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ABSTRACTS

IN VITRO PRODUCTION OF SIRODESMIN PL CORRELATED WITH PATHOGENICITY OF LEPTOSPHAERIA MACULANS TO RAPESEED. R. Assabqui and R. Hall, Department of Environmental Biology, University of Guelph, Guelph, Ontario N1G 2W1.

The role of the toxin sirodesmin PL produced by Leptosphaeria maculans in the development of blackleg in rapeseed (Brassica napus and B. campestris) is unclear. The toxin was detected chromatographically in rapeseed cotyledons after inoculation with conidia of the fungus but in concentrations too low to be measured. Concentrations of the toxin (mg/g dry mycelium) produced by 6 isolates of the fungus in liquid Fries medium shaken in the dark at 21°C for 21 days ranged from 0.35 to 2.53. Lesion diameters (mm) 7 weeks after inoculation of these isolates into stems of 5 cultivars of the host ranged from 6.4 to 75.8. Coefficients of correlation relating toxin production in vitro to lesion diameter ranged from +0.88 for cv. Regent to +0.99 for cv. Karat. The pathogenicity of L. maculans to rapeseed may be related to its ability to produce sirodesmin PL in vivo.

Apple scab lesions, caused by Venturia inaequalis, on shoots in New York; histology and enumeration of inoculum. C. M. Becker, T. J. Burr, Cornell University, NYSAES, Geneva, NY 14456.

Apple scab lesions, 1-3 mm in diameter, were observed on 5% of the current season shoots of 'McIntosh' and 'Cortland' in two unsprayed and one commercial orchard in 1988. The same orchards had lesions on 60% of the shoots in 1989. Unsprayed orchards had an average of 40, 4, and 0.1 viable conidia per lesion during July, and October, 1988, and April, 1989 respectively, whereas 109, 1, and 0 viable conidia per lesion were observed in sprayed orchards. Histological observations in July, and October showed that host periderm had formed below the fungal hyphae prior to normal periderm formation. Fungal hyphae was observed within lesions; however, tissues above the periderm had sloughed off by the following spring, and evidence of hyphae was lacking. Under New York conditions it appears that shoot lesions are not a source of primary inoculum for apple scab.

Association of Venturia inaequalis conidia with apple buds. C. M. Becker, T. J. Burr, Cornell University, NYSAES, Geneva, NY 14456.

Viable V. inaequalis conidia were detected in dormant 'McIntosh' apple buds just prior to budbreak in 1989. In 1988 and 1989, they were observed in close association with expanded apple buds prior to conidial production from ascospore infections in the cultivars 'Cortland', 'Rome', 'RI Greening' and 'Delicious'. In 1988, 2 to 15 viable conidia per bud were detected from unsprayed orchards, while 0.3 to 124 viable conidia per bud were observed in 1989 from orchards that were both sprayed and unsprayed for scab during the previous season. Dissected dormant buds revealed that conidia were more likely to be located on the inside portions of the buds. Conidia that were collected from buds at the silver tip stage of growth were

inoculated onto apple seedlings, and incited disease in the greenhouse. These data indicate that conidia of V. inaequalis can overwinter within apple buds in New York and can serve as initial apple scab inoculum.

MICROSCOPIC STUDY OF THE INTERACTION BETWEEN SPHAEROTHECA PANNOSA f.sp. ROSAE AND THREE POTENTIAL ANTAGONISTS. R. B. Bélanger and M. R. Hajlaoui. Dép. de phytologie-FSAA, Université Laval, Québec, G1K 7P4.

Three reported antagonists of cucumber powdery mildew, Tilletiopsis washingtonensis, Sporothrix flocculosa and Sporothrix rugulosa, were tested and compared for their potential for controlling powdery mildew, caused by Sphaerotheca pannosa f.sp. rosae, on rose. Under controlled conditions, all three fungi colonized and killed S. pannosa f.sp. rosae on miniature roses leaflets within 96 hr following their application. Sp. flocculosa was a faster colonizer, sporulating profusely on the fungus in less than 24 hr. Scanning electron microscopy observations revealed that the antagonists killed the host conidia and conidiophores before the mycelium. All three antagonists acted by causing a rapid and complete collapse of invaded parts but never appeared to penetrate the host conidia or mycelium. It is hypothesized that a toxin is involved in their mode of action. Both Sporothrix spp. were able of epiphytic growth which could make them suitable for use in a preventive program.

ECOLOGICAL SURVEY OF ARMILLARIA IN NEW YORK STATE. James T. Blodgett. 403 Illick Hall, State University of New York, College of Environmental Science and Forestry, Syracuse, New York 13210.

Armillaria is a complex of species which has caused much confusion in the past. The differences of their host species, levels of pathogenicity, and site preferences may be explained by the complex of species previously referred to as Armillaria mellea. A statewide investigation was conducted to: 1) identify species, 2) determine distributions, 3) determine host relationships, 4) determine pathogenicity, and 5) determine soil and stand site preferences of Armillaria in New York. Six species have been identified. Preliminary results indicate that some of the species can be distinguished by soil and forest type preferences.

CHARACTERIZATION OF GRAPE LEAFROLL ASSOCIATED CLOSTEROVIRUS (GLRaV) SEROTYPE II AND COMPARISON WITH GLRaV SEROTYPE III. D. Boscia*, J.S. Hu**, D. Golino***, and D. Gonsalves**. *Centro di studio sui virus e le virosi delle colture mediterranee, C.N.R., 70100 Bari, Italy, ** Dept. of Plant Pathology, Cornell University, NYSAES, Geneva, NY, 14456, USA, *** Dept. of Plant Pathology, University of California, Davis, CA 95616, USA.

A specific polyclonal antiserum was produced against an isolate (CA-5) of GLRaV serotype II. The antiserum was used to detect the virus with ELISA, ISEM and Western Blotting. CA-5 was compared with an isolate (NY-1) of GLRaV serotype III. The two isolates were serologically distinct as shown by ELISA and ISEM. The coat protein molecular weight of CA-5 was 36 K daltons as determined by Western Blot. The same result was obtained with samples purified from four different isolates of serotype II. In a sample infected with a mixture of GLRaV serotype II and III, using a combination of antisera, different molecular weights of the coat proteins of the two serotypes were observed. However, dsRNA analysis showed identical molecular weight of the major bands of GLRaV serotype II and III.

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ISOLATION AND PARTIAL CHARACTERIZATION OF A LINEAR dsDNA PLASMID FROM RHIZOCTONIA SOLANI ANASTOMOSIS GROUP 2-2. T. D. Cavileer, B. I. Hillman, and J. L. Peterson. Dept. of Plant Pathology, Cook College, New Brunswick, NJ 08903.

A 3.1 kb linear dsDNA plasmid was isolated from *R. solani* anastomosis group 2-2 and was designated pRHS29. Analysis was performed with 16 restriction enzymes. Digestion products of HindIII and Sau3A were inserted into pGEM3Zf(+) and transformed into *E. coli* strain DHS-alpha competent cells. ³²P labeled pRHS29 and recombinant plasmids hybridized with native plasmid but not with genomic DNA. Cloning of pRHS29 fragments obtained from digestion with HindIII resulted in clones with several size class inserts (1.2, 1.8, and 2.7 kb). End structure of the native plasmid was investigated using alkali denaturing and subsequent reannealing, proteinase K treatments, and digestion with lambda exonuclease or exonuclease III, but results were inconclusive. No morphological differences were observed between isolates containing plasmids and other isolates of AG 2-2.

SYMPTOM EXPRESSION AND DISEASE SEVERITY OF YELLOWS-INFECTED WHITE ASH TREES AND EFFECTS OF OXYTETRACYCLINE (OTC). B. Cha and T. A. Tattar. Shade Tree Lab., Dept. of Plant Pathology, University of Massachusetts, Amherst, MA. 01003.

Fifty white ash (*Fraxinus americana*) in West Springfield, MA., naturally infected with ash yellows (AY) MLO were observed monthly, 9/86-8/89. Symptoms were witches-broom (WB), foliar chlorosis (CHL), deliquescent branching (DB), tufting (TF), premature spring bud break (PSB), and premature autumn coloration (PAC). Every August each tree was rated for: decline in less vs. more than half the crown. All symptoms except PSB and PAC differed in these two groups. In the 1/2 group, incidence of WB, CHL, and TF increased each year, but DB, PSB, and PAC did not. MLO was verified by DAPI staining. In twigs, both groups showed more MLOs in summer than winter; in roots, conversely. MLO population was more stable in roots than in twigs. Fifteen AY-infected white ashes were injected twice with 4% OTC using Mauguet trunk injection [ave. 0.8 g a.i./tree]. MLO population decreased in the 30 days following OTC injection, then increased to the control level.

ISOLATION AND CHARACTERIZATION OF SIDEROPHORE(S) PRODUCED BY THE BROWN-ROT FUNGUS GLOEOPHYLLUM TRABEUM. Vikas Chandhoke, Jody Jellison, and Frank A. Fekete, Univ. of ME, Orono, ME 04469 and Colby College, Waterville, ME 04901.

Siderophore(s) were isolated from the liquid culture supernatant of the brown-rot fungus *Gloeophyllum trabeum*. Fungus was grown on an iron deficient media for four to six weeks. Harvesting age was determined by monitoring the level of siderophore secretion by Chrome azural-S assay at regular intervals during the growth period. The culture supernatant collected after filtering was concentrated by evaporating it under vacuum. The concentrated supernatant was further purified by passing it through an ultrafiltration unit using a 1000 MW cut-off membrane, and a polymeric adsorbent XAD-4 column. The purified supernatant was subjected to ethyl acetate extraction and the compounds were subsequently separated by TLC. The UV-VIS scans of the isolated compounds showed a single peak in the UV range. The changes in the peak upon addition of iron corresponded with those recorded for the standard siderophore Dihydroxybenzoic acid and other similar compounds.

