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Data Sheets on Quarantine Pests

Bean golden mosaic bigeminivirus

IDENTITY

Name: Bean golden mosaic bigeminivirus
Taxonomic position: Viruses: Geminiviridae: Bigeminivirus
Common names: BGMV (acronym)
Bean golden mosaic, bean golden yellow mosaic (English)
Mosaico dorado (Spanish)
Notes on taxonomy and nomenclature: Brown (1990) reviewed the geminiviruses of legumes in Latin America and the Caribbean, covering isolates which have been named as BGMV and others which have been given different names, especially bean calico mosaic (Brown *et al.*, 1990) and bean dwarf mosaic (Morales *et al.*, 1990; Morales, 1991). She concluded that the relationships between all these viruses needed to be further studied. Swanson *et al.* (1992) found BGMV to be serologically related to bean calico mosaic, cotton leaf crumple, serrano golden mosaic and squash leaf curl geminiviruses; a probe for its DNA-A detected nearly all American geminiviruses, while its DNA-B gave a weak positive reaction with a probe for bean calico mosaic geminivirus. BGMV also has some serological relationship with the Old World mungbean yellow mosaic geminivirus (Shimizu *et al.*, 1987), but in general the Old World legume geminiviruses are quite distinct from BGMV.
EPPO computer code: BNGMXX
EPPO A1 list: No. 204
EU Annex designation: I/A1

HOSTS

The principal cultivated hosts of BGMV are *Phaseolus vulgaris* and *P. lunatus*. The different isolates have been found to infect a range of wild Fabaceae, especially the common weed *Macroptilium lathyroides* and also species of *Phaseolus*, *Vigna* and *Calopogonium*. BGMV is restricted in its host range to Fabaceae, though it has been suggested that the malvaceous weed *Malvastrum coromandelianum* may be a host. The closely related bean calico mosaic geminivirus occurs essentially on *P. vulgaris*. Symptoms of golden mosaic (Brown, 1990) have also been seen on: *Phaseolus longepedunculatus* and *Vigna luteola* in Brazil; soyabeans (*Glycine max*) in Venezuela; *P. acutifolius* and *P. coccineus* in Central America.

GEOGRAPHICAL DISTRIBUTION

Golden mosaic symptoms have been seen on legumes in many countries of tropical America. In many cases, BGMV has specifically been identified, and these cases are indicated as unqualified records below. In other cases, a related virus has been identified or only symptoms have been seen. Since the relationships between BGMV and similar viruses have not yet been fully worked out, these other records (Brown, 1990) are also mentioned here.

EPPO region: Absent.
North America: Mexico (Sonora, bean calico mosaic and cotton leaf crumple; Chiapas, Sinaloa and Yucatan, symptoms only), USA (Florida).
Central America and Caribbean: Costa Rica, Cuba, Dominican Republic, El Salvador (symptoms only), Guatemala, Jamaica, Nicaragua (symptoms only), Panama (symptoms only), Puerto Rico.
South America: Argentina, Brazil (widespread, including Goias, Rio Grande do Sul, São Paulo), Colombia, Venezuela; widespread in tropical and subtropical America.
EU: Absent.

BIOLOGY

BGMV is transmitted in a persistent manner by *Bemisia tabaci*. Adults can acquire the virus in as little as 6 min. BGMV is retained for days or weeks, and through the moult.

It does not multiply in the vector and is not transmitted directly to progeny. Non-vector transmission is by mechanical inoculation (with the exception of isolates from Argentina and Brazil), by grafting, but not by contact between plants. The virus is not transmitted by seed or pollen. The normal source of inoculum is adjacent bean crops, or leguminous weeds.

After inoculation of primary leaves with BGMV, symptoms appear 5-6 days later on trifoliate leaves. The virus multiplies and spreads in the phloem and phloem-associated cells, and finally enters the mesophyll. The titre of BGMV peaks about 10-12 days after inoculation. Symptom development depends on temperature: symptoms are more pronounced and appear earlier at 27-30°C than at 21-24°C (when they may take several weeks to appear) (Haber *et al.*, 1991).

