

Data sheets on quarantine pests
Fiches informatives sur les organismes de quarantaine

Cucurbit yellow stunting disorder crinivirus

Identity

Name: *Cucurbit yellow stunting disorder virus*

Taxonomic position: Viruses: *Closteroviridae*: *Crinivirus*

Synonyms: *Cucurbit yellow stunting disorder closterovirus*

Common name: CYSDV (acronym)

Notes on taxonomy and nomenclature: CYSDV can be divided into two divergent groups of isolates. One group is composed of isolates from Spain, Lebanon, Jordan, Turkey and North America and the other of isolates from Saudi Arabia. Nucleotide identity between isolates of the same group is greater than 99%, whereas identity between groups is about 90% (Rubio *et al.*, 1999)

EPPO code: CYSDV0

Phytosanitary categorization: EPPO A2 action list no. 324; since CYSDV is transmitted by *Bemisia tabaci*, it was before its establishment in Portugal and Spain regulated by the EU as a non-European virus transmitted by that species (Annex I/A1)

Hosts

The natural hosts of CYSDV are restricted to *Cucurbitaceae*: watermelon, melon, cucumber, courgette. In addition, the following experimental host plants have been identified: *Cucurbita maxima* and *Lactuca sativa*. For further details, see Abou-Jawdah *et al.* (2000); Berdiales *et al.* (1999); Célix *et al.* (1996); Desbiez *et al.* (2000); Kao *et al.* (2000); Louro *et al.* (2000); Wisler *et al.* (1998).

Geographical distribution

EPPO region: Israel (Wisler *et al.*, 1998), Jordan (Wisler *et al.*, 1998; Rubio *et al.*, 1999), Morocco (Desbiez *et al.*, 2000), Portugal (Louro *et al.*, 2000), Spain (Célix *et al.*, 1996; including Canary Islands), Turkey (Wisler *et al.*, 1998; Rubio *et al.*, 1999). In the south of France, two isolated outbreaks were found in winter 2001/2002 but were successfully eradicated (Decoin, 2003)

Asia: Lebanon (Abou-Jawdah *et al.*, 2000), Saudi Arabia (Wisler *et al.*, 1998; Rubio *et al.*, 1999), Syria (Hourani & Abou-Jawdah, 2003), United Arab Emirates (Hassan & Duffus, 1991)

Africa: Egypt (Wisler *et al.*, 1998), Morocco

North America: Mexico, USA (Texas – Kao *et al.*, 2000)

EU: present

Biology

The life cycle of CYSDV is strongly dependent on its vector, the whitefly *Bemisia tabaci*, also a regulated pest (EPPO/CABI, 1997). In Portugal, the first symptoms of CYSDV in a field plot of cucumber were associated with heavy infestations of *B. tabaci* (Louro *et al.*, 2000). High populations were also associated with symptoms on melon in the USA (Kao *et al.*, 2000). The spread of the virus may be related to the increase in distribution of the polyphagous B biotype of *B. tabaci* (also known as *B. argentifolii*; Bellows *et al.*, 1994). This moves readily from one host species to the next and is estimated to have a host range of around 600 species. Transmission of CYSDV by biotype B is greater than by biotype A (Wisler *et al.*, 1998). However, biotype Q transmits as efficiently as biotype B (Berdiales *et al.*, 1999). The international trade in poinsettia is thought to have been a major means of dissemination of the B biotype within the EPPO region (EPPO/CABI, 1997).

Within the EPPO region, biotype B is present and widespread in the field in many countries bordering the Mediterranean basin as well as in Slovakia and Ukraine. In northern European countries, it is of limited distribution and confined almost totally to glasshouse crops. Biotype Q is specific to Portugal and Spain (EPPO/CABI, 1997). *B. tabaci* infests polyethylene-covered glasshouses where melons and cucumbers are grown along the south-east coast of Spain. It is displacing *Trialeurodes vaporariorum* as the dominant whitefly in this area and is associated with the change in the agent causing yellowing diseases of cucurbits from *Beet pseudo-yellow closterovirus* (BPYV) to CYSDV (Célix *et al.*, 1996).

