

# Pea & Bean



Every year a significant proportion of UK pea and bean crops 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, agronomists and their staff in the vital task of monitoring crops. It is designed for use in the field to help with accurate identification of pests, diseases, nutrient deficiencies and disorders within a crop. Images of key stages in the life cycles of pests 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.

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 refer to other AHDB Horticulture publications that contain information on a range of control measures.

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# Pea & Bean Crop Walkers' Guide

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# Pea

## Invertebrate pests



**Pea**

*Pisum sativum*

## Bean seed fly

*Delia platura*, *Delia florallega*



- Damage can be localised and sporadic, even though adult flies are common.
- Flies lay eggs on newly disturbed soil in the presence of green vegetation, high levels of organic matter such as farmyard manure or crop debris.
- Seeds and seedlings of later planted peas are attacked by the larvae during germination.
- Larvae are white segmented grubs, reaching 5–8mm, with small dark hooked mouthparts. They tunnel into seeds, stems and upper root system.
- Severely damaged seeds fail to produce a seedling and decay before emergence.
- Adults emerge and larvae feed between March and September.



# Hoverfly

*Syrphidae*



- Hoverflies are a beneficial insect which predate aphids and are often present in heavily infested crops, however larvae and pupae become detached during mechanical harvesting and contaminate vining peas.
- Larvae are flattened, segmented, silvery white to green in colour with a pointed fore end.
- Pupae have pear-shaped bodies and are silver to pale green in colour.

## Leatherjacket

*Tipula* spp.



- Leatherjackets are the larvae of crane flies. They live in soil, feeding on grass roots and other crop debris.
- In spring leatherjackets feed on newly germinating seedlings, the larvae cutting through the stem at soil level.
- Plant loss may be significant when populations are high.
- Larvae are segmented, grey-brown and up to 40mm long.
- Crops grown in newly ploughed grassland or fields with high levels of grass weeds the previous autumn are most at risk of attack.

## Pea and bean weevil

*Sitona lineatus*



- The principal cause of crop damage is by larvae feeding on root nodules, which causes reduced yields.
- Early sown spring peas are most at risk of attack as the adults emerge from over-wintering sites in field margins when the temperature reaches 12–15°C.
- Adult feeding causes U-shaped notches around leaf margins.
- Adults are 4–5mm long, light to dark brown with faint striping along the length of the wing cases.
- Larvae are legless 4–5mm long, cream to white, wrinkled, fleshy and found around roots.



- Pea aphid is a major pest of peas causing reduced yields.
- Development of large colonies may result in growth distortion, flower abortion and mis-shaped pods, as well as generally reducing plant efficiency.
- Pea aphid also transmits a number of viruses including PSbMV, PEMV and BLRV.
- Honeydew produced by aphids can be a contaminant.
- Pea aphids may infest peas at any time from emergence.
- Large green aphid with a pear-shaped body 2–3mm long and with red or black eyes.

# Pea cyst nematode

*Heterodera goettingiana*



- Pea cyst nematode is a soil-borne pest that affects the roots of peas.
- It occurs in patches ranging from a few square metres to large areas of the field.
- Populations develop in fields with a history of peas and broad beans.
- Affected plants are stunted, pale, may fail to develop pods and have poorly developed root systems and no nitrogen fixing nodules. Plants may die prematurely.
- Nematode cysts are small, white and lemon-shaped and are found embedded along roots.
- Soil-borne cysts remain viable for up to 20 years.



- In intensive areas of production, particularly in vining peas which are more determinate than combining peas, pea midge may cause significant yield loss.
- Larvae are small white segmented maggots that feed within the flower bud, resulting in bud distortion and shortening of flower stalks which causes bunching of flower heads. Damaged buds fail to produce pods.
- The adult midge is about 2mm long and has a grey brown body with long legs and fine wings.
- In wet periods, damaged tissue may also provide a site for infection by fungi.
- Presence can be monitored using pheromone traps.

# Pea moth

*Cydia nigricana*



- One of the most damaging pests of peas in the UK, largely due to crop contamination.
- Attacks are most frequent and damaging in intensive pea growing areas.
- Adult moths are silvery brown with indistinct black and white markings on edge of forewings and a wing span of 12–15mm. Adults fly in flowering crops during the sunniest periods of the day.
- The caterpillars are creamy white with brown to black heads and are up to 10mm long when mature.
- They are found feeding on seeds within pods causing damage to the seed and leaving frass.
- A pheromone monitoring and spray forecasting system is available.

## Silver Y moth

*Autographa gamma*



- Larvae feeding causes damage to foliage and pods. Frass and larvae cause contamination.
- The adult is a migrant day flying moth with silver grey forewings with distinct silver 'Y' in the middle of each. Wing span is 35–40mm.
- Larvae are green (varying from bright to very dark green) with white stripes along the sides and back, growing up to 40mm in length.
- They have three pairs of abdominal pro-legs and move with a looping action. When disturbed the caterpillars roll into a ball.
- Migratory pest, so large numbers can build up suddenly.
- A pheromone monitoring trap is available.



## Slugs and snails

*Deroceras reticulatum*, *Ceriuella* spp., *Cepaea* spp.



