Gooseberries

A grower guide to production, variety choice and pest and disease problems

Written by Scott Raffle (HDC)

Edited by Roger Umpelby (Fruit entomologist), Chris Nicholson, Janet Allen and Erika Wedgwood (ADAS)

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Introduction

In the UK soft fruit industry, gooseberry is considered a minor crop. With a small available market for the product, the crop is only grown in significant quantities by a few growers, many of whom sell through Farm Shop and Pick Your Own outlets.

Those who do produce gooseberries, suffer from a number of production problems, most of which are brought about by pest and disease infestations. Gooseberry sawfly, American gooseberry mildew and die-back caused by Phytophthora and Eutypa are a particular problem for many growers.

The HDC soft fruit panel considered that the production of this publication would provide help to gooseberry producers to identify the regularly found pest and disease problems and how best to manage them. It also provides a resume of the current varieties available to growers along with some brief notes on cultural considerations.

Cultural considerations

Site and soil

The gooseberry is the earliest soft fruit to flower in spring, most commonly in March. It is therefore very prone to frost damage, so it is vital to choose a site with free air movement and to avoid areas where frost pockets can occur.

Good shelter is also important to provide optimum conditions for pollination and growth. Windbreaks and hedgerows are a useful asset in exposed areas (Figure 1).

1 Windbreaks and hedgerows are a useful asset in exposed areas

Soils should be deep, well drained medium loams. Sandy textured soils can be used, but irrigation facilities are essential on such soils to maintain adequate growth and longevity of production.

Soil preparation

As a woody perennial, it is essential to prepare the ground well before planting. Good drainage is so important that drains should be installed where necessary and deep ploughing undertaken before final cultivations are carried out.

Where perennial weeds are a problem, it is best to allow at least a season to gain control through the use of a bare fallow and translocated herbicides.

The nutrient status of the soil should be checked, corrected where necessary and the land made in a fit state for planting by early October.

To improve rooting depth and drainage, some growers plant in a raised ridge or bed (Figure 2). Not only does this reduce the risk of root death in wet winters, it helps to hasten early growth in the spring. Polythene and other mulches are often laid to cover a bed or ridge to provide some level of weed control, but be aware that this can provide ideal conditions for vine weevil adults and larvae.

2 Bush fruit plantation growing on a polythene mulched raised bed

Planting

It is best to plant in the autumn months after leaf fall, when temperatures are low and there is sufficient soil moisture to prevent bushes from losing moisture and coming under stress. If soils are not too wet, bushes can be planted during the winter months. However, March is too late, as soils start to dry out rapidly at that time of year.

Choice of planting material

Most propagators supply well rooted bushes with a 15-20cm leg and 3-5 shoots of 20cm length. Some growers have been known to establish new plantations directly from hardwood cuttings. However, it is not unusual for cuttings to fail to root, so the establishment of the crop is slow and uneven. Growers should also be aware that such crops take longer to come into fruit than rooted bushes.

Choice of production system

Growers either establish a plantation by planting bushes in rows or alternatively by supporting the bushes on a wirework trellis and training the branches in a cordon or espalier system.

Where bushes are established in a traditional row system, the rows are generally spaced 1.5 metres apart and the bushes spaced 1.4 metres within the row providing approximately 4,800 bushes per hectare.

Plantations established on a wirework support system will vary in planting density depending on the planting material and system used. In some cases, one year old rooted cuttings are planted at 0.3 metres apart in the row and the plants are grown on the trellis as single cordons. Alternatively, one year old bushes are planted at 0.9 metres apart and three or four shoots are trained on an espalier bush.

Wire support systems

Where growers choose to train their bushes on a wire support system, it is best to erect the supports before or at the same time as planting. The support trellis can be of a similar design to that used for the traditional hedgerow support system used for raspberries (see HDC Factsheet 12/06 – 'Cane management and training of field grown mainseason raspberries'). Three or four fixed wires should be erected and spaced evenly from the bottom of the trellis upwards, with the top wire positioned at 1.5 metres above the ground.

Post planting management

With bushes to be grown in a traditional row system, the shoots selected to form main branches should be well spaced and shortened to about half their length. Remaining shoots should be cut back to about 2cm. Pruning in subsequent years should be lighter for vigorous bushes and heavier for weaker ones. Old, damaged, diseased and low hanging branches should be removed. An open centre bush should be encouraged by shortening cross branches to 2-3cm, if not too strong, or by removing them completely.

In trellis trained gooseberries, leader shoots must be retained either with one per plant to form a cordon or alternatively three or four per plant on a leg. After planting and in subsequent years, shorten each leader by up to one third, depending on vigour, and cut back any lateral shoots to two buds.

Varieties

Rokula

An early season red variety which produces a very compact bush with a characteristic, slightly drooping growth habit. It is well suited to production on a wire trellis system. Typical yields are around 1.5kg per bush. Rokula is resistant to American gooseberry mildew. Fruits are round in shape, are larger than Careless and are dark red when ripe (Figure 3). Rokula is a dessert variety with an excellent sweet flavour, making it well suited to the PYO and fresh markets.

3 Rokula

Xenia

An early-mid season red variety with a high yield potential. Xenia produces a very strong growing upright bush with slightly drooping growth. The upper half of the branches have no thorns. The variety can grow strongly on poor soils, so care must be taken not to over-feed the plants on good soils or else excessive growth will occur. Xenia has some tolerance to American gooseberry mildew but control measures are required. Fruits are large, round in shape, have few hairs and ripen to an attractive red colour (Figure 4). Xenia is well suited to PYO and other fresh market sales.

4 Xenia

Pax

An early-mid season red variety which produces a vigorous bush with a spreading habit. It produces very few spines, making it easier to pick than many varieties. Pax is a heavy yielding variety, producing 1.75kg per bush. It is moderately resistant to both American gooseberry mildew and leaf spot. Fruits have a good oval shape and are dark red when fully ripe (Figure 5). Pax is a dessert gooseberry which is ideally suited to PYO and fresh markets.

