

Data Sheets on Quarantine Pests

Chrysanthemum stunt viroid

IDENTITY

Name: Chrysanthemum stunt viroid

Synonyms: Chrysanthemum stunt mottle virus (in part)

Taxonomic position: Viroids

Common names: CSVd (acronym)

Stunt or measles of chrysanthemum (English)

Rabougrissement du chrysanthème (French)

Stauche der Chrysanthemen (German)

EPPO computer code: CHSXXX

EPPO A2 list: No. 92

EU Annex designation: II/A2

HOSTS

The main hosts of CSVd are florists' chrysanthemums (*Dendranthema morifolium*) and related ornamentals including *Chrysanthemum prealtum*, *D. indicum* and *Tanacetum parthenium*. Susceptibility varies between cultivars, but generally all-the-year-round cultivars are more susceptible.

Many other Asteraceae can be infected experimentally, such as: *Achillea* spp., *Ambrosia trifida*, *Anthemis tinctoria*, *Centaurea cyanus*, other *Chrysanthemum* spp., *Dahlia pinnata*, *Echinacea purpurea*, *Emilia javanica*, *Gynura aurantiaca*, *Heliopsis pitcheriana*, *Liatris pycnostachya*, *Senecio* spp., *Tanacetum* spp., *Venidium fastuosum* and *Zinnia elegans*. Of 39 species and cultivars found to be susceptible, only seven developed discernible symptoms.

For more information, see Brierley (1953). See also the section on Biology for remarks on the host range of related viroids.

GEOGRAPHICAL DISTRIBUTION

EPPO region: Austria (found but not established), Belgium, Czech Republic, Denmark, France, Germany, Hungary (unconfirmed), Italy (including Sicily), Netherlands, Norway, Poland, Sweden, UK.

Asia: China (Jiangsu), India (Assam, Uttar Pradesh), Japan.

Africa: South Africa.

North America: Canada (Alberta, Nova Scotia, Ontario), USA (Kansas, Michigan, New York, Pennsylvania).

South America: Brazil (São Paulo).

Oceania: Australia (South Australia), New Zealand.

EU: Present.

BIOLOGY

Initially, the lack of a suitable assay host was a major limitation in determining the nature of the causal agent. However, the disease agent is now known to be viroid in nature, consisting of an uncoated, low-molecular-weight RNA (Diener & Lawson, 1973). CSVd is closely related to potato spindle tuber viroid and cucumber pale fruit viroid. These three viroids have a similar experimental host range and symptomatology, as well as an identical electrophoretic mobility of their RNA bands (Kryczynski & Paduch-Cichal, 1987).

CSVd is easily transmitted by mechanical means and also by *Cuscuta* sp. Experiments in Poland showed that it can be seed- and pollen-transmitted in artificially infected tomato (Kryczynski *et al.*, 1988).

The viroid appears unusually heat-stable (the thermal inactivation point being between 90 and 100°C) and infectivity is retained in extracts treated with alcohol. In dried tissue, the viroid remains infectious for at least 2 years and it can withstand freezing *in vitro* for at least 1 year. Temperature and light intensity seem to play an important role in the development of the viroid in the plant. Experiments in the USA (Handley & Horst, 1988) showed that symptom expression, disease severity and titre of extractable viroid amount were correlated, individually or in combination, with temperature, light intensity and photoperiod. High light intensities as well as temperatures of 26-29°C are optimal for symptom development while high light intensities and temperatures between 22 and 26°C favour the build-up of extractable viroid RNA.

The incubation period of the viroid in chrysanthemum is relatively long, from 2 to 3 months depending on the cultivar. This time has been reduced experimentally for testing.

For more information, see Smith (1972), Diener & Lawson (1973), Monsion & Dunez (1973), Paludan (1974).

