation was significantly higher than that from infected resistant leaves. Without a prior high temperature exposure sporulation was comparable on agar containing leachates from either infected susceptible or infected resistant leaves. Thus increased electrolyte leakage from corn induced by a prior high temperature exposure may lead to increased sporulation of BMT on infected leaves.

TACTIC RESPONSE OF ERWINIA AMYLOVORA TO ORGANIC ACIDS IN PLANT NECTAR EXTRACTS. R. G. Bayot and S. M. Ries. Department of Plant Pathology, University of Illinois at Urbana-Champaign, 1102 South Goodwin Avenue, Urbana, Illinois 61801.

The chemotactic response of *Erwinia amylovora* to nectar extracts from 24 plant species with varying degrees of resistance or susceptibility to the pathogen was determined by capillary assay. Plants that were immune to *E. amylovora* infection had nectar extracts that were weakly attractive while more susceptible plants had nectar extracts that were strongly

attractive to *E. amylovora*. Nectar extracts were fractionated using anion and cation exchange resins and the organic acid fraction was silylated and chromatographed on a 3/8 SE-52 column. The organic acids attracting *E. amylovora* in nectar extracts appear to be either fumaric or malic acid or a mixture of both. Concentrations of either acid in nectar varied dependent upon nectar extract source.

INHERITANCE OF RESISTANCE TO SOUTHERN CORN LEAF BLIGHT IN NINE INBRED LINES OF CORN. D. C. Burnette and D. G. White. Dept. of Plant Pathology, University of Illinois, Urbana, Illinois 61801.

Twelve families of corn (*Zea mays* L.) derived from crosses of nine resistant and three susceptible inbreds were evaluated for reaction to *Bipolaris maydis* race 0 in 1981 and 1982. Additive genetic effects were highly significant in all families, accounting for 69.7% to 82.6% of the total variation. Significant dominance genetic effects were detected in all families, but accounted for only 17.2% to 27.4% of the total variation. Estimates of broad sense heritabilities ranged from 29.5% to 86.6% and the estimated numbers of effective factors ranged from 2.2 to 14.6. Recurrent selection methods should be effective in developing inbreds for resistance to *Bipolaris maydis* race 0.

STUDIES ON THE TAXONOMY OF DIAPORTHE VACCINII. C. P. Chao and D. A. Glawe, Department of Plant Pathology, University of Illinois, Urbana, IL 61801.

The taxonomic relationship of *D. vaccinii* and *D. phaseolorum* was investigated. Four isolates of *D. vaccinii*, one each of *D. phaseolorum* vars. *caulivora* (Dpc) and *sojae* (Dps), and 3 *Phomopsis* isolates from soybean were studied on 7 culture media. The *D. vaccinii* isolates did not produce teleomorphs, produced large stromata and pink-colored reverses. Dpc and Dps produced teleomorphs, small stromata, and yellow reverses. *Phomopsis* isolates did not produce teleomorphs, formed small stromata and yellow or tan reverses. Conidium sizes were similar among the isolates. *Diaporthe vaccinii* isolates were pathogenic on 'Jersey' blueberry plants while *Phomopsis* isolates were not. *Phomopsis* isolates were pathogenic on 'Wells II' soybeans while *D. vaccinii* isolates were not. The differences in cultural behavior, as well as the host specificity exhibited, suggest that *D. vaccinii* is best regarded as a distinct species.

PROGRESS OF EYESPOT DEVELOPMENT ON TEN MAIZE HYBRIDS. C. M. Chinchilla and C. A. Martinson, Dept. of Plant Pathology, Seed and Weed Sciences, Iowa State University, Ames, IA 50011.

Ten maize hybrids were grown in individual isolation plots and inoculated in mid-June with *Kabatiella zae*. The number of lesions on leaf 6, 10, and 15 was estimated weekly and converted to proportion of diseased tissue (x). Values of x were transformed for the Gompertz model. Lesion diameter and sporulation potential was also determined. Early maturity and eyespot susceptibility were related. The K values for leaf 10 varied from 0.031 (for W64xW117) to 0.008 (for H99xA632). Eyespots developed slowly on leaf 15 early in the season, but in August it increased rapidly in some hybrids. For example, B84xB73 had an initial K value of 0.007 that increased to 0.129. However, W153RxA632 increased from K=0.016 to only 0.043. The change in disease progress on leaf 15 could not be correlated with growth stage or environment. Those hybrids with largest K values had the largest lesions and produced the most conidia per lesion.

EVALUATION OF CHEMICAL SEED TREATMENTS ON STAND AND YIELD OF SCAB-INFECTED WINTER WHEAT. Ben Douppnik, Jr. and J. E. Watkins, Dept of Plant Pathology, Univ of Nebraska, Clay Center, 68933.