HISTOPATHOLOGY OF PHYTOPHTHORA CINNAMOMI IN CRANBERRY ROOTS. L. P. Chang, E. H. Varney, and J. L. Peterson. Plant Pathology, Rutgers University, New Brunswick, NJ 08903.

Phytophthora cinnamomi was recently shown to cause dieback in cranberry growing in northeastern United States. The histopathology of this fungus was studied on Early Black cranberry seedlings inoculated with either zoospores or mycelium. Zoospores encysted mainly on the root elongation region and near wounds, germinated and produced appressoria. Hyphae from the appressoria penetrated the epidermis at the cell wall junctions or through wounds and then entered the cortex both inter- and intracellularly. After colonization of the epidermis and cortex the hyphae penetrated the sieve tubes and parenchyma cells of the phloem but not the vessel elements. When roots were inoculated with mycelium, few appressoria were observed but mycelial constriction occurred at the infection point. Swollen hyphae and chlamydospores formed in the epidermal and cortical cells of roots more readily when inoculated with mycelium than with zoospores.

INTEGRATED PEST MANAGEMENT PROGRAM FOR STRAWBERRIES. Daniel R. Cooley and Sonia G. Schloemann, Dept. of Plant Pathology,

University of Massachusetts, Amherst, MA 01003.

Two years ago, we started an IPM program in strawberries designed to optimize pest management and minimize applications of pesticides near harvest. We concentrated on three problems: gray mold (*Botrytis cinerea*), tarnished plant bug (*Lygus lineolaris*) and two-spotted mites (*Tetranychus urticae*). To manage *Botrytis*, we advised using a spray program which focused applications during bloom, and experimented with approaches for inoculum eradication and biocontrol. Insect and mite pesticide application advice was based on action thresholds, and we experimented with mite biocontrol. In the first year, IPM fields had 34% fewer fungicide and 35% fewer insecticide applications than non-IPM fields. While modified fungicide scheduling was effective against *Botrytis*, biocontrol practices were not. Introducing and enhancing endogenous mite predators for mite management was very effective. No miticides were recommended in either year. IPM growers have not generally applied pesticides from a 2 week period before harvest in either year.

AN IN VITRO SYSTEM TO STUDY THE ROLE OF TOXIC METABOLITES PRODUCED BY *PYTHIUM ULTIMUM*. H. A. Crevier, M.-C. Chagnon, H. Désilets, and R. R. Bélanger. Dép. de phytologie-FSAA, Université Laval, Québec, G1K 7P4.

Four cultivars of geranium were tested in vitro to assess the role of toxic metabolites released by two strains of *Pythium ultimum*. Calli of each cultivar were exposed to different concentrations of partially purified culture filtrates of both strains. The sensitivity of the calli was expressed as dehydration, browning, and poor growth of the cells. Expression of the symptoms increased as culture filtrate concentrations increased. Growth reduction expressed on a dry weight basis was as high as 67% for the most sensitive cultivar. Characteristic cultivar and strain responses were observed. These results suggest that toxic metabolites produced by *P. ultimum* are involved in the pathogenicity of the fungus. Efforts are currently underway to regenerate surviving cells exposed to toxic metabolites to determine if somaclones thus produced have increased resistance to the fungus in vivo.

FUNGI ASSOCIATED WITH MUSHROOMS FROM RETAIL STORES AND FARMS SUPPLYING RETAIL STORES. F. E. Davenport and P. J. Wuest. Dept. of Plant Pathology, Penn State Univ., University Park, PA 16802.

Fungi were isolated from *Agaricus bisporus* sporophores collected periodically from retail outlets and farms between June 1988 and July 1989. Mushroom quality was visually assessed prior to isolations made from beneath the cap surface onto malt agar amended with the bactericide Bronopol. Mushrooms collected at farms were incubated for 1, 4 and 8 days at 14°C before tissue blocks were plated. Fungi isolated included: *Geotrichum* sp., *Verticillium fungicola*, *Penicillium* spp., *Trichoderma* spp. and *Mucor* spp. Significantly more *Geotrichum* sp. was isolated from retail outlet mushrooms in the winter than in the summer. The frequent occurrence of this fungus was unexpected; its source is being investigated. *Verticillium fungicola* was isolated more frequently from mushrooms collected at retail outlets in the summer than the winter. A larger array of fungal genera were recovered in the summer than in the winter. Pathogenicity tests using selected fungal isolates are under way. The impact of fungi on postharvest quality remains to be ascertained.

SURVIVAL OF COLLETOTRICHUM LINDEMUTHIANUM IN DRY BEAN DEBRIS. H. R. Dillard, Dept. of Plant Pathology, NYS Agr. Expt. Station, Cornell University, Geneva, NY 14456

Pods and seeds of 3 bean cultivars either naturally infected or inoculated with *C. lindemuthianum* (CL) were sealed in nylon pouches and placed 0, 10, and 20 cm deep in soil on 11/14/88. The pouches were retrieved at regular intervals through the spring of 1989. CL was isolated from tissue pieces on modified Mathur's agar in March but was below detectable levels from April onward. Samples collected in July were incubated in sterile water for 24 hr and the liquid was atomized on bean plants in the greenhouse. Mild anthracnose symptoms developed on leaves after 7 days, and CL was isolated from symptomatic tissue. In a separate study, samples of pods and seeds of cv. Isabella from a commercial field (planted 6/88) were collected in Jan, March, and May of 1989. CL was isolated on agar medium from samples collected in Jan and March, but not in May. CL was detected in tissue collected in May when a bean plant bioassay was used. Prior to this study, CL was considered unable to overwinter in New York.

SCREENING OF COMMERCIAL CULTIVARS OF RIBES SPP FOR SUSCEPTIBILITY TO *CRONARTIUM RIBICOLA*. A.E. Dorrance and D.R. Bergdahl, Vermont Dept. of Agriculture, Montpelier, VT 05602 and School of Natural Resources, University of Vermont, Burlington, VT 05405.

Eighteen cultivars of gooseberries and currants (*Ribes* spp) were initially inoculated in the field with a mass collection of aeciospores of *Cronartium ribicola* (white pine blister rust). Five leaves were randomly collected from each cultivar on July 13 and analyzed for percent of leaf area infected. The percentages of leaf infected for each cultivar were: Welcome, 50%; Red Jacket, 40%; Green Hansa, 28%; Poorman, 26%; Wilder, 20%; Champion, 20%; Pixwell, 15%; Canada-0273, 14%; Spinefree, 14%; Whitesmith, 10%; Friedl, 9%; Red Lake, 6%; Jumbo, 4%; Cherry, 4%; White Currant, 3%. The cultivars Consort, Coronet and Crusader had no infection which conforms to previous reports. These infection values along with urediniospore and teliospore development information possibly could be used as a basis to recommend cultivars of gooseberries and currants for planting by gardeners and small fruit growers in Vermont's white pine blister rust hazard zones.

RESPONSE OF FIELD GROWN ASPARAGUS TO ROCK SALT. W. H. Elmer, Department of Plant Pathology and Ecology, The Connecticut Agricultural Experiment Station, Box 1106, New Haven, CT 06504.

Rock salt (NaCl) was applied to two established asparagus (cv. Mary Washington) plantings started with 1-yr-old crowns. At Site 1 (1-yr-old field) five replicate plots (2.7 m²) were treated with 0 or 1120 kg/ha of NaCl, and 112 kg/ha of either Ca(NO₃)₂ or NH₄NO₃. At Site 2 (4-yr-old field) four replicate plots (9.0 m²) were treated with 0, 560, 1120 or 2240 kg/ha of NaCl together with 112 kg/ha of Ca(NO₃)₂. One half of the amendments were applied in April and the other half in July, in 1987, 1988 and 1989. Marketable spear weights were significantly increased by NaCl at both sites in 1989. At Site 1, yields were greater when NaCl was combined with NH₄NO₃ rather than with Ca(NO₃)₂. At Site 2, greatest yields were obtained from the 560 kg/ha rate of NaCl. Rock salt treatments decreased root colonization by *Fusarium* spp. and increased colonization by fluorescent *Pseudomonads*.

ESTIMATING THE EFFECT OF AGGREGATED PLANT DAMAGE ON CROP YIELD. Francis J. Ferrandino, Department of Plant Pathology and Ecology, The Connecticut Agricultural Experiment Station, Box 1106, New Haven, CT 06504.

Many plant pathogens and herbivorous insects cause spatially aggregated damage to plants. In many cases, yield is not linearly related to plant damage and variability can have an important effect on yield prediction. It is possible to improve upon yield estimates based solely on mean plant damage by accounting for variability in damage in the analysis. A method is presented in which total yield from a nonhomogeneously damaged field is expressed using the first three terms of a Taylor series expansion of the yield-severity relation. In this way, both mean damage and the variation about the mean are used to estimate yield. A number of theoretical and experimental examples (late blight defoliation of potatoes and nematode damage on tobacco) are presented to help clarify the application of the method.

TIMING POST-INFECTION FUNGICIDE APPLICATIONS TO SIMULTANEOUSLY CONTROL POWDERY MILDEW AND BLACK ROT OF GRAPE. David M. Gadoury and Roger C. Pearson, Department of Plant Pathology, Cornell University, NYSAES, Geneva, NY 14456.

Rain is required for release of ascospores of *Uncinula necator*, the primary inoculum for grape powdery mildew (PM) in NY. Rain also releases ascospores of the black rot (BR) pathogen, *Guignardia bidwellii*, and is required for primary infection. The release of primary inoculum for PM and BR occurs during a 6-8 week period after bud break. We assumed that rain in excess of 2.5 mm and temperatures above 10 C constituted a PM infection period and rain in any amount could initiate a BR infection period if temperatures and leaf wetness duration were favorable. Post-infection sprays were applied within 6 days of PM infection periods, and within 3 days of BR or combined PM & BR infection periods. In 1988 and 1989, the first infection period was followed by an application of triadimefon or myclobutanil. Subsequent applications were made following rain that occurred after an assumed 14-21 day period of fungicidal protection had elapsed, until berries reached 5% sugar in late summer in 1988, or until ascospores of *U. necator* and *G. bidwellii* were no longer detected in early summer in 1989. Two to three post-infection sprays controlled PM and BR as well as 6 protectant sprays on several cultivars.

