Web Blight of Rosemary Caused by *Rhizoctonia solani* AG-1

G. E. HOLCOMB, Professor, Department of Plant Pathology and Crop Physiology, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge 70803

ABSTRACT

Holcomb, G. E. 1992. Web blight of rosemary caused by *Rhizoctonia solani* AG-1. Plant Dis. 76:859-860.

Web (aerial) blight of rosemary (*Rosmarinus officinalis*), characterized by twig and branch blight that results in decline and death of plants, was identified as being caused by *Rhizoctonia solani* AG-1. The disease was observed on large landscape plants of both prostrate and upright forms of rosemary, but only the prostrate form was killed. Disease control was obtained with benomyl, iprodione, and mancozeb in greenhouse tests. This is the first report of web blight of rosemary caused by *R. solani*.

Rosmarinus officinalis L. is an evergreen shrub that is native to the Mediterranean region and grown in hardiness zones 8 and 9 of the southern and western United States. The plant's oil is distilled and used in perfumes, soaps, and medicines, and the dried leaves are used as a culinary seasoning. Rosemary has regained popularity in recent years as a plant for herb and kitchen gardens and also as a container and landscape ornamental (8). Rodale's *Encyclopedia of Herbs* (6) lists 12 cultivars, including three with a prostrate growth habit and others that produce blue, white, or pink flowers.

Except for powdery mildew caused by *Sphaerotheca fuliginea* (Schlechtend:Fr.) Pollacci, only root diseases caused by species of *Armillaria, Phytophthora*, and *Rhizoctonia* have been reported on rosemary in the United States (3,11). This paper reports the occurrence of a new and severe blight on rosemary. Blight was first observed in June 1989 at the Burden Research Plantation on landscape plantings of the cultivar Prostratus (prostrate form) and an unidentified cultivar with upright growth habit. Symptoms consisted of severe web or aerial blight that had killed up to 80% of the branches on Prostratus. The disease was present on lower branches within the canopy of upright rosemary plants but had killed only small branches, and thus did limited damage. Severely infected Prostratus plants died by early fall. Fungal sclerotia were not observed on diseased plants. A preliminary report of this work was published in abstract form (5).

Approved for publication by the director of the Louisiana Agricultural Experiment Station as manuscript 92-38-6079.

Accepted for publication 31 March 1992.

MATERIALS AND METHODS

Pathogen isolation and pathogenicity tests. Samples of diseased rosemary shoot tips were collected from the cultivar Prostratus (prostrate growth habit) and an unidentified rosemary cultivar (upright growth habit) from the Burden Research Plantation demonstration herb garden in Baton Rouge, Louisiana. Samples were treated for 1–3 min in 70% ethanol, rinsed in sterile distilled water, cut into 3-mm-long sections, and plated on sterilized 2% water agar in sterile plastic petri dishes 10 cm in diameter. Hyphal tips of fungi that grew from tissue sections were transferred to, and maintained on, potato-dextrose agar (PDA) medium. Fungal isolates were also stored in tubes of sterile water.

Pathogenicity tests were performed on unrooted rosemary cuttings (80-mm-long cuttings of prostrate and upright cultivars maintained in Jiffy mix in styrofoam flats, 10 replicates per treatment) and on 100- to 150-mm-tall plants (eight replicates per treatment grown in soil mix in clay pots 10.2 cm in diameter) of Prostratus rosemary. Inoculations were made by placing 3 × 5 mm PDA blocks with fungal mycelium (cut from the growing edge of 7-day-old PDA cultures) on the stems of rosemary plants and cuttings. Inoculated plants and cuttings were held in a dew chamber at 25–27 C for 4 days and then placed in a greenhouse for further observation of disease development. Uninoculated plants and cuttings served as controls. Pathogenicity tests were performed three times, and pathogen reisolations were made from inoculated plants that developed disease.

Nuclear condition and hyphal anastomosis tests. The number of nuclei in hyphal cells of two suspected *Rhizoctonia solani* Kühn fungal isolates (one isolate each from prostrate and upright forms of rosemary) was determined by staining with the fluorescent DNA stain mithramycin (0.2 mg/ml in 25% aqueous ethanol plus 15 mM $MgCl_2$) (10). *R. solani* anastomosis group (AG) identification (9) of the rosemary fungal isolates was determined using the slide technique described by Kronland and Stanghellini (7) and also by making pairings on 2% water agar in petri dishes. The following *R. solani* anastomosis group tester isolates were used: AG-1 IA (Ogoshi's CS-2), AG-1 IB (Ogoshi's Shiba 2), AG-2-1 (Ogoshi's FC-2S), AG-3 (Ogoshi's ST11-6), AG-4 HG-1 (Ogoshi's R101), and AG-5 (Ogoshi's ST6-1). AG-1 IC was used to make morphological comparisons of sclerotia with the rosemary isolates but was not used in anastomosis pairings. All AG tester isolates were provided by Earl G. Ruppel, USDA-ARS Crops Research Laboratory, Fort Collins, Colorado.

Disease control. Fungicide disease-control tests were conducted on 100- to

Table 1. Fungicide control of rosemary web blight caused by *Rhizoctonia solani*

Fungicide and rate per liter	Disease rating[x]	
	Test 1	Test 2
Uninoculated control	1.0 a[y]	1.0 a
Benomyl, 180 g	1.0 a	1.0 a
Mancozeb, 180 g	1.1 a	2.8 a
Iprodione, 180 g	1.3 a	2.4 a
Inoculated control[z]	8.1 b	6.6 b

[x] 1 = 0–10% and 10 = 91–100% of foliage blighted.

