



# Crop Walkers' Guide

---

## Cane Fruit

*HDC is a division of the Agriculture and  
Horticulture Development Board*

# Contents

## Introduction 5

## Invertebrate Pests A

Large raspberry aphid	A.1
Small raspberry aphid	A.2
Whitefly	A.3
Two-spotted spider mite	A.4
Raspberry leaf and bud mite	A.5
Blackberry (Redberry) mite	A.6
Common green capsid/Tarnished plant bug	A.7
Raspberry cane midge	A.8
Raspberry beetle	A.9
Vine weevil	A.10
Clay-coloured weevil	A.11
Cantharid beetle	A.12
Raspberry moth (borer)	A.13
Double dart moth	A.14
Slugs	A.15
Leafhoppers	A.16
Blackberry leaf midge	A.17
Bramble shoot moth (webber)	A.18
Other tortrix caterpillars	A.19
Spotted wing drosophila	A.20

## Introduced Predators B

<i>Phtyoseiulus persimilis</i>	B.1
<i>Encarsia formosa</i>	B.2
<i>Amblyseius</i> and <i>Neoseiulus</i> species	B.3

Nematodes	B.4
<i>Metarhizium anisopliae</i>	B.5

<b>Naturally Occurring Predators</b>	<b>C</b>
--------------------------------------	----------

Anthocorid bugs	C.1
Lacewings	C.2
Ladybirds	C.3
Ground beetles	C.4
Rove Beetles	C.5
Parasitic Wasps	C.6
Hoverflies	C.7
<i>Typhlodromus pyri</i>	C.8
<i>Feltiella acarisuga</i>	C.9
<i>Aphidius</i> species	C.10
<i>Aphidoletes</i> species	C.11

<b>Diseases</b>	<b>D</b>
-----------------	----------

Grey mould or Botrytis	D.1
Powdery mildew	D.2
Spur blight	D.3
Cane spot	D.4
Cane blight	D.5
Midge blight	D.6
Yellow rust	D.7
Raspberry root rot	D.8
Verticillium wilt	D.9
Crown gall	D.10
Purple blotch of blackberry	D.11

# Contents

Downy mildew of blackberry	D.12
Rubus stunt of blackberry	D.13
Nematode-borne viruses	D.14
Raspberry leaf mottle and Raspberry leaf spot viruses	D.15
Black raspberry necrosis virus	D.16
Rubus yellow net virus and Vein-banding mosaic disease	D.17
Raspberry vein chlorosis virus	D.18
Raspberry bushy dwarf virus	D.19

## Credits

Acknowledgements	i
Photographic credits	ii
Disclaimer and copyright	vi

Every year, significant losses to cane fruit crops would be incurred unless crops were protected from the ravages of various pests and diseases. The UK horticultural industry has progressed significantly from the routine 'spray and pray' attitude of yesteryear – today the emphasis is on forecasting, monitoring, identifying and then employing biologically friendly treatments.

This Crop Walkers' Guide is aimed at assisting cane fruit businesses with their pest, predator and disease monitoring and identification. It is designed for growers, supervisors and their staff to use out in the field situation and includes images of the various economically important pests and diseases, their life cycles, together with short, easy-to-read comments.

It is impossible to show every symptom of every pest or disease and growers are advised to familiarise themselves with the range of symptoms that can be expressed and be aware that new problems can occasionally arise.

This guide makes no attempt at offering advice on the measures available to control these pests or diseases as these change all too regularly. Having identified a particular pest or disease on their crop, growers should acquaint themselves with the control measures currently available.

**Scott Raffle**

**HDC**



# Invertebrate Pests

# A





# Large raspberry aphid

(*Amphorophora idaei*)



- ▶ Large aphid, sometimes exceeding 3-4mm in length, with long siphunculi (the two tubes extending along the sides of the rear of the abdomen).
- ▶ It is shiny and light green in colour.
- ▶ Colonies are often found, throughout the growing season, on the underside of new raspberry foliage or in the apex of the primocane.
- ▶ Important as a vector of a range of viruses (see section D), but does not cause obvious physical damage to foliage.

# Small raspberry aphid

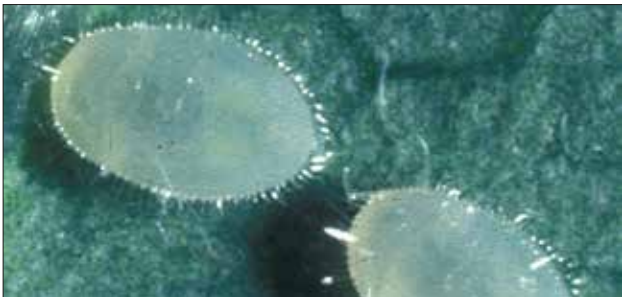
(*Aphis idaei*)



- ▶ Smaller than the large raspberry aphid. Wingless adults are pale green and covered with a waxy powder.
- ▶ Initially found on fruiting canes in late spring, then from mid-summer on primocanes. Colonies of wingless aphids develop on leaves and petioles, with feeding causing leaf curl and distortion.
- ▶ Winged adults are pale cream in colour, occur singly and are found hidden in the junction of two veins on the undersides of leaves.
- ▶ Important as a vector of Raspberry vein chlorosis virus.

# Whitefly

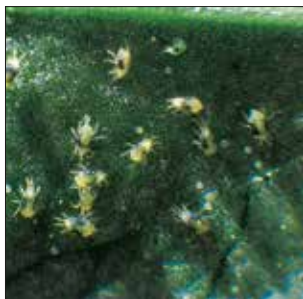
(*Trialeurodes vaporariorum*)



- ▶ Adults and larvae are found on the underside of leaves with the highest numbers normally occurring in late summer.
- ▶ Primarily a problem of glasshouse and fixed tunnel cane fruit crops, although numbers can build up on protected field-grown crops.
- ▶ The canes can be weakened by heavy infestations of the pest.
- ▶ Larvae produce copious amounts of honeydew that can contaminate fruit.

