



Crop Walkers' Guide

Strawberry

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Introduction

Every year a significant proportion of the UK strawberry crop would be lost to insect pests and diseases if growers didn't monitor their crops and employ effective crop protection strategies.

This Crop Walkers' Guide is aimed at assisting growers, supervisors and their staff in the vital task of monitoring strawberry crops. It is designed for use in the field to help with accurate identification of pests, their predators (both introduced and naturally occurring) and diseases within a crop.

Images of key stages in the life cycles of pests, predators and diseases are included along with short easy-to-read comments to help with identification.

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

This Guide does not offer any advice on the measures available for controlling these pests or diseases as both chemical active ingredients and their approvals frequently change. However, having identified a particular pest or disease in their crop, growers should acquaint themselves with the currently available control measures.

Scott Raffle
Horticultural Development Company

Strawberry aphid

(*Chaetosiphon fragaefolii*)



- ▶ Small whitish-green aphid with distinct red eyes and prominent hairs between the antennae.
- ▶ Found on undersides of leaves throughout the year, but numbers reach a peak in early summer.
- ▶ Important as a vector for both strawberry crinkle and strawberry mild yellow-edge viruses.

Shallot aphid

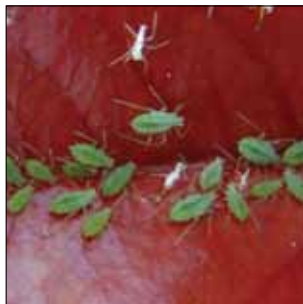
(*Myzus ascalonicus*)



- ▶ Very small aphid, pale brown, yellow/brown or greenish brown, and slightly shiny.
- ▶ Found amongst young leaves in centre of crown from autumn until early spring.
- ▶ Causes plant stunting and twisted foliage.

Potato aphid

(*Macrosiphum euphorbiae*)



- ▶ Large aphids with long legs, antennae, and siphunculi.
- ▶ Colour variable from yellow to green to pink, young aphids have a darker dorsal stripe.
- ▶ Little direct plant damage, but copious honeydew production causes fruit contamination.

Melon-cotton aphid

(Aphis gossypii)



- ▶ Normally present in dense colonies, very variable colour from pale yellow-green, through olive green to almost black.
- ▶ Found mainly on the leaf stems and around the flower and fruit trusses.
- ▶ Vector of strawberry mottle and strawberry mild yellow-edge viruses.

Glasshouse and potato aphid

(*Aulacorthum solani*)



- ▶ Yellow-green slightly globular aphids with long antennae.
- ▶ Body shiny, particularly in young aphids; has distinct dark patches at the base of siphunculi.
- ▶ Mainly on protected crops, but little plant damage caused.

Glasshouse whitefly

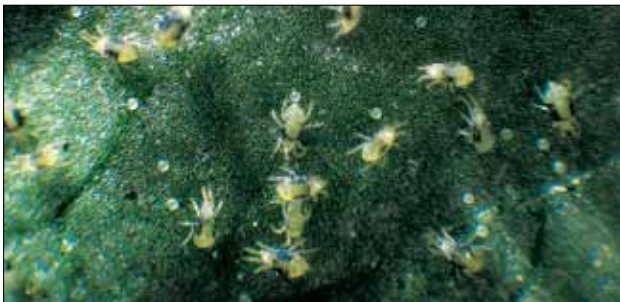
(Trialeurodes vaporariorum)



- ▶ Adults and larvae found on underside of leaves with highest numbers normally occurring in late summer.
- ▶ Mainly a problem of protected/covered crops.
- ▶ Plants are weakened by heavy infestations.
- ▶ The larvae (scales) are sap-feeders and produce copious amounts of honeydew that can contaminate fruit.

Two-spotted spider mite

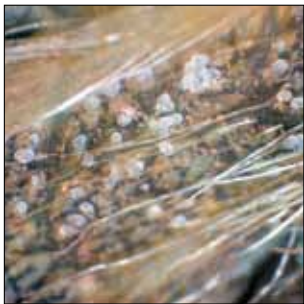
(*Tetranychus urticae*)



- ▶ Found mainly on the undersides of leaves. Adult female mites over-winter on debris in and around the plant.
- ▶ Infestations peak in mid to late summer, and are worst in hot dry weather.
- ▶ Sap sucking results in loss of photosynthetic activity, plant weakening, poor fruit quality and small fruit size.

