2004 Northeastern Division Meeting Abstracts

Abstracts presented at the APS Northeastern Division meeting in State College, Pennsylvania, October 6–8, 2004. The abstracts are arranged alphabetically, by first author's name.

Tuber Fusarium dry rot resistance in a diploid hybrid *Solanum phureja* × *S. stenotomum* population. C. R. BURKHART (1), B. J. Christ (1), and K. G. Haynes (2). (1) Dept. Plant Pathology, Penn State University, University Park, PA 16802; (2) USDA/ARS, Vegetable Lab, Beltsville, MD 20705. Phytopathology 95:S168. Publication no. P-2005-0001-NEA.

Fusarium dry rot on potato caused by *F. sambucinum* has become an economically important storage disease due to the prevalence of fungicide resistant pathogen strains. A diploid hybrid population of *S. phureja* × *S. stenotomum* was evaluated for dry rot resistance in the laboratory. Two-hundred and seventy six clones were inoculated with a mix of three *F. sambucinum* isolates by injecting 20 microliters containing about 10,000 spores (5.0×10^4 spores/ml) in an incision and incubating at 15°C, RH 90% for 40 days. The experimental design was a randomized complete block with 3 replications in four trials. Surface lesions and internal decay cavities along with total tuber width and depth were measured to determine the percentage by volume of internal decay per whole tuber. There were significant differences ($P = 0.05$) between clones for surface lesion size and internal decay cavity size. Some clones exhibited tuber resistance to dry rot. Resistant clones could be used to breed resistant potato varieties.

Ascospore maturation of *Schizothyrium pomi*, cause of apple flyspeck. D. R. COOLEY and A. F. Tuttle. Dept. of Plant, Soil & Insect Sci., Univ. of Massachusetts, Amherst, MA 01002. Phytopathology 95:S168. Publication no. P-2005-0002-NEA.

Flyspeck of apple is a key component of a summer blemish disease complex that is problematic on apples (*Malus* × *domestica* Mill.) in the eastern U.S. *Schizothyrium pomi* (Mont.:Fr.) Arx, the causal fungus, forms flat, circular ascocarps, thyriothecia, that group in colonies on waxy cuticles of a number of plants including apple. This study describes further development of a method to evaluate thyriothecium maturity, and growth and maturation of thyriothecia of *S. pomi* on one of its major, natural reservoir hosts, wild blackberry (*Rubus allegheniensis* Porter) in nature. On blackberry, maturation was driven primarily by temperature, as indicated by the highly significant coefficient of determination ($r^2 = 0.90$) of a model relating thyriothecium maturity to degree-days base 0°C from apple bud-break. A single discrete maturation period corresponded to the phenological development of McIntosh apples, from pink to early fruit development. This information in conjunction with existing methods for apple scab management could provide apple growers with guidelines for more efficient integrated management of flyspeck and other blemish diseases of apple.

Suppression of Fusarium wilt of cyclamen with bioantagonists and fungicides. M. DAUGHTREY and M. Tobiasz. Cornell University, Long Island Horticultural Research and Extension Center, Riverhead, NY 11901. Phytopathology 95:S168. Publication no. P-2005-0003-NEA.

Fusarium wilt caused by *Fusarium oxysporum* f. sp. *cyclaminis* is a devastating disease of cyclamen. Treatments to reliably protect commercial crops have not been identified. A 2004 study tested *T. harzianum* (PlantShield HC), *B. subtilis* (Companion, Rhapsody, and Premier Mix with Biofungicide), triflumizole (Terraguard), a phosphonate (Biophos), and combinations in which Biophos was used biweekly after a single bioantagonist treatment. Cyclamen plugs were potted 21 May. Companion and Premier Mix treatments were made only at planting; preinoculation treatments with other bioantagonists were made 26 May, followed by Biophos 24 hrs later in the combination treatments. On 14 June, pots were inoculated with *Fusarium* (0.5 ml of a slurry from a PDA culture) and biweekly drench treatments (0.5 pint/sq ft) were started. By 9 Aug, 75% of inoculated control plants were dead. Mortality was reduced to as low as 29% by Biophos (1% drench) combined with PlantShield (8 oz/100 gal) pretreatment; Terraguard (8 oz/100 gal) and Biophos alone were similarly effective, while other treatments showed no benefit.

Complete nucleotide sequence of a *Spiroplasma kunkelii* plasmid encoding an adhesin and Type IV secretion elements. R. E. DAVIS (1), E. L. Dally (1), Y. Zhao (1), R. Jomantiene (1,2), and J. Shao (1). (1) USDA-Agricultural Research Service, Beltsville, MD 20705; (2) Fitovirus Laboratory, Institute of Botany, Vilnius 2021, Lithuania. Phytopathology 95:S168. Publication no. P-2005-0004-NEA.

A 14.6 kbp cryptic plasmid, pSKU146, of *Spiroplasma kunkelii* CR2-3X, was cloned and sequenced. Potential protein coding regions (ORFs) were identified that encode proteins similar to virulence-associated proteins involved in cell-to-cell adhesion and conjugal DNA transfer. Putative proteins encoded by the ORFs include SkARP1, highly similar to the ScARP1 adhesin protein involved in attachment of *S. citri* to insect vector gut membrane, and proteins containing domains similar to those in proteins of the Type IV secretion system in pathogenic bacteria, suggesting that the spiroplasma possesses a related secretion system. Plasmid pSKU146 also contains two identical *ori* T-like regions, each containing a potential nick sequence identical to that in the IncP conjugative plasmid family. Features of pSKU146 suggest that the plasmid functions, or once functioned, as a mobile genetic element in conjugative transmission of spiroplasma pathogenicity-related genes.

Enhancing epidemics of *Puccinia punctiformis* on Canada thistle (*Cirsium arvense*) to achieve biological control. A. M. DEMERS (1), P. A. Backman (1), and D. K. Berner (2). (1) Dept. Plant Pathology, Penn State Univ., University Park, PA 16802; (2) USDA-ARS-FDWSRU, 1301 Ditto Ave., Ft. Detrick, MD 21702. Phytopathology 95:S168. Publication no. P-2005-0005-NEA.

