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ABSTRACTS

ACTIVE DISCHARGE OF CONIDIA OF POWDERY MILDEWS IN STILL AIR.
G. C. Adams, Jr. and C. M. Leach, Oregon State University,
Corvallis, OR 97331.

Several researchers, utilizing wind tunnels, have concluded that a minimum wind velocity of 1-1.5 m/sec was required to dislodge conidia from conidiophores of powdery mildews. We examined patterns of spore release, by *Sphaerotheca pannosa* on rose and *Erysiphe pisi* on pea, during manipulation of the environment within an incubator. The incubator was modified to regulate relative humidity (RH) and light, and was equipped to record wind velocity, RH, spore release, and temperature. In still air (air velocity < 0.1 m/sec) of 100% RH, no conidia were released in dark or light ($80 \mu\text{EM}^{-2} \text{sec}^{-1}$). When the RH was lowered rapidly, conidia were discharged in still air and darkness. Conidia discharged more readily in the light than in darkness, when RH was lowered. The pattern of discharge of conidia in response to RH and light suggests an electrostatic mechanism may be operative in spore discharge in powdery mildews.

INTERFERENCE BETWEEN TOBACCO ETCH VIRUS AND POTATO VIRUS Y.

Matthew D. Alegebo and Merritt R. Nelson, Department of Plant Pathology, University of Arizona, Tucson, AZ 85721.

Tobacco etch virus (TEV) and potato virus Y (PVY) are distinct serologically. TEV induces root necrosis, wilt and death of tabasco. PVY induces local lesions followed by systemic necrosis and death of a hypersensitive selection from Anaheim chilli (Special Pepper -SP). When inoculum from standard Anaheim infected with both viruses was used to inoculate SP and tabasco, no lesions were produced on SP while on tabasco, wilt and death occurred. Neutralization, precipitation and elimination of TEV from the inoculum still resulted in no lesions by PVY on SP. Phenotypic mixing occurs between these two viruses.

A NEW STRAIN OF PVY RESULTING FROM MIXED INFECTION BY POTATO VIRUS Y AND PEPPER MOTTLE VIRUS.

Matthew D. Alegebo and Merritt R. Nelson, Department of Plant Pathology, University of Arizona, Tucson, AZ 85721

Pepper Mottle Virus (PeMV) and Potato Virus Y (PVY) induce local lesions followed by systemic necrosis and death of tabasco and Special Pepper (SP), respectively. *Datura metel* (DM) and Agronomico-8 (AG-8, *Capsicum frutescens*) are separation hosts, respectively, for PVY and PeMV from a mixture of both viruses. When sap from a mixed infection of PeMV and PVY in Anaheim chilli was used as inoculum for DM the only virus recovered was a strain that reacted weakly with antisera to PVY and PeMV when tested separately, but strongly when these antisera were mixed. This strain also infects AG-8. Serial transfers of the new strain in DM and between DM and AG-8 have demonstrated its stability. The isolate no longer produces local lesions on SP.

PATHOGENICITY OF *VERTICILLIUM DAHLIAE* FROM FOLIATED AND DEFOLIATED COTTON CULTIVARS AND THE QUANTITATIVE RELATIONSHIP OF INTERNAL INOCULUM TO LEAF DEHISCENCE. L. J. ASHWORTH, JR., Plant Pathologist, Plant Pathologist Dept., University of California, Berkeley, California 94720.

Isolates of *Verticillium dahliae* from Verticillium wilt tolerant cultivar Acala SJ-5 were more aggressive toward four differentially tolerant cultivars of cotton than isolates of the fungus from less tolerant cultivars, 70-110 and Acala SJ-2. Likewise, isolates from plant defoliated by Verticillium wilt were more aggressive than isolates from random infected plants. Isolates the uniformly caused defoliation, did so without regard to the relative Verticillium wilt tolerance of cotton cultivars 70-110, Acala SJ-2, Acala SJ-4, and Acala SJ-5, known in the field. The internal I.D. of *V. dahliae* conidia of lamina tissue was greater for plants of cultivar Acala SJ-2 than for plants of Acala SJ-5. But, I.D. of *V. dahliae* conidia in leaves of both cultivars were similar at the time of dehiscence. Data reported here support the concept that *V. dahliae* in soils is made up of a continuum of strains having great diversity with regard to pathogenic aggressiveness.

ICE NUCLEATION ACTIVE *PSEUDOMONAS SYRINGAE* ASSOCIATED WITH WOODY PLANTS IN NORTHWEST NURSERIES. S. BACA, M.L. CANFIELD, AND L.W. MOORE. DEPT. OF BOTANY AND PLANT PATHOLOGY, OREGON STATE UNIVERSITY, CORVALLIS, OREGON. 97330

Infections by *Pseudomonas syringae* have increased both in incidence and severity in many woody plants grown in Northwest nurseries. In some cases, nurserymen have reported episodes of freezing injury preceding symptom development in several hosts. Because ice nucleation induced by *P. syringae* has been implicated as a predisposing factor to infections in other woody plants, the association of frost injury with subsequent *P. syringae* infections was examined. Strains isolated from healthy and diseased tissues were tested for ice nucleation activity by the freeze drop method at -5°C . Analysis of strains from seven families showed that 100% of the strains isolated from Oleaceae were ice nucleation active; 80% of the strains isolated from the families Magnoliaceae, Rosaceae, Salicaceae, Coronaceae, and Tiliaceae were active; but only 16% of the strains from Aceraceae showed this property.

COTTON YIELD RESPONSE TO OZONE IN THE SAN JOAQUIN VALLEY OF CALIFORNIA. L.F. Benoit and O.C. Taylor. Statewide Air Pollution Research Center, University of California, Riverside, CA 92521.

Acala SJ-2 cotton (*Gossypium hirsutum* L.) ozone yield response was studied during the 1981 and 82 growing seasons on the USDA Cotton Research Station, Shafter, CA. Cotton was grown under 2 irrigation regimes in 24 portable open-top field chambers and exposed to incremental ozone treatments. There were 6 exposures ranging from essentially no ozone (carbon filtered air) to twice the ambient ozone concentrations, in addition to open grown plots as a check. Ambient (outside air) and chamber ozone concentrations were continuously monitored in both seasons. Lint yields were negatively correlated with 7 hr day (09:00-16:00 pdt) seasonal mean ozone concentrations in both seasons ($R^2 = -.70$ and $-.79$ for '81 and '82, respectively). Ambient chamber (non-filtered) yields were reduced as much as 20% in comparison to those of carbon filtered treatments. The results of this and other research in the San Joaquin Valley suggest considerable cotton yield loss potential, due to current ambient ozone concentrations.

INOCULATION OF NATIVE PLANTS WITH VA MYCORRHIZAL FUNGI. Brenda J. Biermann, Native Plants, Inc., 360 Wakara Way, Salt Lake City, Utah 84108

Commercial use of VAM inoculum for the production of container grown native plants may require some modification of current standard growing practices, but it is technically and economically feasible. Growth media such as peat, bark, perlite and vermiculite were less favorable for VAM development than were soil, bentonite and turf. In a favorable soil mix, fertilization with relatively high levels of N and K and a moderate level of P resulted in rapid plant growth and good VAM development.

Inoculation of seedflats with *Acaulospora trappei* effectively established VAM on most plants tested. Pretransplant inoculation with *A. trappei* increased growth of *Ceanothus velutinus*, *C. prostratus*, and *Rhus glabra*. Seven insecticides tested did not affect colonization of red clover roots by *A. trappei*, or growth of mycorrhizal plants. Incidence of root rot in these 3 species after transplant into unpasteurized soil was less severe when plants had been grown in a soil mix favoring VAM.

SEROLOGICAL ANALYSIS OF *AGROBACTERIUM* 50 S RIBOSOMAL SUBUNITS IN DOUBLE DIFFUSION GELS.

H. BOUZAR, L.W. MOORE, Oregon State University, Corvallis, 97331, and N.W. SCHAAD, University of Idaho, Moscow, 83843.

Antisera to 50 S ribosomal subunits of 5 tumorigenic *Agrobacterium* strains were used in Double Diffusion gel assays to group 31 *Agrobacterium* and 6 *Rhizobium* strains into 16 serotypes. Only 1 tumorigenic strain (M9/79) failed to react with any of the 5 antisera, otherwise the antisera were specific at the family level, i.e. these antisera did not react with ribosomes from 8 species outside the Rhizobiaceae. The fast-growing rhizobia could not be differentiated from the agrobacteria. However, all 6 *Rhizobium* species tested were serologically very closely related to *Agrobacterium biovar 3* strain CG64. The 16 serotypes correlated with neither the pathogenic state, the biovar affiliation, the host, nor the area of origin. In contrast to the above, phenol-extracted antigens from whole cells of the 37 *Agrobacterium* and *Rhizobium* strains were tested against the 5 antisera; the reaction was highly specific because only the homologous antigen-antiserum system reacted.

