EPPO Datasheet: *Crinivirus cucurbitae*

Last updated: 2023-06-19

IDENTITY

Preferred name: *Crinivirus cucurbitae*
Taxonomic position: Viruses and viroids: Riboviria: Orthornavirae: Kitrinoviricota: Alsuviricetes: Martellivirales: Closteroviridae
Other scientific names: *CYSDV, Cucurbit yellow stunting disorder closterovirus, Cucurbit yellow stunting disorder crinivirus, Cucurbit yellow stunting disorder virus*
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EPPO Categorization: A2 list
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EPPO Code: CYSDV0

more photos...

Notes on taxonomy and nomenclature

Cucurbit yellow stunting disorder virus (CYSDV) is a member of the genus *Crinivirus*, and isolates that belong to this species can be divided into two divergent groups. One group is composed of isolates from Spain, Greece, Lebanon, Jordan, Türkiye and North America and the other group of isolates that are from Saudi Arabia and Sudan (Rubio *et al*., 2001; Yakoubi *et al*., 2007). Nucleotide identity between isolates of the same group is greater than 99%, whereas identity between groups is about 90% (Rubio *et al*., 1999).

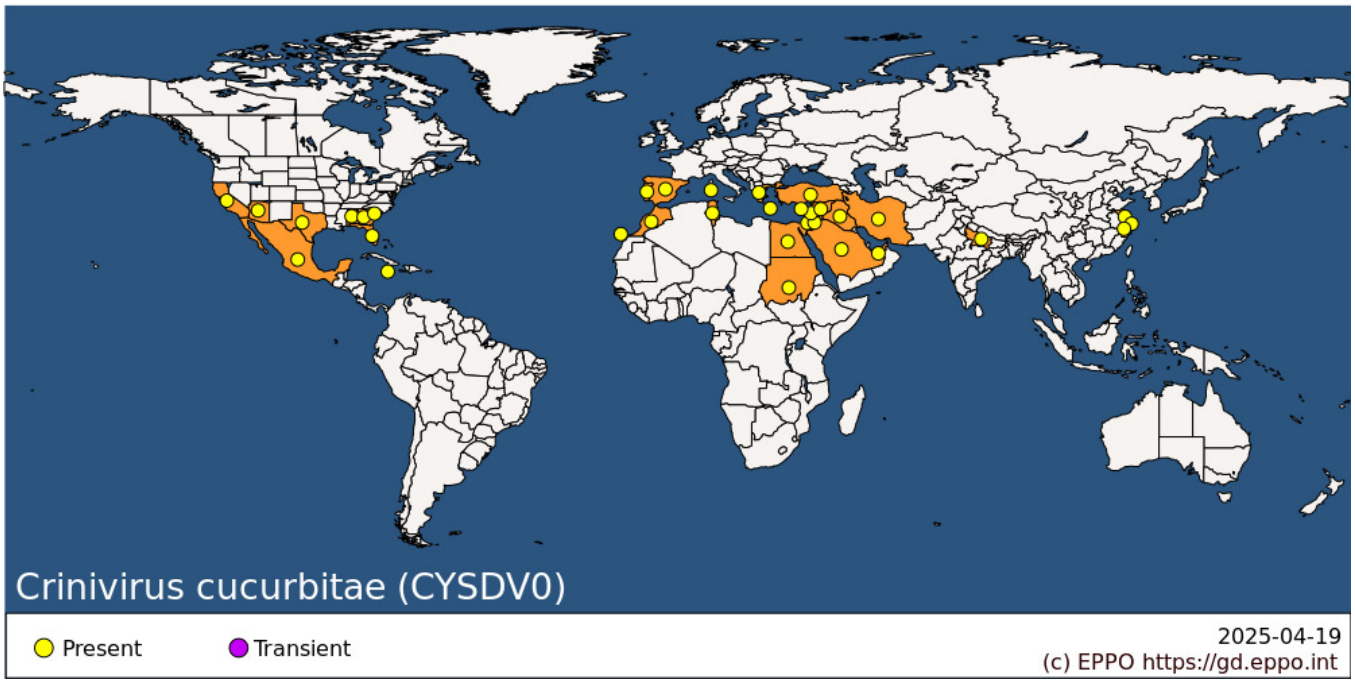
HOSTS

Economic hosts of CYSDV are mainly Cucurbitaceae: watermelon, melon, cucumber, courgette, pumpkin. In addition, a number of host plants in other families have been identi?ed both in crops (e.g. lettuce, alfalfa, snap bean), and in weeds. 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), Wintermantel *et al*. (2009), Orfanidou *et al*. , 2019).

