

# Disease Notes

**A New Begomovirus Species Causing Tomato Leaf Curl Disease in Varanasi, India.** S. Chakraborty, P. K. Pandey, M. K. Banerjee, and G. Kallou, Indian Institute of Vegetable Research, 1 Gandhinagar (Naria), P.O. Box 5002, PO- BHU, Varanasi, 221 005, Uttar Pradesh, India; and C. M. Fauquet, International Laboratory for Tropical and Agricultural Biotechnology, Donald Danforth Plant Science Center, 975 N. Warson Rd., St. Louis, MO 63132. *Plant Dis.* 87:313, 2003; published on-line as D-2003-0115-01N, 2003. Accepted for publication 6 January 2003.

In November 2001, a leaf curl disease of tomato, manifested by yellowing of leaf lamina, upward leaf curling, leaf distortion, shrinking of leaf surface, and stunted plant growth was observed in tomato-growing areas in the Varanasi and Mirzapur districts of eastern Uttar Pradesh, India, which caused yield losses up to 100%. The causal agent was infective to tomato cv. Punjab Chuhara by whiteflies and grafting. Inoculated plants developed symptoms observed in naturally infected tomatoes. Viral DNA was isolated from artificially inoculated tomato plants using 1% CTAB (2) followed by a concentration of supercoiled DNA by alkaline denaturation (1). A geminivirus was confirmed by polymerase chain reaction using DNA-A degenerate primers (3), and a 550-bp amplified product was obtained from artificially and naturally infected plants. Full-length viral genomes of DNA-A and DNA-B were cloned in plasmid pUC18 at *Hind*III and *Xba*I sites, respectively. Partial tandem dimers of the viral clones were infective to *Nicotiana benthamiana* and tomato cv. Organ Spring through particle bombardment. Infected *N. benthamiana* plants exhibited downward and upward leaf curling, big veins, leaf puckering with interveinal chlorosis, and stunting. On tomato, symptoms were the same as those seen on naturally infected plants. Cloned DNA also infected *Capsicum annuum* cv. California Wonder (upward leaf curling and stunting) and tobacco cv. Xanthi (leaf curling and crinkling) but failed to infect *Phaseolus vulgaris*, okra, cotton, and *N. glutinosa*. The Varanasi isolate was sap transmissible (0.1 M potassium phosphate buffer, pH 7.0) from the bombarded plants to *N. benthamiana* and tomato cv. Organ Spring. DNA-A alone infected *N. benthamiana* (upward leaf curling and big veins) and tomato cv. Organ Spring (mild leaf curl), but symptoms were delayed and milder. Full-length genome sequencing revealed DNA-A (AY190290) contained 2,757 nt and DNA-B (AY190291) contained 2,688 nt. DNA-A of the Varanasi isolate shares 98.4% identity with a DNA-A sequence (AF449999) obtained from a tomato showing leaf curl symptoms from the same region and 97.1% identity with an isolate from Gujarat (900 km from Varanasi). All three sequences represent isolates of the same species, herein called *Tomato leaf curl Gujarat virus*, based on the priority of submission of the DNA sequence for the Gujarat region (ToLCGV; AF 413671). All isolates noted were obtained from GenBank. However, except for the DNA-A sequence, no other information is available for these ToLCGV isolates. DNA-A of the ToLCGV-Varanasi isolate shares 66.8% identity with *Tomato leaf curl New Delhi virus*, severe strain (ToLCNdV-Svr) (U15015), and 84.1% with *Tomato leaf curl Karnataka virus* (U38239). No DNA-B has been reported for these two ToLCGV isolates, and no infectious clone proving the etiology of the disease has been constructed, except for ToLCGV-Varanasi. DNA-B of ToLCGV-Varanasi shares 79.2% homology with ToLCNdV-Svr and 84.1% with ToLCNdV-Luc (X89653). These results suggest that the isolate from Varanasi belongs to ToLCGV, a previously undescribed geminivirus species causing a devastating tomato leaf curl disease in Gujarat and Uttar Pradesh.

