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Potentially serious cotton disease

Angular Leaf Spot

established in California

Angular leaf spot of cotton is caused by the bacterium—*Xanthomonas malvacearum*—which enters the plant through wounds or natural openings. Circular translucent lesions on cotyledons, angular lesions on leaves, systemic infection of leaves, stem lesions, and boll rot—all caused by the pathogen—have been observed in California. Yield of cotton may be affected by the disease indirectly, by stunting and premature defoliation of plants, or directly, by loss of bolls due to boll rot.

The disease is confined to Fresno, Kern, Kings, Madera, and Tulare counties. The disorder was first seen in Kern County in 1929; in 1951 it was found in Fresno County and since then it has occurred each year in various parts of the San Joaquin Valley. There appear to be at least four well-documented instances of introduction of the pathogen on imported seed. However, the disease has not been observed in southern cotton-growing areas since the original observation in Imperial County, in 1912.

Sixty-six occurrences of angular leaf spot have been recorded since 1951, concentrated on the western slopes of the San Joaquin Valley, though it has spread recently to other portions of the valley.

Sprinkler Irrigation

The major factor responsible for the establishment of angular leaf spot in California appears to be sprinkler irrigation. The higher incidence in the western portion of the San Joaquin Valley is correlated with a widespread use of sprinkler irrigation. In the eastern portion of the Valley, most of the fields are furrow-irrigated.

Each occurrence of the disease but one on the distribution map is associated with sprinklers. The exception was in a furrow-irrigated field that was flooded by heavy rains when the seedlings were about 2″ high. In addition the grower soaked the seed to hasten germination. The high incidence of the disease—32%—suggests that the seed was inoculated from infested seed during the preplanting soaking.

Two races of the bacterium causing the disease are known in the United States. In 1959, infected leaves were collected from nine widely separated fields in the San Joaquin Valley. The pathogenic isolates obtained from the collections were used for inoculating race-differentiating cotton varieties. The reactions of the differentials indicated that the nine collections were Race *1*. The isolate that produced the disease in 1951, and one from the 1959 introduction, was also identified as Race *1*.

Gin Contamination

The distribution pattern of the disease suggests that infested planting seed is in-

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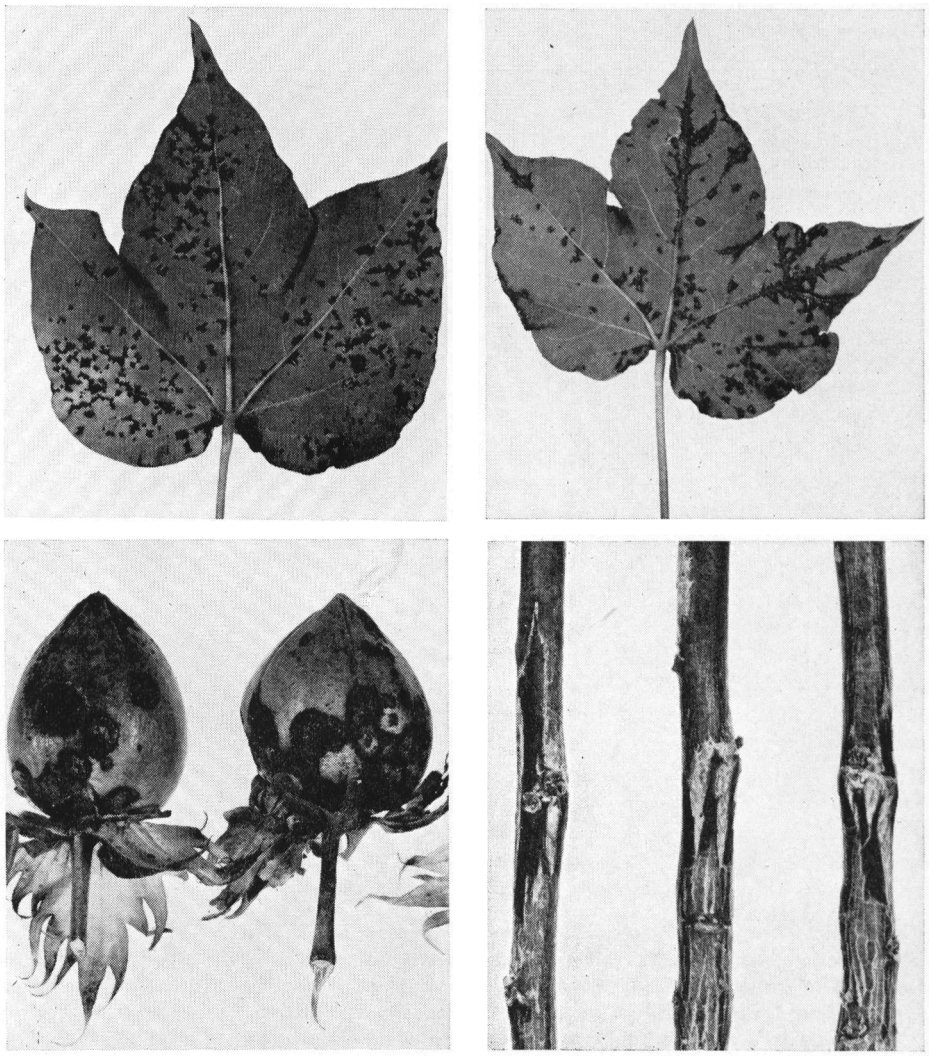
Symptoms of bacterial blight on Acala 4-42 cotton in California. *Upper left*, angular leaf lesions; *upper right*, systemic leaf infection; *lower left*, lesions on cotton bolls; *lower right*, lesions on cotton stems known as black-arm.