- Slugs and snails cause damage all year round, whenever weather and temperature conditions are suitable.
  - Early attack can cause seed and seedling loss, later causes cosmetic damage. Contamination is particularly problematic when harvesting at night or in wet weather.
  - Damaging between 5°C and 20°C in moist conditions.
- The grey field slug is active at close to freezing.
- Slugs are common on soils with high clay content and open cloddy seedbeds, especially those with manure and crop debris. Snails are more frequent on stony/chalky soils.
  - Crop damage most severe when plant vigour is low. Slow growth prolongs the vulnerable period of crop establishment.



- Field thrips affect early sowings of peas and are common on stony soils in dry cool springs. Seedlings are infested before emergence from the soil.
- Small black elongated thunderflies, 1–1.5mm in length, are found in developing leaves of young seedlings.
- The wingless insects feed inside the tightly rolled leaves of the growing point, and continue to feed throughout the growing season.
- Seedlings appear pale and distorted with puckered, leathery leaves and translucent spotting.
- In severe cases peas are dwarfed and produce excess basal shoots, flowers are poorly developed and yield is significantly reduced.

## Thrips – Pea

*Kakothrips pisivorus*



- Heavy infestations are more likely to occur in humid conditions during and after flowering in areas where there is a long history of pea production.
- Damage does not affect yield and quality of peas for processing but pod damage affects those destined for the fresh-picked market.
- Damaged pods have silvered and pitted surface.
- Small black to brown-yellow 2mm long ‘thunderflies’ may be found on pods and flowers.

## Tortrix moth

*Cnephasia asseclana*



- Tortrix moth caterpillars feed on foliage but are rarely damaging enough to result in yield loss.
- They have usually pupated and left the crop prior to harvesting, leading to minimal risk of contamination.
- Caterpillars are dark greenish brown with shiny golden head and about 12mm long when fully grown.
- They are found in the upper foliage, often webbing the leaves together and giving the plants a hooded appearance.

# Wireworm

*Agriotes* spp.



- Attacks usually sporadic and limited to small areas.
- Crops sown within two years of ploughing up permanent pasture are at most risk.
- Wireworms are the larvae of click beetles and are golden yellow or brown, smooth, with rigid bodies up to 25mm long.
- Larvae are slow-growing and can feed on crops for up to five years before they mature.
- Wireworms tunnel into shoots or germinating seeds just below ground level and damage is seen in early spring to summer as they bite through the stem and damage seeds.
- Damaged seedlings may fail to recover.

# Pea Diseases

**BACTERIAL DISEASES**

**FUNGAL DISEASES**

**OOMYCETE DISEASES**

**VIRAL DISEASES**

Diagnosis of viral diseases from symptoms is problematic and should always be confirmed by laboratory investigation



## Pea bacterial blight

*Pseudomonas syringae* pv. *pisi*

- A potentially serious seed-borne disease, which also produces pod symptoms.
- Leaves, stems and stipules develop water-soaked lesions which dry up to form irregular brown lesions with water-soaked edges.
- Pods have circular sunken greasy lesions, eventually contaminating seeds, allowing the disease to become seed-borne. It may survive on infected crop debris over winter.
- Spread by rain splash, susceptibility is increased following physical damage by pests, machinery, hail, frost or herbicide scorch.
- Where infection is severe plants may collapse and rot away.

### Ascochyta leaf and pod spot

*Ascochyta pisi*, *Mycosphaerella pinodes*, *Didymella pinodella*



- *Ascochyta pisi* causes tan coloured spotting on leaves and stems and circular sunken brown to black spotting of pods. *M. pinodes* causes black to purple leaf-flecking and stem blackening, and *D. pinodella* leads to black stem girdling.
- All three pathogens are seed-borne and survive on crop debris, and *M. pinodes* and *D. pinodella* can also be soil-borne.
- As the plant develops the stems or growing points may collapse as the lesions encircle the stem, or a more general leaf spot develops on foliage.
- Infected seeds are often discoloured.



## Botrytis (grey mould)

*Botrytis cinerea*

- Loss of pods affects yield and pod blemishing affects quality of fresh-picked peas.
- *B. cinerea* is a common fungus and may be found on many plant species.
- In peas it develops as grey mould on dead or dying tissue when flower petals stick to pods and stems during wet, humid weather.
- Lesions occur in leaf axils when petals lodge there, leading to grey mould developing around the stem causing plants to senesce and collapse.
- Infected pods contain discoloured seeds.

### Pea wilt

*Fusarium oxysporum* f. sp. *lisi*



- Fusarium wilt is a cause of important reductions in yield.
- A soil-borne disease which can occur in any pea growing area, but generally confined to fields with a long history of pea growing.
- Plants become wilted, stunted and pale in patches during flowering and pod setting, before shrivelling and dying.
- Leaves are rolled downwards and appear greyish-green. Orange/red discolouration occurs in the vascular system of the stems, which is more pronounced at the nodes.

## Powdery mildew

*Erysiphe pisi*

- Common in late maturing crops.
- Foliage and pods are covered with a white powdery covering which develops when conditions are warm during the day, with cool, humid nights.
- Pods become infected, producing small black fruiting bodies within the lesions which appear as speckles.
- Plants produce a distinctive fishy smell and when severe, can cause off-flavour.
- Dust at harvest affects machinery and operators.
- The fungus overwinters on crop debris and other plant hosts such as vetch.