Tarsonemid mite

(*Phytonemus pallidus* ssp. *fragariae*)



- ▶ Tiny. Only seen through x10 or x20 hand lens.
- ▶ The mites are found on young leaf tissue in the centre of the crown from early summer onwards, reaching a peak in hot conditions in August or September.
- ▶ Mites over-winter under leaf scales in the plant crown.
- ▶ Damage symptoms include plant stunting, distorted older leaves, upward-cupped young leaves with brown-stained upper surfaces, and fruit hardening.

Tarnished plant bug / capsids

(*Lygus rugulipennis* / *Lygocoris pabulinus*)



- ▶ Two generations occur each year with adults migrating into plantations from April with a second generation occurring from July onwards.
- ▶ Numbers tend to peak in July and August.
- ▶ The common green capsid causes severe leaf damage and distortion, while the tarnished plant bug feeds on flowers, causing fruit malformation.

Froghoppers

(Various species)



- ▶ Adults variable in colour, 5 to 8 mm long.
- ▶ Larvae normally pale green and covered in a mass of white froth (cuckoo-spit).
- ▶ Feeding damage is not important, but froth causes picking problems and contaminates fruit.

Thrips

(Various species)



- ▶ Up to 2 mm long, adults normally brown or black, larvae very pale and insignificant.
- ▶ Normally found in open flowers.
- ▶ Many generations each year, some as short as 2–3 weeks in hot weather.
- ▶ Most thrips cause little or no damage, but some, eg the western flower thrips, cause bronzing and hardening of the receptacle and, in severe cases, fruit distortion.

Vine weevil

Otiorhynchus sulcatus



- ▶ Adults emerge from late spring and feed at night on leaf margins causing distinctive notching. By day they hide in plant debris.
- ▶ Eggs are laid in late summer, hatching into larvae which feed on roots in the soil through the autumn and winter, giving rise to plant collapse and death.
- ▶ Presence of orange frass in crown tissue indicates larval activity.

Pea and bean weevil

(*Sitona lineatus*)



- ▶ The adult weevils migrate into strawberry crops from legumes such as clover or peas in late July and August and can be found feeding on the leaf margins.
- ▶ Not a major pest of strawberry, but the damage it causes to leaves can be mistaken for vine weevil damage. However, the leaf notches are smaller and more ragged.

Strawberry blossom weevil

(Anthonomus rubi)



- ▶ Adults are found in and around developing flowers from April onwards, peaking in number in late May.
- ▶ Adults feed on leaves and petals causing small holes and discolouration.
- ▶ Eggs are laid in flowers after the female girdles the petiole with punctures. The larva feeds in the dying flower.

Caterpillars – tortrix



- ▶ The strawberry tortrix, the carnation tortrix and the flax tortrix are the species most commonly found on strawberries, and each normally has two generations a year.
- ▶ Tortrix caterpillars cause damage mainly between April and September, webbing young leaves and flower trusses together for protection while they feed. Some species will also feed on developing fruit.

Caterpillars – noctuid



- ▶ Noctuid moth caterpillars, eg the cabbage moth, are much larger than tortrix caterpillars and may have one or two generations each year with most damage occurring between June and October.
- ▶ Noctuid caterpillars do not web leaves together but eat large holes in leaves and sometimes damage the crown or fruit.



- ▶ Slugs are active and feed throughout the year, although they stop feeding and move down into the soil during periods of frost and drought.
- ▶ They are most active on still nights when the soil is wet and the atmosphere humid.
- ▶ Several species cause damage in strawberry crops, mainly by feeding on developing and ripe fruits.
- ▶ String-like frass distinguishes slug damage from other pests.

Strawberry seed beetle

(*Harpalus rufipes*)



- ▶ Damage is caused by adult beetles feeding at night.
- ▶ The beetles remove the seeds and damage the surrounding flesh of the fruit, thus rendering it unmarketable.
- ▶ Adults are almost indistinguishable from some predatory beetles (see page C.4).
- ▶ Birds, such as linnets, can cause similar damage.

