

Harnessing Nature For Pest & Disease Control in UK Top Fruit

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26<sup>th</sup> January 2023



# Part 1

# Pear Sucker (cacopsylla pyricola)



### The Problem

Pear Sucker Adults

#### Pear Sucker Nymphs

Pear Sucker Eggs





## The Damage









## The Control

- Traditionally control of pear sucker relied very heavily on broad spectrum insecticides such as pirimphos-methyl, amitraz or diflubenzuron to name but a few
- These were non-selective and as well as controlling the pest, also controlled the predators!
- As a result, the more you sprayed, the more you needed to spray!
- Well manicured orchards were believed to be best for keeping pear sucker populations low
- This is now widely accepted to NOT be the solution
- Long grass is now considered beneficial to provide shelter for pear sucker predators. Nettles are cultured to encourage anthocorids the main predator
- Earwig shelters also installed in many orchards



#### The Past

#### The Future?







#### Anthocorid Nymph



#### Anthocorid Adult







- $\cdot$  It is possible to introduce Anthocorids artificially
- Rate = 5 bottles/ha at a cost of approximately  $\pounds$ 30/bottle
- $\cdot$  Have to be applied by hand so high labour cost
- $\cdot$  Best applied in evening when more likely to stay on site
- Habitat management critical to ensure sustained control
- Spirotetromat only chemical effective at pear sucker control
- $\cdot$  Can only be used twice/season
- Warmer winters have led to pear sucker becoming a year round problem



# Part 2

# Apple Canker (neonectria ditissima)



## The Problem





## The Problem – Apple Canker

Infects wounds (petal scars, leaf scars, pruning/picking) all year round
 Conidia produced on young cankers - rain splash dispersed.
 Ascospores produced on old cankers (3months+) - wind dispersed !!

 $\cdot$  Killing trees - up to 30% of newly planted orchards

 $\cdot$  Reducing yield, quality and orchard longevity

• Causing **postharvest fruit rot** 

 $\cdot$  Commercial apple cultivars are highly susceptible.

- Difficult chemical control:
  - $\cdot$  Lack of effective chemical products
  - $\cdot$  Timing / delivery issues (leaf scars, picking wounds, rain…)
  - Orchard hygiene labour intensive

• Apple canker impact compounded by climate change





## The Future - Canker Management

Soil microbiome amendments for improved canker and climate change resilience?

In previous R&D projects:-

- Arbuscular mycorrhizal fungi (AMF) were found to:
  - $\cdot$  Help with tree nutrition and water management
  - Increase drought (Wu et al., 2015) and waterlogging tolerance (Tuheteru&Wu, 2017).
  - Reduce the severity of Botryosphaeria canker on apple in India (Krishna et al., 2010).
  - Reduce severity of Neonectria canker in cider apple in the UK (Berdeni et al., 2018).
- **Trichoderma spp**. been shown to control canker diseases on almond (Holland et al., 2021)







## Mycorrhiza (AMF)



- A fungus which grows in association with the roots of a plant in a symbiotic relationship
- Nutrient uptake primarily P, N and Zn
- Protection from biotic stress
  - $\cdot$  pathogens and herbivores
- Protection from abiotic stress
  drought, heavy metal tolerance, salinity
- Soil stabilisation (glomalin), compaction





## Trichoderma

• Fungi present in all soils which interact with the plant resulting in beneficial effects.





## The Future - Canker Management

#### <u>GKM: Resilient Apple Orchards project will investigate:</u>

- The effect of AMF and Trichoderma as soil amendments against abiotic stress and apple canker
  - AMF (SR1, Plant Works)
  - <u>Trichoderma harzianum, Trichoderma atroviride</u>
- In <u>newly established orchards:</u>
  - 4 water logging prone sites, 2 drought prone sites
  - Gala/M9 (160-200 trees per site)
  - 6 treatments: control, AMF, Tricho. 1, Tricho.2, AMF+T1, AMF+T2
  - Tree growth, tree establishment canker incidence measured
  - First results in summer 2023







# Canker Management – the future

## <u>GKM: Resilient Apple Orchards project will investigate:</u>

 $\cdot$  The delivery of AMF as a soil amendment in  $\underline{mature\,orchards:}$ 

- $\cdot$  During root pruning
- $\cdot$  With wild flowers
- $\cdot$  Tree growth, AMF colonisation of apple roots will be measured

Common name	% in mix	Evidence for AMF association
Common Knapweed	14	Yes
Viper's Bugloss	6	no reports
<b>Birdsfoot Trefoil</b>	13	Yes
Oxeye Daisy - (Moon Daisy)	17	Yes
Selfheal	12	Yes
Wild Carrot	11	Yes
Rough Hawkbit	9	Yes
Wild Red Clover	6	Yes
Musk mallow	6	no reports
Devil's-bit Scabious	6	Yes

















## Thanks to YOU for listening and to the following organisations:-





Plus:- Michelle Fountain NIAB EMR

Matt Papp-Rupar NIAB EMR

Louisa Robinson-Boyer NIAB EMR