LEAF SPOT

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volved in its spread in California. Several fields of cotton showing angular leaf spot for the first time in 1958 were planted with seed originally from a single source.

The pathogen has been recovered from dried leaves, stems, and bolls of California cotton and from seed taken from infected bolls. The bacterium is capable of surviving six years in infected dry plant debris, and therefore it is also capable of remaining in a viable state in cotton gins from one ginning season to the following season.

All planting seed used in the San Joaquin Valley is grown free of angular leaf spot. Therefore, possible sources of contamination between harvest and planting were investigated. Some of the cotton gins process both planting seed and seed from sprinkler irrigated fields that may have had angular leaf spot. To reduce chances of contamination, planting seed is processed before possibly diseased seed is ginned.

To learn whether the pathogen could be recovered from gins, samples of seed and of plant refuse were taken from augers of the inclined cleaner, gin stand, feeder cleaner, and from refuse piles as some growers use the refuse material for fertilizer.

The pathogen was recovered from cotton refuse and seed from augers in the inclined cleaner and from the gin stand. It was not found in refuse taken from the auger in the feeder cleaner or from the gin pile. Probably, only gins handling seed from disease-free areas should process planting seed.

Carry-over of bacterium causing angular leaf spot on infected cotton refuse and effect of acid delinting on carry-over on Acala 4-42 cotton seed.

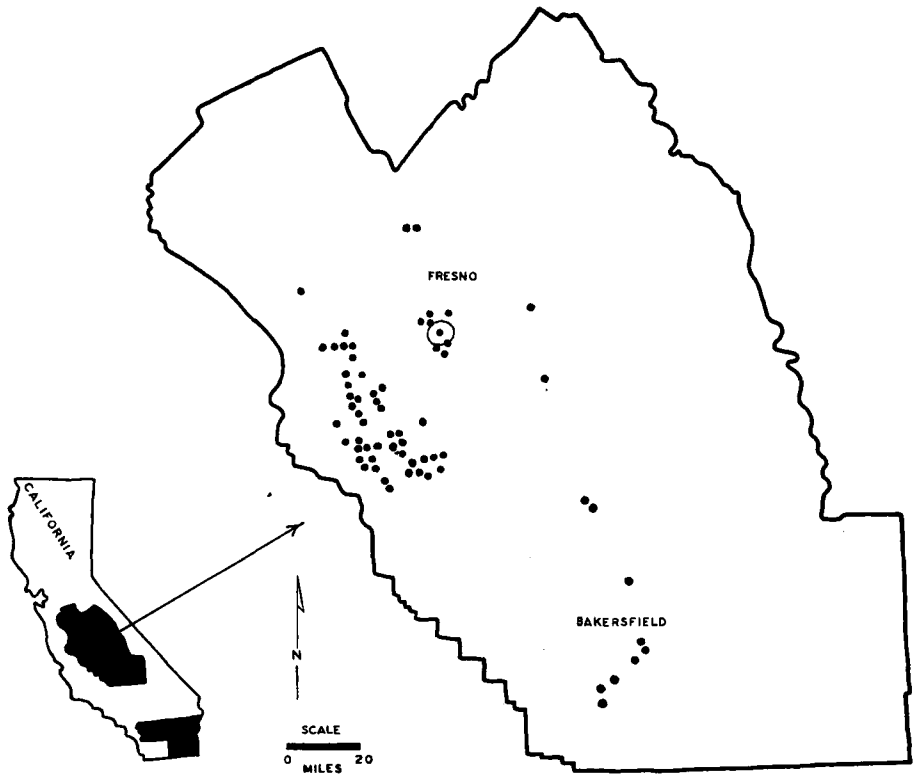
Treatment*	Disease in per cent
1. Infested seed, sterile soil**	10
2. Acid-delinted seed, sterile soil**	0
3. Clean seed, infected cotton refuse	19
4. Clean seed, sterile cotton refuse	0

* Each treatment involved about 400 plants.

** To enhance infection, seeds were soaked in sterile water following treatment.

Recovery of bacterium causing angular leaf spot from refuse taken from several cotton gins in central California.

Source of refuse	No. of gins sampled	No. of gins from which pathogen was recovered
Auger inclined cleaner	3	2
Auger gin stand	3	2
Auger feeder cleaner	1	0
Gin refuse pile	1	0



Distribution map of angular leaf spot of cotton in California 1951–1959. The blackened areas on the small map represent the cotton-growing regions in California. The enlarged map shows the distribution of the disease in the centrally located San Joaquin Valley. Each dot represents a separate occurrence. The open circle indicates the approximate point of disease origin in 1951.

Control

Planting disease-free seed is an effective control measure only in fields free of infected debris and infected volunteers. Because there is little rainfall in the San Joaquin Valley, decomposition of plant refuse is slight and infected debris probably constitutes an important reservoir of the pathogen.

Under California conditions the bacterium carries-over for at least a year in virtually 100% of the fields with a history of the disease. After a field is infested decomposition of cotton debris can be hastened by plowing deeply and adding moisture to the land. Crop rotation using nonhost plants is definitely helpful.

Acid delinting of cotton seed proved effective in controlling angular leaf spot. Results of the tests indicate that there is little if any internal infection and infestation of the seed is mostly external. The probable reason is the lack of severe boll rot because in most cotton growing areas of California humidity is low and rain is often absent before and during harvest.

A preplanting treatment of the cotton seed, with an organic mercury, is usually effective.

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