### Sclerotinia (white mould)

*Sclerotinia sclerotiorum*



- Common problem causing serious yield loss and crop contamination.
- Infection is noticed in early to mid-summer as dense white mycelium which covers stems and pods, when conditions have been wet and warm.
- Stems are often bleached and develop watery rot and collapse, after which they start to desiccate.
- Infected stems and pods contain elongated, black resting bodies (sclerotia) which are 4–10mm long. These are found as contaminants in produce and also remain in soil for several years until stimulated to germinate by a host crop.
- Other host crops include vegetables, oilseed rape, sunflowers, potatoes, linseed and soya.

## Damping off

Several soil-borne spp.

Phythium spp.



- Damping off results in reduced crop establishment.
- Seedlings have decayed stems and roots.
- Peas sown early, when soil temperatures are low and moisture levels are high, can be slow to emerge and susceptible to infection by soil-borne fungi.
- Cotyledons decay, and if germination occurs young roots are infected and seedlings fail to emerge.

## Foot rot

*Fusarium solani*, *Didymella pinodella**Aphanomyces euteiches*

- Foot rot causes serious reductions in yield. It is particularly common on land with a history of frequent pea cropping.
- Infected plants appear either in patches or individually.
- Leaves may be yellow and stunted, pods small and few in number. Plants often die prematurely.
- Stems may have a strangled appearance and roots are brown to black at soil level, with few or no root nodules.
- *Fusarium* often causes brick red discolouration of vascular tissue in the root and stem base.
- Foot rot is often associated with compacted or wet soil conditions, or stress such as physical damage, heat or drought.

## Downy mildew

*Peronospora viciae*

- Downy mildew is the most common disease of peas and can cause serious crop loss.
- Principally soil-borne, it initiates from early emergence of infected seedlings (primary infection).
- Plants are pale and stunted with undersides of leaves covered with grey-mauve velvety mycelium and pale blotchy upper leaf surface.
- More mature plants show similar symptoms, in patches, when secondary infection occurs in cool, damp conditions.
- Pods may be blemished externally, and produce a white cottony growth internally, leading to uneven pod-fill.
- Resting spores are produced, which persist in the soil and initiate primary infections.

### Pea Early Browning Virus

PEBV



- Transmitted by the free-living stubby root nematode (*Trichodorus* spp. and *Paratrichodorus* spp.), more common on sandy soils.
- When soil conditions are moist in spring the nematodes graze on pea roots and the virus is transmitted.
- Patches of the crop appear stunted, stems are brittle and a purple-brown discoloration appears on stems.
- Upper leaves display mottling, browning of veins and tan coloured irregular shaped spots on leaves.
- Causes rust brown staining of vascular tissue.
- Seed coats can become wrinkled and green/grey in colour.



## Pea Enation Mosaic Virus

PEMV



- The virus is transmitted by the pea aphid (*Acyrtosiphon pisum*), the peach potato aphid (*Myzus persicae*), and the potato aphid (*Macrosiphum euphorbiae*).
- Symptoms include vein clearing, pale mottling, and leaf distortion, which appear after flowering. Vein clearing and translucent flecks appear on leaves.
- Enations are thin flaps of tissue that develop along the leaf veins.
- In severe infections flowering shoots, which do not produce pods, appear at the leaf axils.
- Pods are mis-shapen and ridged.
- Overwinter hosts of PEMV include wild and cultivated legumes.

### Pea Seed-borne Mosaic Virus

PSbMV



- PSbMV is a seed-borne and aphid transmitted virus. Many aphid species including the pea aphid and the peach potato aphid can transmit the virus.
- PSbMV is non-persistent and easily spread by aphids as they probe for suitable host.
- Seedlings are stunted with small leaves, and plants develop slightly elongated, upwardly rolled leaves, with secondary development of side shoots from main stem.
- Pods are poorly developed and seeds often have blistering resembling "tennis ball" markings on the seed coat.

## Pea Streak Virus

PeSV



- Symptoms appear later in the growing season when pods are formed but not filled.
- Tops of plants may be mottled and there may be discoloration in vascular stem tissue.
- Pods remain unfilled with pit marks on the surface and there is a purple discolouration of pods.
- If infection is early plants become severely affected and may die before flowering.
- The virus is mainly transmitted by the pea aphid (*Acyrtosiphon pisum*).

# Pea

## Nutrient deficiencies



## **The importance of early diagnosis of crop nutrient deficiencies**

Suspected nutrient deficiencies based on the appearance of symptoms should be confirmed by leaf nutrient analysis. In such cases, the leaf nutrient concentrations will usually be well below the 'critical level' and there should, therefore, be little doubt about the diagnosis.

Leaf nutrient analysis should preferably be used to test for sub-clinical deficiencies or toxicities which may be already limiting growth but which are not yet resulting in visible symptoms. Guidance on collecting leaf samples is described on RB209 and other AHDB publications. Interpretation of laboratory results is possible by comparison with normal levels expected for the crop.



- Severe deficiency leads to yield loss.
- Deficiency results in chlorosis, firstly in older leaves and progressively in younger ones, usually as plants start to flower.
- There is clearly defined interveinal yellowing of foliage but leaf margins remain green.
- It is more likely to occur late in the season on light or acid soils, and is worse in wet years or when excessive potash is applied.