BARLEY YELLOW DWARF VIRUS CONCENTRATIONS IN LEAVES AND CROWNS OF WINTER OAT SEEDLINGS PRIOR TO WINTER HARDENING. E. E. Gildow and D. P. Livingston, Dept. of Plant Pathology and USDA Pasture Lab., Pennsylvania State University, University Park, PA 16802

Five cultivars and five lines of winter oats were inoculated with the PAV isolate of BYDV seven days after planting. Seedlings were grown singly in 2.5 x 11.5 cm plastic tubes containing an artificial mix watered with half-strength Hoagland's solution and maintained in a growth chamber with a 12 hr photoperiod. Three weeks after inoculation seedlings were divided into

leaf and crown tissue and tested by enzyme-linked immunosorbent assay to determine PAV distribution. Results indicated significant differences in PAV among cultivars and lines. Ranked highest to lowest based on PAV/gm f.w. crown tissue were Norline, PA-409, Fulghum, PA-457, PA-287, Wintok, Winter Turf, PA-39, Brooks, and PA-40. Ranking based on leaf PAV content was similar. It is hypothesized that BYDV influences crown tissue metabolism, development, and freezing tolerance.

DETECTION OF TOMATO RINGSPOT VIRUS IN NATURALLY INFECTED APPLE TISSUE BY ELISA AND DOT BLOT HYBRIDIZATION. J. M. Halbrecht, C. A. Powell, A. Hadidi, and J. N. Cummins. The Pennsylvania State University, Fruit Research Laboratory, P. O. Box 309, Biglerville, PA 17307-0309.

'Delicious' Seedling and EMLA 106 rootstocks (resistant and tolerant to Tomato Ringspot Virus (TmRSV), respectively) were naturally infected with TmRSV using three population levels of viruliferous *Xiphinema rivesi*. Root, bark and leaf tissue were assayed for TmRSV by ELISA, Dot Blot Hybridization (DBH), and *Chenopodium quinoa* after four and nine weeks of nematode feeding. After four weeks, TmRSV was detected by DBH in root tissue from 5 of 12 EMLA 106 at high and moderate nematode levels but not at the low nematode level nor in any of the seedling plants. After nine weeks, DBH detected virus in roots and leaves of EMLA 106 and in roots of seedlings at all nematode levels. Two anomalous seedlings were also positive for TmRSV in leaf tissue, one each at the high and moderate nematode levels. ELISA and mechanical inoculation to *C. quinoa* failed to reliably detect TmRSV in all tests.

EFFECT OF PRUNUS NECROTIC RINGSPOT VIRUS ON PEACH TREE GROWTH AND CYTOSPORA CANKER DEVELOPMENT. J. M. Halbrecht, C. A. Powell and R. Shaffer. The Pennsylvania State Univ., Fruit Research Lab, P.O. Box 309, Biglerville, PA 17307-0309.

'Lovell' peach seedlings were budded with either virus-free or Prunus Necrotic Ringspot Virus (PNRSV) infected budwood in 1985. In 1987, 20 healthy and 20 virus-infected trees were identified by ELISA and 10 trees of each were subsequently inoculated with Cytospora canker in 1988. Trunk cross-sectional area (CSA) data showed no significant differences between treatments in 1987. CSA from 1988, however, showed healthy trees to be significantly larger than all others (p = .05). Cytospora-infected trees were significantly larger than PNRSV-infected trees but there were no differences between PNRSV alone or PNRSV plus Cytospora treatments. Terminal lengths were not significantly different between treatments. Cankers on PNRSV-infected trees tended to be larger than from virus-free trees but were not significantly different. All PNRSV-infected trees showed tattered leaves but virus-free leaves were normal.

STABILITY OF METALAXYL RESISTANCE IN FIELD ISOLATES OF *PHYTHIUM APHANIDERMATUM*. L. Hirayama and P.L. Sanders, Dept. of Plant Pathology, Penna. State Univ., University Park, PA 16802.

Single zoospore isolates from metalaxyl-sensitive and metalaxyl-resistant field isolates of the homothallic Oomycete, *P. aphanidermatum*, were screened for metalaxyl resistance by comparing colony counts on 0, 2, and 50 ppm metalaxyl amended CMA. No segregation of metalaxyl resistance was detected in the 6 sensitive isolates (ca. 10⁶ zoospores per isolate) or the 5 resistant isolates screened, indicating an absence of heterokaryosis with respect to metalaxyl sensitivity levels. Crosses between resistant and sensitive single zoospore isolates were attempted on greenhouse-grown perennial ryegrass. Zoospore suspensions from infected grass foliage were plated onto selective medium amended with 0, 2, and 50 ppm metalaxyl to determine the metalaxyl sensitivity levels of the F1 progeny from the crosses. No intermediate sensitivities were detected suggesting an absence of outcrossing between resistant and sensitive isolates. These results suggest that metalaxyl sensitivity is stable in the isolates of *P. aphanidermatum* tested.

GENETIC MOSAICS IN AMERICAN BEECH: PATTERNS OF RESISTANCE AND SUSCEPTIBILITY TO BEECH BARK DISEASE. David R. Houston and Daniel B. Houston, USDA Forest Service, 51 Mill Pond Road, Hamden, CT 06514 and OARDC, Wooster, OH 44691.

Beech bark disease (BBD) occurs when bark of *Fagus* spp., infected by *Cryptococcus fagisuga*, is infected and killed by *Nectria* spp. Some trees (<1%) remain free of scale/Nectria and often occur in nonrandom groupings. Starch gel electrophoresis of 8 polymorphic isozymes from dormant buds has shown that such resistant (R) trees are often closely related, arising as ramets of a clone from root sprouts, as half- or full-sibs, or all of these. Similar relationships occur for susceptible (S) members of the beech population. Knowing the genotypes, ages and distributions of R and S trees within stands, forests, and regions allows us to determine patterns of occurrence and path-

ways of dispersal for traits such as R or S. Understanding how forests are thus compartmented into genetic mosaics is helping generally to explain patterns of insect and disease outbreak and specifically in the design of management plans to enhance levels of BBD resistance.

MOLECULAR CLONING OF COMPLEMENTARY DNA OF SQUASH MOSAIC VIRUS. J. S. Hu, B. L'Hostis, C. Kearney, R. Provvienti, and D. Gonsalves, Department of Plant Pathology, Cornell University, NYSAES, Geneva, NY 14456

Complementary DNA (cDNA) of the middle-component RNA (ca. 4.2 kb) of the melon strain of squash mosaic virus (SqMV) was synthesized by reverse transcriptase with oligo dT as primer. Double stranded cDNA was then produced by the RNase H method of Gubler and Hoffman. The double stranded cDNA was fractionated by sucrose gradient centrifugation, ligated to Eco RI linkers, and cloned into pUC18. Seventy-five clones with inserts ranging in size from 0.8 to 3.3 kb were obtained. Sequence specificity of insert DNA was confirmed by Southern blot hybridization using SqMV single stranded cDNA as probe. Coat proteins of the virus were purified and digested with V8 proteinase. Fragments of the digested coat proteins were purified by HPLC and sequenced. Using the deduced nucleotide sequence, oligonucleotides were synthesized for identification of the coat protein genes from the clones. Mapping and sequencing of a 3.3 kb clone, that hybridizes with the coat protein oligonucleotide probe, is in progress. The coat protein genes will be used to transform melons for transgenic cross protection.

ROSE MOTTLE SYNDROME: 2. ELECTRON MICROSCOPY OF AFFECTED FOLIAGE. H. W. Israel, S. Warsi, and R. K. Horst. Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

Foliage of *Rosa dilicta* 'Royalty', of *R. dilicta* 'Forever Yours' and 'Love Affair', the parent lines of 'Royalty', and of *R. odorata* and *R. manetti*, the understock of 'Royalty', was examined by transmission electron microscopy for cytological evidence of disease. Samples were taken from mature and immature plants grown at 21 C, 27 C, or 31 C that were symptomatic or asymptomatic for rose mottle syndrome. Ultrastructural features exclusive to 'Royalty' and prominent in symptomatic older foliage grown at 31 C included: i) severe sieve cell occlusion and obliteration; ii) unique and distinctive mitochondrial crystals in mesophyll and phloem parenchyma tissues; iii) abundant chloroplast starch; iv) aggregated inclusions of long flexuous viruslike particles in conductive phloem; and v) large, crystalline vacuolar inclusions in palisade mesophyll cells. These preliminary observations may implicate a viral etiology for rose mottle syndrome.

RECOVERY OF TOBAMOVIRUSES FROM FORESTED WATERSHEDS IN THE ADIRONDACK MOUNTAINS. V. Jacobi and J.D. Castello. SUNY College of Environmental Science and Forestry, Syracuse, NY 13210.

This research was conducted to develop a rapid screening method for detecting plant viruses in forested ecosystems. Water samples were collected in spring and summer, 1989 from streams draining deteriorating and non-deteriorating red spruce stands on Esther and Catamount Mts., respectively, and from Taylor Pond in the Adirondack Mts. Each 20 l sample was concentrated to 1 ml by filtration through Zeta Plus 50S membranes followed by high speed centrifugation. TEM revealed characteristic tobamovirus particles which were then transmitted to *Chenopodium quinoa*. Based on host range and serological testing, three different isolates have been recovered, none of which are serologically related to our tobacco mosaic virus isolates. Long flexuous rods and icosahedral particles were also detected by TEM in a water concentrate from Taylor Pond, but these have not been transmitted to herbaceous hosts.

