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Abstracts

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Alphabetized by first author's last name

EFFICACY OF POLYHEXAMETHYLENE BIGUANIDE AS A POSTHARVEST DECAY CONTROL TREATMENT OF FRUIT CROPS. Adaskaveg, J. E. and J. M. Ogawa, Department of Plant Pathology, University of California, Davis CA 95616.

Polyhexamethylene biguanide (PHMB) is a water-soluble and oil-compatible synthetic compound used as a potent antimicrobial agent in disinfectants and preservatives (1000-5000 µg/ml), as well as medicinally for human eye infections. PHMB is also used at 50 µg/ml as an alternative to chlorine in swimming pool sanitation but it has not been evaluated as a postharvest, decay-control treatment of crops. *In vitro* studies indicated that aqueous preparations of PHMB (Vantocil IB®) at 25 µg/ml completely inhibited colony formation on PDA from conidia of the stone fruit decay organisms *Monilinia fructicola* and *Botrytis cinerea*, as well as the citrus pathogens *Penicillium digitatum* and *Geotrichum citri-aurantii*. On stone fruit (sweet cherry, peach, plum) and citrus fruit (navel orange, mandarin) that were wounded and inoculated (20 µl of 30K/ml) with the foregoing organisms, PHMB completely prevented decay at 1000 µg/ml and was very effective at 500 µg/ml. Hypochlorous acid (100 µg /ml) was not effective in comparative tests using wound-inoculated fruit. In other studies, PHMB showed residual activity and was 100% effective after a 16-hr but not a 24-hr incubation period in wound-inoculated citrus fruit. For apples wound-inoculated with *Rhizopus stolonifer*, PHMB was effective at 2000 µg/ml. Currently, the non-volatile, slightly opalescent, and non-phytotoxic PHMB is being evaluated as an alternative to chlorine or as an additional postharvest, decay control treatment of agricultural crops.

BIOTEST FOR THE DETECTION OF PYRROLNITRIN PRODUCTION BY BACTERIA. J.O. Becker[1] and H.-J. Kempf[2], [1]Department of Nematology, University of California, Riverside, CA 92521 and [2]CIBA Ltd., CH-4002 Basle, Switzerland

Antibiotic production by certain plant growth-promoting rhizobacteria has been shown to be responsible for the suppression of various soilborne diseases. The antifungal metabolite pyrrolnitrin has been reported as a major biocontrol component in the mode of action of *Pseudomonas* spp. against fungal pathogens. The discovery of laboratory mutants of *Botrytis cinerea* insensitive to pyrrolnitrin suggested their use in a biotest to screen bacterial strains for the production of this antibiotic. Bacteria selected for their potential to inhibit a wild type strain of *B. cinerea* in vitro were each spotted in the center of two Sabouraud-Maltose plates and incubated in the dark for three days at 23C. One set of plates was overlaid with a conidial suspension of the pyrrolnitrin-sensitive *B. cinerea* and the other set with the insensitive strain. Only pyrrolnitrin-producing bacteria no longer inhibited the insensitive fungal mutant.

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INFLUENCE OF SOIL pH AND SOIL MOISTURE ON GERMINATION OF *CEPHALOSPORIUM GRAMINEUM* CONIDIA IN SOIL. C.A. Blank and T.D. Murray, Dept. of Plant Pathology, Washington State University, Pullman WA 99164-6430.

Cephalosporium stripe is a vascular disease of winter wheat and other small grains. Disease is most severe in conditions of low soil pH and high soil moisture during the autumn. The goal of this study was to determine whether soil pH and moisture influence germination of *Cephalosporium gramineum* conidia in soil. Conidia were grown in shake culture, washed with water and adjusted to 1 x 10^6 conidia/ml. Conidia were stored in water at 4 C for 5 days, collected on membrane filters and buried in soil for 1-2 days at 5 and 10 C. Germination of conidia was up to two-fold greater at 20% moisture than at 32.5% and 45% moisture. Germination was similar at soil pH ranging from 4.7 to 7.5. There was no interaction between soil pH and moisture. Based on these results, enhanced germination of conidia in acid soils or in soils with high moisture does not contribute to increased incidence of Cephalosporium stripe.

IDENTIFICATION OF STRAINS OF POTATO VIRUS Y USING MONOCLONAL ANTIBODIES. G. Bowler, P. Ellis, and R. Stace-Smith, Agriculture and Agri-Food Canada, 6660 N.W. Marine Drive, Vancouver, British Columbia, V6T 1X2.

Monoclonal antibodies (MAbs) were prepared against specific strains representing the common (PVY^O), the tobacco veinal necrosis (PVY^N) and the stipple-streak (PVY^C) strain group of potato virus Y (PVY). These MAbs were compared with commercially available PVY MAbs. None of the PVY MAbs proved to be completely specific when tested against a broad range of PVY strains originating from various parts of the world. The PVY^N-specific MAbs either reacted with one or more of the PVY^O or PVY^C strain groups or failed to react with some of the PVY^N strains. One of the MAbs produced in this study, designated 1F5, detected all of the PVY^N strains tested but it also cross-reacted with two PVY^O strains. Despite this deficiency, it was considered to be superior to any available MAbs for the detection of PVY^N. MAb 4C3 reacted with all PVY strains that were tested and is useful as a universal probe for PVY.

INTEGRATED MANAGEMENT OF BARLEY STRIPE RUST. W.M. Brown,Jr., J.P. Hill and V. R. Velasco. Dept. of Plt. Path./Wd. Sci., Colorado State University, Fort Collins, CO 80523.

Comprehensive field and controlled environment evaluations of selected barley stripe rust-race 24 differential cultivars demonstrate that race 24 is a mixture of different pathotypes. Upon consideration of thestripe rust fungus' diversity, field observations and trial results involvingboth seed and foliar fungicide treatments, an integrated barley stripe rust strategy is proposed. Barley stripe rust IPM using; 1) slow rusting cultivars (i.e., moderately susceptible), 2) seed treatment with triadimenol, 3) early planting, and 4) propiconazole spraying based on scouting, can be initiated where the stripe rust fungus is established or in areas that are potentially vulnerable to introduction of the pathogen.

BARLEY STRIPE RUST INTERNATIONAL TRIALS PROGRAM. W.M. Brown, Jr., V.R. Velasco, J.P. Hill, D.M. Wesenberg*, and H.E. Bocklelman*. Dept. Plt. Path./Wd. Sci., Colorado State University, Fort Collins, CO 80523 and * USDA/ARS, National Small Grains Laboratory, Aberdeen, ID 83210.

Barley stripe rust, caused by *Puccinia striiformis* West, is established in the U.S. Field trials were initiated in Bolivia in 1990 before the fungus was found in the U.S., to evaluate 1) the world barley germplasm collection, 2) advanced lines from public and private programs, and 3) seed treatment and foliar fungicide effectiveness. Over 30,408 barley lines were evaluated for resistance to stripe rust. Of those, 20,455 are from the USDA National Small Grains Collection at Aberdeen,ID, 5,786 from public and private breeders, 796 USDA/ARS advanced selections and 4,267 "Elite" second year testing of promising selections. The "Elite" lines were also tested in Colorado, Ecuador, Germany, and Idaho by cooperators in those countries. Numerous resistant sources have been identified and other effective management methods tested.

RESISTANCE TO *PSEUDOCERCOSPORELLA HERPOTRICHOIDES* IN *TRITICUM MONOCOCCUM*. M.M. Cadle[1], S.S. Jones[2] and T.D. Murray[1], [1]Dept. of Plant Pathology and [2]Crop and Soil Sciences Dept., Washington State University, Pullman, 99164.

