ABSTRACTS OF PAPERS

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ABSTRACTS

LIFE CYCLE OF PUCCINIA CHONDRILLINA IN WASHINGTON. E. B. Adams and R. F. Line, Department of Plant Pathology, Washington State University, Pullman, WA 99164.

Puccinia chondrillina is an autoecious, macrocyclic rust. In Europe pycnia and aecia are rare. However, in Washington, where P. chondrillina was introduced for control of Chondrilla juncea (Rush Skeleton Weed) in 1978 and 1979, all stages of the rust have been found consistently. Uredia and telia have been observed in each year subsequent to release of the urediospores. Pycnia and aecia were observed in the spring of 1980 and 1981. All stages of the rust were also produced in the greenhouse. Teliospores collected from the field in the spring germinated readily, and basidiospores infected leaves and stems of C. juncea, but teliospores produced in the greenhouse failed to germinate. Pycnia appeared 16 days after inoculation. Fourteen days after cross fertilization uredinoid aecia appeared in a circle around the pycnia. The aeciospores, uredospores, and teliospores were as described in the literature. Basidiospores and pycniospores were hyaline, and 3.7-4.6 x 7.4-8.3 µm and 2.3-3.7 x 1.4x2.3 µm, respectively.

THE INFLUENCE OF NUTRITION ON THE IN VITRO FORMATION OF BASIDIA AND SCLEROTIA BY THANATEPHORUS CUCUMERIS (FRANK) DONK= RHIZOCTONIA SOLANI KUEHN. Gerard C. Adams Jr. and Edward E. Butler, Department of Plant Pathology, University of California, Davis, CA 95616

Isolates from five anastomosis groups (AG) of Rhizoctonia solani were grown in partitioned petri plates. The inoculated half of each plate contained a $NaNO_3$-glucose agar, the other half on which sclerotia and reproductive structures formed, contained the same basal medium without $NaNO_3$ and glucose. With glucose at a constant 20g/L, varying the level of $NaNO_3$ controlled the production of basidia and sclerotia. Basidial formation by AG-1 increased linearly with increases in $NaNO_3$ in the range 0.25-6.0 g/L. In contrast, AG-4 formed basidia only when $NaNO_3$ was 0.25g/L or less. Other AG generally would not form basidia on agar. Sclerotial production in all groups increased with increases in $NaNO_3$ in the range 0.25-6.0g/L. A nutrient stepdown was necessary for formation of basidia and also favored sclerotial formation.

A HISTOLOGICAL STUDY OF ANTHRACNOSE ON PAPAYA FRUITS. K. F. Chau and A. M. Alvarez, Department of Plant Pathology, University of Hawaii, Honolulu, HI 96822

The infection process of Colletotrichum gloeosporioides on papaya fruits was studied in vitro, with light (LM), transmission (TEM), and scanning (SEM) electron microscopy. On isolated papaya cuticle used as a substrate in vitro, 94% of the spores germinated and 58% formed appressoria after 10-hr incubation at 24 C. On detached papaya fruit observed with TEM/SEM, a secretion joined the spore and its appressorium to the cuticle. TEM showed that the infection peg penetrated the cuticle and grew either subcuticularly or penetrated the epidermal cells. A deposit believed to be callose formed in several layers of parenchyma cells adjacent to the infection point. SEM of fractured sections showed that the fungus sporulated only on the host surface. Host cuticle and epidermal cell walls were ruptured during the sporulation process, and an acervulus formed. A fibrillar network frequently covered the young spores at early stages of acervulus development.

PROPERTIES OF PLANT AGGLUTININS FOR SAPROPHYTIC PSEUDOMONADS. Anne J. Anderson and Pamela Walzer, Department of Biology, UMC 45, Utah State University, Logan, Utah 84322.

Resistance to bacteria may involve immobilization of the challenge through a process requiring recognition between bacterial and plant cell surfaces. Extracts from bean and alfalfa agglutinate cells of saprophytic pseudomonads. One agglutinin is a glycoprotein complex (6:1 carbohydrate:protein) of molecular size greater than 10^8 daltons. Arabinose (18%), galactose (49%) and galacturonic acid (33%) are the major carbohydrate components and 10-15% of the protein is hydroxyproline. Agglutinin activity was destroyed by prolonged treatments which caused β elimination of sugars from serine or threonine. Linkage of carbohydrates through hydroxyproline may also be involved since treatment at pH 1 for 1 hour at 100° removed carbohydrate and destroyed activity. Periodate oxidation reduced agglutinin activity and decreased the proportion of galactose and uronic acid.

Effects of victorin on oat leaf protoplasts. Carol J. Arny and Penelope Hanchey. Department of Botany and Plant Pathology Colorado State University, Fort Collins, CO. 80523.

Previous studies reported that Helminthosporium victoriae toxin, victorin, caused rapid bursting of protoplasts from disease-susceptible, but not resistant, oat cultivars. Protoplasts from susceptible oat leaves (cv. Park) were suspended in 0.5 M sorbitol and 10 mM calcium chloride, stained with neutral red, and treated with victorin at 50,000 X the ED_{50} concentration for root growth inhibition. Loss of neutral red staining did not occur until protoplasts were disrupted, 4-5 hr after victorin treatment. Protoplast killing and neutral red loss required 10-18 hr in a victorin concentration 1000 X the ED_{50}. In other experiments, victorin did not affect the ability of protoplasts to accumulate neutral red until protoplasts had collapsed. Protoplasts varied in their sensitivity to victorin and leaf epidermal protoplasts were less sensitive than mesophyll protoplasts.

COPPER FOR CONTROL OF VERTICILLIUM WILT OF COTTON. L. J. Ashworth, Jr., Department of Plant Pathology, University of California, Berkeley, CA 94720.

The efficacy of foliage applications of $CuSO_4$ and CuEDTA solutions for control of Verticillium wilt of cotton was reported earlier (Proc. Amer. Phytopath. Soc. 3:314-315, 1976). In a new test soil was drenched three times in one week with 500 ml of a CuEDTA solution containing 100 ppm Cu. Plants were inoculated by stem injection three days later. All inoculated treated and untreated plants became infected with V. dahliae. Treated plants suffered much less defoliation than untreated plants, and had approximately twice the number of flower buds, flowers, and fruit as untreated plants. Healthy untreated plants had about 160% more fruit than untreated infected plants while healthy treated plants had 15% more fruit than treated infected plants. Copper accumulated in leaves (155 ppm) and in roots (207 ppm) for a short time but, 60 days after treatment, roots, leaves, and seed of untreated and treated plants were equal, 14-20 ppm Cu.