# Two-spotted spider mite

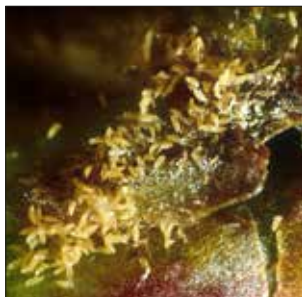
(*Tetranychus urticae*)



- ▶ Found on the underside of leaves, sucking sap. Over winter as adults on plant debris or in support structures. Populations peak in late summer.
- ▶ Sap sucking results in loss of photosynthetic activity, plant weakening, premature leaf drop, poor fruit quality and small fruit size.
- ▶ Foliage damage may be seen as general bronzing or as leaf speckling. In heavy infestations, considerable webbing can occur.

# Raspberry leaf and bud mite

(*Phyllocoptes gracilis*)



- ▶ Very difficult to detect (adults are 0.15mm in length). Females (light brown) over winter under the outer bud scales, while summer adults (translucent/yellow) feed on the undersides of leaves.
- ▶ Feeding causes irregular yellow blotches on leaves (can be confused with virus infection), later turning pale green.
- ▶ Further feeding gives rise to weak, highly branched canes with small leaves. Affected drupelets on fruits ripen prematurely, leading to misshapen berries. On loganberry, fruits dry out before they ripen.

# Blackberry (Redberry) mite

(*Acalitus essigi*)



- ▶ Tiny. Only visible by using x20 magnification.
- ▶ A pest of blackberry, feeding on developing flowers and fruitlets in spring and early summer.
- ▶ Damage is evident from uneven ripening of the fruit, with affected drupelets remaining green to red in colour and hard in texture.
- ▶ The mites over winter among bud scales.

# Common green capsid/Tarnished plant bug

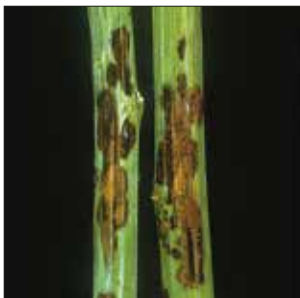
(*Lygocoris pabulinus*/*Lygus rugulipennis*)



- ▶ Two generations occur each year with adults migrating into plantations in May, with a second generation occurring from July onwards.
- ▶ The common green capsid feeds on leaves and in the apex of primocanes, giving rise to cane branching and distortion.
- ▶ The tarnished plant bug is associated with damage to flowers and developing fruits, giving rise to fruit malformation.

# Raspberry cane midge

(*Resseliella theobaldi*)

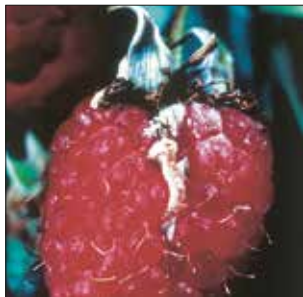


- ▶ Adult midges lay their eggs in the spring in splits in the rind of fruiting canes.
- ▶ The eggs hatch into salmon/pink larvae that feed on the periderm of the cane, giving rise to dark brown patch lesions.
- ▶ The damaged areas of these canes can then be invaded by a number of fungal organisms, leading to midge blight (see section D).
- ▶ Varieties that produce high numbers of splits in the rind of primocanes are most susceptible to attack.



# Raspberry beetle

(*Byturus tomentosus*)



- ▶ One generation per year with adult beetles (4mm long) migrating into crops from late May onwards; eggs are laid in developing flowers.
- ▶ Larvae feed on developing drupelets, initially causing little damage.
- ▶ Mature larvae (6-8mm long) feed mainly inside the ripening fruit on the softening receptacle.
- ▶ The larvae can contaminate harvested fruit and should be checked for on the grading line.

# Vine weevil

(*Otiorhynchus sulcatus*)



- ▶ Can cause significant damage in field plantations of raspberry and blackberry but it is most noted for the damage it causes to pot-grown plants.
- ▶ Adults feed on leaf margins and developing laterals at night and hide in plant debris at soil/compost level by day.
- ▶ Eggs are laid in late summer, hatching into larvae that feed on roots through the autumn and winter, causing plant collapse and death.

# Clay-coloured weevil

(*Otiorhynchus singularis*)



- ▶ Most commonly found in Scottish plantations.
- ▶ Adults are greyish brown in colour and often have particles of soil adhering to them.
- ▶ Very difficult to find as they are nocturnal and are easily dislodged.
- ▶ Feeds on developing buds, preventing flowering, and on laterals where they strip the epidermis causing loss of crop.

# Cantharid beetle

(*Cantharis obscura*)



- ▶ A very localised pest, being confined to districts in the east of Scotland.
- ▶ Adults (top left image) are large, 9-15mm in length, and chew the surface of fruiting laterals in early summer leading to lateral wilting or breakage.
- ▶ Easily confused with other cantharid beetles, most of which are voracious predators, such as the one in the picture (top right).

# Raspberry moth (borer)

*(Lampronia rubiella)*



- ▶ Larvae of this pest (red with a black head) can cause significant damage in the spring months.
- ▶ Adults emerge in early summer and lay their eggs in and around developing flowers.
- ▶ Over winters as larvae in the soil, before climbing the canes in spring and boring through developing buds, leading to bud failure and crop loss.

# Double dart moth

(*Graphiphora augur*)



- ▶ A localised pest in the east of Scotland.
- ▶ Larvae over winter in the soil, before emerging in the spring when they climb up the cane at night and feed on developing buds.
- ▶ Damage can be severe, particularly coinciding with a mild spell of weather.