*References:* (1) H. C. Birnboim and J. Doly. *Nucleic Acids Res.* 7:1513, 1979. (2) K. M. Srivastava et al. *J. Virol. Methods* 51:297, 1995. (3) S. D. Wyatt and J. K. Brown. *Phytopathology* 86:1288, 1996.

**First Report of Petiole Rot of *Pulmonaria longifolia* Caused by *Sclerotium rolfsii* var. *delphinii*.** B. A. Edmunds and M. L. Gleason, Department of Plant Pathology, 351 Bessey Hall, Iowa State University, Ames 50011. *Plant Dis.* 87:313, 2003; published on-line as D-2003-0103-01N, 2003. Accepted for publication 18 December 2002.

*Sclerotium rolfsii* var. *delphinii* was isolated from the bases of discolored petioles on wilted, yellow leaves of *Pulmonaria longifolia* (cultivar unknown), an herbaceous perennial growing in a landscape

planting in Ames, IA. White mycelia and brick red, 2- to 3-mm-diameter sclerotia were found on affected tissue and nearby soil. The isolates were identified as *S. rolfsii* var. *delphinii* based on the formation of dark red, irregularly shaped, >2.0-mm-diameter sclerotia on potato dextrose agar (PDA) around the edge of the culture (1,2). Pathogenicity tests were conducted by inoculating 5-month-old *P. longifolia* cv. E. B. Anderson growing in 20-cm-diameter pots in a greenhouse at 25 to 30°C. Inoculum was produced by transferring plugs from a 1-week-old culture of the *S. rolfsii* var. *delphinii* isolate on PDA to autoclaved carrot disks. After 2 days of incubation, a mycelium-infested carrot disk was placed on the soil surface at the base of each plant. Six plants were inoculated and six plants served as uninoculated controls. All plants were enclosed in plastic bags to maintain high humidity. The pathogenicity test was repeated once. All inoculated plants developed characteristic symptoms within 10 days, whereas all control plants remained symptomless. Sclerotia developed on infected tissue and the media surface, and *S. rolfsii* var. *delphinii* was reisolated on PDA from symptomatic petioles. To our knowledge, this is the first report of petiole rot of *P. longifolia* caused by *S. rolfsii* var. *delphinii*.

*References:* (1) Z. K. Punja. *Annu. Rev. Phytopathol.* 23:97, 1985. (2) Z. K. Punja and A. Damiani. *Mycologia* 88(5):694, 1996.

**First Report on White Smut of *Gaillardia* × *grandiflora* Caused by *Entyloma polysporum* in Virginia.** C. X. Hong and T. J. Banko, Virginia Polytechnic Institute and State University, Hampton Roads Agricultural Research and Extension Center, Virginia Beach, VA 23455. *Plant Dis.* 87:313, 2003; published on-line as D-2003-0114-01N, 2003. Accepted for publication 6 January 2003.

Disease samples of *Gaillardia* × *grandiflora* cvs. Goblin and Baby Cole were received at the Hampton Roads Agricultural Research and Extension Center in Virginia Beach in early April 2002. Samples were from a nursery in eastern Virginia, and most diseased plants had several to more than a dozen, round, flat, white to tan spots with indistinct margins up to 1 cm in diameter on their leaves. The spots later turned brown and necrotic, followed by necrosis of the entire leaf. Leaves of 'Baby Cole' were beginning to wilt and were more spotted than those of 'Goblin'. Fungal fruiting bodies were not observed on the surface of diseased leaves. However, microscopic examination of internal leaf tissues revealed masses of round, double-walled, pale green-to-yellow spores approximately 12 µm in diameter and typical of the ustilospores of *Entyloma polysporum* (2,3). Inoculum for pathogenicity tests was prepared by blending 10 diseased leaves in 200 ml of sterile distilled water (SDW) for 2 min in a blender at low speed. The spore suspension was adjusted to 5 × 10<sup>5</sup> spores per ml with SDW. Healthy 'Goblin' *gaillardia* plants were obtained from a nursery where smut symptoms had never been seen. Four plants in one-gallon containers were inoculated by spraying them to runoff with the spore suspension. Four control plants were sprayed with SDW only. All plants were maintained in a greenhouse (15 to 35°C) and covered with a clean polyethylene plastic sheet overnight (14 h) to maintain high humidity and separated to avoid potential cross contamination. Inoculated and uninoculated plants were hand-watered separately, with application of water to the foliage to enhance spread of the disease. Typical white smut symptoms were observed on inoculated plants 2 weeks after inoculation, and numerous spores of *E. polysporum* were observed in the diseased tissues. No disease symptoms were seen on control plants. White smut has been reported on *gaillardia* in a few other states (1), but to our knowledge, this is the first report of the disease on *gaillardia* in Virginia. Growers at the affected nursery reported observing white smut symptoms on *gaillardia* in previous years, but in the spring of 2002, almost the entire *gaillardia* crop was destroyed. The disease has not been seen on *gaillardia* in any other nurseries, but it could have significant impact on production if it spreads.