Eyespot, caused by *Pseudocercosporella herpotrichoides*, is an important disease of wheat in the Pacific Northwest. Only two sources of resistance for this disease have been identified in hexaploid wheat (2n=6X=42, AABBDD); the genes for resistance are located on chromosomes 7D and 7A in 'VPM' and 'Cappelle Desprez', respectively. A core sample of *Triticum monococcum* (2n=2X=14, AA), the A-genome donor of bread wheat, consisting of 164 accessions from 34 countries was screened for resistance using a GUS-transformed strain of the pathogen. Fifty-one (31%) of the accessions representing 15 different countries were resistant. Half of the accessions collected in Turkey (28 of 55) were resistant. Several accessions were identified that were more resistant than both Cappelle Desprez and VPM. *T. monococcum* is considered a new source of resistance to *P. herpotrichoides*; genetic analysis and transfer of these genes to hexaploid wheat is in progress.

BIOCONTROL OF POSTHARVEST PEAR DISEASES USING SAPROPHYTIC YEASTS. T. Chand-Goyal and R.A. Spotts, Oregon State University Mid-Columbia Agricultural Research & Extension Center, 3005 Experiment Station Drive, Hood River, OR 97031.

Thirty-one morphologically different strains of yeasts, isolated from the surface of pear fruits, were evaluated for biocontrol of postharvest decay of d'Anjou pear. Cryptococcus laurentii strain HRA5 and Rhodotorula glutinis strain HRB6 controlled blue mold caused by Penicillium expansum. Control improved when the yeasts were combined with a low dose of thiabendazole (15 µg per ml). C. infirmo-miniatus strain YY6 was most effective for the control of Mucor rot. All yeasts controlled gray mold caused by Botrytis cinerea and were more effective when combined with a low dose of thiabendazole. Population sizes of yeasts in pear wounds increased 1.3 log units within 10 days at -1 C and 1.7 log units in 2 days at 5, 10 and 20 C. Addition of cell-free supernatants of yeast cultures to wounds did not suppress decay, and antifungal compounds were not detected on culture plates, suggesting that the mode of action may be competition with pathogens for nutrients rather than antibiosis.

FUNGICIDAL CONTROL OF INTERIOR NEEDLE BLIGHT SYNDROME ON NOBLE FIR CHRISTMAS TREES. G.A Chastagner and J.M. Staley, Washington State University Res. and Ext. Center, Puyallup, WA 98371.

Chlorothalonil at 5 g ai/l or benomyl (in '91) followed by thiophanate methyl (in '92 and '93) at 0.6 g ai/l were applied to *Abies procera* in a commercial Christmas tree plantation during 1991, 1992 and 1993. All sprays were applied when new shoots were 2-4 cm long. Half the trees (2X) received an additional application 4 weeks later. Treatments were randomly applied to single trees in each of 10 blocks. Initial effects of the 1991 sprays were not evident until fall 1992. *Mycosphaerella* spp. and *Phaeocryptopus nudus* were the most common fungi associated with symptomatic needles during fall 1994. At that time, 85% of the one-year-old and older needles on the check trees exhibited symptoms of interior needle blight. Benomyl/ thiophanate sprays (2X) reduced this to 58%, while chloro-thalonil reduced this to 35(1X) and 20(2X)%. The only trees whose marketability were not reduced at harvest were the trees sprayed twice with chlorothalonil.

INTERACTIONS OF SCLEROTIUM ORYZAE AND RHIZOCTONIA ORYZAE SATIVAE ON RICE. N.A. Cintas, R.K. Webster, and T.C. Miller. Department of Plant Pathology, University of California, Davis 95616.

Studies have shown that several indigenous rice paddy fungi restrict the stem rot (SR) pathogen, S. oryzae. One of these, R. oryzae sativae, which causes aggregate sheath spot (AGSS) has been shown to decrease the incidence and severity of SR when rice is coinoculated with the two pathogens in the greenhouse. An inverse relationship of incidence of SR and AGSS has also been observed in the field. SR and AGSS have similar disease cycles, i.e. they persist in residue from season to season and initial infections occur at the water surface in flooded paddies. The nature of the interaction was studied on excised leaves, intact plants in tubes and in pots in the greenhouse. These studies showed that competition for infection site is a primary factor in R. oryzae sativae limiting the development of SR. R. oryzae sativae germinates faster and attaches more quickly to the host surface limiting the availability of the infection site to S. oryzae.

TESTING VIRUS RESISTANT POTATO GERMPLASM FOR YIELD AND QUALITY. Dennis Corsini and Joseph Pavek, USDA-ARS, University of Idaho, PO Box AA, Aberdeen, ID, and Charles R. Brown, USDA-ARS, Washington State University, Prosser, WA.

Seven potato selections produced by the ARS-University of Idaho-Washington State University potato breeding projects had complete field resistance to potato viruses X, Y, and leafroll (LR) for three or more years of testing. Four others had only traces of infection with either LR or PVY, and three were susceptible only to PVX. These were compared with standard varieties and other virus resistant cultivars for yield and quality. Eight selections had significantly higher total and U.S. No. 1 yields than either Shepody or Russet Burbank. However, none had significantly higher yields than Achirana or Serrana, partially virus resistant cultivars developed by Argentina (INTA). Five of the high yielding, virus resistant group had superior specific gravity and french fry color compared with Russet Burbank, but generally lacked the ideal shape for french fry processing. Further work will emphasize transferring genes for combined virus resistance into agronomically improved varieties.

FIRST REPORT OF THE LARGE SCLEROTIAL FORM OF *SCLEROTIUM CEPIVORUM* FROM NORTH AMERICA. F. J. Crowe, Oregon State University, Central Oregon Agr. Res. Center, Madras 97741.

In the early spring of 1992, large sclerotia of *Sclerotium cepivorum* were found encircling the stem plate of over wintered onions growing near Culver, OR. Large sclerotia, similar to those described by Backhouse and Stewart in 1988 from New Zealand (Trans. Br. Mycol. Soc. 91, 343-346), measured 2-6 mm long x 2-6 mm wide, and were darkly pigmented on the upper surface but less so on the lower surface. Large sclerotia were found only on plants infected quite early in the spring or in the previous fall. No further development of large sclerotia was observed in the field after soil temperatures warmed above 10 C. Abundant sclerotia of typical size (0.44-0.66 mm dia) were found adjacent to large sclerotia, on other parts of infected onions on which large sclerotia occurred, and on other nearby infected onions on which no large sclerotia were found. Large sclerotia also have been observed to begin to form on onions in the late fall at Tulelake, CA, just prior to harvest. Only small sclerotia of *S. cepivorum* formed on PDA and on onions artificially infected with mycelium derived from large sclerotia, whether these sclerotia were recovered from the field at Culver in 1992, or from Tulelake in other years. Large sclerotia also have formed occasionally in the laboratory around the stem plate of onions used for inoculum production in the laboratory.

SURVIVAL AND VIABILITY OF *SCLEROTIUM CEPIVORUM* IN SOIL WITH AND WITHOUT IN-SEASON FLOODING. F. J. Crowe, Oregon State Univ., COARC, Madras 97741, and H. Carlson, Univ. of Calif., IREC, Tulelake 96134.