LOPHODERMIIUM TWIG BLIGHT OF CRANBERRY: RELATIONSHIPS BETWEEN INOCULUM DENSITY, PERIOD OF HOST SUSCEPTIBILITY, AND DISEASE SEVERITY. P. R. Bristow, West. Wash. Res. and Ext. Ctr., Washington State University, Puyallup, WA 98371.

Ascospores of *Lophodermium oxycocci* (incitant of twig blight) were present from at least late-June through early-October for four years (1978-1981). A Burkard recording volumetric spore trap operated continuously during these periods. To determine when new growth became infected plots were entered into or removed from a (biweekly) spray program using Dithane M-45 (mancozeb). A single period of susceptibility occurred each year. This period varied from year to year but was not related to the stage of host development. The percentage of twigs (uprights) blighted was highly correlated with the average number of ascospores trapped per day during the period of susceptibility but not with the total number of ascospores trapped each year. The number of ascospores trapped during the susceptibility period in a given year was not related to disease severity the previous year. Research continues in an effort to understand what factors determine this susceptibility period.

Barley Yellow Dwarf Virus Occurrence Confirmed in Colorado Small Grains. William M. Brown, Jr., and William F. Rochow. Dept. of Botany and Plant Pathology, Colorado State University, Fort Collins, CO 80523 and ARS, USDA, Plant Pathology Dept., Cornell University, Ithaca, NY 14850.

Diseased wheat plants with symptoms of Barley Yellow Dwarf (BYD) were collected and forwarded to W.F. Rochow of Cornell University in the summer of 1981. Samples were evaluated by enzyme-linked immunosorbent assay (EIA) for BYDV-specific isolates (PAV, MAV, RPV, RMV and SGV) and found to contain BYDV isolates similar to RMV. In 1982 extensive wheat losses occurred in Eastern Colorado and subsequently shown to be caused by BYD-like viruses similar to the SGV isolate. Although, RMV-like and SGV-like BYDV isolates appear to be the principal BYDV isolates found in Colorado, isolates similar to PAV and MAV were also recovered. More study is needed to clearly define the prevalence, distribution, characteristics, and importance of BYDV isolates in barley, wheat and oats grown in Colorado.

A SURVEY OF NURSERY GROWN WOODY ORNAMENTAL PLANTS INFECTED WITH *PSEUDOMONAS SYRINGAE*. M. L. CANFIELD, S. BACA, AND L. W. MOORE. DEPT. OF BOTANY AND PLANT PATHOLOGY, OREGON STATE UNIVERSITY, CORVALLIS, OR. 97330.

A suspected bacterial disease of woody ornamental plants has become increasingly severe in nurseries of the Pacific Northwest over the past several years. Symptoms include tip dieback, canker, gummosis, necrotic stem lesions, water soaked leaf spots and floral blight. The most extensive losses have been in *Acer rubrum*, *Acer palmatum*, *Cornus florida*, *Tilia americana*, *Pyrus calleryana*, *Laburnum anagyroides* and *Populus tremuloides*. During 1982, fluorescent pseudomonads were isolated from 13 families of woody plants which included 42 different cultivars. Tests for oxidase and arginine dihydrolase activity, hypersensitivity on tobacco, pathogenicity on green fruit of yellow pear tomato and ice nucleation activity at -50°C were performed. Of 288 strains which were fluorescent, oxidase negative, arginine negative (typical *Pseudomonas syringae* pattern), 231 induced hypersensitivity on tobacco, 182 were pathogenic on tomato and 161 were ice nucleation active.

THE USE OF COMPLEMENTARY DNA FOR PLANT VIRUS DETECTION. J. C. Carrington and T. J. Morris, Department of Plant Pathology, University of California, Berkeley, CA 94720.

Cucumber mosaic virus (CMV) was used as a model system to investigate the application of ³²P-labeled complementary DNA (cDNA) to virus detection from leaf tissue of infected plants. Complementary DNA was synthesized by the random primer technique. DNA transcribed from genomic CMV RNA was complementary to each viral component as revealed by northern blot analysis, and was approximately 50 to 600 nucleotides in length. Cucumber mosaic virus RNA sequences were detected by dot blot hybridization procedures in leaves from a variety of CMV infected plant species. Positive hybridization signals were observed in 10 micrograms of infected tissue. Similarly, cDNA synthesized from CMV satellite RNA was used to detect this species by dot blot hybridization. Comparisons of this method with ELISA will be discussed.

REACTIONS OF SOME U.S. STRAWBERRY CULTIVARS TO GRAFT INOCULATION WITH TOMATO RINGSPOT VIRUS. R.H. Converse, USDA, ARS, Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331

Susceptibility of 49 U.S. strawberry cultivars to a strawberry isolate of tomato ringspot virus (TmRSV) was determined by leaflet grafting and subsequent detection by ELISA. Thirty-eight cultivars were susceptible: 23 died after inoculation (group 1), and 15 became infected but did not die (group 2). The remaining 11 inoculated cultivars were negative for TmRSV in ELISA tests of at least 10 plants each (group 3). ELISA detection of TmRSV was difficult in many of the grafted susceptible cultivars of groups 1 and 2. In such plants an emerging leaf that began to necrose would often prove to be the only plant part that ever tested positive by ELISA. Detection of TmRSV in susceptible cultivars was 30% reliable, requiring that 10 grafted plants test negative for TmRSV by ELISA in order to state with a confidence level of 95% that a given cultivar was not infected with TmRSV and belonged in group 3.

FAILURE OF METALAXYL TO CONTROL ALL OF THE *PYTHIUM* POPULATION PATHOGENIC ON ROOTS OF PACIFIC NORTHWEST WHEAT. R. J. Cook, B.-X. Zhang, and A. Doerr, USDA-ARS, Pullman, WA.

Metalaxyl as a seed (1.0-1.5g a.i./kg seed) or soil (1-3 kg a.i./ha as 5G formulation in the seed furrow) treatment for wheat failed to control *Pythium* root rot in several field tests in eastern Washington. The growth of *P. torulosum* (one of the pathogenic species) was relatively unaffected on Difco corn meal agar (CMA) amended with metalaxyl at 1 µg/ml, and it grew remarkably well even on CMA with metalaxyl at 100 µg/ml. *Pythium ultimum* vars. *ultimum* and *sporangiferum* and *P. aristosporum* (also pathogenic on wheat roots in the Northwest) were inhibited completely by 1 µg/ml of CMA. Dilution plate-counts on Mircetich's Pirimycin-Vancomycin-PCNB medium (MPVM) revealed 500-1100 *Pythium* propagules per gram soil from typical wheat-pea and wheat-tent fields (where metalaxyl was ineffective) and 1/4-3/4 of randomly selected colonies from these plates grew on MPVM medium + metalaxyl at 1 or 10 µg/ml. Apparently the chemical is ineffective against a significant portion of the *Pythium* population pathogenic to wheat roots.

VERTICILLIUM WILT RESISTANCE RELATED TO MATURITY AND YIELD OF POTATO CLONES. D. Corsini, J. Pavék, USDA, University of Idaho Research & Extension Center, Aberdeen, Idaho 83210.

The importance of verticillium wilt resistance for achieving maximum yields in *Verticillium dahliae* infested soils was demonstrated. Results also indicate that early, rapid tuber growth can be combined with verticillium resistance. Fourteen potato genotypes (*Solanum tuberosum*) were chosen for differential wilt resistance and were compared for the degree of *V. dahliae*, stem colonization, maturity and yield. The incidence of verticillium wilt ranged from 0 to 98% among genotypes and was highly correlated with *V. dahliae* stem colonization. Genotypes were rated for relative maturity on the basis of early to mid-season tuber growth and on vine characteristics. Although susceptibility was related to early maturity, there were exceptions. Selection A6948-4 was rated as early yet had moderate *V. dahliae* resistance. The highest yielding genotypes (up to 50% higher than the Russet Burbank cv) were moderately late in maturity and very resistant to *V. dahliae*.

EFFECTS OF CONTINUOUS CROPPING WITH POTATO GENOTYPES ON VERTICILLIUM DAHLIAE AND PRATYLENCHUS NEGLECTUS. J.R. Davis, L.H. Sorensen, D.L. Corsini, and S.L. Hafez*, University of Idaho Research & Extension Center, Aberdeen, ID 83210, and Parma*, ID 83660.