GROWTH OF AN ENDOMYCORRHIZAL FUNGUS UNDER PARASITIC CONDITIONS M. S. Brown, G. J. Bethlenfalvay and R. S. Pacovsky, Western Regional Research Center, U.S. Department of Agriculture, Berkeley, CA 94710

The symbiotic association (Glycine max + Glomus fasciculatus) was grown in 1.5 l pots in a sand/perlite rooting medium with 200 g of hydroxyapatite [$Ca_5(PO_4)_3(OH)_2$] as the source of P. Development of the endophyte internal and external to the host plant root was determined at regular intervals throughout the ontogeny of the association. Percent infection was estimated by observation of stained mycorrhizal segments. Fungal biomass was determined by measurement of fungal chitin in the mycorrhiza and the rooting medium. Percent fungal biomass per

mycorrhiza was maximum (20%) at week 6 and declined thereafter. The internal mycelium continued to grow till week 15. External fungal mass declined after week 9. Initial growth inhibition of the mycorrhiza (maximum of 50%) was reversed at week 9. Recovery resulted in growth enhancement at week 18. It is concluded that growth depression in the host plant was due to a diversion of assimilate by the endophyte.

CHARACTERISTICS OF RHIZOCTONIA SOLANI AND RHIZOCTONIA-LIKE FUNGI FROM ROOTS AND STOLONS OF LADINO CLOVER. C. L. Campbell, Dept. of Plant Pathology, North Carolina State University, Raleight, NC 27650.

In order to compare the characteristics of Rhizoctonia solani (Rs) and binucleate Rhizoctonia-like fungi (Rlf) which may contribute to decline of Ladino clover in clover-tall fescue pastures, isolates of Rs and Rlf were obtained from roots and stolons of Ladino clover in 4 tall fescue-clover pastures near Raleigh, NC during 1979 and 1980. Of 37 isolates from stolons, 24 were binucleate Rlf and 13 multinucleate Rs; of 87 isolates from roots, 53 were RLF and 34 were Rs. Optimum temperature for growth on PDA was similar for Rs and Rlf isolates (mostly 24-28 C; range 16-32 C). Many Rlf had white mycelium and lacked sclerotia after 8 days on PDA; however, color ranged from white to brown. Rs isolate color ranged from white to brown and sclerotia were usually produced. In the greenhouse 5 of 41 Rs and 0 of 77 Rlf isolates were pathogenic on clover roots; 13 of 77 Rlf and 18 of 41 Rs were pathogenic on tall fescue.

DIFFERENTIAL MEDIUM FOR SEPARATION OF RHIZOCTONIA SOLANI AG-3 FROM AG-4. Carlos Castro and J. R. Davis, University of Idaho, Dept. of Plant & Soil Sci., Moscow, and Univ. of Idaho Res. & Ext. Center, Aberdeen, Idaho 83210.

Anastomosis grouping (Ag) types of Rhizoctonia solani Kühn may have significant implications for studies involving pathogenicity and epidemiology. Because of this, methods providing for rapid separation of Ag-types are desirable. Studies with McConkey agar containing calcium chloride with a pectate layer show this medium to be a potential tool for the rapid separation of R. solani Ag-types commonly found in Idaho potato fields (Ag-3 and Ag-4). On this medium, the colony appearance of 44 R. solani Ag-3 isolates and 25 isolates of R. solani Ag-4 were compared. Hyphal growth of all Ag-3 isolates was sparse, aerial, and brown in appearance. In contrast, Ag-4 types were white and 22 isolates out of 25 showed "heavier" growth than Ag-3 that was densely matted.

INTERACTION OF METRIBUZIN AND POTATO VIRUSES X AND Y. D. Corsini, J. Garner, and R. Callihan. USDA, SEA-AR, and University of Idaho Research & Extension Center, Aberdeen, ID 83210.

Our results suggest that post-emergance application of the herbicide metribuzin can be used as an aid for removing potato virus Y (PVY) infected plants from potato (S. tuberosum) seed fields. Foliar treatment with metribuzin at standard weed control rates (0.57-1.14 kg/ha) caused a necrotic reaction in leaflets of plants infected with PVY, but not in plants infected with potato virus X (PVX) or potato leafroll virus. Necrosis symptoms resulting from metribuzin and PVY interaction were distinct from symptoms of either PVY alone or of metribuzin phytotoxicity. This reaction was similar in several potato cultivars (Russet Burbank, Lemhi Russet, Pioneer). Russet Burbank infected with PVY and PVX, alone or in combination, was treated with metribuzin to study herbicide-virus interaction effects on yield. Secondary PVY infection alone caused a 57% yield reduction, and when combined with PVX caused a 71% yield reduction. Although leaflet necrosis was induced by the metribuzin PVY combination, there was no significant yield interaction.

FACTORS INFLUENCING THE EFFECTIVENESS OF LIME IN CONTROLLING CLUBROOT OF CRUCIFERS CAUSED BY PLASMODIOPHORA BRASSICAE. Robin L. Dobson and R. L. Gabrielson, Washington State University, Western Washington Research and Extension Center, Puyallup, WA 98371.

Lime has historically been recommended and applied for clubroot control, but is has not always been effective. This work was undertaken to define factors influencing the effectiveness of lime as a control measure: mixing of lime in soil, lime particle size (powder to 2 mm), and nitrogen fertilizer source, $CaNO_3$, $(NH_4)_2SO_4$, and NH_4NO_3 at 78 kg of N/ha. Infested Sultan silt loam from western Washington was used in all experiments. Lime was incorporated at 4483 kg $CA(OH)_2$/ha or its equivalent. Soil pH values were determined in 0.01 M $CaCl_2$. Percent clubbing was determined six weeks after seeding. pH variations within limed soil samples decreased with thorough mixing and consistently gave the best control both in greenhouse and field trials. Similarly, the best control was correlated with finest lime particle size and with use of a basic fertilizer, $CaNO_3$.

SURVIVAL OF A BIOLOGICAL CONTROL AGENT IN SOIL. Marcella Dupler, Ralph Baker, Department of Botany and Plant Pathology, Colorado State University, Fort Collins, Colorado 80523

The influence of various environmental factors on the survival of a fluorescent pseudomonad capable of inducing suppressiveness in soil to Fusarium wilt was determined. Population densities of a fluorescent pseudomonad tolerant to rifampin in King B medium amended with this antibiotic were followed. The number of viable cells detected (as colony forming units, cfu) immediately after the addition of the bacteria was inversely proportional over a range of -0.3 to -15 bars. At -100 bars, no cfu were detected; however, when soils were dried slowly from -15 bars, the bacteria survived well when the matric potential reached -100 bars. The bacterium survived in two Colorado soils during the winter with population densities increasing after February. Survival was better at 25 than at a 5cm depth. These results contribute to an understanding of how the biological control agent might be successfully applied to soils for the induction of suppressiveness.

EFFECT OF BARLEY RESIDUES ON RHIZOCTONIA CROWN ROT OF SUGARBEETS. J. A. Fernandez and D. A. Roth. Division of Plant Science, University of Wyoming, Laramie, WY, 82071.