Ten nylon-covered PVC canisters, each filled with 1000 sclerotia of *Sclerotium cepivorum* in 115 ml non-infested field soil, were placed 10-cm deep into field soil in 19-liter microplots. Treatments were replicated 4 times and included non-flooding, continuous flooding Apr-Oct 1992, continuous flooding Apr-Oct 1993, or continuous flooding both Apr-Oct 1992 and Apr-Oct 1993. Microplots were kept free of plant growth, and when not flooded were provided with drainage and irrigated Apr-Oct. A canister was periodically recovered from each microplot and the number of viable sclerotia was recorded based on growth of *S. cepivorum* within 3 wk on water agar following surface sterilization and cracking. An mean of 920 viable sclerotia was enumerated from all microplots after 1 mo burial prior to initial flooding. Viable sclerotia decreased to 16 in Oct 1992 and were 11 in Oct 1993 for microplots plots flooded only in 1992. From microplots flooded in both 1992 and in 1993, viable sclerotia numbered 8 in Oct 1992, then declined from 7 to 0 between Apr and Oct 1993. In these treatments, declines resulted both from loss in viability and decay of intact sclerotia. Viable sclerotia from non-flooded microplots and from those flooded only in 1993 numbered 348 and 460 in July 1992, 455 and 504 in Oct 1992, 641 and 670 in Apr 1993, 52 and 25 in July 1993, and 422 and 670 in Oct 1993. These fluctuations were due to mid-summer reduction in viability together with a decrease in intact bodies, and to fall and spring increases in viability and in total number of intact bodies, a possible indication of limited reproduction in soil during cool periods.

MANAGEMENT OF SOILBORNE MICROFLORA AND THE SUPPRESSION OF VERTICILLIUM WILT OF POTATO BY COVER CROP HARVESTING PROCEDURES. J.R. Davis, O.C. Huisman, L.H. Sorensen, and A.T. Schneider, University of Idaho, Dept. of PSES, Aberdeen, ID 83210.

Wilt suppression (Verticillium dahliae) of cv Russet Burbank potato in 1994 occurred following two consecutive green-manure crops of sweet corn Zea mays in 1992 and 1993. When compared with fallow-treated areas, the corn treatments suppressed the incidence of Verticillium wilt, improved quality, and increased yields of potato by over 37%. The harvesting of corn ears did not significantly change the suppression of Verticillium wilt when compared with a non-harvested treatment. These benefits were not related to populations of V. dahliae in soil, but were negatively correlated to inoculum densities (ID) of Fusarium equiseti in soil. Similar results occurred with sudangrass Sorghum vulgare var. sudanense. All treatments involving either harvested or soil-incorporated sudangrass suppressed Verticillium wilt of potato during the following year and increased yields of marketable tubers by 4 to 5% for cv Russet Burbank, when compared with fallow treatments. When sudangrass was cut and applied to fallow plots or when the whole plant was incorporated as a green manure, the yield of U.S. #1 tubers over 280g increased by over 24%. As with corn experiments, these benefits were closely correlated with the increase in ID of F. equiseti.

ASSESSMENT OF BENEFITS OF COTTON SEED DRESSINGS FOR CONTROL OF SEEDLING DISEASES. R. M. Davis and J. J. Nunez, Dept. of Plant Pathology, University of California, Davis 95616.

Nineteen field trials (each with six replications) in five San Joaquin Valley counties included the following treatments: nontreated seed (cv Maxxa); seed treated with NuFlow M (myclobutanil) for the control of Rhizoctonia-induced damping-off; seed treated with Apron (metalaxyl) for the control of Pythium-induced damping-off; and seed treated with the combination of the fungicides. The following parameters were measured: healthy stands from each treatment, soil populations of Pythium and Rhizoctonia at planting, soil temperature at planting and heat units 5 days after planting, soil particle analysis, salt, calcium, pH, and organic matter. Some of the preliminary results from 1994 data include: the range of pathogen soil inoculum was relatively uniform across locations (Pythium spp., primarily P. ultimum and P. irregulare, averaged 43.8 cfu/g soil and Rhizoctonia solani averaged 1.2 cfu/100 g soil); there was no benefit of using Apron on Maxxa seed; Nuflow M increased stands 13%; and R. solani populations could not alone predict stand losses, despite being the single most important factor in poor stands. Maxxa was relatively susceptible to R. solani but resistant to Pythium spp.

THE INCIDENCE AND VARIABILITY OF CALIFORNIA PEPPER VIRUSES. P. de A. Gurusinghe., R. K. Webster., B. W. Falk, and A. O. Paulus*. Dept. of Plant Pathology, University of California, Davis and Riverside*.

We identified nine different viruses infecting California peppers between 1990 and 1994. Among the viruses the most frequently encountered were pepper mottle potyvirus (PeMV), tobacco etch potyvirus (TEV), potato potyvirus Y (PVY) and cucumber mosaic cucumovirus (CMV). The incidence, distribution and the frequency of these viruses showed spatial as well as temporal variability. Potyvirus infections were the most widespread with PeMV and TEV being most common. Pathogen variability was detected for all viruses by assays on differential genotypes. Initial studies also suggest a possible differential behavior of CMV isolates on some hosts.

MORPHOLOGY OF PLUM FRUIT SKIN IN RELATION TO BROWN ROT RESISTANCE. A. Den Breeÿen, C. L. Lennox, and G. Holz, Department of Plant Pathology, University of Stellenbosch, Stellenbosch 7600, South Africa.

Brown rot, caused by Monilinia laxa, is one of the limiting factors in the South African plum industry. A study of the morphology of the epicuticular wax layers, and of cuticle and skin thicknesses of four plum cultivars was undertaken to determine the role played by these layers in the resistance of plum fruit to M. laxa. Cryo-scanning electron microscopy showed no differences in morphology of the epicuticular wax layers. Cuticle and total skin (cuticle plus epidermal layer) thicknesses of the four cultivars were similar in fruit picked in the 1991/1992 season, however significant differences between cutivars were found in the 1992/1993 season. Resistance of the four plum cultivars to M. laxa was not correlated to either cuticule or total skin thickness. That the skin of plum fruit is an effective barrier to M. laxa is shown by the fact that a wound is required for infection. From this study it is clear that factors other than skin morphology play a role in the resistance of plum cultivars to brown rot.

INEFFECTIVENESS OF BLOOM SPRAYS TO CONTROL THE SUMMER BUNCH ROT COMPLEX OF WINE GRAPES. R.A. Duncan[1], J.J. Stapleton[1], J.C. Broome[2], G.M. Leavitt[3] J.J. Marois[2], K.M. Kelley[4], and T. Martin-Duvall[3]. [1]Statewide IPM Project, University of California, Parlier, CA, 93648, [2]Department of Plant Pathology, University of California, Davis, CA 95616, [3]UC Cooperative Extension, Madera, CA 93637, and [4]Modesto, CA 95355

The summer bunch rot complex occurs in arid climates and involves several genera of fungi, yeasts, and bacteria including *Botrytis, Aspergillus, Penicillium, Rhizopus* and *Acetobacter*. Bloom sprays of iprodione (2.4 g a.i./L) were applied to commercial vines of *Vitis vinifera* cv. Zinfandel at 10%, 50%, 100% bloom, or 2-3 weeks after bloom in Madera (Southern San Joaquin Valley), Stanislaus (Central), and Sacramento (Northern) Counties in 1993 and 1994. Berries and floral debris were sampled ca. 2 weeks after treatment and examined for colonization by *B. cinerea, A. niger,* and *Penicillium* spp. Berries were shaken in buffer solutions and aliquots were plated on agar media to determine fungicide effects on epiphytic mycoflora. Remaining clusters were evaluated at harvest for incidence and severity of summer bunch rot fungi. Bloom sprays reduced floral debris colonization, epiphytic survival, and final disease by *B. cinerea* in all trials in both years. Reductions in *B. cinerea* rot were often offset by increases in *A. niger* rot in fungicide treated clusters, resulting in no significant reduction in total incidence of rot. Incidence of sour rot (caused by *Acetobacter* spp.) at harvest was not consistently affected by the fungicide treatments. Iprodione bloom sprays may not be effective in areas where *A. niger* or sour rot predominate.