# Slugs

(Various species)



- ▶ Slugs emerge from the soil and climb up developing primocanes, stripping the surface of the rind, making the canes more susceptible to secondary fungal infections.
- ▶ Damage occurs most frequently during and following periods of warm wet weather.
- ▶ Leaf damage is usually unimportant, but can be a good indicator for the more significant cane damage.

# Leafhoppers

(Various species)



- ▶ Adult leafhoppers vary in colour from cream to green and can be mottled. They are up to 4mm in length and are very active (flying or jumping). Young leafhoppers run rapidly on the foliage and hide under leaves.
- ▶ Feeding damage appears as distinct pinpricks of white speckling on the leaves and heavy feeding will cause a reduction in plant vigour. Blackberries are most seriously affected.
- ▶ Leafhoppers are a vector of Rubus stunt virus (see section D).



# Blackberry leaf midge

(*Dasineura plicatrix*)



- ▶ Attacks all cane fruit. Adults emerge in May outdoors, but earlier under protection. There are usually two generations each year, but in warm conditions a third can occur.
- ▶ Eggs are laid in furled leaves and the tiny larvae (up to 2mm long) feed together before pupating in the soil.
- ▶ Feeding damage causes leaf twisting and distortion and damaged tissue turns red to black.

# Bramble shoot moth (webber)

(*Epiblema uddmanniana*)



- ▶ A pest of blackberry and hybridberries.
- ▶ Adult moths fly in June and July. Eggs are laid in the tips of primocanes; larvae feed for about 3 weeks before hibernating in cocoons on the plant.
- ▶ The brown-coloured larvae re-emerge in early spring and feed on the shoot tips, fruiting laterals and flower buds.
- ▶ Feeding damage in the spring can lead to death of the primocane tips and cane branching and weakening. Flower damage can significantly reduce yield potential.

## Other tortrix caterpillars

(Various species)



- ▶ As their colloquial name (webbers) indicates, these small caterpillars produce silk which they use to bind leaves tightly together forming a protective canopy.
- ▶ They attack young leaves in shoot tips, often killing the terminal bud, causing stem branching.
- ▶ Caterpillars are slim and yellow green or brown, sometimes heavily spotted, and wriggle backwards rapidly when disturbed. Most species have two, or sometimes three, generations each year.

# Spotted wing drosophila

(*Drosophila suzukii*)



- ▶ Potentially, a very serious pest of all cane fruit crops. Males are characterised by a spot on each wing and females by a serrated ovipositor which allows them to penetrate the surface of the fruit skin.
- ▶ Eggs are laid under the surface of the skin and hatch into small, white larvae.
- ▶ The larvae contaminate the fruit and their feeding can give rise to fruit collapse.

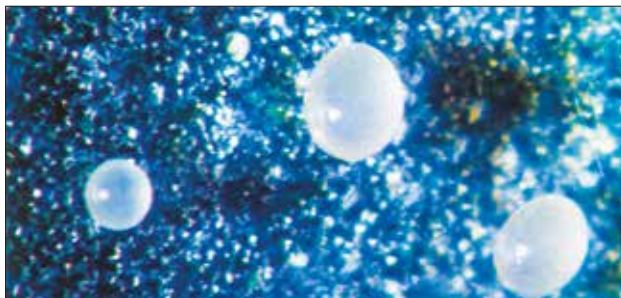
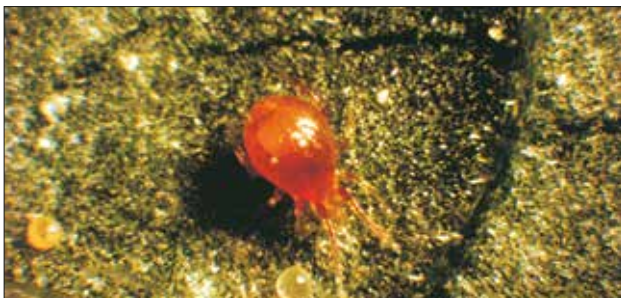
# Introduced Predators

# B



# *Phtyoseiulus persimilis*

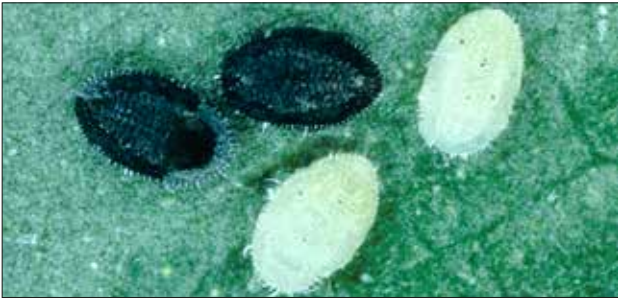
(Controls two-spotted spider mite)



- ▶ A predatory mite – both adults and juveniles feed on all stages of two-spotted spider mite.
- ▶ Plant foliage should be touching to allow the predatory mites to spread easily throughout the plantation.
- ▶ Works best in warm, moist conditions (15-30°C), but not in very hot, dry conditions.

# *Encarsia formosa*

(Controls whitefly)



- ▶ A parasitic wasp that lays its eggs in whitefly scales on the underside of leaves.
- ▶ The egg hatches into a larva that feeds inside the scale before pupating and re-emerging as an adult.
- ▶ *Encarsia formosa* only works well in protected crops and temperatures need to be 18°C for a few hours each day for it to work effectively.