## Manganese deficiency

Mn



- Growth may be retarded in severe cases and yield reduced.
- Plants display marginal and interveinal chlorosis, particularly on new foliage, and the veins remain darker green.
- Peas from deficient crops have a brown spot in the centre of the cotyledons (marsh spot), which spoils them for processing.
- Peas grown for seed produce distorted seedlings that fail to grow normally.
- Manganese deficiency is more common on alkaline or organic soil types.

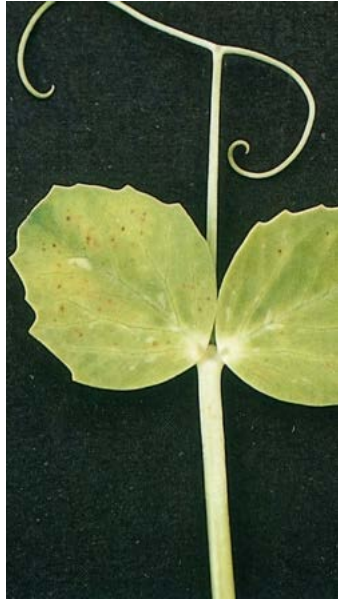


- Seedlings are stunted and show low vigour at emergence.
- Foliage may become darker in colour than normal.
- Reddening of stems, petioles, tendrils and leaf margins can occur, particularly if the plant is stressed.
- Older leaves show symptoms first, showing mottled necrosis and chlorotic leaf margins.
- Eventually, leaf margins become severely chlorotic and may die.



## Sulphur deficiency

S



- Yield is reduced.
- Growth is stunted and foliage is pale.
- Plants have an upright appearance.
- Deficiency is more common on light, free-draining soils in areas of low atmospheric deposition.
- Cold, wet conditions slow sulphur mineralisation and plant uptake.
- Root restricting constraints such as soil compaction, disease or soil acidity will exacerbate deficiency.

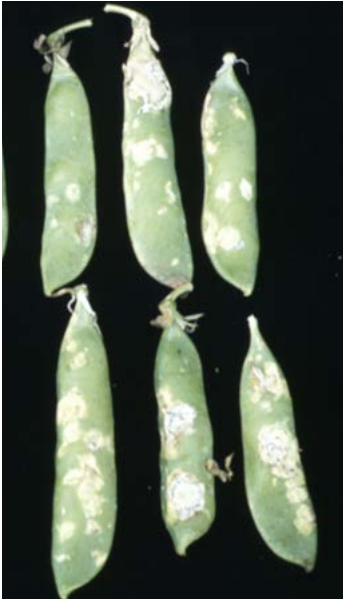


- Occasionally seen in peas grown on fertile, free-draining soils of high pH.
- Chlorosis of upper leaves occurs giving a very bright, pale-yellow effect in the top half of the plant.
- Yellowing occurs during the pre-flower to pod-set stage, following a period of rapid growth in conditions of warm, humid or wet weather.
- Iron becomes temporarily locked up in alkaline soils.
- After c. two weeks, symptoms abate and plants regain their normal colour.
- Although a striking symptom in pea crops, there is no effect on yield and the no treatment is required.

# Pea

## Physiological disorders





Above: hail damage illustrated on sweet peas.

- Where hail has hit the foliage white streaks and other markings appear on leaves and stems.
- Leaves are torn and pods broken open.
- Exposed seeds discolour rapidly.

## Frost injury



- Plants vary in reaction.
- Leaves are bleached and mottled.
- Flower buds are aborted.
- Growing points may become blind
- Developed pods have white mottling on surface.

## Water congestion



- Leaf tips of newest leaves are pinched and necrotic following heavy rain during the summer when plants are growing rapidly.
- Brown discolouration occurs at leaf tip.
- Apical cells of developing leaflets are ruptured and tips of newly formed leaves die back.
- Peas on fertile soils are most likely to show damage.
- Damage is insignificant and usually affects only a single pair of leaves.

# Green and runner beans

## Invertebrate pests

**Green bean**

*Phaseolus vulgaris*

**Runner bean**

*Phaseolus coccineus*



## Bean seed fly

*Delia platura*, *Delia florallega*



- Damage can be localised and sporadic, even though adult flies are common.
- Flies lay eggs on newly disturbed soil in the presence of green vegetation, high levels of organic matter such as farmyard manure or crop debris.
- Seeds and seedlings of late planted beans are attacked by the larvae during germination.
- Larvae are white segmented grubs with small, dark hooked mouthparts. They tunnel into seeds, stems and the upper root system.
- Severely damaged seeds fail to produce a seedling and decay before emergence.
- Plants are unable to compensate for damage which may lead to a 'baldhead' symptom (see 8.1).



## Black bean aphid

*Aphis fabae*



- The wingless aphids are 1.5–3mm long, black or olive green and often have distinct waxy stripes on the upper surface of the abdomen.
- Winged adults are very dark with faint black crossbars on the upper surface of the abdomen.
- Colonies are often noticeably attended by ants.
- Populations usually remain small and colonies of winged and wingless aphids develop on the underside of leaves.
- Occasionally colonies develop on flower clusters and small pods.
- Weeds such as thistle, fat hen and dock are summer hosts.

## Cutworm

*Agrotis* spp.



