Crop Walkers' Guide

Pot and bedding plants

Contents

Contents

Introduction

Every year, growers of pot and bedding plants incur plant losses or loss of plant quality as a result of pests, diseases, mineral deficiencies or physiological disorders.

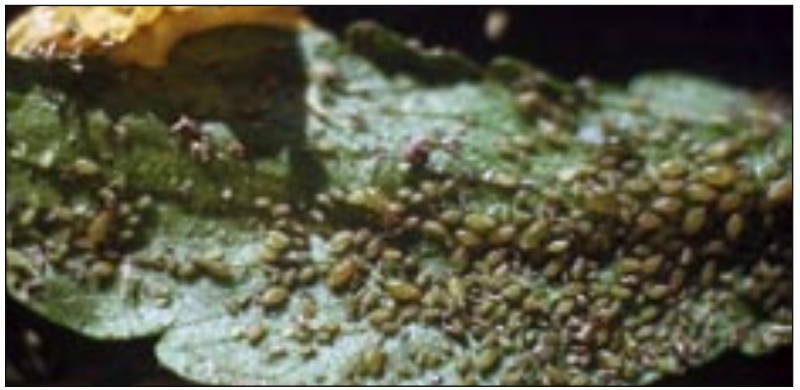
This Crop Walkers' Guide aims to assist growers, supervisors and their staff in the vital task of monitoring crops. It is designed for use directly in the glasshouse to help with accurate identification of each economically important pest, disease or disorder. Images of key stages of each subject along with typical symptoms have been included together with bullet point comments to help identification.

The pot and bedding plant industry produces a diverse range of crops and it is clearly impossible to show every subject/problem on each crop. We have however aimed to present the most commonly occurring symptoms on each card. The cards themselves are arranged within each section in order of importance; the most common or most important first. Growers are advised to familiarise themselves with the range of symptoms that can be expressed and be aware of new problems as they occur.

Whilst covering some of the key biological pest control agents used in protected ornamental crops, this guide does not attempt to offer advice on available control measures as these frequently change. Instead, having identified a particular pest, disease or disorder, growers should acquaint themselves with the currently available control measures.

Jenny Lang
Senior Communications Manager

Peach-potato aphid
(Myzus persicae)



- Can form large colonies on leaf undersides and in young shoots causing distortion.
- Infests many host plants, including chrysanthemum, fuchsia, impatiens, nicotiana, pansy, petunia and primula.
- Pale green, yellowish-green, or pink/red in colour. Siphunculi (the tubes extending from the rear of the body) have dusky black tips.
- Most UK strains are resistant to certain insecticides.

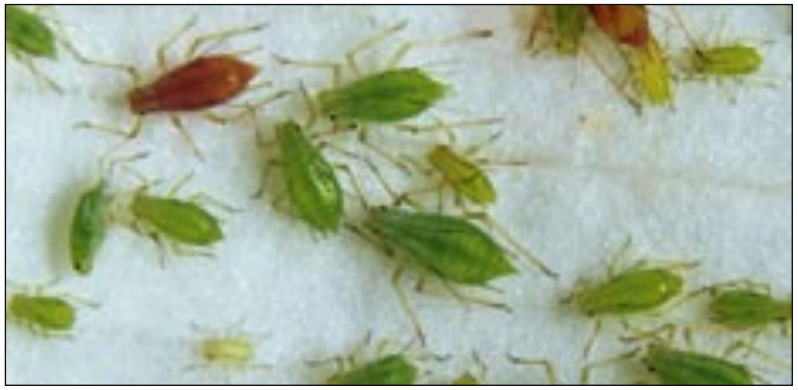
Melon-cotton aphid
(Aphis gossypii)

- Major pest of begonia, chrysanthemum, cyclamen and fuchsia causing leaf distortion and leading to the development of sooty moulds.
- A small aphid, pale green to olive, dark or mottled green or black in colour. Siphunculi (the tubes extending from the rear of the body) are short and black.
- Resistant to the active ingredient pirimicarb and can be resistant to other insecticides.

Glasshouse potato aphid
(Aulacorthum solani)

- Can cause severe leaf distortion.
- Infests many host plants including fuchsia, nicotiana, pelargonium and verbena.
- Pale green or yellowish-green in colour with darker green patches at the base of siphunculi (the tubes extending from the rear of the body).
- Siphunculi have distinct black tips.

Potato aphid
(Macrosiphum euphorbiae)



- Can form colonies in shoot tips causing distortion.
- Infests dahlia, dianthus, fuchsia, pelargonium and petunia.
- Long, pear-shaped aphid, green or pink in colour, often with a longitudinal stripe running down the back.
- Long, slender siphunculi (the tubes extending from the rear of the body) with no black tips.

Silver y moth and tomato moth etc
(eg *Autographa gamma, Laconobia oleracea)*

- Damage symptoms include leaf ‘windowing’ (where only the leaf underside is removed) and leaf holing. Droppings may also be visible on the plants.
- Chrysanthemum, cyclamen, pansy, primula and viola are often attacked.
- Caterpillars vary from green to pale brown.
- Caterpillars may be hard to find as they often hide under trays and pots during the day and emerge at night to feed.