Acquisition periods of 18 h or more and inoculation periods of 24 h or more are necessary for transmission rates of CYSDV of over 80% in tests using melon. However transmission was noted after an acquisition and transmission periods of 2 h (Célix *et al.*, 1996). Research has also shown that CYSDV persists for at least 9 days in the vector with a 72.2-h half-life. This is the longest retention time of all whitefly-transmitted *Closteroviridae* (Wisler *et al.*, 1998). CYSDV is not known to be seed-borne.

Detection and identification

Symptoms

Cucumbers and melons affected by CYSDV show severe yellowing symptoms that start as an interveinal mottle on the older leaves and intensify as leaves age (Abou-Jawdah *et al.*, 2000). Chlorotic mottling, yellowing and stunting occur on cucumber (Louro *et al.*, 2000) and yellowing and severe stunting on melon (Kao *et al.*, 2000). No description of symptoms on courgette has been provided by the authors reporting the natural infection (Berdiales *et al.*, 1999). Symptoms on cucurbit crops are said to be indistinguishable from those caused by BPYV (Wisler *et al.*, 1998).

In experimental transmission experiments, chlorotic spots along the leaf veins of the melon cv. 'Piel de Sapo' were noticed after 14–20 days. Sometimes, initial symptoms also consisted of prominent yellowing sectors of a leaf. Symptoms evolved later to complete yellowing of the leaf lamina, except the veins, and rolling and brittleness of the leaves (Célix *et al.*, 1996).

Morphology

Flexuous, filamentous virus particles typical of the *Closteroviridae* have been found in infected plants. The length distribution of CYSDV particles has shown two peaks at 825–850 nm and 875–900 nm (Célix *et al.*, 1996). Using an improved method for particle measurement, Liu *et al.* (2000) have recorded lengths of 800–850 nm for CYSDV. Analysis of double-stranded (ds) RNA extracts has revealed two major dsRNA species of approximately 8 and 9 kbp. On this basis, CYSDV was classed with the *Closterovirus* spp. with bipartite genomes exemplified by *Lettuce infectious yellows closterovirus* (Célix *et al.*, 1996), as then named. These have now been transferred to a new genus *Crinivirus*.

Detection and inspection methods

CYSDV in infected tissue can be identified by RT-PCR detection assay (Berdiales *et al.*, 1999; Célix *et al.*, 1996) and by dot-blot hybridization analysis using CYSDV-specific probes (Rubio *et al.*, 1999; Tian *et al.*, 1996). Antiserum has been produced and used in both immunoblot and indirect ELISA assays (Livieratos *et al.*, 1999).

Pathways for movement

Within cucurbit crops, natural spread of CYSDV is ensured by its vector, *B. tabaci*. Adults of *B. tabaci* do not fly very efficiently but, once airborne, can be transported long distances in air currents. Internationally, infected young plants of cucurbits intended for planting are a likely pathway to introduce or spread the disease. Also, all stages of the whitefly vector can be carried on plants for planting. There is not, however, known to be a significant movement of cucurbit plants for planting from areas where the disease occurs.

Pest significance

Economic impact

Since the late 1970s, cucumbers and melons grown in 16 000 ha of polyethylene-covered glasshouses in south-east Spain have been seriously affected by yellowing diseases transmitted by whiteflies. The first epidemics were caused by BPYV transmitted by *T. vaporariorum*. Since the early 1990s, in addition to BPYV, CYSDV has been associated with these diseases. Surveys undertaken in 1994/1997 have shown that CYSDV has displaced BPYV as the major virus pathogen. No figures are available on losses caused by CYSDV. In Lebanon, the incidence of CYSDV has been high in summer and early autumn cucurbit crops grown in polyethylene tunnels along the coast. Yield reductions of 40–60% have been reported by farmers. Incidence was much higher in unscreened tunnels than in screened tunnels (Abou-Jawdah *et al.*, 2000).