CONTROL OF PHYTOPHTHORA BLIGHT OF PEPPERS BY INJECTION OF METALAXYL THROUGH DRIP IRRIGATION. S. A. Johnston, Rutgers R&D Center, R.D. #5, Box 232, Northville Rd., Bridgeton, NJ 08302

A field study was conducted to evaluate the efficacy of soil fumigants either applied through drip irrigation, if water soluble, or applied by chisel injection into the soil prior to bedding, if nonwater soluble; a nonionic adjuvant (Induce) drench after transplanting; and a preplant incorporated application of a chitin amendment (Clandosan) on the control of Phytophthora blight of peppers. Half of each plot received 3 applications of metalaxyl (4.7 l/ha) through drip irrigation 0, 30, and 60 days transplanting. The experiment was arranged in a split plot design with 4 replications. There were no significant differences among the various treatments in the incidence of Phytophthora blight or in yield. However, metalaxyl resulted in a 42 and 35% reduction in disease 41 and 73 days after transplanting, respectively. Additionally, metalaxyl re-

sulted in a 113% increase in yield compared to the nonmetalaxyl treated area and a 56% increase in yield/healthy plant.

EVALUATION OF PLANTING DATE AND FUNGICIDES FOR THE MANAGEMENT OF EYESPOT OF WINTER WHEAT IN NEW YORK. D. W. Kalb and G. C. Bergstrom, Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

Delayed planting, seed treatment with triadimenol (40 ml Baytan 30F/45 kg), and foliar applications of benomyl (2.2 kg Benlate 50WP/ha) were tested for their efficacy in control of eyespot caused by *Pseudocercospora herpotrichoides*, in a wheat field with a history of severe disease. Delayed planting (5-Oct) significantly reduced disease by 64, 68, and 15% at tillering, flag leaf emergence and soft dough respectively, compared to the recommended planting date (15 Sep). Fall or spring application of benomyl reduced disease by 80-90% when assessed at tillering and flag leaf emergence, and by 38% at soft dough. Triadimenol reduced eyespot at tillering and flag leaf emergence but not at soft dough. Fungicides had no effect on yield of wheat sown 5-Oct. Yield of plants sown 15-Sep was increased by treatment with triadimenol plus fall or spring benomyl, or by fall benomyl alone.

IDENTIFICATION OF FUSARIUM SPP. ASSOCIATED WITH CORN (ZEA MAYS L.). K. Kaul, J. E. Ayers, and P. E. Nelson, Dept. of Plant Pathology, Pennsylvania State University, University Park, PA. 16802.

Corn cultivar Pioneer 3780 was sampled from the 6-8 leaf growth stage to maturity to determine the time of infection by *Fusarium* spp., and the lag period for symptom development. Nodes, ears, and silks were sampled and *Fusarium* spp. were isolated by placing surface and internal tissue on PCNB media. In 1987, *Fusarium* spp. were not isolated prior to tasseling. A total of 435 cultures were isolated and consisted of 27% *E. equiseti*, 16% *E. proliferatum*, 15% *E. graminearum*, 14% *E. sporotrichioides*, 11% *E. subglutinans*, 6% *E. moniliforme*, and 5% *E. crookwellense*. The remaining 6% consisted of *E. oxysporum*, *E. poae*, *E. semitectum*, *E. acuminatum*, and *E. avenaceum*. The majority of *Fusarium* spp. were isolated when silks were 1-2 cm long through the mid- to late-dough stage. Three corn cultivars sampled in 1988 reflected similar results. Symptoms were observed on only two corn ears in both years indicating the fungus may be present in a plant with no symptoms. No specific time of infection was determined.

INHERITANCE OF RESPONSE OF POPULUS TREMULOIDES TISSUE CULTURE PLANTLETS TO BIOASSAYS OF TOXIC METABOLITES OF HYPOXYLON MAMMATUM. B. M. Kruger and P.D. Manion, College of Environmental Science and Forestry, SUNY. 13210.

P. tremuloides tissue culture plantlets derived from both vegetative buds and seed were bioassayed with culture filtrates of *H. mammatum* to determine if progeny response could be predicted from that of the parents. Seven plantation grown *P. tremuloides* (2 female, 5 male) differing in response to natural inoculum were crossed in all possible combinations. Bioassays, using three metabolite sources on plantlets derived from five parents and three seeds of each of seven families, indicated that metabolite sensitivity of parent affected progeny response. However, the progeny response could not be consistently predicted from that of the parents. The gradation in sensitivity of plantlets to the bioassay, the inconsistency of parent to progeny response and that several toxic metabolites may be present in the culture filtrates suggest a complex inheritance of metabolite sensitivity.

DISEASE INCIDENCE IN LOWBUSH BLUE LUEBERRY PRUNED BY MOWING OR BURNING. David H. Lambert, Dept. of Botany and Plant Path., Univ. of Maine, Orono, ME 04469.

Severity of mummy berry disease (*Monilinia vaccinii-corymbosi*) increased 90-fold in a mowed plot relative to its companion burned plot over a 12-year (6-crop) period. With paired plots established in a previously mowed field, a return to burning reduced disease 6-fold by the second crop. These and interim data indicate that mowing increases mummy berry disease 2-3 fold per crop in a compound manner, and that a return to light burning reduces disease at a similarly gradual rate. Mowing did not increase incidence of powdery mildew (*Microsphaera vaccinii*) or red leaf disease (*Exobasidium vaccinii*). Fruit from these plots were also surveyed as indicators of disease. *Alternaria* fruit rot was twice as common in the mowed plots as in the burned plots. For those fungi which also infected stems and/or leaves, fruit infection by *Glomerella cingulata* (anthracnose) was more prevalent (2-fold) in mowed plots while fruit infections by *Gloeosporium minus* and *Botrytis cinerea* were not.

TAXONOMY OF STREPTOMYCETES CAUSING POTATO SCAB. David H. Lambert, Dept. of Botany and Plant Path., Univ. of Maine,

Orono, ME 04469 and Rosemary Loria, Dept. of Plant Path., Cornell Univ., Ithaca, NY 14853

Four types of streptomycetes cause potato scab. The name *Streptomyces scabies* (Thaxter) Lambert and Loria has been officially revived for the major incitant, which has spiral chains of grey spores and uses raffinose. Removed from the species is a second diverse group with wavy spore chains which includes the previous neotype and several standard strains. A third distinct, acid-tolerant, raffinose-type with white-red spores has been named *S. acidiscabies*. The fourth group, of presumably unrelated strains, causes a superficial "russet scab". The first three, more virulent groups are taxonomically distant from each other, implying their separate evolution as pathogens. Pathogens and saprophytic streptomycetes found in scab lesions are able to degrade a wide range of host wall and cell components. An independent development of pathogenicity in diverse species suggests that few additional metabolic abilities are needed for saprophytes to become scab pathogens.

THE INFLUENCE OF SOIL PH, CALCIUM LEVEL AND NITROGEN FORM ON FUSARIUM WILT OF TOBACCO. J. A. LaMondia and T. M. Rathier, The Connecticut Agricultural Experiment Station, P. O. Box 248, Windsor, CT 06095.

The influence of pH, calcium, and nitrogen nutrition on Fusarium wilt of broadleaf tobacco was examined in factorial greenhouse and outdoor pot experiments. Plants were grown for 8 wk in *Fusarium oxysporum* infested (0.06 to 2.0×10^4 CFU/cm³) soil mixes amended with dolomite, gypsum, sodium bicarbonate, or nothing to result in low or high pH (4.1 to 4.2 or 5.7 to 7.0, respectively) and low or high levels of available calcium. Plants were fertilized with equivalent amounts of nitrogen (NH₄/NO₃ ratios of 100/0; 75/25; 50/50; 25/75; or 0/100). Plant fresh weight was increased and wilt severity was decreased at high calcium rates, especially at high pH's. Plants fertilized with nitrate as the predominant nitrogen source had increased fresh weight and decreased wilt severity, especially at low pH's.

SURVEY OF SUMMER PATCH DISEASE ON GOLF COURSES IN NEW JERSEY AND SURROUNDING AREAS. P.J. Landschoot and B.B. Clarke, Pennsylvania State University, University Park, PA 16802 and Rutgers University, New Brunswick, NJ 08903.

Fifteen golf courses in Southeastern New York, New Jersey and Southeastern Pennsylvania were surveyed to gain information on factors that influence the severity of summer patch disease. Information collected from both diseased and non-diseased turf included the fungus species present, the turf species affected, thatch depth, soil and thatch pH, soil nutrient content, organic matter content and parasitic nematode populations. Results showed that both mating types (A and a) of *Magnaporthe poae* Landschoot and Jackson were isolated most frequently from diseased turf. Summer patch affected *Poa annua* L. on all courses sampled. Only one course showed symptoms on *Agrostis* sp. Thatch depth, soil and thatch pH, soil nutrient content, organic matter content, and parasitic nematode populations were not significantly correlated with disease severity.

INCORPORATION OF MYCELIAL BIOMASS AND SCLEROTIAL FRAGMENTS OF THE BIOLOGICAL CONTROL AGENT *TYPHULA PHACORRHIZA* IN ALGINATE PELLETS. M.B. Lawton and L.L. Burpee, Dept. of Environmental Biology, University of Guelph, Guelph, Ontario N1G 2W1.

Isolates of *Typhula phacorrhiza* suppress *Typhula* blight of creeping bentgrass. A potential delivery system was developed for this antagonist by incorporating mycelial biomass or 1, 2, or 4% w/v sclerotial fragments of isolate T011 into alginate pellets. Pellets were formulated with corn meal or wheat hearts as bulking agents, and calcium gluconate or calcium chloride as gellants. Viability of the pelleted antagonist was assessed before drying pellets for 48 hr at 23 C, immediately after drying, and 1, 2, 4, 8, 12, 16, and 32 wks after storage at -10 and 23 C. Viability was determined by the growth of mycelium from the pellets after 4 wks incubation on BASM agar at 1 C. Drying prior to storage decreased the viability of sclerotial pellets by 28 to 79%; while viability of mycelial pellets remained at 100%. Storage of pellets at -10 C prolonged pellet viability after all periods of storage. Type of bulking agent or gellant had no effect on viability of pellets. Viabilities of pellets increased as the concentration of incorporated sclerotial fragments increased, but viability of pellets containing 4% w/v sclerotial fragments was lower than that of pellets formulated with mycelial fragments.