Carnation tortrix moth etc
(eg Cacoecimorpha pronubana)

- Caterpillars are small and pale green and roll up the growing points or leaves of plants and spin them together with silk to form a shelter in which they feed.
- Host plants include cyclamen, diascia, dianthus, fuchsia and pelargonium.
- Populations can breed continuously during the summer months causing serious damage.
- When disturbed tortrix caterpillars wiggle backwards.

Large yellow underwing moth etc
(eg Agrotis pronuba)

- Damage usually occurs from late June onwards, being more common in hot, dry summers. Damage can be mistaken for that caused by mice.
- Pansy, primula and viola are sometimes affected.
- Caterpillars are pale brown and feed when small on leaves and shoots, but later burrow into the growing medium and feed on stem bases, sometimes severing them.

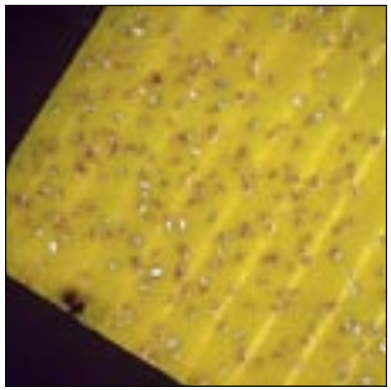
Thrips
(eg Frankliniella occidentalis, Thrips tabaci)




- Damage symptoms include small white or silvery flecks on petals and leaves, leaf curling and leaf or flower distortion.
- Host plants include brachycome, chrysanthemum, cyclamen, fuchsia, primula and verbena.
- Western flower thrips (WFT) adults are small and narrow bodied, yellow or pale brown. Larvae are yellow.
- WFT can also spread tomato spotted wilt virus and impatiens necrotic spot virus.

Glasshouse whitefly
(Trialeurodes vaporariorum)



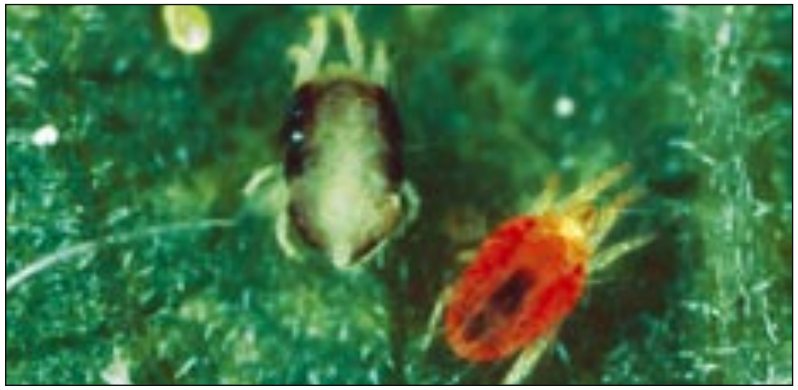



- All stages are found on leaf undersides, with adults usually concentrated on growing points or young shoots. The honeydew excreted by the whiteflies allows the growth of sooty moulds.
- Common host plants include abutilon, datura, fuchsia and regal pelargonium.
- Adults are small, white and moth-like and tend to hold their wings flat across the back when at rest. The scales are white, flat and immobile.

Tobacco whitefly
(Bemisia tabaci)

- Adults are slightly smaller than the glasshouse whitefly and tend to hold their wings slightly apart, exposing the yellow body.
- The larger, older scales are yellow rather than white as in the glasshouse whitefly and are slightly pointed at one end.
- This species is a non-indigenous quarantine pest and there is a risk of importing it on plants or cuttings (patio plant species).

Two-spotted spider mite
(Tetranychus urticae)



- Feeding damage causes fine yellow speckling on the leaves, which later develops into necrotic patches.
- Common hosts include chrysanthemum, dahlia, fuchsia and impatiens.
- The mites are very small and usually found on leaf undersides. The young mites and summer adults are green with two black patches on their backs. In the autumn, the females turn brick-red prior to over wintering.

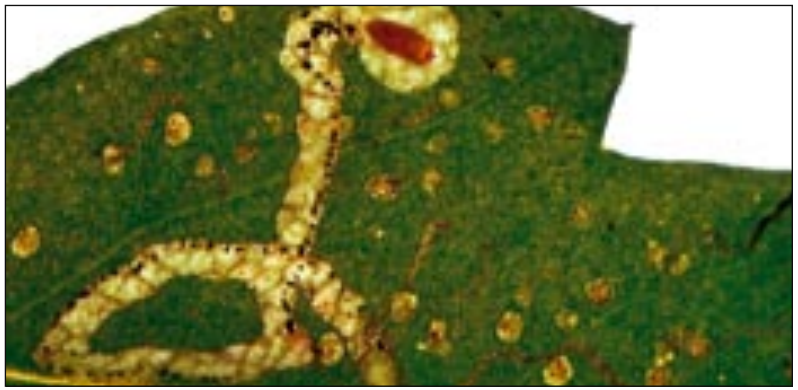
Sciarid fly
(Bradysia difformis)

- Larvae are off-white with a black head and no legs. They live in the growing medium, feeding on fungi and plant roots. Root damage by the larvae can cause plant wilting.
- Young seedlings, cuttings (pelargonium) and slow rooting species are particularly vulnerable.
- Adults are small grey-black gnat-like insects with long legs and antennae, often seen walking on, or flying just above, the growing medium surface. They do not feed on plants, but can transport pathogens such as Pythium.