GEOGRAPHIC DISTRIBUTION OF SEROTYPES OF POTATO VIRUS Y. P. Ellis, R. Stace-Smith, and G. Bowler, Agriculture and Agri-Food Canada, 6660 N.W. Marine Drive, Vancouver, British Columbia, V6T 1X2.

A panel of eight monoclonal antibodies (MAbs) was used to define serotypes among the three recognized strain groups of potato virus Y (PVY): common (PVY^O), tobacco veinal necrosis (PVY^N) and stipple-streak (PVY^C). Six of the MAbs were produced in Canada, one in Japan (4E7) and the other in Scotland (VN295.5). Within the PVY^N strain group, five serotypes were identified and designated N_1 to N_5. The PVY^O strain group was more diverse and we could define twelve serotypes, designated O_1 to O_{12}. In contrast, we could only identify one serotype, designated C_1, within the PVY^C strain group. The same panel of MAbs was used to serotype 632 PVY samples collected from potato seed certification plots in Canada and the United States. Although no PVY^N serotypes were found, 9 of the 12 PVY^O serotypes were identified, and several samples, tentatively assigned to the C_1 serotype, were found.

Biology and Population Dynamics of Wheat curl mites (Eriophyes tulipae (K.)) in north central Washington.
R.L. Gillespie, D. Roberts, & E. Bentley Washington State University Cooperative Extension, Ephrata (98823), Spokane (99202) & Prosser (99350) WA.

Sampling five club winter wheat fields began on 3/15/94 to follow the biology, population dynamics and dispersal of wheat curl mites. Mite populations peaked on 5/10/94 at 250 mites/plant when the plants were in the boot stage. Population declined after this date and were no longer detectable after 7/19/94. Sampling was initiated on 5/10/94 to determine if mites would disperse to spring cereals. Mites were only detected in tillering barley adjacent to common winter wheat on 5/10/94. Mite population in barley peaked at 25 mites/plant on 7/5 when plants were at anthesis; whereas populations in common winter wheat heads reached 3,000/plant on 7/13/94. Mites were detected in spring wheat on 5/26 when plants were beginning to tiller. Mite populations, concentrated in wheat heads of spring wheat, peaked on 7/19 when plants were in the dough stage at 1100 mites/plant. In this study we found that mite populations peaked at different stages of development in club winter wheat versus common winter wheat. Mites dispersed to spring cereals after the 2-3 leaf stage.

IMPORTANCE OF FUSARIUM YELLOWS TO SUGAR BEET PRODUCTION IN WYOMING. F.A. Gray, B.G. Fishburn, D.J. Godfrey and S. Pandiangan, Dept. PSIS, Univ. of Wyoming, Laramie, WY 82071.

Studies were conducted to determine the importance of Fusarium Yellows, caused by *F. oxysporium* f. sp. *betae*, in the Big Horn Basin of Wyoming. Of 129 fields surveyed, 11.1% (4 of 36), 42.9% (18 of 42), and 27.5% (14 of 51) were found to have Fusarium Yellows in 1992, 1993 and 1994, respectively. Incidence in individual fields ranged from less than 1% to 92% symptomatic plants. Root yield and percent sucrose were decreased while impurities were increased in diseased beets. The mortality of plants having moderate or severe symptoms in mid-July was 95% prior to harvest in October. Incidence and severity of Fusarium Yellows was reduced with soil fumigation (Telone II®). Mortality of three isolates of *F. oxysporium* f. sp. *betae* in older plants was 10, 27 and 8%. Seedling morality (pre-emergence damping-off) of the same three isolates was 17.9, 23.7 and 10.3%, respectively. Post-emergence death of seedlings was observed in one of the three isolates. There was an inverse relationship between plant age and mortality with increasing mortality with decreasing plant age. Seed treatment with the standard Apron® + Thiram® or the new biological Kodiak HB® failed to protect seedlings from pre- or post-emergence damping-off.

RESPONSE OF SELECTED BARLEY LINES TO BARLEY STRIPE RUST IN BOLIVIA, ECUADOR, COLORADO AND GERMANY. J.P. Hill, M.R. Johnston*, V.R. Velasco and W.M.Brown, Jr. Dept. of Plt. Path./Wd. Sci., Colorado State University, Fort Collins, CO 80523 and * Dept. of Plt. Path., Montana State University, Bozeman, MT 59717.

"Elite" lines of barley selected from the previous year field trials in Bolivia, were grown in Bolivia, Ecuador, Colorado and Germany. An additional group of 26 differential lines prepared by the second author were also grown in these locations. Results from field trials and growth chamber inoculation studies in Montana by the second author, demonstrate a wide range of reactions according to place, year and source of the "race-24" isolate. From these observations and trials, it seems that barley stripe rust race-24 is not homogeneous but in reality a mixture. This brings into question the value of searching for specific resistance to "race-24" and use of "vertical resistance" in stripe rust management.

WORLD DISTRIBUTION OF DIDYMELLA RABIEI, THE TELEOMORPH OF ASCOCHYTA RABIEI, ON CHICKPEA. W.J. Kaiser, USDA-ARS, Western Regional Plant Introduction Station, Washington State University, Pullman, WA 99164-6402

Didymella rabiei (syn. Mycosphaerella rabiei), the teleomorph (sexual state) of Ascochyta rabiei, was discovered by Kovachevski in 1936 on chickpea residue that had overwintered on the soil surface in Bulgaria. Subsequently it was reported from Greece, Hungary, Spain, Syria and the U.S. The fungus is heterothallic. Fertile pseudothecia developed on naturally infested chickpea debris from Algeria, Bulgaria, Canada, Greece, Iran, Morocco, Pakistan, Portugal, Spain, Syria, Tunisia, Turkey and the U.S., evidence of the widespread distribution of both mating types in nature. Pseudothecia did not develop on debris for Egypt, Hungary, Israel and Libya (one sample each), Cyprus, France and Italy (three samples each), nor from India (nine samples). Ascospores are important as primary inoculum for ascochyta blight of chickpea in the U.S. Pacific Northwest.

***AGROBACTERIUM TUMEFACIENS* ARTIFICIAL CHROMOSOME SYSTEM FOR DEVELOPING SUITABLE PLANT GENOMIC LIBRARIES.**
Tatsuro Kimura, Ken Shirasu, and Clarence I. Kado, Department of Plant Pathology, University of California, Davis, CA 95616

Current efforts in genomic library constructions have relied on yeast artificial chromosomes (YAC's), which have the capacity of cloning DNA fragments of $\geq$ 500 kb. YACs have advanced our ability to organize extensive DNA stretches to generate orderly physical maps. Although workers continue to rely on YACs, there are inherent problems with the construction and manipulation of YAC libraries because a portion of the clones nearly always contain stretches of noncontiguous DNA fragments, and spurious yeast DNA inserts occur within the clones. Two years ago, we developed an alternative to the YAC system by designing and constructing an *Agrobacterium* artificial chromosome cloning system (AgroBAC). Using our AgroBAC plasmid pUCD3499, we cloned large 200 kb DNA in plasmid-free strains of *A. tumefaciens*. pUCD3499 is equipped with a mutated TiC58 plasmid origin of DNA replication for high copy replication, tandem duplication of the pTAR partioning gene (*par*) for maintaining plasmid stability, a hygromycin phosphotransferase gene for selecting plant transformants, a site within a gene encoding levan sucrase (*sacB*) for cloning large DNA fragments near a T-DNA border and for selecting appropriate clones, and a neomycin phosphotransferase gene for bacterial selection. With this vector system it becomes possible to: 1) restore known mutant phenotypes by *in cis* complementation; 2) deliver genomic stretches from one cultivar to another; 3) develop physical maps; and 4) reisolate DNA stretches from plants originally transformed with the AgroBAC system.

