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colonized susceptible and resistant tomato plants equally well, expression of these defense genes increased 24 h (PR1b) to 48 h (GluA) sooner in susceptible tomato plants compared to the resistant line. Moreover, Race 1 biovar 1 strain K60 induced stronger and faster defense gene expression than Race 3 biovar 2 strain UW551 in both tomato lines. It has been hypothesized that the copious extracellular polysaccharide (EPS) produced by *R. solanacearum* prevents plants from recognizing the bacterium and launching defense responses. Supporting this idea, we found that susceptible plants infected with wild-type K60 had much weaker expression of GluA and PR1b than plants inoculated with an EPS-deficient mutant.

The *Alternaria brassicicola Aso1* gene is required for anastomosis and pathogenicity on cabbage

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Anastomosis of vegetative hyphae is a common biological theme for many fungal species to enable the movement of nutrients, proteins, signaling molecules, and even viruses through a colony. We characterized anastomosis and vegetative incompatibility in the necrotrophic plant pathogen *Alternaria brassicicola* and two related species using nitrate-utilization mutants of. Eight *A. brassicicola* isolates, one *Alternaria mimicula* and one *Alternaria japonica* were tested and found capable of establishing self-anastomosis. Additionally, two of the *A. brassicicola* isolates were capable of non-self fusion. In contrast to what is found with some fungal systems, in no case did we observe cell death or the development of a barrage between the incompatible isolates in our study. Incompatible isolates appeared not to recognize or acknowledge the presence of the other isolate. The genome sequence contains homologs to the *N. crassa het* and *so*1 genes. Functional characterization of the *A. brassicicola so*1 homolog (*aso*-1) via disruption resulted in a loss of the ability to undergo self-anastomosis as well as be pathogenic on cabbage leaves. We present analysis of the *aso*-1 locus, its functional characterization, and a model of vegetative compatibility in this important plant pathogen.

Fungicide susceptibility of *Colletotrichum graminicola* isolated from turfgrasses in Southern New England

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Colletotrichum graminicola, the cause of anthracnose in amenity grasses, has emerged in the past decade as a serious turf pathogen. Fungicide resistance in this species has been reported in the eastern United States. Research was undertaken to examine the temporal development of fungicide resistance in *C. graminicola*. Twenty-seven isolates of *C. graminicola* were screened for susceptibility to eight different fungicides. Tested isolates were collected from golf courses in the Northeast in 1993 and 1995 and have been continuously refrigerated at the University of Rhode Island. Isolates were cultured on half-strength PDA amended with commercial formulations of azoxystrobin, chlorothalonil, fludioxinil, iprodione, polyoxin-D, thiophanate methyl, triadimefon, or fosetyl-Al in concentrations ranging from 0 to 1024 ppm. After four days incubation in the dark at 21°C, colony diameter was measured. EC_{50} and EC_{90} values were determined by probit analysis. Several isolates demonstrated significant resistance to thiophanate methyl. Some resistance to chlorothalonil and iprodione was also observed. These results indicate that *C. graminicola* began to develop fungicide resistance as many as 14 years ago. These results also suggest that the presence of resistant strains of *C. graminicola* may decrease the efficacy of thiophanate methyl, chlorothalonil, and iprodione for anthracnose management.

Integrated control of table grape postharvest gray mold by ozone and *Muscodor albus* fumigation

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Fumigation with up to 10,000 ppm ozone (O_3) for up to 2 h was applied to table grapes to control postharvest gray mold caused by *Botrytis cinerea*. Effectiveness of O_3 was better when grapes were inoculated 24 h than 1 h before fumigation. Minor injuries occurred on the cluster rachis in some tests, but never on berries. We evaluated the effectiveness of an integrated treatment with short-term O_3 fumigation during pre-cooling and continuous biofumigation during storage with in-package generators containing *Muscodor albus*, a fungus that produces volatiles lethal to many microorganisms. *M. albus* survived O_3 fumigation, thus it could be placed in boxes when they are prepared in vineyards prior to pre-cooling and fumigation with O_3. Gray mold incidence among inoculated Autumn Seedless grapes was reduced from 91.7 to 19.3% after fumigation for 1 h with 5000 ppm O_3, and further reduced to 10.0% when O_3 and *M. albus* were combined. O_3 and *M. albus* effectiveness was inferior to sulfur dioxide pad fumigation, which is commonly used commercially. Natural gray mold incidence among organically grown Thompson Seedless grapes after storage for one month at 1°C was 31.0, 9.7, 4.4, 3.4, or 1.1% after no treatment, O_3 fumigation, *M. albus* biofumigation, combined O_3 fumigation and *M. albus* biofumigation, or use of sulfur dioxide pads, respectively.

