

## Data Sheets on Quarantine Pests

**Raspberry ringspot nepovirus****IDENTITY**

**Name:** Raspberry ringspot nepovirus

**Synonyms:** Raspberry Scottish leaf curl virus

**Taxonomic position:** Viruses: Comoviridae: *Nepovirus*

**Common names:** RRSV (acronym)

Ringspot diseases of raspberry, strawberry and flowering currant, Lloyd

George raspberry yellow blotch disease (English)

Taches annulaires du framboisier (French)

Manchas anulares del frambueso (Spanish)

Pfeffinger Krankheit (German)

**Notes on taxonomy and nomenclature:** Many minor variants occur, such as the Lloyd George yellow blotch strain, which infects raspberry cultivars immune to the common Scottish type strain (Murant *et al.*, 1968), and the English strain which differs serologically. RRSV may occur in combination with other viruses and, particularly in cherries, these dual infections result in serious diseases, such as rasp leaf and amasya.

**EPPQ computer code:** RYRSXX

**EPPQ A2 list:** No. 98

**EU Annex designation:** II/A2

**HOSTS**

The main host is raspberries (*Rubus idaeus*). Cultivars differ considerably in susceptibility; thus, Norfolk Giant is highly susceptible to the type strain, while Lloyd George is immune to it. Other species of *Rubus* can also be infected by the virus.

Other important hosts are strawberries and cherries. It also occurs in gooseberries, grapes and red currants, but is not so important in these.

RRSV also occurs naturally in many species of wild and cultivated dicotyledonous and monocotyledonous plants. Species in more than 14 dicotyledonous families are susceptible.

A number of other hosts have been infected experimentally; these include *Chenopodium amaranticolor*, cowpeas, *Cucurbita* spp., *Iberis saxatilis*, *Nicotiana* spp., *Petunia*, *Phaseolus vulgaris*, spinach, tomatoes.

Raspberries, the main host, are grown mainly in the northern part of the EPPQ region. The other important hosts, strawberries and cherries, are much more widely distributed.

**GEOGRAPHICAL DISTRIBUTION**

**EPPQ region:** Found in Luxembourg, Poland, Yugoslavia. Widespread in France, Latvia and Norway; locally established in Belgium, Bulgaria, Czech Republic, Finland, Germany, Greece, Hungary (unconfirmed), Ireland, Netherlands, Norway, Slovenia, Spain, Switzerland, Russia (European, Far East), Turkey and UK (excluding Northern Ireland); has been found in Denmark but is now eradicated. Found in the past but not established in Austria.

**Asia:** Kazakhstan, Russia (Far East), Turkey.

**EU:** Present.

For more information, see also Murant (1970a).

## **BIOLOGY**

The virus is mechanically transmissible to a number of herbaceous plants and is also transmitted through seed; in some hosts, more than 50% of progeny seedlings are infected. Besides aiding dissemination of the virus, infection of the seed, especially in weeds, provides an important means of survival of RRSV in soils. Virus can be transmitted to seed of raspberry and strawberry, but plants pollinated with virus-carrying pollen do not become infected.

Cross-protection between virulent isolates of serologically different strains is usually complete, but avirulent isolates do not afford protection. In plant sap stored at room temperature, infectivity is lost in 2-3 weeks.

RRSV is transmitted by two species of the nematode genus *Longidorus*. These free-living, soil-inhabiting vectors are specific for serologically distinctive forms of RRSV (Harrison, 1964); thus, the Scottish and Dutch strains are transmitted most efficiently by *L. elongatus* (Taylor, 1962), while the English form is transmitted by *L. macrosoma* (Debrot, 1964). Other nematode species (including *Xiphinema diversicaudatum* and other species of *Longidorus*) have been suspected of transmitting strains of RRSV, but the methods used to demonstrate the transmissions were not thought to be sufficiently rigorous and these transmissions are not, therefore, considered acceptable (Trudgill *et al.*, 1983).

Both larvae and adults of *L. elongatus* transmit the virus, but the adult does not pass the virus to its progeny, nor is it retained when the nematode moults. Starved *L. elongatus* retain infectivity for up to about 9 weeks. *L. elongatus* also transmits tomato black ring nepovirus (EPPO/CABI, 1996), which produces identical symptoms and is often found together with RRSV.

