

'MONROE' BEAN (*Phaseolus vulgaris*): A LOCAL LESION ASSAY VARIETY FOR BEAN
COMMON MOSAIC AND SOYBEAN MOSAIC VIRUSES¹ /

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Resumen

La variedad de frijol (Phaseolus vulgaris L.) 'Monroe', recomendada como planta indicadora de lesiones locales para el virus del mosaico común del frijol (BCMV), reaccionó con lesiones locales necróticas de forma anillada, tanto a la inoculación de cinco cepas diferentes del BCMV como a cinco aislamientos del virus del mosaico de la soya (SMV). Las condiciones ambientales bajo las cuales se realizaron estas pruebas tuvieron un efecto marcado sobre la aparición y desarrollo de las lesiones locales necróticas anilladas especialmente en el caso del SMV.

Introduction

The bean (*Phaseolus vulgaris* L.) variety 'Monroe' has been used as a local lesion assay plant for bean common mosaic virus (BCMV) since 1971 (3, 5, 6). The local lesions observed on the primary leaves of mechanically-inoculated plants vary from the typical necrotic type to the ringspot pattern. Trujillo and Saettler (5) found that lesions were of the local necrotic type under normal glasshouse light conditions and temperatures between 16°C and 20°C, whereas following a 24 h pre-inoculation darkness period and at temperature between 24°C and 28°C, lesions were of the ringspot type.

Since Topcrop another bean variety recommended for local lesion assay of soybean mosaic virus (SMV) (1), is known to show a similar necrotic reaction when inoculated with BCMV (2), this study was conducted to determine whether 'Monroe' can be recommended as a diagnostic species

for BCMV using various BCMV strains and SMV isolates.

Materials and methods

Five strains of BCMV maintained and characterized at the International Centre for Tropical Agriculture (CIAT), Palmira, Colombia, as the Type, Florida (FLA), New York 15 (NY 15), NL-3 and NL-4 strains of BCMV, and five local isolates of SMV were chosen for this study. The viruses, BCMV and SMV, were maintained in susceptible bean or soybean varieties, respectively. The identity of the SMV isolates, originally isolated from seed-infected soybean plants, was confirmed through infectivity and serological tests.

The inoculum consisted of systemically-infected primary and/or first trifoliolate leaves of 22 day-old bean (for BCMV) or soybean (for SMV) plants. Plant extracts were prepared with the aid of pestle and mortars in 0.01 M potassium phosphate buffer, pH 7.5 until a 1:10 (W/V) dilution was reached. The inoculum was rubbed onto the primary leaves of 8-9 day-old 'Monroe' bean seedlings using a sterile cheese-cloth pad. The inoculated seedlings were placed under two different environmental conditions: a glasshouse

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with a 19°C-28°C temperature range and a growth room with a mean temperature between 16°C-19°C and 12 500 lux eight hours a day.

A group of 'Monroe' seedlings was also kept in total darkness for 24 hours before the inoculation and, subsequently, placed under the two environmental regimes described above, following their inoculation.

Results

Four to five days after inoculation with the BCMV strains, the test plants maintained in the glasshouse, both with and without the pre-inoculation darkness treatment, began to show chlorotic lesions on the inoculated leaves, which developed into the typical brown ring-shaped lesions (Table 1) described for BCMV on 'Monroe' (5). Each of the five BCMV strains induced the same reaction on 'Monroe' (Figure 1, A-E). The pre-inoculation darkness treatment resulted in the appearance of well defined ring-shaped local lesions as early as four days after inoculation.

There were appreciable differences in symptom expression between the glasshouse and growth room-grown test plants. In the growth room only those seedlings inoculated with the Type strain of BCMV and which had been held in the dark before inoculation, showed necrotic local lesions and vein necrosis six days after inoculation (Table 1). The rest of the inoculated test plants showed ring-shaped lesions 15

days after inoculation with the other four BCMV strains.

The SMV-inoculated 'Monroe' plants maintained in the glasshouse, with or without the pre-inoculation darkness period, exhibited chlorotic lesions on the inoculated leaves 5 to 7 days following inoculation. Within 10 days, these lesions had also developed into the typical brown ring-shaped lesions (Figure 1, F) described for BCMV on this bean variety (Table 2). The lesions induced by SMV on 'Monroe' were more abundant and defined than those observed for any of the five BCMV strains tested.