*References:* (1) D. F. Farr et al. *Fungi on Plants and Plant Products in the United States*. The American Phytopathological Society, St. Paul, MN, 1989. (2) W. Fischer. *Manual of the North American Smut Fungi*. Ronald Press, New York, 1953. (3) D. B. O. Savile. *Can. J. Res.* 25(C):109, 1947.

(Disease Notes continued on next page)

## Disease Notes (continued)

**The First *Citrus tristeza virus* Outbreak Found in a Relevant Citrus Producing Area of Sicily, Italy.** S. Davino and M. Davino, Dipartimento di Scienze e Tecnologie Fitosanitarie, Università Degli Studi di Catania, via Valdisavoia 5, 95123 Catania Italy; A. Sambade, Instituto Valenciano de Investigaciones Agrarias (IVIA), Cra. Moncada-Naquera Km. 4,5, 46113 Moncada Valencia Spain; and M. Guardo and A. Caruso, Istituto Sperimentale per l'Agrumicoltura, Corso Savoia 190, 95024 Acireale Catania Italy. *Plant Dis.* 87:314, 2003; published on-line as D-2003-0107-02N, 2003. Accepted for publication 4 December 2002.

In the course of a survey to select superior old citrus lines in the area of Siracusa (Sicily, Italy), trees in several blocks of Fortune (*Citrus reticulata* Blanco), Nova (*C. reticulata* Blanco), Satsuma (*C. unshiu* (Macfad.) mandarins Marc.), and Marsh grapefruit (*C. paradisi* Macfad.) propagated on sour orange (*C. aurantium* L.) rootstock showed stunting, decline, dieback, and small-sized fruits. Stunting was particularly evident in grapefruit. Declined plants consistently showed pin-holing in the cambial face of sour orange bark below the bud union line, which is often associated with *Citrus tristeza virus* (CTV) infection. Young shoots from 600 Fortune, 300 Nova, 400 Satsuma, and 20 Marsh grapefruit plants showing decline were analyzed by double-antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA) (Loewe Phytodiagnostica Biochemica, Sauerlach, Germany) and by immunoprinting-ELISA (Agritest Srl Valenzano-Bari-Italy) using CTV specific polyclonal antibodies. All decline tree samples reacted positively with both techniques while healthy greenhouse controls were negative. Total RNA was extracted from 50 of those plants, 25 Fortune and 15 Nova mandarins, 5 Satsuma, and 5 Marsh grapefruit (Qiagen RNeasy Plant minikit, Qiagen S.P.A., Milan, Italy), and tested in reverse transcription-polymerase chain reaction (RT-PCR) using specific primers for genes *p20* (forward 5'-CGA GCT TAC TTT AGT GTT A-3' from CTV T36 genomic position 17767-17786 and reverse 5'-TAA TGT CAA ACT GAC CGC from CTV T36 position 18269-18286) and *p23* (forward 5'-ACT AAC TTT AAT TCG AAC A-3' from CTV T36 position 18347-18286 and reverse 5'-AAC TTA TTC CGT CCA CTT C-3' from CTV T36 position 19026-19044) (2). In all cases, DNA fragments of the expected size were amplified. Equivalent samples from CTV-free greenhouse control plants did not react in ELISA and yielded no DNA after amplification with the same primers. When the history of the plants in the affected blocks was traced, it was found that all Fortune, Nova, satsuma and Marsh grapefruit trees had been propagated from budwood illegally imported from Spain 10 years before, suggesting the possibility that the imported buds were infected with CTV. The estimated number of infected plants in the area of Siracusa is approximately 10,000, and some evidence suggests that the virus might be spreading in the area (work in progress). Only scattered CTV-infected trees had been detected in Italy previously (1). To our knowledge, this is the first report of an important CTV outbreak in Italy. Additional surveys are being conducted to get a more accurate estimation of the CTV incidence, to determine if the virus is being dispersed by aphid vectors, and to biologically and molecularly characterize the virus strains present in the affected area. Presently, there are approximately 100,000 ha of citrus in Sicily, mostly grown on decline susceptible sour orange rootstock. The presence and potential spread of CTV is a major threat for this citrus industry.