For more information, see Cadman (1956), Murant *et al.* (1968), Kleinhempel (1970), Murant (1970b), Bovey *et al.* (1972).

## **DETECTION AND IDENTIFICATION**

### **Symptoms**

#### **On raspberries**

Infected plants are usually patchily distributed in crops, reflecting vector distribution. In the very susceptible cultivar Norfolk Giant, part or all of the canes may die in winter. Those that survive produce stunted and brittle shoots which have rolled leaves and show dieback progressively from the tip, accompanied by necrosis. In less susceptible cultivars, such as Malling Jewel, Malling Enterprise and Malling Notable, symptoms appear on the leaves of new shoots in spring, but are mild or absent on the leaves of fruiting canes. Young, expanding leaves develop a conspicuous, yellowish-green, ringspot or oak-leaf pattern; chlorotic blotches and a net-like chlorosis along the smaller veins may also be present. Some necrosis and dieback may occur. Malling Promise develops few symptoms and does not die back; Lloyd George and Malling Landmark are immune to the common strain but are susceptible to the Lloyd George yellow blotch strain (Murant, 1970b).

It should be emphasized that raspberries of all cultivars may be infected without showing symptoms, either because their roots are newly infected and the virus has not yet invaded the shoots, or because of seasonal fluctuations in symptom expression.

**On strawberries**

Symptoms vary according to season and strain. In general, progressive dwarfing and ultimate death may be expected. On *Fragaria vesca*, seedlings show yellow blotches during the first year of infection, but not thereafter.

On cv. Huxley, clearly defined, irregularly shaped, chlorotic blotches develop, often with a necrotic centre; there are no line patterns or rings. Symptoms are less clear on leaves developed in summer or at high temperatures. On Royal Sovereign, there is striking development of local necrotic spots (Lister, 1970).

**On cherries**

There is strong evidence to suggest that RRSV causes rasp-leaf symptoms in cherry trees. Arabis mosaic nepovirus may also cause somewhat similar symptoms in cherry. The leaves of affected trees are usually reduced in size, narrow and tough, with abnormally coarse serrations. Depending on varietal sensitivity, enations on the lower surface of the leaves may be few or numerous, large or small and confined to areas of the leaf close to the midrib. Both types of enations may occur on the same tree, either simultaneously or at different stages of infection. Young trees of the sensitive cv. Bing, inoculated by bud grafts in July, usually show conspicuous symptoms in the following year (Cropley, 1961).

**Morphology**

The virus particle is isometric, about 30 nm in diameter, with a five- or six-sided angular outline and, in its nematode vectors *Longidorus* spp., is found in association with the stylet-guiding sheath and buccal capsule.

**Detection and inspection methods**

When leaves of herbaceous indicators are mechanically inoculated with possibly infected plant tissue, the symptoms produced can indicate the presence of RRSV.

Tobacco (*Nicotiana tabacum*) cvs Haronova and Havana 524 react with necrotic rings, while White Burley gives chlorotic local lesions and scattered systemic chlorotic spots and rings. *N. glutinosa* and *Chenopodium amaranticolor* produce chlorotic or necrotic local lesions following artificial inoculation. In general, however, identification of RRSV by host range or symptomatology is not reliable, and serological tests are essential for correct diagnosis. Test methods have been summarized in EPPO's quarantine procedure for *Rubus* viruses (OEPP/EPPO, 1991).

**MEANS OF MOVEMENT AND DISPERSAL**

Natural dispersal of RRSV is accomplished over long range by transport of infected seeds by animals or wind. Short-range dispersal occurs by means of transmission by viruliferous nematodes from plant to plant and, to a more limited extent, by the movement of the nematodes themselves.

In international trade, the disease can be carried in infected *Rubus*, *Fragaria* and cherry plants or parts of plants, including seeds. RRSV might also be present in viruliferous nematodes or infected seeds in the soil accompanying consignments of plants. The nematodes can survive the physical disturbance of international transport but not if the soil becomes dry.

**PEST SIGNIFICANCE****Economic impact**

RRSV causes a severe disease, reducing both growth and fruit yield and killing plants. It is of great economic importance in Germany and Russia, and of some economic importance in the other countries where it is established.