Pollen beetle (*Meligethes* species)



- ▶ Only adults occur in strawberries. Small shiny beetles up to 2.5 mm long.
- ▶ Feed exclusively on pollen, but can cause damage to other parts of the flower reducing pollination capability.
- ▶ With very high numbers, some fruit damage may occur.

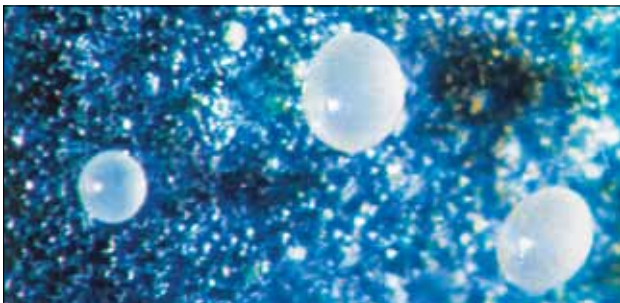
Nematodes (Eelworms)



- ▶ Minute worm-like invertebrates which can only be identified by nematologists using a microscope.
- ▶ Most pest species live in the soil and attack the plant roots, causing stunting.
- ▶ A few species, eg the leaf and bud nematode, live on or in leaf tissue causing distorted foliage and stunting.
- ▶ Some species, such as *Xiphinema* and *Longidorus*, transmit viruses which cause various foliar symptoms and crop loss; see section 'D'.

Phytoseiulus persimilis

(Controls two-spotted spider mite)



- ▶ A predatory mite, all motile stages feed on two-spotted spider mite adults, juveniles and eggs.
- ▶ Works best in warm, moist conditions (15–30°C).
- ▶ Leaves should be touching to allow mites to move from plant to plant.

Feltiella acarisuga

(Controls two-spotted spider mite)



- ▶ A midge that seeks out prey for its larvae and lays eggs in spider mite colonies.
- ▶ The cream/brown legless larvae which hatch out feed on the spider mites, before spinning a cocoon and pupating.
- ▶ Is most effective on heavier infestations of spider mite.

Encarsia formosa

(Controls whitefly)



- ▶ A parasitic wasp that lays its eggs in whitefly scales on the undersides 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.

Aphidius species

(Control aphids)



- ▶ *Aphidius* species are parasitic wasps known as parasitoids. Different species parasitise different species of aphids, so correct identification of the aphid must be made before choosing the appropriate parasitoid.
- ▶ The adult wasps lay eggs in aphids. On hatching, the larva feeds inside the aphid (killing it to leave a mummified aphid) before pupating.
- ▶ Best in protected crops.

Aphidoletes aphidimyza

(Controls aphids)



- ▶ Larvae feed on all species of aphids on strawberry.
- ▶ 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 (ie May-September).

***Amblyseius* species**

(Feed on t.s.s.m, tarsonemid mite and thrips)



- ▶ These predatory mites hide amongst young leaves and in flower buds and can be difficult to find.
- ▶ They need to be present in high numbers for quick 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.

Hypoaspis species

(Feed on thrips & tarsonemid mite)



- ▶ Predatory mites that live in soil or compost and feed on thrips pupae.
- ▶ Will search low down on plants for tarsonemid mites and thrips larvae and adults.

***Orius* species**

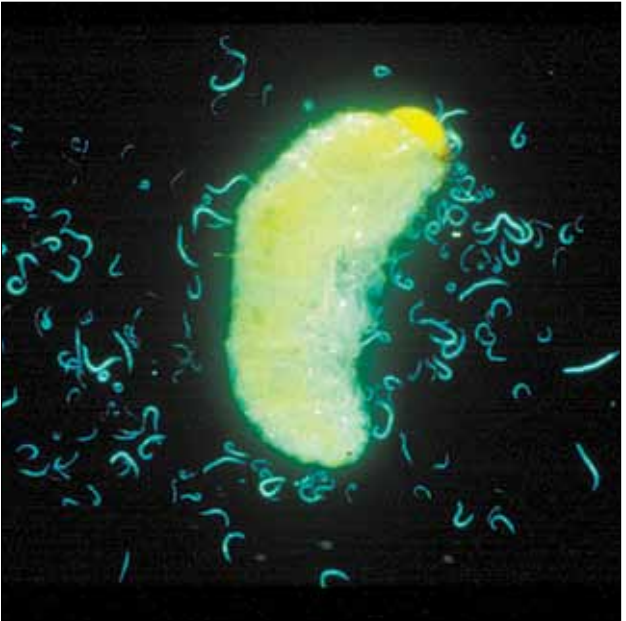
(Feed on thrips and other small pests)