SEROLOGICAL CHARACTERIZATION OF ILARVIRUSES INFECTING HOP, *Humulus lupulus*. R. E. Klein and M. E. Nelson, Washington State University, IAREC, Prosser, WA 99350.

Eighty-eight ilarvirus isolates from hop were characterized serologically by their reactions in double (DAS) and triple antibody sandwich (TAS)-ELISA with up to 4 polyclonal antisera and 3 monoclonal antibodies (MAbs). Hop ilarviruses could be grouped into 2 major serogroups based on the ratios of DAS-ELISA absorbencies using different antisera. MAb reactions in TAS-ELISA also allowed a division of the isolates into 2 groups. However, there was no relationship between the groups defined by polyclonal antisera and those defined by the MAbs. Results suggest that the hop ilarviruses are related to apple mosaic virus, including isolates Fulton and Paradise, but share few affinities with authentic isolates of Prunus necrotic ringspot virus isolated from stone fruits.

LETTUCE VARIETIES RATED FOR DOWNY MILDEW-RESISTANCE.
F.F. Laemmlen, and V. Rubatzky, University of California, Santa Maria, 93455 and Davis, 95616.

Downy mildew (d.m.) (Bremia lactucae) of lettuce is a continuous threat to lettuce culture on the central coast of California. Twenty-one cultivars were planted in a RCB design with 3 replications. 3 cultivars, El Dorado, Mustang and Target (d.m rating 1.67 on a 1-5 scale) were significantly more resistant to d.m. than Top Gun, 93-755M (2.67), Champ, 87-714-2 (3.00), Premier, Raider (3.17), and Specter, Val Sal 210 (3.33). Bronco (1.83), Impact, Diamond, Magnum (2.00), 91-419M, Express (2.17), Stinger, Ace, Legacy (2.33), and Warrior (2.5) showed intermediate levels of d.m. resistance. D.m. resistance in most crisp head lettuce cultivars must be aided with fungicides for successful lettuce culture in the coastal areas of California.

INOCULATION AND EVALUATION OF AN ALFALFA SYNTHETIC FOR ALFALFA MOSAIC VIRUS RESISTANCE. R. C. Larsen, and R. N. Peaden, USDA-Agricultural Research Service, Route 2 Box 2953A, Prosser, WA 99350
An alfalfa synthetic (W45) has been developed which, under growth chamber and field conditions, exhibits resistance to alfalfa mosaic virus (AlMV). Field plots of W45 in Oregon and Washington were sampled for natural infection of AlMV. Virus incidence was compared with five commercially available alfalfa cultivars and synthetics during 2-year and 5-year field trials. Fifteen percent of W45 was infected after a 5-year field trial in 1992 while the infection rate in commercial varieties ranged from 69% to 81%. Six isolates of AlMV collected from different areas of North America were used to inoculate test plants in growth chamber experiments. The mean infection rate of all isolates was 31.6% for W45 in contrast with 87.5% and 83.2% for cultivars DuPuits and Vernal, respectively. Variables examined for the inoculation technique included pre-inoculation dark period on plants and use of purified AlMV. This is the first known alfalfa synthetic with resistance to geographically diverse populations of AlMV.

USE OF VEGETATIVELY COMPATIBLE POPULATIONS TO DETERMINE FIELD DISTRIBUTION OF *R. SOLANI* AG-8.
G. C. MacNish[1] and D. E. Carling[2]. [1]Department of Agriculture, Esperance, Australia 6450. [2]University of Alaska Fairbanks, Palmer, Alaska, USA 99645

The categories of anastomosis reaction in *R solani* include category (C) 0 (no vegetative interaction); C1 and C2 (a vegetative interaction but unsuccessful anastomosis); and C3 (fusion of walls and membrane leading to a successful anastomosis). The first three categories are vegetative incompatibility reactions whereas C3 is a vegetative compatibility reaction. *R. solani* AG-8, the cause of bare patch disease of cereals, can be sub-divided into five zymogram groups (ZG). Pairing of field isolates from different ZGs gives a C2 whereas pairing from within the same ZG gives either a C2 or C3. We propose that any group of field isolates of AG-8 that give a C3, when paired in any combination, be designated a "Vegetatively Compatible Population" (VCP). The number of VCPs within any of the five ZGs is unknown, but a study at Esperance using isolates from 122 patches showed the number may be limited at any given location. Patches were caused by representatives from four ZGs with one ZG having four VCPs and the other ZGs only one VCP each.

FIRST REPORT OF *Pseudomonas corrugata* CAUSING PITH NECROSIS ON GERANIUMS. Andew C. Magyarosy and Bob B. Buchanan. University of California, Department of Plant Biology, Berkeley, CA 94720

Tomato pith necrosis caused by *Pseudomonas corrugata* has been reported worldwide as a pathogen on tomato but not on ornamental plants. We have found several geranium plants in nurseries in California that showed disease symptoms suggesting a bacterial etiology. The stems of affected plants had brown negrotic lesions up to two inches long and the foliage of affected stems showed various degrees of wilting. From these necrotic lesions, gram negative, oxidase positive, non-flourescent bacilli were consistently isolated that showed characteristic blue pigmentation and corrugated colonies on YDC medium. The bacterium was identified as *Pseudomonas corrugata* with the Biolog system and with physiological and biochemical tests. Koch's postulates were confirmed with geranium cultures and with *P. corrugata* tomato isolates obtained from the Biolog company. Results of cross infectivity with *P. corrugata* type cultures and isolates from geraniums have shown that this bacterium is not host specific and able to cause pith necrosis on both host plants.

PRELIMINARY PHYSIOCHEMICAL CHARACTERIZATION OF A NEW LETTUCE VIRUS FOUND IN THE IMPERIAL VALLEY OF CALIFORNIA. J.M. McLain, S. Castle, and R. Creamer. Department of Plant Pathology, University of California, Riverside, CA 92521 and USDA, ARS, Irrigated Desert Research Station, Brawley, CA 92227.

A new lettuce virus vectored by the silverleaf whitefly causes significant damage to lettuce crops in the Imperial Valley of California. Initial studies of the characterization of the virus and development of a detection method were conducted. This virus was purified from infected *Nicotiana benthamiana* plants. Long flexuous rod-like particles 750-950 nm in length were found most often, while several particles of up to 1550 nm in length were also obtained. RNA extracted from the purified virus was determined to be app. 15 kb. Based on the morphology of the virion and the RNA size, we believe that the virus is closterovirus-like. Polyclonal antisera was produced to purified virus in rabbits. The antisera specifically reacted with the new virus.

INDUCTION OF RESISTANCE TO FUSARIUM WILT IN CUCUMBER BY NON-PATHOGENIC ISOLATES OF FUSARIUM OXYSPORUM. H. Nassar and J. P. Hill, Department of Plant Pathology and Weed Science, Colorado State University, Fort Collins, CO 80523.