## *Amblyseius* and *Neoseiulus* species

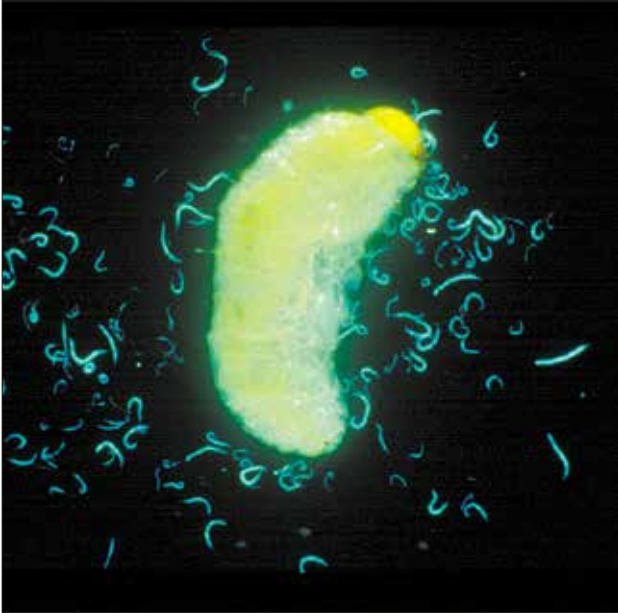
(Feed on mite species and thrips)



- ▶ Predatory mites (*N. cucumeris* is the most commonly used) that are most easily found on the underside of leaves.
- ▶ Adults and juveniles feed on small mites and thrips but can be slow to achieve good control. They need to be present in high numbers for good control to be achieved.
- ▶ Temperatures should be at least 10°C for these mites to work and leaves should be touching to allow mites to move from plant to plant.

# Nematodes

(Control vine weevil larvae, thrips and slugs/snails)



- ▶ Minute parasitic worm-like creatures applied as drench or spray.
- ▶ Carry pathogenic bacteria which kill target pest.
- ▶ *Heterorhabditis* spp and *Steinernema* spp. control vine weevil larvae.
- ▶ *Steinernema feltiae* controls thrips.
- ▶ *Phasmarhabditis hermaphrodita* controls slugs and some snails.

# *Metarhizium anisopliae*

(Controls weevil, midge and thrips larvae)



- ▶ An entomopathogenic fungus that kills the larval stage of weevils, midges and thrips in soils and soil-less substrates.
- ▶ The fungus is incorporated in the soil or substrate in a granular formulation and infects the larvae it comes into contact with.
- ▶ The fungal spores attach to the surface of the larvae, penetrate the surface and grow rapidly inside, causing the insect to die.
- ▶ The fungus also spreads by insect-to-insect transmission.



# Naturally Occurring Predators

# C





- ▶ A bug that feeds on aphids, spider mites, scale insects, small caterpillars, thrips and various eggs.
- ▶ Both adult and larval stages are predatory.

# Lacewings



- ▶ Feed on aphids and spider mites.
- ▶ Voracious predators – all larvae and some adults are predators.





- ▶ Feed on aphids, spider mites, thrips, small caterpillars and scale insects.
- ▶ All motile stages are predatory.

# Ground beetles

(*Carabids*)



- ▶ Feed on a wide range of soil pests and other insects that pupate in the soil, including caterpillars, vine weevil, slugs, midges and thrips.
- ▶ Both adults and larvae are predatory. Adults may feed on foliage pests low down on the cane.

# Rove Beetles

(Staphylinids)



- ▶ Feed on a wide range of soil pests and others, which pupate in the soil, including caterpillars, vine weevil, slugs and thrips.
- ▶ Normally found in the soil, but some species readily feed on foliage pests such as aphids and spider mites, during the night.

# Parasitic Wasps

(*Brachonids, Chalcids and Ichneumonids*)



- ▶ Each species has specific prey type and may be very specific to certain pest species.
- ▶ Aphids, beetles and caterpillars (including sawfly) are the usual prey types.
- ▶ Most are internal parasites, some insert only one egg per prey, others insert multiple eggs.
- ▶ Some adults are predatory.



- ▶ Adults are pollen and nectar feeders.
- ▶ Larvae are voracious predators feeding mainly on aphids; they are particularly useful for established aphid colonies.
- ▶ In the absence of aphids, larvae will also feed on a range of other invertebrates, including small caterpillars and spider mites.

## *Typhlodromus pyri*



- ▶ The most common of a number of predatory Phytoseiid mites (*Amblyseius* and *Neoseiulus* species are also seen) that are commonly found on perennial plants, particularly woody ones in hedgerows, coppices and woodland, especially trees.
- ▶ These mites feed mainly on spider mites, including two-spotted spider mite, but will also attack leaf and bud and blackberry mites.



- ▶ A predatory midge of two-spotted spider mite that seeks out its prey in a plantation.
- ▶ The adults fly, searching for spider mite colonies and lay small orange eggs.
- ▶ The cream/brown larvae that hatch out, feed on the spider mites before spinning a cocoon (pupa) and emerging as an adult midge.
- ▶ Most effective on heavy infestations of spider mite.

# Aphidius species



- ▶ *Aphidius* species (which prey on aphids) are parasitic wasps known as parasitoids. Different species parasitise different species of aphids, so for commercial introductions, the correct identification of the aphid is essential before choosing the appropriate parasitoid.
- ▶ The adult wasps fly and seek individual aphids or colonies.
- ▶ The adult female lays one egg in an aphid. The resulting larva feeds inside the aphid, killing it to leave a mummified aphid, before pupating and hatching as an adult.
- ▶ They work most reliably in protected crops.





- ▶ A midge that feeds on all species of aphids.
- ▶ The adult female midge searches for aphid colonies where she lays eggs that hatch into predatory larvae.
- ▶ Only works well when there are 15+ hours of daylight (May-September).