Chemical seed trts were compared for efficacy to increase stand and yield of 2 lots of scab-infected (*F. graminearum*) wheat. Chemicals and rates included: 1) carboxin 1.5 oz ai/100 lb; 2) carboxin 0.68 + thiram 0.68 f oz ai/100 lb; 3) captan 0.8 + carboxin 0.8 oz ai/100 lb; 4) maneb 1.0 + lindane 0.375 oz ai/bu; 5) maneb 1.0 + lindane 0.375 + imazalil 0.024 oz ai/bu; 6) maneb 0.5 + HCB 0.1 oz ai/bu; and 7) PCNB 0.464 + terrazole 0.116 f oz ai/bu. Seed was treated by shaking in plastic bags and planted on 8 Oct 1982. Untreated seed served as controls. Stand counts were made 18 Nov 1982 and plots harvested 18 July 1983. Stand and yield of lot A (pretreatment laboratory germination of 84%) was not significantly affected by any of the trts. Stand of lot B (pretreatment laboratory germination of 42%) was significantly increased by Trt 2 and yield was significantly increased by Trt 4. Trt 1 was phytotoxic to the stand of both lots. There was no significant correlation between stand counts and yields with lot A; but, there was with lot B.

A MICROCOMPUTER FOR PREDICTING GRAPE BLACK ROT INFECTION PERIODS. M. A. Ellis, L. V. Madden and L. L. Wilson. Department of Plant Pathology, The Ohio State University, OARDC, Wooster, OH 44691.

The temperature and wetness duration parameters developed by R. A. Spotts (Phytopathology 67:1378-1381) for infection of grape leaves by *Guignardia bidwellii* were programed into a microcomputer. The unit accurately predicted black rot infection periods in the vineyard during the 1983 growing season. All infection periods were validated using a deWit leaf wetness meter and hygrothermograph. The ergosterol inhibiting fungicide, triadimefon, applied at 72 and 96 hr after the initiation of predicted infection periods provided excellent black rot control. Ferbam provided excellent control when applied in a standard protectant program, but was not effective when applied 72 hr after the initiation of an infection period. Well-timed curative sprays of triadimefon were as effective as a protectant spray program of Ferbam, but were more efficient because four fewer sprays were made to achieve equal control.

USE OF A COLOR MUTANT OF *FUSARIUM OXYSPORUM* F. SP. APII RACE 2 IN STUDIES OF SOIL POPULATION DYNAMICS. W. H. Elmer and M. L. Lacy, Department of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824-1312

An orange pigmented mutant (OM) of *Fusarium oxysporum* f. sp. *apii* Race 2 (FOA2) that formed orange colonies on Komada's Selective Medium (KSM) was used to differentiate between FOA2 propagules amended into soil and non-pathogenic *F. oxysporum* propagules already present. The OM was selected from a colony arising from a surviving microconidium exposed to ultra-violet light. The OM was pathogenic on celery seedlings, but less virulent than the wild type FOA2. Growth studies in Czapeks-Dox broth revealed a 24 hr lag in growth (dry weight) of the OM when compared to the wild type FOA2, but no significant difference was detectable in biomass after 8 d. The mutant has been stable while stored in soil tubes for 12 mo. Soil dilutions on KSM demonstrated that OM populations increased after 3 wk in celery residue-amended soil artificially infested with the OM, but no increase occurred in non-amended soil.

SPLASH DISPERSAL OF PHYTOPHTHORA CACTORUM FROM INFECTED STRAWBERRY FRUIT. G. G. Grove, L. V. Madden, and M. A. Ellis, Department of Plant Pathology, The Ohio State University, OARDC, Wooster, OH 44691.

Strawberry fruits (cv. Tristar) infected with *Phytophthora cactorum* were used to demonstrate and quantify the effects of water splash on dispersal and distribution of inoculum. Water drops, averaging 0.026 and 0.41 cm in diameter, were dropped from various heights on infected fruits adjacent to petri plates positioned up to 1 m away and containing selective medium. Sporangia, zoospores, and mycelia were readily dispersed; colonies formed up to 1 m from inoculum source. Colony number in plates followed a negative gradient with increased distance from inoculum source. A multiple regression model described colony number as a function of distance and water drop velocity at impact. Splash dispersal of inoculum from infected to healthy fruit was demonstrated using potted plants.

EFFECT OF SOYBEAN SEED QUALITY AND SEED TREATMENT ON COLD TEST PERFORMANCE UNDER VARYING LEVELS OF *PYTHIUM ULTIMUM* INOCULUM I.J. Gupta, A.F. Schmitthenner, M.B. McDonald and M.A. Ellis. Dept. of Plant Pathology, OARDC, Wooster, OH 44691 and The Ohio State University, Columbus, OH 43210

Three soybean seed lots of cultivar 'Pella' of high, medium and low quality based on fungal pathogen infection and germination were evaluated for cold test performance (exposing planted

seed to 10 C for 7 days then 25 C for 6 days). Untreated or seeds treated with metalaxyl (Apron 25 WP) at rates of 0.5, 1.0 and 1.5 g/kg seed were planted in a 1:2 soil-sand mixture with *Pythium ultimum* inoculum at 0, 100, 200, 300 and 400 colony forming units/g soil-sand mixture. All levels of *Pythium* significantly decreased seed emergence and the number of normal seedlings compared to the uninoculated check. In *Pythium* infested soil, seed treatment with 0.5g Apron 25 WP/kg seed increased seed emergence by 174% in low, 168% in medium, and 140% in high quality seed lots over untreated seed.

