

Fruit for the Future – 2014

Raspberry virus diseases update

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- Raspberry leaf blotch virus (RLBV)
- Viruses and crumbly fruit
- Comments on report of plant virus and bee health

Wendy McGavin – virology
Carolyn Mitchell – entomology
Alison Dolan and Yvonne Pitkin –
soft fruit certification and nuclear
stock



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Raspberry leaf blotch virus (RLBV) and raspberry leaf and bud mite

**A new virus associated with an old disease and
on the increase in the UK and Europe**

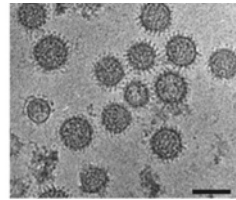
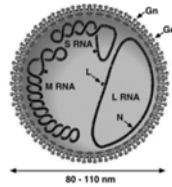
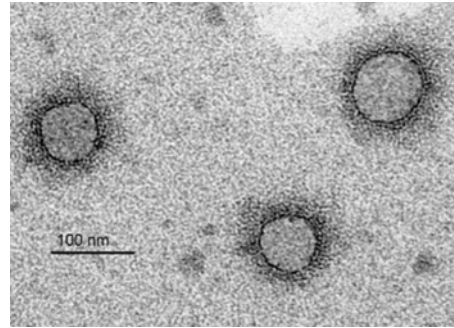


In 2007 we saw strong disease symptoms in covered crops growing at several farms in Fife and Tayside.

The disease symptoms had been seen previously (1970s/1980s), given the name raspberry leaf blotch disorder and attributed to the Raspberry Leaf and Bud Mite (*Phyllocoptes gracilis*). The disease is now very prevalent, perhaps because new cultivars are highly susceptible – recently there are reports from European countries outside the UK.



RLBV first identified at JHI Dundee. With a diagnostic molecular (RT-PCR) test that we have devised, the virus is now identified in England, Scandinavia and the Balkans no reports yet published for rest of Europe or USA.



RLBV belongs to a very new group of plant viruses that infect Mountain Ash, maize, fig, pigeon pea, rose and bramble – all are transmitted by mites.

They have some similarities to important insect-transmitted viruses (bunyaviruses) of humans and vertebrate animals, and also plant viruses e.g. Tomato spotted wilt virus.

We don't know yet how the full virus is composed – the bunyaviruses have 3 genetic segments, whereas RLBV has at least 8. We would like to know what function all these RLBV genes have – we expect the virus can multiply in both plants and mites, and maybe some of the virus components are necessary for the mite-infecting part of its life-cycle?

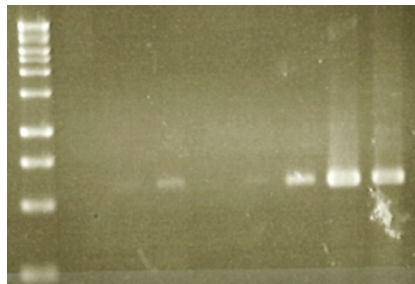


Janet Allen – ADAS - was concerned that RLBV might be responsible for a general die-back and decline that she has observed in Octavia and Tulameen, even though obvious virus symptoms are usually not present.

In 2013 she sent us material from England that we tested for the presence of RLBV.

1. Glen Fyne
2. Tulameen
3. Octavia
4. Glen Doll
5. Octavia

H 1 2 3 4 5 + +



RLBV detection by
RT-PCR in field
samples 1, 2, 4 & 5



Two new HDC projects have just begun at JHI Dundee that are related to RLBV

SF 158/31701480: Understanding the scale and importance of raspberry leaf blotch virus and its association with raspberry leaf and bud mite.

SF 149/31701490: Exploring whether redberry disease of blackberry is caused by a mite-transmitted virus.

Both projects undertaken in collaboration with Janet Allen and Harriet Roberts (ADAS)



SF 158/31701480: Understanding the scale and importance of raspberry leaf blotch virus and its association with raspberry leaf and bud mite.

