Research Note

METHODOLOGY FOR SCREENING COMMON BEAN RESISTANCE TO WEB BLIGHT[1,2]

Manuel de J. Bautista-Pérez[3] *and Rodrigo Echávez-Badel*[4]

J. Agric. Univ. P.R. 84(1-2):91-94 (2000)

Rhizoctonia solani Kühn [teleomorph: *Thanatephorus cucumeris* (Frank) Donk], which causes stem rot and web blight (WB) on common bean (*Phaseolus vulgaris* L.), has gained importance in Puerto Rico and the Caribbean. The disease is favored by the hot rainy weather of the tropics (Gálvez et al., 1989), which increases the incidence, thus reducing bean yield and seed quality (Godoy-Lutz et al., 1996). The objective of this research was to test a methodology for screening common bean to determine resistance to WB.

Several methods for screening common bean for WB reaction have been reported in Colombia (Cárdenas-Alonso, 1989), Costa Rica (Galindo et al., 1983) and Puerto Rico (Polanco et al., 1996), but these methods are impractical and tedious when evaluating a large number of common bean lines. We used two inoculation methods: a) inoculating trifoliolates with colonized potato dextrose agar (PDA) disks in the laboratory (detached-leaf) and greenhouse; b) spraying the inoculum suspension on the foliage of plants in the field.

The detached-leaf method was recently reported by Steadman et al. (1997), who evaluated common bean lines and cultivars for resistance to white mold (*Sclerotinia sclerotiorum*). The third trifoliolate of plants grown in the field at V4 growth stage (Van Schoonhoven and Pastor-Corales, 1987) was detached and placed in orchid tubes containing 10 ml of tap water. Aluminum pans (30.5 × 39 × 9 cm) were lined with wet paper towels, and four 10-cm diameter petri dishes were inverted and placed on the bottom of each pan to prevent the trifoliolate from touching the wet paper towel. Four 4-mm diameter disks of PDA from six-day-old cultures of *R. solani* (Rs 011 and Rs 012 isolates) were placed near the center of two leaflets of each leaf; the third leaflet was inoculated with PDA only as control. Water was added to the bottom of each pan, which was then covered tightly with a plastic bag to provide high humidity. Pans were incubated at 24° C under artificial room lighting.

Colonized PDA disks with Rs 011 and Rs 012 isolates were also inoculated on the third trifoliolate of plants grown in the greenhouse (V4 stage). Disks of PDA alone were used as control. Plants were watered and covered with plastic bags for three days to increase humidity. Temperature ranged from 24 to 30° C throughout the experiment. Suspensions of mycelial mats (1 g mycelia per 300 ml of distilled water) of the same isolates were sprayed with a manual sprayer (30 ml/1.60 m^2) on the foliage of the plants at

[1]Manuscript submitted to the Editorial Board 14 October 1998.

[2]The authors thank Dr. Raúl Macchiavelli and Dr. James S. Beaver, Department of Agronomy and Soils, College of Agricultural Sciences, for assistance with the statistical analysis and for providing helpful comments on the manuscript.

[3]Former Graduate Research Assistant, Department of Crop Protection.

[4]Researcher in Plant Pathology, Department of Crop Protection, College of Agricultural Sciences, University of Puerto Rico-Mayagüez, P.O. Box 9030, Mayagüez, PR 00681-9030.

the V4 stage in the field. Control treatment using distilled water was included. Sprinkler irrigation was used after inoculation when necessary to maintain high humidity. The temperature at the Isabela Substation ranged from 18 to 31° C throughout the test.

We recorded web blight severity, at 48 h of incubation (laboratory and greenhouse) and then weekly, beginning seven days after the inoculation in the field, by using a CIAT scale (Van Schoonhoven and Pastor-Corrales, 1987) slightly modified for us. One to 10% of the foliar area affected indicates a low disease severity or resistant reaction; 10.1 to 40% = moderate WB severity or intermediate reaction; more than 40% = high disease severity or susceptible reaction. Common bean genotypes Mus 138 and Talamanca from the Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia, and PR 9418-2 and PR 9607-27 from the bean breeding program of the Agricultural Experiment Station, University of Puerto Rico, Mayagüez Campus, were evaluated in the field, greenhouse, and laboratory. We used a randomized complete block design and a factorial arrangement with four replications. Severity data were subjected to analysis of variance, and means were separated by Tukey's test. We made correlations for disease severity scores among the inoculations in the laboratory and those conducted in the greenhouse and in the field.