Shore fly
(Scatella tenuicosta)

- The flies can leave black faecal spots on the foliage of plants.
- Adults are small, stout-bodied black flies with short antennae and pale spots on their wings. They are often seen sitting on plants and the surface of growing media. They can be more numerous on slow-growing plants (seed raised begonia).
- Larvae are brown with no obvious head. They feed on algae not on the crop plants.

Leaf miners
(eg Chromatomyia syngenesiae, Liriomyza spp.*)*



- Larvae feed within the leaf causing whitish mines in plants such as brachycome, chrysanthemum, cineraria and marguerite.
- The most common species on bedding plants is the native chrysanthemum leaf miner. There is a risk of introducing non-indigenous quarantine species on imported plants.
- Adult leaf miners are small, robust flies like miniature houseflies. They have a grey or black body and *Liriomyza* species have a yellow spot on their backs.

Leafhoppers
(eg Hauptidia maroccana, Eupteryx melissae)

- Leafhoppers cause indistinct white or pale yellow spots or flecks on the leaves, which often coalesce to form bleached areas that later turn brown.
- The main species damaging bedding plants is the glass-house leafhopper, common on primula, but also found on chrysanthemum, fuchsia, nicotiana and salvia.
- The adults are whitish-yellow, with two grey chevron-shaped marks on the wings. Nymphs are whitish without any markings.

Flea beetles
(Altica lythri and *Phyllotreta* spp.*)*

- Large numbers can build up, causing many small leaf pits or ‘shot-holes’.
- The large blue flea beetle is a common pest of fuchsia during the summer months. Other flea beetle species (turnip flea beetle) also attack ornamental cabbage, stocks and wallflowers.
- Adult flea beetles are metallic bright blue, green or black in colour. They jump or fly actively when disturbed. Larvae are off-white with a brown head.

Vine weevil
(Otiorhynchus sulcatus)

- Adults are large, wingless, slow-moving, black weevils with pale yellowish/orange flecks on their backs. They are nocturnal, feeding at night on foliage, causing notching of leaf edges, usually between late June and September.
- Larvae are legless, cream or white with a pale brown head, often lying in a ‘C’ shape within the growing medium. They feed on roots, stem bases and corms between July and September, causing plant stunting and collapse.
- Common hosts are cyclamen, ferns and primula.

Amblyseius species
(For the control of thrips)

- Predatory mites used for thrips control, feeding on young thrips larvae.
- The predators are small, oval and straw-coloured, living on leaf undersides, growing points, buds and flowers.
- Supplied in bottles with a bran or vermiculite carrier for sprinkling onto plants, or in slow-release paper sachets for hanging on plants or hanging baskets.

Orius species
(For the control of thrips)

- Predatory bugs used for thrips control, feeding on thrips adults and larvae. Often found in flowers.
- Adult predators are black with paler markings on the wings, so that the wings appear to have black diamond-shaped markings.
- The nymphs are yellow or pinkish with red eyes, and develop immature wing buds on the sides of the body.
- Supplied in bottles with a buckwheat carrier.

Encarsia formosa
(For the control of glasshouse whitefly)

- A small yellow and black parasitic wasp used for whitefly control.
- The adult wasp lays an egg into a whitefly scale and the young parasite develops inside the scale, turning it from white to black.
- The new adult wasp cuts a hole in the top of the black scale and emerges. The parasites are supplied as parasitised black scales, often stuck on cards, for hanging on plants.

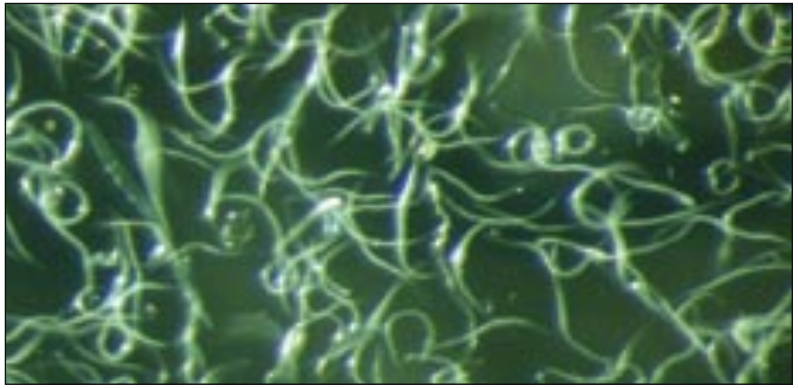
Hypoaspis species
(For the control of sciarid fly)

- Ground-dwelling predatory mites, primarily used for sciarid fly control but will also feed on other prey including thrips larvae (that drop to the ground to pupate) and pupae.
- The predators are off-white with a pale brown shield covering most of the upper surface of the body.
- Supplied in bottles with a peat and vermiculite carrier for sprinkling on the floor or benches. The predators are very active and can be found running over the growing medium or the bench or floor covering under pots and trays.

