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Data Sheets on Quarantine Pests

Tobacco ringspot nepovirus

IDENTITY

Name: Tobacco ringspot nepovirus
Synonyms: Tobacco ringspot No. 1 Nicotiana virus 12
Taxonomic position: Viruses: Comoviridae: *Nepovirus*
Common names: TRSV (acronym)
Ringspot (in tobacco and various hosts), bud blight (in soyabean), necrotic ringspot, Pemberton disease (in blueberry), necrosis (in anemone) (English)
Notes on taxonomy and nomenclature: TRSV is serologically related to eucharis mottle and potato black ringspot nepoviruses, of Peruvian origin. Both have been considered strains of TRSV. In particular, the latter was called the Andean potato calico strain of TRSV in the data sheet on non-European potato viruses of EPPO/CABI (1992). It should be regarded as a distinct virus, and is now considered in a separate data sheet (EPPO/CABI, 1996a).
EPPO computer code: TORSXX
EPPO A2 list: No. 228
EU Annex designation: I/A1

HOSTS

Like many other viruses of the Nepovirus group, of which it is the type member (Stace-Smith, 1985), TRSV occurs in a wide range of herbaceous and woody hosts. It causes significant disease in soyabeans (*Glycine max*), tobacco (*Nicotiana tabacum*), *Vaccinium* spp., especially *V. corymbosum*, and Cucurbitaceae. Many other hosts have been found naturally infected, including: *Anemone*, apples (*Malus pumila*), aubergines (*Solanum melongena*), blackberries (*Rubus fruticosus*), *Capsicum*, cherries (*Prunus avium*), *Cornus*, *Fraxinus*, *Gladiolus*, grapes (*Vitis vinifera*), *Iris*, *Lupinus*, *Mentha*, *Narcissus pseudonarcissus*, pawpaws (*Carica papaya*), *Pelargonium*, *Petunia*, *Sambucus* and various weeds. Some are symptomless carriers. The host range is very similar to that of tomato ringspot nepovirus (EPPO/CABI, 1996b), which TRSV generally resembles, except that it is much less important on fruit crops than ToRSV and infects the weed *Plantago major* rather than *P. lanceolata* (Gonsalves, 1988).

The experimental host range is wide (see Detection and inspection methods).

For the EPPO region, the relevant hosts, besides soyabeans, are mainly woody fruit crops (cherries, *Vaccinium*, *Vitis* etc.) in which TRSV may in fact be rare but potentially interferes with the "virus-free" status of certified planting material.

GEOGRAPHICAL DISTRIBUTION

TRSV has its origin in central and eastern North America, but there are now scattered records from many countries around the world, most of which are probably associated with material exported from North America. Since the virus mostly does not cause striking

symptoms or spread rapidly, it is difficult to determine from the published literature whether TRSV has established in the various countries in which it has been detected.

EPPO region: Austria (unconfirmed), Belgium (unconfirmed), Bulgaria, Czech Republic, Denmark (unconfirmed), France (unconfirmed), Germany (unconfirmed), Greece (unconfirmed), Hungary, Italy (Bellardi & Marani, 1985; found but not established), Lithuania (Makutenajte, 1977), Morocco, Netherlands (Asjes, 1979; found but not established), Poland (in *Forsythia* - Kaminska, 1985; in *Lupinus* - Kowalska, 1971; the latter is wrongly given as a record in USSR by Stace-Smith, 1985), Romania, Russia (European; also soybean bud blight in Far East only; Murav'eva, 1976), Spain (unconfirmed), Switzerland (unconfirmed), UK (found but not established in *Anemone* - Hollings, 1965; in *Gladiolus* - Lister, 1963; in *Pelargonium* - Stone, 1980), Ukraine, Yugoslavia (Mickovski, 1969). Brown & Trudgill (1989) have briefly reviewed the status of TRSV in the EPPO region.

