DEVELOPMENT OF *Phaseolus vulgaris* L. TOLERANT TO BEAN GOLDEN MOSAIC VIRUS

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Bean Golden Mosaic Virus (BGMV) has been a devastating disease during the dry bean growing season in Central and South Brazil regions. An area of over one million hectares has been estimated to be affected. Crop loss can reach up to 100% depending on weather parameters as well as planting time, among other factors. No immune response to this disease has been found among the germ plasm tested since its first occurrence. Selection for disease resistance in the past did not lead to commercially resistant varieties, for reasons such as the inefficiency to distinguish tolerant plants or lines from the susceptible ones. The main causes of this inefficiency in the selection process were the variable plant age at the time of infection in the field and high pressure of insect pests other than the vector *Bemisia tabaci*. These constraints were crucial in the levelling off the potential for plant productivity.

In an attempt to accelerate progress in finding beans with acceptable degrees of disease resistance, we have experimented greenhouse testing with limited term inoculation to complement field data, as well as greenhouse inoculation followed by transplant to a field situation keeping insects and diseases under control.

In a first trial, bean varieties were tested in the greenhouse, using pots with a volume of 3 Kg of soil containing one plant each, with an equal number of uninoculated control plants. Inoculation was done by exposing 7-day old seedlings for 24 h to a viruliferous population of whiteflies, followed by killing of the flies. The second trial, was conducted in the winter, when the whitefly population in the field was low. In this case, small, perforated plastic bags or 300 ml plastic cups filled with fertilized soil, were seeded with two seeds. Germination usually took place in 5-6 days, when seedlings were thinned to one per container. Twelve plants per treatment were used for each of seven varieties inoculated or kept uninoculated as controls, with three replications in a completely randomized design. Inoculation was done as above. Typically, between 40 and 70 flies colonized each seedling by the end of the inoculation time. An equal number of seedlings exposed to whiteflies was kept as non-inoculated control plants. After the inoculation period, the seedlings had the whiteflies removed and were transplanted in a prepared field including application of a granulated systemic insecticide. Irrigation, insecticides, and fungicides were applied as needed to avoid the effect of any other factor on plant development, besides BGMV. Lastly, 1378 accessions were tested using this technique from May to September 1990, with ten inoculated and ten uninoculated plants, in a non-replicated nursery.

Inoculation efficiency was consistently near 100%. The greenhouse experiments (data not shown) showed that there is a definitive degree of genetic variability in the bean germ plasm inoculated at early stages, when other factors do not play important role. A replicated field plot confirmed the greenhouse results, and provided strong indication that preliminary screen of germ plasm could be made more successfully than using the traditional technique of relying upon the natural population of whiteflies for the inoculation (Table 1).

Bean lines bred for tolerance to BGMV were clearly spotted in the field. Among entries not previously screened for tolerance to BGMV, some were selected for further testing in replicated trials (Table 2). Genetic variability in the bean germ plasm has been both confirmed and facilitated by this new inoculation and management procedures. Some of the advanced lines, as well as some landraces collected in Brazil have commercial types, and after further testing in replicated trials, can be released to farmers. The characteristics associated with tolerance to BGMV have been near to normal plant growth, normal pod setting, and, pod and seed development. Infected plants retaining a more green leaf pattern does not seem to correlate well with tolerance, when looking at pod formation and final yield or yield reduction. Finally, the handling of all of the steps involved in the procedure is time consuming, but became a reliable process to facilitate progress toward improved tolerance to bean golden mosaic virus.

Table 1. Percent yield reduction of selected germ plasm uniformly inoculated with bean golden mosaic virus

Accession	Yield (g/plant)		Mean		% Reduction	
	Uninoc.	Inoc.	(g)			
27-R	14.1	2.4	8.2	a	82.3	a
D. Red kidney 8099	13.1	2.7	7.9	a	79.5	ab
Costa Rica 2	16.4	3.7	10.0	ab	77.7	ab
Rico 23	15.0	4.0	9.5	a	72.8	abc
Redlands Greenleaf C	13.4	5.8	9.6	a	57.3	bcd
MD 632	16.9	8.5	12.7	bc	49.6	cd
LM 30630	18.8	9.8	14.3	c	47.2	d

Duncan's Multiple Range Test at 5% probability.

Table 2. Best accessions from the 1990 BGMV nursery in Goiânia(GO)

Accession	Ranking	Yield (g/plant) Control	Inoculated	%Reduction
CF 840655	1	24.4	15.3	37.4
CF 840497	2	19.3	12.6	34.7
CF 840595	3	18.5	11.5	37.5
CF 840503	4	17.2	11.2	34.5
AN 911018	5	16.8	11.0	34.1
RH 5-08	6	14.7	10.9	26.3
A 775	15	10.8	8.7	19.4
A 774	22	13.6	8.0	37.8
Redl..Gl. C	51	7.4	6.6	10.8

References

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