Canada thistle (CT) is an introduced invasive weed in the U.S. and Canada and a key target of biological control efforts. *Puccinia punctiformis* is an endemic, autoecious rust that limits flowering and vegetative growth of CT. Systemic infections of CT root buds by rust basidiospores give rise to spindly, pale shoots that usually die after producing infective spores. The key to enhancing CT biological control is to increase teliospore-root bud contact to achieve a high incidence of systemically infected (SI) shoots and counterbalance disease escape through clonal growth. Experimental plots were set up to evaluate potential methods of enhancing systemic infection in CT patches. Late-season mowing enhanced dispersal of SI plant parts during a single season leading to a greater proportion of SI shoots. Furthermore, regrowth of systemically infected shoots may help overcome the monocyclic nature of the pathogen significantly magnifying disease spread. These strategies offer promise for successful biological control of CT.

Fusarium wilt of Hiemalis begonia caused by *Fusarium foetens*. W. H. ELMER (1), C. Vossbrinck (1), and D. M. Geiser (2). (1) The Conn. Agric. Expt. Sta., P. O. Box 1106, New Haven, CT 06504; (2) Pennsylvania State University, University Park, PA 16802. Phytopathology 95:S169. Publication no. P-2005-0006-NEA.

In August 2003 and March 2004, Hiemalis begonias (*Begonia* × *hiemalis* Fotsch) from different suppliers developed wilt symptoms in a commercial greenhouse in Connecticut. Affected stems collapsed and became covered with sporodochia of *Fusarium* sp. Conidia cultured on carnation leaf agar had profuse sporulation, minimal aerial mycelium, and the rare occurrence of polyphialides. A comparison of a partial sequence of the 1-alpha elongation factor gene showed a 100% match with isolates of *F. foetens*, a new species described in association with a new disease of Hiemalis begonias in Europe. Koch postulates have been satisfied on over 12 CT isolates. Heterokaryon tests showed that 13 isolates from Europe were all vegetatively compatible with each other and with 24 CT isolates. All Hiemalis cultivars tested so far are susceptible, but rex and angel wing begonias did not develop symptoms in inoculation tests.

Clumps, quadrats, and correlation for binary epidemics: Size really does matter. F. J. FERRANDINO. Dept. of Plant Pathology and Ecology, The CT Agric. Expt. Stat., New Haven, CT 06504. Phytopathology 95:S169. Publication no. P-2005-0007-NEA.

In the past decade, it has become common practice to pool mapped binary epidemic data into quadrats. The resultant "quadrat counts" are fitted to a probability distribution. The fact that there is an intrinsic dependence of such analyses on quadrat size and shape is well known. However, a clearcut exposition of the connection between the spatial properties of the two dimensional pattern of infected plants and the results of quadrat-based analyses is lacking. To examine this problem I stochastically generated a set of "mock epidemics" using Neyman-Scott cluster process. The resultant spatial point-patterns of infected plants have a fixed number of disease foci characterized by a monodisperse length scale and saturated to a known disease level. When quadrat samples of these "pseudo-epidemics" are fit to a beta-binomial distribution, the resultant measures of aggregation are most strongly dependent on the ratio of the length scale of the quadrat to the length scale of spatial aggregation and to a lesser degree on disease severity within individual foci.

Variation in the timing of ontogenic resistance against *Uncinula necator* in the USDA-ARS, PGRU *Vitis* germplasm collection. C. T. GEE (1,2), D. M. Gadoury (2), and L. Cadle-Davidson (1,2). (1) USDA-ARS, PGRU, Geneva, NY 14456; (2) Department of Plant Pathology, Cornell University, Geneva, NY 14456. Phytopathology 95:S169. Publication no. P-2005-0008-NEA.

Powdery mildew of grape (*Uncinula necator*) remains one of the most important diseases in the vineyard. Previous work by Gadoury and colleagues has shown that grape berries from selected cultivars of *Vitis vinifera* gain resistance much earlier than previously expected, typically within 20 days post anthesis. The goal of this research is to determine the variation in duration of ontogenic susceptibility within *Vitis* spp. To accomplish this, three rows with high species diversity within the Plant Genetic Resources Unit's *Vitis* germplasm collection were selected to be inoculated with *U. necator* on a time-series based on the bloom date of the cluster. Disease was assessed macroscopically at harvest and disease was rated as percentage coverage of rachis, pedicel, and berry. Epidemiological data will be presented as will genomic and proteomic techniques being developed to uncover the molecular basis for ontogenic resistance.

Critical role of crop rotation in the management of leaf blight diseases of carrots in New York. B. K. GUGINO and G. S. Abawi. Dept. of Plant Pathology, NYSAES, Cornell University, Geneva, NY. Phytopathology 95:S169. Publication no. P-2005-0009-NEA.

Leaf blights are major production constraints to carrot production in New York. These diseases are caused by the fungi *Alternaria dauci* and *Cercospora carotae* and the bacterium *Xanthomonas campestris* pv. *carotae*. A minimum of 2 years' rotation and the use of clean seeds are recommended as part of the IPM program being developed for blight management. Results from trials conducted in collaboration with carrot growers have clearly demonstrated that longer crop rotations have significantly delayed the onset and severity of leaf blight diseases. The rotations have resulted in significant reductions in the required number of sprays to manage leaf blights, thus improving profitability. In 2002, carrots grown in a field that was 2 years out of carrots never reached the threshold level required to trigger the first fungicide application, while a nearby field that was only 1 year out of carrots required five fungicide applications. Similarly in 2004, one field that had never been planted to carrots reached threshold level on August 16 while a nearby field that was only 1 year out of carrots required the first fungicide application 3 weeks earlier.

Field reaction of carrot cultivars to Alternaria and Cercospora leaf blights of carrot in New York. B. K. GUGINO and G. S. Abawi. Dept. of Plant Pathology, NYSAES, Cornell University, Geneva, NY. Phytopathology 95:S169. Publication no. P-2005-0010-NEA.

Fungal leaf blights of carrot caused by *Alternaria dauci* and *Cercospora carotae* require effective management for profitable carrot production in New York. Although both blights occur annually, Alternaria blight was more prevalent prior to 2000, whereas Cercospora blight has since become more common. Carrot cultivars used by collaborating growers to validate an IPM program in New York in 1998 were first observed to differ greatly in their tolerance to leaf blights as suggested by the onset and severity of disease and the number of fungicide sprays needed. In one field, the threshold level of 25% infected leaves was reached on the cultivars Eagle and Carson on July 7 and Sept 9, respectively. Since then, the reaction of >20 carrot cultivars grown in New York have been evaluated under natural inoculum conditions and their reactions to both pathogens varied considerably. The cultivars Bolero, Neal and Fulback appeared to be more tolerant to both pathogens than Fontana and Napa, which were least tolerant. Detailed information on the reaction of the tested cultivars over the past several years will be presented at the meeting.