- Severe plant loss affects yield and damage may occur in rows or patches, allowing competition from weeds.
- Cutworms are the larvae of Noctuid moths, the turnip moth being the most common.
- Adults emerge from May onwards and, after mating, lay eggs on host plant leaves and roots.
- Larvae can be up to 40mm long, olive green or brown. They feed just below soil surface in dry periods during early to mid-summer.
- Seedlings are severed and stems left on the soil surface.
- Pheromone traps can be used to ascertain risk. A cutworm forecasting system is available.

## Springtail

*Collembola* spp.



- Small, jumping insects that appear in spring and early summer.
- Adults are narrow bodied and brownish in colour.
- Nymphs are pale to white and smaller than adults.
- Damage occurs as numerous pits or holes in leaves and stems.
- Springtails inhabit soils, especially moist soils with large quantities of organic matter.

## Two-spotted spider mite

*Tetranychus urticae*



- Damage is first seen as areas of pale tissue or chlorotic spotting on the leaf surface. Leaf undersides have a fine-webbed covering.
- Leaves may desiccate and fall off and bean pods may be damaged by feeding, leading to yield reduction. Blemished pods may be unsuitable for the fresh market.
- Two spotted spider mites are small round yellowish brown in appearance and have two dark spots on the abdomen.
- The mites are invisible to the naked eye.
- They are common in warm, dry weather and can overwinter inside runner bean bamboo canes.

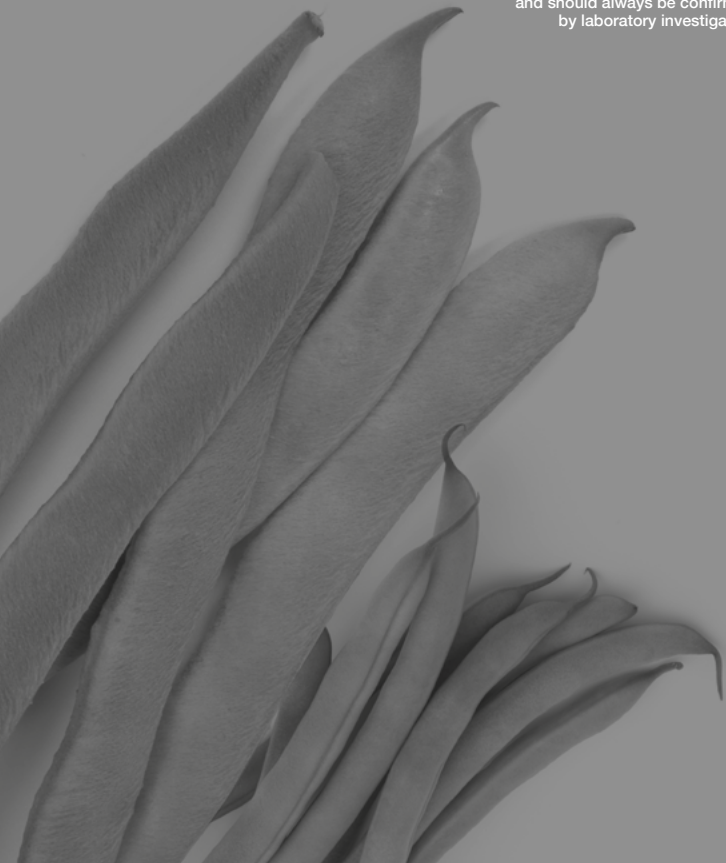
# Green and runner beans Diseases

**BACTERIAL DISEASES**

**FUNGAL DISEASES**

**VIRAL DISEASES**

Diagnosis of viral diseases from symptoms is problematic and should always be confirmed by laboratory investigation



## Common blight

*Xanthomonas axonopodis* pv. *phaseoli* = *X. c.* pv. *phaseoli*



- Water-soaked spots appear on the leaves which coalesce and become necrotic and irregular in shape, surrounded by bright yellow, narrow margins.
- Pods develop water-soaked round to oval spots later surrounded by a brick red colouration.
- Common blight is seed-borne and spread to surrounding plants by rain splash, irrigation and contaminated machinery.
- Contaminated crop and weed hosts can cause disease carry-over.
- It is favoured by periods of high temperature 28–32°C with high humidity. Symptoms usually appear just before flowering.

### Halo-blight

*Pseudomonas syringae* pv. *phaseolicola*



- Distinct yellow haloes on leaves surround water-soaked lesions, which later dry up. Water-soaked greasy lesions occur on pods which are unsuitable for the fresh market.
- Halo-blight is seed-borne and infested seed are an important source of disease.
- Seedlings grown from infected seed may be stunted and have 'bald-head' distortion; symptoms affect the first or second set of trifoliate leaves.
- Spread by rain splash, irrigation or contaminated machinery.
- Infection spreads to surrounding plants from single infected seedlings, forming scattered circular groups of infected plants.
- Halo-blight is favoured by cool, wet conditions, 16–23°C.

## Anthracnose

*Colletotrichum lindemuthianum*

- Anthracnose is very destructive and can cause serious losses.
- Anthracnose is a seed-borne fungus and dark sunken lesions may first appear on the stems of newly emerging seedlings.
- Lesions are typically 1–2cm long, causing stem collapse when they girdle the stem.
- Leaf lesions are angular, brown/black in colour with reddish edges. Affected sections of leaf veins are similarly coloured.
- Pod lesions are sunken, circular and dark brown/black with spores produced on the surface that appear as pink or orange specks.
- Seed infection occurs when pod lesions extend into the seed pod, causing yellow or brown under-developed, shrivelled seeds.



