Benomyl-Tolerant Strains of *Cercospora beticola* from Arizona[1]

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Received for publication June 2, 1976

Strains of the sugarbeet (*Beta vulgaris* L.) leaf spot fungus (*Cercospora beticola* Sacc.) tolerant to methyl 1-(butylcarbamolyl-2-benzimidazolecarbamate (benomyl) have been reported from Greece (1)[3] and the panhandle region of Texas (4). Although it was recommended that the use of one selective fungicide on large acreages should be discouraged (4), most growers have continued almost exclusive use of benzimidazoles where leaf spot is epidemic.

Diminished effectiveness of benomyl for controlling leaf spot was observed in sugarbeet fields near Willcox, Arizona, in 1974, and in a fungicide **trial** near Willcox in 1975. Consequently, tests were conducted to determine if benomyl-tolerant strains were present.

Cercospora-infected leaf samples were collected from sugarbeet plots that had been sprayed with benomyl or triphenyltin hydroxide, and from nontreated control plots. Samples were dried at room temperature, crushed, and used to inoculate sugarbeets in the greenhouse. When leaf spots developed, sporulation was induced by placing the plants in a humidity chamber. Single spore isolations (30 per sample) were made as previously described (2), and the resultant cultures were plated on potato-dextrose agar (PDA) containing 5 μg active ingredient (a.i.) benomyl/ml. A known benomyl-sensitive isolate of *C. beticola* (C-1; ATCC 24078) from Colorado was included in all plates as a control. In this test, all isolates from Arizona grew profusely on benomyl-amended PDA, whereas isolate C-1 was completely inhibited.

In a second test, 20 randomly selected single-spore isolates from cultures described above and isolate C-1 were plated on PDA containing 0, 1, 10, 100, 1,000 μg a.i. benomyl/ml. Measurements of linear growth after 7 days incubation at 25°C revealed that the

[1]Cooperative investigations of the Agricultural Research Service, U.S. Department of Agriculture; Spreckels Sugar Division, Amstar Corporation; the Colorado State University Experiment Station; and the Beet Sugar Development Foundation. Published with approval of the Director, Colorado State University Experiment Station, as Scientific Series Paper No. 2124.

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[3]Numbers in parentheses refer to literature cited.

Arizona isolates had varied degrees of benomyl tolerance similar to those isolates from sugarbeets grown in Texas (3). The ED^{50} (concentration of benomyl causing 50% growth inhibition) of nine isolates was between 100 and 1,000 μg/ml, whereas four isolates had an ED^{50} of 100 μg/ml. Six isolates had an ED^{50} between 10 and 100, and only one isolate had an ED^{50} of 10 μg/ml. Isolate C-1 grew only on the benomyl-free medium. No isolate was as tolerant as H1-12 (ED^{50} = between 1,000 and 5,000 μg/ml) from Texas (3).

Alternating benzimidazole and protectant-type fungicides has not provided adequate control of sugarbeet leaf spot in Texas (E. G. Ruppel, *personal observation*). Thus, we recommend that the use of benzimidazoles be discontinued in areas where benomyl-tolerant strains are found. The use of other fungicides, such as triphenyltin hydroxide (5), and growing sugarbeet cultivars resistant to *C. beticola* should effectively control the disease.

Literature Cited

(1) GEORGOPOULOS, S. G. and C. DOVAS. 1973. A serious outbreak of strains of *Cercospora beticola* resistant to benzimidazole fungicides in northern Greece. Plant Dis. Reptr. 57: 321-324.

(2) RUPPEL, E. G. 1972. Variation among isolates of *Cercospora beticola* from sugar beet. Phytopathology 62: 134-136.

(3) RUPPEL, E. G. 1975. Biology of benomyl-tolerant strains of *Cercospora beticola* from sugar beet. Phytopathology 65: 785-789.

(4) RUPPEL, E. G. and P. R. SCOTT. 1974. Strains of *Cercospora beticola* resistant to benomyl in the U.S.A. Plant Dis. Reptr. 58: 434-436.

(5) SCHNEIDER, C. L., H. S. POTTER, and F. B. RUSSELL. 1971. Control of Cercospora leaf spot of sugarbeet through aerial application of systemic and surface-protecting fungicides. J. Am. Soc. Sugar Beet Technol. 16: 525-529.