- ▶ Predatory bugs which eat both thrips adults and larvae.
- ▶ Can be used in flowering crops as part of an IPM strategy to contribute to control where numbers of thrips are high.

Nematodes

(Various genera and species)



- ▶ 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.
- ▶ *Phasmorhabditis hermaphrodita* controls slugs and some snails.



Anthocorid bugs



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

Lacewings



- ▶ Feed particularly on aphids, but many other small foliage pests are attacked.
- ▶ Voracious predators – all larvae and some adults are predators.



- ▶ Aphids are the preferred prey; also feeds on moth eggs, small caterpillars, spider mites, thrips, and whitefly scales.
- ▶ All motile stages are predatory.

Ground beetles

(Carabids)



- ▶ Feed on a wide range of soil pests such as vine weevil and slugs.
- ▶ Also feed in the soil on the pupae of pests such as thrips and caterpillars.
- ▶ Some carabids will climb onto the lower leaves to feed on foliage pests.

Rove beetles

(Staphylinids)



- ▶ Feed on a wide range of soil pests and pupae in the soil, including caterpillars, vine weevil, slugs and thrips.
- ▶ Normally found in the soil, but some smaller species readily climb on the foliage at night and feed on small pests such as aphids and spider mites.

Parasitic wasps

(Brachonids, Chalcids and Ichneumons)



- ▶ Each species has specific prey type and may be very specific to certain pest species. Aphids, beetles and caterpillars (including sawfly) are the usual hosts.
- ▶ The larvae usually are internal parasites, but a few attacking caterpillars are external parasites.
- ▶ Numbers of parasites per host individual varies from one for aphid parasites, to over 50 for some caterpillar parasites.

Hoverflies

(Syrphids)



- ▶ Larvae feed mainly on aphids, but will also feed on other small prey such as caterpillars and spider mites.
- ▶ Larvae are voracious feeders, particularly in established aphid colonies.
- ▶ Adults are not predatory.

Predatory mites

(Mainly *Amblyseius* spp. and *Typhlodromus pyri*)



- ▶ Small active, normally colourless or pale, mites which are common on perennial plants in hedgerows, coppices and woodland.
- ▶ Mainly predators of spider mites and their eggs, but they also feed on other mites, eg tarsonemid mite, and on thrips.

Botrytis

(*Botrytis cinerea*)



- ▶ Commonly known as grey mould, *Botrytis* is found on old leaf debris, young leaves, leaf petioles, flower buds, petals and flower stalks as well as ripening and ripe fruits.
- ▶ Initial symptoms are a brown rot, often on the calyx end or sides of fruit with the infected part or the whole fruit later becoming covered in a grey dusty mat of fungal spores.
- ▶ The fungus is most active during warm, humid conditions.

Powdery mildew

(*Podosphaera aphanis*)



- ▶ This fungus is found on leaves, flower stalks, flowers and fruit.
- ▶ White powdery mycelium can be found on infected fruits and on the undersides of leaves. When infection becomes more severe on the leaves, they become up-cupped displaying dark red or purple blotches on their lower surface.
- ▶ The disease is most active and damaging during warm, dry, but humid weather conditions. Protected crops are most susceptible to infection.

Blackspot

(*Colletotrichum acutatum*)



- ▶ This is mainly a disease of ripe fruit, but can also attack leaves, petioles, stolons and the crown, where it can remain almost symptomless until conditions favour it.
- ▶ Sunken brown or black lesions are the most common symptom on fruits, petioles and stolons.
- ▶ The disease is spread by water splash, wind-blown rain, insects and pickers.
- ▶ It infects and spreads most rapidly during warm (25–39°C), wet and humid conditions.