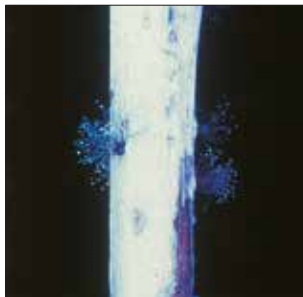


D



# Grey mould or Botrytis

(*Botrytis cinerea*)



- ▶ Botrytis can infect ripening and ripe fruits, producing a grey/ brown fluffy mycelium.
- ▶ Infection is most common during warm, wet and humid periods of weather.
- ▶ Also infects canes, producing pale brown water-soaked lesions between and around buds in the summer and autumn months.
- ▶ During the winter, lesions turn silvery/grey in colour and are often covered by the black resting bodies of the fungus (sclerotia).

# Powdery mildew

(*Sphaerotheca macularis*)



- ▶ This fungus attacks both green and ripe berries, producing a white powdery growth.
- ▶ Infection can occur on leaf tissue, particularly in the tips of primocanes.
- ▶ The disease is favoured by dense cane canopies and shaded conditions. It is most active and damaging during warm, dry, but humid weather conditions.

# Spur blight

(*Didymella applanata*)



- ▶ Infection occurs initially around developing buds on primocanes, producing purple coloured lesions, which, when rubbed, reveal a dark chestnut brown colour.
- ▶ Lesions extend as the canes grow and become grey/white.
- ▶ Tiny black dots called pseudothecia develop on the lesion as the winter progresses.
- ▶ The disease is favoured by warm, wet summer/autumn weather.

# Cane spot

(*Elsinoe veneta*)

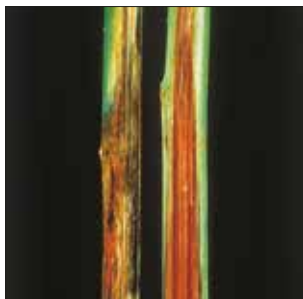


- ▶ Small sunken lesions or spots are initially found on the primocanes, leaves and flower stalks. Purple at first, they later turn grey as they enlarge and become sunken.
- ▶ Spots can coalesce and girdle a cane, which then dries out, and dies during the winter.
- ▶ Fruits can also be infected, with drupelets becoming pitted, remaining small and failing to ripen.
- ▶ Cane spot is most active in wet weather and most severe in uncovered plantations in wet seasons.



# Cane blight

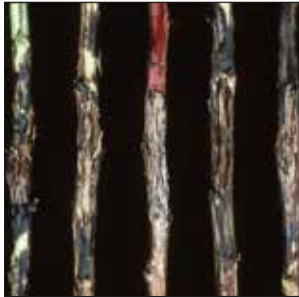
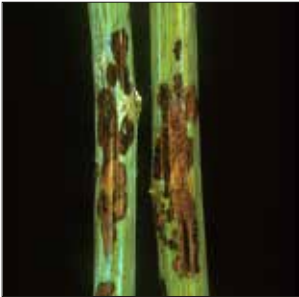
(*Leptosphaeria coniothyrium*)



- ▶ Affected plantations sometimes fail to break bud in the spring, or break bud and produce laterals that grow, before suddenly collapsing.
- ▶ Infected canes can be readily snapped near the base, where they are brittle.
- ▶ Initial infection usually occurs in the primocane during the growing season at the site of a wound.
- ▶ Although these are initially symptomless, the rind of the lower section of infected canes can be removed to reveal striped, brown vascular lesions.

# Midge blight

(Various)



- ▶ Often confused with cane blight, the affected canes failing to break bud, or producing laterals that suddenly collapse in spring.
- ▶ Characterised by dark brown patch lesions at the base of the canes resulting from fungal invasion following initial feeding by the raspberry cane midge.
- ▶ The midge invades splits in the rind of primocanes in spring and summer with lesions developing from mid-summer onwards.
- ▶ Infected canes show symptoms of die-back the following spring.

# Yellow rust

(*Phragmidium rubi-idaei*)



- ▶ Symptoms are usually first seen in the late summer as bright orange/yellow pustules on the underside of leaves. These later turn black.
- ▶ Spores over winter on cane bases and in leaf debris, infecting upper surfaces of lower leaves in spring.
- ▶ The disease is favoured by warm, moist weather.

# Raspberry root rot

(*Phytophthora rubi*)



- ▶ Fruiting canes and primocanes initially start to wilt and die, the latter often wilting from the tip downwards, appearing like a shepherd's crook.
- ▶ A lack of new spawn growth is noticeable in spring.
- ▶ Black/brown lesions can often be found at the base of primocanes, which often display early autumn leaf colours and premature leaf drop.
- ▶ The root system has very little new growth and remaining roots are dead and dying (brown/black in colour).

# Verticillium wilt

(*Verticillium dahliae*)



- ▶ Primocane leaves turn pale in summer, and then recover in autumn. In mainseason varieties, leaves on fruiting canes turn yellow (starting at the bottom), wilt and die and only a tuft of leaves remains at the top following leaf drop.
- ▶ In severe cases, infected primocanes are stunted and develop a blue colour on one side of the cane.
- ▶ In worst cases, yields are reduced or non-existent as a result of wilting, stunting and death of the canes.

# Crown gall

(*Agrobacterium tumefaciens*)



- ▶ A bacterium causing large cankerous swellings on raspberry and blackberry canes and roots.
- ▶ These growths draw upon the canes' resources, weakening the canes and reducing vigour.
- ▶ In most cases, the growths are only found on the roots below soil level.
- ▶ In severe cases, galls or growths can be found above ground at the base of canes or higher. In such cases, the section of cane above the gall or growth will die.

# Purple blotch of blackberry

(*Septocytia ruborum*)



- ▶ Characterised by red or brown coloured lesions that appear on primocanes in the autumn and winter months.
- ▶ From February until April the lesions expand up to 2cm in length and eventually coalesce to cover the stem.
- ▶ In severe cases, axillary buds fail to develop fully, then die back. The entire cane can often take on a barren/ desiccated appearance in the spring and can be confused with late spring frost damage.