GREENHOUSE EVALUATIONS OF REACTIONS OF SWEET CORN HYBRIDS TO PUCCINIA SORGHI. J. M. Headrick and J. K. Pataky. Department of Plant Pathology, University of Illinois, Urbana 61801.

Fifteen sweet corn hybrids and two dent corn inbreds were evaluated in five greenhouse trials for reaction to *Puccinia sorghi*, the causal agent of common rust. Plants were at the five to six leaf stage when inoculated with a mixture of urediospore isolates. Differences between genotypes were observed for latent period (development of first pustules), rate of pustule development, inoculum efficiency (pustules per plant and/or lesions per plant), and pustules per lesion. Hybrids were grouped as susceptible, moderately susceptible or moderately resistant. In trials inoculated in a settling tower or with a urediospore suspension, Style Pak, Florida Staysweet and Honeycomb were susceptible; Gold Cup, Sugar Loaf and NK 199 were moderately susceptible; and Miracle, Jubilee and dent corn inbreds Mo 17 and FR 37 were moderately resistant. These seedling reactions were similar to reports in the literature of reactions of field grown adult plants.

EFFECT OF MOIST PERIOD DURATION ON SEPTORIA BLOTCH OF WHEAT. Dale Hess and Gregory Shaner, Dept. of Botany and Plant Pathology, Purdue University, West Lafayette, IN 47907.

Field plots of cultivar Arthur were inoculated on 29 April 1983 at the 5-node stage of growth with an aqueous suspension of conidia of *Mycosphaerella graminicola* and sealed in clear plastic enclosures, which kept foliage wet continuously, for up to 88 hr. Subsequent disease development was proportional to duration of the moist period. Disease developed equally in inoculated and uninoculated plots that received the same moisture treatment. Positive correlations existed between disease severity on the spike and on the flag leaf and between severity on the flag leaf and on the penultimate leaf. Kernel number and weight per kernel were negatively correlated with disease severity on the spike. Weight per kernel and total weight of kernels per spike were negatively correlated with severities on the flag and penultimate leaves. Area under the disease progress curve, based upon 7 severity assessments at 8-day intervals, better predicted reduction in yield and seed weight than did apparent infection rate.

RESISTANCE TO STEM CANKER OF SOYBEAN AND PATHOGENIC SPECIALIZATION OF THE CAUSAL ORGANISM, *DIAPORTHE PHASEOLORUM* VAR. *CAULIVORA*. P. M. Higley and H. Tachibana. Dept. of Plant Pathology, Seed and Weed Science, Iowa State Univ., and USDA-ARS, Ames, IA 50011

Forty soybean lines were screened for resistance to stem canker using an Iowa isolate of *Diaporthe phaseolorum* var. *caulivora* (Dpc). Cultivar Midwest showed a high level of resistance when screened at reproductive stage 5-6, and A78-227016, Hawkeye, Hawkeye 63, and Pride B216 were resistant when screened as seedlings. Resistance of some cultivars changed with plant maturity. One isolate of Dpc from Iowa and two from Mississippi were inoculated into the seedlings of 10 soybean cultivars from the two geographic areas. Dpc isolates from Iowa and Mississippi reacted as two pathogenic races. The soybeans Blackhawk, Harosoy, and L4404, adapted to Iowa, were susceptible to the Iowa isolate and resistant to the Mississippi isolates. The line J77-339, adapted to Mississippi, was susceptible to the Mississippi isolates and resistant to the Iowa isolate.

EFFECT OF TILLAGE ON "WINTER-KILL" CAUSED BY RHIZOCTONIA SOLANI (BINUCLEATE). D.M. Huber, T.S. Abney, M.M. Schreiber, and M. White, Purdue University, West Lafayette, IN 47907.

Rhizoctonia solani (binucleate) causes severe "winter-kill" of wheat throughout the Midwestern U.S. when cool, wet conditions persist for several weeks before growth resumes in the Spring. Disease severity on winter wheat in a corn-soybean-rotation in the USDA-ARS-SEA/Purdue IPM project was limited to older leaves during the mild winters & springs of 1981 & 1983. This contrasted with severe stand reduction encountered during the cold, wet springs of 1982 & 1984 when 52 and 18%, respectively, of the wheat planted without tillage were killed. Chisel plowing followed by discing prior to seeding reduced disease severity to 39 & 2% of plants killed each year. Least disease (38 & trace % kill), occurred with conventional (moldboard plow,

disc) tillage. Higher disease on minimum weed control plots was correlated with the amount of surface residue present. This research indicates that the risk of "winter-kill" from *Rhizoctonia* is significantly greater with no-till than conventional tillage practices.

THRESHOLD CONCENTRATIONS OF ATTRACTANTS OF *ERWINIA HERBICOLA*. M. J. Klopmeier and S. M. Ries, Department of Plant Pathology, University of Illinois at Urbana-Champaign, 1102 South Goodwin Avenue, Urbana Illinois 61801.