5 Pax

Careless

One of the older green varieties still grown by gooseberry producers, Careless is considered to be a mid-season variety. However, in practice Careless can be picked early to achieve higher market returns, but in so doing yields tend to be lower. Conversely, it can be picked late, when yields are higher but market returns may be suppressed. It is moderately vigorous on good soils but weak on poor soils. The bush is upright when young but spreading later. It is susceptible to American gooseberry mildew. Berries are large (7.7g), oval in shape, green in colour, turning milky-white when ripe. Careless is normally grown as a culinary variety and was traditionally grown for processing.

6 Careless

Invicta

Invicta is viewed as a mid season green fruited variety. However, like Careless it can be picked early to achieve higher market returns, but in so doing yields tend to be lower. Conversely, it can be picked late, when yields are higher but market returns may be suppressed. It produces a large, vigorous, spiny bush which may require extra pruning. It is well suited to production on a wire trellis system. Yields can be at least 30% higher than Careless. When first bred, it was resistant to American gooseberry mildew but some races of the pathogen have now overcome this resistance. Invicta does appear to be vulnerable to Phytophthora infection. Fruits are slightly pear shaped, green in colour, but becoming paler than Careless as they ripen (Figure 7). Invicta is a culinary variety, suitable for PYO and processing.

7 Invicta

Leveller

A mid season yellow fruited variety, Leveller produces a moderately vigorous bush which requires hard pruning to produce fruit of a large size. It requires good drainage and a fertile soil to grow successfully. Leveller is very susceptible to American gooseberry mildew and leaf spot. Fruits are light green, turning to yellow when fully ripe. Leveller is a dessert variety with wonderful flavour and is suited to PYO and fresh markets.

8 Leveller

Greenfinch

A mid season green fruited variety which crops at the same time as Careless. Greenfinch produces a spiny, weak growing bush, which can be difficult to grow on poor soils because it lacks vigour. However, if grown well on good soils, it can produce heavy yields. It has resistance to American gooseberry mildew and leaf spot. Fruits are smooth and green but slightly smaller than those of Careless and Invicta. Greenfinch is a culinary variety, suitable for PYO and processing and has potential for use in organic production systems.

Whinham's Industry

A mid season red fruited variety, Whinham's Industry produces a vigorous bush with a spreading habit, which needs regular pruning for best results. It can produce heavy crops on a range of soils and succeeds better than most on clay textured soils. Whinham's Industry is highly susceptible to American gooseberry mildew with both shoots and fruits affected. Fruits are medium in size, oval in shape, hairy and turn dark red when fully ripe (Figure 9). The fruits are sweet and are suited for dessert sales through PYO and other fresh markets.

9 Whinham's Industry

Hinnonmaki Red

A mid season red fruited variety which produces a semi-upright bush. Hinnonmaki Red is a very hardy variety which can survive cold winters. It is resistant to American gooseberry mildew. Fruits are medium in size, turning dark red as they ripen. Flavour is excellent and sweet, making this dessert variety ideally suited to PYO and other fresh markets. It has potential for use in organic production systems.

Hinnonmaki Green

A mid season green fruited variety which, like Hinnonmaki Red, is extremely hardy and tolerant of cold winters. The bush is vigorous, upright and round. Well drained neutral soils are preferred for optimum growth. The bush is resistant to American gooseberry mildew. It is a prolific cropper and produces large olive green fruit.

Martlet

A mid-late season red fruited variety producing a moderately vigorous globose shaped bush with short internodes and short soft spines. Martlet is a high yielding variety, having produced yields in excess of 4kg per bush. It is resistant to American gooseberry mildew and appears to have a high tolerance to leaf spot. Fruits are oval in shape, large, hairless and have a strong red colour (Figure 10). They are succulent with good flavour, making them suitable as a dessert variety for PYO and other fresh markets. It has potential for use in organic production systems.

10 Martlet

Hinnonmaki Yellow

A late season yellow fruited variety which, like Hinnonmaki Red, is a very hardy variety and is tolerant of cold winters. The bush has a spreading habit and benefits from some support. The bush is resistant to American gooseberry mildew. Fruits are medium in size and yellow when ripe. They have an aromatic flavour with a hint of apricot. Hinnonmaki Yellow is a dessert variety which is well suited to PYO and other fresh markets. It has potential for use in organic production systems.

Captivator

A late season burgundy red fruited variety which is very cold hardy (Figure 11). The bush is vigorous, virtually thornless and has a spreading habit. It is resistant to American gooseberry mildew. The berries are pear shaped and their sweet flavour make them a suitable dessert variety for PYO.

11 Captivator

Aphids

Four aphid species are commonly found feeding on gooseberry in the UK, causing damage to the crop. The most common are the gooseberry aphid *(Aphis grossulariae)* and currant-lettuce aphid *(Nasonovia ribisnigra)* but the gooseberry-sowthistle aphid *(Hyperomyzus pallidus)* and the gooseberry root aphid *(Eriosoma grossulariae)* are also found.

Gooseberry aphid *(Aphis grossulariae)*

Biology

Adults are small, dark green to greyish-green in colour, with a mealy, waxy coating. Eggs normally hatch in March and early April. At first, wingless aphids feed on the fruit buds but later, infestations spread to the tips of the young shoots, where dense colonies establish. This aphid is present on gooseberry throughout the summer, although some winged forms migrate to willowherb (a secondary host), before returning to gooseberry in the autumn. Other winged aphids disperse to other gooseberry plants or plantations. Eggs are laid in the autumn and over-winter on the shoots (Figure 12).

12 Gooseberry aphid egg

Damage

Feeding gives rise to significant leaf curl and development of stunted and distorted shoots (Figure 13). Damaged leaves remain a uniform colour with no banding.