- 3 year project.
- Survey of UK raspberry plantations, recording crop details, mite status and presence or absence of RLBV – detailed examination of selected infected plants in 2nd year, looking at seasonal effects on virus levels and detection.
- Grafting experiments to examine virus movement in raspberry and potential interactions with other viruses.
- Are all varieties equally susceptible to the virus?
- Is it possible to separate the virus from the mite or vice versa?



SF 149/31701490: Exploring whether redberry disease of blackberry is caused by a mite-transmitted virus.

- 1 year project.
- Use new technology to see if redberry-affected plants carry virus(es)
NB. Redberry is associated with mites.





Viruses and crumbly fruit



- A major problem worldwide
- No known single cause but may have genetic and environmental triggers.
- Virus infection can be associated with crumbly fruit and Raspberry bushy dwarf virus (RBDV, pollen-transmitted) is clearly associated in some “outbreaks”.
- RBDV testing, usually by ELISA (antibody detection) is routinely done for all material in JHI high-health collection.

Recent work (2013) in the USA showed that crumbly fruit-affected plants were infected with RBDV and two other viruses – Raspberry leaf mottle virus (RLMV) and Raspberry latent virus (RpLV). Both RLMV and RpLV are transmitted by the large raspberry aphid.

The presence of multiple viruses was associated with reduced can growth, fruit firmness and fruit weight. The concentration of RBDV in the plants was increased 400x by the presence of RLMV – an explanation for why having multiple viruses in a plant increases disease symptoms.

We have this (large raspberry) aphid and RLMV is commonly found in local raspberries. Very limited testing by us did not find RpLV but we have not looked properly!



Report of plant virus “infecting” honeybees



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How a Plant Virus May Help Cause the Beepocalypse

Bryan Walsh @bryanrwalsh | Jan. 22, 2014

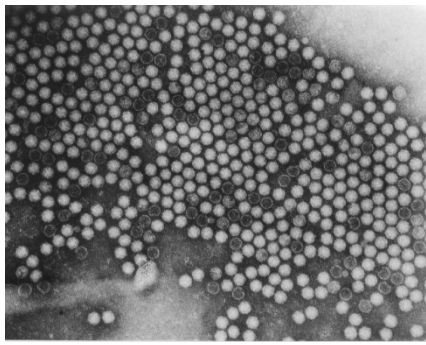
A new study finds that a plant pathogen could play a role in honeybee colony collapse disorder

Honeybees **are dying**. In the winter of 2012-2013, **one-third of U.S. honeybee colonies died or disappeared**, a 42 percent increase from the year before and well above the 10-15 percent losses beekeepers once

A new study says that a plant virus could be killing honeybees

YunhyokChoi via Getty Images

Systemic spread and propagation of a plant-pathogenic virus in European honeybees, *Apis mellifera*. Li et al., 2014 mBio 5, 1.



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What did they do?

Bees are known to be infected with a variety of viruses, the presence of which may be related to colony collapse disorder. The researchers **purified virus particles** from different bee colonies (homogenise the insects and do a physical separation to purify particles of virus size) then looked in the virus preparation to identify several viruses, including the plant virus, **Tobacco ringspot virus (TRSV)**.

They dissected bees into different parts and did a **sensitive test (RT-PCR) to detect TRSV in all tissues** (except for eye) - potential problem as no obvious negative controls shown in the paper?

They looked by RT-PCR for evidence of virus replication – potential problem as this assay is **prone to false positives**

Did a microscopy staining test (detecting TRSV RNA) in sections of **varroa mite**, finding the virus in the **mite gut only**. Suggested this was ingested virus only. Did not appear to do this test with bees!

Did RT-PCR to **look for TRSV** and other viruses **in 6 strong bee colonies and 4 weak bee colonies**. Found **TRSV only in weak colonies** And some of the other viruses were present at higher levels in the weak colonies. Used this to suggest these viruses “cause” Colony weakness (i.e. could lead to colony collapse).

Did not show **whether TRSV** in these bees was **infectious**, either by close contact transmission to other bees or by inoculation to plants.

What do we know about TRSV?

Pollen transmitted, inside or outside? Replication in insects known for other viruses but not for TRSV or similar viruses, **nematode transmitted**, pollen transmitted, seed transmitted, **wide plant host range** including **raspberry and blueberry**.