The 'Monroe' plants previously held in the dark and then placed in the growth room, also showed the characteristic ring-shaped local lesions seven days after inoculation (Table 2). Those SMV-inoculated test plants which had not been held in the dark prior to their inoculation took two weeks to show the ring-shaped local lesions. These reactions were observed with the five SMV isolates tested.

Discussion

The results obtained in this study clearly demonstrate that the bean variety 'Monroe' cannot be recommended as a diagnostic or local lesion assay plant exclusively for BCMV, since this variety proved here to react with local ring-shape lesions to a related but different virus, SMV.

Table 1. Local lesion development on the primary leaves of 'Monroe' bean plants inoculated with five strains of bean common mosaic virus under two environmental conditions and pre-inoculation treatments.

BCMV Strain	Without pre-inoculation darkness treatment				With pre-inoculation darkness treatment			
	I		II		I		II	
	GH ¹	GR	GH	GR	GH	GR	GH	GR
Type	2/4 ²	0/4	4/4	0/4	4/4	4/4 ³	4/4	2/4 ³
Florida	4/4	0/4	4/4	0/4	4/4	0/4	4/4	0/4
New York-15	4/4	0/4	4/4	0/4	4/4	0/4	4/4	0/4
NL-3	2/4	0/4	4/4	0/4	4/4	0/4	4/4	0/4
NL-4	4/4	0/4	4/4	0/4	4/4	0/4	4/4	0/4