When compared to 'Russett Burbank' cv. (RB), continuous cropping for five years with two wilt-resistant clones (A66107-51 and A68113-4) resulted in significant reduction of soilborne *V. dahliae*. When RB was cropped in these sites the sixth year, wilt severity and *V. dahliae* colonization in stem tissue were reduced. Wilt incidence was negatively correlated with both yield and grade. Five years of cropping with 'Butte' cv. resulted in comparative reductions of *P. neglectus* in the soil and in roots of RB cropped during the sixth year. \log_{10} *P. neglectus* counts in roots were negatively correlated with wilt severity.

INOCULUM ADDITIVES TO INCREASE THE SUSCEPTIBILITY OF LEMONS TO *Geotrichum candidum* LINK. Aristoteles P. de Matos and J. W. Eckert. Dept. of Plant Pathology, University of California, Riverside, CA 92521.

The susceptibility of lemon fruits to wound infection by *Geotrichum candidum* (sour rot) is highly variable leading to inconclusive results in disease control experiments. The inoculum concentration required for 50% infection (ED₅₀) was reduced markedly by the addition of either cycloheximide (10 µg/ml), blasticidin S (10 µg/ml), glyphosate (10 µg/ml), pectinase (Rohaspect D5S, 10 mg/ml) or sodium polypectate (10 µg/ml) to the inoculum. Addition of 1 mM HCl or 0.01 mM H₃PO₄ to the suspension of conidia increased the incidence of infection to a lesser degree. Galacturonic acid, ascorbic acid, oxalic acid, bacitracin, pyridoxine, pectin methyl esterase, cellulase, EDTA, cAMP, or benomyl were ineffective at concentrations tolerated "in vitro" by *G. candidum*. The most effective additives are being added to the inoculum to insure a high level of infection in fungicide tests to control sour rot.

POPULATION DYNAMICS OF *SCLEROTINIA MINOR* IN NATURALLY INFESTED LETTUCE FIELDS. H. R. Dillard, L. J. Stowell, and R. G. Grogan. Department of Plant Pathology, University of California, Davis, CA 95616.

Lettuce fields naturally infested with sclerotia of *Sclerotinia minor* were studied to determine the spatial distribution of inoculum and the effect of four different cover crops (vetch, rye, sudangrass, vetch/rye mix) and lettuce on the inoculum distribution. Soil samples were taken before planting, at harvest, and after disking in each of the two fields. Four replicates consisting of 25 individual 100 cc soil samples from each treatment were assayed for sclerotia of *S. minor* by a wet sieving technique. The sclerotia were found to be aggregated and their distribution in the field was best described by the negative binomial distribution fit to the sample estimators (\bar{x} and s^2). Vetch was susceptible to *S. minor*, resulting in increases in sclerotia numbers. Rye and sudangrass were not susceptible in the standing crop, however soil samples obtained after disking showed increases in sclerotia numbers indicating colonization of the residue by *S. minor*.

THE EFFECT OF HOST EXUDATES ON INFECTION CUSHION MORPHOGENESIS

OF *RHIZOCTONIA SOLANI*. A. J. Downer and V. N. Armentrout. Bio Sci Dept, Calif. State Polytech. Univ., Pomona, CA 91768 USA

Rhizoctonia solani penetrates seedling hypocotyls with an infection cushion (IC). The IC develops with the production of T-shaped branches, or "feet". Reduction of internode length and increased foot formation (FF) precede IC formation (ICF). Aggregations of hyphae without this pattern of development are not truly IC. It is uncertain whether the stimulus for ICF is chemical (host exudates) or physical (surface contact). When light-grown hypocotyls are inoculated, ICF is extensive; however, with dark-grown hypocotyls ICF is not observed. Preliminary studies show that light-grown exudates do not differ significantly from dark-grown exudates in their internode shortening ability. *R. solani* on replicas grew along anticlinal wall junctions, with branching and FF only with dilute growth medium present. Feet formed only on susceptible host or replica surfaces. Our hypothesis is that hyphae of the fungus are directed and FF stimulated by the topography of the host, while exudates provide a substrate for the hyphal growth necessary for ICF.

VARIATION IN *EUTYPA ARMENIACAE* AND DISCOVERY OF ITS ASCIGEROUS STAGE IN CALIFORNIA'S CENTRAL VALLEY. Harley English, J. R. Davis, J. M. Ogawa, and F. J. Schick. First, third, and fourth authors, Department of Plant Pathology, Univ. of Calif., Davis, CA. 95616; second author, University of Idaho Research and Extension Center, Aberdeen, ID 83210.

Eight spores were isolated from an ascus of *E. armeniacae* and compared for cultural morphology and virulence in apricot. When the isolates were grown on a high-glucose medium in the laboratory for 5 mos, 4 had produced abundant stromata, 2 abundant pycnidia and 2 were mycelial and sterile. Pruning-wound inoculations showed significant differences in virulence among the isolates. Virulence was not correlated with colony morphology. Many of the cankers induced by the least virulent isolates became quiescent and completely healed within 12 mos, whereas many cankers caused by the most virulent isolates were still active after 33 mos. The pathogen's infectious, ascigerous stage, not previously observed in California's Central Valley, was found in autumn, 1982, on a grapevine in Davis. This finding may help explain distribution of the disease in California.

INTERNAL POPULATIONS OF FUNGI AND BACTERIA IN COTTONSEED STORED UNDER VARIOUS ENVIRONMENTAL CONDITIONS. R. H. Garber, D. Ferguson, and L. M. Carter, USDA, ARS, U.S. Cotton Research Station, Shafter, CA 93263.

Seed of cotton harvested from fields in California, and stored in tarped field modules, deteriorated rapidly at seed moistures of 12 percent and above. Temperatures tended to rise rapidly in modules with high seed moisture, adversely affecting seed quality. Seed ginned from seed cotton samples, from forty-five predetermined locations within modules, were assayed on Czapeks and PDA agar for their microbial populations. Assays for the predominant fungi *Aspergillus*, *Rhizopus*, *Penicillium*, *Alternaria* and *Hormodendron* were remarkably uniform. This was true of samples collected early or late in the harvest season, during periods of low or high relative humidity, from modules with low or high green leaf trash, from seeds with low or high germination or from before or after storage. Most seeds contained fewer bacteria before than after storage. A microbial inhibitor applied to cotton at harvest did not influence the populations or types of organisms isolated.

Corn Stalk Rot in Colorado. R.L. Gilbertson, W.M. Brown, and E.G. Ruppel. Dept. of Botany and Plant Pathology, Colorado State University and USDA, ARS Crops Res. Lab., Fort Collins, CO 80523.

Stalk rot of corn was the most serious disease in Colorado field corn in 1982. The major fungi associated with stalk rot were *Fusarium moniliforme*, *F. moniliforme* var. *subglutinans*, and *F. roseum* var. *graminearum*. The ratio of *Fusarium* species isolated varied among fields sampled. Corn kernels were frequently infested with *F. moniliforme*, even in fields with no stalk rot. Seed treated commercially with thiram, whether damaged or undamaged was consistently infested by *F. moniliforme*. A benomyl (100 micrograms a.i./ml) soak of thiram-treated seed eliminated *F. moniliforme*. *F. moniliforme* also was isolated from washed and surface-disinfested western corn rootworm adults (*Diabrotica virgifera* L.), and from kernels damaged by these insects. *F. roseum* var. *graminearum* was isolated from one seed lot, but not from rootworm adults.

OCCURRENCE AND CONTROL OF UROMYCES ALOES IN CALIFORNIA.

W. D. Gillette, T. T. Matsumoto* and C. K. Fukushima*. Santa Barbara County Department of Agriculture, Santa Barbara, CA 93101 and *California Department of Food and Agriculture, Sacramento, CA 95814.

Rust of aloes caused by Uromyces aloes was found in 1980 at a private estate near Santa Barbara, California. Twenty-two Aloe species and two Gasteria species were infected with the rust. In spring of 1982, approximately 3,500 aloes plants were found infected and subsequently removed in an effort to eradicate the disease. A fungicide trial showed mancozeb and triadimefon to be most effective in preventing new infections. A control program consists of biweekly fungicide applications and removal of diseased plants. The current infection rate among the remaining 10,000 aloes plants is 0.1%.

SEED AND APHID TRANSMISSION OF THE LENTIL STRAIN OF PEA SEED-BORNE MOSAIC VIRUS (PSBMV-L) IN LENS CULINARIS, J.J. Goodell and R.O. Hampton, Dept. of Botany and Plant Pathology, Oregon State University, Corvallis, Oregon 97331.