Effects of grape cluster compactness and debris retention on Botrytis bunch rot development. B. HED (1) and J. W. Travis (2). Dept. Plant Pathology, Penn State University, (1) North East, PA 16428; (2) Biglerville, PA 17307. Phytopathology 95:S169. Publication no. P-2005-0011-NEA.

In clusters of *Vitis* interspecific hybrid 'Vignoles', floral debris retention was evaluated in connection with cluster compactness, for effects on development of Botrytis bunch rot (*Botrytis cinerea*). In 2001, debris retention was low, and although the incidence of bunch rot was greater than the check, the increase was not statistically significant. In 2002, debris retention was high and significantly increased rot in combination with cluster compactness. High debris retention had no effect on rot in loose clusters (less than 9 berries per cm rachis), but significantly increased rot in compact clusters (9 or more berries per cm). In both years, compactness had a more significant effect on rot than grape berry moth infestation (*Endopiza viteana*), debris retention, or the interaction between debris retention and compactness. In 2002, trials were initiated to evaluate treatments aimed at reducing bunch rot by reducing cluster compactness. The most successful treatments include cluster clipping, and leaf removal, which reduced bunch rot by 51 and 19, and 59 and 65%, in 2002 and 2003, respectively.

Phylogenetic relationships of phytoplasmas inferred from analysis of DNA-directed RNA polymerase beta subunit, RpoB. R. JOMANTIENE (1,2), R. E. Davis (2), and D. Valiunas (1). (1) Institute of Botany, 2021-Vilnius, Lithuania; (2) USDA-Agricultural Research Service, Beltsville, MD 20705. Phytopathology 95:S169. Publication no. P-2005-0012-NEA.

Phytoplasmas are plant pathogenic, cell wall-less bacteria that reside in phloem in diseased plants and are classified in class Mollicutes. Most phylogenetic analyses of phytoplasmas have utilized sequences of conserved genes, such as 16S rDNA, or gene products involved in protein synthesis. The *rpo*B gene offers an alternative phylogenetic tool that is more variable than 16S rRNA at species level of many bacteria. We cloned and analyzed a 8.6 kbp DNA segment of the clover phyllody (CPh) phytoplasma genome containing protein coding sequences (open reading frames, ORFs) encoding proteins including DNA-directed RNA polymerase beta (RpoB) and beta' (RpoB') subunits, respectively. Phylogenetic analysis of bacterial RpoB proteins, including the CPh RpoB (143.4 kDA, 1273 amino acids), indicated that phytoplasmas formed one of three distinct subclades within class Mollicutes; a sister clade relationship was observed between Mollicutes and Gram-positive bacteria.

Incidence and severity of dead spot, pseudothecia development, and overwintering of *Ophiosphaerella agrostis* in creeping bentgrass. J. E. KAMINSKI and P. H. Dernoeden. Dept. of Natural Res. Sci. and LA, Univ. of Maryland, College Park, MD 20742. Phytopathology 95:S169. Publication no. P-2005-0013-NEA.

Dead spot (*Ophiosphaerella agrostis*) is a relatively new disease of creeping bentgrass (*Agrostis stolonifera*). The objectives of this research were to determine the peak period of dead spot activity and the ability of *O. agrostis* to overwinter. Patch diameter of *O. agrostis* infection centers generally increased at a linear rate between mid-June and early August. Pseudothecia production closely followed increasing patch diameter. Pseudothecia could be found as early as the first day of symptom expression and as many as 478

pseudothecia were found in a single dead spot. Although new infection centers appeared between late-August and early-October, increases in patch diameter and pseudothecia development were negligible during this period. Dead spot was most severe after the initial green construction or after fumigation with methyl bromide. *O. agrostis* was capable of overwintering as pseudothecia or as hyphae within or on various bentgrass tissues, especially nodes of stolons. Despite winter survival of the pathogen, disease severity declined dramatically in the second year.

Environmental influences on ascospore release of *Ophiosphaerella agrostis* under controlled and field conditions. J. E. KAMINSKI (1), P. H. Dernoeden (1), and N. R. O'Neill (2). (1) Dept. Natural Res. Sci. and LA, Univ. of Maryland, College Park, MD 20742; (2) USDA-ARS, Beltsville, MD 20705. Phytopathology 95:S170. Publication no. P-2005-0014-NEA.

Ophiosphaerella agrostis, the causal agent of dead spot of creeping bentgrass (*Agrostis stolonifera*), produces prodigious numbers of pseudothecia and ascospores throughout the summer. The objectives of this research were to: 1) determine the influence of changes in light and relative humidity on ascospore release; 2) document the seasonal and daily discharge patterns of ascospores; and 3) elucidate environmental conditions that promote ascospore release. In a growth chamber study, a sharp decrease in relative humidity resulted in a rapid discharge of ascospores, regardless of light. In field studies, ascospores were collected between May and October 2001-2002. Major ascospore release events generally occurred during the early morning and evening hours or during precipitation events. Few ascospores were released when the bentgrass canopy was dry. Ascospore discharge occurred in a cyclic pattern that peaked about every 12 days. New infection centers appeared approximately 3 to 10 days after a large release of ascospores.

Impact of scleroderris canker, American race, on seeded *Pinus banksiana*. G. LAFLAMME. Canadian Forest Service, 1055 du P.E.P.S., Sainte-Foy, Québec, Canada G1V 4C7. Phytopathology 95:S170. Publication no. P-2005-0015-NEA.