### Botrytis (grey mould)

*Botrytis cinerea*



- Infection occurs under cool conditions, and is associated with damaged tissues. It usually starts where flower petals stick to leaves or pods.
- Stem girdling also can occur just above soil level at the point of contact with the remains of the cotyledon.
- Once damaged tissues have been colonised, there is rapid enlargement of water-soaked lesions and the development of characteristic grey fungal growth.
- Common in dense crops during periods of wet weather.
- Direct contact between infected and healthy pods leads to secondary spread, in the field, in transit or in storage.

*Fusarium* spp. *T. basicola*, *R. solani* and others



- One of the most important causes of crop loss in beans.
- Germinating seedlings develop brown to red/brown sunken lesions on the stems and roots below the soil surface.
- Lesions may continue to develop until the stem base and roots are severely discoloured, both internally and externally.
- Roots may become shrivelled and the plant may die as a result.
- Surviving plants will be chlorotic and stunted as flowering begins. Growth is poor with resulting yield loss.
- The foot rot diseases are principally soil-borne fungi and often associated with consolidated or wet soil conditions.

### Rust

*Uromyces appendiculatus*



- Rust can cause significant crop loss, especially on runner beans.
- Symptoms appear on leaves and pods as numerous small, red to brown pustules, which are usually surrounded by a pale coloured zone.
- Infected leaves turn yellow, desiccate and plant growth ceases.
- Outbreaks are sporadic and associated with extended periods of warm temperature and high humidity.
- Vigorous crops with dense foliage are especially susceptible.
- Rust overwinters on infected crop debris.

## Sclerotinia (white mould)

*Sclerotinia sclerotiorum*

- Infection is usually noticed early to mid-summer when the crop is flowering and conditions are warm and wet.
- Stems and pods become covered in dense white fungal growth and infected stems collapse in a soft rot.
- Stems are often bleached as they desiccate and plants wilt and die. Pods shrivel and rot.
- Secondary spread occurs by fungal mycelium where there is direct contact between diseased and healthy plants.
- Black resting bodies (sclerotia) develop inside or outside of infected stems and pods.
- Sclerotia remain in soil for several years and can also contaminate seed. Other vegetables are also hosts.

### Bean Common Mosaic Virus

BCMV



- Symptoms are seen from the formation of first trifoliate leaves.
- Beans curl downwards and may grow longer than normal leaves.
- Leaves show irregular patterns of light and dark green on the surface, sometimes developing a mosaic pattern.
- Symptoms may vary according to bean variety and virus strain.
- Brown discolouration may develop on leaf veins. Roots may be blackened.
- The virus is transmitted by the pea aphid, black bean aphid, peach-potato aphid and other aphid species.

## Bean Yellow Mosaic Virus

BYMV



- BYMV develops at any time before flowering.
- Yellow mottling can occur on leaves, which may be crinkled and pointed with 'top necrosis'.
- Plants are stunted and vein clearing occurs.
- Pods are poorly developed, distorted and with an uneven surface.
- Symptoms may vary according to bean variety and virus strain.
- The virus is transmitted by the pea aphid, black bean aphid and peach-potato aphid and other aphid species.

# Green and runner beans

## Nutrient deficiencies





- Newly developing leaves show interveinal chlorosis.
- Common on soils of high pH or with high levels of organic matter.



## Potassium deficiency

K



- Plant growth is stunted and foliage pale with interveinal chlorosis followed by scorching at leaf margins.
- Deficiency may appear first on older leaves.
- Stems become brittle and break.

# Green and runner beans

## Physiological disorders





- Seedlings emerge with no growing point.
- Damaged seedlings have no true leaves within the cotyledons and fail to develop.
- Mechanical injury to the embryonic plumule results from rough seed handling, before or during sowing.
- May result from bean seed fly damage (see 5.1).
- Also known as 'snakeshead'.

# Broad bean

## Invertebrate pests



**Broad bean**

*Vicia faba*



- Causes significant damage to crops, mainly by direct feeding, causes yield loss if populations grow large enough.
- Wingless adults are 1.5–3mm long. Winged adults are very dark; both have white markings on the upper surface of the abdomen.
- Dense colonies form on upper stems and pods and move down the plant as colonies develop.
- Infested plants wilt and pods may not fill, causing loss of yield quality and quantity.
- Viruses are also transmitted, including BLRV, PEMV, BYMV and BYV.

## Broad bean stem borer

*Melanagromyza fabae*



- The larvae of flies bore inside the stem at the base of plants.
- Infested plants wilt especially in dry conditions.
- Larvae are small white grubs and pupae are golden brown.

## Bruchid beetle

*Bruchus rufimanus*



- Seed damaged by bruchid beetle is reduced in value and may lead to crop rejection.
- Adult beetles are 3.5–4.5mm long and oval, black/dark brown with the tip of the abdomen protruding from the wing cases.
- Larvae are creamy white with a light brown head, 3mm long at maturity and found inside developing seed.
- Eggs 0.5mm long, are laid singly or in small groups on pods. Larvae bore through the pod wall after hatching.
- Damaged seed has a small brown track mark where larvae enter through the seed coat.
- Common in areas of intensive field bean growing.