Atheta coriaria
(For the control of sciarid and shore flies)

- A ground-dwelling predatory ‘rove’ beetle used for control of sciarid and shore flies.
- The adult beetle is small, dark brown and shiny, often hidden in the growing media or under pots and trays.
- The larvae are white when young and brownish-yellow when older and are usually hidden in the growing medium. The head is the same colour as the body and there are three pairs of legs at the front end.

Steinernema species
(For the control of sciarid fly, vine weevil and thrips)



- Microscopic worm-like nematodes, supplied in a gel-like carrier in plastic trays.
- Used in water as a growing media drench for the control of sciarid fly (*S. feltiae*) and vine weevil (*S. kraussei*) or as foliar sprays for the control of thrips (*S. feltiae*).
- The nematodes enter the insect's body and release bacteria that kill the insect. With larger insect hosts eg sciarid fly and vine weevil larvae, the nematodes multiply inside the body and are released into the growing medium.

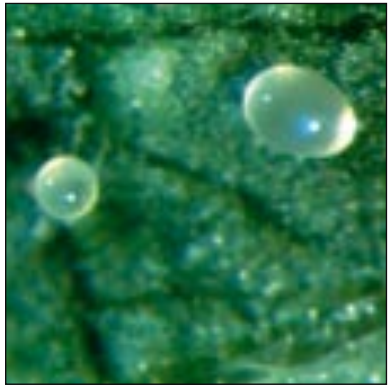
Aphidius species
(For the control of aphids)

- Small brown and black parasitic wasps used for aphid control.
- *Aphidius colemani* attacks the peach-potato aphid and the melon cotton aphid. *A. ervi* attacks the glasshouse potato aphid and the potato aphid.
- The adult wasps fly out of the bottle and lay eggs inside the aphids. The young parasite develops inside the aphid, turning it into a pale brown 'mummy' (usually found on leaf undersides).

Aphidoletes aphidimyza
(For the control of aphids)

- A predatory midge that eats most aphid species.
- Supplied as pupae in vermiculite, in either bottles or ‘blister packs’. The adult midges emerge from the pupae and lay eggs amongst aphid colonies.
- The yellow/orange larvae hatch from the eggs and feed on the aphids.

Phytoseiulus persimilis
(For the control of two-spotted spider mite)



- An orange-red predatory mite used for spider mite control, feeding on both spider mites and their eggs.
- The adult predator is slightly larger and with longer legs than a spider mite and has a shiny body. The predator eggs are pale pink, oval and about twice the size of the round spider mite eggs. Predators and eggs are found on leaf undersides.
- The predators are supplied in bottles with a bran or vermiculite carrier that is sprinkled on the plants.

Dacnusa and *Diglyphus* species
(For the control of leaf miner)




- Small parasitic wasps used for leaf miner control. *Dacnusa* is black with long antennae and *Diglyphus* is metallic green with short antennae.
- Supplied as adults in bottles.
- *Dacnusa* adults lay eggs inside leaf miner larvae where as *Diglyphus* adults lay eggs onto the surface of the leaf miner larvae inside the mine. The parasite larvae feed on the leaf miner larvae and kill them.

Grey mould or Botrytis
(Botrytis cinerea)

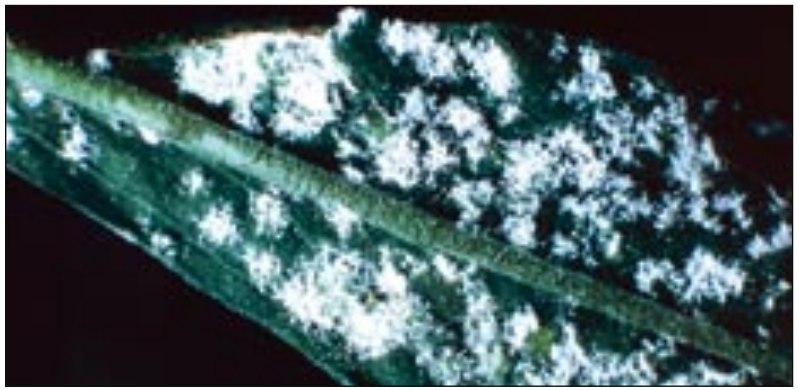



- Can infect many bedding plant species and most plant parts. Produces fluffy grey-brown fungal strands bearing masses of spores and causes plant collapse and death.
- Infection is most common in cool (around 15°C) humid conditions and on senescent or damaged tissue and fallen flowers.
- Leaves in contact with moist growing medium are often the initial site of infection in primula. Botrytis is also found in and sporulates on plant debris.

