The Food & Environment Research Agency

Assessment of European mountain ash ringspot associated virus

Description of the pathogen

European mountain ash ringspot associated virus (EMARAV) is the tentative name of a virus obtained from symptomatic *Sorbus aucuparia* L. (commonly known as Rowan or European mountain ash).

Symptoms of ring-spots and line patterns on the foliage of affected trees was first recorded in 1960 (Kegler quoted in Benthack *et al*, 2005) and further reference to the presence of symptomatic *S. aucarpia* in Finland and the UK is made in Cooper (1979) where diseased trees are described as frequently occurring. A symptomatic sample of *S. aucarpia* was received at SASA in 2007 (J. Chard, Pers. Comm.) showing symptoms typical of the malady as described in Cooper (1979). The symptoms were also shown to be passed to non-affected scions through graft transmission (Fuhrling & Buttner, 1995 quoted in Benthack *et al*, 2005).). indicating the disease almost certainly infects the host systemically.

Benthack *et al* (2005) isolated 4 double-stranded RNA (dsRNA) molecules from affected leaves and bark of *S. aucarpia,* which were not isolated from asymptomatic samples. This paper also reports further PCR studies that rule out the presence of other graft transmissible pathogens such as *Phytoplasma*. Due to the association of the symptoms with the presence of dsRNA, the tentative name of European mountain ash ringspot associated virus (EMARAV) has been given to the virus and this is proposed to belong to a novel virus genus, Emaravirus.

There is no evidence available that the authors have fulfilled Koch's postulates for this pathogen (Mielke & Muehlbach, 2007) i.e. this would require isolation of viable virus into an alternate host followed by back inoculation into the original host species and the development of initial symptoms. This appears to be due to the inability to transmit the virus mechanically and no vector being confirmed (Valkonen & Rannali, 2010). For this reason there is also a lack of available data on alternate hosts of this virus.

Present geographical distribution

There are few reports to indicate how widely the virus is distributed. Within Europe the symptoms and/or the virus have been reported from the Czech Republic (Polak *et al* 1990), Finland (Cooper, 1979; Kallinen, 2009), Germany (Kegler, 1960; Robel et al, Unpublished), Poland, (Polak *et al* 1990), Russia (Valkonen & Rannali, 2010), Sweden (Robel *et al*, Unpublished) as well as the United Kingdom (Cooper, 1979; Robel *et al*, Unpublished).

Robel *et al* (Unpublished) reports that 23 samples from Scotland, UK, tested positive for the virus. These were taken from symptomatic trees found in diverse locations in the Central and West Highlands of Scotland, covering the administrative regions of Stirling, Perth and Kinross and Highland, with samples from as far afield as Killin, in Stirlingshire, Eilean Donan Castle in the West Highlands and Ullapool in Highland.

Other than the reports from Scotland the UK range of the virus is unknown. However, given that both the host and possible vectors (see below) are widely distributed throughout the UK,

it seems highly likely that the virus will also be present in other parts of the UK to some extent.

Is the pest established, transient or suspected to be established or transient in the UK?

Evidence exists of the widespread distribution across remote areas of Scotland (Robel *et al*, Unpublished). Additionally genetic diversity data presented in this report suggests a distinct genetic 'Scottish' clade of the virus from the virus recovered from samples collected in Germany and Sweden.

There are records of the symptoms occurring frequently in the UK from Cooper (1979), taking into account the recent additional Scottish distribution and associated phylogenetic data it can be concluded that the pathogen has been present and established in the UK in excess of 30 years.

What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?

The primary known symptomatic host is *Sorbus aucuparia* L. (commonly known as Rowan or European mountain ash).

As the virus appears to be non-transmissible through mechanical means (Valkonen & Rannali, 2010) little is known about the range of alternate hosts. As this appears to be a previously unidentified genus of virus it is difficult to estimate the potential range of this group. However, it is unlikely to be restricted to Rowan and may affect other members of the genus *Sorbus* or even the family Rosaceae. Without further data firm conclusions cannot be drawn.

If the pest needs a vector, is it present in the UK?

Vertical transmission (i.e. through seed) has not been observed and a putative vector has yet to be identified. (Mielke-Ehret et al, 2010)

Mielke-Ehret *et al* (2010) associated the presence of galls of the mite Eriophyes pyri (formerly *Phytoptus pyri*) with trees exhibiting symptoms of the disease. Using RT-PCR and immunoflouresence microscopy the presence of virus specific RNA and P3 protein were detected in mites taken from the galls of infected trees, indicating that this species could be a potential vector. However, there is also the possibility that feeding on the infected tree may lead to accumulation of viral proteins.