Amino acids, organic acids, and sugars have been shown to be attractants of *Erwinia herbicola* (112Y), a common leaf saprophyte which inhibits apple blossom infection by *Erwinia amylovora*, the causal agent of fire blight. Threshold concentrations of selected strong and weak attractants were determined by capillary assay. The threshold concentration was defined as the concentration of attractant that results in a greater accumulation of bacteria per capillary than the control or blank value. Regression analyses, multiple comparison tests and standard deviations were used to determine threshold values. For example, asparagine and serine, the best amino acid attractants, had threshold values of 10^{-5} to 10^{-6} M.

EFFECT OF ROOT FEEDING BY STRIPED CUCUMBER BEETLE LARVAE ON FUSARIUM WILT OF MUSKMELON. R.X. Latin and G.L. Reed, Dept. of Botany and Plant Pathology and Dept. of Entomology, Purdue University, W. Lafayette, IN 47907

Studies were conducted to determine the effect of root feeding by larvae of the striped cucumber beetle (STCB), *Acalymma vittata* (F.), on incidence and severity of infection by *Fusarium oxysporum* f. sp. *melonis* (FOM). *Fusarium* wilt was evaluated on muskmelon seedlings grown in soil-less media infested with FOM microconidia and STCB eggs. Inoculum levels of FOM were 0, 10^3 , 10^5 and 10^7 microconidia/seedling and STCB infestation levels were 0, 5, 10 and 20 eggs/seedling. STCB eggs were reared so that root feeding larvae would hatch within 12 hr of infestation. Significantly greater wilt incidence and severity occurred where treatments included STCB infestations of 5, 10 and 20 eggs/plant, indicating that root feeding by STCB larvae caused increased disease expression. Results reinforce rationale for controlling this insect on muskmelon and may warrant similar investigations on other cucurbits.

THE EFFECT OF THE *Ht*₁ GENE IN CONDITIONING RESISTANCE TO EXSEROHILUM TURCICUM RACE TWO IN MAIZE. S. Leath and W. L. Pedersen, Department of Plant Pathology, University of Illinois, Urbana-Champaign, IL 61801.

Of the three known physiologic races of *Exserohilum turcicum*, causal fungus of Northern leaf blight of maize (NLB), race 1 is avirulent and race 2 virulent on maize with the *Ht*₁ allele. Field studies were conducted in 1982 and 1983 to determine the effectiveness of the *Ht*₁ gene in conditioning resistance to *E. turcicum* race 2. Lesion size, lesion expansion rate and area under the disease progress curve were lower ($p < 0.05$) for the hybrid A632Ht₁xA619Ht₁, than for its near isogenic counterpart A632xA619. This hybrid has a low level of polygenic resistance to NLB. Smaller differences ($p < 0.10$) were detected within near-isogenic hybrid pairs with moderate levels of polygenic resistance: Mo17xA634, Mo17xN28 and B73xMo17. Yields of the four *Ht*₁ converted hybrids were greater than the yields of their counterparts when both were infected with *E. turcicum* race 2. Results from greenhouse studies were similar.

EFFECT OF TAKE-ALL ON YIELD COMPONENTS OF THREE SOFT-RED WINTER WHEATS IN OHIO. Patrick E. Lipps, Department of Plant Pathology, The Ohio State University/OARDC, Wooster, OH 44691.

In 1981 and 1983 oat kernels infested with *Gaeumannomyces graminis* var. *tritici* were mixed with healthy seed of Hart, Titan, and Arthur wheats at infested:healthy seed ratios of 0:1, 1:10, 1:5, and 1:1 and then planted in field plots. Disease severity was determined at harvest by rating 50 tillers per plot on a scale of 0-5 (0=no symptoms, 5=entire culm base black). Analysis of variance indicated no significant ($P < 0.05$) interactions among cultivars over the different inoculum levels for number of heads per m row, percentage white heads, yield, thousand kernel weight or disease index. Results indicated that the three cultivars responded similarly to inoculum level. However, based on analysis of main effects, yield of Hart was significantly greater than Titan and Arthur in 1981 but not significantly different from Titan in 1983.

POTENTIAL BIOCONTROL FUNGI ON LEAFY SPURGE. Littlefield, L. J. and J. G. Hoch, North Dakota State Univ. Fargo, ND 58105.

Euphorbia esula, a serious rangeland weed, hosts several fungi with diverse potential as biocontrol agents. *Uromyces striatus* kills nearly all infected plants; it seldom occurs, and since the 0,I stages do not repeat, little chance exists for establishment of epidemics. Moreover, alfalfa is the telial host. *Sclerotinia sclerotiorum* causes rapid wilting and death, but its wide host range precludes its use. *Sclerotium rolfsii* provides similar results, but regrowth from root and crown buds leads to rapid recovery. *Alternaria tenuissima* f. sp. *euphorbiae* causes extensive stem and floral necrosis. Natural infections occur more commonly in localized areas of high humidity than on open prairies. Inoculation with 5.5×10^5 conidia/ml provides heavy infection indoors; the choice of wetting agent is important (Dupont WK is the best to date). Stems ≤ 1 mm are more seriously affected than larger ones. All floral structures are killed and seed set is prevented. Of the fungi studied to date, *A. tenuissima* f. sp. *euphorbiae* shows the best potential for biocontrol of leafy spurge.