PSBMV-L is a seedborne contaminant of the international collection of lentil germplasm. The virus was transmitted in 5% of the seeds from mechanically inoculated, greenhouse-grown plants of lentil cv. Tekoa. Seed transmission rates up to 16.7% were observed in field plantings of infected lentil accessions. The virus is non-persistently transmitted by Acyrtosiphon pisum. Acquisition access periods as short as one minute facilitate aphid transmission of PSBMV-L. Maximum rates of aphid transmission occurred with access periods of 3 to 5 min., and ranged from 80 to 100% with a single aphid per test plant. Aphid-transmission rates decreased from 81% at 18°C to 15% at 35°C. Apparent bimodal transmission of PSBMV-L corresponded to that of the standard strain, as reported by Lim & Hagedorn. Detection of PSBMV-L from both seed and aphid transmission was by means of enzyme-linked immunosorbent assay.

THE EFFECT OF EDAPHIC FACTORS ON THE PARASITISM OF ALFALFA BY DITYLENCHUS DIPSACI. G. D. Griffin, Crops Research Laboratory, USDA-ARS, Utah State University, Logan, UT 84322

There was a positive correlation between soil moisture and soil temperature and the alfalfa penetration rate by Ditylenchus dipsaci. The greatest percentage of invaded plants occurred at 61-94% soil moisture F. C., and the number of infested plants increased by increasing soil temperature from 12 to 28 C. The same correlation of moisture and temperature occurred in relation to the nematode density invading plant tissue; the greatest number of nematodes/g plant tissue were found at 61-94% F. C., and 20-28 C. There was not, however, a direct relationship between the degree of plant damage and soil temperatures. Plant growth suppression occurred at all temperatures, and there were no differences in the degree of parasitism at 12 to 28 C. Fall burning for weed control resulted in significant decreases in nematode infection in the following spring growth, while spring burning increased the incidence of penetration, and plant growth suppression.

RECOVERY OF PHYTOPHTHORA SPECIES FROM DOUGLAS-FIR AFTER TREATMENT WITH METALAXYL. P. B. Hamm, Oregon State University, Corvallis, OR 97331, S. J. Cooley, USDA Forest Service, Portland, OR 97208 and E. M. Hansen, Oregon State University, Corvallis, OR 97331.

One-year-old Douglas-fir in Phytophthora infested beds in two nurseries were treated with metalaxyl (Subdue®) up to 3 times. Multiple treatments were applied at 3 mo intervals through the season. Roots were examined for symptoms and Phytophthora isolations were made using selective medium before and after each application and at uplifing. Three Phytophthora spp. were recovered from each nursery, with individual seedlings often infected by more than one species. Species composition fluctuated over the 10 mo of sampling. At one nursery, Phytophthora were isolated from 73.4% of the trees before treatment. After 7 mo Phytophthora spp. were isolated from 48.9, 14.9, 14.3 and 19.7% of seedlings treated with metalaxyl 0, 1, 2 and 3 times, respectively. At the other nursery, Phytophthora spp. were isolated from 97.3% of the seedlings before treatment, and after 7 mo, 86.2, 80.5 and 90.7% for 1, 2 or 3 fungicide applications. These results indicate that Phytophthora spp. may survive in infected roots even after multiple applications of metalaxyl.

EPIDEMIOLOGY OF TOMATO YELLOW TOP VIRUS IN RELATION TO RELATED LUTEOVIRUSES. Sher Hassan and P.E. Thomas, USDA, ARS, Irrigated Agriculture Research & Extension Center, Prosser, WA 99350.

Tomato yellow top virus (TYTV) is related to potato leafroll (PLRV) and beet western yellows (BWVY) viruses. Tests were performed to determine whether the epidemiology of TYTV is associated with that of PLRV or of BWVY. In August, TYTV-infected tomato plants in a field adjacent to a plot of chronically PLRV-infected potatoes were distributed at random in the field, while a high incidence of PLRV was detected in symptomless tomato plants in a row adjacent to the potato plot. The distribution and incidence of TYTV diseased plants in the field adjacent to PLRV-infected potatoes was similar to that found in a field 300 M away. Rows of sugarbeets were grown between rows of tomatoes which contained about 50% TYTV-infected tomato plants by the end of the season. Not a single sugarbeet plant, among 500 tested, became infected with a virus transmissible to Physalis floridana, a common host of the three viruses. These results suggest an etiology for TYTV distinct from that of PLRV or of BWVY despite serological relationships.

TWO TYPES OF IMMUNITY TO TOMATO YELLOW TOP VIRUS IDENTIFIED IN LYCOPERSICON PERUVIANUM AND ITS TOMATO HYBRIDS. Sher Hassan and P.E. Thomas, USDA, ARS, Irrigated Agriculture Research & Extension Center, Prosser, WA 99350.

Interspecific Lycopersicon esculentum x L. peruvianum hybrids (F4 open pollinated) and the L. peruvianum parental line were screened for resistance to tomato yellow top virus (TYTV) by graft inoculation with 20 TYTV isolates. Two types of immunity were identified. In one, called passive immunity, virus moved from the infected scion into the test plant but could not sustain itself in cuttings of the test plant grown independently of the infected scion. In the other, called active immunity, virus could not be recovered from test plants even when the infected scion remained grafted to the test plants. The virus either did not move from the scion into test plants or was inactivated when it did. Some TYTV isolates were more invasive than others, but immunity to each isolate was identified among both hybrid and parental plants. Identical types of immunity to beet curly top virus were previously identified in the same germplasm used here.

ALTERNARIA BLIGHT OF MARIGOLD (TAGETES ERECTA) R.B. Hine, University of Arizona, Tucson, AZ 85721

Approximately 3000 ha of Marigolds (Tagetes erecta) are grown each year for xanthophyll production in the coastal areas of Mexico in Guasave, Los Mochis and Navajoa. During February, 1979, Alternaria tagetica was identified as a major cause of flower, stem and leaf blight. This was the first observation of this disease in North America. Fresh flower yields were reduced from 18-20 to 8-10 tons/ha during 1979-1980. Optimum environmental conditions for disease are leaf-wetness periods of at least 12 hr at temperatures ranging from 15-25 C. Alternaria tagetica does not cause a root or seedling disease. Captafol and iprodione were shown to be more effective as protectant fungicides than propiconazol, triforine, triphenyltin hydroxide and chlorothalonil.

CONTROL OF PHYMATOTRICHUM ROOT ROT OF COTTON IN ARIZONA WITH PROPICONAZOL. Hine, R.B., R.S. Whitson, and S.D. Lyda. Department of Plant Pathology, University of Arizona, Tucson, AZ 85721 and Texas Agricultural Experiment Station, College Station, TX 77843.

Replicated field plots were established in soils heavily infested with Phymatotrichum omnivorum in order to evaluate propiconazol (CGA-64250) for control of Phymatotrichum root rot in cotton. The emulsifiable concentrate (EC) was applied as a foliar spray at rates of 0.12, 0.25, and 0.5 kg/ha (a.i.) in 200 and 400 l of water/ha on 5 and 8 wk old plants, respectively. Side-dress applications of granules were applied 10 cm from the base of the plants and 10 cm deep, at rates of 1.0 and 2.0 kg/ha (a.i.). Foliar sprays of propiconazol at 0.5 kg/ha (a.i.) and side-dress applications of granules at 1.0 and 2.0 kg/ha (a.i.) produced significant reductions in percent disease and increases in yield in upland cotton (DPL-55), but not in Pima cotton (Pima S-5). This is the first report of a systemic fungicide applied to the foliage of cotton to control Phymatotrichum root rot.

SEROLOGICAL RELATIONSHIP AMONG SOME MEMBERS OF DIANTHOVIRUS GROUP AS DETERMINED BY MEANS OF MONO- AND POLYCLONAL ANTIBODIES. C. Hiruki, Y. Furuya, G. Figueiredo, and

A.L.N. Rao. Dept. of Plant Science, Univ. of Alberta, Edmonton, Alberta T6G 2P5, Canada.

Dianthovirus is one of the newest plant virus groups with bipartite genomes, having carnation ringspot virus (CRSV) as the type member. Further serological tests were conducted to elucidate the interrelationship between selected members of the dianthovirus group such as CRSV, redclover necrotic mosaic virus (RCNMV)-Swedish strain, clover primary leaf necrosis virus, a presumptive strain of RCNMV, and sweet clover necrotic mosaic virus (SCNMV). SCNMV was serologically distinct when subjected to the ring-interface test, agar double-diffusion test, ELISA, passive hemagglutination test, and reverse passive hemagglutination inhibition test against the 3 viruses mentioned above, but each member except CRSV showed different degrees of distant serological relatedness to SCNMV.

PRUNE BROWNLINER DISEASE: DIFFERENTIAL SUSCEPTIBILITY OF PRUNE ROOTSTOCKS AND ROLE OF TOMATO RINGSPOT VIRUS STRAINS. J. W. Hoy and S. M. Mircetich, USDA, ARS, Dept. of Plant Pathology, Univ. of Calif., Davis, 95616.