Various barley residue management regimes are employed in the barley-sugarbeet rotation commonly practiced in the Big Horn Basin of Wyoming. Most growers in this area maintain that fall removal of barley crop residues lessens the severity of Rhizoctonia crown rot in the following sugarbeet crop. Studies were initiated to determine the effect of fall incorporation of various amounts of barley straw on Rhizoctonia crown rot. Treatments, followed by tillage, included: 1) 0 t/ha straw (existing straw removed), 2) 4.5 t/ha straw (amount of existing straw unadjusted), and 3) straw added to total 9 t/ha. Shortly before harvest, the following season, beets were removed from plots and rated on a disease severity scale of 0 to 5 representing 0, 10, 35, 65, 90, and 100% of the surface area of beets discolored by Rhizoctonia solani. Mean disease percentages for 0, 4.5, and 9 t/ha barley straw treatments were 53, 35, and 21, respectively.

CLUBROOT OF CRUCIFERS IN CALIFORNIA: CONTROL OF CLUBROOT IN A LIME-RESPONSIVE SOIL IN THE FIELD. A. S. Greathead, University of California, Cooperative Extension Service, Salinas, CA 93901 and R. N. Campbell and D. F. Myers, Dept. of Plant Pathology, University of California, Davis, CA. 95616.

The efficacy of lime for control of clubroot of crucifers in the field was tested in a Placentia sandy loam soil in which lime successfully controlled clubroot in greenhouse tests. Lime was applied to plots (7.6 x 7.6 m) at rates of 0, 2.8, 5.6, 11.2 or 22.4 tonnes of $CaCO_3$/ha in four replications and disced three times prior to planting broccoli cultivar Topper 430 one month later. The pH of limed soils was 6.7-7.0 at planting and 6.7-7.2 at harvest. All lime treatments gave excellent disease control. In a second trial planted 1 day after the lime was incorporated into beds by rototilling, excellent disease control also was obtained at 5.6, 11.2 or 22.4 tonnes/ha. Although liming gave excellent control in this soil type, it needs further study in other soils in the Salinas Valley that may not respond to lime for disease control.

DISTRIBUTION AND LOSSES ATTRIBUTED TO THE ALFALFA STEM NEMATODE IN WYOMING AND ITS POSSIBLE ASSOCIATION WITH WINTER KILL. F. A. Gray, R. H. Abernethy, R. H. Delaney and Don A. Roth, Plant Science Division, University of Wyoming, Laramie, WY, 82071.

The alfalfa stem nematode, Ditylenchus dipsaci, was found in all three major alfalfa growing regions of Wyoming. Damage was most severe in the Big Horn and Wind River Basins of central Wyoming. Plants exhibiting the white flagging symptom were prevalent during most of the 1980 growing season. Average stem heights and fresh weights of 200 heavily infected and 200 apparently healthy plants of the cultivar Ladak were measured to estimate losses attributable to D. dipsaci. Stem heights

and fresh weights of infected plants were reduced by 59 and 75%, respectively, as compared to healthy plants. Mid-October levels of non-structural carbohydrates (NSC) of infected plant roots were significantly lower than those of healthy plants. The relationship between NSC in stem nematode infected plants and winter kill will be discussed.

YIELD COMPONENTS AND DISEASE REACTION OF SPRING BARLEYS TO COMMON ROOT ROT INFECTION. W. E. Grey and D. E. Mathre. Montana State University, Bozeman, MT 59717.

For evaluation of Common Root Rot sixteen varieties were chosen from four barley backgrounds, Hannchen, Smyrna, Manchuria, and Coast, which were also agronomically adapted to Montana. Two environments were selected, a high moisture area in Bozeman, MT, and a dryland site in Glasgow, MT. Helminthosporium sativum infested oat kernels, added concurrently at the time of planting, increased the disease reaction (DR) from 28.2 to 39.0 (0-100), whereas with natural inoculum in Glasgow the DR was 39.2. In spite of the mean increase in disease severity of the inoculated rows, the high moisture season in Bozeman negated the early pathogenic effects of H. sativum, resulting in no change in yield. This was primarily due to the ability of the later developed yield components, kernels/spike and kernel weights to compensate for the initial reduction in fertile tillers. 'Clark', selected for its yielding ability over numerous locations, showed a low DR, even though it had not been screened for Common Root Rot.

FACTORS AFFECTING THE POPULATION DYNAMICS OF HETERODERA SCHACHTII ON SUGARBEET. G. D. Griffin, Crops Research Lab., USDA, SEA, AR; Utah State University, Logan, UT 84322

Sugarbeet seed (AH-3) were planted into sugarbeet cyst nematode (H. schachtii) infested soil at nematode populations of 0.0, 0.4, 1.2, 2.4, 4.3, 6.4, and 7.9 larvae/g soil. After 206, 181, 169, and 154 days growth in soil at initial soil temperature of 8, 12, 16, and 20C, plants were harvested and terminal nematode populations were correlated to initial nematode populations and sugarbeet yields. The smallest sugarbeet yield (15 metric tons/ha) and the lowest terminal nematode population (1.3 larvae/g soil) resulted from planting sugarbeet seed in soil with an initial nematode population of 7.9 larvae/g soil at 20C. The greatest sugarbeet yields (81.3 metric tons/ha) and the greatest terminal nematode population (8.4 larvae/g soil) resulted from planting sugarbeet seed in soil with an initial nematode population of 0.4 larvae/g soil at 8C.

EFFECT OF TEMPERATURE AND WATER POTENTIAL ON IN VITRO GROWTH OF PSEUDOCERCOSPORELLA HERPOTRICHOIDES. A. P. Grybauskas and R. L. Powelson, Oregon State University, Corvallis, OR 97331.

A previous water relations study with Pseudocercosporella herpotrichoides did not detect ecotypic strains from eastern Washington. Isolates for the current study were obtained from both eastern and western Oregon to re-examine pathogen variability. Osmotic potential of half strength potato dextrose agar was adjusted with KCl or mannitol to relative potentials of 0 (basal media alone) to -20 bars at 5 bar intervals. Colony diameters on the osmotically amended media were compared after 2 weeks incubation in the dark at 5 C intervals from 10 to 30 C. Optimal hyphal extension of all isolates, regardless of source, was between 0 and -10 bars at temperatures below 25 C, and at 25 C and above the optimum was at -10 bars or lower. The response of these isolates supports the previous conclusion and the resultant hypothesis that in the field, high temperature and low moisture may not restrict pathogen growth and consequent lesion development in foot rot of wheat.

THREAD BLIGHT DISEASE IN KENTUCKY. J. R. Hartman, C. A. Smith, R. E. Stuckey, Dept. of Plant Pathology, University of Kentucky, Lexington, KY 40546.

