TRANSMISSION OF XANTHOMONAS MALVACEARUM IN COTTON SEED OF THREE VARIETIES INTRODUCED INTO CALIFORNIA IN 1967

Variety	Trial 1	Trial 2	Trial 3	Trial totals	Transmission
	Infected plants/healthy palnts				%
PD 2165	0/48	0/158	7/134	7/340	2.1
PD 0259	0/149	0/144	2/149	2/442	0.5
PD 3307	2/112	—	—	2/112	1.8
				Average	1.5

were confined primarily to the lower stem. Several examples of black arm were seen at Tulare, but collections at Madera could not be considered typical, since the density of the plants there made observations difficult. Samples were taken for isolation from all three locations, however.

Isolation and race determination

Isolations were made from diseased tissue that had been dried for four to seven days in the laboratory. Race-differentiating varieties were inoculated with several isolates from the Arvin and Tulare plots. Isolates suspected of being *X. malvacearum* were pathogenic and proved to be Race 1. The pathogen was recovered from collections at Arvin and Tulare but not Madera.

Seed transmission

Seed samples were obtained of the varieties suspected of carrying the pathogen. Several unhealthy-appearing seeds were taken from each sample for direct isolation of the pathogen. *X. malvacearum* was not recovered from any of the nine selected seeds. Two hundred seeds were taken from each sample and soaked for 18 to 19 hours in 60 ml of sterile glass-distilled water. (Soaking facilitates detection by increasing the percentage of diseased seedlings that result from an infected seed lot, particularly if there is external contamination.) Although this seed had been acid-delinted and fumigated—making the chances of external contamination small—it was hoped that soaking would enhance disease expression from internal infection. The seed and suspension were agitated periodically and then poured onto autoclaved soil, covered with autoclaved soil, and held at 80–85°F. Readings for disease began two weeks later and continued for another two weeks. Two of the varieties required several trials before disease transmission could be demonstrated.

Approximately 1.5 per cent of the plants of the three varieties exhibited typical blight lesions on cotyledons (see table). Isolations made from the lesions, and subsequent inoculation to susceptible varieties, proved that *X. malvacearum* was seed-borne. The low transmission percentage indicates that the seed-borne infection was internal; with external seed-borne contamination the techniques described generally result in infection ranging above 10 per cent.

Conclusions

It was concluded that although bacterial blight occurred on imported cotton varieties planted adjacent to commercial cotton, there was no spread into the commercial growing crop. Since infected plants in variety trials were destroyed and the seed was not processed in a commercial cotton gin, it is unlikely that the disease will become established as a result of its introduction.

Since the pathogen was recovered from plants at the Arvin and Tulare plots, it can be assumed that it was introduced at Madera also, even though it was not isolated from plants at that location.

The occurrence of bacterial blight in 1967 demonstrates how easily the pathogen can be introduced in seed. *X. malvacearum* has probably been introduced into California many times, although only five introductions are documented. Introductions could go undetected when plants are furrow-irrigated, though it is generally detected where sprinkler irrigation is used. The difference between the two types of irrigation in the development of the disease was well illustrated in 1967. Only the black arm phase on the lower stem was observed where furrow irrigation was used, but all of the typical blight symptoms were present under sprinklers.

Screening advisable

Even though acid-delinted and fumigated cotton seed can be brought into California legally, it seems advisable to screen introduced cotton varieties in the greenhouse for bacterial blight transmission before planting in the field, especially if sprinkler irrigation is used. Greenhouse screening might also detect other seed-borne pathogens of cotton. To eliminate virtually all risk of establishing bacterial blight in the future, introduced varieties should be grown only in furrow-irrigated plots.

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Control of

BOTRYTIS or "fire" in Easter lily foliage and flowers is a devastating disease in the lily growing areas of southwest Oregon and northwest California. Botrytis foliage blight is caused by the fungus, *Botrytis elliptica*. The disease causes a tear-drop shaped lesion on the leaves and may completely defoliate plants not protected by a suitable fungicide. Through a magnifying hand lens the mycelium of the fungus can be seen growing on the surface of the leaf. The fungus is especially prevalent during periods of cool, wet weather.

Bordeaux mixture is usually applied about 22 times per season and is the standard protectant fungicide. Rates of application vary from grower to grower but are generally in the range of 6-6-100 to 10-10-100. The lower concentration is usually applied during the early part of the season but when Botrytis becomes severe later in the season the higher concentration is used. Numerous other materials have been tried with limited success during the past 20 years. The carbamate materials, such as maneb, give good control of mild blight, but must be applied at least every seven days. Unfortunately rainy weather may limit applications, so growers have reverted to the Bordeaux mixture. Botrytis blight was extremely serious during the 1968 season and 100 per cent control was not obtained even with the Bordeaux treatment.

Systemic fungicides

New systemic fungicidal materials have been developed during recent months and two of these materials were tried under experimental conditions in a grower's field near Smith River, Del Norte County. Benlate 50W—formerly Du Pont 1991—(methyl 1-(butylcarba-

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BOTRYTIS BLIGHT OF EASTER LILIES WITH SYSTEMIC FUNGICIDES

Test plot photos above taken at a Del Norte County Easter lily planting, show dead foliage (left photo) from Botrytis blight resulting in the check plot, as compared with healthy foliage in plots treated with the systemic fungicide Benlate (right photo).

moyl)-2-benzimidazole-carbamate) and Thiabendazole (TBZ) 60W (2-(4-thiazolyl) benzimidazole)—a Merck Chemical Division product—were used at 2 lbs of the formulation per 100 gallons of water. Plots were 30 feet long and established in a grower's field with the Ace variety. The fungicides were applied with a Hudson hand sprayer. Treatments were replicated four times and applications were made on May 1, 15, 29 and June 12, 1968. The lily field was sprinkler irrigated throughout the season. All plots, including the check, received applications of Bordeaux mixture up to the start of the treatments on May 1 and after the treatments beginning June 26.

Observations made on June 26 of the amount of Botrytis blight indicated no significant differences between any of the treatments. Consequently the spraying was stopped because of the apparent lack of effectiveness of the treatments to this initial infection. However, upon reviewing the Del Norte County plot during the early part of September, 1968, surprising differences existed among the treatments and the best treatment was obviously better than the standard Bordeaux treatment. The plot was reevaluated on September 23 and the percentage of leaf area destroyed on plants from each treatment was noted as follows:

Fungicide	Rate per 100 gals.	Average leaf area destroyed on plants
Benlate 50W	2 lbs	18.8%
Thiabendazole 60W	2 lbs	79.3%
Check		94.5%

The percentage figures were adjusted to make allowances for multiple infections and the diminishing proportions of healthy tissue available for infection as the disease increased. On this basis the infection rating for check plots was 290; 158 for Thiabendazole; and 21 for Benlate. Infection was reduced to about $\frac{1}{14}$ of the amount in the check plot by Benlate and about $\frac{1}{2}$ by Thiabendazole.

Benlate

These results suggest that Benlate became systemic in the lily plants and protected the foliage throughout the remainder of the season. Thiabendazole gave unsatisfactory control of Botrytis blight. Observations indicated that Benlate was far superior to the standard commercial application of Bordeaux mixture applied by the grower.

Trials are underway in the greenhouse at the University of California, Riverside to determine the nature of any possible systemic action in Easter lily by Benlate. Additional grower trials are planned for the 1969 season.

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