Leaf spot

(*Mycosphaerella fragariae*)



- ▶ Lesions develop on leaves, petioles, stolons and fruit. Leaf lesions are most common and are found on the upper and lower side of the leaf.
- ▶ First seen and most distinct as small irregular deep purple or reddish spots on the upper surface of mature leaves, later becoming grey with a clear reddish margin, often with a pin-point white centre.
- ▶ Similar symptoms are seen on infected petioles and runner stolons.

Leaf blotch

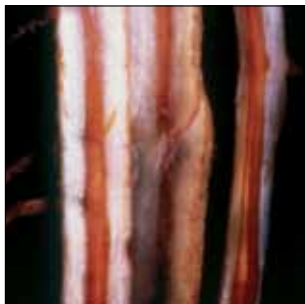
(*Zythia fragariae*)



- ▶ Mainly a disease of the leaf, although lesions can spread to fruiting stalks resulting in shrivelling of stalk tissues and subsequent loss of fruit.
- ▶ Symptoms appear on leaves as brownish blotches with yellow margins on the leaves that eventually cover and kill the leaf and spread down the petiole.

Red core

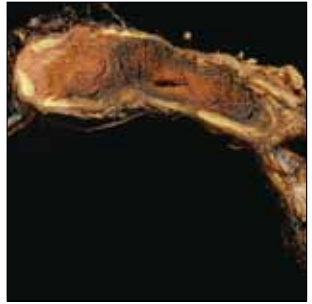
(*Phytophthora fragariae*)



- ▶ A soil-borne fungal disease that affects the roots, causing root death, plant collapse and plant death.
- ▶ Symptoms on the plant appear initially as stunting in the spring and early summer, with leaves exhibiting a blue/green appearance.
- ▶ Inspection of the root symptoms reveals unbranched roots (resembling a rat's tail) and when sliced longitudinally, these exhibit a red colour in the stele or cortex of the root.

Crown rot

(*Phytophthora cactorum*)



- ▶ A soil-borne fungal disease that affects the plant crown.
- ▶ Initial symptoms appear on the plant in spring and summer, often during hot spells of weather. The plant often exhibits stunting, before wilting and dying. In addition, sometimes blackening of petioles occurs with an internal dry brown rot at their base.
- ▶ When removed from the soil and split longitudinally, the crown tissue exhibits staining with dark red or brown colour.

Verticillium wilt

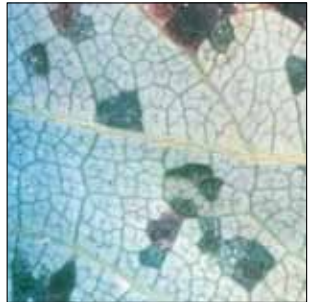
(*Verticillium dahliae*)



- ▶ A soil-borne disease that infects plant roots and reduces the ability of plants to take up water from the soil.
- ▶ Most commonly seen in strawberry following a period of hot and dry weather.
- ▶ Infected plants show wilting symptoms starting from the older leaves around the circumference of the plant. This gives the plant a 'halo' effect. Severe infection causes the whole plant to collapse and die.
- ▶ No visual symptoms can be seen on the roots or in the crown of infected plants.

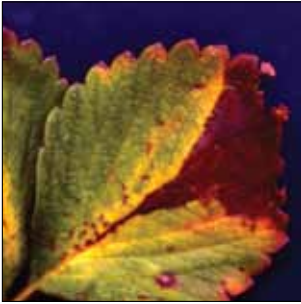
Angular leaf spot

(*Xanthomonas fragariae*)



- ▶ A bacterial disease that is not currently a major problem in the UK.
- ▶ Initial symptoms appear as small angular water soaked spots on the under surface of leaves which enlarge to 1–4 mm in diameter, appearing on the upper leaf surface and become black or reddish brown, covered by a slimy bacterial exudate.
- ▶ Where spots are numerous, they can coalesce, leading to leaf necrosis. Further spread in the vascular system to the crown tissue can lead to whole plant death.