EFFECT OF CORN STUNT SPIROPLASMA ON SURVIVAL AND FECUNDITY OF THREE DALBULUS LEAFHOPPER VECTORS. L. V. Madden and L. R. Nault, Department of Plant Pathology and Entomology, The Ohio State University, OARDC, Wooster, OH 44691.

Survival and fecundity (reproduction) of three *Dalbulus* leafhopper species was determined after acquisition of the corn stunt spiroplasma (CSS). As in a previous study, CSS significantly reduced survival of *D. elimatus* and *D. gelbus*, as measured by the time to 50% (t_{50}) survival and scale parameter (b) of the Weibull distribution model. The Weibull b is inversely related to the rate of population decline. CSS also reduced the fecundity of these two species, as measured by the net reproductive rate (R_0 ; average number of eggs laid per leafhopper female per generation). CSS did not significantly affect the corn leafhopper, *D. maidis*. These results support our hypothesis that a long association between a plant pathogen and its vector results in a selection of highly compatible vector biotypes and pathogen strains.

EFFECT OF SIMULATED ACID RAIN ON ENDOMYCORRHIZAL DEVELOPMENT AND GROWTH OF BLACK LOCUST. Carolyn J. McQuattie, USDA, FS, 359 Main Rd., Delaware, OH 43015 and Landon H. Rhodes, Dept. of Plant Pathology, Ohio State University, Columbus, OH 43210.

Black locust (*Robinia pseudoacacia* L.) seeds were inoculated with *Rhizobium* and planted in a pH 7.4 coarse sandy loam (Soil A) or a pH 5.4 loam (Soil B) with or without inoculum of *Glomus fasciculatum*. Seedlings were grown in a growth chamber and watered with one of four simulated rain solutions (pH 5.6, 4.6, 3.6, or 2.6) for 8 or 12 weeks. Stem height, shoot dry weight, total root length, and nodulation were significantly greater and mycorrhizal infection (MI) less in Soil B after 12 weeks. Rain below pH 5.6 resulted in lower MI in roots from Soil A after 8 weeks, but not after 12 weeks, whereas rain acidity had no effect on MI in roots from Soil B. Nodule number decreased with increasing acidity. The results indicate a difference in MI under acid rain conditions, although seedling growth was unaffected during the 12-week study.

THE PREVALENCE OF CERATOCYSTIS ULMI PERITHECIA IN DISEASED AMERICAN ELMS. H. L. Morton, School of Natural Resources, Univ. of Mich. 48109-1115.

Fifty American elms, *Ulmus americana*, were studied in S.E. Michigan as each tree had Dutch elm disease. Bark beetle galleries were found in 82% of the trees. Seventy-five percent had been colonized by the smaller European elm bark beetle (*Scolytus multistriatus*) while 23% had been colonized by the native elm bark beetle (*Hylurgopinus rufipes*). Overall, perithecia were found in 26/33 trees with galleries. Seventy-three percent of the trees colonized by *S. multistriatus* contained galleries with perithecia, while 55% of the trees colonized by *H. rufipes* contained galleries with perithecia. Overall, coremia were found in 29/33 trees with galleries. Coremia were present in 93% of the trees with *S. multistriatus* galleries and 45% of the trees with *H. rufipes* galleries. Morphologically, perithecia were identified as *C. ulmi*. Wilting was caused by 38/42 single ascospore isolates. Fertile perithecia were formed in mating tests by spores from 4/6 collections, but by only 6/26 isolates.

BARLEY SEEDLING DISEASE REACTION NOT A GOOD PREDICTOR OF ADULT PLANT REACTION TO SPOT BLOTCH (*HELMINTHOSPORIUM SATIVUM*). F. W. Nutter, Jr. and V. D. Pederson, North Dakota State University, Fargo, ND 58105.

Screening of greenhouse barley seedlings for disease resistance to spot blotch was evaluated as a method to predict disease reaction of barley lines in the field. A total of 297 lines were evaluated: 42 in 1981, 92 in 1982, and 163 in 1983. Plants were inoculated in the field after anthesis with a spore suspension of *Helminthosporium sativum*. Lesion sizes on the flag leaves were recorded 7 days later using a rating scale of 1 to 9 where 1=fleck and 9=large chlorotic lesions. The same lines were grown in seed germination papers (Phytopathology 71:1117) for 10 days, inoculated with *H. sativum*, and evaluated 7 days later as above. Coefficients of determination (R^2) relating seedling reaction to field reaction were 31.1, 23.5, and 37.0% for 1981, 1982, and 1983 respectively. Selection of seedling lines rated ≤ 3.0 identified only 3 out of 43 with field reactions ≤ 3.0 . Lines grown in the greenhouse and then inoculated after the boot stage of growth provided ratings which better predicted field ratings ($R^2=92\%$).

EFFECT OF DIFFERENT ISOLATES OF *PUCCINIA CORONATA* ON YIELD AND SEED WEIGHT OF OAT CULTIVARS. J. H. Oard and M. D. Simons. Dept. of Plant Pathology, Cornell University, Ithaca, NY 14853; and ARS, USDA, Dept. of Plant Pathology, ISU, Ames, IA 50011.