Scleroderris canker caused by the North American race of *Gremmeniella abietina* induces damage to pine shoots covered with snow. Jack pine (*Pinus banksiana*) is a native species affected by this disease. Most reports of damage concern plantations. Our observations have been on-going since 1989, in an area where Jack pine was seeded over an area of 552 ha in 1979. This stand is located near lac Nippon, 100 km west of Saint-Felicien, Lac-Saint-Jean region. Even if 96% of the Jack pines were infected in 1989, the rate of mortality only increased from 64 to 72% between 1990 and 1994. The maximum height of infected shoots in trees rose from 0.9 to 1.5 m during the same period. In 1994, the mean height of dead saplings was 0.9 m, while the height of surviving Jack pines was 1.9 m. Since 1995, the disease has been at an endemic level, because of the lack of healthy shoots to be infected under the snow cover. Fast growing or older pines survived the disease. Very few residual trees have shown cankers on the main stem in 2004. There were enough stems left in the stand and a thinning operation was conducted in 2000. The disease was an element of the natural selection of Jack pine regeneration.

Effects of grape downy mildew on photosynthesis of 'Niagara' grapevine leaves. B. L. LEHMAN (1), J. A. Flore (2), and A. M. C. Schilder (1). (1) Dept. Plant Pathology; (2) Dept. Horticulture, Michigan State University, East Lansing, MI 48824. Phytopathology 95:S170. Publication no. P-2005-0016-NEA.

Downy mildew (*Plasmopara viticola*) reduces photosynthesis in infected leaf areas of grapevines. To study the underlying physiological causes, leaves of potted 'Niagara' vines were artificially inoculated with sporangia of *P. viticola*. Photosynthesis and chlorophyll fluorescence in the inoculated area were measured at 48-h intervals after inoculation, while an uninoculated area on each leaf served as a control. Symptoms appeared 7 days after inoculation but physiological changes occurred before that. Chlorophyll fluorescence, a negative indicator of Photosystem II efficiency, increased while carboxylation efficiency, quantum efficiency, maximum photosynthesis, stomatal conductance, carbon dioxide compensation point, and light compensation point decreased significantly compared to the control. Carboxylation efficiency decreased earlier and more rapidly than the other parameters, indicating a decrease in ribulose-1,5-bisphosphate (RuBP) concentration or RuBP carboxylase (Rubisco) activity.

Genetic interactions of the Arabidopsis *CPN1* gene with defense signaling genes. J. LIU, N. Jambunathan, and T. W. McNellis. Plant Pathology Department, 211 Buckhout Laboratory, Pennsylvania State University, University Park, PA 16802. Phytopathology 95:S170. Publication no. P-2005-0017-NEA.

Mutations in the Arabidopsis *COPINE 1* (*CPN1*) gene cause a lesion-mimic phenotype, dramatically increased resistance to *Pseudomonas syringae* pv. *tomato* (*P. s. t.*) bacteria and constitutive PR gene expression. Further study showed that *CPN1* acts as a suppressor of defense responses and its expression is pathogen inducible. In the current study, we found that *cpn1-1/npr1-1* and *cpn1-1/eds5-1* double mutants still had lesions, but overall showed a weaker phenotype compared to *cpn1-1*. The double mutants were slightly less resistant to virulent *P. s. t.* than *cpn1-1*, but much more resistant than Col-0. Constitutive *PR* gene expression patterns were altered, but not abolished in the double mutants. These results suggested that salicylic acid (SA) partially contributes to the *cpn1-1* mutant phenotype. The induction of *CPN1* transcripts was independent of *NPR1*, *EDS5*, *RAR1*, and *PAD4*, but dependent on *NDR1* in response to avirulent *P. s. t.*, indicating that pathogen induction of *CPN1* expression is an early signaling event. This study helps in the understanding of the nature of *cpn1-1* mutant phenotype.

Evaluation of isolates of *Magnaporthe grisea* from perennial ryegrass turf for sensitivity to azoxystrobin. B. MA and W. Uddin. Plant Pathology Dept., Penn State University, University Park, PA 16802. Phytopathology 95:S170. Publication no. P-2005-0018-NEA.

One hundred and twenty isolates of *Magnaporthe grisea*, the causal agent of gray leaf spot of perennial ryegrass (*Lolium perenne* L.), collected between 1995 and 2004 from golf courses in several regions of the U.S., were evaluated for azoxystrobin sensitivity. The sensitivity of the isolates from golf courses with a history of azoxystrobin use was compared to that of several baseline isolates. Media components, incubation time, and temperature were optimized for a modified in vitro spore germination assay to determine the sensitivity of the isolates. The coefficient of variation for 50% effective concentration (EC_{50} value) were 0.006-0.477 (mean 0.14) for five repeated assays. The EC_{50} values of baseline isolates ranged from 0.002-0.089 microgram/ml, and no significant differences were observed between baseline isolates and other isolates tested. The results indicate that a shift in sensitivity to azoxystrobin might not have occurred in the *M. grisea* population of these golf courses. Further survey will be conducted to monitor the sensitivity of *M. grisea* population to strobilurins in golf courses in the northeastern U.S.

TomFAST, a tomato fungicide-timing program that combines the advantages of FAST and Tomcast. A. A. MACNAB. Dept. Plant Pathology, Penn State University, University Park, PA 16802. Phytopathology 95:S170. Publication no. P-2005-0019-NEA.

Basic FAST and Tomcast systems occasionally result in inadequate disease control. Eight FAST-based variations were evaluated from one to four times in field trials from 2001-2004. In addition to basic FAST and Tomcast programs, variations included: method of calculating temperature during wetness periods, addition of a 14-day threshold, use of relatively high threshold values when chance of precipitation is less than 50%, and combination of elements from both FAST and Tomcast (TomFAST). Addition of a 14-day threshold, as well as use of TomFAST consistently resulted in acceptable levels of defoliation associated with early blight and Septoria, and of ripe fruit rots. The advantage of TomFAST over Tomcast is the consideration of a Rain-RH-Temp model in addition to a Dew-Temp model. The advantage of TomFAST over basic FAST versions is the retention of Dew-Temp model daily severity values after they are more than 7 days old. On the basis of results from these experiments, TomFAST will be used in Pennsylvania as a fungicide-timing program to help control tomato early blight, Septoria leaf spot, and anthracnose.

Timely dissemination of BLITECAST and TomFAST information. A. A. MACNAB and E. M. Hay. Dept. Plant Pathology, Penn State University, University Park, PA 16802. Phytopathology 95:S170. Publication no. P-2005-0020-NEA.