Downy mildews
(eg Bremia lactucae, Peronospora violae)

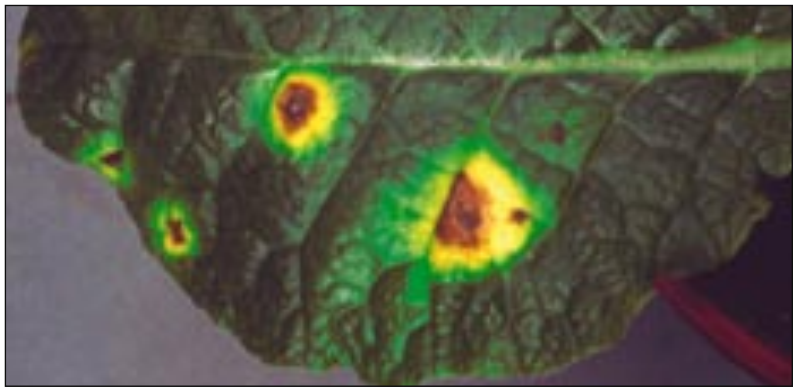
- Primarily foliar diseases, typically causing a yellowing on the upper leaf surface. In some hosts, infection results in leaf and shoot distortion.
- Species commonly affected include alyssum, aubretia, chieranthus, cineraria, impatiens, matthiola, nicotiana and pansy.
- Sporulation is usually visible as a felty growth on the lower leaf surface, ranging from white to purplish or grey.

Powdery mildews
(eg Erysiphe cichoracearum, Oidium sp.)



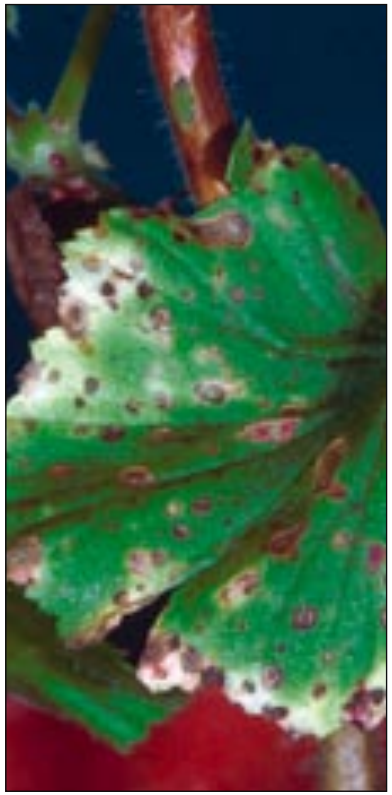
- Primarily affects leaves, especially young leaves, usually on the upper surface. Growth may be visible as distinct white spots or as a sparse white, or off-white, mycelium.
- Species commonly affected include cineraria, dahlia, pansy, petunia, phlox and verbena.
- Several fungi cause powdery mildew diseases and they are usually host-specific.

Ramularia leaf spot
(eg Ramularia agrestis, Ramularia lactea)



- Most commonly affects pansy, primrose and polyanthus.
- Symptoms on pansy range from small black flecks to white or pale brown spots with narrow brown borders.
- Symptoms on primrose and polyanthus are usually round or irregular pale brown leaf spots with a bright yellow border; sometimes the centres drop out leaving shot-holes.

Alternaria leaf spot
(Alternaria spp.)



- Occurs on a range of species including cheiranthus, cineraria, lobelia, pelargonium, tagetes and zinnia.
- On lobelia seedlings, the fungus causes orange-brown leaf spots and a similarly coloured stem constriction resulting in damping-off.
- On cineraria the fungus causes dark brown to black, irregular leaf spots, whilst on pelargonium infection often shows as pale brown, V-shaped leaf sections.

Septoria leaf spot
(Septoria drummondii)

- Causes a pale-brown irregular leaf spot or tip necrosis usually with a narrow, dark border.
- Shiny, grey-black spore cases develop within affected tissue and are just visible with the naked eye.
- Relatively uncommon; the most susceptible hosts are antirrhinum and phlox.
- Infection and spread are favoured by high humidity and water splash.

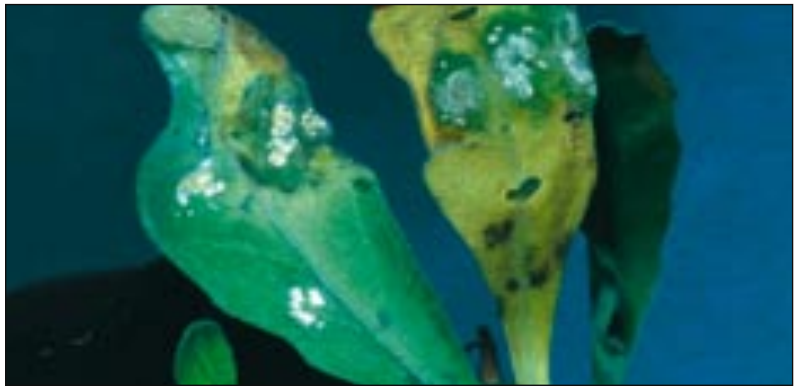
Bacterial leaf spots
(Pseudomonas spp. and *Xanthomonas* spp.*)*

- Usually appear as small necrotic spots with a dark-coloured margin.
- They can be circular, angular (limited by leaf veins) or irregular in shape.
- If spots are numerous, they can coalesce leading to leaf neorosis.
- Species affected include alyssum, antirrhinum, impatiens, lobelia, primrose, tagetes, verbena and viola.

Rust diseases
(eg Puccinia antirrhini, Puccinia distincta)

- Visible on the upper leaf surface as pale yellow spots and/or yellowing growth; leaves may be distorted.
- Brightly-coloured pustules of spores are produced, usually on the leaf underside.
- Rust colours vary from white (chrysanthemum) to yellow (bellis) to orange (fuchsia) to dark-brown (pelargonium).
- Most rust diseases are host-specific; some produce more than one spore type (often of different colours).

