Department for Environment Food & Rural Affairs

Plant Pest Factsheet

Rose rosette disease caused by Rose rosette virus and its vector the eriophyoid mite *Phyllocoptes fructiphilus*

Figure 1. Multiple witches' broom on a rose rosette virus infected rose. Courtesy: EPPO - Patrick Di Bello, Oregon State University (US)

Background

Rose rosette disease (RRD) is a damaging and often fatal condition affecting *Rosa* spp. caused when the host plant is infected with rose rosette virus (RRV). This disease was first observed in the 1940s in a limited number of states in Canada and the USA, but is now found throughout much of North America. In 2017, the virus was detected by surveys in two ornamental gardens in India (West Bengal). Rose rosette virus is currently absent from the UK, but it has the potential to cause significant damage to the rose industry should it be introduced. Horticulturalists and gardeners are advised to remain vigilant for signs of the virus.

Figure 2. Witches broom symptoms and excessive thorniness on a rose rosette virus infected rose © Fera Science Ltd.

Figure 3. Excessive thorniness, reddened leaves and witches' brooms on a rose rosette virus infected rose © Fera Science Ltd.

Figure 4. Distorted leaves within a witches' broom on the plant infected with rose rosette virus in the right of the image © Fera Science Ltd.

Figure 5. Abnormal flower development caused by infection by rose rosette virus © Fera Science Ltd.

Geographical Distribution

RRV was only known to occur in the USA and Canada, but was detected for the first time outside North America when its presence was confirmed in two botanic gardens in West Bengal, India in 2017. The virus is suspected to have been introduced to India in a *Rosa multiflora* (many flowered-rose) hybrid breeding line originating from the USA.

The virus is believed to be native to the eastern Rocky Mountains and was originally recorded as present in Manitoba, Canada, and California and Wyoming in the USA in the 1940s. However, from the 1960s onwards, the virus has been spreading across the USA, and is now present in 36 states including Alabama, Arkansas, California, Connecticut, Delaware, District of Columbia (Washington), Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin and Wyoming. Symptomatic plants have been observed in the north of Mexico but the presence of RRV has not been confirmed.

It is thought that the virus will continue to spread into new areas in the USA where hosts are available and climatic conditions are suitable for *Phyllocoptes fructiphilus*, the proven vector of RRV. *Phyllocoptes fructiphilus* was first described from Clarksburg, California, from the native host *Rosa californica*, a species that has a natural range that includes Canada and mid-to-eastern states of the USA. It is thought that *Phyllocoptes fructiphilus* has also been recorded as *Phyllocoptes slinkardensisis*, as specimens of these two species are very similar. *Phyllocoptes slinkardensisis* was described from *Rosa woodsii* ssp. *ultramontana* in Mono County, California. The natural range of *Rosa woodsii ssp. ultramontana* is Canada (British Colombia) and the western states of the USA.

Therefore the natural distribution of *P. fructiphilus* (= syn. *P. slinkardensisis*) is likely to mirror that of its two known native hosts *R. californica* and *R. woodsii* ssp. *ultramontana* and where environmental conditions are suitable for it to complete its life cycle. Although records of this mite do not entirely correspond to the distribution of RRV, the geographical distribution of *P. fructiphilus* is not fully known at the present time, as eriophyoid mites are poorly studied and can be very difficult to detect and identify. The mite is therefore probably present in more, if not all, states where RRV has been found.

Host Plants

All *Rosa* species, including climbers, hybrid teas, floribundas, miniatures and antique rose species and varieties, are considered to be susceptible or potentially susceptible to RRV and its mite vector *Phyllocoptes fructiphilus*. *Rosa multiflora* is highly susceptible to RRV and infection with the virus is always lethal in this species. Indeed, RRV was initially used as a biocontrol to limit the spread of *R. multiflora* in the USA, after this rose species was

aggressively introduced as a hedge plant but subsequently came to be viewed as an invasive, noxious weed.

In the USA, an extensive research effort is focussed on identifying genes or molecular markers conferring resistance to RRV. However, there are currently no confirmed species or cultivars of *Rosa* exhibiting tolerance or resistance to RRV.

Most eriophyoid mites are either highly host-specific or oligophagous (restricted to a limited number of hosts of same plant family or genus). *Phyllocoptes fructiphilus* has only been recorded on *Rosa* species to date including a wide range of cultivars. All *Rosa* species and hybrids are considered hosts.

Description and symptoms

Symptoms of RRV are highly variable in different rose cultivars, and can be dependent on the age and growth stage of the plant. Climatic conditions can also have an effect on symptom development. Generally symptoms first appear on leaves, before emerging on stems and branches. Leaves redden and become distorted, whilst shoots elongate and redden. Witches' brooms and excessive thorniness are characteristic of RRV infection, and these particular symptoms are more easily distinguishable in winter when stems are not masked by dense, healthy foliage. During the later stages of infection, reduced flowering and flower malformations are common.

