Prepared by CABI and EPPO for the EU
under Contract 90/399003

Data Sheets on Quarantine Pests

# Citrus mosaic badnavirus

## IDENTITY

**Name**: Citrus mosaic badnavirus
**Taxonomic position**: Viruses: *Badnavirus*
**Common names**: CiMV (acronym)
**Notes on taxonomy and nomenclature**: In Japan, a well characterized virus causing 'citrus mosaic' is serologically related to, and now considered to be a strain of satsuma dwarf 'nepovirus' (SDV) (EPPO/CABI, 1996a). This nepovirus is not related to CiMV occurring in India.
**EPPO computer code**: CSMXXX
**EU Annex designation**: II/A1 - as Citrus mosaic

## HOSTS

CiMV has been recorded mainly on oranges (*Citrus sinensis*), but also on *Aegle marmelos*, *C. limonia*, *Fortunella* spp., grapefruits (*C. paradisi*), lemons (*C. limon*), mandarins (*C. reticulata*) and pummelos (*C. maxima*). In artificial inoculation experiments by grafting, the above *Citrus* spp., *C. volkameriana*, *C. jambhiri*, *C. aurantium* and *C. mitis* were mostly susceptible, while *C. limettioides*, *C. aurantiifolia* and *C. medica* were more rarely infected and gave milder symptoms (Ahlawat *et al.*, 1996).

## GEOGRAPHICAL DISTRIBUTION

**EPPO region**: Absent.
**Asia**: India (Andhra Pradesh, Arunachal Pradesh, Assam, Delhi, Maharashtra, Manipur, Meghalaya, Rajasthan and Uttar Pradesh).
**EU**: Absent.

## BIOLOGY

While citrus mosaic has been known for many years in India, it has only recently been attributed to a specific virus (Ahlawat *et al*., 1993, 1996). CiMV is transmitted by grafting (Dakshinamurti & Reddy, 1975), and by dodder laurel (Reddy *et al*., 1985). It is reported to be mechanically transmissible, but in a recent trial on six *Citrus* spp., only one plant of one species, *C. decumana*, (=*C. maxima*) was infected in this manner (Ahlawat *et al*., 1996). Seed transmission has also been reported in the earlier literature, but this seems implausible. CiMV was claimed to be aphid-transmitted (by *Myzus persicae* and *Aphis craccivora*; Ahlawat *et al*., 1984), or *Toxoptera citricidus* (Pandey *et al.*, 1986). However, insect transmission was not confirmed in recent trials with the aphids *M. persicae*, *A. gossypii* and the mealybug *Planococcus citri* (Ahlawat *et al*., 1996). It is possible that some of the properties previously attributed to CiMV was due to confusion with other viruses.

## DETECTION AND IDENTIFICATION

### Symptoms

As originally described, citrus mosaic in India involved stunting, chlorosis and uniformly distributed leaf mosaic, followed by a leathery texture of mature leaves. The characteristic symptoms due to CiMV in field-infected orange and pummelo are bright-yellow mottling of the leaves and yellow flecking along the veins (Ahlawat *et al*., 1996). Rather more variable symptoms develop on graft-inoculated *Citrus* spp. in the glasshouse. It is possible that some of the field symptoms earlier described could be due to other causes, or to mixed infections with other viruses (which are quite common in orchard trees in India).

### Morphology

CiMV has non-enveloped bacilliform particles, 30 x150 nm, located in the cytoplasm, typical of badnaviruses. These have been observed by electron microscopy in all symptomatic test plants.

### Detection and inspection methods

CiMV has been tested by grafting on mandarins cv. Darjeeling orange. More recently, graft transmission to pummelo has been recommended. Mechanical inoculation to *C. decumana* (= *C. maxima*) may also provide a test. PCR and ISEM methods have mainly been used up until now to compare CiMV with other badnaviruses. They may, however, provide the basis of future test methods.