EFFECTS OF *PYTHIUM* SPECIES ON THE GROWTH OF SUGARCANE IN PATHOGENICITY TESTS AND FIELD SOIL. Youn Su Lee, Dept. of Plant Pathology, University of Massachusetts, Amherst, MA. 01003.; J. W. Hoy, Department of Plant Pathology and Crop Physiology, Louisiana State Univ., Baton Rouge, LA 70803.

Isolates of *Pythium arrhenomanes* were highly virulent to sugar-

cane (*Saccharum officinarum*) cultivar CP 70-321. Root rot severity, caused by *Pythium arrhenomanes*, was not significantly affected by the addition of *P. spinosum* or *P. irregulare*. Isolates of *P. spinosum* and *P. irregulare* and the combined effects of the two species had varied effects on sugarcane. Significant reductions in shoot and root weight resulting from root rot occurred following inoculation with both species. *Pythium arrhenomanes* was the most frequently isolated species from plants that exhibited severe root rot symptoms and significant growth reductions as a result of being grown in soil amended with sugarcane field soils.

CARBOHYDRATES IN WINTER OAT CROWNS INFECTED WITH BARLEY YELLOW DWARF VIRUS. D.P. Livingston III and F.E. Gildow. USDA Pasture Research Lab and Dept. Plant Pathology, Penn State Univ., Univ. Park, PA 16802.

One week old seedlings of two winter oat cultivars, Wintok and Fulghum, and an experimental line PA-40 were infected with the RPV isolate of BYDV. Plants were grown 5 wks at 16C and then grown for 3 wks at -3C (hardening), which promotes carbohydrate accumulation. Carbohydrates were extracted with ethanol/water and analyzed by HPLC. No significant difference was found in total crown carbohydrate between infected and non-infected plants. However, the concentration of larger fructans (degree of polymerization (DP) 3) was significantly reduced in infected plant crowns, while DP3 fructan, and simple sugars were significantly increased. Results suggest that BYDV infection alters fructan metabolism; these effects may influence winter survival and subsequent spring regrowth.

AN OZONE EFFECTS MONITORING PROGRAM FOR CLASS I WILDERNESS AREAS IN NEW ENGLAND. W. J. Manning and J. D. Bergman, Dept. of Plant Pathology, and G. C. Smith, Dept. of Forestry and Wildlife Management, Univ. Massachusetts, Amherst, MA., 01003.

An ozone (O₃) effects monitoring program was developed for the Lye Brook Area in the Green Mountains National Forest in Vermont and the Great Gulf and Presidential-Dry River Area in the White Mountains of New Hampshire. O₃ is monitored continually from 1 June through 30 September at a site on a slope of Mt. Equinox and at the base of Mount Washington. Bel-W3 and Bel-B tobacco (*Nicotiana tabacum*) plants are evaluated weekly at each site for O₃ injury. Black cherry (*Prunus serotina*), red spruce (*Picea rubens*), and white ash (*Fraxinus americana*) seedlings are grown for the season at each site in two open-top chambers with carbon filters, two without carbon filters, and two chamberless ambient air plots to determine O₃ sensitivity and growth effects. Surveys are conducted in each area to determine incidence of O₃ injury symptoms on all classes of indigenous vegetation. Injury occurs at both sites.

EFFECT OF ETHEPHON AND DROUGHT ON CONTAINERIZED *PINUS RESINOSA* SEEDLINGS. S.F. Maynard, Botany & Plant Path., and W.H. Livingston, Forest Biology, Univ. Maine, Orono 04469

A factorial design was used to evaluate the effects of ethephon (0, 25, 75 ppm), an ectomycorrhizal fungus (+/-), *Fusarium subglutinans* (Wollenw.) (Reinking) Toussoun and Marasas (+/-), and drought (+/-) on growth of *Pinus resinosa* Ait. (24 treatments, 49 seedlings/treatment). Two week old seedlings were inoculated via soil with both fungi. Eight weeks later, weekly drenches of ethephon began and continued for 13 weeks. Water was then withheld from one-half of the seedlings for 13 days, when the controls (ethephon=0 ppm) visibly wilted. Watering and ethephon treatments then resumed for 4 weeks, and the seedlings were harvested. *Fusarium* produced no disease or other effect in the experiment. Ethephon at 25 and 75 ppm decreased (P<0.01) cumulative length of first order lateral roots by 14% and 43%, respectively. Ethephon and ectomycorrhizae decreased branching and total root length (no ectomycorrhizae: 11.2, 5.2, 2.1 m for 0, 25, 75 ppm; ectomycorrhizae: 7.2, 3.3, 1.6 m). Ethephon increased the thickness of the roots (0.8, 1.7, 3.6 mg/cm). Drought resulted in mortality (30%) in the controls (ethephon=0 ppm) only. Ethephon treatments alter root growth of containerized red pine resulting in improved drought resistance.

PATHOLOGICAL ANATOMY OF SCOTS PINE NEEDLES INFECTED BY *CYCLANEUSMA MINUS*. S. G. Mikel and W. Merrill, Dept. of Plant Pathology, Penn State University, University Park, PA.

Infected, symptomless needles of *Pinus sylvestris* collected in mid-September contained sparse intercellular hyphae of *Cyclaneusma minus* closely appressed to the walls of scattered groups of discolored mesophyll cells. Epithelial parenchyma in some resin ducts was partially degraded. By November, when infected needles were chlorotic and the characteristic transverse brown bars had developed, the mesophyll had collapsed totally, phloem cells were breaking down, and epithelial parenchyma of the resin ducts had disintegrated. Hyphae were abundant throughout the transfusion tissue and the remnants of the mesophyll. Where fruiting bodies began to develop within the bar-

red areas, hyphae aggregated initially in the substomatal chambers. Pycnidia formed directly under stomata. Apothecia developed below the hypodermis, pushing up the hypodermis and epidermis, and crushing the underlying remnants of the mesophyll.

RELATIONSHIPS OF *Colletotrichum graminicola* INOCULUM LEVELS, MAIZE ONTOGENIC STAGE AND WOUND PREDISPOSITION TO ANTHRACNOSE STALK ROT. A. Muimba-Kankolongo and G.C. Bergstrom, Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

Stalks of maize hybrids Cornell 281 and CM174 x LB31, susceptible and resistant to anthracnose stalk rot (ASR), respectively, were inoculated with a 1 ml suspension of 10^2 , 10^4 , 10^6 , or 10^7 *Colletotrichum graminicola* conidia/ml. Inoculation was into a wound in the internode above the brace roots at mid-whorl or anthesis stages, and immediately or 6 hr after stalk wounding. Less ASR developed in CM174 x LB31 at each inoculum level, ontogenic stage and time interval. Inoculation of the two hybrids at anthesis and directly after wounding resulted in the most severe ASR at each level of inoculum. The results indicate that genotypic, ontogenic, and "wound healing" resistance in maize each are expressed even when maize stalks are exposed to *C. graminicola* inocula as high as 10^7 conidia/ml.

APPLICATION OF TOP-DRESSINGS AMENDED WITH COMPOSTS AND ORGANIC FERTILIZERS FOR THE SUPPRESSION OF BROWN PATCH (*Rhizoctonia solani*) ON A CREEPING BENTGRASS PUTTING GREEN. E.B. Nelson and C.M. Craft, Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

Top-dressings formulated with mixtures of sand and various composts or organic fertilizers were applied to two creeping bentgrass putting greens in 1989 to evaluate the effectiveness of organic matter amendments in controlling brown patch. Formulations consisted of 70% fine sand and 30% organic component (v:v) and were applied at the rate of 400 $\text{cm}^3/0.8 \text{ m}^2$ plot. Top-dressings were applied at monthly intervals and plots evaluated for disease severity prior to each application. Top-dressings amended with either organic fertilizers composed of plant and animal meals or with certain composted animal manures, sewage sludges, or leaves significantly reduced brown patch severity over untreated plots. Organic fertilizers composed of plant and animal meals as well as composts prepared from turkey manure were as effective as repeated fungicide applications in reducing brown patch severity.

USE OF DISEASE-SUPPRESSIVE TOP-DRESSINGS FOR THE CONTROL OF DOLLAR SPOT (*Sclerotinia homoeocarpa*) ON A CREEPING BENTGRASS PUTTING GREEN. E.B. Nelson and C.M. Craft, Department of Plant Pathology, Cornell University, Ithaca, NY 14853

Top-dressings formulated with sand:organic matter mixtures (70:30; v:v) were applied to a creeping bentgrass putting green in 1988 and 1989 to evaluate their effectiveness in suppressing dollar spot. A suppressive microflora was introduced into top-dressings either as complex microbial mixtures found in composted organic wastes and plant and animal meals or as individual bacterial strains isolated from various plant sources. In experiments with individual bacterial strains, populations of select strains were monitored over the course of the experiment using rifampicin-resistant derivatives of parental strains. Top-dressings prepared from mixtures of plant and animal meals (Ringer Corp.), or a corneal sand preparation of *Enterobacter cloacae* (EcCT-501) significantly suppressed dollar spot development as compared to untreated plots. In some experiments, strains of *E. cloacae* were as effective as iprodione in reducing dollar spot severity. Top-dressings formulated with composts prepared from nearly all sewage sludges, animal manures, leaves, or brewery waste were ineffective in suppressing dollar spot. Initial populations of bacterial strains applied in a corneal sand top-dressings were established at levels of 10^7 - 10^9 CFU/g dry wt of thatch in both 1988 and 1989 and remained at high levels for up to 13 wk.

EVALUATION OF FUSARIUM MONILIFORME AND FUSARIUM NYGAMAI FROM MILLET AND SORGHUM SEED BY ISOZYME ANALYSIS. Nwanma B. Onyike, P. E. Nelson, and C. D. Therrien, Dept. of Plant Pathology, The Pennsylvania State University, University Park, PA 16802.