Prune trees on Myrobalan, peach or Marianna 2624 rootstocks were graft inoculated in the rootstock with rootchip inoculum from a prune brownline (PBL) affected tree. None of 14 prune/Marianna 2624 trees developed a brownline at the graft union while 14 of 14 prune/Myrobalan and prune/peach trees developed PBL. In another experiment, prune trees on the same rootstocks were graft inoculated in the rootstock with inoculum infected with the PBL, peach yellow bud mosaic, Prunus stem pitting, Calif. stem pitting or cherry leaf mottle strains of tomato ringspot virus (TomRSV). None of the 5 strains infected or induced PBL in prune/Marianna 2624 trees while all 5 strains infected and induced PBL in prune/Myrobalan and prune/peach trees. Control trees in both experiments did not develop PBL. Apparently, five strains of TomRSV may cause PBL in prune trees on Myrobalan and peach rootstocks but not in trees on Marianna 2624.

AVOCADO BLACKSTREAK DISEASE (ABS): A NEWLY RECOGNIZED MAJOR DISEASE OF AVOCADO (*Persea americana* Miller) IN CALIFORNIA. Ramon L. Jordan, H. D. Ohr and G. A. Zentmyer. Dept. of Plant Pathology, University of California, Riverside, Ca. 92521.

The most characteristic and diagnostic symptom of ABS is the black lesions on the main trunk and branches that exude a white powdery sugar. Other symptoms can include chlorotic, thinning foliage, interveinal and leaf tip necrosis, and pitting of the stem wood below the graft union; usually followed by general decline, defoliation and death. The disease affects primarily Hass and Reed cultivars and affects Hass irrespective of the rootstock. The incidence of ABS in surveyed groves varied from a few to more than 37%. Statistical analysis of the number and field spread of ABS indicates a non-random distribution of ABS-affected trees. No bacteria or fungi have been found associated with ABS-affected trees. A stem pitting agent has been graft transmitted by bud inoculation. ABS, which can result in the economic loss of a tree in 2 to 5 years, has characteristics of a serious disease with the potential to limit avocado production in California.

B-1,3-GLUCANASE INDUCTION BY TMV AND ABIOTIC LOCAL LESIONS. C.M. Kearney and J.H. Wu. Dept. of Biological Science, California State Polytechnic Univ., Pomona, CA, 91768, USA.

Others have found that the callose hydrolase, B-1,3-glucanase, greatly increases in activity with the appearance of necrotic local lesions of TMV on *Nicotiana glutinosa*. Since callose deposition has been postulated as a localizing barrier to viral spread, this study was undertaken to examine how enzymatic activity is related to the spread of TMV in *N. glutinosa*. Activity and lesion size both increased with increasing temperature when inoculated plants were incubated at 16°, 20°, or 24° C. At 28° and 36° C, viral spread was more rapid and formed large irregular lesions and a mosaic, respectively, but enzymatic activity was lower. To check the effects of necrosis on enzymatic induction, abiotic, necrotic local lesions were made chemically and mechanically. Only low enzymatic activity resulted. In conclusion, high B-1,3-glucanase activity is associated with restricted viral necrotic lesions, but not with systemic viral symptoms or with the types of abiotic necrosis examined here.

"EARLY DYING" DISEASE OF POTATOES AS CAUSED BY *ERWINIA CAROTOVORA*

SUBSP. *ATROSEPTICA* AND *E. CAROTOVORA* SUBSP. *CAROTOVORA*. M.L. Kirkland, Dept. of Bot. and Pl. Path., Colorado State University, Fort Collins 80523, and M.L. Powelson, Dept. of Bot. and Pl. Path., Oregon State University, Corvallis 97331.

Erwinia carotovora subsp. *atroseptica* (Eca) and *E. carotovora* subsp. *carotovora* (Ecc) were associated with "early dying" disease symptoms of potatoes under field conditions. The frequency of Eca, Ecc and *Verticillium dahliae* isolated from symptomatic plants grown at a cool site (16.7 C mean) was 21, 16 and 0%, respectively, and 6, 53 and 5%, respectively, at a warm site (20.2 C mean). Greenhouse pathogenicity studies were conducted in which air-rooted Russet Burbank potato cuttings were inoculated by dipping clipped roots for 1.5 hr in cell suspensions of Eca, Ecc or *V. dahliae*, a known causal agent. Visual comparison with the control and *V. dahliae* treated plants showed that Eca and Ecc caused typical symptoms, characterized by progressive foliar chlorosis and necrosis without any accompanying stem rot disorder. Reisolations from diseased plants yielded the same organism used as inoculum.

USE OF INDIRECT IMMUNOFLOUORESCENCE MICROSCOPY TO STUDY GLOMUS SPP. J.L. Kough, Dept. of Botany and Plant Pathology, Oregon State Univ. Corvallis, OR 97331; N. Malajczuk, CSIRO, Wembley, W. Australia 6014; R.G. Linderman, USDA-ARS Horticultural Crops Research Lab, Corvallis, OR 97330.

Extracted chlamydospore wall preparations of the vesicular-arbuscular (VAM) fungus *Glomus epigaeum* served as an antigen to elicit antiserum production in rabbits. Titer of the serum never exceeded 1:50, assayed by an agglutination reaction. This antiserum reacted specifically to chlamydospores and hyphae of *Glomus epigaeum*, *G. deserticola*, and *G. mosseae* but not to azygospores and hyphae of *Gigaspora margarita*, *Acaulospora spinosa*, and *A. trapepei*. The serological reaction was used to visualize VAM hyphae in the rhizoplane by employing the indirect FITC staining method. FITC allowed VAM hyphae of *Glomus* species to be distinguished from other aseptate fungi present in the rhizoplane. No cross-reaction to the serum was found when other root inhabiting fungi such as *Phytophthora cinnamomi*, *Fusarium oxysporum*, *Verticillium dahliae*, *Pisolithus tinctorius*, and *Cenococcum geophilum* were tested.

THE ROLE OF *HELMINTHOSPORIUM SATIVUM* IN BARLEY CROWN ROT AND YIELD LOSS. A. Lutz, N. K. Van Alfen, R. Kidambi. Biology Dept., Utah State University, Logan, Utah 84322.

A five year study has investigated the impact of crown rot on yield of barley in Utah. *Helminthosporium sativum* Pamm. King and Bakke was isolated from 50-80% of diseased crowns. Pathogenicity was demonstrated in greenhouse studies. Variability in yield loss occurred during the five year period. Yield loss assessment showed that when the disease reduces yield, its primary effect is reduction of kernel weight. During 1978 and 1980, kernel weights of severely diseased plants were reduced up to 60%. However, in 1981 and 1982 no correlation between disease index and kernel weight was observed. Environmental and microbial factors may influence the pathogen's effect on grain yield. However, disease was not correlated with adverse effects on host water relations. *Fusarium oxysporum* Schlecht. was isolated from leading necrotic edges with increasing frequency as the barley matured during 1982. Greenhouse pathogenicity tests showed *F. oxysporum* is not pathogenic, but can survive within barley.

FACTORS AFFECTING THE COLONIZATION OF CROP RESIDUES BY *PYTHIUM ULTIMUM*. F. N. Martin and J. G. Hancock, Department of Plant Pathology, University of California, Berkeley, CA 94720.

Several agricultural soils have been identified in central California which do not support the saprophytic activity of *Pythium ultimum* on crop residues (low *P. ultimum* soils, LP). These soils tended to have higher [Cl⁻] and a greater saprophytic activity of other primary colonizing fungi (in particular *Pythium oligandrum*) than did adjacent soils which did support the saprophytic activity of *P. ultimum* (HP soils). Upon assaying HP and LP soils for *P. oligandrum* population densities with a differential medium, it was found that there was an occasional disparity in the relationship between densities of propagules of *P. oligandrum* and an LP rating. However, in studying organic matter colonization, it was found that the saprophytic activity of *P. oligandrum* was higher in LP soils, even when compared with HP soils with equivalent *P. oligandrum* population densities. In addition, soil [Cl⁻] also has a marked effect on the saprophytic activity of these two *Pythium* spp. For example, as the [Cl⁻] was increased up to 9.5 meq/100 g using an HP soil, the organic matter colonization by *P. ultimum* was reduced by 75%, while colonization by *P. oligandrum* was increased 12-fold.

IDENTIFICATION OF SMUT FUNGI OF REGULATORY SIGNIFICANCE BY SCANNING ELECTRON MICROSCOPY. T. T. Matsumoto, D. W. Showers, C. K. Fukushima, F. Kuo and J. Pangborn*, California Department of Food and Agriculture, Sacramento, CA 95814 and *University of California, Davis, CA 95616.