Thread blight caused by Ceratobasidium stevensii (Burt) Talbot was found in 5 counties in eastern and southeastern Kentucky. This disease, normally associated with tropical or subtropical climates, was active in 1979 during a cooler and wetter growing season than normal, and in 1980 during a warmer and drier season than normal. The disease was most damaging to apple (Malus pumila) especially in poorly managed orchards, and was also found on flowering dogwood (Cornus florida), snowball (Viburnum sp.) and Japanese honeysuckle (Lonicera sp.). Infected leaves were brown and necrotic. Signs of the fungus included tan or silvery rhizomorphs and white to brown sclerotia on affected twigs and branches. Apple leaf inoculation, using sclerotia, under humid greenhouse conditions, resulted in leaf blight and rhizomorph and sclerotia formation on infected twigs. Captan, mancozeb, and benomyl were only partially effective in preventing infection under greenhouse conditions.

HOST RANGE, TRANSMISSION PROPERTIES, AND RELATIONSHIPS OF TOMATO YELLOW TOP VIRUS. Sher Hassan, and P.E. Thomas, IAREC, Box 30, Prosser, WA 99350.

Sixty-six virus isolates were recovered with green peach aphids from field grown tomato plants with tomato yellow top-like symptoms. Symptoms varied among isolates, but all produced yellow top symptoms on tomato plants and potato leafroll-like symptoms on Datura tatula and Physalis floridana. Three of fifteen isolates produced very mild leafroll symptoms on potato while twelve infected this host without symptoms. Definite but weak ELISA reactions occurred between two different potato leafroll virus antisera and some, but not all, of the isolates. Host range of five isolates was restricted largely, but not entirely, to Solanaceae. Green peach aphids acquired the virus in a threshold period of about 3-hr and transmitted in a minimum of 3-hr after a minimum latent period of 16-hr. Aphids retained infectivity for life and the virus was not transmitted transovarily to offspring. A single aphid could transmit the virus, and no difference in disease severity occurred with 5, 10, or 15 aphids.

THE DEVELOPMENT OF HELMINTHOSPORIUM SOLANI ON POTATO TUBER PERIDERM. Dana Kelly Heiny and Gary A. McIntyre, Dept. of Botany and Plant Pathology, Colorado State University, Fort Collins, Colorado 80523.

Tuber tissue (Solanum tuberosum var. Norchip) infected with Helminthosporium solani Dur. & Mont. was prepared for examination by light, scanning- or transmission-electron microscopy. Naturally infected tissue was identified by sporulation of the fungus on tubers incubated in the dark for 3 weeks at 90% relative humidity and 20-24 C. Growth of the fungus on tuber periderm artificially inoculated with a suspension of spores was followed daily. Conidial germ tubes branch and often form appressorium-like structures which appear to initiate periderm penetration. Hyphae proliferate, penetrating both inter- and intracellularly. Conidiophores, which arise from a thickened hyphal mass, sporulate within 7 days after inoculation. Radial walls of cork cells in infected periderm appear to disintegrate partially, leading to development of pockets within the periderm and collapsing and shedding of tissue.

X-RAY MICROANALYSIS OF TELIOSPORES OF THREE SPECIES OF TILLETIA. W. M. Hess*, A. C. Rencher†, J. V. Allen*, E. J. Trione§, and J. A. Hoffmann¶. *Department of Botany, Brigham Young University, Provo, UT 84602; †Department of Statistics, Brigham Young University; §Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331; and ¶Crops Research Lab, Utah State University, Logan, UT 84332.

Teliospores of three species of Tilletia (T. caries, T. controversa and T. foetida) were grown on experimental plots without addition of pesticides or fertilizers. Teliospores were analyzed with energy dispersive X-ray microanalysis. Statistical analyses included univariate and multivariate analysis of variance, discriminate analysis, and classification analysis. Elements used for analysis were K, P, Mg, S, and Ca. There were significant differences between pairs of species, and K alone demonstrated the means of the three species to be different. The element which added the most to K was S. With K, S, and Ca the three pairwise comparisions were highly significant ($p < .0001$). Separation with all five elements is only marginally superior to separation achieved by K and S.

X-RAY MICROANALYSIS OF TILLETIA CARIES AND T. CONTROVERSA TELIOSPORES FROM DIFFERENT GEOGRAPHIC LOCATIONS AND CULTURAL CONDITIONS. W. M. Hess*, A. C. Rencher†, J. V. Allen*, E. J. Trione§, and J. A. Hoffmann¶. *Department of Botany, Brigham Young University, Provo, UT 84602; †Department of Statistics, Brigham Young University; §Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331; and ¶Crops Research Lab, Utah State University, Logan, UT 84332.

Teliospores of T. caries were grown with nutrient deficiencies in soil and vermiculite and analyzed with TEM and SEM. Telio-

spores of T. controversa from ten different geographic areas were also analyzed with energy dispersive X-ray microanalysis. Statistical analyses included univariate and multivariate analysis, discriminate analysis, and classification analysis. Elements used for analysis were K, P, Mg, S, and Ca. In nutrient studies differences in elemental composition were significant in most instances, both for soil and vermiculite. Four of the five elements also give clear separation of the ten geographic areas. The first two discriminant functions account for 88% of the separation.

CONTROL OF HOP DOWNY MILDEW WITH THE SYSTEMIC FUNGICIDE METALAXYL. R.M. Hunger and C.E. Horner, Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331.

Control of hop downy mildew (Pseudoperonospora humuli) with metalaxyl (Ridomil 2EC) was evaluated in Oregon at 5 commercial hop fields in 1979 and 3 fields in 1980. Metalaxyl was applied in mid-April at .3 g ai/plant in 100 ml H_2O. Disease incidence was measured at 2 week intervals for 12 weeks in 1979 and 6 weeks in 1980. Hop cone samples from untreated plots and plots treated at 2 rates (.3 g and .6 g ai/plant) were collected from OR, WA, and ID in 1980 and analyzed for residues by Ciba-Geigy Crop. Residues were <2 ppm. In 1979, 90 systemically infected shoots (spikes) occurred on 2,029 treated plants compared to 19,859 spikes on the same number of untreated plants. In yield trials at 2 locations, treated plants yielded 25% and 75% more than untreated plants. In 1980, 18 spikes occurred on 252 treated plants compared to 683 spikes on the same number of untreated plants. These results were used in 1981 to obtain a section 18 emergency registration for use of metalaxyl on hops in OR, WA, and ID.

FORECASTING DOWNY MILDEW EPIDEMICS OF HOPS D. A. Johnson and C. B. Skotland. Irrigated Agricultural Experiment and Research Station, Prosser, WA 99350.

A system to forecast downy mildew epidemics of hops was developed. Forecasts were based on the presence of initial inoculum and on conditions favorable for infection. Initial inoculum was determined by visually monitoring hop yards for primary spikes and by monitoring environmental conditions for sporulation. Sporulation occurred on spikes when night temperatures were above 5°C and the relative humidity was greater than 50%. Advisories to apply fungicide were issued after sporulation and before weather conditions became favorable for infection. A severe epidemic of downy mildew developed in Washington in 1980 and three advisories to spray fungicides were issued. Epidemics in six yards with about the same initial amount of primary spikes were monitored. The epidemic increased little (3% incidence) in yards where the forecasts were followed; whereas, it increased greatly (36-60% incidence) in yards where the forecasts were not followed.

