

Grower Summary

SF 148

Understanding the scale and importance of raspberry leaf blotch virus and its association with raspberry leaf and bud mite

Annual 2015

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Project Title: Understanding the scale and importance of raspberry leaf blotch virus and its association with raspberry leaf and bud mite

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GROWER SUMMARY

Headline

- There is a strong link between raspberry leaf blotch virus infection and the presence of its vector raspberry leaf and bud mite.

Background and expected deliverables

Crop damage previously solely associated with the feeding of raspberry leaf and bud mite (RLBM), is an increasing problem around the UK and it is now known that in some cases, infection with *Raspberry Leaf Blotch Virus* (RLBV) is also involved. It affects Glen Ample in particular but symptoms are increasingly being seen on other varieties (Figures 1 and 2). There is also a suggestion (preliminary results: J. Allen/S. MacFarlane) that the recent health decline in certain varieties such as Octavia (poor lateral development, die back, blotchy leaves and malformed fruit - Figures 3 and 4) could be associated with this pest and/or virus. The association between the mite and RLBV has been proven, but increasingly, crop damage symptoms are being observed without the mite being seen in the field.

This project aims to carry out a UK-wide sampling effort of plantations and conduct experiments to try and elucidate the links between the mites, the virus, plantation age, variety, yield loss and plant source, to inform strategies for control.

Symptoms



Figure 1. Minor leaf blotch symptom - primocane leaf



Figure 2. Moderate to severe infection to floricane lateral, blotches to primocane leaves



Figures 3 & 4. Severe infection - curled twisted chlorotic leaves and malformed fruit

Summary of the project and main conclusions

UK wide sampling and assessment

During the summer and early autumn of 2014, ADAS consultants contacted and visited 28 raspberry growers. In this first year of the project (to make sure positive samples were collected) sampling was targeted to sites with a history of this pest, where potential symptoms had been observed in 2013 or where there was a long history of raspberry production. At each site the grower was interviewed and up to five plantations were selected for sampling; both symptomatic and asymptomatic plantations and a wide range of flori (summer) and primocane (autumn) fruiting varieties were sampled to differentiate why some plantations are affected by the mite and/or virus and why others are not. Within each plantation a single plant was selected and five of the newest fully emerged leaves from a primocane were collected and sent to the James Hutton Institute for molecular analysis by PCR (polymerase chain reaction). Detailed cropping information was collected for each site to support and inform the results, including: variety, planting date, planting material, spawn management, acaricide use, yield observed in 2013, presence of wild hosts and level of symptoms at sampling.

Scale and severity of RLBM and RLBV

RLBV was confirmed in 30% of the 95 plantations sampled. Positive samples were found on 40% of the holdings and 42% of the 24 different varieties sampled. Mites were detected on 30% of the samples, 24% of which were also positive for RLBV. Both the mite and virus were detected in all of the key fruit growing regions of the UK on both small and large holdings utilising both protected and containerised production. This suggests the mites and the virus are closely associated and widely distributed around the UK.

The presence or absence of RLBM strongly indicated whether or not the sample was likely to be positive for the virus (Table 1). A total of 84 out of 91 samples (88.4%) gave results consistent with the proven link that RLBM is a vector for RLBV.

Table 1. Association of Raspberry Leaf Blotch Virus (RLBV) with presence of raspberry leaf and bud mite (RLBM) in UK Raspberry crops – 2014

Number of samples in each category			
RLBM - RLBV -	RLBV + RLBM -	RLBV - RLBM +	RLBV + RLBM +
61	6	5	23

Mite-virus interaction and links with plantation decline

Several of the worst affected sites sampled in 2014 were grubbed at the end of the season because of plantation decline as a result of this mite virus complex. It is clearly a damaging condition and one that can build up over time. However it is still unclear whether the virus can move systemically within a plant or whether overwintering populations of the mite perpetuate the virus infection and plant damage. In this study the virus was rarely found in the absence of the mite, which is promising as there is a much greater potential to control the mite on farm than the virus. Overall there was good agreement between characteristic symptoms of yellow leaf blotching and presence of the mite and or virus. However, in the newer plantations a greater proportion of ambiguous symptoms did yield positive virus results.

A summary of factors that appear to be associated with a high incidence of RLBV is provided in Table 2.

Table 2. Summary of some factors that appear to be associated with RLBV symptoms from

examination of 95 raspberry plantations in 2014

Factor	Comment	High(er) Incidence*	Low(er) Incidence*
Variety	10 out of 24 cv's positive	Glen Ample Octavia	Tulameen
Plantation age	Trend for greater in older plantations	-	-
Region	Present in all regions	West Mids	East Anglia South East
Planting material	Present in plantations grown from all types of planting material	Bare root short cane	Root Modules
Spawn management	Present whatever system used; worse where mechanical	Mow or Strim	Hand or Shark
Wild raspberry	Greater chance or infected crop if wild raspberry is adjacent	-	-
Mite control	Less RLBV if a mite control strategy is in place (be it for RLBM or two spotted spider mite)	No mite control	Acaricide or predators used
Cropping system	Present in plantations grown in all types of system	Outdoor Soil	Tunnelled containerised

*Only reported where sample size is greater than or equal to 10

Varietal susceptibility

Glen Ample and some of the older florican varieties, as expected, were the varieties most commonly affected by the condition, but more modern varieties including CV-C and some primocane varieties (previously considered less susceptible) were also found to be affected. This suggests a wide cohort of varieties could be infested with both the mite and virus. In this first year the sampling effort was deliberately targeted to sites with a history of this pest, where potential symptoms had been observed in 2013 or where there was a long history of raspberry production. Wherever possible both symptomatic and asymptomatic plantations and varieties were sampled at each site. To gain a more representative indication of the level of RLBM and RLBV in the UK raspberry industry, further sampling is proposed in 2015 to collect information from a larger number of plantations including those with no history of the pest or virus and located on sites in areas of the UK which until recently have not been used for raspberry production and have been planted with modern primocane fruiting raspberry varieties.