Scanning electron microscope (SEM) observation of exospore or spore wall ornamentation provides an additional tool which can be used in the identification of thirty species of smut fungi regulated by some Federal, State or County Departments of Agriculture. These smuts are found in the following genera: Entyloma, Sphacelotheca, Thecaphora, Tilletia, Tolyposporium, Urocystis and Ustilago. The SEM technique permits the identification of small and mixed populations of smuts and minimizes the problem of improper host identification and contamination of disease samples with other host material (e.g. weeds). A preliminary key has been developed for the identification of regulatory smut fungi based on exospore characters and spore size without the need for host or soral information.

DISTRIBUTION OF POTATO VIRUSES X,S,Y,M, AND LEAFROLL IN THE LEAVES, STEMS, AND ROOTS OF TISSUE CULTURE PLANTLETS. J. P. McMorran and T.C. Allen. Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331.

Maintaining potato viruses in tissue culture plantlets is a convenient, cost and space effective alternative to the use of greenhouse plants. Tissue culture plantlets infected with potato viruses X,S,Y,M, and leafroll were found to be more reliable than greenhouse-grown plants as known-virus controls in ELISA testing. Another advantage was the prevention of contamination of these plantlets by other viruses or other pathogens. Leaves, stems, and roots of virus infected plantlets were tested separately for antigen levels by ELISA. In these tests potato viruses S and M were uniformly distributed in plantlet tissues, while the highest levels of PVX were found in the roots. Leafroll virus and PVY concentrations were highest in leaf tissues, but lowest in root tissue. These results differ from reports of similar tests using greenhouse and field grown plants.

AVAILABILITY OF PHAEOCRYPTOPUS GAEUMANNII ASCOSPORES AND CONDITIONS WHICH INFLUENCE THEIR RELEASE. E. Michaels and G. A. Chastagner, Dept. of Plant Pathology, Wash. State Univ., Pullup, WA 98371.

Swiss needle cast, caused by Phaeocryptopus gaeumannii, is common in Douglas-fir Christmas tree plantations throughout western Washington and Oregon. Using infected needles collected from the field, studies were conducted to determine the period of ascospore availability and conditions which influence their release. Ascospores were released from April through September and maximum numbers were released during June and July. Ten times as many ascospores were released from one-year-old than from two-year-old infected needles. Pseudothecia released all available ascospores within four hours of misting, 75% within 20 minutes. Ascospore release occurred at temperatures from 5-25 C with an optimum at 20 C. Ultraviolet or fluorescent light sources enhanced ascospore release. Since infection is limited to the period during shoot elongation, these data indicate that changes in host susceptibility rather than ascospore availability determine the infection period.

CONTROL OF DECAY OF FRESH FRENCH PRUNES DURING COLD STORAGE. T. J. Michailides, J. M. Ogawa, and P. L. Sholberg. Dept. of Plant Pathology, Univ. of Calif., Davis, CA 95616.

Fresh prunes can be held in cold storage with no internal breakdown for 2-3 weeks according to Mitchell *et al.* [1981, Cal. Agr. (1 & 2)]. However, molds that cause decay, such as species of Cladosporium, Monilinia, Mucor, Penicillium, and Botrytis, amount of decay, and reduction of mold by chemical treatment are directly related to methods of harvest and source of the prunes. Untreated prunes held at 4°C started to develop mold on the 7th day; on the 20th day, 14%, 40%, and 94% decay developed on prunes from Tulare, Yuba City, and Healdsburg, respectively. Those treated with chlorine (400 mg/L water), CGA 64251 (4.5 g/L water), and K-sorbate (2%) showed no mold until the 10th day and significantly less decay on the 20th day. Prunes from Tulare and Yuba City (both mechanically harvested) showed significantly less decay than prunes from Healdsburg (hand-harvested from the ground). No differences were evident between washed and unwashed prunes.

DETECTION OF dsRNA IN LETTUCE BIG VEIN INFECTED LETTUCE

(Lactuca sativa). T. E. Mirkov and J. A. Dodds. Department of Plant Pathology, University of California, Riverside, CA 92521.

Three major (MW=2.3, 2.1, 0.72 x 10⁶) and three other double-stranded RNAs have been repeatedly detected in roots, but not leaves of lettuce plants inoculated with Olpidium brassicae and showing symptoms of lettuce big vein (LBV) disease in the leaves. These dsRNAs were also detected in roots of plants vegetatively propagated from LBV infected shoots which were not infected with O. brassicae. They were not detected in roots of lettuce infected with LBV-free O. brassicae. The diagnostic dsRNAs can be detected as early as 6 days after inoculation. They can be obtained from as little as 1.0g of tissue by cellulose chromatography, and have different mobilities from tobacco necrosis virus dsRNAs after electrophoresis on polyacrylamide gels. Similar results have been obtained with three California and one Dutch isolate of LBV. The results are interpreted to mean that an RNA virus is associated with LBV disease.

NEW DISEASE OF KIWI FRUIT. D.C. Opgenorth, C.M. Lai, M. Sorrell and J. White. California Department of Food and Agriculture, Sacramento, California 95814.

A new disease of Kiwifruit (Actinidia chinensis) has been seen in California. Symptoms appear in early spring with wilt and cane blight commonly seen. Cane cankers have deeply shriveled and dried bark with internal tissue being a red rusty brown. Pruning wounds are found in proximity to cane cankers. Isolation of a fluorescent Pseudomonas sp. hypersensitive to tobacco is common. Further characterization has shown isolates to be positive for syringomycin production, Potato rot, sucrose utilization, Levan utilization and negative for oxidase, Arginine and D(-)Tartarate utilization. Inoculation of peach and kiwifruit shoots has shown injury when subjected to low temperatures.

BIOCONTROL OF PYTHIUM ULTIMUM DAMPING-OFF OF SUGAR BEETS WITH RHIZOSPHERE BACTERIA. R. M. Osburn, A. H. McCain, and M. N. Schroth, Department of Plant Pathology, University of California, Berkeley, CA 94720.

Strains of Pseudomonas and an actinomycete applied to sugar beet seed decreased significantly preemergence and postemergence damping-off caused by Pythium ultimum in greenhouse experiments. Trials were conducted in two natural field soils with P. ultimum populations of 75-150 sporangia/g soil. The bacterial strains were applied individually and in combination to the seed in a mixture of 0.1 M MgSO₄ and 2% methylcellulose, and were then coated with talc. Bacterial treatments were compared with four seed treatment fungicides (captan, fenaminosulf, metalaxyl, and thiram) and pelleted or unpelleted controls. Bacterial treatments decreased pre- and postemergence damping-off, increasing significantly the final stand of sugar beets 20-48%. These increases were similar to fungicide seed treatments. Effective bacterial treatments included Pseudomonas sp. R20 and combinations of the Pseudomonas strains and the actinomycete. The remaining bacterial treatments significantly increased emergence and final stand in some trials but not in others. Strain R20 significantly increased stand in all trials in both soils.

FUNGICIDES FOR THE CONTROL OF LATE BLIGHT OF TOMATO. Albert O. Paulus, Jerry Nelson and Harry Otto, Plant Pathology Dept., University of California, Riverside, California, 92521.

Late blight (Phytophthora infestans) of tomato was rarely seen in California during the period from 1950 through the late 1970s. Late blight was epidemic from 1979-1982 in greenhouses and fields in selected areas of California and especially the coastal-growing areas. Fungicides were evaluated for control in plots at University of California Field Station, Santa Ana. Mancozeb, chlorothalonil, mancozeb + captafol or captafol alone were significantly better than propiconazole or anilazine when sprays were applied every 7 days in 1981. Sprays of metalaxyl + mancozeb controlled the foliage disease significantly better than mancozeb, captafol and chlorothalonil which were intermediate for control in 1982. Botrytis (Botrytis cinerea) fruit rot was also severe in 1982 and highest yields of healthy fruit were obtained from applications of chlorothalonil, anilazine and metalaxyl + mancozeb. Poor control of late blight was obtained with anilazine.

RECOVERY OF SUNFLOWER FROM SCLEROTINIA WILT: THE ROLE OF ENZYME-MEDIATED TOXIN DEGRADATION. R. C. Peet and J. G.

Hancock, Department of Plant Pathology, University of California, Berkeley, CA 94720.