MYCOFLORA CONTAMINANT OF DODDER SEED IN LOTS OF ALFALFA SEED. J. W. Guthrie and L. K. Lahman, Department of Plant and Soil Sciences, University of Idaho, Moscow, Idaho 83843.

The presence of weed seeds in certified alfalfa seed is recognized as an important mode of weed transmission. The additional potential for contaminant dodder seeds to carry fungi harmful to alfalfa was investigated. Dodder seeds were obtained from 7 alfalfa seed lot samples and plated on moist filter paper. The fungi identified most frequently were Cladosporium cladosporioides, Cladosporium herbarum, Penicillium sp., Alternaria alternata and Ulocladium botrytis. When dodder and alfalfa seed from 5 seed lots were compared, the genera of recovered fungi were similar on both seed types. However, significantly greater percentages of dodder seed harbored C. cladosporioides and A. alternata, whereas significantly greater percentages of alfalfa seed habored Fusarium sp. While most of the fungi observed were common saprophytes, some species, such as A. alternata and C. herbarum, can be facultative parasites. Contaminant dodder seed, therefore, may contribute seed-borne pathogens to alfalfa seed.

CONTROL OF PYRENOPHORA GRAMINEA IN BARLEY WITH SYSTEMIC SEED TREATMENTS. D. E. Mathre, R. H. Johnston, and S. G. Metz. Dept. of Plant Pathology, Montana State University, Bozeman, MT. 59717.

Seed of Summit barley naturally infected with Pyrenophora graminea was treated with a number of registered and experimental systemic fungicides. In a field trial with seed >90% infected, materials with carboxin reduced infection as much as a mercury treatment, while fenapronil provided complete control and increased yield by 331% compared to the non-treated control. Greenhouse tests using a seed lot with 20% infected seed indicated that nuarimol, prochloraz, imazilil, triadimenol, and Ciba-Geigy 64251 all provided excellent control, although some treatments slowed plant growth at the rates tested. Control of this disease may involve production of seed under dry conditions plus the use of one of the above seed treatments.

SPORULATION OF PYRENOCHAETA LYCOPERSICI ON V-8 AGAR MEDIA. D. M. McGrath and R. N. Campbell. Department of Plant Pathology, University of California, Davis, CA 95616.

Pyrenochaeta lycopersici, the primary cause of corky root of tomato, has been difficult to identify because it sporulates poorly, or not at all, on agar media and erratically in the Clerjeau melon seedling test. The factors affecting sporulation were studied using isolates obtained from infected tomatoes in 1980. V-8 agar was superior to potato dextrose agar or any of the seventeen media tested. Light was required for sporulation, and continuous illumination was better than a 12 hr photo period. Near UV light and cool white flourescent light appeared to be equally effective in promoting the formation of pycnidia. The temperature range for optimum sporulation was 20-24 C.

FUNGI ASSOCIATED WITH COMMON ROOT ROT OF WINTER WHEAT IN WYOMING. M. S. McShane and J. A. Fernandez, Plant Science Division, University of Wyoming, Laramie, WY 82071.

Fungi were isolated from wheat roots, subcrown internodes, crowns, and culms exhibiting symptoms of common root rot. Pathogenecity of 400 isolates was rated on a scale of 0 to 3 representing no, slight, moderate, and severe infection of wheat seedlings inoculated and grown under laboratory conditions. One hundred and ninety-one isolates received mean pathogenicity ratings of 2 or greater and were selected for identification. These fungi were: Helminthosporium sativum (31% of the selected isolates), Fusarium acuminatum (21%), Hendersonia crastophila (11%), F. solani (9%), F. moniliforme (6%), F. equiseti (4%), F. oxysporum (3%), F. sambucinum (2%), Curvularia inaequalis (2%), F. avenaceum (1%), F. culmorum (1%), F. tricinctum (1%), F. oxysporum var. redolens (1%), F. poae (0.5%), Nigrospora sphaerica (0.5%), and non-sporulating fungi (6%). Aid in the identification of some Fusarium spp. was provided by the Fusarium Research Center, The Pennsylvania State University.

IMMUNITY TO TOMATO YELLOW TOP VIRUS IN LYCOPERSICON PERUVIANUM AND ITS TOMATO HYBRIDS. G. I. Mink, P. E. Thomas, and M. W. Martin. IAREC, Box 30, Prosser, WA 99350.

Epidemics of tomato yellow top disease, first reported in the United States in Washington in 1974, continue to occur there annually. All tomato cultivars appear to be highly susceptible to the disease. In search of a source of resistance, we examined a number of Lycopersicon peruvianum, L. peruvianum var. dentatum, L. hirsutum, and L. glandulosum P.I. lines. One L. peruvianum line, P.I. 128655 contained both susceptible and resistant plants. The resistant plants continued to appear healthy after graft inoculation with infected tissue and the virus could not be recovered from these plants either by insect or graft inoculation methods. F_3 hybrids derived from an interspecific cross between a single plant selection of P.I. 128655 and L. esculentum cultivar Bonnie Best contained both susceptible and immune plants. Experiments are underway to define the inheritance of immunity in L. peruvianum and to fully incorporate this immunity into L. esculentum germ plasm.

CLUBROOT OF CRUCIFERS IN CALIFORNIA: SOILS RESPOND DIFFERENTIALLY TO LIME FOR CLUBROOT CONTROL. D. F. Myers and R. N. Campbell, Department of Plant Pathology, University of California, Davis, CA 95616 and A. S. Greathead, University of California, Cooperative Extension Service, Salinas, CA 93901.

Liming of soil to produce an alkaline pH is used widely for control of clubroot of crucifers; however, disease control is inconsistent. Limed autoclaved soils from the Salinas Valley were infested with 10^4 resting spores/g of Plasmodiophora brassicae and sown with broccoli in the greenhouse. Lime applied at 2.8, 5.6, 11.2, and 22.4 tonnes/ha controlled clubroot

in 10 soils termed "lime responsive." There was virtually no disease with the lowest lime treatment (2.8 tonnes/ha) at a soil pH as low as 6.7. Lime gave poor control in four soils, termed "lime non-responsive," with lime treatments as high as 11.2 tonnes/ha and at a soil pH as high as 7.7. The factors influencing lime responsiveness are unknown. Nevertheless, soil pH alone is not a reliable indication of the potential for clubroot control in all soils.

PSEUDOMONAS SYRINGAE AS AN ANTAGONIST: LABORATORY AND GREENHOUSE EFFECTIVENESS AGAINST DUTCH ELM DISEASE. D. F. Myers, Department of Plant Pathology, University of California, Davis 95616 and G. A. Strobel, Department of Plant Pathology, Montana State University, Bozeman, MT 59717.