DETECTION AND IDENTIFICATION

Symptoms

In florists' chrysanthemums, about 30% of plants are symptomless carriers. However, even when symptoms are manifest, comparison with a healthy plant cannot always confirm diagnosis which, in general, can only be established by indexing on differential hosts. Infected plants bloom earlier than normal plants of the same cultivar and this effect increases with time; on plants coming from infected mother plants, it is usually shorter in the first year of infection (a few days) than in the following year (up to more than 3 weeks). Flowers are fewer and smaller and the colour, particularly of the bronze and red ones, may be bleached to a lighter shade.

Plants infected the previous summer produce far fewer laterals the following spring. Leaves are reduced in number and size; a striking crinkle symptom is found in cvs Blanche and Yellow Garza, the leaf surface being wavy or crumpled with associated yellowish-green patches. Stems become very brittle and break easily where they branch.

Tanacetum parthenium cv. Matricaria Golden Ball may show a dwarfing with associated pale leaves and shortened, crowded inflorescences. *Chrysanthemum prealtum* may develop rosetting.

For more information, see Hollings (1960), Monsion & Dunez (1971), Teyssier & Dunez (1971), Smith (1972), Bachelier *et al.* (1976).

Detection and inspection methods

There are three main methods of detection:

(a) By chip-budding: Two stem chips from the plant to be tested are grafted onto a plant 15-20 cm tall of cv. Mistletoe on each side of a bud. Following this, the plant is cut

off above the higher chip. The bud subsequently develops and should show characteristic symptoms in 4-5 weeks if plants are maintained at 22°C.

(b) Extracts from diseased plants are mechanically inoculated onto *Senecio cruentus*. Although the procedure is simpler, it is less reliable than chip-budding.

(c) Several laboratory tests are available for rapid detection of CSVd, including the EPPO-recommended method (OEPP/EPPO, 1989) of 'return' polyacrylamide gel electrophoresis, which can be performed within a day and is quite reliable.

For differential hosts, the typical symptoms are as follows:

On chrysanthemum cv. Mistletoe, obvious measles symptoms appear 6 weeks after grafting with stunt-infected scions. Leaves are sprinkled with bright-yellow, roughly circular spots, up to 7 mm in diameter in summer, but much smaller in winter. There may be some leaf crinkling. In cv. Blazing Gold, infected leaves have diffuse, yellowish bands along the veins. Cvs Bonnie Jean and Sunfire develop weak symptoms 2-3 weeks after inoculation; these appear as tiny chlorotic spots on the leaf margins.

Leaves of *S. cruentus* may show local lesions in 30 days after inoculation with an extract of diseased tissue, but this reaction is unreliable.

MEANS OF MOVEMENT AND DISPERSAL

International spread of the viroid is most unlikely by natural means, but can result from transplant of infected chrysanthemum plants and cuttings; there is also the possibility that the viroid is present in plant material of other species.

PEST SIGNIFICANCE

Economic impact

Chrysanthemum stunt was first recognized in the USA, in a disastrous epidemic in 1947. It is a serious disease; in the year of infection, plant height may be reduced by 55% and, if cuttings from such plants are used, reductions in height of over 90% may result the following year. Moreover, within 2 years, the number of cuttings which can be produced from infected mother plants may be reduced by 90%. The induction of early flowering has serious consequences for producers of pot plants.

Control

Control of the disease is extremely difficult due to its highly contagious nature and long latent period. Viroid-free plants may be obtained by meristem-tip culture, which may be combined with heat treatment. However, the proportion of viroid-free plants which can be obtained is only about 5% (Hollings & Stone, 1970; Bachelier *et al.*, 1976).

Phytosanitary risk

CSVd is an EPPO A2 quarantine pest (OEPP/EPPO, 1978). Future developments in EPPO will, however, probably exclude the viroid from the quarantine list, because it will be covered within an EPPO certification scheme for chrysanthemums.

PHYTOSANITARY MEASURES

Plants for planting of chrysanthemums should be no further than the third generation from mother plants tested by EPPO Quarantine Procedure No. 24 (OEPP/EPPO, 1989) and found free from the viroid. Alternatively, the consignment should derive from mother plants found free from CSVd at the time of flowering by inspection of 30 plants or 10% of the consignment, whichever is the greater (OEPP/EPPO, 1990).

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