Fusarium moniliforme and *F. nygamai*, isolated from millet and sorghum seed, were toxigenic in a duckling bioassay, and are characterized by formation of slightly sickled-shaped macroconidia, and oval- or club-shaped microconidia in chains. *Fusarium nygamai* differs by producing chlamydoconidia. This study was designed to elucidate the relationship between these two species of *Fusarium*. Mycelial plugs of single conidial cultures of *F. nygamai* and *F. moniliforme* were grown in potato dextrose yeast broth at 25 °C for 7d in the dark. Mycelial mats of these cultures were recovered by vacuum filtration and homogenized for 3 min in 1.5 ml Tris-EDTA buffer (pH 6.8) with ice bath cooling. Horizontal starch gel electrophoresis of the enzyme extracts of the two fungi were performed in different buffer systems. Electrophoretic patterns of 11 enzymes extracted from *F. moniliforme* and *F. nygamai* cultures were similar, suggesting a close relationship between these two species.

COMPARISON OF THE HOST RANGE AND ECONOMIC IMPORTANCE OF GLOBODERA SOLANACEARUM (OCN) AND GLOBODERA TABACUM (TCN). W. W. Osborne, International Agricultural Institute (IAI), Inc. South Boston, VA 24592

Globodera solanacearum (Miller and Gray 1972) Behrens 1975 is named the Osborne's cyst nematode (OCN). The OCN occurs only in Virginia and one location in North Carolina. *Globodera tabacum* (Lownsbery and Lownsbery 1954) Behrens, 1975 is named the tobacco cyst nematode (TCN). The TCN occurs only in Connecticut, Massachusetts, and Bulgaria. The OCN and TCN differ greatly in host range, pathogenicity and morphology. The TCN prefers weed hosts, *Solanum nigrum* and *Solanum burbankii*. Research shows the TCN, by itself, is of little importance on tobacco and tomato. TCN hosts that are non-hosts of the OCN are: *Capsicum frutescens*, *Nicotiana glauca*, *Nicotiana longiflora*, *Nicotiana repanda*, *Nicotiana rustica*, *Physalis angulata*, *Nicandra physaloides*, and *Nicotiana glutinosa*. The OCN prefers economic crops such as tomato, tobacco, and eggplant as hosts and causes losses in excess of fifty percent in each of these crops.

VERIFICATION OF A HOST-PATHOGEN INTERACTION IN RESISTANT ALFALFA INFECTED WITH *VERTICILLIUM ALBO-ATRUM*.

B.W. Pennypacker, K.T. Leath and R.R. Hill, Jr. Penn State Univ. and USDA-ARS U.S. Pasture Lab, Univ. Park, PA 16802.

Verticillium albo-atrum was previously reported to reduce the growth and flowering of resistant alfalfa cultivars. However, inoculation of the heterogeneous populations comprising alfalfa cultivars and subsequent loss of susceptible plants may have resulted in differences due to genotype, rather than to host-pathogen interactions. Therefore, two resistant clones were stubble inoculated with *V. albo-atrum* and controls with water. Height, # of internodes and stems, leaf, stem and aerial biomass, and flowering were assessed after 12 wks., then weekly for 6 wks. The study was repeated and the data pooled. Height, flowering, and stem, leaf and aerial biomass were reduced in inoculated clones--evidence of a host-pathogen interaction. Thus, the reduced growth and flowering reported in inoculated, resistant cultivars was due in part, to a host-pathogen interaction.

BIOLOGICAL CONTROL OF FUSARIUM WILT IN CHINA ASTER WITH CHITIN AND CHITINOLASTIC BACTERIA. S. E. Pfister and J. L. Peterson. Department of Plant Pathology, Rutgers University, New Brunswick, NJ 08903.

Chitinoclastic bacteria, antagonistic to *Fusarium oxysporum* f. sp. *calistephi*, were isolated from soil. Chitin (Clandosan 618) was mixed with *Fusarium* infested field soil at 0.1, 0.2 and 0.4% (w/w), and placed in 4-inch peat pots. Twenty milliliters of the bacterial suspension (6.4×10^8 cfu/ml) were added to each Clandosan containing pot. Two weeks later China aster (cult. Single Rainbow) seeds were then planted in each pot. Bacteria-infested, chitin-infested, infested, and noninfested soil control treatments were also included. At flowering time disease in the 0.4% Clandosan-bacteria treated plants was significantly less (37%) than in the infested soil control plants, but not significantly different from the noninfested control plants. The two lower Clandosan-bacteria rates reduced the disease only 17%. Disease was not significantly reduced when chitin or bacteria alone were added.

IMPACT OF INOCULUM CONCENTRATION AND SELECTED FUNGICIDES ON THE DEVELOPMENT OF SUMMER PATCH IN BARON KENTUCKY BLUEGRASS. K.A. Plumley, B.B. Clarke and P.J. Landschoot, Department of Plant Pathology, Cook College, New Brunswick, NJ 08903

An evaluation of the impact of inoculum concentration and selected fungicides on the development of Summer Patch (*Magnaporthe poae* Landschoot and Jackson) was conducted at the Rutgers University Turf Research Farm in North Brunswick, NJ. One year old Baron Kentucky bluegrass was inoculated at a depth of 2 cm with three concentrations of oat grain inoculum. Each plot (1x3 m) received one of forty fungicide treatments which included experimental and registered compounds. The treatments were replicated six times in a complete randomized block design. They were applied at four week intervals with a CO₂ compressed air sprayer. Inoculum concentration was positively correlated with visual symptom development. This effect was masked by compounds which delivered high levels of control, but was apparent in treatments where control was less than adequate. Fungicide rate was negatively correlated with disease development. Timing, formulation and combinations of fungicides were found to influence efficacy. Benomyl (Tersan 1991), cyproconazole, fenarimol (Rubigan), propiconazole (Banner), terbuconazole (Lynx) and triadimefon (Bayleton) controlled Summer Patch at the inoculum concentrations tested.

GLOBODERA ROSTOCHIENSIS JUVENILE EGRESSION RATES FROM RESISTANT AND SUSCEPTIBLE CULTIVARS. Porter, L. L., and Horst, R. K. Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

Prior work (J. Nematol. 20:335) indicated a significantly larger mean number of *Globodera rostochiensis* second-stage juveniles (J2s) exiting roots of a resistant potato cultivar than from its susceptible counterpart. These cultivars differed in the presence or absence of a single, dominant resistance gene. In this study, several other potato cultivars were evaluated for expression of this same resistance mechanism. To measure J2 egression, roots of three-week old plants were washed 48 h after inoculation with ca. 1500 J2s of *G. rostochiensis*. Standard volumes were collected after an additional 48 h, and J2s counted for each plant sample. As in the earlier work, cultivars with the resistance gene exhibited a significantly greater exodus of J2s 96 hr post-inoculation. J2 egression associated with cultivars possessing the resistance gene provides an explanation for low cyst production, the *G. rostochiensis* resistance criterion presently used.

REACTIONS OF WINTER BARLEY CULTIVARS TO BARLEY YELLOW DWARF VIRUS INFECTION. M. L. Risius, and F. E. Gildow, Dept. of Agronomy and Dept. of Plant Pathology, Pennsylvania State University, University Park, PA 16802.

Five winter barley cultivars, Pennco, Venus, Wysor, Maury, and Barsoy, were infested with aphids carrying the PAV isolate of barley yellow dwarf virus (BYDV) to evaluate reactions of the cultivars to this isolate. Field plots were established at two locations and plants were infested at the two-leaf stage in the fall. Grain yield reductions attributable to BYDV were significant for Barsoy and Maury at both locations. Averaged over locations, percentage reductions were 52 and 38%, respectively, for Barsoy and Maury. Pennco and Venus were least affected by BYDV. Kernel weight reductions due to BYDV were significant for Barsoy and Maury in Centre County but not significant in Lancaster County. The number of spikes per unit area was reduced by BYDV in Centre County. In Lancaster County, the reduction in number of spikes per unit area was significant for Barsoy but not for the other four varieties.

THE NUCLEAR DNA CONTENT, MATING TYPE AND METALAXYL SENSITIVITY OF FIFTY-THREE ISOLATES OF PHYTOPHTHORA INFESTANS FROM POLAND. D. L. Ritch, Dept. of Human Biol., Univ. of Wisconsin, Green Bay, WI; L. J. Spielman, Dept. of Plant Pathology, Cornell Univ., Ithaca, NY; L. Sujkowski, Inst. for Potato Research, Mluchow, Rozalin, Poland; and C. D. Therrien, Depts. of Biol. and Plant Pathology, Penn State Univ., University Park, PA.

The recent appearance of the A2 mating type and metalaxyl resistance in Western Europe has prompted an investigation of the population of *P. infestans* in Poland for these characters. Analysis of the nuclear DNA content of 53 Polish isolates shows that the population is similar to that of Western Europe in ploidal structure. Furthermore 15% of the isolates collected during the 1988 blight season were metalaxyl resistant, whereas none isolated in 1986-1987 were resistant. Also, a single isolate of the A2 mating type was among the thirty-three 1988 isolates. Preliminary isozyme data, coupled with ploidy, mating type and metalaxyl resistance data suggest a Western European origin of isolates with these characters.

INCIDENCE AND MBC-SENSITIVITY OF *PENICILLIUM AURANTIOGRISEUM* FROM APPLE PACKINGHOUSES. D. A. Rosenberger, V. A. Korjagin, and S. M. Rondinaro, NY State Agric. Exp. Sta., Cornell University, Box 727, Highland, NY 12528.

