

Genetic Analysis of Phytophthora Rot Resistance in the Soybean PI 567.504

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Introduction

The soilborn fungus *Phytophthora sojae* causes the disease Phytophthora root rot. The disease can attack soybeans at any stage of development. Seed rot and pre-emergence damping-off can occur in flooded areas or ponded soils. Post-emergence damping-off and seedling stem rot cause wilting and plant death ([Schmitthenner, 1985](#)). Plant Introduction (PI) [567.504](#) is resistant to hypocotyl inoculation of races 1, 4, 7, 13, and 25 and susceptible to races 3, 5, 12, and 20. [Hegstad et al. \(1998\)](#) suggested on the basis of RFLP analysis that PI 567.504 carries the [Rps3a](#) gene for resistance to *P. sojae*. The objective of this study was to determine the genetic control of resistance to *P. sojae* race 25 in PI 567.504.

Materials and Methods

In the summer of 1996, crosses were made between PI 567.504 and the following 'Williams' isolines: Williams (*rps*) (designated LNX96163), [L83-570 \(Rps3a\)](#) (designated LNX96173), [L85-2352 \(Rps4\)](#) (designated LNX96178), and [L85-3059 \(Rps5\)](#) (designated LNX96183). Crosses were made at the Crop Sciences Research and Education Center in Urbana, IL. The F₁ plants were grown in 1997 to produce F₂ seed. During the winter of 1998, 50 F₂ seeds from each cross were planted in the greenhouse for evaluation of their reaction to race 25 of *Phytophthora sojae*. Plants were inoculated using the hypocotyl inoculation method with zoospores ([Moots, et al., 1983](#)). Parental lines were included in the experiment to check their reaction to race 25 of *P. sojae*. Single soybean plants were evaluated as alive or dead five days after inoculation. The data were analyzed by the chi-square test for goodness of fit to expected ratios.

Results and Discussion

Williams was susceptible to race 25 while PI 567.504, L83-570, L85-2352, and L85-3059 were all resistant. Population LNX96163 was probably the result of

self-fertilization since segregation was not found in the F₂ and all plants in the population were susceptible. All other populations used in this study segregated in a ratio of approximately fifteen resistant to one susceptible ([Table 1](#)). The calculated Chi-Square probability for the LNX96173 cross with a 15 to 1 ratio was between .05 and .01 indicating a loose fit. The calculated Chi-Square probability for LNX96178 and LNX96183 crosses with the same 15 to 1 ratio was between .20 and .05 indicating a fairly good fit to the expected ratio ([Table 1](#)).

The data from the F₂ populations suggests that there are two genes controlling resistance to race 25 in each cross with known genes. Therefore, PI 567.504 has one gene for resistance to race 25 that is not allelic to *Rps3a*, *Rps4*, or *Rps5*. However, this does not eliminate the possibility of a new gene.

References

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- Moots, C.K., C.D. Nickell, and S.M. Lim. 1983. Reaction of soybean cultivars to 14 races of *Phytophthora megasperma* f. sp. *glycinea*. *Plant Dis.* 67:764-767.
- Schmitthenner, A.F. 1985. Problems and progress in control of *Phytophthora* root rot of soybean. *Plant Dis.* 69:362-368. [[AGRICOLA](#)]

Table 1. Segregation analysis of F₂ populations from LNX96163, LNX96173, LNX96178, LNX96183 crosses when inoculated with race 25 of *Phytophthora sojae*.

Population or Parent	Res.	Susc.	Theoretical Ratio	Chi-Square	Chi-Square Prob.
PI 567.504	All				
LNX96173	40	7	15 : 1	5.99	0.014
L83-570 (<i>Rps3a</i>)	All				
LNX96178	42	7	15 : 1	5.40	0.020
L85-2352 (<i>Rps4</i>)	All				
LNX96183	40	6	15 : 1	3.62	0.057
L85-3059 (<i>Rps5</i>)	All				