Host list: *Amaranthus blitum, Amaranthus retroflexus, Bassia hyssopifolia, Benincasa fistulosa, Chenopodium album , Citrullus lanatus, Cucumis callosus, Cucumis melo, Cucumis sativus, Cucurbita foetidissima, Cucurbita maxima, Cucurbita pepo, Cucurbitaceae, Datura stramonium, Ecballium elaterium, Heliotropium europaeum, Lactuca sativa, Lysimachia foemina, Malva neglecta, Malva parviflora, Malvella leprosa, Medicago sativa, Phaseolus vulgaris, Physalis acutifolia, Sisymbrium irio, Sisymbrium sp., Solanum elaeagnifolium, Solanum nigrum, Solanum tuberosum , Sonchus oleraceus, Sonchus sp., Tribulus terrestris*

GEOGRAPHICAL DISTRIBUTION

CYSDV is present in several countries from the Mediterranean area, North America, Africa and Asia.



EPPO Region: Cyprus, Greece (mainland, Kriti), Israel, Italy (Sardegna), Jordan, Morocco, Portugal (mainland), Spain (mainland, Islas Canárias), Tunisia, Türkiye
Africa: Egypt, Morocco, Sudan, Tunisia
Asia: China (Jiangsu, Shanghai, Zhejiang), India (Uttar Pradesh), Iran, Islamic Republic of, Iraq, Israel, Jordan, Lebanon, Saudi Arabia, Syrian Arab Republic, United Arab Emirates
North America: Mexico, United States of America (Alabama, Arizona, California, Florida, Georgia, South Carolina, Texas)
Central America and Caribbean: Jamaica

BIOLOGY

The life cycle of CYSDV is strongly dependent on its vector, the whitefly *Bemisia tabaci*, also a regulated pest (EPPO, 2023). Adult insects acquire the virus by sucking on phloem sap, and can further transmit it to another plant when feeding. The virus does not circulate or replicate in the insect. The spread of the virus is believed to be related to the increase in distribution of the polyphagous cryptic *B. tabaci* species MEAM1 (Middle East Asia Minor 1 group, formally known as B biotype of *B. tabaci*, or *B. argentifolii*; Bellows *et al*. (1994) and MED (Mediterranean, formally known as *B. tabaci* biotype Q) (De Barro *et al.*, 2011; Wisler *et al*., 1998; Berdiales *et al*., 1999).). MED possibly originated in the Iberian Peninsula, but has since spread globally (Horowitz *et al.*, 2003; Chu *et al.*, 2010).

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). CYSDV persists for at least 9 days in the vector with a 72.2-h half-life, which is the second-longest retention time of all whitefly-transmitted *Closteroviridae* (Martin *et al*., 2011; 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 leaf mottling and yellowing occur on cucumber and melon (Louro *et al*., 2000) and yellowing and severe stunting on melon (Kao *et al*., 2000). CYSDV on its own does not cause symptoms on courgette, but may cause additional symptoms in mixed infection with other viruses, such as CVYV (Gil-Salas *et al*., 2011)). Symptoms on cucumbers and melons are said to be

indistinguishable from those caused by *Beet pseudoyellows virus* BPYV (Wisler *et al*., 1998) or by *Cucurbit chlorotic yellows virus* (CCYV) (Okuda *et al*., 2010). 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). Non-cucurbits hosts and weeds are often symptomless (Wintermantel *et al*., 2009; Orfanidou *et al.*, 2019).

Morphology

Flexuous, filamentous virus particles with estimated lengths of 800–850 nm have been found in infected plants (Liu *et al.* ,2000). The virus has a bipartite positive sense single-stranded RNA genome with an RNA-1 containing 9126 nucleotides and an RNA-2 of 7281 nucleotides (Livieratos & Coutts, 2002; Aguilar *et al.*, 2003; Coutts & Livieratos, 2003). The coat protein gene contains 756 nucleotides and encodes the coat protein of 28.5 kDa (Livieratos *et al*., 1999).