Xanthomonas arboricola pv. *fragariae*



- ▶ Dry brown necrotic leaf spots and large brown V shaped lesions around the leaf margins, mid rib and major leaf veins. These spots differ from those of Angular leaf spot (caused by *Xanthomonas fragariae*) in that they are dry rather than being water soaked in appearance.
- ▶ Small red/brown spots on the leaf surfaces enlarge and become surrounded by a chlorotic halo.
- ▶ In the latter stages of the disease, leaf yellowing occurs followed by complete withering of the leaf. However, no symptoms are observed on flowers or fruits.

Strawberry green petal



- ▶ A phytoplasma spread by leafhoppers.
- ▶ In spring, young leaves are chlorotic, reduced in size, and frequently asymmetrical.
- ▶ Flower petals are smaller than normal and are sometimes green. The fruits fail to swell and the plants often wilt and die during the summer months.
- ▶ After flowering, the mature leaves become red or bronze in colour.

Strawberry mottle virus



- ▶ Spread by the strawberry aphid and melon-cotton aphid, this is the most common virus of strawberries.
- ▶ There are numerous strains which are often symptomless.
- ▶ When symptoms do appear, they range from a mild mottle on leaves to severe stunting and distortion through to plant death.

Strawberry crinkle virus



- ▶ A virus spread by the strawberry aphid.
- ▶ Symptoms are chlorotic to necrotic spots associated with the veins of leaves, with short lengths of cleared or yellowed veins often radiating from them. The leaflets of infected leaves usually vary in size and are distorted and crinkled.

Strawberry mild yellow edge virus



- ▶ Transmitted by the strawberry aphid, this virus often occurs in mixed infections with one or more of the other strawberry viruses.
- ▶ Initial symptoms appear as small, chlorotic flecks on the minor veins.
- ▶ The chlorosis later increases, and affected leaves become necrotic and die.

Strawberry vein-banding virus



- ▶ Transmitted by the strawberry aphid, this is the least common of the aphid borne viruses.
- ▶ Most varieties remain symptomless when infected, but when mixed with other viruses such as crinkle virus, more serious damage occurs.
- ▶ On the rare occasions where strawberry vein-banding virus does produce symptoms on its own, vein-banding, leaf curl or necrosis may occur.

Arabis mosaic virus



- ▶ Transmitted by the free living nematode *Xiphinema diversicaudatum*.
- ▶ Infected foliage shows chlorotic mottling (diffuse, vivid yellow spots, blotches or streaks) or mosaic symptoms. Leaves may be twisted, up-cupped or crinkled. Leaf symptoms are most visible in the spring and autumn months.

Acknowledgments

This revised version of the Strawberry Crop Walkers' Guide (2010) has been amended to include a number of pests and diseases that were not included in the original version (2004).

The HDC is extremely 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.

Janet Allen (ADAS) and **Angela Berrie** (East Malling Research) spent considerable time in revising the text and procuring new and improved images for the disease section.