13 Gooseberry aphid damage

Currant-lettuce aphid *(Nasonovia ribisnigra)*

Biology

Adults are dark green in colour, shiny and slightly larger than the gooseberry aphid (Figure 14). Eggs over-winter at the base of buds on bushes. Colonies become noticeable in young shoot tips in April and early May. Winged aphids disperse to lettuce and other summer hosts in May or June before returning in the autumn to gooseberry.

14 Currant-lettuce aphid

Damage

Damage occurs in spring when dense colonies form in shoot tips, causing slight leaf curl and some shoot stunting.

Gooseberry-sowthistle aphid *(Hyperomyzus pallidus)*

Biology

A green coloured aphid which is related to the currant-sowthistle aphid which feeds on currants. However, this is far less common. Feeding on gooseberry occurs in spring. In summer, winged aphids disperse to their secondary host, corn sowthistle, before the aphid returns to gooseberry in the autumn.

Damage

Feeding causes shoot distortion and a distinctive yellow vein-banding of the leaves (Figure 15).

15 Vein-banding caused by gooseberry-sowthistle aphid

Gooseberry root aphid *(Eriosoma grossulariae)*

Biology

Adults are small (1-1.5mm long), oval, pink to yellowish white in colour and surrounded by white woolly masses of wax. The primary host is elm *(Ulmus)* but winged forms migrate to gooseberry in June and July where nymphs are deposited in or near the soil. The nymphs feed on underground stems and roots. Dense colonies of wingless wax-covered aphids develop during the summer before winged aphids form in autumn, which return to elm.

Damage

Infestations on mature bushes are rarely noticed, but young bushes can be weakened or stunted by root feeding.

Monitoring for aphids

Check plantations weekly or at least fortnightly from bud burst until the autumn. Carefully inspect the shoot tips and undersides of leaves for the presence of aphids. Check in and around the soil at the base of newly planted bushes for the presence of gooseberry root aphid.

Control of aphids

Environmental and cultural control

Aphids are ubiquitous insects and it is impossible to control the environment to prevent them from invading gooseberry plantations. Reducing alternative aphid host species close to established plantations and avoiding establishing plantations close to alternative hosts will reduce the risk of infestation.

Biological control

A wide range of both naturally-occurring beneficial insects and introduced biological control agents feed on aphids. Naturally-occurring beneficials include anthocorids (Figure 16) and other predatory bugs, earwigs, hoverfly larvae, lacewings, ladybirds, parasitic and social wasps and predatory midge larvae. Additionally, centipedes and some species of rove and ground beetles predate soil-living aphids. To enhance the populations of these insects, it is vital to provide diverse vegetation in the vicinity of the plantation including trees, woodland, hedgerows (with different species) and low-growing mixed herbaceous vegetation and a range of nectar sources.

16 Anthocorid adult feeding on aphid

Of the available biological control agents, parasitic wasps *(Aphidius* species, *Aphelinus abdominalis* and *Praon myziphagum)*, predatory midges *(Aphidoletes aphidimyza)* and lacewings *(Chrysoperla carnea)* are all useful for gaining some control. However, experience shows that although biological control offers some level of control, it can't be relied upon to control large population explosions of aphids.

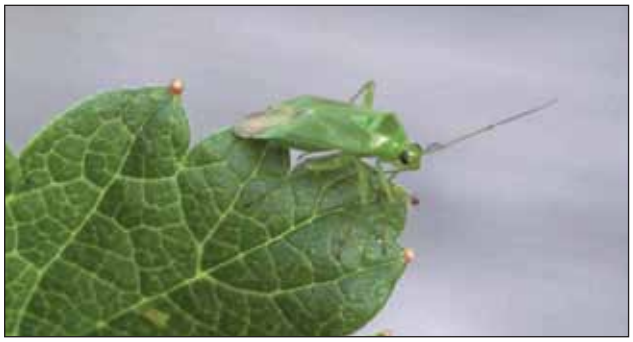
Chemical control

To gain rapid control of aphids, growers may need to rely upon the use of chemical control. A list of the currently available active ingredients and products can be found in Table 2 in the crop protection products section at the back.

Common green capsid *(Lygocoris pabulinus)*

Biology

The bright green adults are up to 6.5mm long and can run rapidly over plants but fly readily if disturbed (Figure 17). The juvenile stages cannot fly but run rapidly (Figure 18). This species over-winters as an egg laid in the bark; eggs hatch in April and develop into adults in June. These adults usually leave gooseberries and start a second generation on herbaceous plants. Second generation adults return to gooseberries and other woody plants in the autumn.



17 Common green capsid adult

18 Common green capsid nymph

Damage

Feeding in shoot tips results in small irregular holes in the expanding leaves of shoot tips often resulting in stunted growth (Figure 19). Severe damage can lead to death of the shoot tip and subsequent branching. Occasionally fruit damage can occur.

19 Typical leaf damage caused by common green capsid

Monitoring for capsids

Check the young leaves and shoot tips on a weekly basis from April onwards. Look for puncture marks or distortion in shoot tips.

Both adults and nymphs can be difficult to detect as they hide when disturbed. They are more easily detected in bright sunny warm weather, in the growing points or on the surface of young leaves. The rapid movement of this insect is often the first sign that the pest is present. Another option is to beat the bush over a white tray; this dislodges the insects from the foliage and they can easily be seen in the tray.

Control of common green capsid

Environmental and cultural control

It is difficult to influence populations of common green capsid through environmental and/or cultural means. They readily feed on a wide range of woody and herbaceous species, so habitat management is not an option.

Biological control

Common green capsids have few natural enemies, but some Nabid bugs will predate them but are likely to have little impact on the population. Some general invertebrate predators will feed on young capsids, particularly when they are moulting. No biological control agents are currently available for purchase. A Defra Horticulture LINK project (HL 0184, PC/SF 276) has succeeded in identifying the sex pheromone of the common green capsid and work is in progress to deploy this in management and control strategies.