It is highly likely that once symptoms of RRV are apparent in some plants, neighbouring plants will have also become infected with the virus. Diseased plants exhibit a gradual decline and die within 1-5 years, usually as a result of enhanced susceptibility to frosts. Rose rosette virus symptom progression is quicker in smaller, younger plants with infected seedlings rarely surviving after one year.

Symptoms similar to RRV are sometimes caused by herbicide misuse or some nutrient deficiencies, but usually roses can overcome these injuries if given sufficient care. Other diseases of rose cause symptoms similar to those induced by RRV, such as the excessive thorniness caused by a phytoplasma in the aster yellows subgroup, or a newly described phytoplasma causing witches' broom on *Rosa* x *damascena*. Additionally, a new closterovirus has been reported to induce leaf rosette symptoms on rose.

The vector of RRV, *P. fructiphilus*, is a microscopic eriophyoid mite. The adults are amber or light yellow in colour, spindle-shaped and at most measure 0.170 mm in length by 0.04 mm in width. Therefore they are not easily visible to the naked eye.

Biology

RRV is an Emaravirus which is able to move to all parts of an infected plant, although some parts of the plant can appear symptomless. Grafting experiments have shown that the virus can move over the graft joint within one week and can be detected in all parts of the plant within three weeks. The virus can have variable incubation times as symptoms are not always apparent and can sometimes take up to a year to develop. Symptom

development following vector-mediated transmission of RRV has been shown to take between 17 to 146 days.

The mite, *P. fructiphilus*, has a fairly typical lifecycle for an eriophyoid mite consisting of the egg, larva, nymph and adult stages. Mature females overwinter in sheltered places on the host plant such as under the bark or under bud scales, before emerging in the spring to lay their eggs. The eggs hatch within 3-4 days, developing from larvae to nymphs within about 2 days, and from nymphs to adults within a further 2 days.

During the spring and summer *P. fructiphilus* can be found under bud scales, growing shoot tips, within the leaf folds of new shoots or at the base of petioles. The population builds throughout the summer as multiple generations are produced. The lifecycle slows down as temperatures decline, but generations can be produced uninterrupted under protected environments. It has been shown that *P. fructiphilus* is able to survive at 4°C on plant material stored in sealed plastic bags and kept in complete darkness for 2 months.

Dispersal and Detection

RRV is mainly spread by *Phyllocoptes fructiphilus*, the only known vector of the virus in North America. The virus is also able to spread through infected propagating material and grafting practices, but it is thought unlikely that these modes of spread would cause large-scale epidemics of the disease. The virus is not known to be spread by seed, pollen or in soil. Although mechanical spread of the virus has not been conclusively proven, a precautionary approach to cleaning pruning tools is recommended.

Phyllocoptes fructiphilus main mode of spread is thought to be by passive aerial dispersal and by mites actively entering the air column particularly on warm, sunny days. In the USA, *Rosa* plants planted downwind of infected *R. multiflora* are considered to be more at risk of infection.

It is possible that *P. fructiphilus* can spread by crawling between plants that are in physical contact with each other, although due to its extremely small size, this mode of transmission is thought to be an unlikely mechanism for wide-scale spread. Other modes of dispersal, such as presence on pruning tools, equipment and clothing or via dispersal by splash or rain water, are possible for localised spread.

Economic Impact

Rose rosette virus reduces the aesthetic appearance of roses and can kill infected plants within 1-5 years after symptoms first appear. In the USA, the virus has caused adverse economic impacts on the commercial rose industry, as well as causing the destruction of large scale plantings of roses in public parks, botanic gardens and plantings in domestic settings. Discovery of the virus has led to many gardens and parks removing and replacing roses in long-established rose gardens in a bid to control the disease.

Rose production businesses in the USA have reported losses of up to 25% in gross revenue as a result of RRV. The USA rose industry is worth $250 million annually, leading the USDA to invest $4.6 million US dollars of funding for research into control of RRV.

Pest Management and Reporting

Suspected outbreaks of RRV or any other non-native plant pest should be reported to the relevant authority:

For **England and Wales**, contact your local **APHA Plant Health and Seeds Inspector** or the **PHSI Headquarters**, York.

Tel: 0300 1000 313 (please select option 3 when calling)

Email: planthealth.info@apha.gov.uk

For **Scotland**, contact the **Scottish Government's Horticulture and Marketing Unit:**

Email: hort.marketing@gov.scot

For **Northern Ireland**, contact the **DAERA Plant Health Inspection Branch:**

Tel: 0300 200 7847 Email: planthealth@daera-ni.gov.uk

Web: https://www.daera-ni.gov.uk/topics/plant-and-tree-health

For additional information on UK Plant Health please see:

https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/

https://planthealthportal.defra.gov.uk/

https://www.gov.uk/plant-health-controls

http://www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases

https://www.daera-ni.gov.uk

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