Three hundred sixty-eight isolates of *Penicillium* were recovered from water dumps in four apple packinghouses. The 343 isolates pathogenic to apples were identified to species and tested for sensitivity to methyl 2-benzimidazolecarbamate (MBC) and diphenylamine (DPA). Sixty-five isolates were *P. expansum*, 277 were *P. aurantio-griseum*, and one was *P. dendriticum*. Thirty-one isolates of *P. expansum* were sensitive to MBC, 27 were MBC-resistant but DPA-sensitive, and 7 were resistant to both MBC and DPA when tested *in vitro*. Ninety-five percent of the 277 isolates of *P. aurantio-griseum* were resistant to both MBC and DPA. *P. aurantio-griseum* was recovered in large numbers on all five monthly sampling dates (November to March) whereas 74% of the *P. expansum* isolates were recovered in November and December. In a postharvest test in which wounded apples were inoculated and stored at 2.2 C for 80 days, *P. expansum* caused twice the decay-incidence observed with MBC-sensitive *P. aurantio-griseum* and four times the incidence observed with MBC-resistant *P. aurantio-griseum*. A pre-storage treatment of benomyl plus DPA provided commercially-acceptable control of decays caused by all *P. aurantio-griseum* and *P. expansum* except those isolates of *P. expansum* that were resistant to both MBC and DPA in our *in vitro* tests.

REDUCED SUMMER SPRAY PROGRAMS FOR CONTROLLING SOOTY BLOTCH AND FLYSPECK ON APPLES. D. A. Rosenberger, F. W. Meyer, and S. M. Rondinaro, NY State (Geneva) Agric. Exp. Sta., Box 727, Highland, NY 12528.

Sprays were applied in two Golden Delicious orchards to evaluate residual activity of fungicides against sooty blotch and flyspeck (SBFS), apple diseases caused by *Gloeodes pomigena* and *Zygophiala jamaicensis*, respectively. Fungicide treatments for apple scab were terminated during the first week of June. In 1988, test fungicides were applied with a handgun on June 18 and Aug. 3 in orchard A and on June 20 and Aug. 5 in orchard B. Disease incidence was evaluated by collecting 25 fruit from each plot 40, 50, and 60 days after the August sprays. Fruit were evalu-

ated for SBFS immediately after they were harvested and again after they had been held in the lab at 20 C and 100% RH for 17-20 days. Despite heavy summer rainfall (8.73 inches between June 23 and Aug 2), mean incidence of SBFS over the three harvest dates was <5% for treatments involving mancozeb or metiram (120-180 µg/ml), 5-12% for benomyl (15-30 µg/ml) used alone, and >85% for unsprayed controls. We conclude that two summer applications of mancozeb or metiram used at appropriate rates will provide adequate protection against SBFS in southeastern New York. Growers who have been applying summer sprays every 2-3 weeks for SBFS should be able to eliminate one or two summer sprays each season by taking advantage of the long residual activity of mancozeb and metiram.

PRESYMPTOM ERADICATION OF SOOTY BLOTCH AND FLY SPECK ON APPLES. D. A. Rosenberger, S. M. Rondinaro, and F. W. Meyer. NY State (Geneva) Agric. Exp. Sta., Cornell University, Box 727, Highland, NY 12528.

Laboratory and field tests were conducted to evaluate the eradication activity of benomyl against sooty blotch and flyspeck, apple diseases caused by *Gloeodes pomigena* and *Zygophiala jamaicensis*, respectively. In lab tests, detached Delicious fruit were inoculated with conidia and mycelial fragments, incubated at 20 C and 100% RH, dipped into fungicides at varying intervals after inoculation, and evaluated for symptoms 17 days after inoculation. Benomyl applied one, four, and seven days after inoculation provided 93, 76, and 35% control, respectively, for sooty blotch and 65, 34, and 22% control for flyspeck. In a field test, replicated treatments were applied Sept. 14 to Delicious apple trees with fruit just beginning to show flyspeck symptoms. Fruit harvested just prior to and 20 days after treatment were evaluated for visible symptoms at harvest and again after either 17-20 days incubation at room temperature or after 40 and 90 days storage at 2 C. Development of existing sooty blotch infections was arrested both by the Sept. 14 application of benomyl and by storage at 2 C. However, neither the benomyl treatment nor cold storage arrested development of flyspeck. In a separate trial with Golden Delicious fruit, development of both sooty blotch and flyspeck was reduced but not completely arrested when fruit were stored at 2 C.

VELVETLEAF (*ABUTILON THEOPHRASTI*), POTENTIAL INOCULUM RESERVOIR OF *VERTICILLIUM* SPP. PATHOGENIC TO CROPS. W. E. SACKSTON and L. A. WYMORE, Department of Plant Science, Macdonald College of McGill University, 2111 Lakeshore Road, Ste. Anne de Bellevue, Que., H9X 1C0, Canada.

Velvetleaf (*Abutilon theophrasti*) was successfully inoculated by root dip (RD) and by injection by hypodermic needle (HI) with an isolate of *Verticillium dahliae* from sunflower (*Helianthus annuus*) and with three isolates of *V. albo-atrum* from alfalfa (*Medicago sativa*). Plant elongation was reduced initially by HI inoculation with all four isolates, but recovered. Plants inoculated by RD did not recover to the same extent from initial growth retardation except for those in the *V. dahliae* series. The respective pathogens were reisolated from plants inoculated by HI, and from about half of the plants inoculated by RD. Velvetleaf possibly could serve as an inoculum reservoir for *Verticillium* isolates pathogenic to crops. This is apparently the first report of infection of velvetleaf by *V. albo-atrum* virulent on alfalfa.

BEHAVIOR OF *PYTHIUM* SP. IN A FLOOD AND DRAIN SUBIRRIGATION SYSTEM. Soumaila Sanogo and Gary W. Moorman. Department of Plant Pathology, Pennsylvania State University, University Park, PA. 16802.

Species of the genus *Pythium* cause major diseases in greenhouse crops grown in recirculating hydroponic systems. There are no reports of *Pythium* sp. spreading or causing crops losses in the drain and flood (or ebb and flow) subirrigation system. Trials are underway to determine the behavior of *Pythium aphanidermatum* and *P. ultimum* in such a system. Preliminary experimental results indicate that *Pythium* sp. can be transported via recirculated nutrient solutions in greenhouse grown cucumber (*Cucumis sativus* L.) and geranium (*Pelargonium hortorum* L.H. Bailey).

WHEAT SEED INFECTION BY AND SEED TRANSMISSION OF *Pyrenophora tritici-repentis*. A. M. C. Schilder and G. C. Bergstrom. Department of Plant Pathology, Cornell University, Ithaca, NY 14853-5908.

Pyrenophora tritici-repentis, incitant of tan spot of wheat, was isolated from 32% of the seed in a New York winter wheat seed lot collected in 1986. A salmon-pink pigment, associated with 88% of the infected seed, was useful in the identification of the fungus. In an *in vitro* seedling symptom test, shoot length and total plant weight were reduced in infected seedlings. Other symptoms included necrotic upper roots and numerous small necrotic lesions on the coleoptile. Similar symptoms were observed on seedlings grown in field soil from infected seed in the greenhouse. Surface sterilization of seeds did not reduce the percentage of infection. In a small plot field experiment, control of seedborne inoculum with triadimenol (Baytan) seed treatment resulted in a slight reduction in tan spot severity compared to untreated plots.

PREMATURE NEEDLE DROP AND SYMPTOMS ASSOCIATED WITH BROWN SPOT NEEDLE BLIGHT ON *PINUS STROBUS* IN NORTHCENTRAL PENNSYLVANIA. Glen Stanosz, PA Dept. Environ. Resources, Bur. of Forestry, Div. of For. Pest Mgmt., 34 Airport Dr., Middletown, PA 17057.

Scattered *Pinus strobus* in northcentral Pennsylvania dropped previous-year needles during shoot elongation in 1987 and 1989. These needles had chlorotic tips, bases, or both, or necrotic tips; losses varied within crowns and was generally light. On symptomatic needles, acervuli were often present in light brown bands with borders that remained green. Acervuli, spores, and cultures derived from spores were identified as *Lecanosticta acicola* (Thüm) H. Sydow, the cause of brown spot needle blight which severely damages hard pines in the southern U.S. and Lake States. Brown spot needle blight of *P. strobus* has been reported rarely and *L. acicola* had been identified only once previously in Pennsylvania, on *P. rigida*. This fungus should be considered, along with other biotic agents, as a potential cause of premature loss or damage to *P. strobus* foliage.

CHRYSANTHEMUM PHLOEM NECROSIS: SEROLOGICAL DETECTION. M. S. Szyniel, J. R. Hogue, R. K. Horst, H. W. Israel, and E. M. Paduch-Cichal. Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

Polyclonal antisera were developed to the mycoplasma-like organism (MLO) associated with chrysanthemum phloem necrosis (CPN), a disease of florists' chrysanthemum. MLO-enriched root preparation of diseased *Dendranthema grandiflora* 'Pink Marble' was used as antigen for immunizing BALB/c mice. Antisera were tested by dot-immunobinding assay following cross absorption with root preparation of healthy 'Fanfare' (no healthy 'Pink Marble' available) and antibody precipitation with sodium sulfate. Positive serological reactions were observed with roots of diseased 'Pink Marble'. Immunosorbent electron microscopy of 'Pink Marble' root preparation revealed immunological recognition of bodies with optically dense cores resembling those observed in diseased roots *in situ*. These antisera will be useful for immunological studies of CPN.

SPATIAL DISTRIBUTION AND TEMPORAL EVOLUTION OF *FUSARIUM OXYSPORUM RADICIS-LYCOPERSICI* IN HYDROPONIC SYSTEMS IN GREENHOUSE TOMATO. J. Thériault, A. Gosselin and D. Dostaler, Département de phytologie, Université Laval, Québec (Québec), Canada G1K 7P4.