Relationships between BGMV isolates from different American countries are still being worked out. The original isolate from Colombia (BGMV-CO) has been less fully documented than the isolate from Puerto Rico (BGMV-PR) (Goodman, 1977; Goodman & Bird, 1978). The isolate from Venezuela (BGMV-VE) differs in DNA hybridization analysis from BGMV-PR (Debrot *et al.*, 1986). Nardo & Costa (1986) have differentiated five isolates of BGMV in Brazil on the basis of severity of infection. An isolate (BGMV-F) has been described in Florida (USA) (Hiebert *et al.*, 1991). One strain from Goias (Brazil), BGMV-BZ, differs from Central American and Caribbean isolates, including those from the Dominican Republic (BGMV-DR) and Guatemala (BGMV-GA), in not being sap-transmissible and in sequence homology (Gilbertson *et al.*, 1991a,b, 1993). Isolates from Argentina are also not mechanically transmissible (Haber *et al.*, 1991).

DETECTION AND IDENTIFICATION

Symptoms

Vein yellowing, netting and clearing, extending to bright-yellow interveinal chlorosis. Leaves emerging after symptoms have first appeared curl down, fail to expand and become stiff and leathery. Seed set is poor (Haber *et al.*, 1991).

Morphology

Geminate particles, 18-20 nm in diameter and 30 nm in length. BGMV has been much studied in relation to the characterization of geminiviruses, e.g. first demonstration of a bipartite genome (Haber *et al.*, 1981). Isolates BGMV-PR and BGMV-BZ have been fully sequenced (Howarth *et al.*, 1985; Gilbertson *et al.*, 1993).

Detection and inspection methods

Preparations of BGMV are immunogenic. The virus reacts in standard gel diffusion tests and is also detectable by ELISA. The recommended indicator plant is *Phaseolus vulgaris* cv. Top Crop, which gives conspicuous systemic vein chlorosis and golden mosaic.

MEANS OF MOVEMENT AND DISPERSAL

BGMV moves only in its vector *Bemisia tabaci*, which can spread it between fields in infested areas. In international trade, it is very unlikely to be carried by plants of *Phaseolus* spp., since these are short-lived vegetable; crops not normally moved. The vegetables as such would not be likely to carry *B. tabaci*, and the disease is not seed-transmitted. So the main risk of movement is in *B. tabaci* on other host plants (e.g. ornamentals), given the fact that the vector moves readily from one host to another and that the virus can persist in the vector for several weeks after acquisition.

PEST SIGNIFICANCE

Economic impact

BGMV, first described in Colombia in 1976 (Galvez & Castanõ, 1976), is reported as the most devastating disease of beans in Latin America (Galvez & Cardenas, 1980). Losses up to 75% have been recorded in Brazil (Menten *et al*., 1980; Almeida *et al*., 1984; Fazio, 1985). This has been associated with marked increases in the populations of *Bemisia tabaci* since the 1970s, BGMV first being recorded there in 1979 (Barreto *et al*., 1980).

The disease continues to increase in importance in Latin America and the Caribbean, especially in situations where bean crops are planted alongside sources of the vector, so that they become infested early and the disease can spread readily. The increasing abundance of *B. tabaci* biotype B on many hosts favours this early infestation.

Control

Bean crops should be planted at times, or in places, where they are not exposed to high populations of *B. tabaci*. Sources of inoculum (leguminous weeds) should be removed or controlled. Chemical control of the vector (e.g. with carbofuran + monocrotophos in Brazil; Farias & Zimmermann, 1988) does reduce disease incidence and increase yields, but such treatments have not generally proved very practical. Coloured mulches may be used to reduce whitefly populations. Resistance to BGMV is important in bean breeding, e.g. at CIAT (Schwartz & Sanders, 1979; Morales & Niessen, 1988), though up till now only moderate resistance has been found (Haber *et al*., 1991). The coat protein genes of BGMV have been successfully genetically engineered into *Phaseolus* (Russell *et al*., 1993), but it is not clear whether they confer resistance.

Phytosanitary risk

BGMV was recently added to the EPPO A1 list but has not been considered a quarantine pest by any other regional plant protection organization. It clearly presents a considerable danger to legume crops in the Old World tropics. For the EPPO region, crops of *Phaseolus vulgaris* would be at risk throughout the more southern parts. With its preference for *P. vulgaris*, it certainly presents a much greater risk to the EPPO region than the similar Old World geminiviruses (mungbean yellow mosaic, horsegram yellow mosaic), adapted to Old World *Vigna* spp. not cultivated in Europe, or than the "non-European *B. tabaci*-transmitted" cowpea mild mottle 'carlavirus' (EPPO/CABI, 1996).

PHYTOSANITARY MEASURES

Host plants of *Bemisia tabaci* from areas where BGMV occurs should come from a place of production free from BGMV and *B. tabaci* (or treated against *B. tabaci*) during the last growing season. This applies especially to the ornamental *Euphorbia pulcherrima*, which is notorious for carrying *B. tabaci* inconspicuously.

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