Twenty-six isolates of *Puccinia coronata* Cda. were used to inoculate 10 susceptible oat (*Avena sativa* L.) cultivars in field trials in Iowa. Yield and mean seed weight data were expressed as indexes relative to rust-free controls. Isolates (averaged over cultivars) and cultivars (averaged over isolates), showed significant variation for reduction in both yield and seed weight. The isolate X cultivar interaction was also significant. Certain pairs of cultivar-isolate combinations showed large differences, e.g., Richland and Allen infected with isolate 38R had seed weight indexes of 0.59 and 0.86, respectively. Allen infected with isolate 61T had a seed weight index of 0.61. Thus, the data demonstrated host specificity at the "susceptible" level of host-parasite interaction.

USE OF BAYLETON 50 WP ON APPLES. Larry G. Olsen. MOBAY CHEMICAL CORPORATION. 13591 Tucker Drive, DeWitt, MI 48820.

Bayleton 50 WP was sprayed on apple trees at different rates and timings to determine the most practical application method for powdery mildew control. When applied at 2 ounces of product per acre at pink, bloom, petal fall plus first cover, it provided significantly fewer infected terminals, percent leaves infected, and percent leaf surface area infected than 4 ounces of product per acre applied at pink plus petal fall, or standard sulfur or Benlate programs. Visually sampling the number of infected terminals per tree provides just as reliable an estimate of the severity of the disease and level of control as percent leaves infected ($R = .73$) and percent surface area infected ($R = .80$).

A SIMPLIFIED METHOD TO ESTIMATE YIELD LOSSES FROM INFRARED COLOR PHOTOGRAPHS. V. D. Pederson and F. W. Nutter, Jr. Department of Plant Pathology, North Dakota State University, Fargo, ND 58105

Infrared aerial photography has been useful as a means to detect plant diseases but its use for estimating crop losses has been hampered because of the high cost of image analysis. A low cost method to quantify red light transmitted through plot images was accomplished by using a compound microscope to project plot images against the face of a cadmium sulfide photoconductive cell. Positioning of each plot image from an infrared color Ektachrome slide was facilitated by using a mirror reflex housing. Transmitted light was filtered with a Wratten A25 filter. The output voltage from a voltage circuit divider, which included the photocell, was read for each plot image and stored in a Radio Shack model 100 portable computer. Values of red light transmitted through each plot image were used in a linear regression model to estimate yield loss in barley due to spot blotch (*Helminthosporium sativum*).

A NEW ALLELE AT THE *Rps3* LOCUS FOR RESISTANCE TO PHYTOPHTHORA MEGASPERMA F. SP. GLYCINEA IN SOYBEAN. L.D. Ploper, K.L. Athow, and F.A. Laviolette, Department of Botany and Plant Pathology, Purdue University, West Lafayette, IN 47907.

The genetics of resistance to *Phytophthora megasperma* Drechs. f. sp. *glycinea* Kuan and Erwin was studied in soybean (*Glycine max* (L.) Merr.) PI 172901, which is resistant to races 1-16 of the pathogen. PI 172901 was crossed to Harosoy (*rps*), Mukden (*Rps1*), Sanga (*Rps1^b*), Wells II (*Rps1^c*), Williams 82 (*Rps1^k*), PI 86972-1 (*Rps3*), PRX27-108 (*Rps1Rps4*) and Altona

(*Rps6*). The F_2 populations and the progenies of the F_2 plants from each cross were evaluated for their reaction to physiologic races 1, 2, 3, 4, 5, 7, and 9. The results showed two independent, dominant genes for resistance in PI 172901. One was *Rps1^b* which conveys resistance to races 1, 3, 4, 5, 7, and 9, and susceptibility to race 2. The other gene was an allele at the *Rps3* locus which gives resistance to the seven physiologic races used in this study. The symbol *Rps3^b* was proposed for this gene to discriminate it from *Rps3*, which conditions susceptibility to race 7.

INDUCED PATHOGENICITY IN GLYPHOSATE-TREATED SOYBEANS. K. D. Simcox and J. D. Paxton. Dept. Plant Pathology, Univ. of Illinois at Urbana-Champaign, 1102 S. Goodwin, Urbana, IL 61801

Death of soybeans treated with low levels of glyphosate was due to the susceptibility of the treated plants to resident soil microflora, not phytotoxicity of glyphosate. Harosoy-63 plants were treated by injecting 5 μ g of glyphosate into the cotyledon of 14-day-old seedlings, planted in non-sterile soil or sterile vermiculite. After three days, the glyphosate-treated plants grown in non-sterile soil wilted and died. A Pythium sp. was isolated from wilted plants. When re-inoculated into treated and non-treated plants, the Pythium caused wilting in only the glyphosate-treated plants. Since glyphosate-treated plants grown in sterile vermiculite did not show symptoms, death was due to the invasion of the Pythium, not just glyphosate phytotoxicity. Apron seed treatment of glyphosate-treated plants grown in non-sterile soil resulted in the isolation of pathogenic fungi other than Pythium.

