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Data Sheets on Quarantine Pests

Arabis mosaic nepovirus

IDENTITY

Name: Arabis mosaic nepovirus
Synonyms: Raspberry yellow dwarf virus
Taxonomic position: Viruses: Comoviridae: *Nepovirus*
Common names: ArMV (acronym)
Arabis mosaic (English)
EPPO computer code: ARMXXX
EU Annex designation: II/A2

HOSTS

ArMV has a wide host range including a number of important crop plants. When mechanically inoculated, 93 species from 28 dicotyledonous families were shown to be infected (Schmelzer, 1963). In a survey of alternative hosts for hop viruses, positive ELISA-readings were obtained in 33 out of 152 species tested (Eppler, 1989).

Principal hosts are strawberries, hops, *Vitis* spp., raspberries (*Rubus idaeus*), *Rheum* spp. and *Sambucus nigra*.

The virus has also been reported from sugarbeet, celery, *Gladiolus*, horseradish and lettuces. A number of other cultivated and wild species have been reported as hosts. All these crop hosts and many wild plant hosts occur throughout the EPPO region.

GEOGRAPHICAL DISTRIBUTION

EPPO region: Belgium, Bulgaria, Cyprus (found but not established), Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Luxembourg, Moldova, Netherlands, Norway, Poland, Romania, Russia (European, Far East), Slovakia, Sweden, Switzerland, Turkey, UK, Ukraine and Yugoslavia.
Asia: Japan, Kazakhstan, Russia (Far East), Turkey.
Africa: South Africa.
North America: Canada (British Columbia, Nova Scotia, Ontario, Quebec).
Oceania: Australia (Tasmania, Victoria), New Zealand.
EU: Present.

BIOLOGY

On the basis of polyclonal antisera, all ArMV strains known so far are closely related to one another and distantly related to grapevine fanleaf virus (GVFLV). The close relationship of ArMV and GVFLV (not only serologically) has given rise to the assumption that the two viruses may have the same origin, or even that GVFLV is the origin of ArMV (Hewitt, 1985). The recent finding that there is a cross-protecting capacity in the interrelationship of these two viruses (Huss *et al.*, 1989) substantiates this theory.

Despite their close serological relationships, ArMV strains may differ in host range, symptom expression and transmissibility by nematode vectors. Further evidence for this

has recently been given for ArMV in *Rubus* (Jones *et al.*, 1989), while ArMV-H (on hop) has been known for some time to have an extremely narrow host range compared with other strains.

Several dorylaimid nematodes of the family Longidoridae have been suspected of transmitting ArMV, but only the evidence for *Xiphinema diversicaudatum* is adequate (Trudgill *et al*., 1983). Although this nematode varies in its ability to transmit different strains, in most cases efficient nematode transmission occurs. Once the nematodes have acquired the virus by feeding on the roots of an infected plant, they retain infectivity for up to approximately 15 months in soil without host plants. The virus is not retained through the moult between stages of the nematode life cycle, nor is it passed from female to the progeny.

Vegetatively propagated plant material is the most effective means of spread. ArMV-infected plants occur in plantations either randomly distributed or in patches or a combination of both. The random distribution can be explained by the use of partially infected planting material. The patchy distribution indicates either an irregular distribution of infective nematodes or populations that had become infective by the introduction of virus using partially infected planting material.

Seed transmission is a common feature and was found in at least 15 species out of 12 plant families with up to nearly 100% of the progeny being infected (Murant, 1970). But this type of spread is of little importance in crops that are propagated vegetatively like hops, grapes, etc.

Spread of ArMV by plant contact in the field seems to be rare if it occurs at all. Some evidence exists for pollen transmission of ArMV in hops (Eppler, 1983), but no proof has yet been furnished that healthy mother plants can be infected by virus-carrying pollen.

In non-cultivated vegetation, spread occurs initially by seed and, secondarily, over shorter distances by nematode transmission (McNamara, 1980).

DETECTION AND IDENTIFICATION

Symptoms

The most common symptoms induced by ArMV are leaf mottling and flecking, stunting and several forms of deformation including enations. The symptoms vary depending on the host plant but also on virus isolate, cultivar, season and year. Many infections with ArMV are latent and the plants do not show symptoms.

Morphology

ArMV has a bipartite genome with two RNA-species of molecular weights 2.4 and 1.4 x 10^6. The virus particles are isometric and about 30 nm in diameter. They sediment in three classes: T (53S), M (93S) and B (126S). There is a single coat protein with a molecular weight of 54 x 10^3 (Murant, 1981; Francki *et al*., 1985).