1 GH = glasshouse conditions (19°C-28°C); GR = growth room conditions (16°C-19°C).

2 Number of plants with local lesions over number of plants inoculated.

3 Local necrotic lesions, not of the ring-shaped type.

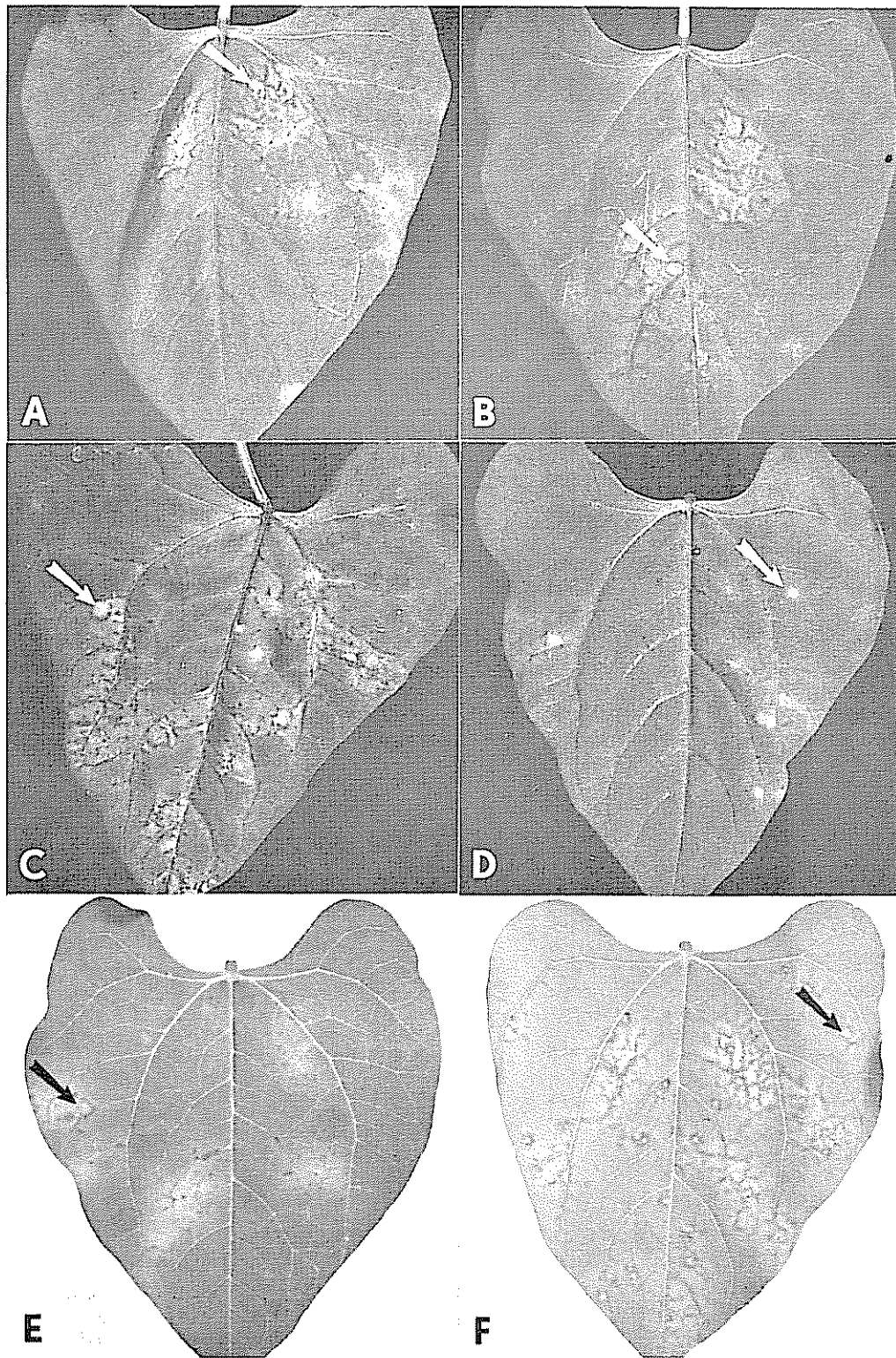


Fig. 1. Ring-shaped local lesions (shown by arrows) induced on bean 'Monroe' leaves mechanically inoculated with the: A) Type; B) NL3; C) NL4; D) New York 15; or E) Florida strain of bean common mosaic virus; and with F) a local isolate of soybean mosaic virus

Table 2. Local lesion development on the primary leaves of 'Monroe' bean plants inoculated with five isolates of soybean mosaic virus under two environmental conditions and pre-inoculation treatments.

SMV Isolates	Without pre-inoculation darkness treatment				With pre-inoculation darkness treatment			
	I		II		I		II	
	GH ¹	GR	GH	GR	GH	GR	GH	GR
SMV-1	4/4 ²	0/4	4/4	0/4	4/4	2/4	4/4	0/4
SMV-2	2/4	0/4	2/4	0/4	4/4	3/4	4/4	3/4
SMV-3	2/4	0/4	2/4	0/4	4/4	4/4	4/4	4/4
SMV-4	4/4	0/4	2/4	0/4	4/4	2/4	4/4	0/4
SMV-5	2/4	0/4	2/4	0/4	3/4	1/4	4/4	1/4

1 GH = glasshouse conditions (19°C-28°C); GR = growth room conditions (16°C-19°C).

2 Number of plants with local ring-shaped lesions over number of plants inoculated

In agreement with previous workers, it was also shown that environmental conditions play an important role in the development of local lesions on 'Monroe' plants inoculated with either BCMV or SMV variants and that a pre-inoculation darkness treatment enhances symptom expression.

Summary

The Monroe bean (*Phaseolus vulgaris* L.), recommended as an indicator plant of local lesions for the common bean mosaic virus (BCMV), reacted with local ringed necrotic lesions, both from inoculation of five different strains of BCMV, and to five isolations of the soy mosaic virus (SMV). The environmental conditions under which these tests were done had a striking effect on the appearance and development of local ringed necrotic lesions, especially for SMV.

Literature cited

- BOS, L. Soybean mosaic virus No. 73 In Descriptions of plant viruses. Commonw. Mycol. Inst., Assoc. Appl. Biol., Kew, Surrey, England. 1972. 4 p.
- DRIJFHOUT, E. Genetic interaction between *Phaseolus vulgaris* and bean common mosaic virus with implication for strain identification and breeding for resistance. Agricultural Research Dept., Center for Agr. Publishing and Documentation, Wageningen. 1978. 98 p.
- SAETTLER, A. W., and TRUJILLO, G. E. Monroe bean as a local lesion host for bean common mosaic virus. *Phytopathology* 62:489-490. 1972.
- SCHNEIDER, I. R., and WORLEY, J. F. A local-lesion assay for common bean mosaic virus (Abstr.). *Phytopathology* 52:166. 1962.
- TRUJILLO, G. E. and SAETTLER, A. W. Monroe bean as a new local lesion host for bean common virus (Abstr.). *Phytopathology* 61:1026. 1971.
- TRUJILLO, G. E. and SAETTLER, A. W. Local lesion assay of bean common mosaic virus (BCMV) on 'Monroe' bean. *Plant Disease Reporter*, 56:714-718. 1972.
- TRUJILLO, G. E. and SAETTLER, A. W. Algunos aspectos locales en caraota (*Phaseolus vulgaris* L.) por el virus del mosaico común de la caraota (BCMV). *Agronomía Tropical* 23:379-391. 1973.