# Capsid

Lygus spp. and others



- Capsid feeding scars the seed coat of developing seed, causing reductions in quality.
- Capsids or shield bugs are usually green or green and brown, oval, with a hard exoskeleton.
- Capsids puncture pods and feed by sap-sucking.
- They are common in dry conditions in crops close to large hedges but cause little damage to broad bean yield in most years.





- Leatherjackets are the larvae of crane flies or 'daddy longlegs'.
- They are soil-inhabiting pests that mainly feed on roots and underground stem parts.
- Often a problem following ploughing of long-term grassland, leatherjackets feed on seedlings.
- The primary shoot is severed and secondary shoots grow in its place, which are weak and may not survive.
- Plant establishment may be affected in patches.
- Leatherjackets are grey/brown, up to 40mm, with a tough skin and a blunt posterior.

## Pea and bean weevil

*Sitona lineatus*



- The principal cause of crop damage is by larvae feeding on root nodules, which causes reduced yields.
- Spring crops are most at risk of attack as the adults emerge from over-wintering sites in field margins when temperature reaches 12–15°C.
- Adult feeding causes U-shaped notches around leaf margins.
- Adults are 4–5mm long, light to dark brown with faint striping along the length of the wing cases.
- Larvae are 4–5mm long, cream to white, wrinkled, fleshy and found around roots.
- Adult feeding can transmit viruses, including BBSV.

## Pea aphid and Vetch aphid

*Acyrtosiphon pisum* and *Megoura viciae*



- Pea aphid is a major pest of beans causing reduced yields by spoiling flowers, causing reduced pod fill and reducing plant efficiency.
- Pea aphids are large and green with a pear-shaped body, 2–3mm long, with red or black eyes.
- Vetch aphids are similar in size, a dull green colour with black legs, antennae and head.
- Colonies consist of wingless adults and nymphs, often covering pods.
- Infested shoot tips may become chlorotic, wilting may occur, virus infections develop and pods fail to fill.
- These aphids transmit several viruses, including BLRV, PEMV and BYMV.

## Slugs

*Derocerus* spp., *Arion* spp. and others



- Slug damage is more severe in autumn planted broad beans.
- Slugs cause damage all year round, when temperatures are between 5°C and 20°C in wet soil conditions. The grey field slug is active at close to freezing.
- Seed hollowing may occur and plants fail to establish.
- Primary shoots are rasped or tunnelled from an early crop growth stage.
- Slugs are common on soils with high clay content and open cloddy seedbeds, especially those containing manure and crop debris.
- Crop damage is most severe when plant vigour is low. Slow growth prolongs the vulnerable period of crop establishment.

## Stem nematode

*Ditylenchus dipsaci*



- Affected plants are stunted and distorted and stems are brown and twisted.
- Infested seed is often black and may contain thousands of nematodes. When planted, infested seed will introduce nematodes to clean land.
- Microscopic nematodes form dense 'wool' inside stems and pods and the nematodes are returned to soil in crop residues following harvest.
- Nematodes may be spread by rain, flood water and wind.
- Both seed and soil-borne, stem nematode can remain viable for many years.

## Thrips – Field

*Thrips angusticeps*



- Seedlings are attacked before and during emergence – thrips overwinter in soil.
- Small black elongated 1–1.5mm ‘thunderflies’ feed inside the tightly rolled leaves of the growing point, and continue to feed throughout the growing season, both there and on the leaf surface.
- Nymphs are orange or yellow.
- Undersides of affected leaves are bronzed.
- Thrips are more common on stony soils and damage is more severe in cool dry springs.
- Plants may outgrow damage as temperature warms during the spring.

# Broad bean Diseases

**FUNGAL DISEASES**

**OOMYCETE DISEASES**

**VIRAL DISEASES**

Diagnosis of viral diseases from symptoms is problematic and should always be confirmed by laboratory investigation



## Ascochyta leaf and pod spot

*Ascochyta fabae*

- *Ascochyta fabae* lesions occur on stems and leaves and have a light brown centre surrounded by a darker grey to black area.
- Within the lighter centre are pycnidia, small black pinpoint sized protrusions which may be produced in concentric rings.
- As the plant develops the stems or growing points may collapse as the lesions encircle the stem.
- Pods may display circular sunken brown to black lesions.
- Infected seeds often show brown/black discolouration.
- The pathogen is seed-borne and survives on crop debris. Rain splash and wind spread the infection.



### Cercospora leaf spot

*Cercospora zonata*



- Yield losses in the UK due to this disease are not well quantified and disease levels vary.
- Lesions are dark grey to black, forming a zonate pattern, but unlike *Ascochyta*, do not contain pycnidia.
- It is easily mistaken for *Ascochyta* (*A. fabae*) or chocolate spot (*Botrytis*) in beans.
- *Cercospora* survives on crop debris.
- Warm, wet conditions encourage infection and it is spread by rain and wind.
- It is not known to be seed-borne.

## Chocolate spot

*Botrytis fabae, Botrytis cinerea*

- Chocolate spot is common in areas where beans are regularly grown and causes up to 50% crop loss.
- Small brown circular spots appear on leaves, coalescing into extensive lesions.
- If the disease becomes aggressive, defoliation occurs and red-brown streaks may appear on stems.
- Bronzing occurs on pods and this pod blemishing may result in broad beans for the fresh market being downgraded or rejected.
- The disease is encouraged by cool humid conditions and survives on crop debris.
- Autumn sown crops can be affected from early spring, particularly if frost damaged, during prolonged wet and overcast weather.