Chemical control

Normally, commercial growers will need to resort to the use of a chemical control measure. A list of currently available active ingredients and products can be found in Table 2 in the crop protection products section at the back.

Woolly currant scale *(Pulvinaria ribesiae)*

Biology

The body of a female scale insect forms a hard smooth tortoise shaped scale, up to 6mm long when fully grown (Figure 20). Scales of the male are much smaller and difficult to spot. After mating in the autumn the males die and the females hibernate until plant growth starts in early spring. In May they spin a cushion-like sac of white waxen threads, then lay a mass of eggs within these threads. The adult dies but soon afterwards, the bulk of the egg mass lifts the scale off the branches, revealing the pink eggs and copious white wax threads (Figure 21). In June, the eggs hatch into ‘crawlers’ which move onto first year wood, become sedentary and form new scales which mature in September.

20 Woolly currant scales

21 Woolly currant scale eggs and crawlers

Damage

In heavy infestations feeding damage weakens the bush resulting in significantly reduced crops. The waxen threads are easily blown about by wind, contaminating shoots and fruit (Figure 22).

22 Woolly currant scale infestation in blackcurrant

Monitoring for woolly currant scale

Examine bare branches in the dormant season, looking for scales. These will become more obvious in the spring, when the scales start to lift and reveal the white waxen threads. If left uncontrolled, numbers of the pest will often increase year on year and the pest will be easier to find.

Control of woolly currant scale

Environmental and cultural control

Although the adult females cannot fly, the dispersal of the species is by transfer of the eggs on the sticky wax filaments, sometimes by wind but more usually via flying insects or even birds. The pest can also be transferred on workers' clothing so avoid moving from an infested plantation into an uninfested one. New planting material should be checked for the presence of scales and rejected if infested.

Biological control

Ladybirds (Figure 23), capsids and anthocorids are among a range of predators which feed on scale insects. As trees and hedges are favoured habitats for such predators, provision of hedgerows with a range of species should be made in the vicinity of gooseberry plantations. Nettles are also very good host plants for predators, so these should be retained in the vicinity.

23 Ladybirds are among a range of predators which feed on scale insects

No commercially available introduced predators offer reliable control of scale insects.

Chemical control

In most instances, when populations of scale insects reach damaging levels, chemical control measures are necessary. A list of currently available active ingredients and products can be found in Table 2 in the crop protection products section at the back.

Sawfly caterpillars

Biology

There are three sawflies commonly found on gooseberry in the UK: the common gooseberry sawfly *(Nematus ribesii)*, the pale-spotted gooseberry sawfly *(Nematus leucotrochus)*, and the small gooseberry sawfly *(Pristiphora pallipes)*.

Caterpillars of the common gooseberry sawfly and the pale-spotted gooseberry sawfly are green with numerous black spots and can be up to 15-20mm in length (Figure 24). The larva of the small gooseberry sawfly is smaller (10mm), is pale green/yellow in colour but has no spots. Sawfly caterpillars on gooseberries are easily distinguished by their seven pairs of prolegs, compared to a maximum of five pairs for moth caterpillars.

24 Gooseberry sawfly larvae

Adults are more difficult to recognise or distinguish between species. They range from 4.5-7mm in length, have a head, thorax and abdomen with two pairs of wings.

The adults appear in April and early May. Eggs are laid on leaves, the location varying with species. The common gooseberry sawfly lays its eggs in rows on the undersides of leaves (Figure 25). The pale-spotted gooseberry sawfly lays its eggs singly on either leaf surface. The small gooseberry sawfly lays its eggs at the edges of leaves, usually one per leaf. The larvae hatch out and feed on gooseberry leaves (Figure 26). Three generations of the common gooseberry sawfly can occur per year, up to four generations occur in the small gooseberry sawfly but only one per year in the pale-spotted gooseberry sawfly. In all cases, they over-winter as pre-pupa in the soil before pupating the following spring.

25 The common gooseberry sawfly lays its eggs in rows on the undersides of leaves

26 Gooseberry sawfly larvae feeding on leaves

Damage

The most significant damage is caused by the common gooseberry sawfly larvae, which devour large sections of the leaf lamina, often leading to complete bush defoliation (Figure 27). Damage occurs in the centre of the bush first, but larvae disperse and feed on leaves through the whole bush.

27 Defoliation caused by gooseberry sawfly

The pale-spotted gooseberry sawfly larvae bite holes around the edges of leaves but damage is rarely significant. Larvae of the small gooseberry sawfly are usually present in small numbers, so damage is less significant. However, where present in large numbers, defoliation can occur.

Monitoring for sawflies

From April onwards, check weekly for the presence of eggs on the undersides of leaves and around their edges. Look particularly on leaves in the lower and middle part of the bushes where eggs tend to be laid. As the season progresses, look for signs of feeding on the leaves, particularly where large chunks of leaf tissue are missing. Check for the presence of sawfly larvae on the edges or undersides of leaves, starting in the middle and lower parts of the bush and working outwards.

Control of sawflies

Environmental and cultural control

Environmental and cultural control measures have little impact on sawfly populations.

Biological control

Sawfly caterpillars are attacked by various naturally-occurring parasitic wasp species (Brachonids, Chalcids and Ichneumons). Most wasp larvae are internal parasites (Figure 28), sometimes with only one parasite per prey. Some wasp adults are predatory, showing excellent searching behaviour, so are useful for controlling low pest populations. Parasitic wasps are most commonly found in mixed vegetation such as field margins and hedgerows.

28 Caterpillar parasitized by a parasitic wasp

Eggs and young larvae are predated by some general invertebrate predators but *Nematus* spp. caterpillars are often avoided by birds.