Tomato and potato growers interested in using disease forecast systems to help time fungicides need accurate and timely information. We obtain hourly environmental data daily for 18 sites within Pennsylvania. For 10 sites, we measure and access the data using computers and cellular phones. For the others, we purchase National Weather Service based (Skybit, Inc.) data and receive it via e-mail. Appropriate data is applied to TomFAST and BLITECAST forecast-systems, and output is provided to growers. Site-specific output includes theoretical spray dates for fungicides, and a daily index value to indicate relative favorability for disease development. Within 4 to 6 hr of accessing environmental data, we can update forecasts and provide information as a 3-min toll-free phone message (1-800-PENN-IPM). Detailed information is provided via our web site (www.vegdis.cas.psu.edu/index); to facilitate rapid updating, we use a "map" format to summarize theoretical spray dates, and use a "calendar" format to summarize daily favorability for disease development. Simplicity of our web page design facilitates rapid updating and rapid access.

Frequency and levels of two classes of sphinganine analog mycotoxins in maize silage. M. A. MANSFIELD (1), D. D. Archibald (2), A. D. Jones (3), and G. A. Kuldau (1). The Pennsylvania State University, (1) Department of Plant Pathology; (2) Crop and Soil Sciences Department; (3) Department of Chemistry, University Park, PA. Phytopathology 95:S171. Publication no. P-2005-0021-NEA.

Two classes of sphinganine analog mycotoxins (SAMs) have been found in maize silage, the fumonisins, produced by *Fusarium* spp., and AAL-toxins, produced by *Alternaria* spp. Although cattle are less acutely sensitive to fumonisins than horses or swine, there is indication that these toxins impact hepatic and immune function, potentially leading to reductions in health and productivity. SAMs are not routinely tested in maize silage and most published methods focus on a single toxin. Our objectives were: (1) to develop a high-performance liquid-chromatographic method to simultaneously detect fumonisins B1, B2, and AAL toxins TA and TB, and (2) to ascertain the levels and frequency of SAMs in maize silage produced in Pennsylvania. Maize specimens were collected from 32 dairies in 2001 and 39 dairies in 2002. Samples were collected at harvest and approximately six months after ensiling. The presentation will discuss current progress in determining the levels and frequency of SAMs in these maize silage samples.

Alternative methods for genetic analyses of *Pseudozyma flocculosa*, a biocontrol fungus. G. MARCHAND, B. Neveu, Y. Cheng, F. Belzile, and R. R. Bélanger. Département de phytologie, Université Laval, Québec Canada G1K 7P4. Phytopathology 95:S171. Publication no. P-2005-0022-NEA.

Pseudozyma flocculosa is an antagonistic fungus which kills powdery mildew fungal structures by means of antibiosis. Very little is known about the genetics of this yeast-like basidiomycete (Ustilaginales). Genetic transformation of protoplasts has led to the obtention of mutants which displayed reduced antibiosis. Analyses of these mutants by different approaches have revealed that the large size of plamidic insertions hinders the cloning of genes responsible for antibiosis. In order to obtain mutants more amenable to this type of analysis, alternative transformation methods yielding less insertions sites and shorter insertions are necessary. *Agrobacterium tumefaciens* mediated transformation (ATMT), which has the potential to yield single T-DNA insertions and is now proven to be applicable to numerous fungal species, could represent a suitable alternative.

Symptom development and fungal colonization in tomato lines interacting with *Crinipellis perniciosa*, the causal agent of cacao witches' broom. J.-P. MARELLI (1), S. Kang (1), S. Maximova (2), K. P. Gramacho (3), P. Backman (1), and M. J. Guiltinan (2). Depts. (1) Plant Pathology and (2) Horticulture, Penn State University, University Park, PA 16802; (3) CEPLAC/CEPEC/SEFIT Itabuna, BA, Brazil. Phytopathology 95:S171. Publication no. P-2005-0023-NEA.

We have developed a pathogenicity assay on tomato with strains of the S-biotype of *Crinipellis perniciosa* (*CP*). Artificial inoculation on 3-week-old tomato seedlings was performed with a basidiospore suspension at 6×10^5 concentration. The symptoms observed (swelling, axillary bud activation, and elongation) varied considerably between inoculated plants. To investigate the causes of this variability, we followed the locations of *CP* colonization within infected plants. This was achieved by plating excised tomato tissue from different plant parts on selective media, amplifying *CP* DNA with specific PCR primers, and microscopically observing stained cross sections of infected tomato tissue. These approaches will advance our knowledge on the infection process of *CP* in tomato and will aid in the development of a model for understanding disease mechanisms in cacao trees.

Mixed mating in natural populations of the chestnut blight pathogen, *Cryphonectria parasitica*. R. E. MARRA (1), P. Cortesi (2), M. Bissegger (1), and M. G. Milgroom (1). (1) Plant Pathology, Cornell Univ., Ithaca, NY 14853; (2) Istituto Patalogia Vegetale, Universite degli Studi di Milano, Milan, Italy. Phytopathology 95:S171. Publication no. P-2005-0024-NEA.

The chestnut blight pathogen, *Cryphonectria parasitica*, is an ascomycete previously shown to have a mixed mating system in one population in Virginia. In this report, we show that both selfing and outcrossing occur in 10 additional populations of *C. parasitica* sampled from Japan, Italy, Switzerland, and N. America. Progeny arrays from each population were assayed for segregation at vegetative incompatibility (*vic*) and DNA fingerprinting loci. Outcrossing rates were estimated as the proportion of arrays showing segregation at one or more loci, corrected by the probability of nondetection of outcrossing. Outcrossing estimates varied from 0.74 to 0.97, with the lowest rates consistently detected in USA populations (0.74-0.78). Five populations (four in USA and one in Italy) had outcrossing rates significantly less than 1. The underlying causes of variation in outcrossing rates among populations of *C. parasitica* are not known, but we speculate that outcrossing is a function of ecological, demographic, and genetic factors.

Dollar spot control in bentgrass as influenced by fungicide spray dilution and timing. S. J. MCDONALD and P. H. Dernoeden. Dept. of Nat. Res. Sci. and LA, Univ. of Maryland, College Park, MD 20742. Phytopathology 95:S171. Publication no. P-2005-0025-NEA.