The effect of initial inoculum concentrations (10^2 , 10^3 and 10^4 microconidia \cdot ml $^{-1}$) on temporal evolution and spatial distribution of *Fusarium oxysporum radicum lycopersici* (FORL), the causal agent of crown and root rot of greenhouse tomato (cv. Perfecto), was monitored in three hydroponic systems: nutrient film technique (NFT), rockwool and peatmoss. A significant interaction inoculum concentration X hydroponic systems was found. In NFT, FORL was not recovered two days after inoculation for the three initial concentrations. In further samplings, cfu varied erratically in NFT. For rockwool, a constant gap was maintained between the treatments with 10^3 - 10^6 cfu/g 10 weeks after surface inoculation of the substrate. Population decrease or increase was found in peatmoss, for a final cfu= 10^4 -g after 10 weeks, no matter the initial concentrations. In rockwool and peatmoss, ten weeks after inoculation, a gradient (10^4 and 10^2 cfu respectively) of the fungal population was found. In rockwool and peatmoss, light symptoms were limited to the roots near the surface of the substrates; in NFT, no typical lesion was observed.

MATING TYPE, NUCLEAR DNA CONTENT AND ISOZYME COMPOSITION OF THIRTY-THREE ISOLATES OF PHYTOPHTHORA INFESTANS FROM JAPAN. C. D. Therrien and S. S. Daggett, Depts. of Biol. and Plant Pathology, Penn State Univ., University Park, PA; D. L. Ritch, Dept. of Human Biol., Univ. of Wisconsin, Green Bay, WI; N. Sato, Hokkaido Natl. Agric. Expt. Station, Sapporo, Japan; L. J. Spielman, Dept. of Plant Pathology, Cornell Univ., Ithaca, NY; and P. W. Tooley, USDA-ARS, Ft. Detrick, Frederick, MD.

The two mating types of *P. infestans* exist in a 1:1 ratio in Northern Japan. Mean nuclear DNA values for these isolates vary from 0.84 arbitrary units (a.u.) to 1.46 a.u., with a mean value of 1.10 a.u. Inasmuch as diploid isolates have a mean DNA values of approximately 0.55 a.u., all isolates are polyploid. The fact that the isolates are polyploid and of both mating types suggest that they are of European rather than Mexican origin. Results of isozyme analyses suggest that genetic recombination is not occurring within this population. This observation is consistent with the concept that polyploidy may act as a barrier to sexual reproduction in nature.

A PRELIMINARY SURVEY OF SCARLET OAK INFECTED WITH *CRYPHONECTRIA PARASITICA* (Murr.) Barr IN PENNSYLVANIA. M.L. Torsello, B.L. Nash, D.D. Davis, and J.M. Skelly, Dept. of Plant Pathology, The Pennsylvania State University, University Park, PA 16802.

The presence of *Cryphonectria* cankers and associated "butt swell" on scarlet oak was surveyed in 24 oak stands (14

counties) located across the host's geographic range in Pennsylvania. Twenty of these stands contain symptomatic trees, eighteen of which had trees with signs of *Cryphonectria*. Only small amounts of fungal fruiting were detected using a 10x hand lens in the field. Microscopic examination (45x) revealed greater numbers of perithecial stromata and isolated perithecia. Stem flow samples were collected diluted and plated onto Difco potato dextrose agar. Subsequent colonies of *C. parasitica* indicated viable propagules were present. These isolates produced typical virulent cankers when inoculated into American chestnut. Infected white oak (4 counties) and post oak (1 county) were also found during the survey. Fruiting on white oak appears to be less frequent than on scarlet oak.

EFFECTS OF FUNGICIDE SPRAY REGIMES ON DISEASE CONTROL AND DEVELOPMENT OF DICARBOXIMIDE RESISTANCE IN *BOTRYTIS CINEREA*. R.J. Valli and G.W. Moorman, Department of Plant Pathology, Pennsylvania State University, University Park, PA 16802.

Control of *Botrytis cinerea* on geranium and the development of resistance to vinclozolin were evaluated on leaf discs. Discs were inoculated with a mixture of conidia from resistant and sensitive strains (0.2% resistant). After 10 days, conidia were collected, assayed for resistance, and used to inoculate new leaf discs. Vinclozolin provided 10% control after 4 generations, but resistance reached 100% by the second generation. Chlorothalonil and cupric hydroxide provided 50-70% control and did not promote resistance (<30%). Effective control was achieved with a mixture of vinclozolin + chlorothalonil. Vinclozolin + cupric hydroxide provided better control than vinclozolin alone, however resistance developed. Alternate applications of vinclozolin and chlorothalonil, or vinclozolin and cupric hydroxide provided partial control, although resistance still developed. Spore production varied and did not correlate with disease development. Fitness parameters (sporulation, growth rate, virulence, and sclerotia formation) and sensitivities to five fungicides did not differ for the resistant and sensitive strains.

ROSE MOTTLE SYNDROME: 1. SYMPTOMATOLOGY AND ENVIRONMENTAL EFFECTS. S. Warsi, R. K. Horst and H. W. Israel. Department of Plant Pathology, Cornell University, Ithaca, NY 14853.

Rosa dilecta 'Royalty' is the premier commercial hybrid tea red rose in the USA. Prolonged periods of high temperature lead to the development of commercially undesirable characteristics in this cultivar, collectively termed Rose Mottle Syndrome. Symptoms include chlorosis, mottling, and mosaic of adaxial leaf surfaces, necrotic lesions of stems, sepal distortion, and abnormal development of floral heads. In cuttings of 'Royalty' grown on its own rootstock, the minimum exposure necessary for onset of symptoms is five consecutive days at 27 C. Expression of symptoms can be delayed by high light intensity, optimal nutrition, and high humidity. However, such suppression is readily overcome by even higher temperatures. These observations have led to an investigation for a possible causal agent for rose mottle syndrome.

PSEUDOMONAS CICHORII LEAF SPOT OF *CALATHEA PICTURATA* 'ARGENTEA'. R. L. Wick and Robin Shrier. University of Massachusetts, Suburban Experiment Station, 240 Beaver St., Waltham, MA 02154.

Several blighted specimens of *Calathea picturata* C. Koch & Lin. 'Argentea' were received in the Plant Disease Diagnostic Lab, at Waltham, MA. The foliage had numerous brown lesions which ranged in size from several mm to several cm and were angular in shape. Bacteria were consistently associated with lesions as determined by light microscopy. Bacterial isolates from diseased tissues that were fluorescent on King's medium B were identified as *Pseudomonas cichorii* (Swingle) Stapp by Lopat tests (---+), their inability to utilize geraniol, benzoate, cellobiose, sorbitol, trehalose, sucrose, D-tartrate, D-arabinose, L-rhamnose, and their ability to utilize mannitol and M-tartrate. Koch's postulates were successfully completed by spray inoculating bacteria onto needle-wounded foliage. Lesions developed only at wounds. *Calathea picturata* 'Vanderheckei' and *Calathea vittata* Koern also developed lesions following inoculation whereas *Calathea zibrina* Lindl. did not.

EFFECT OF CHRONIC OZONE EXPOSURE ON GROWTH OF HYBRID POPLAR AND ITS SUSCEPTIBILITY TO SEPTORIA CANKER. P. B. Woodbury, J. A. Laurence¹, G. W. Hudler. Dept. of Plant Pathology, Cornell University, Ithaca, NY 14853 and ¹Boyce Thompson Institute for Plant Research, Tower Rd., Ithaca, NY 14851.

Cuttings of hybrid poplar (DN 34) were grown in pots in open-topped chambers at Ithaca, NY, during 1988. Charcoal-filtered air was blown into each chamber, and ozone was added to provide a concentration of 0.5, 1, or 2 times the ambient ozone level for 8 to 12 hr/day for 112 days

of the growing season. Shallow wounds were made into the bark tissue with a hypodermic needle and inoculated with either an aqueous suspension of conidia of *Mycosphaerella populorum* or sterile water on September 1 and 2. Ozone significantly decreased leaf retention time and stem growth, but increased leaf initiation and the incidence of canker induction by *M. populorum*. We conclude that ozone levels in the Northeast may predispose hybrid poplar to canker diseases.

EFFECT OF BLACK DOT (BD) DISEASE ON POTATO TUBER DEVELOPMENT AND POTENTIAL CONTROL WITH SEED PIECE TREATMENTS. T. A. Zitter and D. E. Halseth, Departments of Plant Pathology and Vegetable Crops, Cornell University, Ithaca, NY 14853.

Incorporation of a spore suspension of *Colletotrichum coccodes* into pots filled with sterile Cornell mix and planted with disease-free plantlets of the varieties Chippewa, Hampton, and Green Mountain resulted in extensive disease consisting of discoloration and rotting of roots and stolons and a reduced number of tubers. Tuber surfaces were discolored and were occasionally predisposed to bacterial soft rot, especially for Hampton. When whole Monona tubers naturally infected with high (70% or more surface area affected) or low (40% or less surface area affected) levels of BD were treated with four fungicides (CGA 455, TOPS + PCNB, TBZ + PCNB or TOPS), no significant differences in days to emergence, shoot

number or height were noted. Levels and number of discolored tubers set were highest when treated with TOPS followed by TBZ + PCNB and TOPS + PCNB. CGA 455 provided excellent control on tubers.

ULOCLADIUM LEAF SPOT OF CUCUMBER IN NEW YORK. T. A. Zitter and L. Hsu. Department of Plant Pathology, Cornell University, Ithaca, NY 14853

A leaf spot disease of cucumber occurred in commercial fields in western NY and in breeding plots near Ithaca during August and September 1988. Immature lesions were dark brown and measured 1-2 mm in diam. Mature lesions on the lower leaves of fruit-bearing plants typically had beige centers, a surrounding dark brown ring and a circular brown halo measuring 6-7 mm in diameter. *Ulocladium cucurbitae* and *Alternaria alternata* were consistently isolated from these lesions. In greenhouse inoculations only *U. cucurbitae* induced lesions similar to those observed in the field. *A. alternata* could colonize *U. cucurbitae*-produced lesions. Lesions developed on *U. cucurbitae*-inoculated Poinsett cucumber leaves after a 24 hr moist chamber treatment. Both lesion number and size increased with longer incubation. *U. cucurbitae* has previously been isolated from breeding plots in NY, but this is the first report of the disease in commercial fields in the United States.

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