# Downy mildew of blackberry

(*Peronospora sparsa*)



- ▶ Initial infection appears as a yellow discolouration on the upper leaf surface that soon changes to a red/purple colour.
- ▶ In many cultivars, distinctive purple angular lesions or blotches appear on the leaf mid rib and extend along the lateral veins.
- ▶ In severe cases, yellow margins develop around the lesions, which turn brown and die. This can lead to premature leaf drop.
- ▶ Infection of developing fruits induces premature reddening and the berries shrivel and darken rapidly.





- ▶ Rubus stunt, caused by a mycoplasma-like organism (MLO), is transmitted by a leafhopper.
- ▶ In both fruiting and primocanes, this causes a proliferation of dwarf spindly shoots, producing a 'witches broom' effect.
- ▶ Infected plants soon fail to produce a crop and eventually die.

# Nematode-borne viruses



- ▶ Four viruses (raspberry ringspot virus, tomato black ring virus, arabis mosaic virus, strawberry latent ringspot virus) are transmitted by soil inhabiting nematodes.
- ▶ The presence and type of symptoms depend upon the particular virus and cultivar combination. Laboratory analysis is essential for correct identification.
- ▶ Foliar symptoms in sensitive cultivars occur singly or in combination and include yellow flecks, rings or patterns, vein-yellowing of the lower leaves and downward curling of leaf margins. Cane stunting frequently occurs.

# Raspberry leaf mottle and Raspberry leaf spot viruses



- ▶ These two viruses are transmitted by the large raspberry aphid.
- ▶ Many cultivars show no symptoms when infected, but some develop randomly scattered angular chlorotic leaf spots on the leaves.
- ▶ Leaves are often small and deformed. Plantations decline in vigour and die within 2-4 years of infection.

## Black raspberry necrosis virus



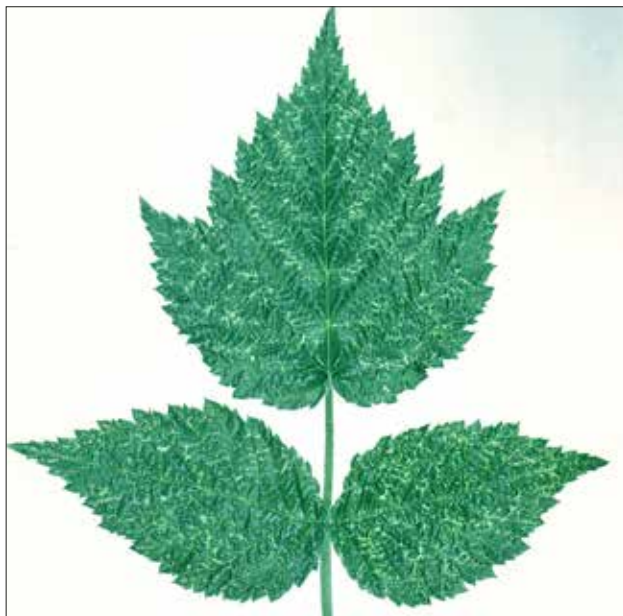
- ▶ Transmitted by the large raspberry aphid.
- ▶ Many cultivars show no symptoms, although some show faint chlorotic spots or mottling adjacent to the main leaf veins.
- ▶ Fruit quality is impaired in some cultivars.
- ▶ When present together with other viruses, the effects on growth and yield are greatly enhanced.

## Rubus yellow net virus and Vein-banding mosaic disease



- ▶ Transmitted by the large raspberry aphid.
- ▶ On its own, rubus yellow net virus causes no symptoms, but is often present in a complex with other aphid-borne viruses with some cultivars developing raspberry vein-banding mosaic disease.
- ▶ This produces a chlorosis of the leaf lamina adjacent to the main veins and can induce puckering of the leaf surface and an associated degeneration of vigour.

## Raspberry vein chlorosis virus



- ▶ Transmitted by the small raspberry aphid.
- ▶ Leaf symptoms are most commonly seen in late spring/early summer. Fully expanded leaves on primocanes develop a chlorosis of the fine leaf veins. Although plant growth is not normally visibly impaired, in some infected varieties, canes become thin and fruit size small.
- ▶ Most black and hybrid berries are immune, while raspberries differ in the severity of symptoms.

# Raspberry bushy dwarf virus



- ▶ Raspberry bushy dwarf virus is transmitted to plants by pollen and can, therefore, be spread by wind or insects. Raspberry, blackberry and loganberry are all susceptible.
- ▶ Most cultivars show no obvious symptoms, although some develop yellowing of the older leaves in late spring or early summer. Veinal chlorosis, inter-veinal chlorosis or complete yellowing of the leaf may occur.
- ▶ In addition, infection may induce the development of 'crumbly fruit' and a decline in plantation vigour.





This revised version of the Cane Fruit Crop Walkers' Guide (2013) has been amended to include some additional pests and introduced predators, along with a number of new and improved images.

The HDC is indebted to the following people for their help in making the revisions.

**Roger Umpelby** (Fruit entomologist) spent many hours photographing and collecting new and improved images for the guide, which had not been available when producing the original version. Roger also carefully amended and revised the text for the pest and predator sections.