Detection and inspection methods

Several herbaceous indicator plants react with typical symptoms. *Chenopodium quinoa* and *C. amaranticolor* develop chlorotic local lesions followed by a systemic mottle (Murant, 1970). *Cucumis sativus* may react with chlorotic local lesions on the infected cotyledons and systemic vein banding or yellow flecks. *Phaseolus vulgaris* may react with chlorotic local lesions, systemic necrosis and distortion, *Petunia hybrida* with local chlorotic lesions or small necrotic rings and a systemic ring and line pattern or vein clearing. However, not all strains (e.g. the hop strain, ArMV-H) induce these distinct symptoms either clearly visible or on every infection. For this reason and because ArMV frequently occurs in mixed infections, quite often with strawberry latent ringspot nepovirus (SLRV) with which

it shares the nematode vector and which induces comparable symptoms (EPPO/CABI, 1996), a serological identification is more reliable.

ELISA is widely used for screening purposes using IgG from polyclonal antisera. Monoclonal antibodies have also been prepared (Tirry & Welvaert, 1989). One of the clones seems to be specific for an isolate of ArMV-H from a Belgian 'nettlehead'-diseased hop plant. Another clone detected all 11 ArMV-isolates from different plant species tested so far. The German ArMV-H or at least some of its isolates cannot be detected with the monoclonal antibody specific to ArMV-H. But strain differences may also be detected using the F(ab')2-based ELISA-procedure of Barbara & Clark (1982) (Adams *et al.*, 1987).

ArMV can also be detected by electron microscopy and even in single nematodes using ISEM. This method is at least 1000 times more sensitive than conventional EM (Roberts & Brown, 1980). Decoration with antibodies is also frequently used to discriminate ArMV from other nepoviruses.

Those British ArMV isolates infecting hop (ArMV-H) which possess additional satellite nucleic acids (S-NAs) can be distinguished by polyacrylamide gel electrophoresis of viral RNA (Davies & Clark, 1983; 1989).

Another means of detecting ArMV is the use of cDNA-clones, which were developed in at least two laboratories (Jelkmann *et al.*, 1988; Steinkellner *et al.*, 1989), in dot-hybridization tests.

MEANS OF MOVEMENT AND DISPERSAL

ArMV is transmitted by its nematode vector over short distances only. In international trade, only movement of infected planting material would be important. The significant host plants are not moved as seeds.

PEST SIGNIFICANCE

Economic impact

Diseases caused by ArMV are generally of a local and/or crop-specific character but can have a devastating effect where they occur. Strawberries and raspberries can be severely affected and in some cultivars plants may even be killed by the virus. The diseases caused in certain cultivars are called mosaic and yellow crinkle of strawberry and yellow dwarf of raspberry. These were previously of economic importance in the south of the UK but are now rarely found.

In the UK the virus is associated with several diseases of hop, such as 'nettlehead', 'severe split leaf blotch', 'bare bine' (only visible early in the season) and 'chlorotic disease' which can lead to a considerable reduction in yield. 'Nettlehead' also occurs in the hop-growing regions of Belgium and Czechoslovakia. In German hops, neither symptoms nor significant damage have yet been observed despite the fact that the virus was found, in some hop-growing regions, in up to 40% of the plants tested. A survey of hop cultivars grown in southern Germany indicated that resistance to ArMV does not seem to exist in any of these cultivars.

In cherries, mixed infections of ArMV with prune dwarf ilarvirus or prunus necrotic ringspot ilarvirus induce 'European rasp leaf'.

Control

A basic measure for the control of ArMV is the distribution of virus-free planting material underlying a strict certification scheme. In areas where infective nematode-vector populations are present, replanting of virus-free material without additional measures will be ineffective: soil fumigation and/or fallow for at least one year seem to be good

additional procedures for the limitation of disease spread. For hops this has been reviewed by Thresh & Ormerod (1989).

In some species, like *Phlox paniculata*, resistant cultivars are reported to exist (Lisovskaya, 1989). Breeding for resistance in species where seed transmission occurs might thus be a good strategy, if these plants are of economic importance.

Phytosanitary risk

ArMV is of quarantine significance for NAPPO. EPPO does not list it as a quarantine pest. It does not justify quarantine status on the grounds that it is widely distributed throughout the region, is transmitted by seed and is readily transmitted by its nematode vector.

PHYTOSANITARY MEASURES

Planting material should only be taken from a certification scheme. Cuttings should be free from soil remnants to prevent translocation of nematode vectors.

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