



# **Grower Summary**

## **Resistance and susceptibility in interactions between apple and woolly aphid**

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Annual report 2021

**Project title:** Resistance and susceptibility in interactions between apple and woolly aphid

**Project number:**

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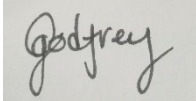
# AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

Cindayniah Godfrey

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# GROWER SUMMARY

## Headline

Woolly apple aphids in the UK are genetically different from in other countries and there is genetic variation within UK populations sampled. This is likely through sexual reproduction which was previously thought to not occur in the UK and may lead to spreading virulence genes such as for overcoming resistant rootstocks.

## Background

Woolly apple aphid (WAA) is a sap-feeding pest which originates from North America but has been in the UK since the 18<sup>th</sup> century. In America WAA shows both sexual and asexual reproduction but has broadly lost the sexual stage in the rest of the world, leading to reduced genetic diversity.

There have been reports of sexual forms of WAA in a number of countries around the world, including New Zealand, India, and Australia, all in major apple growing regions. A number of commercially available rootstocks contain WAA resistance genes including MM106, M.116, and some individuals from the Geneva rootstock line. There are some isolated reports of WAA feeding on some of these resistant rootstocks, mostly in the southern hemisphere however it is not yet certain how prolific these resistance-breaking WAA are.

Sexual reproduction leads to genetic flow between individuals and between isolated populations which can allow for faster spread of traits undesirable for growers, such as potential genes for insecticide resistance, although this has not yet been documented. Some WAA populations have been found in other countries which can feed on rootstocks which were bred to be resistant to WAA. It is not known what gene(s), if any, are responsible for this resistance-breaking ability but a sexually reproducing WAA population will be more likely to be able to spread this type of virulence gene between individuals.

It is thought that WAA in the UK are exclusively asexual and therefore there would be little genetic flow between populations. Woolly apple aphid are not especially mobile so it is unlikely that separate populations will be able to mix without sexual reproduction. Understanding the genetic diversity of WAA in the UK and around the world will help to predict how WAA populations are mixing and to speculate about how virulence genes may be able to spread.

This project aims to both better understand the pest species to aid their control and to develop potential novel control methods. Breeding plant material that is resistant to aphid feeding is an effective control method for integrated pest management. A number of resistant rootstocks

are currently available but there have been some reports in other countries of aphids feeding on these rootstocks. Expanding the potential breeding programme for WAA resistance to include resistances from different sources will give a greater range of resistance genes to choose from. Such a resource reduces the likelihood that resistance-breaking aphids will be able to break every resistance. There is also the possibility to combine multiple resistance genes to give longer lasting resistance to WAA.

## **Summary**

The main work package undertaken in the second year of this project was to analyse the genetic diversity of woolly apple aphid (WAA) samples collected from nineteen locations, mostly from around the south east of England. Samples were included from North America where the pest originates, and New Zealand where WAA is a serious pest, sexual WAA have been found, and populations has been observed feeding on rootstock material containing resistance genes.

## **Financial Benefits**

The UK apple industry is worth approximately £190M and makes up a significant proportion of the 605000 tonnes of top fruit sold in the UK annually (<https://agri-epicentre.com/impact/extending-the-availability-and-flavour-of-uk-apples/>). A 2011 report found that without pesticides the UK apple industry would suffer serious yield losses and become commercially unviable. The costs of plant protection services have increased in the fresh fruit sector since 2015 and with likely further pesticide restrictions in the future it is important to consider alternate pest control options. Resistant rootstocks offer a one-time investment at the beginning of an orchard's life to control WAA underground for that rootstock's use.

## **Action Points**

No action points for growers at present.