**Adrian Harris** (EMR entomologist) who spent time photographing spotted wing drosophila larvae.

# Photographic credits

## Section A – Invertebrate Pests

- A1 (W) Large raspberry aphid adults, **Umpelby**  
A2 (TL) Small raspberry aphid colony, **JHI**  
A2 (TR) Close up of small raspberry aphids, **JHI**  
A2 (BL) Leaf curl caused by small raspberry aphid feeding, **JHI**  
A2 (BR) Small raspberry aphid eggs, **Umpelby**  
A3 (T) Whitefly scales, **Jacobson**  
A3 (B) Whitefly adults, **FLPA**  
A4 (TL) Adult two-spotted spider mites and their eggs, **ADAS**  
A4 (TR) Early symptoms of two-spotted spider mite damage, **Umpelby**  
A4 (BL) Severe feeding damage caused by two-spotted spider mite, **Umpelby**  
A4 (BR) Webbing produced by two-spotted spider mite, **ADAS**  
A5 (TL) Raspberry leaf and bud mite damage, **Umpelby**  
A5 (TR) Raspberry leaf and bud mite damage to upper leaf surface, **Umpelby**  
A5 (BL) Raspberry leaf and bud mite damage to lower leaf surface, **Umpelby**  
A5 (BR) Over wintering colony of raspberry leaf and bud mite under bud scales, **JHI**  
A6 (T) Blackberry mite damage to fruit, **Defra**  
A6 (B) Blackberry mite damage to fruit, **JHI**  
A7 (TL) Tarnished plant bug adult, **Umpelby**  
A7 (TR) Common green capsid adult, **Umpelby**  
A7 (BL) Capsid damage on blackberry leaf, **Umpelby**  
A7 (BR) Capsid damage on blackberry shoot tip, **Umpelby**  
A8 (TL) Female adult raspberry cane midge, **JHI**  
A8 (TR) Raspberry cane midge eggs, **JHI**  
A8 (BL) Raspberry cane midge larvae, **JHI**  
A8 (BR) Patch lesions caused by larval feeding, **JHI**  
A9 (TL) Raspberry beetle adult, **Defra**  
A9 (TR) Raspberry beetle larva on fruit plug, **JHI**  
A9 (BL) Fruit damaged by raspberry beetle larva, **JHI**  
A9 (BR) Larva on fruit, **Defra**  
A10 (TL) Adult vine weevil, **JHI**  
A10 (TR) Vine weevil larvae, **Defra**  
A10 (BL) Adult vine weevil feeding on leaf margin, **Umpelby**  
A10 (BR) Vine weevil notching on raspberry leaf, **Umpelby**  
A11 (TL) Clay coloured weevil adult, **JHI**  
A11 (TR) Clay coloured weevil adult, **Umpelby**  
A11 (BL) Clay coloured weevil damage to bud, **JHI**  
A11 (BR) Damaged versus unaffected canes, **JHI**  
A12 (TL) Adult Cantharid beetle, **JHI**  
A12 (TR) Predatory soldier beetle, **Umpelby**  
A12 (B) Adult Cantharid beetle damage to lateral, **JHI**  
A13 (TL) Raspberry moth larva feeding on bud, **JHI**  
A13 (TR) Raspberry moth larva, **JHI**

A13 (B) Raspberry moth adult, **JHI**  
A14 (L) Double dart moth adult, **JHI**  
A14 (R) Double dart moth larvae feeding on buds, **JHI**  
A15 (TL) Grey field slug, **Defra**  
A15 (TR) Slug *Arion ater*, **Defra**  
A15 (B) Slug leaf damage, **Umpelby**  
A16 (TL) Leafhopper adult, **Umpelby**  
A16 (TR) Leafhopper nymph, **Umpelby**  
A16 (B) Leafhopper damage to leaf, **Umpelby**  
A17 (TL) Blackberry leaf midge larvae, **EMR**  
A17 (TR) Blackberry leaf midge larvae, **ADAS**  
A17 (B) Blackberry leaf midge damage to shoot tip, **ADAS**  
A18 (T) Bramble shoot moth larva, **Smart**  
A18 (B) Bramble shoot moth damage to blackberry, **Thirlwell**  
A19 (T) Tortrix caterpillar on raspberry leaf, **Umpelby**  
A19 (BL) Tortrix damage on raspberry shoot, **Umpelby**  
A19 (BR) Tortrix damage on raspberry leaf, **Umpelby**  
A20 (TL) Adult male spotted wing drosophila, **EMR**  
A20 (TR) Adult male spotted wing drosophila on raspberry, **WSU**  
A20 (B) Spotted wing drosophila larva, **EMR**

#### **Section B – Introduced Predators**

B1 (T) *Phytoseiulus persimilis* adult, **ADAS**  
B1 (B) *Phytoseiulus* eggs, **ADAS**  
B2 (TL) *Encarsia formosa* adult, **ADAS**  
B2 (TR) *Encarsia formosa* laying eggs in whitefly scale, **BCP**  
B2 (B) Whitefly scales and parasitised scales, **ADAS**  
B3 (W) Neoseiulus cucumeris adult, **Syngenta Bioline**  
B4 (W) Vine weevil larva parasitised by nematodes, **BU**  
B5 (W) Vine weevil larvae killed by *Metarhizium anisopliae*, **UOS**

#### **Section C – Naturally Occurring Predators**

C1 (T) Anthocorid adult feeding on aphid, **Defra**  
C1 (B) Anthocorid juvenile feeding on aphid, **Umpelby**  
C2 (TL) Lacewing adult, **Umpelby**  
C2 (TR) Lacewing egg, **Umpelby**  
C2 (BL) Lacewing cocoon, **Umpelby**  
C2 (BR) Lacewing larva feeding on aphid, **Defra**  
C3 (TL) Ladybird eggs, **Defra**  
C3 (TR) Ladybird larva, **Defra**  
C3 (BL) Ladybird pupae, **Defra**  
C3 (BR) Ladybird adult, **Umpelby**  
C4 (T) Carabid adults feeding, **Umpelby**