*References:* (1) M. Davino and G. Terranova. *Frutticoltura* 61:18, 1999. (2) A. Sambade et al. *Plant Pathol.* 51:257, 2002.

**First Report of Choke Disease Caused by *Epichloë baconii* in the Grass *Agrostis castellana*.** M. Romo Vaquero, B. R. Vázquez de Aldana, A. García Ciudad, B. García Criado, and I. Zabalgoeazcoa, IRNA-CSIC. Apartado 257, 37071 Salamanca, Spain. *Plant Dis.* 87:314, 2003; published on-line as D-2003-0110-01N, 2003. Accepted for publication 2 January 2003.

*Agrostis castellana* is common in semiarid natural grasslands of the province of Salamanca, Spain. In this area, plants showing fungal stromata in their stems were observed in July of 2001. These symptoms are typical of choke disease, caused by *Epichloë* species in several grasses (3). In this disease, external fungal stromata develop around the leaf sheath of the flag leaf during the reproductive cycle of the plant host. As a result, the inflorescence does not emerge. In natural populations of *A. castellana*, less than 1% of plants showed disease symptoms, and all

the stems of infected plants were sterilized by stromata. Intercellular endophytic mycelium was observed by microscopy in stem pith of diseased plants, but not on samples of 30 apparently healthy plants (1). Ergovaline, a fungal alkaloid, was not detected in lyophilized samples of infected plant tissue (2). In a fungal culture obtained from surface-disinfected leaf sheaths of a diseased plant (1), reniform conidia and conidiophores characteristic of the genus *Epichloë* were observed (4). To determine the fungal species, the nucleotide sequence of the ITS1-5.8S rRNA-ITS2 region and the three first introns of the beta-tubulin gene were obtained (EMBL Accession Nos. AJ490938 and AJ490939). When compared to those of other *Epichloë* species, these sequences identified the fungus from *A. castellana* as *E. baconii* (3). This fungus has been previously described as a pathogenic fungal endophyte in other *Agrostis* and *Calamagrostis* species (3,4). The fact that all stems of infected plants were diseased, infection incidence was low, and no alkaloids were detected in plants suggests that this grass-endophyte interaction is pathogenic and not mixed or mutualistic.

*References:* (1) E. Clark et al. *J. Microbiol. Methods* 1:149, 1983. (2) N. Hill et al. *Crop Sci.* 33:331, 1993. (3) A. Leuchtmann et al. *Mycol. Res.* 102:1169, 1998. (4) J. White Jr. *Mycologia* 85:444, 1993

**First Report of Blackleg Disease Caused by *Leptosphaeria maculans* on Canola in Brazil.** W. G. D. Fernando and P. S. Parks, Department of Plant Science, University of Manitoba, Winnipeg, MB R3T 2N2, Canada; G. Tomm and L. V. Viau, Pesquisador da Embrapa Trigo, 99001-970 Passo Fundo, RS, Brazil; and C. Jurke, Advanta Seeds, Inc. 3-75 Scurfield Blvd., Winnipeg, MB R3Y 1P6, Canada. *Plant Dis.* 87:314, 2003; published on-line as D-2003-0117-01N, 2003. Accepted for publication 7 January 2003.