Oxalic acid acts as a toxin in *Sclerotinia* wilt of sunflower. Sunflower leaves exhibiting the initial symptoms of wilt, flaccidity and water-soaking, are capable of recovery if the half-stem containing the lesion in split-stem plants is severed above the lesion. Enzyme-mediated degradation of the toxin may contribute to recovery. Degradation of (^{14}C) oxalic acid occurs in leaf discs, leaf homogenates and in a fraction precipitated with ammonium sulfate (85% of saturation) as evidenced by the release of $^{14}\text{CO}_2$. The reaction was inactivated by heating at 90 C for 2 min, had a pH optimum of 4-5, was inhibited under anaerobic conditions in the dark, and was competitively inhibited by glyoxylate but not glycolate. The reaction obeys Michaelis-Menten saturation kinetics. In a greenhouse study, the lower threshold concentration of oxalic acid in planta that elicited wilting was found to be 9-10 mM. Based upon the rate of oxalic acid degradation in leaf discs, approximately 11% of the oxalate pool at this "critical" concentration would be degraded over a 24 hr recovery period.

THE RELATIONSHIP OF GROWTH RATE, MYCELIAL DRY WEIGHT, AND PRODUCTION OF OXALIC ACID, CELLULASE, AND POLYGALACTURONASE TO VIRULENCE IN *SCLEROTIUM ROLFSSII*. Z. K. Punja, C. W. Holloway, and S. F. Jenkins, Dept. of Plant Pathology, North Carolina State University, Raleigh 27650.

Three parental and 24 progeny single-basidiospore isolates were studied. Growth rates (GR, mm/hr) on PDA were measured after 72 hr. Dry weight (DW, mg) and oxalic acid (OA, mg) were determined from a liquid salts medium (LSM, pH 5.8) containing 2% glucose. Relative activities of cellulase (CX) and polygalacturonase (PG) in LSM containing 2% Na-carboxymethyl cellulose or citrus pectin, respectively, as the C-source were assayed using standard viscometric methods. Relative virulence (0 to 1.0 scale) was estimated from the extent of colonization of carrot root slices and sugarbeet leaf discs, and mortality to carrot and sugarbeet seedlings. The isolates ranged from highly virulent (HV) to weakly virulent (WV). The HV isolates (46%) had rapid GR, high OA, CX, and PG. The WV isolates (21%) had variable GR, high OA and CX, and very low PG. Estimated PG activity was highly correlated ($r=0.86$) with virulence in these isolates.

STUDIES ON THE EXCLUSION OF *FUSARIUM* FROM CONIFEROUS FOREST SOILS. D.A. Schisler and R.G. Linderman, Dept. of Botany and Plant Pathology, Oregon State University and USDA-ARS Horticultural Crops Research Laboratory, Corvallis, Oregon 97330

Fusarium was recovered from only 1 of 14 Pacific Northwest coniferous forest soils but from all 7 nursery soils tested. Assays using high concentrations of macroconidia added to soil showed that forest soils stimulate conidial germination ($\bar{x}=1.2\%$), while nursery soils support little conidial germination ($\bar{x}=1.5\%$). Also, conidial germ tubes in forest soils often lysed or formed stunted chlamydospores. Treatment of forest soils with aerated steam (minimum of 45° C/30 min), radiation or propylene oxide reduced germination in forest soils, suggesting that the forest soil microbiota stimulates conidial germination. Bacteria isolated from *Fusarium* hyphae placed in forest, field or nursery soils on nylon screens did not significantly influence germ tube lysis when combined with conidia in a nutrient broth. Chemical, physical, and nutritional properties of forest soils likely affect the capacity of the forest soil microbiota to influence *Fusarium* conidial germination and germ tube lysis.

EXPLOITABLE SOIL VOLUME, EFFICIENCY OF PHOSPHATE UPTAKE, AND ROOT:SHOOT RATIO IN THE TOMATO MYCORRHIZAL RESPONSE. R. W. Schneider, K. H. Brownell, and S. Selfridge, Dept. of Plant Pathology, University of California, Berkeley, CA 94720.

Isolates of *Glomus fasciculatus* were used which increased (Gf6) and decreased (Gf3) tomato growth and yield relative to nonmycorrhizal controls in greenhouse and field studies. Exploitable soil volume (ESV) was controlled experimentally by growing plants in pipes of various diameters. Shoot dry weights relative to the controls for Gf6 and Gf3 were 2.69 and 1.16, respectively, at an ESV of 0.3 liters, but decreased to 0.91 and 0.51, respectively, at an ESV of 2.7 liters. Root:shoot (R:S) ratios decreased as a function of increasing ESV for both isolates and the control; however, relative to the control, the R:S ratios for Gf6 were significantly less than 1.0 at all but the largest ESVs tested. Integration of these data with tissue phosphorus concentrations indicated that efficiency of phosphate uptake ($\text{g PO}_4\text{-P/meter root/day}$) and influence on root growth are the primary determinants in the tomato mycorrhizal response. Thus, reductions in the R:S ratio by mycorrhizal fungi must be offset by an increased PO_4 uptake efficiency in order to stimulate plant growth.

USE OF ULTRAVIOLET RADIATION FOR CONTROL OF *PHYTHIUM APHANIDERMATUM* IN RECIRCULATING HYDROPONIC SYSTEMS. M.E. Stanghellini, L.J. Stowell, and M.L. Bates. Dept. of Plant Pathology, University of Arizona, Tucson, AZ 85721

Greenhouse recirculating hydroponic systems facilitate continuous dissemination of an introduced plant pathogen. Trials were conducted to determine the efficacy of ultraviolet radiation treatment of infested water for the control of root rot of lettuce and spinach caused by *Pythium aphanidermatum*. Seventy-two two-wk-old lettuce and spinach seedlings were transplanted into separate hydroponic chambers which received, from a common source, either recirculated ultraviolet treated or untreated water. Water was infested with ca. 15 encysted zoospores and 5 oospores/ml and was recirculated at a flow rate of ca. 124 l/min. A model L-200, ultraviolet disinfection system (Ultraviolet Technology, Inc) was used as the source of radiation. Within seven days after transplant, all spinach seedlings were dead and all lettuce plants were infected in the chamber receiving untreated water. No plant death or root infection occurred in the chamber receiving ultraviolet treated water.

THE CORRELATION BETWEEN QUANTITATIVE CHARACTERS AND VIRULENCE OF *ERWINIA CAROTOVORA*. L. J. Stowell and M. E. Stanghellini, Dept. of Plant Pathology, University of Arizona, Tucson, AZ 85721.

Nine strains of *Erwinia carotovora* representing several geographic locations and several hosts were evaluated for motility, polygalacturonate (PG) degradation, and decay of potato tubers. Motility was evaluated using a semi-solid agar plate assay by measuring the diameter of the expanding zone of bacterial growth after various time intervals. PG degradation was also evaluated by a plate assay by measuring the zone of PG degradation after varying incubation times. Potato tubers were inoculated after wounding with a sterile hypodermic needle by submersing the tubers in a suspension of bacteria. Tubers were removed from the inoculum after 15 min. and placed into an incubator at 30 C and 90-99% RH. Tuber decay was evaluated 48 hr later by calculating the weight loss due to decay after washing away the rotted tissue with a forceful stream of water. Motility was found to be correlated with percent infection ($r=0.82$, $p=0.01$) and PG degradation with decay of tubers ($r=0.83$, $p=0.01$).

CALIFORNIA FIELD ISOLATES OF CITRUS TRISTEZA VIRUS (CTV) HAVE LITTLE CROSS-PROTECTING ABILITY AGAINST A SEVERE SEEDLING YELLOW STRAIN OF CTV. S. Tamaki, C. N. Roistacher, J. A. Dodds and D. J. Gumpf. Department of Plant Pathology, University of California, Riverside, CA 92521.

A virulent seedling yellows (SY) strain of citrus tristeza virus (CTV) which is transmitted by *Aphis gossypii* and causes severe stunting and stem pitting was used as a challenge inoculum in a cross-protection experiment in sweet orange. Eighteen of 20 field isolates of CTV, which by themselves induced no obvious symptoms in sweet orange, offered no protection against the effects of CTV-SY, regardless of whether the challenge inoculation was by bud grafting (2 plants) or by aphid transmission (3 plants). Symptom expression of the challenge strain was delayed initially in plants infected with two of the field isolates. Infection by the challenge virus was assayed by symptom expression and detection of a strain specific viral double-stranded RNA. Another approach will have to be used if strains able to cross-protect against CTV-SY are to be developed.