Control

The control of CYSDV centres on the control of its vector *B. tabaci*, and elimination of sources of infection. In particular, cucurbit seedlings for planting should come from disease-free stocks.

Chemical control of populations of *B. tabaci* to levels that result in a significant drop in disease incidence has proved difficult. In general, chemical control of the vectors of *Closteroviridae* has not been effective in preventing the spread of the diseases they cause (Berdiales *et al.*, 1999). Some of the difficulties are the wide host range of the vector, the presence of the whitefly on the undersides of leaves, the extreme motility of adults and the ability of *B. tabaci* to develop resistance to most classes of existing insecticides. Many conventional insecticides such as organophosphorus compounds, carbamates and pyrethroids have effectively reduced whitefly populations, but provided only partial virus control even when sprayed as frequently as 2–3 times a week (Nakhla & Maxwell, 1998). Imidacloprid, a systemic insecticide that can be applied to soil and foliage, is used to control whiteflies, but resistance is now reported (Elbert & Nauen, 2000). Insects resistant to aldicarb and buprofezin were also detected (Anonymous, 1996). The parasite *Encarsia formosa* and the fungus *Verticillium lecanii* can be used as biological agents against *B. tabaci*, but are unlikely to affect virus transmission.

Cultural control: roguing infected cucurbit plants and removing overwintering crops early in the spring prior to the emergence of adult whiteflies may prove useful. To be effective, this sort of control measure should be applied over a whole area and preferably where there is no continuous production in glasshouses, which are often the sites of whitefly activity and active virus spread throughout the year. Weeds in and surrounding glasshouses should also be destroyed as they could act as hosts for *B. tabaci*. In Israel, covering the soil with a mulch of sawdust, fresh wheat straw or yellow polyethylene sheets has markedly reduced populations of *B. tabaci*. Whiteflies are

attracted to the yellow colour and are killed by the heat. The fading of the mulch colour and changes in the ratio of canopy to mulch area is believed to cause a reduction in control. Interplanting with a species that is a good host for the vector, but not the virus may reduce virus incidence. In Lebanon, insect-proof nets and sticky yellow traps are used for control (Abou-Jawdah *et al.*, 2000). Growing plants under physical barriers, such as low mesh tunnels and shade-cloth, may also have a positive effect.

No resistant cultivars of susceptible hosts are currently available commercially.

Phytosanitary risk

Cucurbits are important crops in the EPPO region, both in the field and under glass, and CYSDV causes a serious disease notably on cucumbers and melons in Spain, Portugal, Turkey and the Middle East. Within Europe, cucumber and gherkin production is significant. In 2000, 1.66 million t were harvested in the EU. The Netherlands and Spain were the biggest producers, harvesting 465 000 and 420 000 t, respectively, according to FAO. Economic losses from CYSDV that could be expected in glasshouse-grown cucurbits, especially cucumber, in northern Europe are difficult to predict, but are likely to be substantial. Spread of the pest is likely to be much facilitated by the presence of its vector *B. tabaci* in glasshouses in many countries of the EPPO region. Control of CYSDV is difficult due to the ability of the vector *B. tabaci* rapidly to become resistant to insecticides. A breakdown of efficacy of insecticides could result in serious problems. There is a strong probability that CYSDV will become a serious problem in other Mediterranean countries and in northern Europe, if introduced.

Phytosanitary measures

CYSDV was added in 2004 to the EPPO A2 action list, and endangered EPPO member countries are thus recommended to regulate it as a quarantine pest. For the moment, there are no specific measures against CYSDV in Europe, and in particular there are no restrictions on the movement of cucurbit seedlings from areas where the disease occurs. There is a potential danger that infected seedlings could move from countries where CYSDV occurs to other parts of the region, thus spreading the virus. Possible measures would be the same as those proposed for CVYV (OEPP/EPPO, 2005).

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