Significant differences ($P < 0.05$) were obtained between the white-seeded line, PR 9418-2, and the remaining genotypes in the laboratory, greenhouse and field testing (Table 1). Mus 138 showed low severity, followed by Talamanca and PR 9607-27 with moderate disease severity. PR 9418-2 showed high WB severity. Similar results with Talamanca and Mus 138 were reported in Colombia (Cárdenas-Alonso, 1989; M. Pastor-Corrales, CIAT, personal communication). The source of resistance of Mus 83 to WB has been used to improve the resistance of the line PR 9607-27 (J. S. Beaver, Department of Agronomy and Soils, UPR, Mayagüez, PR, personal communication). No symptoms were observed in controls in the laboratory, greenhouse and field. Positive and significant correlations for disease severity were obtained among beans with the detached leaf method and with methods used in the greenhouse ($r = 0.71$) and in the field ($r = 0.89$) (Figure 1A, B). Although the methodologies used in the laboratory, greenhouse, and field are reliable

TABLE 1.—*Web blight severity on common bean genotypes artificially inoculated in the laboratory and greenhouse with colonized PDA disks and in the field with mycelia suspension of* Rhizoctonia solani, *Rs 011 and Rs 012 isolates.*

		Percentage of web blight severity[1]		
Genotypes	Origin[2]	Laboratory	Greenhouse	Field
PR 9418-2	UPR	70.00 a[3]	53.80 a[3]	80.00 a[3]
PR 9607-27	UPR	35.00 b	28.40 b	11.00 b
Talamanca	CIAT	12.50 bc	13.60 bc	10.50 bc
Mus	CIAT	10.00 d	12.30 d	5.25 d
Tukey (0.05)		22.54	22.43	13.35

[1]Web blight severity was determined by the CIAT scale (low disease severity = 1% to 10% of the foliar area affected and high severity = more than 40%).

[2]UPR = University of Puerto Rico; CIAT = Centro Internacional de Agricultura Tropical, Cali, Colombia.

[3]Mean of four replications. Values followed by the same letter within a column are not significantly different ($P < 0.05$).