No commercially available introduced predators or parasites offer any control of sawflies.

Chemical control

As sawflies tend to lay significant numbers of eggs, large numbers of larvae hatch out simultaneously and can cause high levels of damage very rapidly. As a result, growers tend to rely on chemical control measures to gain quick control. A list of currently available active ingredients and products can be found in Table 2 in the crop protection products section at the back.

Moth caterpillars

The caterpillars of tortrix moths (various species), winter moths *(Operophtera brumata)* and currant clearwing moths (*Synanthedon tipuliformis*) are the most commonly found moth caterpillars causing damage to gooseberry, although a number of others may occur.

Tortrix caterpillars (various species)

Biology

Several species of tortrix caterpillars can be found feeding on gooseberry. Tortrix species over-winter either as larvae or eggs, so larvae can start to appear from April onwards. Tortrix caterpillars can be recognised by their characteristic habit of wriggling rapidly backwards when disturbed. When fully grown, they can be 15-20mm in length and green, grey or brown depending on the species (Figure 29). Most species have two or sometimes three generations each year.

29 Tortrix caterpillar

Damage

The caterpillars spin the leaves of bushes together with silk to form shelters inside which they feed, protected from most predators and parasites (Figure 30). They favour young leaves in shoot tips, often killing the terminal bud causing stem branching.

30 Tortrix caterpillars spin leaves together with silk

Winter moth *(Operophtera brumata)*

Biology

Adults occur from October to January but are most abundant in November and December. The male is greyish/brown in colour and measures about 25mm across the forewings. The female is smaller and cannot fly, but crawls up the trunk of a bush and lays eggs in crevices in the bark. Eggs hatch in spring into larvae which when mature are 25mm long, rather plump, pale green with a dark green dorsal stripe and several cream stripes along the back and sides (Figure 31). They only have two pairs of prolegs. One generation occurs per year with feeding continuing until May or early June.

31 Winter moth caterpillar

Damage

The caterpillars use silk to pull leaves loosely together for protection. They feed mainly on the foliage (Figure 32), not shoot tips generally, but feeding on flowers and young fruitlets can cause significant yield loss.

32 Winter moth caterpillar feeding on leaf

Currant clearwing moth *(Synanthedon tipuliformis)*

Biology

The wasp- or fly-like adults have blackish bodies with narrow transverse yellow bands (Figure 33). The wings are brown-bordered but otherwise transparent with a span of 1.5-2cm. They are active in sunny weather and may be found in gooseberry bushes in June and July. Pale yellow eggs are laid singly on the stem near a bud or wound. Young caterpillars are whitish with a brown head. They burrow into the pith to begin feeding, and then burrow either upwards or downwards (Figures 34 and 35). They become fully grown in April, when about 1.5cm long. Pupation takes place just below the surface of the stem.

33 Currant clearwing moth adults mating

34 Currant clearwing moth pupa in stem

35 Currant clearwing moth stem damage

Damage

Once the caterpillars are tunnelling in the stem there is no external sign of their presence, although the foliage may be paler and wilt in hot dry spells. Infested shoots are less vigorous and fruit size is reduced. Previously infested stems are brittle and readily snap off (Figure 36 - overleaf).

36 Hole created by currant clearwing moth – such stems are easily snapped off

Monitoring for moth caterpillars

It is much easier to find and identify caterpillars than adult moths. From early spring, look weekly or at least fortnightly for the presence of caterpillars. Look for signs of leaves webbed together and check both shoot tips and foliage throughout the bush. Check for holes in branches during the winter, which might reveal the presence of currant clearwing moth and check for weak and brittle branches which might be a sign of the same pest.

Control of moth caterpillars

Environmental and cultural control

As moths fly into plantations, environmental and cultural control methods are of little benefit in controlling any species of moths. Pheromone traps are available for a range of moth species and are very useful for warning of a potential attack making timing of control measures more accurate.

Biological control

A wide range of naturally-occurring beneficial insects

will feed on and control moth caterpillars. Anthocorids, ladybirds, hoverflies (Figure 37), ground beetles, rove beetles, solitary and social wasps will all feed on moth eggs and caterpillars. Caterpillar parasitism by the larvae of parasitic wasps is very common. A wide diversity of vegetation in the vicinity of a gooseberry plantation will provide a habitat for these species. In particular, woodland, trees, hedgerows (with different species) and low-growing mixed herbaceous vegetation (including nettles) offering a range of nectar sources is ideal. Many species of small birds are excellent predators of caterpillars. Blue tits and sparrows are particularly good so provision of nest boxes in and around plantations would be beneficial.

37 Hoverfly larvae feed on small caterpillars

The bacterial insecticide *Bacillus thuringiensis* var kurstaki (Dipel DF) offers effective control of a range of caterpillar species. Given its biological nature, there is no risk of incurring chemical residues. In addition, in protected cropping situations, the egg parasite *Trichogramma brassicae* is also available for control of caterpillars but this is not effective at controlling all moth species.

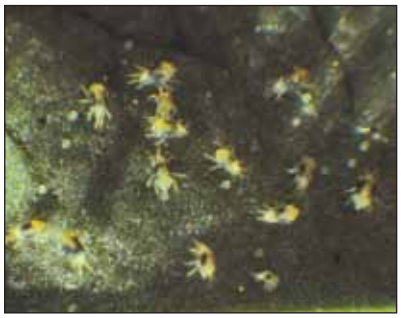
Chemical control

A list of currently available active ingredients and products can be found in Table 2 in the crop protection products section at the back.

Two-spotted spider mite *(Tetranychus urticae)*

Biology

Adults are around 0.5mm long, pale yellow/green in colour, with two dark patches at the sides of the body (Figure 38). Eggs are laid on the undersides of leaves. They are 0.13mm across, globular and translucent, becoming pale red/orange before hatching. Eggs hatch into nymphs which develop through a series of stages before developing into adults. As temperatures increase above 12°C, the mites feed and breed more rapidly. In the autumn, in response to shortening day length, over-wintering forms of adult female develop which are orange/red in colour. These seek shelter in cracks in the bark and even in debris in the soil. In early spring they become active and start to lay eggs.