Canola (*Brassica napus* L.) is a relatively new crop in Brazil, having been grown there for approximately 8 years. In 2000, leaf lesions and stem cankers were observed in cvs. Hyola 420 and Hyola 401 in farmers' fields in the state of Rio Grande do Sul. Cankered stems were received at the University of Manitoba, Canada, from Rio Grande do Sul for disease identification. Small pieces of the stem were cut from the cankered area, and standard protocol was followed to surface sterilize the stem pieces. Stem pieces were plated on V8 agar medium and incubated under light for 12 days. Typical fungal colonies with concentric rings containing pycnidia formed on the V8 agar. The colony characteristics were typical of the blackleg pathogen, *Leptosphaeria maculans* (Desmaz.) Ces. & De Not. (anamorph = *Phoma lingam*) (Tode:Fr.) Desmaz.). Blackleg is an economically important and serious disease in many parts of the world including Australia, Canada, the United States, and Europe. *L. maculans* strains can be characterized in four pathogenicity groups (PG1 through PG4) based on differential testing procedures giving interaction phenotype (IP) reactions (2). Two weeks after plating on V8 media, plates were flooded with sterile distilled water, and pycnidiospores were harvested. Flats of multipots filled with Metro Mix were seeded with three cultivars (Westar, Glacier, and Quinta). One-week-old cotyledons from the three cultivars were inoculated with pycnidiospore suspensions ( $2 \times 10^7$  pycnidiospores per ml) of seven Brazilian isolates, numbered 7, 8, 9, 11, 15, 16, and 18, respectively. Each cotyledon leaf, punctured in the center with a needle, was inoculated with a 10- $\mu$ l droplet of the inoculum. Disease evaluations were made 11 days after inoculation using a 0 to 9 rating scale (1). This screening was repeated three times from February 2001 to October 2001. After the second repeat, the isolates from Rio Grande do Sul were passed through the highly susceptible canola cv. Westar. Results from all four trials were consistent, and yielded one PG1 isolate (No. 7) and six PG3 isolates. PG1 is classified as a nonaggressive strain, whereas PG3 isolates are classified as aggressive. PG3 isolates would have an IP reaction of 7 to 9, 7 to 9, and 3 to 6 on cvs. Westar, Glacier, and Quinta, respectively. PG2 is the most commonly found aggressive strain in the Canadian prairies. PG3 is predominantly found in Australia, the United Kingdom, and the United States. To our knowledge, this is the first report of blackleg disease caused by *L. maculans* on canola in Brazil. Differential testing fulfilled Koch's postulates and determined the PG groups found in Brazil (PG1 and PG3).

*References:* (1) P. A. Delwiche. Genetic aspects of blackleg (*Leptosphaeria maculans*) resistance in rapeseed (*Brassica napus*) Ph.D. thesis. University of Wisconsin-Madison, 1980. (2) A. Mengistu et al. *Plant Dis.* 75:1279, 1991.

**First Report of *Bremia lactucae* Causing Downy Mildew on *Helichrysum bracteatum* in Italy.** A. Garibaldi, A. Minuto, G. Gilardi, and M. L. Gullino, DIVAPRA—Patologia vegetale, Via Leonardo da Vinci 44, 10095 Grugliasco, Italy. Plant Dis. 87:315, 2003; published on-line as D-2003-0109-01N, 2003. Accepted for publication 30 December 2002.