Two non-pathogenic isolates of *Fusarium oxysporum* (C14 or N1) were introduced into the soil at the rate of 1.2- or 3 X 10^4 colony forming units (cfu) /g soil. Incidence and severity of cucumber wilt, caused by *F. o.* f.sp. *cucumerinum* (FOC), were reduced significantly by each isolate under field levels of pathogen inoculum (750 cfu/g soil). *F. oxysporum* C14 and N1 delayed the appearance of wilt symptoms for 3 weeks. Four weeks after planting, 80% of the cucumber plants in the C14 and N1 treatments survived, while all nontreated plants were dead. Eight weeks after planting, no additional cucumber plants were lost in the N1 treatment while 45% of the plants survived in the C14 treatment.

EVALUATION OF BIOLOGICAL AND CHEMICAL AGENTS FOR CONTROL OF STRAWBERRY POWDERY MILDEW, *SPHAEROTHECA MACULARIS* F. SP. *FRAGARIAE*. M. D. Nelson and W. D. Gubler, Dept. of Plant Pathology, Univ. of Calif., Davis 95616.

Three fungal species, *Ampelomyces quisqualis* (Aq), *Sporothrix flocculosa* (Sf), and *Acremonium lanosoniveum* (Al) were evaluated for control of strawberry powdery mildew in laboratory, greenhouse and fruit production field trials. In the lab, all three organisms provided significant eradicative control of *S. fragariae* on detached leaflets maintained at 94% rh., compared to water-sprayed and untreated controls. Three greenhouse trials were conducted using strawberry plants maintained at 75-80% rh. In the first trial, Al significantly reduced foliar disease severity compared to the untreated check, and provided control comparable to that of myclobutanil. None of the biocontrol treatments significantly reduced disease in the other two tests. In a fruit production field trial, Aq significantly reduced foliar disease severity and Sf-treated plants produced significantly more marketable fruit than the untreated control. Together these results indicate that Aq, Sf and Al can control strawberry powdery mildew, but that their effectiveness is probably dependent on the rh. level.

RADISH ROOT SPOT CAUSED BY PYTHIUM POLYMASTUM. Robin L.Parks and Michael A. Yoshimura. Biological Sciences Department, California Polytechnic State University, San Luis Obispo, CA 93407.

A fungus with large (diameter 45-48 um), spiny oogonia, identified as Pythium polymastum Drechs., was isolated from radish (Raphanus sativus L.) roots grown in Southern California and from radishes purchased from a local grocery store. Infected roots had small (diameter 1-3 mm), black, sunken spots with definite margins. Radish seedlings inoculated with both radish isolates and a known culture of P. polymastum became stunted and discolored. Inoculated cabbage and lettuce seedlings, reported hosts of P. polymastum, were similarly stunted and discolored. Root spots were reproduced by incubating mature radish roots with cubes of vegetable juice agar permeated with P. polymastum isolates for 48 hours in humid conditions. Isolates were reisolated from radish seedlings and inoculated mature radish roots. This is the first report of P. polymastum as a naturally found pathogen of radish.

CONTROL OF SUNFLOWER RUST (*PUCCINIA HELIANTHI*) WITH FUNGICIDES. A. O. Paulus, M. Vilchez, and Karen Robb. Plant Pathology Department, University of California, Riverside 92521.

Rust of sunflower resulting from infection by the fungus, *Puccinia helianthi*, is a common disease in California. The most conspicuous symptom is brown, powdery pustules scattered on all green parts of the plant but mostly on the leaves. Losses are most severe when the weather is warm and moist. Several new fungicides, tebuconazole from Bayer; fenbuconazole and myclobutanil from Rohm and Haas; JMS Stylet Oil (aliphatic petroleum distillate) from JMS Flower Farms and M-Pede (potassium salts of fatty acids) from Mycogen were evaluated for control of sunflower rust. Forty-four sunflower plants were used per plot and replicated four times. Sprays were applied on a 14-day schedule. Tebuconazole, fenbuconazole and myclobutanil were consistently effective for control. JMS Stylet Oil and M-Pede provided variable control and further trials are warranted before a recommendation can be made.

INTERACTION OF THE PLANT ENCODED, dsRNA-DEPENDENT KINASE WITH AN INHIBITOR OF elF-2α PHOSPHORYLATION. Roth, D.A. and Langland, J.O., Dept. PSIS, University of Wyoming, Laramie, WY 82071.

Plant virus or viroid infection induces the expression and phosphorylation of a host encoded, dsRNA-dependent protein kinase, pPKR. pPKR is an analog of the mammalian interferon-induced, dsRNA-dependent kinase implicated in the regulation of protein synthesis, gene regulation, cell division and apoptosis. The enzyme is found in plant embryos as well as in mature tissues where it is localized in the soluble cytoplasmic fraction and is ribosome-associated. The significance of pPKR in the regulation of pathogenesis and normal cell function is not clear, however, elF-2α is phosphorylated by pPKR suggesting a role in the regulation of protein synthesis. We have found that levels of an elF-2α-associated inhibitor (p67) are temporally regulated at the level of transcription and protein synthesis. The functional significance of the p67-pPKR interaction in regulation of protein synthesis will be discussed.

VARIATION AMONG ISOLATES OF BEET SOILBORNE MOSAIC VIRUS. C.M. Rush, G.B. Heidel, and S.K. Manohar, Texas Agricultural Experiment Station, P.O. Drawer 10, Bushland, TX 79012.

Beet soilborne mosaic virus (BSBMV) is similar to beet necrotic yellow vein virus (BNYVV), which causes rhizomania. The main difference between BNYVV and BSBMV is in symptom expression. Over the last two years, isolates of BSBMV that produce foliar symptoms on *Chenopodium quinoa*, which are similar to those produced by BNYVV, have been recovered from several states. Furthermore, BSBMV has been recovered from sugar beets in Texas exhibiting typical symptoms of rhizomania but BNYVV could not be detected. In 1994, two viral isolates, serologically distinct from BNYVV and BSBMV, were recovered from beets. However, when used as templates in rt-PCR with primers specific for BSBMV, the expected product was formed. Several primers developed specifically for BNYVV are able to amplify BSBMV rt-PCR products, and a near full length product from BSBMV RNA3 has been amplified. Sequence analysis of this product should help explain observed variation among isolates of BSBMV.

EVIDENCE OF SYSTEMIC INVASION OF OLIVE TREES BY THE OLIVE KNOT BACTERIUM *PSEUDOMONAS SAVASTANOI*. M.N. Schroth[1], W. Krueger[2], S. Wang[1], and B.L. Teviotdale[3], University of California: [1]Berkeley 94720, [2]Glenn County,Orland 95963, [3]Davis 95616.

Sudden outbreaks of olive knot in young presumably disease-free trees and in older trees suggest that *Pseudomonas sevastanoi* survives as an internal resident, an epiphyte or both. Branches surface disinfested with bleach plus detergent were vacuum infiltrated with water and the extruded liquid plated on King's B culture plates. Small pieces of wood removed from the branches were either triturated and plated or drawn across the surface of King's B culture plates. *P. savastanoi*, in populations of 10^6 or greater CFU per 1.0 ml exudate, and several unidentified bacterial species were isolated during winter and early spring. In winter, spring and summer, intact limbs swabbed with bleach were wounded with a surface-disinfested saw and immediately wrapped with tape or left unwrapped. Knots formed in winter- or spring-wounded but not in summer-wounded branches in both wrapped and nonwrapped wounds.

