Management of aphids and viruses in peas

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Aphid damage

• Large colonies cause significant feeding damage in peas

• The presence of honeydew leads to the development of disease infections

• Natural enemies are in some cases contaminants in peas

• Aphids are virus vectors
Key aphid species in peas

- **Pea aphid (Acyrthosiphon pisum)**
- Host plants: Moderate host range including peas, field beans, broad beans, vetch, clover and lucerne
- Considered one of the 14 aphid species of most agricultural importance in the world (Blackman and Eastop, 2007)
- Each adult female produces up to 12 nymphs per day – each nymph develops to adulthood in 7-10 days
- Is a vector for more than 30 viruses worldwide

Population growth optimal at 16 to 23°C
Aphid mortality increases above 23°C
Key aphid species in peas

- **Peach potato aphid (Myzus persicae)**
- Host plants: Highly polyphagous on summer hosts including species of potatoes, sugar beet, brassicas, lettuce and legumes; winter hosts are mainly *Prunus* spp. (eggs) and other crops and herbaceous plants (mobile stages)
- Has been shown to transmit over 100 viruses in about 30 different plant families
- Moves from plant to plant when crowded and doesn’t form dense colonies

  Risk is higher if overwintered brassica crops or other plant hosts are grown in neighbouring fields

  Mild winter conditions may lead to larger and earlier spring migration
Key aphid species in peas

- **Peach potato aphid (Myzus persicae)**
- Widespread resistance to car bamates (pirimicarb) since mid-1980’s and pyrethroids since late 1990’s – metabolic and target site resistance
- Resistance to neonicotinoids is recorded in some regions of Southern Europe where peaches are produced (target site and penetration resistance) and has been present since early-21st Century teens

Timeline of resistance development in *M. persicae*. Green bars indicate years where insecticides provide good control. Red bars indicate the development of control compromising resistance. Bass et al., 2014
Key aphid species in peas

- **Black bean aphid (Aphis fabae)**
- Host plants: Highly polyphagous on summer hosts including species of Allium, asparagus, beet, pepper, Chenopodium, thistle, soya, sunflower, legume but mainly affects sugar beet and legume crops; winter host is the common spindle (eggs) or wild legumes (mobile stages)
- Colonies in peas tend to be smaller than those seen in beans
- Greater impact from direct feeding than from virus transmission, although it can transmit viruses and spread existing infections from plant to plant
Total number of aphids recorded in suction traps per month 2017 (AHDB Aphid News)

In partnership with PGRO, Rothamsted Research, BBSRC, Frontier Agriculture, Agrii, Hutchinsons, FERA and SASA
Average suction trap totals per week 2002 to 2011

Bayer Crop Science with Rothamsted Research Insect Survey
Virus transmission

• Aphids have piercing-sucking mouth parts – they probe plant epidermal tissue and ingest phloem sap
• Viruses are transmitted by aphids in either a circulative (persistent) or non-circulative (non-persistent) manner
Virus transmission

• Circulative/ persistent – virus particles pass through the aphid gut and are transmitted in saliva

✓ Longer time for acquisition by the aphid and for the virus to become circulative and transmissible

✓ Depends on a specialised relationship between the aphid and the virus and therefore vector range tends to be more limited

✓ Allows for chemical control to be effective before the virus is transmitted
Virus transmission

• Non-circulative/ non-persistent – virus particles are attached to aphid mouth parts and are transmitted in this way
  ✓ Rapid acquisition and transmission, usually less than a few minutes
  ✓ ‘Probe’ feeding to find a suitable host can result in transmission
  ✓ Often these viruses have a broad range of aphid vectors and are transmitted more quickly than aphids can be knocked down by insecticides
Viruses present in peas in the UK

• **Seed-borne**
  ✓ Pea Seed-borne Mosaic Virus (PSbMV) – seed source, non-persistent and transmitted by a number of aphids including pea aphid, black bean aphid, cereal aphids and peach potato aphid
  ✓ Pea Early Browning Virus (PEBV) – semi-persistent and transmitted by seed and stubby root nematodes – cannot survive in the absence of nematodes