SCREENING FOR TOLERANCE TO *PUCCINIA CORONATA* IN PROGENIES OF VISUALLY SUSCEPTIBLE STRAINS OF *AVENA FATUA*. M. D. Simons and L. W. Briggie. ARS, USDA, Dept. of Plant Pathology, ISU, Ames, IA 50011; and Plant Genetics and Germplasm Institute, Bldg. 001, BARC-West, Beltsville, MD 20705.

About 400 strains of *Avena fatua* L. were susceptible to 5 races of *Puccinia coronata* Cda. as seedlings, and to common races as adult plants in the field. Five strains were crossed with the susceptible cultivar Clinton, and 20 cultivated-type lines from each cross were planted two years in replicated hill plots exposed to *P. coronata*. Tolerance in terms of reduction in yield and mean seed weight relative to rust-free control plots varied significantly among the 5 families, and these family means were generally lower than Clinton. Many lines were equal in tolerance to Clinton; none were consistently superior. Heritability values for yield reduction ranged from 64 to 82%, and for seed weight reduction from 53 to 89%. Rust-free yields of individual lines, many equal to Clinton, were not correlated with tolerance.

EFFECT OF HOMOKARYOTIC AND HETEROKARYOTIC CULTURES OF THE MYCOPARASITE *SPHAERONAEMELLA HELVELLAE* ON *GIBBERELLA ZEAE* IN VITRO. Nader G. Vakili. ARS, USDA, Dept. of Plant Pathology, ISU, Ames, IA 50011.

When single ascospore cultures of *Gibberella zeae* were exposed to diverse homokaryotic cultures of *Sphaeronaemella helvella* on corn-meal-agar medium, a range of responses by *G. zeae*, including reduction in mycelia, conidia and pigment formation, was observed. The response of *G. zeae* to *S. helvella* heterokaryons derived from crosses of highly and slightly mycopathogenic homokaryons was intermediate between responses to the parents. Perithecia production in a given culture of *S. helvella* was negatively correlated with conidia production in the *G. zeae* culture that it was parasitizing. Breeding of fungiculous fungi with greater mycopathogenicity for use as a component of an integrated biocontrol program for cornstalk diseases is proposed.

BEE WESTERN YELLOWS VIRUS IN ILLINOIS. E. L. Timmerman, Cleora J. D'Arcy, and W. E. Splittstoesser. Departments of Horticulture and Plant Pathology, University of Illinois, Urbana, IL 61801.

Host screening for beet western yellows virus (BWYV) by ELISA showed that BWYV occurs in a wide range of crop and weed hosts throughout Illinois. Volunteer turnip greens and spinach crops and chickweed are overwintering hosts of BWYV in the East St. Louis area, and may be sources of inoculum for spring crops. BWYV was detected in spring 1983 crops after aphids were sighted, and eventually infected 80% of the turnip greens and 33% of the spinach tested. Green bell peppers and redroot pigweed are summer hosts of BWYV and may be sources of inoculum for fall-planted turnip greens and spinach. The BWYV-ELISA system directed attention to potential hosts of BWYV. However,

high background levels in ELISA from some weeds (chickory, dandelion, field bindweed, giant ragweed, horseweed, prickly lettuce, smallflower galinsoga, spurge) suggest that ELISA results be verified by other methods, such as transmission, when screening a wide range of plants.

THE ROLE OF FUNGICOLOROUS FUNGI IN BIOLOGICAL CONTROL OF SAPROPHYTIC AND PHYTOPATHOGENIC FUNGI OF CORN KERNELS. Nader G. Vakili, USDA/ARS, 411 Bessey Hall, ISU, Ames, IA 50011.

Kernels of four corn inbreds were treated with spores of Sphaeronaemella helvellae, Gliocladium roseum, Trichothecium roseum, Exobasidiellum sp., and Gonatobotrys simplex, and water. Seeds were germinated in the standard Cold (10 then 25 C) and Warm Tests (25 C). Samples of germinated seeds and plumule discs were placed on corn-meal-agar medium and emerging fungi were recorded. Fungicolous fungi reduced the frequency and severity of seedling infection in both tests. G. roseum eliminated Penicillia and reduced Fusarium moniliforme, T. roseum reduced the frequency of Rhizopus sp. In inbred B-73, T. roseum prevented and S. helvellae reduced infection by Cephalosporium acremonium. Reduction in Penicillia and F. moniliforme was negatively correlated with an increase in a Mycelium strelum. The use of fungicolous fungi as complementary components to disease resistance in an integrated biocontrol of corn seedling diseases is suggested.

AERATION RESPONSE OF Pythium graminicola SUBR. Rickie P. Voland and C. A. Martinson, Dept. of Plant Pathology, Seed and Weed Sciences, Iowa State University, Ames, IA 50011.