Detection and inspection methods

CYSDV can be detected in infected plants using conventional and real-time RT-PCR (Berdiales *et al*., 1999; Célix *et al*., 1996; Gil-Salas *et al*., 2012) and by dot–blot hybridization analysis using CYSDV-specific probes (Ruiz *et al*., 2002 ; 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; Cotillon *et al.*, 2005).

Plants for planting may be inspected as described in EPPO Standard PM 3/077 (EPPO, 2022).

PATHWAYS FOR MOVEMENT

Within cucurbit crops, natural spread of CYSDV occurs through its vector, *B. tabaci*. Adults of *B. tabaci* do not fly very efficiently but, once airborne, can be transported long distances in air currents, and thus represent the main pathway of local and natural dispersal. Internationally, infected young plants of cucurbits intended for planting are the most likely pathway to introduce or spread the disease (EFSA, 2013). Viruliferous (infected) adult stages of *B. tabaci* can be carried on traded plant materials but they are not likely to remain viruliferous long enough to constitute a significant pathway for long-distance movement if the plants are not infested (EFSA, 2013; Pasquali *et al* ., 2015). CYSDV is not known to be seed-borne.

PEST SIGNIFICANCE

Economic impact

CYSDV has been associated with yellowing diseases transmitted by whiteflies in cucumbers and melons grown in 16 000 ha of polyethylene-covered glasshouses in South-East Spain, ever since the early 1990s. The disease led to an approximate yield reduction of 30–50 % in Spain and Lebanon (Célix *et al*., 1996; Hourani and Abou-Jawdah, 2003). In Arizona, the outbreak of CYSDV in 2006 caused an estimated 60 % reduction in marketable melon yield and a subsequent USD 18 million loss (McGinley, 2008; EFSA, 2018). In Greece and Cyprus, CYSDV has become the most prevalent virus on cucurbits (Orfanidou *et al*., 2019) replacing *Beet pseudo-yellows virus* (BPYV).

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.

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 and Spain, insect-proof nets and sticky yellow traps are used for control (Abou-Jawdah *et al*., 2000; Janssen *et al*., 2009). Growing plants under physical barriers, such as low mesh tunnels and shade-cloth, may also have a positive effect.

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 white?y 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 (EPPO, 2023, Horowitz *et al*., 2020).

Biological control: The predator *Amblyseius swirskii*, the parasite *Encarsia formosa* and the fungus *Verticillium lecanii* can be used as biological agents against *B. tabaci*, but are unlikely to directly affect virus transmission. *A. swirskii* does not prevent the primary infection from whitefly-transmitted tomato leaf curl New Delhi virus in courgette but it can reduce the reproduction of the vector and the secondary viral spread within crops so this could apply as well to other whitefly-transmitted viruses such as CYSDV (Tellez *et al*. 2017 cited in CABI, 2023).

Several commercial cucumber varieties show intermediate resistance to CYSDV, and provided efficient virus control especially when combined with the use of insect-proof nets (Janssen *et al*., 2003). To date there are no resistant commercial melon varieties available, but partially resistant genotypes have been identified (Sese *et al*., 1999; Marco *et al*., 2003; Martin and Pico, 2021).

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 Greece, Spain, Portugal, Türkiye and the Middle East. Within Europe, cucurbit production is significant; in 2021, 6.14 million tonnes of cucumber and gherkin harvested in the EU. Spain and the Netherlands were the biggest producers, harvesting 746 000 and 440 000 tonnes, 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 especially difficult when the virus is transmitted by insecticide-resistant B. tabaci whiteflies. A breakdown of efficacy of insecticides could result in serious problems. There is a strong probability that CYSDV will become a serious threat to host crops in other Mediterranean countries and in Northern Europe, if introduced. In this case, commercial varieties of intermediate resistance to CYSDV can limit possible losses in cucumber.

PHYTOSANITARY MEASURES

International trade in young host plants for planting seems the main pathway. Seedlings should be protected from infection before entering trade. Visual inspections of export material may not detect the virus since it is asymptomatic in some hosts and may take some time to express symptoms in others. Suitable measures for host plants for planting from areas where CYSDV occurs are as follows: crop or place of production freedom from the virus and exclusion of the vector *B. tabaci.*

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CABI resources used when preparing this datasheet

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Datasheet history

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