White blister
(Albugo candida and *Albugo tragoponis)*

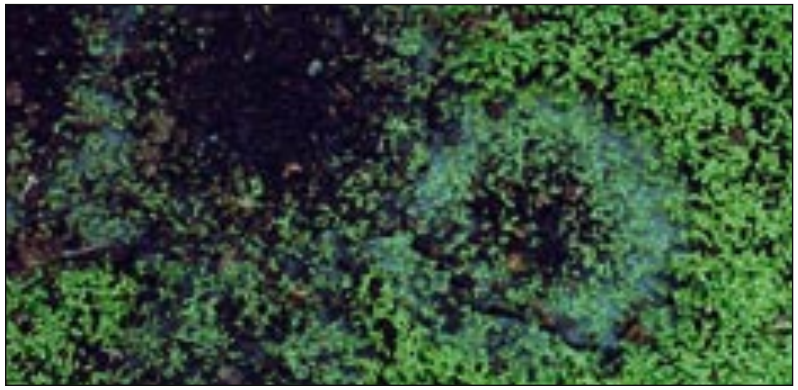


- Similar in appearance to rusts. Creamy white pustules (blisters) develop on the leaf underside, usually in irregular groups or concentric circles. Surrounding tissue eventually becomes chlorotic.
- Alyssum and cineraria are the bedding plant species most commonly affected.
- Infection is favoured by wet leaves.

Black root rot
(Thielaviopsis basicola)

- Causes stunted growth, leaf chlorosis and purpling, and blackened and decayed roots. Plants often rot off at their stem bases.
- Has a wide host range but is most often found on autumn/winter-flowering pansy.
- Infection is favoured by high moisture levels in the growing medium, warm temperatures (17–23°C), high pH (6.5+) and 'stress'.

Pythium root rot
(Pythium spp.*)*

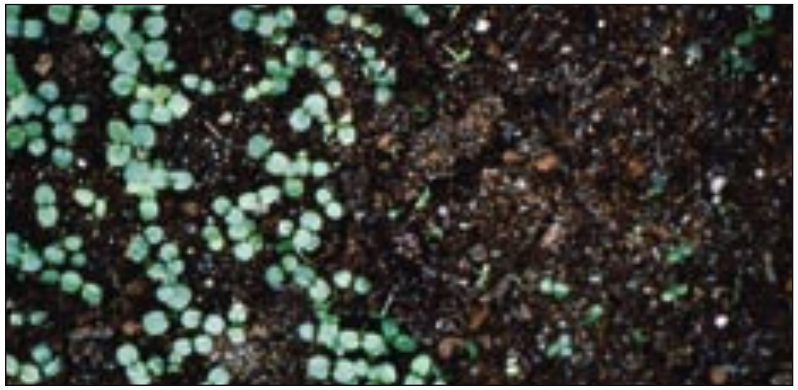


- Causes damping-off, poor growth, root decay, and occasionally a stem base rot.
- The most susceptible plant species are alyssum, antirrhinum, lobelia, pelargonium and nemesia.
- The disease is favoured by high moisture levels in the growing medium.
- *Pythium* spp. produce long-lived resting spores that can contaminate matting and growing media.

Phytophthora root rot
(Phytophthora spp.*)*

- Closely related to Pythium but is less common on bedding plants.
- Root decay by Phytophthora is generally more severe than that caused by Pythium, and may extend to cause a stem base rot.
- Brown core of primrose is caused by the host-specific species *Phytophthora primulae*.
- Other susceptible hosts are cineraria, pansy and petunia.

Rhizoctonia root and stem rot
(Rhizoctonia solani)



- Usually starts at substrate level and causes damping-off in seedlings and a stem base rot and root rot in older plants.
- Rhizoctonia affects a wide range of bedding plants and especially members of the crucifer family (alyssum, aubretia, cheiranthus, matthiola); also impatiens and salvia.
- The fungus is spread by fragments of fungal strands that can contaminate most parts of a nursery.

Sclerotinia disease

(Sclerotinia sclerotiorum)

- Early symptoms are a brown soft rot and dense masses of white, cotton-wool like, fungal strands.
- Not host-specific and attacks plants in all stages, particularly fleshy tissues.
- Large hard, black resting bodies may eventually develop, among the fungal strands or within stems.
- Infection occurs from spores in the air or from fungal strands that develop from the resting spores.

Tomato spotted wilt virus (TSWV)

- Symptoms are extremely variable, ranging from leaf spots, line patterns and rings to leaf vein blackening and leaf and stem necrosis.
- Many bedding plant species are susceptible including chrysanthemum, cineraria, cyclamen, dahlia, fuchsia, impatiens, New Guinea impatiens and primrose.
- The virus is most commonly transmitted by western flower thrips (WFT), sometimes in cuttings, rarely in seed.

Impatiens necrotic spot virus (INSV)

- Very similar to TSWV and has become more common than TSWV in recent years.
- Susceptible plant species include impatiens, coleus, fuchsia, lobelia and nemesia.
- The virus disease is transmitted in the UK by western flower thrips and by propagation from infected plants.