Dollar spot (*Sclerotina homoeocarpa*) is a chronic disease of *Agrostis stolonifera*. Chlorothalonil is a contact fungicide used for dollar spot control, but its use has been restricted and methods of improving its performance are needed. Propiconazole is a penetrant fungicide, which generally provides longer dollar spot control. Fungicides often are applied to turfgrass early in the morning in the presence of dew. The purpose of this study was to investigate the efficacy of chlorothalonil (5.5 kg ha^{-1}) and propiconazole (3.3 kg ha^{-1} in 2003 and 1.6 kg ha^{-1} in 2004) applied alone or tank-mixed on dollar spot as influenced by water dilution and dew. Two spray dilutions (468 and 1020 L ha^{-1}), three timings (AM dew or displaced; PM dry), and three fungicide treatments (contact and penetrant alone or tank-mixed) were evaluated. Quantified dew on the turfgrass canopy ranged from 993 to 2579 L water ha^{-1}. Dollar spot control was improved by applying chlorothalonil in the low volume and to dry turf. No differences were observed with propiconazole; however, the tank-mix usually provided better dollar spot control than propiconazole alone.

Evaluation of compost tea and biofungicides for managing foliar diseases in organically-produced pumpkin and tomato. M. T. MCGRATH. Dept. Plant Pathology, Cornell Univ., Riverhead, NY 11901. Phytopathology 95:S171. Publication no. P-2005-0026-NEA.

Field experiments were conducted in 2003. Dairy manure-based vermicompost and grape pumice compost were brewed with liquid kelp, fish emulsion, and humic acid in an aerated brewer for at least 24 hours. Composts were high in fungal activity while compost tea produced was bacterial-dominant (analyses performed by Soil Foodweb NY). Tea was applied undiluted with nuFilm P a total of 14 times beginning on 18 July before disease symptoms were seen through 24 Sept. Tea was applied at low pressure (40 psi) using a nozzle with a large orifice causing little resistance (FloodJet) to minimize potential damage to organisms. Treatments with biofungicides Serenade or Sonata and copper fungicide Champion were applied separately at higher pressure. In pumpkin, compost tea alone did not suppress powdery mildew. Significant suppression occurred when Serenade or Sonata was also used. Champion used alone was slightly more effective. Sonata alone was ineffective. In tomato, severity of mildew and Septoria leaf spot were numerically lowest where Sonata and compost tea were applied; however, control was not significant. Research was continued in 2004.

Bacterial endophytes as biological control agents for black pod rot of cacao. R. L. MELNICK (1), P. A. Backman (1), B. Bailey (3), S. Maximova (2), and M. Guiltinan (2). The Pennsylvania State University, (1) Dept. of Plant Pathology and (2) Dept. of Horticulture, University Park, PA 16802; (3) USDA-ARS ACSL, Beltsville, MD 20705. Phytopathology 95:S171. Publication no. P-2005-0027-NEA.

Black pod rot of cacao, caused by *Phytophthora* spp., can severely reduce pod yield and bean quality. Phytosanitation and chemical controls are often ineffective and costly. We hypothesize that bacterial endophytes potentially are suited to control black pod rot, since they are ubiquitous colonizers and may induce resistance. Our previous research showed that *Xanthomonas campestris* pv. *malvacearum* (*Xcm*), a non-pathogen of cacao, was capable of endophytically inhabiting cacao for up to 28 days when applied to foliage with a poly-silicon adjuvant. In this study, *Xcm* inoculated cacao plants were analyzed for ability of *Xcm* to colonize cacao tissues and reduce *Phytophthora capsici* disease severity. Northern blots and microarray analysis will be used to test the activation of cacao defense genes associated with induced resistance to *Phytophthora*. The ability of *Xcm* to successfully colonize cacao, and the resulting effects on disease severity and gene expression will be discussed.

Influence of fungicide application at budswell on development and sporulation of nectarine scab twig lesions. E. MURDAY, N. Lalancette, and K. A. Foster. Rutgers University, Agricultural Research and Extension Center, Bridgeton, NJ. Phytopathology 95:S171. Publication no. P-2005-0028-NEA.

The impact of early season fungicide applications on development of overwintering twig lesions caused by *Cladosporium carpophilum* was studied in 2004. Protectant and curative fungicides were applied at budswell (March) to 'Redgold' trees followed by a standard program (STD). In June, infected

twigs were removed and incubated for 24 h at 25°C and RH >95%. The number of conidia produced was estimated using a hemacytometer. Twig and lesion areas were estimated using digital image analysis. Analysis of disease severity indicated that fungicide application at budswell did not influence development of twig lesions. All fungicides significantly reduced sporulation below that of the non-treated control (NTC). However, only trifloxystrobin treated lesions had significantly less sporulation than the STD. Trifloxystrobin treated lesions had 46% and 66% less sporulation than the STD and NTC, respectively. These results indicate that early season fungicide applications, typically applied for leaf curl, may be useful in reducing inoculum on twigs prior to initiation of scab epidemics on fruit.

Effects of silicon on development of gray leaf spot in perennial ryegrass turf. U. N. NANAYAKKARA (1), W. Uddin (1), and L. E. Datnoff (2). (1) Plant Pathology Dept., Penn State University, University Park, PA 16802; (2) Plant Pathology Dept., University of Florida-IFAS, Gainesville, FL 32611. Phytopathology 95:S172. Publication no. P-2005-0029-NEA.

The effects of silicon (Si) on development of gray leaf spot (GLS) in perennial ryegrass (*Lolium perenne* L.) (PR) turf was evaluated. The experiment was set up as a split-split-plot design with soil types as main-plot factor (peat:sand mix with Si 5 ppm (PSM) and Hagerstown silt loam with Si 70 ppm (HSL)), sources of Si as split-plot factor (Wollastonite and Calcium silicate slag), and rate of Si (0, 0.5, 1, 2, 5, and 10 metric ton/ha) as split-split-plot factor. Nine-week-old PR grown in Si-treated soil was inoculated with *M. grisea* (3.5×10^4 conidia/ml H_2O). Disease incidence (DI) and severity (DS) were assessed two weeks after inoculation. Si content in plant tissue significantly increased with increasing levels of Si in both soil types ($P \leq 0.05$). DI and DS were significantly lower ($P \leq 0.05$) in plants grown in Si-treated PSM than those grown in non-amended control. Similar results were obtained in HSL. Results of this study indicate that Si can be suppressive to GLS of PR turf; however soil type may influence the magnitude of this response.