TECHNIQUE FOR SCREENING CHEMICALS AND BIOCONTROL AGENTS AGAINST ROOT DISEASE INCITING FUNGI. M.J. Thirumalachar, Jeersannidhi Anderson Institute, Walnut Creek, CA 94596

Root disease inciting fungi such as *Sclerotium rolfsii*, *Macrophomina phaseolina*, *Rhizoctonia solani* species of *Pythium* and *Phytophthora*, each alone or in combination, were first grown in Petri dishes on 15 cc nutrient agar medium suitable for rapid growth. When the Petri dish was covered with fungal growth, the mycelium was overlaid with sterile soil and host seed dibbled in. For biocontrol agent seeds were coated with spores of antagonist before planting. 10 cc of test chemical solution was poured in each plate and incubated for 10 to 15 days. In controls without treatment there was pre-emergence killing or seedling wilting. Where chemical or biocontrol agent was effective, germination was normal. This technique evaluated both fungicidal activity and phytotoxicity of the chemicals used.

PATHOGENS ASSOCIATED WITH THE OAK DECLINE COMPLEX.
W. D. Thomas, Jr. & Christopher A. Boza. Forest Ag,
P. O. Box 745, Lafayette, CA 94549.

Inoculations of *Quercus lobata* and *Q. agrifolia* saplings with *Verticillium albo-atrum*, *Pestalotia macrotricha*, *Dothiorella quercina*, *Cephalosporium diospyri*, *Phialophora* sp., or *Fusarium oxysporum* resulted in development of symptoms associated with oak decline, varying according to host and pathogen involved. Each pathogen was recovered from roots, crowns, and inoculation sites of inoculated trees. Symptom development and severity was directly related to maximum air temperatures and inversely related to soil moisture.

IN-VITRO GERMINATION OF BRANCHED BROOMRAPE SEED.
S. Wilhelm, J. E. Sagen, and A. H. Gold, Department of Plant Pathology, University of California, Berkeley, CA 94720.

Branched broomrape (*Orobancha ramosa*), a serious phanerogamic root parasite of many plants, in California attacks primarily tomato and lettuce. Detailed studies and the development of soil fumigation over the past 30 years have resulted in the eradication of new outbreaks. However, broomrape seed, produced in great abundance, persists in the soil for years and appears to germinate in response to specific host root secretions. In-vitro germination of the seed was found to have two distinct requirements, not necessarily host-related: preconditioning for several weeks in soil that is biologically conducive to broomrape, and subsequent exposure to low concentrations of ethylene or gibberellin. Average germination of seed so treated was 88.5%. In earlier seed germination trials without preconditioning (Phytopathology 50:772-774), only 1-17% (avg. 2%) germinated. Recently, germination of preconditioned seed on agar with an addition of autoclaved millet seed extract averaged 91%. The active principle in millet seed extract is not known.

PHENOTYPE MODIFICATION FOR HIGH-DENSITY PLANTING ACHIEVES EARLY MATURITY AND VERTICILLIUM WILT CONTROL IN ACALA COTTON. S. Wilhelm, J. E. Sagen, and H. Tietz, Department of Plant Pathology, University of California, Berkeley, CA 94720.

During at least 10 years of field testing, two new cotton lines, to be designated 'Acala Cal-120' and 'Acala Cal-150,' have withstood heavy *Verticillium* infestations in the San Joaquin Valley of California. Although infected, they resist symptom expression when grown in densities of approx. 200,000 plants/ha. 'Acala Cal-120' carries wilt resistance from *Gossypium barbadense* (Seabrook); 'Acala Cal-150' was derived in part from the USSR line '4727-S.' Both cottons bear short fruiting sympodia over the entire length of the main stem, and rank monopodial side branch growth is suppressed. They mature for once-over harvesting by spindle or stripper harvester within 165-180 days from planting. The early harvest allows early shredding of stalks and drying of shreds on the soil surface, measures that reduce the build-up of inoculum. Lint yields have been consistently between 1000 and 1335 kg/ha, exceeding those of wilt-susceptible Acala cottons by up to 100%.

REDUCTIONS IN FUSARIUM OXYSPORUM INFECTION AND SYSTEMIC COLONIZATION OF CARNATION FROM TREATMENT WITH RHIZOBACTERIUM MFA1. G. Y. Yuen and M. N. Schroth, Dept. of Plant Pathology, University of California, Berkeley, CA 94720.

Reduction in Fusarium wilt severity in carnation resulted from treatment with MFA1, a gram (-), nonfluorescent bacterium isolated from a Fusarium-suppressive soil, and was related to a decrease in systemic colonization by the fungus. Rooted cuttings were treated with a 10^8 cfu/ml of MFA1 or were left untreated before planting into soil infested with 10^3 propagules/g of *Fusarium oxysporum* f. sp. *dianthi*. After 3 mo, MFA1-treated plants exhibited a 50% decrease in wilt severity compared to untreated plants. Neither treated nor untreated plants showed wilt symptoms when rated after 1 mo. At that time, triturated root tissue

from MFA1-treated plants plated on Komada medium yielded 55% fewer pathogen colonies per mg root. Other experiments indicated that MFA1 seed treatment also reduces root infection. Carnation seeds were dipped in 10^8 cfu/ml of MFA1 and planted into pathogen-infested soil. Washed roots from 10- to 14-day-old seedlings were placed intact on Komada medium. MFA1 caused significant decreases (14-38%) in the number of pathogen colonies per cm root in three separate trials.

INFLUENCE OF WOOD MOISTURE CONTENT ON THE FUNGICIDICITY OF METHYLISOTHIOCYANATE TO PORIA CARBONICA. A. R. Zahora and M. E. Corden. Department of Botany and Plant Pathology, Oregon State University, Corvallis, Oregon, 97331.

Poria carbonica causes a major decay problem in Douglas-fir products and can be controlled in wood by application of volatile fungicides; e.g., Vorlex. The methylisothiocyanate (MS) component in Vorlex was eight fold more effective in wood than the chlorinated C_2 hydrocarbon components. Dosage-response curves were developed for MS fungitoxicity to *Poria* in wood fumigated at three different moisture contents. A continuous flow fumigation apparatus was used to maintain constant fumigant levels in the air surrounding infested wood blocks. The *Poria* population in wood blocks was estimated before and after fumigations. Although MS was effective in controlling *Poria* at all three wood moisture contents tested, *Poria* in wood at about 20% moisture content was significantly more resistant to MS than in wood at about 40 or 75% moisture content, even though the drier wood absorbed more of the MS than did the wetter wood. The dosage-response curves were used to generate concentration-time (CT) relationships for specific levels of fungitoxicity. The CT relationships should be useful in predicting the effectiveness of MS treatments of wood products under various environmental conditions.

MASS SCREENING OF FLUORESCENT PSEUDOMONADS FOR SUPPRESSIVENESS TO TAKE-ALL. Bing-Xing Zhang, D. M. Weiler, and R. J. Cook, USDA-ARS, Wash. State Univ., Pullman, WA 99164.

A test of fluorescent pseudomonads for ability to suppress take-all used wheat seedlings grown from seed treated with the candidate strains, with roots allowed to grow through a 1-cm-thick (5g) layer of soil amended with fragments (0.25-0.5 mm diam) of oat grains colonized by *Gaeumannomyces graminis* var. *tritici* (Ggt). The soil was sandwiched between two layers of vermiculite in 15-cm-long, plastic, tapered tubes ("Conetainers") (200 per rack), two seedlings per tube. The candidates were from wheat roots and were selected initially based on their ability to inhibit Ggt on agar media. In fumigated soil amended with 0.15% and 0.45% (w/w) of the Ggt-infested fragments, 83% and 77%, respectively, of 122 strains gave significant take-all suppression. In non-fumigated soil, 70% and 48% of the strains were effective at these two inoculum densities, respectively. Of six, two gave significant suppression of take-all in field plots.

CHEMICAL DESICCATION OF WHEAT PLANTS AS A SIMULATOR OF POST-ANTHESIS SEPTORIA LEAF BLOTCH STRESS. M. Zilberstein, A. Blum*, and Z. Eyal. Dept. of Botany, Tel Aviv Univ., Tel Aviv, Israel, and (*) Div. of Field Crops, The Volcani Center, ARO, Bet Degan, Israel.

Kernel growth was studied in *Septoria tritici* infected and chemically desiccated wheat cultivars. Virulent *S. tritici* isolates were used to inoculate plots weekly until epidemic was established. In other plots awns, glumes, leaf laminae and parts of the spike-peduncle and sheaths were destructed by spraying with magnesium chlorate 14 days after anthesis. *Septoria* progress on the 4 uppermost leaves was assessed from flag leaf emergence, and kernel dry weight was measured from anthesis to maturity. *Septoria* differentially reduced grain growth among cultivars expressing similar *Septoria* progress values. The susceptible tolerant cultivars Hazera 337, Lakhish, and Miriam consistently expressed the least loss in kernel growth and kernel weight. These cultivars responded similarly to chemical desiccation. High correlations were found between losses in kernel weight in *Septoria* affected and chemically desiccated plants.