38 Adult two-spotted spider mites

Damage

The mites feed on the undersides of leaves, sucking sap. When populations reach high levels, the feeding gives rise to speckling and bronzing on the upper surface of the leaf (Figure 37), leading to leaf death and premature leaf fall.

39 Two-spotted spider mite feeding gives rise to speckling on the upper surface of the leaf

Monitoring for two-spotted spider mite

From early spring onwards, check the undersides of developing leaves, particularly those close to ground level. Look for the presence of the dark red over-wintering adult females and their eggs. As the season progresses, continue to check the undersides of all leaves but particularly lower down on the bush, checking for adults (with two spots) and their eggs.

Control of two-spotted spider mite

Environmental and cultural control

Spider mites are ubiquitous pests with a tremendous range of host plants. It is very difficult to influence their population size through environmental or cultural control.

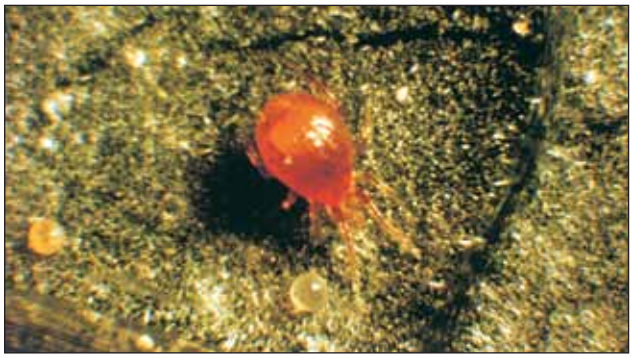
Biological control

A large number of naturally-occurring beneficial insects will prey on two-spotted spider mite including anthocorid bugs, capsids, lacewing larvae (Figure 40), ladybird larvae and adults and hoverfly larvae. Additionally a range of mite species, including *Typhlodromus, Amblyseius* (Figure 41), Anystids and Trombids, are voracious predators of two-spotted spider mite. To enhance the populations of all these species, a wide diversity of natural habitats is essential, including trees and woody species (provided by hedgerows) as well as nettles and herbaceous species found in hedgerows and field margins.

40 Lacewing larvae will prey on two-spotted spider mite

41 *Amblyseius* adults will feed on two-spotted spider mite

In addition, the predatory mite *Phytoseiulus persimilis* is available commercially for introduction to the crop to control two-spotted spider mite (Figure 42). It works best between the temperature range of 15-30°C. However, many of the approved chemical insecticides are harmful to this predator (see crop protection products section at the back). Other useful predators which can be introduced include the predatory midge *Feltiella acarisuga* (Figure 43 - overleaf) and the predatory mite *Amblyseius californicus* (approved in closed protection situations only).



42 *Phytoseiulus persimilis* can be introduced to control two-spotted spider mite

43 *Feltiella acarisuga* larva

Chemical control

A list of currently available active ingredients and products can be found in Table 2 in the crop protection products section at the back.

Vine weevil (*Otiorhynchus sulcatus*)

Biology

One generation occurs each year. Adults, which are all female, are 7-11mm in length, are pale brown when emerging from the soil, darkening to a shiny black to dull brown colour when mature (Figure 44). Adults emerge from the soil in May and June and feed on foliage at night. By day, they hide in leaf litter and debris at ground level. Adults lay eggs in soil in mid to late summer, which hatch in C-shaped cream coloured larvae with an orangey-brown head (Figure 45). When fully grown, the larvae are 8-10mm long. They pupate in earthen soil cells before emerging in the spring or early summer as adults.

44 Adult vine weevil

45 Vine weevil larvae in soil

Damage

Adult feeding at night causes distinctive marginal notching of leaves (Figure 46). However, it is the larvae which are more damaging, feeding on the roots of the bush, leading to weakening and stunting of the bush and, in severe cases, ultimately death.

46 Distinctive marginal notching of leaves caused by vine weevil adults

Monitoring for vine weevil

In June and July, check for signs of notching around the leaf margins. Where notching is found, search for the presence of adults at soil level, either in leaf debris at the base of the bush, or where mulches are employed, underneath the mulch. Adults can be found on the foliage at night, but are easily disturbed causing them to drop to the ground. Where adults are found or their presence is suspected, dig into the surface of the soil in August and September, looking for the presence of weevil larvae, feeding on the roots of the gooseberry.

Control of vine weevil

Environmental and cultural control

Adult vine weevils enjoy the protection provided by plastic mulches, containers, picking trays etc. Care should be taken to remove all used trays, punnets etc after harvest, to prevent adults from sheltering. Many growers choose to establish gooseberries through a plastic mulch in field soils, both to gain control of weeds and to warm the soil and retain moisture in the root zone. If vine weevil is present on a farm, it is wise to remove the polythene early in the life of the plantation to prevent a rapid build up of the pest.

Biological control

Vine weevils have a number of natural enemies. Work done by East Malling Research and ADAS (Projects SF 15b and 15c) has shown that a range of ground beetles (Carabids) and rove beetles (Staphylinids) feed on vine weevil (Figure 47). Different species feed on different life stages of the pest. Although they won't prevent vine weevil from becoming a problem, they are worth encouraging wherever possible. These predatory beetles do not like to cross bare soil as they are vulnerable to predators such as birds or small mammals; providing them with cover in the form of low-growing herbaceous vegetation in the alleys will encourage these beetles. Indiscriminate use of some slug pellets may adversely affect beetle populations, so their use should be kept to a minimum. A number of bird species are also known to feed on adult vine weevil. Blackbird and song thrush will consume weevils but are not widespread in plantations. Pheasant and partridge are more common and can be useful as they tend to scratch and peck around the base of plants where the adults are found. Chickens work in the same way and can also be very beneficial if present in high enough numbers. Observational evidence also points to hedgehogs as useful night time predators of vine weevils.