Real-time PCR-SYBR® green detection of *Phaeomoniella chlamydospora* and *Phaeoacremonium* spp. B. E. OVERTON, E. L. Stewart, Xinshun Qu, N. G. Wenner, and B. J. Christ. Department of Plant Pathology, the Pennsylvania State University, University Park, PA 16802. Phytopathology 95:S172. Publication no. P-2005-0030-NEA.

Petri disease of grape, caused by *Phaeomoniella chlamydospora* (W. Gams, Crous, M.J. Wingfield & L. Mugnia) Crous & W. Gams (Pch) and several species of *Phaeoacremonium* W. Gams, Crous & M.J. Wingfield, has been reported worldwide and associated with vine decline in commercial vineyards. The primer pairs, Pmo1f + Pmo2r, and Pac1f + Pac2r, were designed for genus specific amplification of Pch and *Phaeoacremonium* spp., respectively, using real-time PCR. The primers were specific for each target genus and showed no primer dimers until after 35 cycles. Pch was detected in roots, shoots, and young trunks of drill-inoculated vines. *Phaeoacremonium aleophilum* (Pal) was detected in trunk cross sections of naturally infested vines from which Pal had been isolated. Real-time PCR affords nursery owners and growers a non-destructive method for detecting the presence of Petri disease fungi. The protocol presented here could be utilized as a detection system for a clean vine certification program.

Persistence and root colonization by commercial microbial inoculants in soil-less potting mixes. A. PASURA and G. Elliott. Dept. of Plant Science, University of Connecticut, Storrs, CT 06269-4067. Phytopathology 95:S172. Publication no. P-2005-0031-NEA.

Several microbial inoculants (MI) are commercially available for plant disease control in greenhouse crops. Little information exists on the ability of MI to colonize roots of floricultural plants and to persist in the rhizosphere of plants grown in soil-less potting mixes (SPM). This research was conducted to determine the population dynamics and root colonization of commercial MI, including *Bacillus subtilis* GB-03 and MBI600, *Streptomyces lydicus* WYEC 108, and *Trichoderma harzianum* T-22, on geranium and cyclamen plants grown in SPM amended with MI at recommended rates. All MI tested effectively colonized roots and persisted in SPM throughout the crop production cycle. Decreases in CFU over time occurred with *B. subtilis*. Inoculation did not increase CFU for *Streptomyces*. The relationship between persistence of MI and control of blackleg disease caused by *Pythium* sp. in geranium will be discussed.

Calcium enrichment during brown-rot wood decay and the possible role of oxalate regulation. J. S. SCHILLING (1), J. Jellison (1), and W. C. Shortle (2). (1) Dept. of Biological Sciences, University of Maine, Orono, ME 04468; (2) USDA Forest Service, Durham, NH 03824. Phytopathology 95:S172. Publication no. P-2005-0032-NEA.

Site index (SI) is used to predict stand-specific tree growth potential as a function of site quality. An important variable that influences site quality is soil base-cation availability. In collaboration with the USDA Forest Service, we are using ICP analyses to monitor long-term cation dynamics in decaying spruce boles, and preliminary results show significant calcium (Ca) accumulation during the first 8 years. Ca accumulation has also been observed via ICP and SEM of Ca-oxalate crystals in laboratory brown-rot decay trials. In these laboratory trials, we have begun using ion-exchange HPLC to monitor soluble and acid-extractable oxalate during brown-rot decay. Results from this work suggest that brown-rot fungi regulate soluble oxalate at a fixed concentration during wood decay, and that increases in soil Ca enhance wood Ca accumulation and increase acid-extractable oxalate levels, but do not affect soluble oxalate. Studies are underway examining further the relationship between a species-specific brown-rot oxalate "optimum" and Ca accumulation.

Identifying possible initial inoculum sources for common rust on sweet corn using back trajectory analyses. D. A. SHAH and H. R. Dillard. Dept. of Plant Pathology, NYSAES, Geneva, NY 14456. Phytopathology 95:S172. Publication no. P-2005-0033-NEA.

Common rust of sweet corn, caused by *Puccinia sorghi*, arrived and became established relatively early in the 2004 western New York sweet corn season. To monitor the arrival of urediniospores via atmospheric transport, seedlings of the susceptible sweet corn hybrid *Snow White* were exposed for periods of about 48 hr at each of three sites in western NY. Using this live trap plant detection system, viable urediniospores were first detected arriving into the region around 08 June 2004, almost a month earlier than in the previous two years. Disease incidence observed 10 days later in commercial fields was very low, but suggested viable spores may have arrived as early as the last week of May. Back trajectory analyses suggested atmospheric transport into western NY from regions in the southern U.S. (Texas, Louisiana, Alabama). Another possible introduction into western NY occurred around 12 June, from the Delaware region. No spores were trapped from 13 to 19 June, possibly because of washout by rain during transport from source regions. After 19 June, rust was observed consistently on trap plants until trapping ended on 3 July.

High-speed countercurrent chromatography for the study of induced plant metabolites altering powdery mildew development. N. SHALLOW, W. Rémus-Borel, C. Labbé, and R. R. Bélanger. Département de Phytologie, Université Laval, Québec, QC, G1K 7P4, Canada. Phytopathology 95:S172. Publication no. P-2005-0034-NEA.

The study of secondary metabolites involved in plant induced resistance requires the scale-up of suitable analysis techniques. High-speed countercurrent chromatography (HSCCC) is a method that facilitates separation and purification of compounds from biological sources. This technique is a form of liquid-liquid chromatography that requires two immiscible solvent phases. Since it is an all-liquid technique, it eliminates the irreversible adsorption of samples to a solid phase. It has been used extensively in pharmacology but has yet to be exploited in phytopathology. The objective of this study was to develop a separation method using HSCCC to purify large quantities of induced metabolites from wheat infected by *Blumeria graminis* f. sp. *tritici*. This method provided both qualitative and quantitative advantages leading to the isolation of two pure compounds.

Survival of *Phytophthora capsici* in contaminated water and its role in disease dissemination. R. D. TIMILA and R. A. Ashley. Univ. of Connecticut, Storrs, CT 06269. Phytopathology 95:S172. Publication no. P-2005-0035-NEA.