Photographic credits

A1 (T) Strawberry aphid, **EMR**; A1 (B) Strawberry aphid colony, **EMR**; A2 (TL) Twisted foliage caused by shallot aphid, **EMR**; A2 (TR) Shallot aphid, **ADAS**; A2 (B) Plant stunting caused by shallot aphid, **Defra**; A3 (T) Potato aphid colony, **Umpelby**; A3 (BL) Potato aphid, **Umpelby**; A3 (BR) Close up of potato aphid colony, **Umpelby**; A4 (TL) Melon-cotton aphid colony, **Umpelby**; A4 (BL) Melon-cotton aphid, **ADAS**; A4 (R) Melon-cotton aphid colony on plant stem, **Umpelby**; A5 (T) Glasshouse and potato aphid, **EMR**; A5 (B) Glasshouse and potato aphid in strawberry flower, **Umpelby**; A6 (TL) Glasshouse whitefly – scales, **BCP Certis**; A6 (TR) Glasshouse whitefly – adult and scales, **Umpelby**; A6 (B) Glasshouse whitefly – adults, **FLPA**; A7 (T) Two-spotted spider mite – eggs and adults, **ADAS**; A7 (BL) Two-spotted spider mite – webbing, **FLPA**; A7 (BR) Two-spotted spider mite – damage to leaf, **Umpelby**; A8 (TL) Tarsonemid mite – eggs and adults, **ADAS**; A8 (TR) Tarsonemid mite – leaf damage, **Umpelby**; A8 (B) Tarsonemid mite – plant damage, **Umpelby**; A9 (TL) Tarnished plant bug adult, **Umpelby**; A9 (TR) Common green capsid adult, **Umpelby**; A9 (BL) Common green capsid nymph, **Umpelby**; A9 (BR) Damage caused by capsid feeding, **Umpelby**; A10 (T) Froghopper adult, **Umpelby**; A10 (BL) Froghopper larva, **Umpelby**; A10 (BR) Froth produced by frog-hopper, **Umpelby**; A11 (TL) Cereal thrips, **Defra**; A11 (TR) Thrips damage to petals, **EMR**; A11 (BL) Fruit malformation caused by thrips feeding, **Umpelby**; A11 (BR) Fruit bronzing caused by thrips feeding, **ADAS**; A12 (TL) Vine weevil adult, **Umpelby**; A12 (TR) Leaf damage caused by adult vine weevil, **Umpelby**; A12 (BL) Vine weevil larva, **Umpelby**; A12 (BR) Damage to crown caused by vine weevil larvae, **ADAS**; A13 (TR) Pea and bean weevil adult, **Umpelby**; A13 (B) Leaf damage caused by adult pea and bean weevil, **Umpelby**; A14 (TL) Strawberry blossom weevil adult, **Umpelby**; A14 (TR) Strawberry blossom weevil adult feeding on petal, **Umpelby**; A14 (BL) Damage to flower buds caused by strawberry blossom weevil, **Umpelby**; A14 (BR) Petiole punctured behind flower bud by strawberry blossom weevil, **Umpelby**; A15 (T) Tortrix moth caterpillar, **FLPA**; A15 (B) Leaf damage to blackcurrant caused by tortrix moth caterpillar, **Umpelby**; A16 (TL) Noctuid moth eggs, **Umpelby**; A16 (TR) Cabbage moth caterpillar and adult, **Umpelby**; A16 (BL) Leaf damage caused by noctuid moth caterpillar, **Umpelby**; A16 (BR) Fruit damage caused by noctuid moth caterpillar, **Umpelby**; A17 (TL) Field slug, **Defra**; A17 (TR) Slug – *Arion* species, **Defra**; A17 (BL) String-like slug frass and leaf damage, **Umpelby**; A17 (BR) Damage caused by slugs, **ADAS**; A18 (W)