Eight antibiotic-producing isolates of Pseudomonas syringae were antagonistic to Ceratocystis ulmi and 25 isolates of C. ulmi were sensitive to P. syringae when both were grown either on modified Dye's medium or on a similar medium containing xylem sap from American elm. The fungal isolates also were sensitive to preparations of culture filtrates containing antibiotics from P. syringae. Injections of isolates of P. syringae from either barley (M27m) or pear (M323m) into 1-year-old elm seedlings significantly reduced the extent of vascular discoloration in seedlings then challenged with C. ulmi. Isolates of P. syringae which lacked the ability to produce antibiotics were selected from cultures of M27m and M323m and these did not suppress disease development. Production of fungicidal amounts of antibiotics in treated elms could account for the effectiveness of P. syringae against Dutch elm disease in the greenhouse.

ASPARAGUS RESISTANCE TO FOUR SPECIES OF MELOIDOGYNE. E.L. Nigh, Jr. Dept. of Plant Pathology, Univ. of Arizona, Yuma, AZ 85364

Meloidogyne incognita, M. arenaria, M. hapla, and M. javanica at levels of 250 and 1000 larvae per 10 cm pot were added separately to 20-day-old asparagus (cv UC 500) seedling roots. Each treatment replicated 6 times was harvested after 30, 60, and 90 days. Roots were weighed and egg masses counted. Eggs produced were determined by tomatos grown for 30 days in the infested soil after asparagus harvest. All species infected and reproduced on asparagus in 30 days. M. incognita produced the greatest number of egg masses and total eggs followed by M. hapla, M. javanica and M. arenaria, respectively. By 60 days egg production was diminished by 88% and in 90 days no nematodes were recovered in any stage of development. These observations were supported by the tomato bioassay. In a second study, M. incognita were added to 30-day-old asparagus for 180 day incubation. No larvae or eggs were recovered. This suggests that asparagus is initially susceptible to rootknot infection and resistance increases with age developing within 60-80 days after germination and continuing until immunity exists.

INFLUENCE OF WATER AND FERTILIZER RATES DELIVERED BY SPRINKLER IRRIGATION ON FOLIAR DISEASES OF ASPARAGUS. E.L. Nigh, Jr., Dept. of Plant Pathology, Univ. of Arizona, Yuma, AZ 85364

Tip blight caused by Alternaria sp., leaf and stem spotting by Cercospora asparagi Sacc. and a spear decline from unknown causes were observed in sprinkler irrigated asparagus at rates of 50, 65, 100, 135 and 150% consumptive use (100 cu=60 acre inches water). Nitrogen at 34, 39, 85, 121 and 136 Kg/A was added at each water rate as liquid ammonium nitrate. February planted crowns averaged 1 to 2.7m by August when symptoms of Alternaria sp. appeared in treatments of higher water and fertilizer rates. Cercospora and Alternaria were both found in mid-September in all treatments. In October the tip blight failed to continue developing while the leaf spotting became more severe until plants became dry due to suspension of irrigation. Cercospora was most severe at 150% cu regardless of fertilizer rates and could become a problem with continuous sprinkler irrigation. Spear decline observed June-August was less severe in higher water and fertilizer rates indicating the condition may be temperature related.

PLANT GROWTH PROMOTING ACTIVITY OF HEAT-KILLED CELLS OF PSEUDOMONAS FLUORESCENS. M.W. Olsen and I.J. Misaghi. Dept. of Plant Pathology, Univ. of Arizona, Tucson, AZ 85721

Inoculation of seeds and roots of plants with live, non-pathogenic bacteria (bacterization) is known to promote plant growth. It was recently found that heat-killed cells of Pseudomonas fluorescens are as effective as live cells in promoting growth of alfalfa seedlings. Root inoculations of ten-day-old seedlings with live or heat-killed cells of P. fluorescens resulted in an increase of 194% and 167%, respectively, in dry-weight compared to non-inoculated controls 30 days after inoculation. These results show that the growth response in the above system does not depend on the metabolic activity of the added bacterium in the rhizosphere.

WATER RELATIONS IN COTTON PLANTS INFECTED WITH PHYMATOTRICHUM OMNIVORUM. M.W. Olsen, I.J. Misaghi, D. Goldstein, and R.B. Hine. Dept. of Plant Pathology, Univ. of Arizona, Tucson, AZ 85721

The mechanism of wilt development in cotton plants infected with Phymatotrichum omnivorum was investigated. Measurements of leaf osmotic potentials, total water potentials and relative water contents of plants subjected to artifically-induced and Phymatotrichum-induced wilting showed that changes in leaf cell permeability are probably not involved in wilting. Moreover, studies of leaf diffusive resistance showed that wilting is not caused by abnormal stomatal opening. In infected field-grown plants, in early stages of wilting, resistance to water flow increased up to 775 times in roots and up to 725 times in lower stems compared to healthy plants. As disease progressed, root resistance reached infinity. Increased xylem resistance may therefore contribute to wilting in infected field-grown cotton plants in Arizona during summer months when transpiration is very high.

CHANGES IN MACROCONIDIA OF MONILINIA FRUCTICOLA IN RESPONSE TO INCUBATION TEMPERATURE. D. J. Phillips, USDA-SEA/AR, P.O. Box 8143, Fresno, CA 93747

Incubation at 15°, 20°, or 25°C caused differences in the size, germination, and virulence of 2-week old macroconidia from 2 isolates of M. fructicola (Wint.) Honey cultured on potato dextrose agar. M. fructicola (isolate 79-1) conidia produced at the above temperatures had average volumes of 950μ^3, 700μ^3 and 550μ^3, respectively, as determined with a particle counter. Average germination times of conidia of this isolate grown on water agar were 1.5, 4.5 and 5 hr for conidia produced at 15°, 20° or 25°. Lesion diameters after 3 days on punctured, inoculated peaches (cv. Windsor) were 24 mm, 12 mm, and 10 mm for conidia produced at 15°, 20° or 25°, respectively, when 300 washed conidia were placed on each puncture. Similar results were found when 100 non-punctured sound fruits (cv. Autumn Gem) were inoculated. Infection decreased from 57% for conidia previously grown at 15°, to 30% for those grown at 20°, and to 24% for those grown at 25°.

CHANGES OF MYCORRHIZAL INOCULUM POTENTIAL IN STOCKPILED TOPSOIL F. Brent Reeves, Steve Schmidt, Janine Sabaloni, Sue Schwab, and Ed Redente, Colorado State University, Fort Collins, Colorado 80523.

Often topsoil is stockpiled for long periods prior to its use in the reclamation of disturbed habitats. The mycorrhizal inoculum potential (MIP) in a topsoil storage pile established in 1978 in the Piceance Basin of western Colorado was measured with a 21 d corn bioassay. Soil samples (8 cm diam cores) of this pile were taken to a depth of 150 cm in 1978, 1979, and 1980. The MIP (of vesicular-arbuscular mycorrhizal fungi) decreased significantly after 27 mo storage. The rate of decrease in MIP was greater in the upper 60 cm of the pile. These data suggest that the quality of stored topsoil as a growth medium for plants requiring VA mycorrhizae can deteriorate rapidly under semi-arid conditions in the West.

