Relationship of Postinoculation Humidity to Bacterial Leaf Blight Development on Soybean

B. W. Kennedy & T. W. Mew

Associate Professor and Research Assistant, respectively, Department of Plant Pathology, University of Minnesota, St. Paul 55101.

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ABSTRACT

Conditions on sand benches in the greenhouse were favorable for severe bacterial leaf blight development on potted plants. Blight was consistently less severe on plants subjected to high humidity in growth chambers, lighted or unlighted humidity chambers, or plastic bags. Phytopathology 61:879-880.

Additional key words: Pseudomonas glycinea, Glycine max.

Bacterial blight of soybeans (*Glycine max* [L.] Merr.) usually is most severe during or following wet weather. For this reason, it has been a common practice, after inoculating plants, to expose them for 1-2 days in a humid chamber, the aim being to promote a rapid and uniform infection. In our work with *Pseudomonas glycinea* Coerper, we have used various postinoculation treatments in an attempt to obtain uniform and heavy infection. We have consistently had better results when we placed potted plants on a sand greenhouse bench, without any postinoculation treatment, than when we have incubated the plants, after inoculation, in a moist chamber or enclosed them in plastic bags.

A total of eight experiments were made to evaluate these observations. In two identically designed greenhouse experiments, plants growing in 4-inch clay pots were inoculated by gentle rubbing of young unifoliolate leaves with a cotton swab dipped in either a suspension containing about 10^8 cells/ml of *P. glycinea* race 2, or in an aqueous suspension containing 2 infected leaves (moderate severity) ground in 25 ml of water. By either method, healthy young leaves were dusted with Carborundum (No. 400) before inoculation. Immediately following inoculation, plants were treated as follows: (i) placed on a sand bench in the greenhouse; (ii) placed in a lighted chamber (14-hr day with 500-600 ft-c of light via cool-white fluorescent lamps, temperature 20-22 C and relative humidity 100%), and after 2, 4, or 6 days, plants were removed to sand benches in the greenhouse; (iii) pots were placed in the lighted humidity chamber after being covered with an inverted pot to exclude all but about 25 ft-c of light, and after 2 and 4 days, covers were removed and plants were transferred to a sand bench in the greenhouse; (iv) wet plants were enclosed within plastic bags and pots were then placed on the sand bench, and bags were removed 2, 4, and 6 days thereafter (free water remained on inner surface of bags for the entire period).

Readings for blight severity were made periodically, and a final observation was made at the end of experiments, 9 days after inoculation. Each treatment consisted of two pots containing four plants of the susceptible cultivar Chippewa.

In general, there was a direct correlation between development of blight and time plants were subjected to high humidity. If compared to plants incubated continuously on the greenhouse bench after inoculation, severity of blight (estimation of numbers, size, and distinctiveness of water-soaked lesions) was reduced by about 50% on those plants receiving postinoculation treatment of high humidity for 2 days either in the lighted humidity chamber or in polyethylene bags. High humidity treatment for a 4-day period resulted in further reduction in symptom development on plants inoculated in chambers and prevented symptom development in polyethylene bags. A 6-day exposure precluded blight development in any treatment. It is interesting to note, however, that development of halos was striking around the limited numbers of lesions that formed on leaves incubated under reduced light in the humidity chamber for 2 or 4 days (treatment 3). We note that Lucas & Grogan (2) indicate that more bacterial blight lesions develop on cucumber if plants are covered with polyethylene bags before inoculation than after, or before and after inoculation.

Given favorable light and temperature conditions following inoculation, these data indicate that humidity at or near 100% is not optimum for blight development. Although light is a determining factor in disease development (3), it is not considered to be the main factor reducing disease severity in the lighted chamber or within plastic bags in our studies. Light was reduced by about 20% in plastic bags and by about 50% in the lighted humidity chamber, as compared to the sand bench treatment. According to previous work (3), light should be sufficient for blight development in the chamber. Therefore, we conclude that light probably is not the critical factor causing blight reduction due to postinoculation high-humidity treatments.

In a series of six experiments using controlled environment chambers, evaluation of the effect of relative humidity on blight development was made at 20 C. Relative humidity was set for 70% in one chamber and at 90% ($\pm$ 10%) in another. Fluctuation in relative humidity to as low as 55% in the chamber set for 70% was frequent. Inoculum loads varied from a calculated 62 cells/ml up to 10^6 cells/ml. Races 1, 2, and 4 of *P. glycinea* were used on cultivars Acme and Chippewa soybeans, and each treatment consisted of three pots with three plants/pot. One young unifoliolate leaf on each plant was inoculated by first pricking the leaf with a fine wire brush, then gently spraying it with bacteria. The opposite leaf was inoculated by water-congesting a circular area 0.5 cm in diam by use of an airbrush (1). Blight severity readings were made 14 days after inoculation.

Plants averaged 3 cm taller and were lighter green in

color in the chamber having higher relative humidity. There were no differences in symptoms among plants, regardless of humidity treatment, if the host-pathogen combination was one resulting in a resistant (hypersensitive) reaction as was the case with higher inoculum loads of race 1 on Chippewa. All other combinations resulted in a susceptible reaction, and plants in three of the six experiments showed detectably more severe symptoms at 70% than at 90% relative humidity. No differences could be observed in the other three experiments.

While unreliability of humidity control in one chamber makes interpretation of our growth chamber experiments difficult, the data suggests again that maintenance of high humidity at or near saturation does not favor severe blight development. We did have the advantage of having four inoculum dosages of three races of *P. glycinea* to compare on two cultivars of soybean inoculated by two different methods. In susceptible combinations, blight developed sooner at high than at low inoculum density, and severity was generally a function of inoculum concentration.

These data and our general experience in using a variety of postinoculation humidity treatments indicate that much is unknown about humidity factors affecting blight development in soybeans. While one might suspect that low relative humidity would hinder its development, maintaining 100% relative humidity for 2 or more days following inoculation appears also to be deleterious even though conditions are otherwise favorable.

LITERATURE CITED

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