## MEANS OF MOVEMENT AND DISPERSAL

Since the earlier claims of aphid transmission have not been confirmed, it seems that CiMV may not be vector-transmitted in nature (although some other badnaviruses are transmitted by mealybugs). In India, it has probably been disseminated in infected budwood, and this is the most likely means of distribution in international trade.

## PEST SIGNIFICANCE

### Economic impact

CiMV is widespread in India and of great economic importance to the citrus industry. It is particularly common on sweet orange, on which it is locally very damaging. Losses range from 10 to 70% in orchards of cv. Satgudi in Andhra Pradesh. In some areas, orchards have had to be abandoned because of the disease. Losses in fruit yield of 77% have been recorded in infected trees. CiMV has also been found in many commercial nurseries. The disease also commonly occurs on pummelo, but this species is not grown commercially in India, so the extent of losses is not known (Ahlawat *et al.*, 1996).

### Control

Use of healthy budwood is the only method of control.

### Phytosanitary risk

CiMV has only recently been characterized, and no real risk assessment of it as a quarantine pest has yet been done. Citrus mosaic disease in India is widespread and important, but could not hitherto be attributed to any particular pathogen. The results of Ahlawat *et al.* (1996) point clearly to a constant association of CiMV with citrus mosaic symptoms. Besides, this virus is able to infect most *Citrus* spp. cultivated in the EPPO region. On this basis, CiMV certainly presents a very significant risk to the production of virus-free citrus budwood. More information is needed on the biology of the virus (multiplication at different temperatures, damage at different temperatures) before its

potential to cause losses in citrus orchards in Mediterranean countries can be estimated. The fact that natural vectors are not known diminishes the probable risk. However, much research remains to be done on this newly characterized virus, which should lead to a clearer estimation of risk.

## PHYTOSANITARY MEASURES

Import of citrus planting material from India should be prohibited. This is already so on account of a number of more serious citrus pests, e.g. citrus greening bacterium (EPPO/CABI, 1996b).

## BIBLIOGRAPHY

Ahlawat, Y.S.; Chenulu, V.V.; Viswanath, S.M.; Pandey, P.K.; Bhagabati, K.N. (1984) Studies on a mosaic disease of citrus in India. *Current Science, India* **54**, 873-874.

Ahlawat, Y.S.; Chakraborty, N.K.; Jagadishchandra, K.; Srivastava, M.; Varma, A. (1993) Association of a rhabdovirus with yellow vein mosaic, a new disease of citrus. In: *Proceedings of the 12th Conference of the International Organization of Citrus Virologists*, pp. 455-457. University of California, Riverside, USA.

Ahlawat, Y.S.; Pant, R.P.; Lockhart, B.E.L.; Srivastava, M.; Chakraborty, N.K.; Varma, A. (1996) Association of a badnavirus with citrus mosaic disease in India. *Plant Disease* **80**, 590-592.

Dakshinamurti, V.; Reddy, G.S. (1975) Mosaic - a transmissible disorder of sweet oranges. *Indian Phytopathology* **28**, 398-399.

EPPO/CABI (1996a) Satsuma dwarf 'nepovirus'. In: *Quarantine pests for Europe*. 2nd edition (Ed. by Smith, I.M.; McNamara, D.G.; Scott, P.R.; Holderness, M.). CAB INTERNATIONAL, Wallingford, UK.

EPPO/CABI (1996b) Citrus greening bacterium. In: *Quarantine pests for Europe*. 2nd edition (Ed. by Smith, I.M.; McNamara, D.G.; Scott, P.R.; Holderness, M.). CAB INTERNATIONAL, Wallingford, UK.

Pandey, P.K.; Nimbalkar, M.R.; Dhale, M.G. (1986) Observations on a mosaic disease of citrus in Maharashtra State. *Journal of the Maharashtra Agricultural Universities* **11**, 254.

Reddy, M.R.S.; Naidu, P.H.; Raju, D.G. (1985) Dodder laurel transmission of citrus mosaic from sweet orange to acid lime. *Indian Phytopathology* **38**, 172.