If we consider Eriophyd mites as candidate vectors, of the 10 nominal species of eriophyoid mites recorded from the host *Sorbus acuparia* L. at least three are synonymous with previously described species thus leaving 7 species. Of these, two have been recorded as present in Britain, namely:

- *Eriophyes pyri* (Pagenstecher, 1857): the almost cosmopolitan pear leaf blister mite, which is known to feed on a very wide range of Roseacae and
- *Eriophyes sorb*i (Canestrini, 1891): This has only been recorded from the host genus Sorbus.

In addition *Phyllocoptes sorbeus* (Nalepa, 1926) is recorded in Ireland, and there is no reason why this species should not be present in Britain as it is fairly widespread in the rest of Europe.

Eriophyoid mites are generally under recorded and there is no accurate checklist of the British eriophyoid fauna. In all likelihood the range of British fauna on both *Sorbus* and other hosts is likely to be much more extensive and diverse than current records indicate. (Joe Ostoja-Starzewski, pers. Comm.)

What is the pest's economic/environmental/ social impact within its existing distribution?

In addition to being broadly distributed as a native tree species trees, *S. aucuparia* is a pioneer plant tolerant of poor soil/growing conditions. Economically it is of significance when used as an ornamental species in parks and gardens. Additionally it is used in wood turning decorative carpentry. EMARaV-infected mountain ash trees suffer from chlorosis and growth reduction of varying severity, which impairs their value as an ornamental and for carpentry (Valkonen & Rannali, 2010).

Additionally there are reports of trees suffering a slow dieback within a few years of symptoms first being observed (Mielke *et al* 2008). Without further study it is difficult to weight the severity or speed of this decline of an infected individual.

IMAGES OF PEST SYMPTOMS

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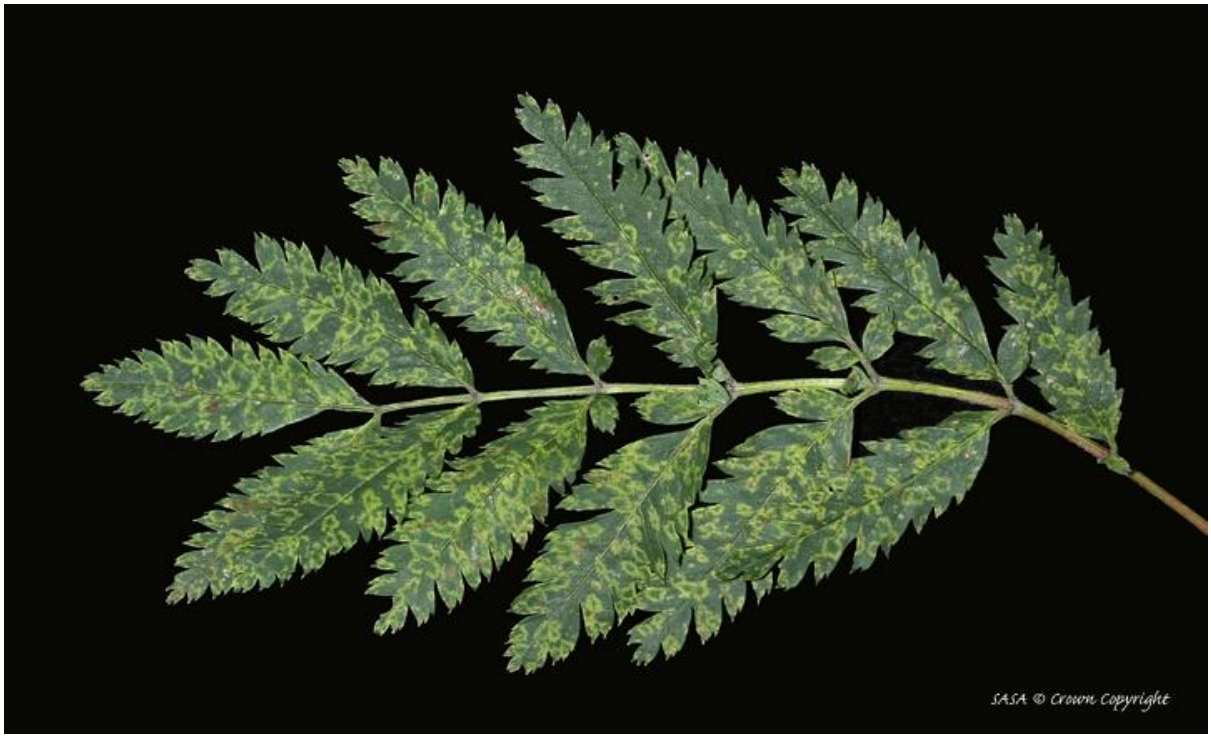

Photo courtesy of SASA

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