Asia: China (Hebei, Heilongjiang, Henan, Jiling, Liaoning, Sichuan, Shandong, Yunnan, Zhejiang), Georgia, India (Tamil Nadu), Indonesia (Java, Sumatra), Iran, Japan, Kyrgyzstan, Russia (Far East), Sri Lanka, Taiwan.

Africa: Malawi, Morocco, Nigeria, Zaire.

North America: Canada (New Brunswick, southern Ontario), Mexico, USA (eastern and central states to Texas and Wisconsin, including Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Michigan, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia, and also recently Oregon, on *Vaccinium*).

Central America and Caribbean: Cuba, Dominican Republic

South America: Brazil (Parana, São Paulo), Uruguay (few reports).

Oceania: Australia (Queensland, South Australia, Western Australia), New Zealand, Papua New Guinea.

EU: Absent (found but not established).

Distribution map: See CMI (1984, No. 144).

BIOLOGY

In its native range, TRSV is transmitted by the nematode *Xiphinema americanum*, which in the part of North America concerned is most probably *X. americanum sensu stricto*, and also *X. rivesi* (Brown & Trudgill, 1989; EPPO/CABI, 1996c). The virus is acquired within 24 h and is transmitted by both adult and larval stages (Stace-Smith, 1985). The nematode can transmit to many different host species, at high efficiency (Douthit & McGuire, 1978). A number of other vectors have been suggested: *Thrips tabaci* and *Melanoplus differentialis* (a grasshopper) for the disease on soyabeans, *Tetranychus* spp., *Epitrix hirtipennis* and aphids. The virus is readily transmitted mechanically to herbaceous hosts.

Seed transmission has been reported in several hosts, such as *Cucumis sativus* and *Glycine max* (up to 100% in the latter, in which it is the main form of transmission). It probably occurs to some extent in most hosts (Stace-Smith, 1985).

DETECTION AND IDENTIFICATION

Symptoms

In soyabean, plants are most severely affected when they are infected young (less than 5 weeks old or from seed), the virus spreading systemically in the plant (Demski & Kuhn, 1989). The terminal bud is curved to form a crook (bud blight), and other buds become brown, necrotic and brittle. Brown streaks can be seen in the pith of stems and branches,

and occasionally on petioles and leaf veins. Leaflets are dwarfed and rolled. Pods develop poorly and late.

In tobacco, TRSV causes ring and line patterns on the foliage and stunting (Gooding, 1991). In cucurbits, leaves are mottled and stunted, and fruits are deformed (Sinclair & Walker, 1956).

Grapevine shows symptoms of decline, exactly as with ToRSV, i.e. new growth is weak and sparse, internodes are shortened, leaves are small and distorted, and plants are stunted. Berries are sparse and develop unevenly (Gonsalves, 1988).

Vaccinium corymbosum shows stem dieback and stunting. On a susceptible cultivar such as Pemberton, leaves are deformed and somewhat thickened, become chlorotic and show necrotic spots, and may drop giving a shothole or tattered effect (Ramsdell, 1987).

In cherry, in which the disease has only ever been seen in a few individual trees, young leaves show irregular chlorotic blotching over the whole leaf blade, and the leaf margins are deformed and lobed. These symptoms are seen in scattered leaves throughout the crown. Fruits mature late on infected trees (Stace-Smith & Hansen, 1974).

Morphology

Virus particles are isometric, about 28 nm in diameter and sediment in sucrose density gradients as three components similar in size: empty protein shells and two nucleoproteins containing different amounts of RNA (2.4 and 1.4 x 106 Da). Some isolates are associated with a satellite RNA. For further details, see Stace-Smith (1985).

Detection and inspection methods

TRSV is readily transmitted to herbaceous indicator plants. Diagnostic species include *Chenopodium amaranticolor* and *C. quinoa*, *Cucumis sativus*, *Nicotiana tabacum*, *Phaseolus vulgaris*, *Lycopersicon esculentum* and *Vigna unguiculata* (Stace-Smith, 1985). The virus is a good immunogen and ELISA can readily be used for detecting TRSV in herbaceous hosts.