Strawberry seed beetle and damage, **Defra**; A19 (W) Pollen beetle adults in flower, **Umpelby**; A20 (T) Free living nematode damage on beds, **Umpelby**; A20 (BL) Leaf and bud nematode damage, **ADAS**; A20 (BR) Stem eelworm (*Ditylenchus*) damage, **ADAS**; B1 (T) *Phytoseiulus persimilis* adult, **ADAS**; B1 (B) *Phytoseiulus persimilis* eggs, **ADAS**; B2 (T) *Feltiella acarisuga* larva, **FLPA**; B2 (B) *Feltiella acarisuga* pupa, **FLPA**; B3 (T) *Encarsia formosa* adult, **ADAS**; B3 (B) Whitefly scales and parasitised scales, **ADAS**; B4 (T) *Aphidius ervi* adult, **FLPA**; B4 (B) Mummified aphid parasitised by *Aphidius* sp., **Umpelby**; B5 (W) *Aphidoletes aphidimyza* larvae feeding on aphids, **ADAS**; B6 (W) *Amblyseius cucumeris* adults, **ADAS**; B7 (W) *Hypoaspis* mites feeding on scarid fly larva, **EMR**; B8 (W) *Orius* sp. feeding on thrips, **FLPA**; B9 (W) Vine weevil larva parasitised by nematodes, **Becker Underwood**; C1 (T) Anthorcorid adult feeding on aphid, **Defra**; C1 (B) Anthorcorid larva feeding on aphid, **Umpelby**; C2 (TL) Lacewing egg, **Umpelby**; C2 (TR) Lacewing larva, **Umpelby**; C2 (B) Lacewing adult, **Umpelby**; C3 (TL) Ladybird eggs, **Defra**; C3 (TR) Ladybird larva, **Defra**; C3 (BL) Ladybird pupae, **Defra**; C3 (BR) Ladybird adult, **Umpelby**; C4 (T) Carabid adults, **Umpelby**; C4 (B) Ground beetle larva, **Umpelby**; C5 (T) Staphylinid beetle, **Umpelby**; C5 (B) Devil's coachhorse with vine weevil larva, **Umpelby**; C6 (T) Ichneumon fly adult, **Umpelby**; C6 (B) Parasitised angle shades caterpillar, **Umpelby**; C7 (TL) Hoverfly egg, **Umpelby**; C7 (TR) Hoverfly larva, **Umpelby**; C7 (B) Adult hoverfly and pupa, **Umpelby**; C8 (W) *Typhlodromus* mite, **FLPA**; D1 (TL) *Botrytis* on strawberry, **Umpelby**; D1 (TR) *Botrytis* sporing on straw-berry leaf, **EMR**; D1 (BL) *Botrytis* infected fruits, **EMR**; D1 (BR) *Botrytis* sporing on leaf petiole, **EMR**; D2 (TL) Powdery mildew white mycelium on leaf, **Fera**; D2 (TR) Up-curved leaves caused by powdery mildew, **Fera**; D2 (BL) Red blotches caused by powdery mildew, **Fera**; D2 (BR) Powdery mildew white mycelium on fruit, **Fera**; D3 (TL) Blackspot infection on ripe fruits, **EMR**; D3 (TR) Sunken lesions caused by black spot, **EMR**; D3 (BL) Blackspot infection on green fruit, **ADAS**; D3 (BR) Blackspot infection on stolon, **EMR**; D4 (W) Lesions caused by *Mycosphaerella*, **EMR**; D5 (W) Leaf blotch fungus (*Zythia*) on leaf along with *Mycosphaerella* lesions, **EMR**; D6 (TL) Red core – field infection, **EMR**; D6 (TR) Red core – rat tail appearance to roots, **ADAS**; D6 (BL) Red core – red colouration of stele, **ADAS**; D7 (TL) Crown rot – plant wilting, **ADAS**; D7 (TR) Crown rot – brown staining of crown tissue, **ADAS**; D7 (BL) Crown rot – partial staining of crown, **ADAS**; D7 (BR) Crown rot – plant death, **EMR**;

D8 (T) Verticillium wilt – field infection, **ADAS**;
D8 (BL) Verticillium wilt – halo effect from dead
leaves, **EMR**; D9 (TL) Angular leaf spot on
leaflet, **Mazz**; D9 (TR) Angular leaf spot along
vein, **Caff**; D9 (BL) Angular leaf spot on whole
leaf, **Caff**; D9 (BR) Angular leaf spot close up,
Mazz; D10 (TL) *Xanthomonas arboricola* pv.
fragariae – reddish brown lesions, **ISF**; D10 (TR)
Xanthomonas arboricola pv. *fragariae* – enlarged
lesions, **ISF**; D10 (BL) *Xanthomonas arboricola*
pv. *fragariae* – lesion with chlorotic halo, **ISF**;
D11 (L) Straw-berry green petal – bronzing of
older leaves, **EMR**; D11 (R) Strawberry green
petal – green flower petals and asymmetrical
young leaves, **EMR**; D12 (W) Strawberry mottle
virus, **Nak**; D13 (W) Strawberry crinkle virus,
EMR; D14 (W) Strawberry mild yellow edge virus,
Nak; D15 (W) Strawberry vein-banding virus,
Nak; D16 (W) Arabis mosaic virus, **Umpelby**.

Key

Image position:

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

Image source:

ADAS;

BCP Certis;

Becker Underwood;

Caff = Dr Caffier (via Fera);

Defra = Department of Environment,
Food and Rural Affairs;

EMR = East Malling Research;

Fera = The Food and Environment
Research Agency;

FLPA = FLPAs Images of Nature;

ISF = Istituto Sperimentale per la Frutticoltura
(Marco Scortichini);

Mazz = Professor Mazzucchini (via Fera);

Nak = Naktuinbouw Test Centre,
Horst, Netherlands;

Umpelby = Roger Umpelby,
Consultant entomologist