DISTRIBUTION AND TRANSLOCATION OF THE FUNGICIDE ICIA5504 IN TURFGRASS FOLLOWING FOLIAR APPLICATION. G. J. Simms[1], D. W. Bartlett[2], G. Kingston[2]. [1]Zeneca Ag Products, Richmond, CA 94804, and [2]Zeneca Agrochemicals, Bracknell, Berkshire, RG42 6ET, England.

ICIA5504 is a novel, broad-spectrum fungicide with contact and systemic activity on most major turfgrass diseases. A laboratory study to investigate the distribution of ICIA5504 in turfgrass following foliar application was conducted on perennial ryegrass grown in sand pots (10 cm.) A single application of 0.11 g/m^2 ICIA5504 was applied in approximately 1200 l/ha . Ryegrass clippings were collected 3, 7, 10, 14, 17 and 21 days after treatment. The pots were destructively sampled 21 days after treatment and the clippings, roots/thatch and sand were analyzed separately by HPLC. The amount of ICIA5504 in clippings decreased with time to 13µg/g at 21 days, at which time 18.5 µg/g was found in the roots/thatch, suggesting that persistence of effect may be due to root uptake. A similar study, with the addition of separate thatch analysis, was conducted in the field on both perennial ryegrass and bentgrass. The results indicate that under field conditions, over time, ICIA5504 will be found predominately in the thatch.

CONTROL OF POSTHARVEST DECAY OF LEMONS BY IMMERSION IN HEATED SOLUTIONS OF SO_2, ETHANOL, Na_2CO_3 or $NaHCO_3$. J. L. Smilanick, D. A. Margosan and D. J. Henson, HCRL, USDA, ARS, 2021 South Peach Avenue, Fresno 93727

Lemon fruit were inoculated with spores of the green mold pathogen, *Penicillium digitatum*, incubated for 12, 24, 48, or 60 h at 20 C, immersed in solutions employing combinations of concentration, duration, temperature, and post-treatment rinses, and stored 3 wk at 20 C. Two treatments were tested repeatedly: 1) 10% ethanol (EtOH) at 45 C for 150 s without rinsing; and 2) 2% SO_2 at 45 C for 150 s followed by two water rinses. Heat was improved efficacy. They were compared to immersion in 3% Na_2CO_3 or $NaHCO_3$ at 45 C for 150 s followed by two water rinses, or 1000 μg/ml imazalil (IMZ) at 25 C for 60 s. Decay of fruit inoculated 48 h or less before treatment was reduced by $\geq$85% by SO_2 or EtOH and their efficacy was about equal to carbonate or IMZ treatments. Only IMZ controlled sporulation. SO_2 and EtOH did not injure the fruit and their residues were low. SO_2 content of fruit immediately after treatment was < 1 μg/g. Fruit EtOH content after 1 or 7 d post-treatment storage at 20 C was 58.6 ($\pm$9.6) and 24.4 ($\pm$11.7) μg/g, respectively. EtOH content of untreated fruit was 3.3 μg/g.

ANTIFUNGAL ACTIVITY OF CERTAIN CRUCIFEROUS AMENDMENTS WHEN COMBINED WITH SOIL HEATING FOR BIOFUMIGATION. J. J. Stapleton, R. A. Duncan, and C. Thomassian, Statewide IPM Project, Kearney Agricultural Center, University of California, Parlier, CA 93648.

Combining cabbage amendment with soil heating (solarization) is a nonchemical approach for biofumigation which is known to improve the control of soilborne pathogens. Other cruciferous soil amendments also are under increased investigation regarding their potential for soil disinfestation, primarily because of their constitutive production of glucosinolates. These amendments have shown moderate antifungal activity, but it usually does not approach that of synthesized soil fumigant chemicals. *In vitro* amendment of soil with cruciferous plants, including black mustard, bok choy, broccoli, cabbage, cauliflower, and wild radish, reduced germination of *Pythium ultimum* by 52-91% and of *Sclerotium rolfsii* by 2-65% ($P<0.05$) over the nontreated control after 7 days in incubated soil. Addition of a sublethal, diurnal heating regime (38 C max/27 C min) to the 7 day incubation period reduced germination of *P. ultimum* and of *S. rolfsii* by by 97-100% and 87-100%, respectively.

GENOTYPIC VARIATION AND DEFECTIVE-INTERFERING DNA OCCURRENCE WITHIN A FIELD POPULATION OF BEET CURLY TOP VIRUS. Drake C. Stenger, Northern Illinois University, DeKalb, 60115.

During October 1994 a field population of the geminivirus beet curly top virus (BCTV) was examined for genotypic variation and defective-interfering (DI) DNA accumulation. Twelve BCTV infected sugar beet plants collected from six fields in the Texas Panhandle region were evaluated for BCTV DNA forms by Southern hybridization of total DNA extracts. All twelve samples contained typical genome-length ss and ds viral DNA forms. In addition, most samples also contained less than genome-length viral DNA forms which varied among samples in size, abundance and complexity, and are likely DI-DNA molecules produced under natural conditions. Thirty five full-length BCTV DNA genomes derived directly from eleven of the field samples were cloned as *Eco*R I inserts in the *E. coli* plasmid pUC8. Endonuclease restriction mapping of the cloned BCTV genomes indicated that at least six genotypes were present in the Texas Panhandle population. Genotypic heterogeneity was observed at all population levels; examples of more than one genotype present within a single plant, field, or locality were observed. All of the genotypic variants were most closely related to the previously characterized CFH isolate of BCTV, based upon endonuclease restriction mapping and sequence comparisons of the DNA replication origin.

EFFECT OF TEMPERATURE ON ROOT INVASION BY THE PEA CYST NEMATODE *HETERODERA GOETTINGIANA*. E. C. Tedford and D.A. Inglis. Washington State University-Mount Vernon. 1468 Memorial Hwy., Mount Vernon, WA 98273-9788.

Pea root invasion by second-stage juveniles (J2) of *H. goettingiana* (*Hg*) was compared under constant and fluctuating soil temperatures in greenhouse and field experiments, respectively. In the greenhouse, peas were grown in 50 cm^3 of *Hg*-infested (22 eggs/cm^3) soil. Plants were incubated at 10, 18, 26, or 30 C. Root invasion was quantified after 286 degree hours (basal temperature 4.4 C). In the field, peas were planted into *Hg*-infested (21 eggs/cm^3) soil and temperatures were measured hourly. Root invasion was quantified weekly. J2 invaded roots at greenhouse temperatures ranging from 10-26 C, but not at 30 C. After 286 degree hours a greater ($P < 0.05$) number of J2 penetrated pea roots at 10 C than at 18 or 26 C. J2 penetrated roots when field temperatures were less than 10 C, and J2 in roots did not begin to molt until temperatures exceeded 7 C. We suggest that early planting dates and cool soil temperatures in western Washington may enhance pea cyst nematode invasion of pea roots.

TWO-FOLD-REDUCED-WEIGHT METHOD, A QUANTITATIVE BAITING PROCEDURE FOR DETECTING PHYTOPHTHORA LATERALIS IN PORT-ORFORD-CEDAR SOILS. P. H. TSAO[1], L. A. Portales[1], D. Perinova[1], and J. T. Kliejunas[2], [1]University of California, Riverside 92521 and [2]USDA Forest Service, Pacific SW Region, San Francisco, CA 94111.