*Helichrysum bracteatum*, also known as strawflower, is commonly grown for the production of dried flowers and, more recently, as a potted plant. This latter cultivation system is becoming increasingly important on the Liguria Coast in northern Italy. During the spring of 2002, severe outbreaks of a previously unknown disease were observed in commercial farms in the area of Albenga (northern Italy) on several cultivars of *H. bracteatum*. Leaves of infected plants appeared curled and blistered; the infected portions of leaves turned chlorotic. On the lower leaf surface of chlorotic areas, a dense, whitish growth was evident. Infected leaves eventually wilted without dropping. Basal leaves with poor air circulation were the most severely affected. Certain cultivars of *H. bracteatum* (such as 'Florabella Pink') were most seriously affected, while others ('Florabella Gold' and 'Florabella White') had less disease. Microscopic observations revealed sporangiophores emerging from the stomata that were dichotomically branched, ending with 4 to 7 sterigmata. The sporangia were globose and measured 15.5 to 16.8 µm in diameter. The pathogen was identified as *Bremia lactucae* based on the morphological characteristics. Pathogenicity was confirmed by inoculating healthy *H. bracteatum* (100-day-old 'Florabella Gold') as well as *Lactuca sativa* (25-day-old 'Salad bowl') plants with a sporangial suspension ( $1 \times 10^5$  sporangia/ml). Five plants of *H. bracteatum* and 10 of lettuce were used as replicates. Noninoculated plants served as controls. Inoculated and uninoculated plants were maintained in a growth chamber at 20°C and 90 to 95% relative humidity. After 7 to 10 days, typical symptoms of downy mildew developed on *H. bracteatum* and lettuce plants artificially inoculated. *Bremia lactucae* was observed on infected leaves. Uninoculated plants did not show symptoms. To our knowledge, this is the first report of *Bremia lactucae* on *H. bracteatum* in Italy. *B. lactucae* was previously reported as the causal agent of downy mildew on *H. bracteatum* in several countries including the United Kingdom (3), the United States (1), and Egypt (2).

**References:** (1) S. A. Alfieri et al. Index of plant diseases in Florida. Bull. No. 11, 1984. (2) H. Elarosi and M. W. Assawah. Rev. Plant Prot. Res., 39:583, 1959. (3) W. C. Moore. British Parasitic Fungi. Cambridge University Press, Cambridge, 1959.

**First Report of *Phytophthora nicotianae* and *P. citricola* Associated with English Walnut Decline in Europe.** A. Belisario and M. Maccaroni, Istituto Sperimentale per la Patologia Vegetale, Rome, Italy; A. M. Vettrano and A. Vannini, Dipartimento Protezione delle Piante, Università della Tuscia, Viterbo, Italy. Plant Dis. 87:315, 2003; published on-line as D-2003-0107-01N, 2003. Accepted for publication 12 December 2002.

English (Persian) walnut (*Juglans regia*), among the most widely cultivated species of *Juglans* worldwide, is cultivated primarily for fruit production but also for timber. In the last 10 years, walnut decline causing leaf yellowing, sparse foliage, overall decline, and plant death has increased in Italian commercial orchards. In Italy, *Phytophthora cactorum*, *P. cambivora*, *P. cinnamomi*, and *P. cryptogea* are associated with this disease (1,4). Over the last 5 years, *P. cinnamomi* was the most widely isolated and destructive species (1). Recently, a different species of *Phytophthora* was isolated from diseased roots and soil from around lateral roots of 10 declining trees in two orchards in the Veneto Region of northern Italy. Another species of *Phytophthora* was isolated consistently from rotted roots of declining walnut trees in two orchards in the Campania Region of southern Italy. *Phytophthora* spp. were isolated directly from plant material or *Rhododendron* spp. leaf baiting on soil samples with PARBhy selective medium (10 mg of pimaricin, 250 mg of ampicillin [sodium salt], 10 mg of rifampicin, 50 mg of hymexazol, 15 mg of benomyl, 15 g of malt extract, 20 g of agar in 1,000 ml of H<sub>2</sub>O). Two species of *Phytophthora* were identified based on morphological and cultural characteristics (2). The species from trees in the Veneto Region was identified as *P. nicotianae*. All isolates produced papillate, spherical to obturbinate, occasionally caducous sporangia with short pedicels, terminal and intercalary chlamydo-spores, and were mating type A2. The species isolated from trees in the Campania Region was identified as *P.*