Cucumber mosaic virus (CMV)

- Symptoms include flower streaks (colour ‘break’) and leaf mosaic.
- Susceptible hosts include cyclamen, dahlia, pansy, and primrose.
- Usually transmitted by aphids, occasionally in seeds.
- In recent years the disease has been uncommon in ornamentals.

Nitrogen (N)

- Deficiency (top and bottom images) results in stunted plants that are pale green to yellow. Red colouration can develop on older leaves. Later necrotic symptoms can occur on the older leaves particularly along the margins. Plants with coloured leaves may exhibit less intense colours. All symptoms progress from older to younger growth.

- Toxicity symptoms include the production of blue-green, soft, fleshy leaves that are susceptible to disease. High levels of nitrogen can lead to leaf wilting under mild stress.

Phosphorus (P)

- Deficiency (top and bottom images) gives rise to stunted plant growth. Foliage is a dark green in colour. Older leaves become purple, in some species bronzed. All lower leaves eventually become chlorotic and then necrotic. All symptoms progress from older to younger growth. Root systems become highly branched and fibrous.

- Toxicity symptoms are similar to those induced by high pH induced iron deficiency, stunted very pale to white young growth.

Potassium (K)

- Deficiency (image) leads to slow growth with older leaf margins becoming chlorotic, eventually necrotic. The necrosis can extend from the margins to cover all the leaf. Premature leaf drop may occur. With some species a downward leaf curling may result.

- Toxicity can lead to induced calcium and magnesium deficiencies. High levels of potassium can lead to root damage and wilting.

Magnesium (Mg)

- Deficiency (image) symptoms include an interveinal chlorosis on the older leaves. Necrotic spots may also form. Eventually leaves may become completely chlorotic and fall off. Symptoms progress from older to younger growth.
- Toxicity may induce calcium deficiency and older leaves may show ‘russeting’.

Calcium (Ca)

- Deficiency (both images) can lead to immature leaf tips becoming chlorotic and necrotic. Growing points in shoots and roots can stop growing and abort. Young leaves can become distorted. In some species an upward leaf curling may develop. Root tips may appear ‘clubbed’. Symptoms are restricted to younger growth.
- Toxicity symptoms not really known.

Iron (Fe)

- Deficiency (image) produces an interveinal chlorosis in the younger leaves. Leaves may be become totally yellow and later necrotic. Symptoms are restricted to younger tissue.
- Toxicity often leads to associated manganese accumulation.

Boron (B)

- Deficiency produces a leaf thickening and a downward leaf curl. Leaves may become chlorotic with necrotic spots. Growing points may abort, flower buds may drop and stems may become brittle. Symptoms are restricted to the younger tissue.
- Toxicity (image) causes a marginal leaf necrosis on older leaves, which spreads up the plant. Flower set is poor and abortion often occurs.

Manganese (Mn)

- Deficiency (top image) causes a star like mottling on young leaves. On heavily chlorotic leaves light tan sunken spots can develop between the leaf veins. Symptoms are restricted to younger tissue.
- Toxicity (bottom image) symptoms include brown/gold spotting on older leaves, eventually merging to form necrotic areas. Overall plant growth (including root growth) is restricted.

Molybdenum (Mo)

- Molybdenum deficiency (image) is usually associated with low pH in the growing medium.
- Leaves may become pale and scorched and in the case of certain plant species become disfigured so that they are ‘strap’ or ‘whip-like’. Symptoms become progressively worse on developing leaves.
- Toxicity symptoms are not generally noted.

Copper (Cu)

- Deficiency (left image) symptoms include stunted growth and growing point distortion. In some cases leaf chlorosis can occur on younger leaves and in severe cases leaf size is reduced and a leaf ‘burn’ occurs.
- In terms of toxicity (right image), plants initially grow normally but then develop leaf rolling and tip burning on the older leaves first.

Zinc (Zn)

- Deficiency (top image) leads to a chlorosis of the younger leaves and a shortening of the internodes that creates a ‘rosette like’ growth habit. Leaf size is reduced and growing point abortion may occur. Symptoms occur generally in the younger tissue.
- Toxicity (bottom image) leads to stunted yellow growth on plants.

Chloride (Cl)

- Toxicity (image) causes a paleness of the new growth, a leaf edge necrosis and leaf cupping. Very poor shoot and root development is another characteristic.

Ammonium (NH_4)

- Toxicity causes a chlorosis of the growing point, reduced growth, leaf curling, stem lesions and wilting. Ammonium toxicity can occur in conjunction with high growing media pH.

Mechanical damage

- Transplanting damage may take many forms, often various shaped holes can be seen in the foliage as a result of the transplanting machine's fingers piercing leaves/cotyledons on larger plugs.
- Other damage may include torn leaves and broken leaf petioles and stems.
- Plugs can also be misplaced in packs/pots or be planted too high or too low in the growing medium.

Drought stress

- First symptoms may be a slight change in leaf colour from green to grey/green. Leaves wilt and eventually with continued stress may become chlorotic, purple or red depending upon the plant species. Extreme drought will cause the whole plant to collapse.
- Depending upon the plant species and the severity/ longevity of the lack of water, leaf scorch and flower bud drop may occur and plants may become more stunted in growth. If the level of watering is uneven then crop uniformity can be affected.