We report a quantitative baiting procedure, the "two-fold-reduced-weight" (TFRW) method, for detecting Phytophthora lateralis (PL) in soils of Port-Orford-cedar (POC, Chamaecyparis lawsoniana). It is a modified serial-dilution-endpoint (SDEP) method. Progressively (2-fold) smaller amounts (20, 10, 5, 2.5, 1.25, 0.62, and 0.31 g) of a well-mixed, root-free soil sample were weighed into plastic cups in duplicate series. Qualitative baiting was performed with each sample (150 ml water, 10 wounded POC branchlet pieces as baits, at 15 C, for 6 days). Bait pieces were then plated onto PARP medium containing hymexazol at 10 or 25 ppm. The endpoint of positive PL recovery in the series was determined. A soil that produced an endpoint at 2.5 g soil (equivalent to DPI of 8 in SDEP method; theoretical number of propagules per gram [ppg] of soil = 0.4) was considered to have a population (or disease potential) four times greater than that of a soil that produced an endpoint at 10 g soil (DPI = 2; theoretical ppg = 0.1). TFRW method proved to be a more sensitive test than the SDEP method.

ISOLATION OF PHYTOPHTHORA LATERALIS IN SOIL DILUTION PLATES FROM NATURALLY AND ARTIFICIALLY INFESTED PORT-ORFORD-CEDAR SOILS. P. H. Tsao[1], L. A. Portales[1], E. G. Vedenyapina[1], and J. T. Kliejunas[2], [1]University of California, Riverside 92521 and [2]USDA Forest Service, Pacific SW Region, San Francisco, CA 94111.

Isolation of slow-growing Phytophthora lateralis (PL) in soil dilution plates was feasible on semi-selective PARP medium containing hymexazol at 10 ppm ($PARPH_{10}$) if artificially infested soils of Port-Orford-cedar (POC, Chamaecyparis lawsoniana) contained at least 10 PL propagules per gram (ppg) of soil. At 1/10 soil dilution, an average of one colony per plate (or more) could be detected in 2-4 days at 18 C. Hymexazol at 10 ppm was only slightly inhibitory to PL, but reduced the incidence of Pythium (Py) and Mortierella (Mo) in dilution plates. At 1/5 or 1/2 soil dilution, however, Py and Mo greatly interfered with PL recovery. PL was present in extremely low populations in 50 naturally infested POC soils tested, mostly below 0.1 ppg, making the dilution plate method impractical. Scores of natural POC soils, showing positive PL recovery by the baiting method, yielded no PL colonies in soil dilution plates. Omitting or reducing concentrations of pimaricin, PCNB, or hymexazol, or adding lecithin, Tween 80, or Triton X-100 in $PARPH_{10}$ medium did not improve PL recovery.

THE INCIDENCE OF APHIDS AND APHID-TRANSMITTED VIRUSES IN MELON CULTIVARS AND BREEDING LINES IN CALIFORNIA. K. C. Umesh, J. Valencia, W. D. Gubler and B. W. Falk. Department of Plant Pathology, University of California, Davis, CA 95616.

California melons are affected by a number of aphid-transmitted viruses. We monitored the incidence of watermelon mosaic potyvirus (WMV), zucchini yellow mosaic potyvirus (ZYMV), papaya ringspot potyvirus (PRV), cucumber mosaic cucumovirus (CMV) and cucurbit aphid-borne yellows luteovirus (CABYV) in commercial fields and experimental plantings in the San Joaquin and Sacramento Valleys over 3 years. Virus incidence varied spatially and temporally within a given season, as well as between years. WMV, CMV and CABYV were the most common and important viruses. All commercial cultivars and experimental genotypes tested were susceptible to WMV, CMV and CABYV. However, one breeding line, AR5, showed resistance to the cotton-melon aphid, *Aphis gossypii*.

EVALUATION OF BARLEY STRIPE RUST CONTROL WITH SEED TREATMENTS AND/OR FOLIAR FUNGICIDES. V. R. Velasco, W.M. Brown, Jr. and J.P. Hill. Dept. of Plt. Path./Wd. Sci., Colorado State University, Fort Collins, CO 80523.

Barley stripe rust (*Puccinia striiformis* West) race 24 was introduced into the Western Hemisphere in 1975 in Columbia, S.A. The fungus spread rapidly through South America and into Texas in 1991, Colorado in 1992, and Montana in 1993. It has also been reported in Arizona, California, Idaho and Utah. Commercially acceptable resistant cultivars are unavailable. Seed treatment trials and foliar fungicide trials were undertaken in Bolivia in 1994 and 1995. All combinations of triadimenol and foliar fungicides enhanced disease suppression and resultant yield. A combination of carboxin and triadimenol gave better stripe rust protection than 2 foliar applications without seed treatment.

EFFECT OF PARASITISM OF *APHIS FABAE* BY *LYSIPHLEBUS TESTICEIPES* ON TRANSMISSION OF BEET YELLOWS CLOSTEROVIRUS. C. A. Weber, L. D. Godfrey, and P. A. Mauk, Univ. of California, Cooperative Extension, Davis, 95616.

Lysiphlebus testiceipes, a parasitoid, lays eggs within the bean aphid, *A. fabae,* killing the aphid within 6 days. The influence of parasitism on the ability of *A. fabae* to vector BYV to sugar beet was examined under laboratory conditions. In the lab, parasitized aphids were less efficient in transmitting BYV than non-parasitized aphids. Transmission efficiency in the parasitized aphids was reduced by 16.2, 22.4, 32.3, and 44.5% at 2, 3, 4, and 5 days following parasitism, respectively. Experiments, in cages and in the field, were conducted to determine if increased mobility due to parasitism would increase the spread of BYV to other plants. In all experiments, aphids were removed 7 days after infesting the plants. In cage experiments, parasitized and non-parasitized aphids were placed onto a BYV source plant in the middle of separate flats of sugar beet plants. The incidence of BYV was greater within the parasitized treatments than non-parasitized treatments. Similarly in field studies 3 wk following emergence, beet plants were infested with parasitized and non-parasitized viruliferous aphids. Virus incidence in plants directly adjacent to the virus source was greater in parasitized treatments than in non-parasitized treatments. Parasitized aphids transmitted BYV to 14.3% and non-parasitized aphids transmitted BYV to 0% of remaining plants. Although the use of parasitoids may decrease aphid populations, it may not be a viable alternative if virus control is needed.

EVIDENCE OF SELECTION FOR STRAINS OF *UNCINULA NECATOR* RESISTANT TO FENARIMOL AND TRIADIMEFON BY REPEATED APPLICATIONS OF FENARIMOL. H.L. Ypema and W.D. Gubler, Department of Plant Pathology, Davis, CA 95616

Triadimefon and fenarimol have been used to control grape powdery mildew (*Uncinula necator*) in California since 1982 and 1989, respectively. Resistance in *U. necator*, affecting fungicide efficacy, was observed to triadimefon but not to fenarimol five years after introduction. To determine whether fenarimol can be used in control programs without the risk of increasing resistance to triadimefon, container-held populations of *U. necator* were subjected to sublethal applications of fenarimol and evaluated for resistance to each fungicide. Resistance was determined by measuring conidial germ tube lengths 72 hours after inoculating conidia onto leaf discs treated separately with a range of concentrations for each fungicide. After two fenarimol applications, conidial germ tube lengths of the treated population were significantly longer compared to those of the untreated population at all concentrations of fenarimol and triadimefon applied to the leaf discs. This study indicates that repeated applications of fenarimol may increase resistance levels of *U. necator* to triadimefon.