- C4 (B) Ground beetle larva, **Umpelby**
- C5 (T) Staphylinid beetle, **Umpelby**
- C5 (B) Devil's coachhorse with vine weevil larva, **Umpelby**
- C6 (T) Parasitic wasp – Ichneumon, **Umpelby**
- C6 (B) Parasitised angle shades caterpillar, **Umpelby**
- C7 (TL) Hoverfly egg, **Umpelby**
- C7 (TR) Hoverfly larva, **Umpelby**
- C7 (BL) Adult hoverfly and pupa, **Umpelby**
- C7 (BR) Young hoverfly larva feeding on aphid, **Umpelby**
- C8 (W) *Typhlodromus pyri*, **EMR**
- C9 (T) *Feltiella acarisuga* larva feeding, **FLPA**
- C9 (B) *Feltiella acarisuga* pupa, **FLPA**
- C10 (T) *Aphidius ervi* adult, **FLPA**
- C10 (BL) Mummified aphid parasitised by *Aphidius*, **Umpelby**
- C10 (BR) Small raspberry aphids parasitised by *Aphidius*, **Umpelby**
- C11 (W) *Aphidoletes aphidimyza* larvae feeding on aphids, **ADAS**

#### **Section D – Diseases**

- D1 (TL) Botrytis on fruit, **ADAS**
- D1 (TR) Cane Botrytis in Autumn, **JHI**
- D1 (BL) Cane Botrytis in Spring, **JHI**
- D1 (BR) Botrytis sporulating in Spring, **JHI**
- D2 (TL) Powdery mildew on fruit, **JHI**
- D2 (BL) Powdery mildew infection on leaf, **ADAS**
- D2 (R) Powdery mildew infection on primocane, **ADAS**
- D3 (TL) Spur blight in Autumn, **JHI**
- D3 (TR) Spur blight in Spring, **ADAS**
- D3 (B) Spur blight in Spring, **JHI**
- D4 (TL) Cane spot in Summer, **ADAS**
- D4 (TR) Cane spot in Winter/Spring, **ADAS**
- D4 (B) Cane spot on fruit, **JHI**
- D5 (TL) Cane blight on wounded canes, **ADAS**
- D5 (TR) Cane blight in summer, **JHI**
- D5 (B) Cane blight over wintered, **JHI**
- D6 (T) Midge blight, **JHI**
- D6 (BL) Cane midge patch lesions, **JHI**
- D6 (BR) Second and third generation cane midge feeding damage, **ADAS**
- D7 (TL) Yellow rust on petiole, **Umpelby**
- D7 (TR) Yellow rust, **Umpelby**
- D7 (BL) Yellow rust on underside of leaf, **ADAS**
- D7 (BR) Black pustules on underside of leaf, **ADAS**
- D8 (TL) Phytophthora symptoms in primocane tip, **JHI**
- D8 (TR) Phytophthora symptoms in primocanes, **JHI**

D8 (B) Phytophthora damage to raspberry, **JHI**  
D9 (W) Verticillium wilt in field crop, **EMR**  
D10 (T) Crown gall, **Defra**  
D10 (B) Crown gall on blackberry canes, **ADAS**  
D11 (TL) Purple blotch on blackberry canes, **JHI**  
D11 (TR) Purple blotch close up on blackberry, **JHI**  
D11 (B) Purple blotch close up on blackberry, **ADAS**  
D12 (W) Downy mildew on blackberry leaf, **EMR**  
D13 (W) Rubus stunt in blackberry, **EMR**  
D14 (TL) Arabis mosaic virus, **JHI**  
D14 (TR) Strawberry latent ringspot virus, **JHI**  
D14 (BL) Raspberry ringspot virus, **JHI**  
D14 (BR) Raspberry ringspot virus, **JHI**  
D15 (TL) Raspberry leafspot virus, **JHI**  
D15 (TR) Raspberry ringspot virus, **JHI**  
D15 (BL) Raspberry leafspot virus, **JHI**  
D15 (BR) Raspberry leafspot virus, **JHI**  
D16 (W) Black raspberry necrosis virus, **JHI**  
D17 (W) Rubus yellow net virus, **JHI**  
D18 (W) Raspberry vein chlorosis virus, **JHI**  
D19 (TR) Raspberry bushy dwarf virus - crumbly fruit, **JHI**  
D19 (B) Raspberry bushy dwarf virus, **JHI**

### **Key**

Image position:

(T) = Top, (B) = Bottom, (L) = Left, (R) = Right, (W) = Whole page

### **Original source:**

**ADAS**

**BCP** = Biological Crop Protection

**BU** = Becker Underwood

**Defra** = Department of Environment, Farming and Rural Affairs

**EMR** = East Malling Research

**FLPA** = FLPA Images of Nature

**Jacobson** = Rob Jacobson

**JHI** = James Hutton Institute

**Smart** = Ben Smart

**Syngenta Bioline** = Syngenta Bioline

**Thirlwell** – Ian Thirlwell

**Umpelby** = Roger Umpelby

**UOS** = University of Swansea

**WSU** = Washington State University

While the Agriculture and Horticulture Development Board, operating through its HDC division, seeks to ensure that the information contained within this document is accurate at the time of printing, no warranty is given in respect thereof and, to the maximum extent permitted by law, the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

© Agriculture and Horticulture Development Board 2013. No part of this publication may be reproduced in any material form (including by photocopy or storage in any medium by electronic means) or any copy or adaptation stored, published or distributed (by physical, electronic or other means) without the prior permission in writing of the Agriculture and Horticulture Development Board, other than by reproduction in an unmodified form for the sole purpose of use as an information resource when the Agriculture and Horticulture Development Board or the HDC is clearly acknowledged as the source, or in accordance with the provisions of the Copyright, Designs and Patents Act 1988. All rights reserved.

***HDC is a registered trademark of the Agriculture and Horticulture Development Board (AHDB).***

***All other trademarks, logos and brand names contained in this publication are the trademarks of their respective holders. No rights are granted without prior written permission of the relevant owners.***