• **Aphid-borne**
  ✓ Pea Enation Mosaic Virus (PEMV) – persistent – pea aphid, potato aphid and peach potato aphid
  ✓ Pea Streak Virus (PeSV) – non-persistent – pea aphid
  ✓ Bean Leaf Roll Virus (BLRV) – persistent (pea top yellows virus) – pea aphid and peach potato aphid
  ✓ Bean Yellow Mosaic Virus (BYMV) – non-persistent and transmitted by a number of aphids including pea aphid, peach potato aphid, potato aphid and black bean aphid

• **Other**
  ✓ Broad Bean True Mosaic Virus (BBTMV) – transmitted by weevils and may be seed-borne
Pea Enation Mosaic Virus

Currently one of the most prevalent viruses in peas in the UK

Leaves develop a mosaic, mottled symptom at the top of the plant and vein clearing can occur. Veins may be ridged

Newer leaves may be smaller and distorted and older leaves may develop scaly structures (enations)

In severe infections when virus is transmitted prior to flowering, adventitious shoots develop from the leaf axils, which produce flowers that remain green and do not produce pods

Pods and peas are malformed

Plant hosts include field and broad beans, sweet pea, vetch and other wild legumes as winter hosts
PEMV control

- Infection may be prevented or reduced by the timely application of aphicides – applications should be related to aphid presence
  https://cereals.ahdb.org.uk/monitoring/aphid-news.aspx
- Bean Leaf Roll Virus, also persistent, may also be controlled using aphicides
- There may be difficulties predicting timing effectively when peas are grown in a schedule
- Each sowing may need slightly differently timed applications to prevent infection
- Peas at different growth stages in close proximity to each other, or to faba beans, may be at higher risk
- Some pea varieties may have better tolerance to PEMV
Pea Seed-borne Mosaic Virus

If the source of infection in a plant is seed, growth is stunted at an early stage. Infection can be aphid transmitted from primary infected plants and this can occur at any growth stage.

Leaves are rolled and pale in colour, pods are small and contain few seeds.

Where virus is transmitted prior to flowering the infection and symptoms are more severe.

Seeds may be undersized and display blistering or blemishing on the testa – this may resemble tennis ball markings.
PSbMV management

• Reduction of PSbMV transmission is difficult to achieve in the crop with aphicides as the virus is non-persistent, therefore transmitted quickly by pea aphid, black bean aphid and peach potato aphid. It is also thought to be spread by migrating cereal aphids that are probing for a suitable host.

• Use of un-infected seed is the principal means to control infection.

• Field and broad beans may also be infected and can act as a reservoir of infection if in close proximity to peas.
Active substances currently available in the UK

- **Pirimicarb**
  - 1 application
  - Maximum dose rate 0.28 kg/ha
  - 7 day harvest interval
  - Apply between 1 May and 31 August and not before GS 51 (first flower buds visible)
  - Will not always control *M. persicae*
- **Thiacloprid**
  - 2 applications
  - Maximum individual dose 0.4 litres/ha
  - 7 day harvest interval
  - Also controls pea midge
- **Pyrethroids**
  - Only partial control achieved
  - Maximum dose rate, number of applications and harvest interval varies with active substance
  - Incidental control may be achieved when pyrethroids are applied for control of pea moth
Resistance management

• Widespread and long-term reliance on a limited number of active substances has increased the level and potential of resistance

• Use alternating actives where possible – pea aphid and black bean aphid are still susceptible to both pirimicarb and thiacloprid, but only partially controlled by pyrethroids

• Peach potato aphid is currently susceptible to neonicotinoids in the UK and careful management of thiacloprid is required to prevent resistance

• New active substances with novel modes of action are required to allow alternation of insecticides for effective control

• Crop rotation and location are important to reduce the spread of viruses by aphids from crop to crop
Thank you

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