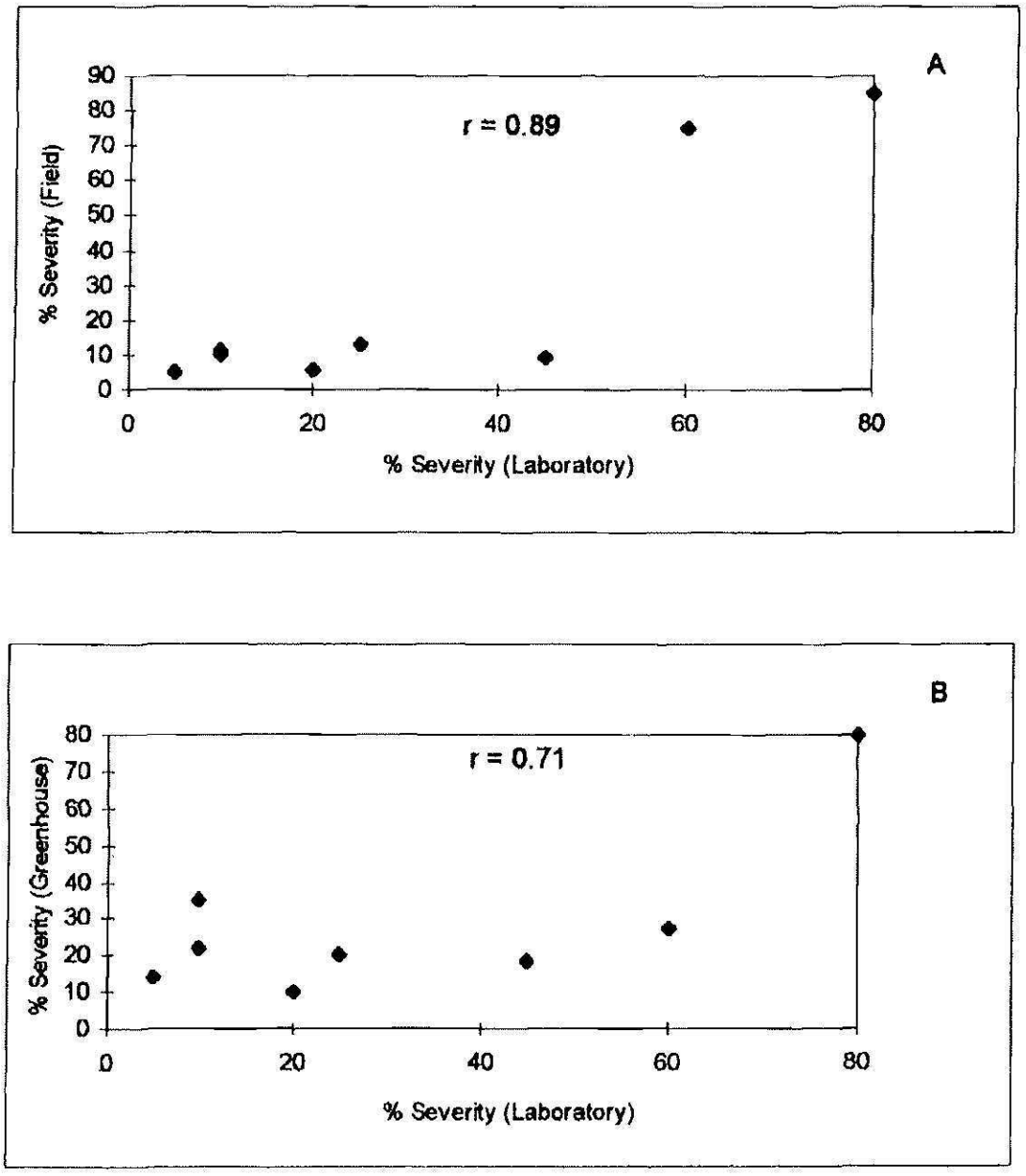

FIGURE 1. Correlations for percentage of web blight severity on common bean genotypes between the methodology used in the laboratory (detached-leaf) and that used in the field (A) and the greenhouse (B).

for screening WB-resistant lines and cultivars, the detached-leaf laboratory technique was found to be less tedious, faster and more economical for screening a large number of common bean genotypes. The field technique followed as second best.

LITERATURE CITED

Cárdenas-Alonso, M. R., 1989. Web blight of beans (*Phaseolus vulgaris* L.) incited by *Thanatephorus cucumeris* (Frank) Donk, in Colombia. Ph.D. Thesis, Cornell University, Ithaca, NY. 163 p.

Galindo, J. J., G. S. Abawi, G. Gálvez and H. D. Thurston, 1983. Source of inoculum and development of bean web blight in Costa Rica. *Plant Dis.* 67:1016-1021.

Gálvez, G., B. Mora and M. A. Pastor-Corrales, 1989. Web blight, p. 195-209. *In* M. A. Pastor-Corrales and H. F. Schwartz (eds). Bean Production Problems in the Tropics. CIAT, Cali, Colombia.

Godoy-Lutz, G., J. Arias, J. R. Steadman and K. M. Eskridge, 1996. The web blight pathogen: its effect on common bean seed quality, germination and early disease development. *Ann. Rep. of Bean Improv. Coop.* 39:154-155.

Polanco, T. A., R. del P. Rodríguez and J. S. Beaver, 1996. Microgotas: Método de inoculación con *Rhizoctonia solani* Kühn para evaluar genotipos de habichuela (*Phaseolus vulgaris* L.). *J. Agric. Univ. P.R.* 80:111-122.

Steadman, J. R., K. Powers and H. Becky, 1997. Screening common bean for white mold resistance using detached leaves. *Ann. Rep. of Bean Improv. Coop.* 40:140-141.

Van Schoonhoven, A. V. and M. A. Pastor-Corrales, 1987. Standard System for the Evaluation of Bean Germplasm. CIAT, Cali, Colombia. 53 p.