Tolerance of Pythium graminicola to poor aeration was suspected as a reason for increased maize root rot by this pathogen in some soils. Local isolates of P. graminicola from maize roots were grown in Czapek Dox broth (Difco) and on agar made with Czapek Dox broth in different concentrations of O₂ and CO₂ maintained by continuous-flow gas mixers. In aerated broth with no added CO₂, and O₂ concentrations of 0%, 1%, 14%, and 26%, the fungus grew, respectively, 21%, 23%, 84%, and 100% of the growth in bottled air (26% O₂). In aerated broth at an O₂ concentration of 16%, and CO₂ concentrations of 7%, 14%, and 19%, the fungus grew, respectively, 131%, 63%, and 32% of the growth without added CO₂ (0%). Inhibition of growth at low O₂ and at high CO₂ concentrations was greater in broth culture than on the solid medium. Although the growth of P. graminicola was inhibited by poor aeration, the fungus appears to be adapted to growth in high CO₂ and in low O₂ conditions.

EFFECTS OF CROP ROTATION AND WEED MANAGEMENT LEVELS ON LESION NEMATODE POPULATIONS. R.H. von Qualen and G.B. Bergeson, Dept. of Botany and Plant Pathology, Purdue University, West Lafayette, Indiana 47907.

The lesion nematodes, Pratylenchus hexincisus and P. scribneri, were studied for four years in plots under various rotations of corn, soybeans, and wheat; and under three weed management levels. Inclusion of wheat in the rotation reduced the P. hexincisus population in corn to 138 nematodes per g of root compared to 858 in other rotations. In greenhouse tests, inoculated corn and soybeans yielded similar numbers of nematodes per g of root but a greater total build-up of the nematodes occurred on corn because of its larger root system. Weed population differences of 125 versus 37 per 1.1 x 10⁻³ hectare in the three weed management levels had no significant

effect on lesion nematode populations. Greenhouse studies on 13 common weed species showed a wide range of host suitability among weeds. Thus a build-up of the nematode population due to weeds would depend on the weed species present.

USE OF LEAF WHORL INOCULATION TECHNIQUE FOR EVALUATION OF STALK ROT RESISTANCE. H.L. Warren and S.K. von Qualen. USDA, SEA, Purdue University, West Lafayette, IN 47907

Maize inbreds, B73 and Mo17, and the hybrid B73XMo17 were evaluated for ear and stalk rot resistance following leaf whorl inoculation. Plants were inoculated 1,2,3, or 4 weeks prior to anthesis with an 8 ml spore suspension of Stenocarpella maydis (= Diplodia maydis) or S. macrospora (= D. macrospora) at 20,000 spores/ml. The percentage of ears rotted and severity of stalk rot were evaluated at plant maturity. Both ear and stalk rot severity increased when plants were inoculated closer to anthesis. B73 was most susceptible to both pathogens and B73XMo17 was least susceptible. This technique permitted evaluation of two phases of the disease with one inoculation. The development of disease approximates natural infection and allows accurate field evaluation of resistance to ear and stalk rots caused by S. maydis and S. macrospora.

EVIDENCE FOR DISTINCT POPULATIONS OF V. DAHLIAE PATHOGENIC TO POTATO VS. SUNFLOWERS IN MINNESOTA. P. J. Zambino and N. A. Anderson, Dept. of Plant Pathology, Univ. of Minnesota, St. Paul, MN 55108

Auxotrophic mutants were induced by UV irradiation in two potato and five sunflower isolates of V. dahliae. Prototrophic growth occurred in pairings made on minimal medium between all mutants of isolates from the same host species, but was not noted in pairings of potato + sunflower isolate mutants. Color mutants were induced by UV irradiation in three potato and two sunflower isolates. Melanin production was restored in 4:66 pairings of potato + potato isolate mutants and in 1:36 pairings of sunflower + sunflower isolate mutants, but in 0:117 pairings of potato + sunflower isolate mutants. Genetic isolation between potato and sunflower isolates is suggested by the above. The occurrence of genetic isolation between V. dahliae populations pathogenic to potato vs. sunflower may explain the low virulence to potato hosts that has been observed in sunflower isolates in field and greenhouse experiments.

VERTICILLIUM WILT YIELD LOSSES IN POTATO RELATED TO ONSET OF INFECTION AND EXTENT OF PLANT COLONIZATION. P. J. Zambino and N. A. Anderson, Dept. of Plant Pathology, Univ. of Minnesota, St. Paul, MN 55108.

In experiments using pathogen-free seed, potato yield losses on irrigated Hubbard sandy loam soil in central Minnesota to V. albo-atrum (VAA) and V. dahliae (VD) in 1979 and 1980 were as follows: cv. Kennebec VAA 12.53 and 22.51%, VD 16.73 and 17.94%; cv. Norland VAA 23.71 and 12.39%, VD 13.14 and 9.08%; cv. Russet Burbank VAA 4.34 and 11.77%, VD 21.43 and 6.13%. In 1979, plant and tuber infection in cvs. Norland and Russet Burbank was first detected by the Verticillium species causing greater yield loss; in cv. Kennebec, VAA and VD were detected on the same date of sampling, but with greater incidence of VD. In 1980, regressions of percent yield loss on percent infection in lateral stem tissue sampled at early senescence were as follows: for VAA, $y=1.36x + 2.186$. ($r=0.96$); for VD, $y=0.49x - 21.47$. ($r=1.00$).