

Soybean Leaf Blight Caused by *Cercospora kikuchii*

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ABSTRACT

WALTERS, H. J. 1980. Soybean leaf blight caused by *Cercospora kikuchii*. Plant Disease 64: 961-962.

Soybean leaf blight incited by the purple seed stain fungus *Cercospora kikuchii* is reported under field conditions in the United States. Symptoms first appear during initiation and development of seed. Infection of leaves and petioles causes rapid defoliation beginning with the uppermost leaves and moving down. Resistance to the disease varies among cultivars. Fungicides reduce disease loss.

Cercospora leaf blight, caused by *Cercospora kikuchii* (T. Matsu & Tomoyasu) Chupp, is a destructive disease of soybean in Arkansas (13). The fungus, also responsible for purple seed stain of soybean, was first reported in Korea in 1921 (11). Matsumoto and Tomoyasu (7) indicated that the fungus attacked leaves, stems, and pods to some extent but primarily damaged seed. Han (3) reported wide distribution of the disease in Taiwan and described symptoms on leaves, stems, pods, and seed.

In the United States, purple seed stain was first observed in 1924 in Indiana (2). In 1950, Lehman (6) reported that seedlings from infected seed were stunted or killed after emergence. In 1951, Murakishi (8) described symptoms on hypocotyls, stems, leaves, and petioles of

greenhouse-grown soybean plants inoculated with mycelium of the fungus and on plants grown from infected seed. Although *C. kikuchii* has been shown to cause a seedling disease and has been isolated from infected stems (4-6,8), *Cercospora* leaf blight only recently has been reported as a disease occurring under field conditions in the United States (13).

Defoliation, beginning with the uppermost leaves and progressing down, has been observed in soybeans for many years and has often been mistaken for early maturity by growers. When efficient fungicides are used to control foliar pod and stem diseases, top defoliation usually does not occur.

The Southern Soybean Disease Workers estimated yield losses from *Cercospora* leaf blight in 1978 of 6.35 million bu in Arkansas and 130.5 million bu in 15 southern states (9). In 1979, they reported losses of 7.73 million bu in Arkansas and 18.4 million bu in the 15 southern states (10).

Under field conditions, the first symptoms of the disease are observed during the late R5 (beginning seed) and early R6 (full seed) soybean growth stages (1). Upper leaves exposed to the sun have a light purple, leathery appearance. Reddish purple, angular-to-irregular lesions later occur on both upper and lower leaf surfaces. Lesions vary from pinpoint spots to irregular patches up to 1 cm in diameter and may coalesce to form large necrotic areas. Veinal necrosis may also be observed. Numerous infections cause rapid chlorosis and necrosis of leaf tissue, resulting in defoliation starting with the young upper leaves. Green leaves often occur below the defoliated area. Lesions on petioles and stems are slightly sunken, reddish purple areas several millimeters long. Infection of petioles increases defoliation. The most obvious symptom is the premature blighting of the younger, upper leaves over large areas, even entire fields. On more susceptible cultivars such as Forrest and Bedford, round, reddish purple lesions, which later become purplish black, occur on pods (Fig. 1).

MATERIALS AND METHODS

Isolates of the causal fungus were obtained from spores picked with a drawn capillary tube from seeds, leaves, stems, and petioles of soybeans that had been kept in a moisture chamber 3-4 days



Fig. 1. Symptoms of *Cercospora* leaf blight on Forrest soybeans: (A) blighted leaves and leaf and petiole lesions; (B) circular lesions on pods.

Published with the approval of the Director of Arkansas Agricultural Experiment Station.

0191-2917/80/10096102/\$03.00/0

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Table 1. Disease ratings of 10 soybean cultivars inoculated with *Cercospora kikuchii*^a

Cultivar	Disease rating ^b
Bragg	5.0
Hood 75	4.9
Forrest	4.9
Dare	4.6
Pickett 71	4.6
Bedford	3.7
Mack	3.7
Davis	2.8
Lee 74	2.4
Tracy	2.0

^a Rating for each cultivar is the mean from 40 plants inoculated in the V 1 growth stage.

^b Disease ratings from 1 to 5: 1 = no symptoms observed; 2 = veinal purpling and/or few small lesions; 3 = moderate number of lesions, 25% of leaf affected; 4 = severe infection, 50% of leaf affected; 5 = more than 50% of leaf affected and/or leaf abscission.

at 23–30 C. Spores were placed on Difco potato-dextrose agar (PDA) and incubated at 28 C.

Inoculum was prepared from a representative isolate from seeds, foliage, petioles, and stems. Plants of the Forrest cultivar were inoculated as described by Vathakos and Walters (12). Five rows of Forrest seeds were planted in 45 × 60 cm flats filled with a sterilized mixture of sand, peat, and soil (1:1:1 v/v). After emergence, seedlings were thinned to 10 plants per row. Spore suspensions from each isolate were atomized to runoff onto the fully developed unifoliolate leaf stage (V 1) of one row in each of four flats. Plants were placed in a mist chamber at 22–31 C for 4 days and then on a greenhouse bench to allow disease development. All treatments were replicated four times in randomized design.

Ten soybean cultivars—Mack, Forrest, Bedford, Dare, Hood 75, Pickett 71, Lee 74, Davis, Tracy, and Bragg—were evaluated for resistance to *C. kikuchii*. Seedlings were grown in flats with one

row of 10 plants of each of five cultivars. Each cultivar was randomized within flats and replicated four times. After being inoculated with a virulent isolate of the fungus, plants were placed in the mist chamber for 4 days and then in randomized design on a greenhouse bench. Plants were rated for disease 14 days after removal from the mist chamber.

RESULTS AND DISCUSSION

Isolates of *C. kikuchii* from seeds, leaves, petioles, and stems on PDA developed typical dense mats of mycelium with a reddish purple pigment in the medium surrounding each colony. Only vegetative growth of the fungus occurred on PDA. No differences in growth were observed among colonies originating from seeds, leaves, petioles, or stems.

Symptoms developed on inoculated plants 2–3 days after removal from the mist chamber. Veinal purpling preceded lesion development, and the cultivar Tracy often exhibited only this symptom. Ten to 14 days after inoculation, reddish purple, angular-to-irregular lesions developed on both upper and lower surfaces of the leaves, varying from pinpoint spots to areas 1 cm in diameter. Reddish purple, sunken lesions one to several millimeters long later developed on stems. Lesions appeared on new leaves as they developed. Typical symptoms of *Cercospora* leaf blight developed on Forrest soybean plants with isolates of *C. kikuchii* from seeds, leaves, petioles, and stems, indicating that the leaf blight and purple seed stain are caused by similar strains of the same fungus.

Soybean cultivars Bragg, Hood 75, Forrest, Dare, Pickett 71, Bedford, and Mack were very susceptible to *Cercospora* leaf blight. Davis and Lee 74 were moderately susceptible, and Tracy was only slightly susceptible (Table 1). Some cultivars, such as Hood 75, are resistant

to purple seed stain but susceptible to *Cercospora* leaf blight.

Surveys in Arkansas during the full pod (R6) growing stage showed that most soybean fields had some damage from the disease. Temperatures of 28–30 C with extended periods of high humidity are favorable for disease development. Nonetheless, considerable damage occurs in years of abnormally dry weather during the later part of the growing season when dew is sufficient for spore germination and infection of plants by the fungus. The disease is more severe on early maturing cultivars than on those that mature later at lower temperatures.

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