ENDOSULFAN FOR CONTROL OF PINEAPPLE INTERFRUITLET CORKING, LEATHERY POCKET AND FRUITLET CORE ROT. K. G. Rohrbach, R. Namba*, and G. Taniguchi, Departments of Plant Pathology and *Entomology, University of Hawaii, Honolulu, HI 96822.

Pencillium funiculosum was shown to be the primary cause of interfruitlet corking (IFC), leathery pocket (LP), and fruitlet core rot (FCR) in Hawaii. Pineapple fruit mites, primarily Steneotarsonemus ananas, have been implicated in the development of pineapple fruit diseases. Endosulfan (Thiodan, FMC Corp.) was examined as a control measure based on the hypothesis that mites act as vectors and/or in the pathogenesis of P. funiculosum. Endosulfan was applied at 3.36 kg a.i./ha in 2338 l water with a double nozzle, compressed air sprayer simulating commercial application. Applications were made 3 wk prior to and 1 and 5 wk following forcing (chemically induced differentiation).

Under severe disease conditions, endosulfan resulted in 81, 55, and 72% control of IFC, LP and FCR, respectively. These results indicate that mites are involved in the pathogenesis of P. funiculosum since control was obtained with inoculum being placed at the infection count.

DRY BEAN DISEASE LOSS ASSESSMENT. H. F. Schwartz, Department of Botany & Plant Pathology, Colorado State University, Fort Collins, CO 80523; M. Pastor-Corrales, and M.J. Katherman, Bean Program, CIAT, Apartado Aereo 6713, Cali, Colombia, S.A.

A series of standardized visual scales was developed to estimate the percentage leaf, foliage, and pod areas affected by various types of dry bean pathogens such as Colletotrichum lindemuthianum, Erysiphe polygoni, Isariopsis griseola, Pseudocercosporella albida, Pseudomonas phaseolicola, Uromyces phaseoli, and Xanthomonas phaseoli. Each scale was based upon standard damage classes of 1,10,20,40,60, and 80% area affected by a pathogen that characteristically incites lesions of less than 2, 2-5, 5-10, or more than 10 mm in diameter. The actual and estimated damage was generally close when the unit area affected was greater than 5 mm in diameter. These standard disease scales were useful in obtaining valid disease indices based upon the stage of plant development and degree of infection by complexes of dry bean pathogens.

INHERITANCE OF RESISTANCE TO THE NL-8 AND NY-15 STRAINS OF BEAN COMMON MOSAIC VIRUS. M. J. Silbernagel, USDA-SEA/AR, IAREC, Box 30, Prosser, WA 99350.

Greenhouse studies on the inheritance of resistance to the NL-8 and NY-15 strains of Bean Common Mosaic Virus (BCMV) showed that resistance is due to a single dominant factor in each case, which is not the well-known dominant "I" gene. The susceptible cv Sanilac was crossed to resistant Monroe, and F_1, F_2, and BC_1F_1 populations were tested to each strain of the virus. The reactions to NL-8 were consistent with the expression of a single dominant factor for resistance in all tests. The response to NY-15 indicated a single dominant factor with a penetrance of 0.71. These results are at variance with recent studies which showed resistance to both strains to be due to a single recessive gene. However, my results agree with an earlier suggestion that resistance to the NY-15 strains is epistatic to type strain resistance. Implications to breeding programs are discussed.

INTERACTIONS AMONG ALFALFA, PHYTOPHTHORA MEGASPERMA AND FLUORESCENT PSEUDOMONADS. L.C. Spearman, I.J. Misaghi, and M.W. Olsen. Dept. of Plant Pathology, Univ. of Arizona, Tucson, AZ 85721

Two-week-old alfalfa seedlings were inoculated with isolates of fluorescent pseudomonads and/or with Phytophthora megasperma by adding bacterial and fungal suspensions to the soil. Inoculation of alfalfa seedlings with isolates of fluorescent pseudomonads resulted in up to 320% increase in shoot dry-weight over non-inoculated controls. The incidence of Phytophthora root rot was reduced 38% in greenhouse-grown alfalfa seedlings inoculated simultaneously with a fluorescent Pseudomonas isolate and with P. megasperma, compared to seedlings inoculated with the fungus alone. It is not known if the observed growth enhancement and disease reduction are related phenomena.

PSEUDOMONAS SYRINGAE AS AN ANTAGONIST: FIELD TESTS OF ITS EFFECTIVENESS AGAINST DUTCH ELM DISEASE. G. A. Strobel, Department of Plant Pathology, Montana State Univ., Bozeman, MT, 59717 and D. F. Myers, Department of Plant Pathology, University of California, Davis, 95616.

In laboratory and greenhouse tests, certain isolates of Pseudomonas syringae are effective antagonists against Ceratocystis ulmi. The field effectiveness of P. syringae was tested on 22 matched pairs of elms showing Dutch elm disease. Root flares were injected with 5×10^{11} cells of P. syringae at 10 psi for 24 h. After two growing seasons 7/22 treated trees showed no further decline, while 21/22 control trees died. All surviving trees had been treated in early summer and had shown <20% crown damage due to Dutch elm disease at the time of treatment. Antibiotic-producing isolates of P. syringae were isolated from all treated, surviving trees. Although these data are not sufficient to establish this approach as a useful control for Dutch elm disease, they encourage further studies.

PARTIAL CHARACTERIZATION OF A VIRUS ISOLATED FROM A TOMATO PLANT WITH YELLOW TOP SYMPTOMS. P. E. Thomas, G. I. Mink, and B. L. Saddler. IAREC, Box 30, Prosser, WA 99350.

A virus transmitted in a persistent manner by the green peach aphid was isolated from a field grown tomato plant with tomato yellow top disease symptoms. The virus produced typical tomato yellow top symptoms in tomato and leafroll symptoms in potato, Datura tatula and Physalis floridana plants. Purified virus sedimented as three components ($S_{20,w}$=60,100,142) in sucrose density gradients. Particles in all components were isometric and about 30 nm in diameter. Antisera (1:2000 in agar gels) were prepared in rabbits against middle and bottom components. Each antiserum reacted with top and bottom components but not with middle component in gel diffusion and ELISA. All antisera reacted with middle component using the electron microscope decoration technique. Aphid transmission of purified virus to D. tatula produced symptoms identical to the original symptoms.

SELECTING FOR X-RESISTANT SWEET CHERRY VARIETIES. Sherman V. Thomson and Bryce N. Wadley, Department of Biology, Utah State University and USDA-SEA-AR, Logan, UT 84322.