Trends in cropping situations where RLBV occurs

This initial survey also suggests that the way in which crops are managed may affect the condition. Spawn management appears to have some effect on levels of the mite and virus with physical methods of unwanted primocane removal (as opposed to chemical) seemingly showing greater levels of the mite and virus. Potentially this could be related to seasonal carry-over of mites as the presence and proximity of young primocane foliage to infested

floricane leaves allows mites to migrate onto next year's canes. Earlier removal of the first or second flush of primocane could hinder this migration and or systemic movement of the virus. In this first year the question posed to growers was to describe their spawn management approach, from which we received some basic responses; in 2015 information will also be sought on timing of management.

Sites which used the acaricide abamectin and/or releases of the predatory mites, appeared to have a lower level of RLBV and RLBM suggesting use of these agents could be providing incidental control of the mite, thereby reducing levels of the virus. One site where leaf blotching was observed early in the season on floricane leaves, was specifically treated with abamectin for RLBM. Samples of both floricane and primocane leaves were collected. No blotching or virus was detected on the primocane despite the floricane showing severe symptoms and testing positive for RLBV. Specific sampling of identified locations in 2015 will collect further information on this topic. Presence of wild raspberry in close proximity to raspberry plantations seemed to increase the proportion of plantations affected. As both RLBM and RLBV can be found on wild raspberry hosts, proximity of infested wild raspberry to commercial raspberry plantations could be responsible for infection into new plantations.

All sources of planting material (bare root short and long cane, modules and root cuttings) used to establish the plantations examined in this study, showed examples of RLBV and RLBM infection. However, bare root short cane planting material showed a greater incidence of RLBV infection compared with other types. This might be explained by the fruiting plantation age and/or growing system whereby the more traditionally managed and older plantations which tended to show more RLBV, would more commonly have used standard bare rooted plants for establishment.

A higher proportion of the more recently planted fruiting plantations were established using root cuttings, or small soft module raised plants. Within this study only a small number of samples were collected from plantations using these materials. In general however, these showed a lower proportion of RLBV infection. It cannot be assumed however that this type of planting material is less likely to be affected by RLBV, as the risk would be expected to depend on the age, health status and the method of production used to grow the mother plant. At present we do not know whether or not different plant material provides a lower risk as regards the virus originating from propagation, but neither the mite nor the virus are currently covered by the PHPS inspector scheme.

Tunnelled and containerised production gave mixed results and will be further investigated in the wider survey in 2015.

Virus transmission trials

It is not clear whether the disease symptoms seen in plants infected by RLBV are caused by the virus alone, moving within the plant systemically, or results from movement of mite carrying the virus to different parts of the affected plant. It has been shown that the bright yellow sectors of symptomatic raspberry leaves do carry higher levels of virus than the adjacent green sectors of the same leaves, but presence of virus in root samples suggest there can be movement of the virus without mite feeding. One method, in principle, to separate the virus from the mite vector, is to transfer the virus from an infected plant to another healthy plant by grafting, which should bypass the need to have mites to carry out the virus transmission. Grafting is a long-established method for virus-testing and is known to achieve the transfer of the great majority of viruses from plant to plant. Grafting experiments were initiated in 2014 to investigate whether the virus is moving systemically within raspberry in the absence of the mite. To do this, a section of an infected raspberry plant is grafted to a growing healthy raspberry plant using the bottle graft method.

In Year 1 grafts have been set-up to healthy Glen Ample, and to several other older cultivars that are maintained in collections at the James Hutton Institute known to be infected with other raspberry viruses. These latter graft experiments will test the hypothesis that infection of plants with multiple viruses results in increased disease symptoms and might also increase the level of virus in the plant and, thereby, increase the chance of successful transmission of RLBV through the graft. Grafted plants will be monitored in 2015 for visual symptoms and presence of the virus by PCR.

Main conclusions

- 30% of 95 samples taken in 2014 from 28 holdings throughout the UK tested positive for *Raspberry leaf blotch virus* (RLBV).
- There was a strong link between RLBV infection and presence of its vector raspberry Leaf and Bud mite (RLBM).
- 66% with characteristic RLBV symptoms were positive for the virus, with just 4% of samples showing no symptoms being positive.
- It has not been possible in this first year to determine if RLBV is moving systemically within raspberry plants.
- Several factors appear to be associated with a high incidence of RLBV including: variety, plantation age, type of planting material, spawn management, occurrence of wild raspberry and measures used for mite control which will be further investigated in 2015.

Financial benefits

- Increased knowledge of the scale, severity and main causes of this disorder which is becoming an increasing problem for many commercially grown varieties.
- Potential to reduce crop damage through development of a rational control strategy based on this better understanding of the mite-virus interaction.

Action points for growers

- Careful monitoring and virus testing of young plantations is important to identify the issue early and attempt to control the mite to avoid build-up of the mite over time.
- Highly susceptible varieties could be used as indicator plants in new plantations.