MEANS OF MOVEMENT AND DISPERSAL

Long-range dispersal in trade is in host plants and parts of plants, including seeds; accompanying soil may harbour infective seeds and the nematode vector.

PEST SIGNIFICANCE

Economic impact

The only really serious disease caused by TRSV is bud blight of soyabean in USA (Demski & Kuhn, 1989), which can involve serious damage to plants, yield losses of 25-100%, and poor seed quality. Although described on tobacco and widespread on this crop in the USA, TRSV causes only minor damage (Gooding, 1991). The same applies on cucurbits (Sinclair & Walker, 1956), and on a number of ornamentals.

On woody fruit crops, TRSV has a certain impact on grapevines in northeastern USA, causing a decline. *Vitis vinifera* is most readily affected, but is relatively little grown in that area compared with interspecific hybrids which are less affected (Gonsalves, 1988). TRSV causes blueberry necrotic ringspot disease of susceptible cultivars of *Vaccinium corymbosum*. Infected bushes show a slow but steady decline in productivity (Ramsdell, 1978), and the disease has been an important factor in blueberry production in the USA since the 1950s. TRSV is much more important in *Vaccinium* than ToRSV (Ramsdell, 1987). TRSV has been recorded in a few individual cherry trees, and rather more often from ornamental *Prunus* spp. (*P. serrulata*, *P. incisa*, *P. serrula*) (Uyemoto *et al*., 1977). It has been recorded once from apple (Lana *et al*., 1983), once from *Rubus fruticosus* and

also from wild *Rubus* spp. in North Carolina (USA) (Stace-Smith, 1987). With the exception of *Vaccinium* and *Vitis*, TRSV has very minor impact on fruit crops, the records on some species being no more than scientific curiosities of no practical importance.

Control

For soyabeans, disease-free seeds should be used. For fruit crops, it is relatively easy to test for TRSV in potential mother plants and establish virus-free nuclear stock, to be propagataed and distributed through a certification scheme. In the EPPO region, where the vector *Xiphinema americanum* does not occur, the problem of re-infection does not then arise. In North America, it may be necessary to test soil for vector nematodes, and if necessary treat with nematicides, before replanting with healthy stock, e.g. for *Vaccinium* (Ramsdell, 1987). For most of the fruit crops, however, TRSV infection is so rare that no special measures are needed to prevent reinfection of healthy planting material.

Phytosanitary risk

TRSV has recently been added to the EPPO A2 list and is considered as a quarantine pest by APPPC. TRSV presents a significant risk to grapevine and *Vaccinium* in the EPPO region. Although it has been recorded in the EPPO region, it is generally thought (Brown & Trudgill, 1989) that these records are associated with imported material and that TRSV has probably not established, at least in Western Europe. Certainly, the few European records are almost all in herbaceous ornamentals (*Anemone*, *Gladiolus*, *Iris*, *Narcissus*, *Pelargonium*), which are relatively short-lived. Further, in the absence of the vector *Xiphinema americanum*, the possibilities for establishment are limited. Nevertheless, the records of TRSV in Europe exist and there is no certain basis for asserting that the virus is now absent. This is the reason why it has been added to the EPPO A2 list.

PHYTOSANITARY MEASURES

Planting material of *Vaccinium* and *Vitis* from North America should be derived from certification schemes guaranteeing freedom from TRSV. EPPO recommends certification schemes for fruit trees (OEPP/EPPO, 1991) and grapevine (OEPP/EPPO, 1994), which cover TRSV and ToRSV in the context of general virus freedom. Similar requirements could readily be made for other fruit crops, since TRSV is covered by North American fruit certification schemes. In view of the generally lesser importance of TRSV compared with ToRSV, it does not seem necessary to make requirements for any of its ornamental hosts. If the need should arise, requirements similar to those for ToRSV would be appropriate (EPPO/CABI, 1996b). Soyabean seeds should be free from TRSV.

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