

Tolerance of *Phaseolus lunatus* to Bacterial Brown Spot

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ABSTRACT

Three hundred eighty-three lima bean (*Phaseolus lunatus*) lines were tested for reaction to *Pseudomonas syringae* in the field. Twenty lines showed some tolerance in the field, the most tolerant being P.I. 183412. However, all were equally susceptible under greenhouse conditions. *Phytopathology* 61: 1406-1407.

Additional key words: lima beans.

Bacterial brown spot of lima beans (*Phaseolus lunatus* L.) was reported in Wisconsin by Thaung & Walker (1) in 1957. They showed that the pathogen, (*Pseudomonas syringae* van Hall), could be introduced by contaminated seed and that it could survive in the soil through the Wisconsin winter and throughout the following growing season. Environmental conditions favorable for disease development were also elucidated. This disease has continued to be a problem in lima bean production in Wisconsin, and no satisfactory control measure has been developed. Therefore, a thorough search for resistance to *P. syringae* was undertaken.

All of the readily available lima bean lines in the United States were collected for planting in the field in 1969. This included 39 lima bean cultivars or breeding lines from commercial seedsmen and 321 P.I.'s from the USDA Regional Plant Introduction Station, Pullman, Wash. These lines, together with the control cultivar Early Thorogreen, were planted at Galesville, Wisc., in 5-ft-long randomized plots. Seeds of Early Thorogreen were dusted with dried, finely ground, infected leaves to supplement naturally occurring inoculum, and were planted every other row. Seeds of individual lima bean lots were so limited in 1969 that replicate plantings could not be made. The randomization of the lots in the test and the uniform occurrence of the disease in the plots gave credence to the results even though proper statistical treatment of the data could not be made. A severe outbreak of the bacterial brown spot disease had developed at the third trifoliate leaf stage, and reliable disease severity ratings could be made before the blossom stage and at late pod stage.

The 1970 test included the 143 best lines from the 1969 test and 23 new P.I. lines. A total of 166 lines were planted in a completely randomized block and replicated 4 times. The same technique for supple-

menting naturally occurring inoculum was employed, with the exception that the artificially infested seeds were planted every third row. Since the bacterial brown spot disease developed slowly, the foliage of the plants in the 14 rows containing the P.I. lines was inoculated at the fifth trifoliate leaf stage by dusting with finely ground, dried infected leaves.

In the greenhouse tests, the plants were grown in compost soil in 5-inch clay pots. Bacterial inoculum was grown on a medium containing 0.8% nutrient broth, 2.0% glycerol, and 2.0% agar for 24 hr at 28 C. The cells were washed with sterile distilled water, and the inoculum level was adjusted to 1.5×10^8 cells/ml using a Bausch & Lomb spectronic 20 colorimeter. The first trifoliate leaves were inoculated using a DeVilbiss atomizer at 15 psi without water-soaking and without the use of a moist chamber. At least two trials, of five or more plants, were made.

A disease index was calculated for each P.I. A disease index of 0 indicated that all plants were healthy, and 100 indicated that all plants were severely diseased.

In the 1969 test, 42 of 321 P.I. lines appeared to have some tolerance to *P. syringae*. The six most tolerant P.I. lines had disease indices of 10 (Table 1). Another 36 P.I. lines, including 183412, had a disease index of 15. In contrast, 34 P.I. lines had an extremely high disease index of 90, and 54 had a disease index of 100. The disease index for Early Thorogreen control was 66.

The 16 most tolerant lima bean lines were tested for disease reaction in the greenhouse during the winter of 1969-70. Under these conditions, all of them proved to be as susceptible as Early Thorogreen, which had a disease index of 65 (Table 1).

The 1970 field results were analyzed statistically with a disease index for Early Thorogreen control of 35. The least significant difference (LSD) was 24 at the 5% level and 32 at the 1% level. At the 5% level, 14 P.I. lines with disease indices of 10 were significantly more tolerant than the control (Table 1). Only five P.I. accessions were significantly more susceptible than the control, although 10 others had disease indices between 50-58.

Twelve of the most promising lima bean P.I. lines from the 1970 plot were tested for reaction to bacterial brown spot in the greenhouse during the winter of 1970-71. All of them were found to be susceptible with the exception of 183412, which showed slight-to-moderate reaction to *P. syringae* (Table 1). The average disease index for the Early Thorogreen control was 75.

Lima bean cultivars and lines from commercial sources were similar to the P.I. lines in their reaction to the bacterial brown spot disease. However, none was as highly susceptible as many P.I. lines (with disease indices higher than 75). One line, G1, had a disease index of 0 in the field and 75 under greenhouse conditions. The 12 rather tolerant lines, with a disease index of 15, included Spartan Freezer, HR13, HRL13, G2, 109-68, 111-68, 112-68, 113-68, 117-68, 119-68, 121-68, and 141-68. Ten commercial

TABLE 1. Field and greenhouse reaction of field tolerant lima bean plant introductions to *Pseudomonas syringae* during 1969 and 1970

1969 disease index			1970 disease index					
P.I. no.	Field	Greenhouse	P.I. no.	Field	Greenhouse	P.I. no.	Field	Greenhouse
180462	10	75	183412	10	40	257364	10	60
200932	10	50	188696	10	75	257409	10	75
201287	10	50	248789	10		257558	10	60
256807	10	60	249024	10	75	257562	10	75
256820	10	75	249042	10	75	260414	10	
299385	10	50	256809	10	90	309817	10	75
Control, Early Thorogreen 66		65	257358	10	75	314902	10	75
				Control, Early Thorogreen			35	75

lines of lima beans had disease index readings of 75, indicating definite susceptibility.

This is the first known comprehensive study of the reaction of lima bean germ plasm to *P. syringae*. The most striking fact discovered was that the apparent tolerance to bacterial brown spot observed in the field was of such low degree that it could not be identified under controlled greenhouse tests. Also, lima bean strains which were promising in one field test were, with very few exceptions, susceptible in the other field trial. For example, when 32 low-disease index lines from the 1969 test were studied in 1970,

only one, P.I. 183412, had significantly less disease than did the control. Of the 14 P.I. lines which were significantly less susceptible than the control in 1970, nine were tested in 1969, but only one, P.I. 183412, was then tolerant. This P.I. appears to be the most promising lima bean as a source for tolerance to bacterial brown spot.

LITERATURE CITED

1. THAUNG, M. M., & J. C. WALKER. 1957. Studies on bacterial blight of lima bean. *Phytopathology* 47:413-417.