*citricola*. Isolates were homothallic, produced semipapillate, persistent, obclavate to obpyriform sporangia, occasionally with two apices, and antheridia paragynous. Identifications were confirmed by comparing restriction fragment length polymorphism patterns of the internal transcribed spacer region of rDNA with those obtained from previously identified species of *Phytophthora*. Pathogenicity of two isolates each of *P. citricola* and *P. nicotianae* was tested on 2-year-old potted walnut seedlings. Inocula were prepared by inoculating sterilized millet seeds moistened with V8 broth with plugs of mycelium and incubated for 4 weeks at 20°C in the dark. Infested seeds were added to potting soil at a rate of 3% (wt/vol). One day later, pots were flooded for 48 h to promote sporulation. Ten noninoculated seedlings were used as the control. Symptoms were assessed 2 months after inoculation. Seedlings inoculated with *P. nicotianae* developed necrosis of feeder and lateral roots, but only limited infection of taproots. Seedlings inoculated with *P. citricola* developed necroses at the insertion points of lateral roots. All four isolates produced visible damage to lateral roots on inoculated plants. *P. nicotianae* and *P. citricola* were reisolated from respectively infected roots. Results from these inoculations confirmed *P. nicotianae* and *P. citricola* as root pathogens of English walnut. Both species were associated with walnut decline as reported in the United States (3). To our knowledge, this is the first report of *P. nicotianae* and *P. citricola* on *J. regia* in Europe.

**References:** (1) A. Belisario et al. Petria 11:149. (2) D. C. Erwin and O. K. Ribeiro. Phytophthora Diseases Worldwide. The American Phytopathological Society, St. Paul, MN, 1996. (3) M. E. Matheron and S. M. Mircetich. Phytopathology 75:977, 1985. (4) A. M. Vettrano et al. Plant Dis. 86:328, 2002.

**First Report of *Phytophthora ramorum* on Canyon Live Oak in California.** S. K. Murphy and D. M. Rizzo, Department of Plant Pathology, One Shields Ave., University of California, Davis 95616. Plant Dis. 87:315, 2003; published on-line as D-2003-0102-01N, 2003. Accepted for publication 14 December 2002.

During August 2002, *Phytophthora ramorum* S. Werres & A.W.A.M. de Cock was isolated from branches <2.0 cm in diameter on a canyon live oak (*Quercus chrysolepis*) in Mt. Tamalpais State Park, Marin County, CA. The shrub was a cluster of stems <1 m in diameter and 1 m high. Similar cankers were observed on small branches of adjacent canyon live oaks and there was dieback of the branches distal to the lesions. Many tanoak (*Lithocarpus densiflorus*), California bay laurel (*Umbellularia californica*), and evergreen huckleberry (*Vaccinium ovatum*) were also infected by *P. ramorum* at this site. The isolate was identified as *P. ramorum* by its abundant chlamydo-spores and caducous, semi-papillate sporangia and internal transcribed spacer (ITS) rDNA sequences identical to those of isolates of *P. ramorum* from *Quercus* spp., tanoak, and *Rhododendron* (1,3). To test for pathogenicity, two greenhouse trials (5 seedlings per trial plus controls) were conducted on 20- to 24-month-old canyon live oak seedlings. Coast live oak (*Q. agrifolia*, section *Lobatae*) seedlings were included in the trials as a comparison because the species is known to be susceptible (1). Stems (approximately 1 cm in diameter) were wound inoculated (1). After 6 weeks, lesion lengths in the cambium of canyon live oak averaged 17.2 mm (range 16 to 30 mm), which was significantly greater (analysis of variance [ANOVA],  $P < 0.05$ ) in both trials than those of control inoculations (mean = 6 mm). Coast live oak seedlings inoculated at the same time had mean lesion lengths of 22.6 mm (range 15 to 30 mm). *P. ramorum* was recovered from 100% of inoculated stems. Canyon live oak has a wide geographic range within California, but is not common in the areas currently affected by *P. ramorum*. We have not observed disease symptoms or unusual mortality on overstory canyon live oaks. Although a number of understory canyon live oaks at the site on Mt. Tamalpais were apparently infected, the long-term effect of *P. ramorum* infection on understory trees remains unclear. To our knowledge, this is the first report of infection by *P. ramorum* of an oak species outside of the section *Lobatae* (red oaks); canyon live oak is classified in the section *Protobalanus* (intermediate or golden cup oaks) (2). Oaks in the section *Quercus* (white oaks) have not been observed to be infected by *P. ramorum* in the field.

**References:** (1) D. M. Rizzo et al. Plant Dis. 86:205, 2002. (2) P. Manos et al. Mol. Phylogenet. Evol. 12:333, 1999. (3) S. Werres et al. Mycol. Res. 105:1155, 2001.