47 The Devil's Coachhorse is a type of rove beetle which feeds on vine weevil

Both insect pathogenic nematodes and a bio-insecticide are commercially available for control of the larval stage of the pest. In the case of nematodes, species of both *Steinernema* and *Heterorhabditis* are available. They are applied in a drench to the soil or substrate when young larvae are present in the growing medium. The soil or compost must be moist for the nematodes to work effectively. The nematodes swim through the moisture film around the particles of soil/compost to find and enter the vine weevil larvae. Once inside the larvae, they release bacteria which kill the host within a few days. The nematodes reproduce inside the larvae and the next generation of nematodes swim off to find more prey. Nematodes do not prevent vine weevil infestations and will only control existing vine weevil larvae in soils or composts.

The bio-insecticide is an entomopathogenic fungus *Metarhizium anisopliae* (sold as Met 52 granular). Its spores germinate and the fungal hyphae penetrate and grow within the insect (Figure 48). Death usually occurs within a few days and a new generation of spores are produced on hyphae emerging from the dead insect. In the absence of a suitable host, the spores can remain in the soil for years without germinating, providing longevity from a single treatment.

48 Illustration of *Metarhizium anisopliae* progressively destroying vine weevil larvae

Specific details of the products available are listed in Table 1 in the crop protection products section at the back.

Chemical control

A number of insecticides currently approved for use on gooseberry for other pests, will provide incidental control of vine weevil adults when applied to the foliage of the bush. However, unlike some other crops, none of the approved insecticides have a recommendation for use as a drenching spray applied to the roots for controlling vine weevil larvae. A list of currently available active ingredients and products can be found in Table 2 in the crop protection products section at the back.

Clay-coloured weevil *(Otiorhynchus singularis)*

Biology

Clay-coloured weevil adults are smaller than vine weevil (6-8mm), more compact in appearance and speckled brown rather than black/brown (Figure 49). Adult females can live up to three years and can lay fertile eggs without fertilisation. Unlike with vine weevils, males do occur, but are very rare. Adult females emerge from the soil in spring and after a period of intensive feeding, they lay a first batch of eggs. Eggs hatch into larvae which feed on bush roots to a depth of 50cm. The larvae pupate in the soil in late winter; adults emerge later the same spring.

49 Comparison of vine weevil (left) and clay-coloured weevil (right)

Damage

Most damage is caused by adults feeding at night in the spring and early summer. They feed on developing buds, the rind of shoots and stems, on leaf petioles and flower stems. Damage on woody stems takes the form of bark grazing often leading to ring-barking and stem death. On soft tissue, such as petioles and new shoots, crooking and breakage often occurs.

Monitoring for clay-coloured weevil

In early spring, carefully examine breaking buds and developing shoots, looking for signs of feeding in the unfurling leaves, also look for bark stripping. Where damage is found, look for adults at soil level; either in cracks in the ground, in leaf debris at the base of the bush or, where mulches are employed, underneath the mulch.

Control of clay-coloured weevil

Environmental and cultural control

Like vine weevil, clay-coloured weevils enjoy the protection afforded by plastic mulches, trays and up-turned picking containers, so growers should make an effort to keep the plantation tidy and consider removing mulches after a plantation has established.

Biological control

Like vine weevil, it is likely that naturally-occurring ground beetles (Carabids – Figure 50) and rove beetles (Staphylinids) will feed on clay-coloured weevil but less work has been undertaken on this pest, to be able to identify which species feed on which stage of the life cycle. Although they won't control large populations of clay-coloured weevil, they are worth encouraging to provide some form of control. Indiscriminate use of some slug pellets may adversely affect populations of ground and rove beetles, so their use should be kept to a minimum. Bird species such as blackbird and song thrush are known to consume weevils. Pheasant and partridge are more commonly found on some farms. They can be useful as they tend to scratch and peck around the base of plants where the adults hide.

50 Adult carabids will feed on clay-coloured weevil

Both predatory nematodes and the entomopathogenic fungus *Metarhizium anisopliae* are approved for use on gooseberries for the control of vine weevil larvae. It is likely that they may also control the larvae of clay-coloured weevil when it is present in the soil during the spring and summer months. However, no trials have been done to confirm this and it may be more difficult to gain full control as the larvae of clay-coloured weevil can live to depths of 50cm in the soil profile, where they are less accessible to drenches of nematodes or incorporation of granular formulations of *Metarhizium*.

Chemical control

A number of insecticides currently approved for use on gooseberry for other pests, will provide incidental control of clay-coloured weevil adults when applied to the foliage of the bush. However, none of the approved insecticides have a recommendation for use as a drenching spray applied to the roots for controlling clay-coloured weevil larvae. A list of currently available active ingredients and products can be found in Table 2 in the crop protection products section at the back.

Grey Mould *(Botrytis cinerea)*

Symptoms

Infection can occur in flowers, fruits, young shoots and branches. On fruits, light brown patches appear initially on the fruit leading to a soft rot, but over time fungal hyphae appear which produce the characteristic mass of grey dusty spores (Figure 51). On branches, infection can occur following frost or hail damage, natural breakage of young soft shoots by the wind, mechanical damage to mature wood or through pruning wounds. In most cases this leads to wilting, branch die-back and in some cases bush death.

51 Botrytis infection on gooseberry fruit

Spread

In spring, over-wintered hyphae produce powdery spores called conidia. These are produced at night and are often spread by air currents in the morning. At high humidity conidia can germinate in hours. Infection most commonly occurs in wounds in the branches or in open flowers. Damaged flowers (e.g. frost injury) and older flowers are more susceptible to infection.