[y] Means in a column followed by the same letter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

[z] Five of eight (test 1, 63%) and four of eight (test 2, 50%) inoculated control plants were killed.

150-mm-tall Prostratus rosemary plants grown in soil mix in clay pots 15.24 cm in diameter. Plants were sprayed to runoff, with fungicides and rates as follows: benomyl 50WP (Benlate, Du Pont Co., Wilmington, DE), 180 g/L; iprodione 50WP (Chipco 26019, Rhone-Poulence, Inc., Monmouth Junction, NJ), 180 g/L; and mancozeb 80WP (Dithane M-45, Rohm and Haas Company, Philadelphia, PA), 180 g/L. Triton CS-7 spreader was used at the rate of 1.25 ml/L with benomyl and iprodione. The fungicides were applied with a hand sprayer and the plants allowed to air-dry before being inoculated. Fungicide-treated plants were inoculated by the placement of a 3 × 5 mm agar block with *R. solani* mycelium (cut from the growing edge of 7-day-old cultures grown on PDA) at the base of the stem and midway up the stem on each plant. Plants were held at 25–27 C in a dew chamber for 4 days after inoculation and then moved to a greenhouse, where temperatures ranged from 25 to 30 C. Treatments included uninoculated unsprayed controls and inoculated unsprayed controls. Each treatment contained eight single-plant replications, and the experiment was performed two times. Disease ratings were taken after 15 days (test 1) and after 30 days (test 2) and were based on the estimated percent of foliage blighted (1 = 0–10%, and 10 = 91–100%).

RESULTS AND DISCUSSION

Pathogen isolation and identification. A fungus with mycelial branching and cultural characteristics resembling *R. solani* was consistently, and almost exclusively, isolated from symptomatic tissue from prostrate- and upright-growing cultivars of rosemary. Hyphal cells of the two fungal isolates (also used in pathogenicity tests) were multinucleate (as determined by mithramycin staining) and anastomosed with *R. solani* tester groups AG-1 IA and AG-1 IB. Sclerotial and colony morphology and pigmentation matched those of intraspecific tester group IB.

Pathogenicity and disease control tests. Pathogenicity tests using one fungal isolate from the prostrate form and one from the upright form of rosemary were positive, and *R. solani* was reisolated from inoculated cuttings and plants. Necrotic areas appeared on inoculated stems and leaves on the 2nd day after inoculation, and blight developed rapidly in the dew chamber but slowed after plants were removed to the greenhouse. Cuttings were completely blighted and killed after 5–7 days. Blight developed more slowly on intact plants, but 50% of inoculated unsprayed plants were killed after 30 days in one test. Uninoculated control plants remained healthy in these tests.

Disease control. Significant disease control was obtained with the three fungicides tested (Table 1), although none of these fungicides have specific approval for use on rosemary. Sixty-three percent and 50% of inoculated control plants were killed in tests 1 and 2, respectively. Prostrate forms of rosemary will probably have to be protected with fungicides to ensure their survival as landscape plants when grown in environments similar to those in southern Louisiana.

Web blight is a serious disease on many ornamental plants in the hot, humid southern United States in the greenhouse, nursery, and landscape environment. Both succulent and woody ornamentals are susceptible to this disease, and it was recently shown that both multinucleate and binucleate *Rhizoctonia* species are involved (2,4). It is now recognized that *R. solani* AG identifications are essential to a successful breeding program for disease resistance to this pathogen (1).

LITERATURE CITED

1. Anderson, N. A. 1982. The genetics and pathology of *Rhizoctonia solani*. Annu. Rev. Phytopathol. 20:329-347.
2. Chase, A. R. 1991. Characterization of *Rhizoctonia* species isolated from ornamentals in Florida. Plant Dis. 75:234-238.
3. Farr, D. F., Bills, G. F., Chamuris, G. P., and Rossman, A. Y. 1989. Fungi on Plants and Plant Products in the United States. American Phytopathological Society, St. Paul, MN. 1,252 pp.
4. Frisina, T. A., and Benson, D. M. 1987. Characterization and pathogenicity of binucleate *Rhizoctonia* spp. from azaleas and other woody ornamental plants with web blight. Plant Dis. 71:977-981.
5. Holcomb, G. E. 1991. Aerial blight of rosemary caused by *Rhizoctonia solani*. (Abstr.) Phytopathology 81:812.
6. Kowalchik, C., and Hylton, W. H., eds. 1987. Rosemary. Pages 428-432 in: Rodale's Illustrated Encylopedia of Herbs. Rodale Press, Emmaus, PA.
7. Kronland, W. C., and Stanghellini, M. E. 1988. Clean slide technique for the observation of anastomosis and nuclear condition of *Rhizoctonia solani*. Phytopathology 78:820-822.
8. Odenwald, N., and Turner, J. 1987. Identification, Selection, and Use of Southern Plants for Landscape Design. Claitor's Publ. Div., Baton Rouge, LA. 660 pp.
9. Ogoshi, A. 1987. Ecology and pathogenicity of anastomosis and intraspecific groups of *Rhizoctonia solani* Kühn. Annu. Rev. Phytopathol. 25:125-143.
10. Slater, M. L. 1978. Staining fungal nuclei with mithramycin. Methods Cell Biol. 20:135-140.
11. Wheeler, J. E., and Boyle, A. M. 1971. Identification of four *Phytophthora* isolates previously unreported from Arizona. Phytopathology 61:1293-1296.