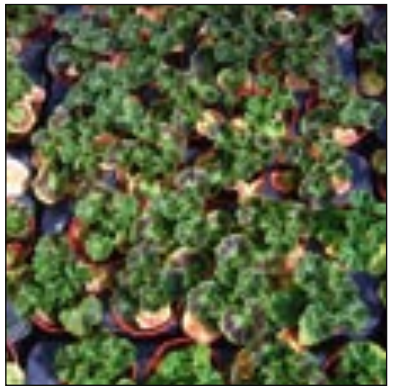
Overwatering

- Overwatering results in a waterlogged growing medium within the pack/container with corresponding root loss.
- Foliage may become yellow and wilt. Plants can become stunted and collapse as a result of excessive root loss and/or the establishment of diseases (Pythium) or pests (sciarid fly).
- If the level of watering is uneven then crop uniformity can be affected.

High humidity

- High environmental humidities can limit the rate of water loss from leaves leading to physical injury and the development of a range of symptoms.
- In the case of ivy leaf pelargonium, high humidities can lead to the physiological disorder known as oedema, typified by the production of ‘corky’ marks on the lower surface of older foliage.
- Other plant species may show symptoms of leaf ‘glassiness’ or water soaking.

Cold temperature injury



- Where temperatures are only a few degrees below optimum, growing point/leaf chlorosis can occur (impatiens).
- More excessive leaf chlorosis, purpling or reddening and leaf drop can occur on crops transferred from high to low temperatures to ‘harden off’.
- Where plants have been chilled/frosted, leaves and stems become glassy and water soaked and plants collapse and die.

Sun scorch

- Sun scorch often takes the form of bleached areas on the foliage, sometimes followed by necrosis.
- It can occur where levels of shading are inadequate on young/sensitive crops or where crops are transferred from low to high light conditions and the symptoms occur on the soft foliage produced under the low light conditions.
- Plants usually grow away from the symptoms.

Pesticide damage
(Insecticides and fungicide damage)

- The most common symptom is a physical leaf scorch. Leaves become bronzed and then necrotic and may drop off.
- Other symptoms include leaf chlorosis, leaf necrosis and growing point distortion.
- Plants usually grow away from the symptoms unless they are very severe.

Pesticide damage
(Chemical growth regulator damage)

- Generally plant growth is restricted if the rates or volumes applied are too high. Other symptoms include reduced flower size, reduced flower stem length (if chemicals are applied too close to flowering), reduced internode length, reduced leaf size, delayed flowering, increased leaf 'greenness' etc.
- Chlormequat gives rise to a leaf chlorosis (especially leaf margins) if used at higher rates and paclobutrazol can give rise to severe stunting if applied at too high a rate or volume.

Pesticide damage
(Herbicide damage)

- Contact herbicides can give rise to a necrotic spotting where droplets have drifted onto plants. Direct applications may kill the plant.
- Systemic herbicides can cause a yellowing/interveinal yellowing of the growing points, growth distortion and eventual plant death.
- Residual herbicides can cause leaf chlorosis (marginal, interveinal, veinal) necrosis, intense growth distortion, stunting etc.

Genetic instability

- Symptoms including flower colour instability, leaf bleaching, whole plant bleaching through to reversion to parental type have all been associated with genetical instability or mutation.
- In many cases the exact cause and nature of the problem has never been fully identified.
- Symptom expression may be limited to the odd plant in a crop (pansy) but may also be more common across the crop (nicotiana).

Distortion

- Symptoms of distortion have been noted on several species most often on pansy (often referred to as pansy mottle syndrome) and petunia.
- The exact cause of the problem has yet to be confirmed.
- It may be found in a few isolated plants or it may be associated with specific varieties or flower colours.
- Symptoms include a ‘hardening’/distortion of the growing point, leaf curling, twisting and bleaching.

Ethylene damage

- Ethylene is a gaseous substance released in minute amounts by plants when they are under stress.
- Symptoms take the form of leaf chlorosis and premature leaf and flower drop.
- Its effects can be seen (usually at warmer temperatures) if the gas cannot readily escape into the surrounding environment (cuttings in sealed bags).
- Plants generally grow away from the symptoms.

Etiolation

- Symptoms are noted if plants are kept in the dark or semi-darkness for too long (during delivery).
- The stems of plant stretch, leaves become smaller and sparser in number and the plants become chlorotic.
- Plant quality is reduced and plants can become more susceptible to disease.
- Once back in the light plants grow away from the symptoms.

Acknowledgements

The production of this Crop Walkers' Guide has been made possible thanks to the committed involvement of several key industry figures.

Wayne Brough of ADAS has led the project with valued contribution from his colleagues Tim O'Neill (Pathologist), John Buxton and Jude Bennison (Entomologists). Our thanks go to all of them but particularly to Wayne for his tireless efforts in bringing the final guide to such a successful conclusion.

Thank you also to Neil Bragg, Bulrush Horticulture Ltd, who compiled the text and images for the nutritional disorders section.

And finally, our thanks go to the British Protected Ornamentals Association for supporting the production of this publication – we very much hope we have delivered a helpful aid to your businesses.

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