Open-pollinated seedlings of Napa, Long-Stem Bing and Dicke Broun Blankenburger were selected for good horticultural qualities and resistance to X disease. Over 1500 seedlings were grown for 4-7 yrs to determine fruit qualities and those with acceptable fruit were selected for additional testing. Seedling Mahaleb rootstocks were top-worked with the sweet cherry selections and grown to 2-3 m height. For inoculation, three buds from an X-infected tart cherry were T-budded into each of 5 trees during late July. Trees susceptible to X disease showed the typical wilt and decline symptoms during the following summer. Selections showing resistance were tested for susceptibility to X-disease for 6 to 8 additional years. Crosses of X-resistant selections were made with Bing, Van and Royal Ann varieties and progeny are currently being tested. Thus far three varieties have been released from this program with moderate to high resistance to X disease; Angela, Sweet Ann and Utah Giant.

COPPER DEFICIENCY OF MANZANITA GROWN IN A BARK-SAND MIXTURE. J. Vlamis, R. D. Raabe, and K. Fong, Departments of Plant and Soil Biology, and Plant Pathology, University of California, Berkeley, California, 94720.

Nursery-grown plants of manzanita (Arctostaphylos densiflora) grown in a fir bark-sand mix in 14.8 cm pots grew slowly, the leaves of the new growth were small and the growing points were necrotic. No pathogens were isolated from the affected tissues. The visual symptoms suggested a nutrient deficiency possibly caused by a lack of boron, copper or calcium. The fertilizer program supplied adequate amounts of N, P, K, Fe, Ca, Mg, and S. Tissue analysis showed copper as being extremely low with values of about 3 ppm. Additions of boric acid, copper sulfate and gypsum were made to affected plants. Only plants receiving copper responded and plants treated at the rate equivalent to ten pounds of copper per acre or 8 milligrams per pot produced leaves and new growth showing no symptoms.

CONTROL OF TAKE-ALL OF WHEAT WITH FLUORESCENT PSEUDOMONADS. David M. Weller and R. James Cook. USDA, SEA, AR, Washington State University, Pullman, WA 99164.

Fluorescent pseudomonads were isolated from wheat roots grown in take-all suppressive soil and screened for the ability to protect wheat against take-all caused by Gaeumannomyces graminis var. tritici (Ggt). In greenhouse pot tests, isolate 2-79 or 13-79 (inhibitory to Ggt in vitro), either alone or in combination, reduced the amount of disease on wheat plants grown in Ggt infested soil when the bacteria were added to seeds or incorporated into the soil. Treatments without bacteria or with autoclaved bacteria provided no protection. In field plots of fumigated or natural soil amended with Ggt, isolate 2-79 or 2-79 and 13-79 (10^8 CFU/seed) reduced seedling disease, increased plant height, or increased yield compared to treatments without bacteria. A strain of 2-79, resistant to rifampin and nalidixic acid, was added to fall-planted wheat in order to study bacterial colonization of the root system. The bacteria advanced with the growing root tips of the wheat plants and numbers ranged between 10^3-10^6 CFU/0.1 g of root. These pseudomonads appear to protect the roots from infection and spread of Ggt.

CONTROL OF WHEAT TAKE-ALL AND OPHIOBOLUS PATCH OF AGROSTIS TURFGRASS BY FLUORESCENT PSEUDOMONADS FROM A FUSARIUM WILT-SUPPRESSIVE SOIL. P. T. W. Wong and R. Baker, Department of Botany and Plant Pathology, Colorado State University, Fort Collins, CO 80523.

In greenhouse experiments, fluorescent Pseudomonads isolated from a Fusarium wilt-suppressive soil from Salinas Valley, California, controlled take-all (Gaeumannomyces graminis var. tritici) in wheat and Ophiobolus Patch (G. graminis var. avenae) in Agrostis turfgrass. Dry weights of tops of both hosts were significantly greater ($P > 0.05$) in treatments where 10^7 colony forming units of bacteria were added per gram of infested soil compared to infested controls without the bacteria. All the fluorescent Pseudomonads produced fluorescent siderophores on King's B medium and most isolates also produced antibiotic zones of varying widths when paired with the pathogens on potato dextrose agar. Preliminary results suggest that antibiotic production by the bacteria may be an important factor in disease suppression.

SEEDLING BLIGHT OF BRASSAIA ACTINOPHYLLA CAUSED BY PYTHIUM SPLENDENS. B. T. Yamamoto and M. Aragaki. Department of Plant Pathology, University of Hawaii, Honolulu 96822.

Grayish to brown, water-soaked lesions at the stem base were characteristic of a seedling blight on Brassaia actinophylla Endl. caused by Pythium splendens Braun. Artificial inoculations induced pre-emergence and post-emergence damping-off, as well as root rot and stem cankers of 4-month-old plants characterized by chlorotic leaves and reduced growth rates. Pythium splendens was identified by its large, spherical sporangia (diam. 31.0-38.6 µm) borne terminally. Pairings in all combinations and with compatibility testers, revealed that the isolates from brassaia were represented by both compatibility types. All 5 P. splendens isolates from brassaia, and single isolates from anthurium and papaya were pathogenic. Ridomil at 25 ppm a.i. and ethazole at 250 ppm a.i. were effective in controlling the disease; these were phytotoxic at 500 ppm a.i. and 1000 ppm a.i., respectively.

THE COMPARATIVE EFFICIENCY OF CRYSTAL VIOLET PECTATE AND SODIUM POLYPECTATE MEDIA ON THE RECOVERY OF PECTOLYTIC ERWINIA FROM SOIL FOLLOWING ENRICHMENT. A. Zaid and M.E. Stanghellini, Dept. of Plant Pathology, Univ. of Arizona, Tucson, AZ 85721

Naturally infested soils were amended with asparagine and incubated at 27 C for 24 hr. Serial dilutions were then dispensed on crystal violet pectate (CVP) and sodium polypectate media and incubated for 48 hr. Pectolytic Erwinia spp. were consistently recovered from all amended soils using sodium polypectate. CVP, however, completely suppressed or greatly reduced the development of colonies of the pectolytic Erwinia. Thus, the success in recovery of Erwinia from soil following asparagine enrichment is dependent upon the type of medium used for isolation.

UTILIZATION OF MICHIGAN AMBER WHEAT TO CHARACTERIZE MONTANA ISOLATES OF WHEAT STREAK MOSAIC VIRUS. S. K. Zaske, T. W. Carroll, and R. H. Brlansky.* Dept. of Plant Pathology, Montana State University, Bozeman, MT 59717.* Agricultural Research and Education Center, Lake Alfred, FL 33850.

Eight isolates of wheat streak mosaic virus (WSMV) collected from diverse areas of Montana were separated on the basis of their symptom severity on Michigan Amber winter wheat (CI 11379). The type culture PV57 and the mild AC85 strain of WSMV were used as standard references to compare with the Montana isolates. When mechanically inoculated into Michigan Amber, only one of the Montana isolates resembled the type culture in forming a severe yellow mottle or streak symptom while the other seven were more similar to the mild strain in producing a light green mottle. Eight other wheat cultivars were also inoculated with each isolate; however, the isolates could not be differentiated relative to the symptoms that were produced.