## Control

Fumigants such as dazomet or dichloropropane-dichloropropene, directed at the nematode vectors, give good control of virus transmission in raspberry plantations.

## Phytosanitary risk

RRSV is listed by EPPO (OEPP/EPPO, 1983) as an A2 quarantine pest. Although RRSV is already fairly widespread in the EPPO region, the importation and planting of infected material could spread the virus to uninfested regions. It is also of quarantine significance to NAPPO.

## PHYTOSANITARY MEASURES

EPPO recommends (OEPP/EPPO, 1990) that consignments of plants for planting of *Rubus* must come from a field found free from RRSV during the last growing season. The use of certified planting material can ensure the absence of virus diseases; EPPO published (OEPP/EPPO, 1994a; OEPP/EPPO, 1994b) internationally acceptable certification schemes for the production of healthy planting material of *Rubus* and *Ribes*, including testing for RRSV.

## BIBLIOGRAPHY

- Bovey, R. *et al.* (1972) *La défense des plantes cultivées* (6th edition). Payot, Lausanne, Switzerland.
- Cadman, C.H. (1956) Studies on the etiology and mode of spread of Scottish raspberry leaf curl disease. *Journal of Horticultural Science* **31**, 111.
- Cropley, R. (1961) Viruses causing rasp leaf and similar disorders of sweet cherry. *Annals of Applied Biology* **49**, 530-534.
- Debrot, E.A. (1964) Studies on a strain of raspberry ringspot virus occurring in England. *Annals of Applied Biology* **54**, 183-191.
- EPPO/CABI (1996) Tomato black ring 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.
- Harrison, B.D. (1964) Specific nematode vectors for serologically distinctive forms of raspberry ringspot and tomato black ring viruses. *Virology* **22**, 554-550.
- Kleinhempel, H. (1970) [On the reliability of detection of mechanically transmitted viruses when testing mother plants of black currant]. *Archiv für Gartenbau* **18**, 267-272.
- Lister, R.M. (1970) Nematode-borne viruses as pathogens in strawberry. In: *Virus diseases of small fruits and grapevines, a handbook* (Ed. by Frazier, N.W.), pp. 34-36. University of California, Berkeley, California, USA.
- Murant, A.F. (1970a) Raspberry ringspot virus. *CMI/AAB Descriptions of Plant Viruses* No. 6. Association of Applied Biologists, Wellesbourne, UK.
- Murant, A.F. (1970b) Soilborne viruses and diseases in *Rubus*. In: *Virus diseases of small fruits and grapevines, a handbook* (Ed. by Frazier, N.W.), pp. 132-136. University of California, Berkeley, California, USA.
- Murant, A.F.; Taylor, C.E.; Chambers, J. (1968) Properties, relationships and transmission of a strain of raspberry ringspot virus infecting raspberry cultivars immune to the common Scottish strain. *Annals of Applied Biology* **61**, 175-186.
- OEPP/EPPO (1983) EPPO data sheets on quarantine organisms No. 98, Raspberry ringspot virus. *Bulletin OEPP/EPPO Bulletin* **13** (1).
- OEPP/EPPO (1990) Specific quarantine requirements. *EPPO Technical Documents* No. 1008.
- OEPP/EPPO (1991) Quarantine procedures No. 31, *Rubus* viruses: inspection and test methods. *Bulletin OEPP/EPPO Bulletin* **21**, 241-244.
- OEPP/EPPO (1994a) Certification schemes No. 9, Pathogen-tested material of *Ribes* *Bulletin OEPP/EPPO Bulletin* **24**, 857-864.
- OEPP/EPPO (1994b) Certification schemes No. 10, Pathogen-tested material of *Rubus* *Bulletin OEPP/EPPO Bulletin* **24**, 865-874.

- Taylor, C.E. (1962) Transmission of raspberry ringspot virus by *Longidorus elongatus* (de Man) (Nematoda: Dorylaimidae). *Virology* **17**, 493-494.
- Trudgill, D.L.; Brown, D.J.F.; McNamara D.G. (1983) Methods and criteria for assessing transmission of plant viruses by longidorid nematodes. *Revue de Nématologie* **6**, 133-141.