Identification of Phytophthora diseases in Tennessee nurseries

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Phytophthora is a serious pathogen in field and container-grown trees in Tennessee nurseries and is economically important in urban settings where it is associated with sporadic death of trees and shrubs. A survey for Phytophthora was done in mid-Tennessee where samples were collected from symptomatic and non-symptomatic plants. Direct isolation of Phytophthora from plant tissue including leaves, stem, and roots was done using a selective medium. Leaf-discs of *Rhododendron* and *Pieris*, Pine needles, and pear and apple fruits were used as baits to isolate *Phytophthora* spp. from soil and from irrigation water. All isolates were characterized morphological and representative of each morphological types were analysed using DNA sequence analysis of the ITS region. Out of 540 isolates collected, several Phytophthora species were identified. These included *P. citricola, P. citrophthora, P. nicotianae, P. fragariae, P. tropicalis, P. foliorum*, and *P. cactorum*. In addition to *Phytophthora*, other soil borne pathogens such as *Fusarium oxysporum* and *Botryosphaeria* were also isolated from symptomatic plants. The incidence of *Phytophthora* and of other pathogens, host plants sampled, disease symptoms and pathogenicity test results will be used to describe the role of *Phytophthora* spp. and of the other pathogens in affected nurseries.

Fungi associated with dogwood die back and decline

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Cornus florida are flowering ornamental small trees native to the southeastern United States. Nearly 75% of all dogwoods sold in the U.S. are produced in Tennessee with an annual value ranging from $30 to $40 millions in annual sales. This plant is susceptible to an increasing number of fungal pathogens and requires season-long routine fungicide applications. Diseases such as dogwood anthracnose (*Discula detructiva*), powdery mildew (*Erysiphe* (Sect. *Microsphaera*) *pulchra*), spot anthracnose (*Elsinoe corni*), septoria leaf spot (*Septoria cornicola*), and cercospora leaf spot (*Cercospora cornicola*) affect the aesthetic value of this plant and contribute to dogwood decline. Field observations showed that stem-tip dieback was an important source of primary inoculum for leaf spot and leaf scorch problems in dogwood (*Cornus* spp.). A total of 90 fungal isolates associated with leaf spots, leaf scotch and stem tip dieback were separated into morphological types, evaluated for pathogenicity and identified using morphological features and DNA sequence analysis. Several isolates of *Fusarium* spp. that included *Fusarium oxysporum, Cercospora, Botryodiplodia* (*Botryosphaeria*) and *Pestalotia* were commonly isolated from symptomatic plants. Pathogenicity studies confirmed that these fungi were primary pathogens causing leaf spots, leaf scorch, and tip dieback. Although some fungi such as *Pestalotia* (syn *Pestalotiopsis*) are considered as secondary pathogens, they caused tip dieback and leaf lesions in inoculated plants as primary pathogens.

***Bean pod mottle virus* movement in insect feeding resistant soybeans**

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Bean pod mottle virus (BPMV) impacts yield and seed quality. BPMV is vectored primarily by the bean leaf beetle (*Cerotoma trifurcata*) in Ohio. A 2-year experiment was carried out at two locations in Ohio to determine if resistance to insect feeding reduces disease incidence and spread in soybeans. The experimental design was a split-plot with four repetitions, three host genotypes susceptible to insect feeding (Resnik, Williams 82, and Troll), and two host genotypes resistant to insect feeding (HC94-24, and HC95-15); and two inoculum levels. The incidence of BPMV was assessed twice during each year (at growth stages R2 and R7) using ELISA, and data were analyzed using a generalized linear mixed model. Resnik and Williams 82 were the most susceptible, with the highest disease levels, whereas HC94-24, HC95-15 and Troll had much lower levels of incidence. There was a higher incidence of BPMV infection in plots with the higher inoculum level. There was also a positive correlation of disease incidence to initial inoculum level.