Surface irrigation ponds often provide inoculum source for rapid spread of soil-borne diseases. Experiments were conducted to determine irrigation pond contamination, survival of *P. capsici* in water, and relationship between colony forming units (cfu) recovery and disease incidence. Pond water was collected at 5 locations. Leachate water was collected by passing tap water through potting mix containing diseased plants of bell pepper at weekly intervals in order to have 0, 1, 2, 3, and 4 weeks of storage. Cfu were detected by plating filter paper that was used in filtering contaminated pond/leachate water on PARPH-V8 medium. Cfu were detected from only one pond in September, 2002. In collected leachate, cfu declined over storage periods for both sporangia and oospores ($P \leq 0.0001$). Cfu were detected for 3 weeks of storage with sporangial inoculum and for 4 weeks with oospores. A significant positive correlation was found between cfu recovery and pepper blight incidence. Thus, monitoring of irrigation pond water for contamination might be helpful in integrated management of Phytophthora blight disease by alerting growers before irrigation.

Managing fungicide resistance on wine grapes with alternative materials. J. W. Travis (1), N. O. Halbrendt (1), J. Rytter (2), and B. HED (3). Department of Plant Pathology, Penn State University, (1) Biglerville, PA 17307; (2) University Park, PA 16802; (3) North East, PA 16428. Phytopathology 95:S173. Publication no. P-2005-0036-NEA.

Field trials evaluated the efficacy of alternative materials for powdery mildew (*Uncinula necator*) control on 3 wine grape varieties in Pennsylvania. Averaging across all varieties in 2003, JMS Stylet Oil, and foliar fertilizers First Choice pHortress 0-37-25 and Elemax 40-0-20 significantly reduced the incidence and severity of leaf disease, whereas Potassium bicarbonate and Compost tea significantly reduced only leaf disease severity. JMS Stylet Oil was the most effective alternative material on all varieties. In 2004, alternatives JMS Stylet Oil, Potassium bicarbonate, Monopotassium phosphate, and Neem Oil were rotated into conventional programs of Kresoxim-methyl, Quinoxyfen, Fenarimol and Tebuconazole, at timings least critical for disease control. Results were compared to conventional programs. By mid season, all programs significantly reduced the severity of powdery mildew on leaves and clusters. There was no significant loss of disease control in programs where alternatives replaced some conventional fungicide applications.

Antimicrobial activity of aluminum chloride and sodium metabisulfite against *Erwinia carotovora* subsp. *atroseptica*: an ultrastructural study. E. S. YAGANZA (1), D. Rioux (2), M. Simard (2), J. Arul (1), and R. J. Tweddell (1). (1) Centre de recherche en horticulture, Université Laval, Québec, Qc G1K 7P4 Canada; (2) Natural Resources Canada, Canadian Forest Service – Québec Region, P.O. Box 3800, Québec, Qc G1V 4C7 Canada. Phytopathology 95:S173. Publication no. P-2005-0037-NEA.

Aluminum chloride and sodium metabisulfite were shown to be toxic against *Erwinia carotovora* subsp. *atroseptica*. In an effort to understand their antibacterial modes of action, structural changes in *E. carotovora* subsp. *atroseptica* after exposition (0-20 min) to 0.05, 0.1, and 0.2M of aluminum chloride and sodium metabisulfite salts were examined in transmission electron microscopy. Bacteria exposed to aluminum, but particularly at 0.2M, exhibited cell wall alterations, cytoplasmic aggregations, and absence of extracellular vesicles. With sodium metabisulfite, retraction of the plasma membrane was evident with increasing concentration. Membrane damage assessed using SYTOX® was significant only with aluminum chloride at 0.2M. While aluminum causes mainly wall and membrane damage, metabisulfite displays its effect intracellularly following free diffusion of molecular SO_2.

The phylogenetics of fumonisin production in the *Gibberella fujikuroi* species complex. N. C. ZITOMER (1), D. M. Geiser (1), D. D. Archibald (2), M. M. Jimenez-Gasco (1), K. O'Donnell (3), and G. A. Kuldau (1). (1) Dept. of Plant Pathology, and (2) Dept. of Crop and Soil Sciences, Penn State University, University Park, PA; (3) Microbial Genomics and Bioprocessing Research Unit, NCAUR, USDA ARS, Peoria, IL. Phytopathology 95:S173. Publication no. P-2005-0038-NEA.

Fusarium species are difficult to identify morphologically. This is of concern since many are toxigenic, producing such toxins as trichothecenes, fumonisins, and zearalenone. Fumonisins are sphingolipid analogues associated with the *Gibberella fujikuroi* species complex (GFC) that cause fatal diseases in horses and swine and are associated with cancers. In order to make precise connections between phylogenetically well-defined *Fusarium* species and fumonisin production we have generated a GFC phylogenetic tree based on elongation factor 1-alpha sequences. Members of new and previously uncharacterized species were analyzed for fumonisin production using High Pressure Liquid Chromatography (HPLC) methods. To aid in this analysis, we screened isolates using a PCR assay of the FUM1 gene, which is required for fumonisin biosynthesis. We present the results of both analyses, and their correlation.

Erratum

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The following abstract was presented at the APS Northeastern Division meeting in Bedford, New Hampshire, October 22–24, 2003.

Snow: A key factor in the development of Scleroderris canker and in triggering off an epidemic in pine plantations. G. LAFLAMME. NRCan, Canadian Forest Service, Laurentian Forestry Centre, P.O. Box 3800, Sainte-Foy, QC, Canada G1V 4C7. Phytopathology 95:S173. Publication no. P-2004-0023-NEA.

Few tree diseases develop in snow. The best known are snow blights, caused by *Phacidium* spp., and brown felt blight, caused by *Herpotrichia* spp. Scleroderris canker, caused by the fungus *Gremmeniella abietina*, North American race, also needs snow to initiate its development. This disease is found mainly on *Pinus resinosa* and *P. banksiana* in eastern Canada. Snow provides conducive conditions for the disease to progress into the shoots while trees are in a latent period, this fungus being still active at –6°C. Another effect is mechanical, but it is related to the previous one: the weight of snow brings down branches and even causes whole trees to bend down; thus, more shoots are snow-covered. Finally, snow can trigger off an epidemic: it accumulates in greater quantities in topographic depressions, erroneously called frost pockets, creating conducive conditions for several shoot infections to develop on a large portion of the crown and on numerous neighbouring trees. All these infections raise the inoculum rate, creating a centre of infection and spreading the disease to the entire plantation.