### Foot rot

*Fusarium solani*, *Fusarium culmorum* and others



- Infected plants are pale, stunted and die prematurely.
- Roots are brown or black with few or no root nodules.
- *Fusarium* spp. cause red discolouration of the vascular tissue in the root and stem base.
- The base of the stem is decayed with pink/white mycelial growth if *Fusarium* spp. are responsible.
- Lesions can be infested by pink Reseliella midge larvae, which may exacerbate the effects of fungal infections.
- The diseases are often associated with consolidated or wet soil conditions, periods of drought or other plant stress.



- In severe infections plants defoliate and yield is lost if pods are not completely filled.
- Numerous small yellow to orange pustules begin to develop on lower leaves and infection spreads rapidly to the upper foliage.
- The pustules are usually bordered by a chlorotic halo and later break open releasing the dusty orange-brown spores.
- Rust is favoured by hot days and cool, humid nights.
- Symptoms on spring beans tend to be more serious than on winter beans.
- Most damage occurs if infection begins during flowering and pod set.

### Downy mildew

*Peronospora viciae*



- Symptoms develop first on the leaves of seedlings as a primary infection from a soil-borne source. Plants are often pale and stunted.
- Undersides of leaves are covered with grey-mauve velvety mycelium.
- Leaves of more mature plants show similar symptoms in patches.
- Primary infected plants produce many spores which are then spread in the air to surrounding plants, causing secondary infection.
- Cool humid conditions are favourable for disease development.
- Disease occurs more often in spring sown broad beans.

## Bean Leaf Roll Virus

BLRV



- BLRV is persistent virus with a range of legume hosts, including peas, clover and some wild legumes.
- It is transmitted by the pea aphid and other aphids, including the peach-potato aphid *Myzus persicae*.
- Infection is usually more severe when the virus is transmitted at an early crop growth stage.
- Early infection of BLRV causes stunting and reduction in size of the developing leaves.
- Later infections cause leaf thickening and leaves are rolled upwards, as well as showing interveinal chlorosis. There is also a significant reduction in pod set.
- Not considered seed-borne.

### Bean Yellow Mosaic Virus

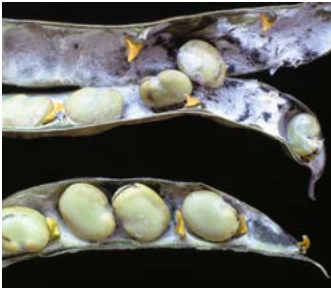
BYMV



- BYMV is a persistent virus with a range of hosts, including wild and cultivated legumes, and other species.
- The pea aphid is the principal vector but BYMV is also transmitted by the black bean aphid, peach potato and other aphid species.
- BYMV is the most common cause of mosaic symptoms in broad bean. There may be transient vein chlorosis followed by green or yellow mosaic. There is usually no leaf distortion.
- Early infections may cause stunting and slight narrowing and clearing of the leaflets.
- Exact symptoms depend on whether 'typical' or 'pea mosaic' strains are involved.

## Broad Bean Stain Virus

BBSV



- Bean seeds develop a brown necrotic edge which affects the quality of broad beans for the fresh and processed markets.
- BBSV is seed-borne and transmitted by various species of pea and bean weevils.
- Mosaic symptoms may vary between successive leaves.
- BBSV also causes plant stunting and pod deformation.
- Yield is not usually affected, but quality may be compromised.



### Pea Enation Mosaic Virus

PEMV



- PEMV is a persistent virus with a range of legume hosts.
- It is transmitted primarily by the pea aphid and peach-potato aphid but other aphid species are also involved.
- Symptoms include vein clearing, pale mottling and leaf distortion and may be more severe when the virus is transmitted earlier in the crop growth stage.
- Pods are distorted and seeds may be malformed.
- Often associated with BYMV and BLRV.

# Broad bean

## Nutrient deficiencies





- Potassium deficiency in broad beans results in yellowing or scorching of leaf margins and forward curled leaves.
- Stems may be shortened between nodes.
- Symptoms of nitrogen deficiency may occur due to lack of nodulation and reduction in nitrogen fixation caused by the potassium deficiency.
- Deficiency may make plants more susceptible to disease development, especially chocolate spot
- Deficiency will reduce yield.

# Broad bean

## Physiological disorders





- Where hail has hit the foliage white streaks and other markings appear on leaves and stems.
- Leaves are torn and pods smashed open.
- Stems may be damaged and tops of plants broken off.
- Exposed seeds discolour rapidly.

## Water congestion



- Black discolouration occurs at leaf tips.
- Water congestion causes rupturing of apical cells of developing leaflets and tips of newly formed leaves die back.
- Leaf tips of newest leaves are pinched and necrotic following heavy rain during the summer when plants are growing rapidly.
- Damage is not significant and usually affects only a single set of leaves.

# References



The production of this Crop Walkers' Guide has been made possible thanks to Becky Howard, PGRO and Adrian Fox, Fera.



# Pea & Bean Crop Walkers' Guide

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### **Section 1 Pea – Invertebrate pests**

1.2 Hoverfly (top), Fera

1.14 Wireworm (bottom left and right), Bayer Crop Science

### **Section 5 - Green and runner beans – Invertebrate pests**

5.3 Cutworm (bottom right), The University of Warwick



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