Germinating conidia give rise to new hyphae which spread in tissue to form mycelium, from which conidiophores are produced leading to fresh conidia. The fungus infects the developing fruit, where it may remain dormant until the fruit ripens or is picked.

Monitoring for Botrytis

From spring onwards throughout the season, check shoots, flowers and developing fruits for signs of browning, soft rots or the appearance of characteristic grey mould. Look especially at fruits in the centre and low down on bushes. Check branches for symptoms of wilting and branch die-back.

Control of Botrytis

Environmental and cultural control

As Botrytis infection is favoured by wet weather or periods of high relative humidity, growers should aim to grow bushes on sites where they will dry out rapidly after rainfall or after heavy overnight dew. To aid air circulation, traditional bush or trellis trained gooseberries should be pruned to keep their foliar canopy open, avoiding the overlapping of major branches or a high density of shoots or branches within their centres.

Weather or mechanically damaged shoots and flowers are more prone to infection. Sites where bushes are likely to be prone to damage by frost or wind during the spring and early summer should be avoided.

The over-use of nitrogen fertilisers should also be avoided as it can lead to excessive shoot and leaf production, creating a dense bush which is likely to be more vulnerable to infection.

Where polythene tunnels are employed, special care should be given to venting to avoid the build up of humidity.

Biological control

The bacterial fungicide Serenade ASO (containing *Bacillus subtilis*) can be used on both outdoor and protected crops to provide protection and control of Botrytis. This can be used up until harvest and leaves no risk of residues occurring. Unlike many conventional fungicides, the risk of resistance developing to this product is extremely low.

Chemical control

A range of fungicide products can be relied upon to provide protection from infection. A list of currently available active ingredients and products can be found in Table 3 in the crop protection products section at the back.

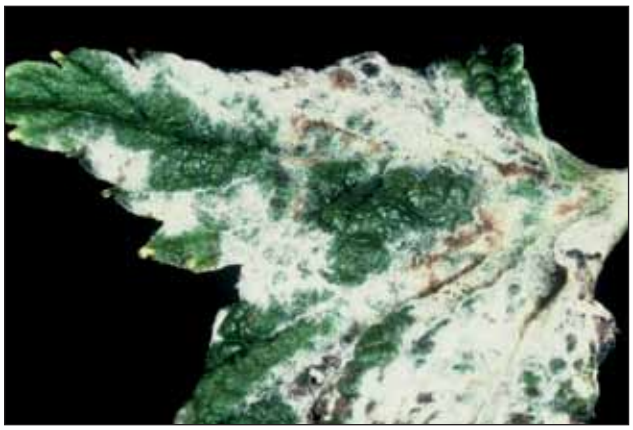
To protect fruit from infection, two or three spray applications using a range of fungicides are usually made during flowering, the first just prior to first open flower.

American gooseberry mildew (*Podosphaera mors-uvae,* previously *Sphaerotheca*)

Symptoms

American gooseberry mildew attacks leaves, shoots and fruits. Initially in the late spring or early summer, infected leaves may become slightly up cupped at their edges then become covered in a white powdery spore producing growth (Figure 52). As the season progresses, the growth becomes matted (Figure 53) and changes in colour to fawn, then chocolate brown and contains black specks of fruiting bodies. Fruits which are infected early are retarded in growth and may fall.

52 White powdery growth typical of American gooseberry mildew



53 Powdery growth becomes matted as the season progresses

Later infection usually results in sections of the fruit surface being covered with fawn growth, rendering the fruit unsightly and unmarketable (Figure 54). Infection on the current season's growth leads to stunting and deformity. High levels of infection inevitably lead to substantial crop loss in the current and subsequent season.

54 Later infection produces fawn growth rendering the fruit unmarketable

Spread

Infection is favoured by hot dry weather accompanied by periods of high relative humidity overnight. Conidia infect fruits and shoots to produce hyphae which develop into the matted brown mycelium. Minute fruiting bodies called chasmothecia can be embedded in it. These can carry the pathogen over-winter and then release airborne spores but perennation in the buds as mycelium is probably more important.

Monitoring for American gooseberry mildew

From bud burst through to the end of the season, check leaves, shoots and developing fruits for the presence of white powdery growth or fawn coloured matted growth. Look particularly carefully in the centres of bushes and low down, where air humidity may be higher and infection is more likely to occur. Such areas of the bush may be less accessible to spray penetration also. The same species attacks blackcurrant and so these bushes should be checked for powdery mildew as well.

Control of American gooseberry mildew

Environmental and cultural control

Like Botrytis, American gooseberry mildew is favoured by high humidity. Growers can therefore manage the environment and the crop to reduce incidence of infection and spread. Pruning bushes and trellis trained crops to avoid dense canopies, overlapping branches and thick foliage will help to reduce humidity. Maintaining an open bush will also help to improve spray penetration when control measures are required. Overuse of nitrogen fertilisers should be avoided as this favours rapid shoot and leaf growth which increases humidity and reduces spray penetration. Where tunnels are employed, careful attention should be given to venting to keep the temperature as low as possible in hot weather and to reduce the relative humidity.

Biological control

No means of biological control are currently available for American gooseberry mildew in the UK. Some growers have found that the routine application of products containing citrus oil both prior to and during harvest, has provided useful control of this disease.

Chemical control

A list of currently available active ingredients and products can be found in Table 3 in the crop protection products section at the back. Some fungicides applied in the spring soon after bud break can also provide some control or at least suppression of over-winter inoculum. Thereafter, where susceptible varieties are being grown (e.g. Careless), a programme containing a range of protective and eradicant fungicides is usually applied every 7-14 days from just prior to flowering until as close as possible to the onset of harvest. To avoid resistance, products from a range of fungicide groups should be employed.

Currant and gooseberry leaf spot (*Drepanopeziza ribis*) syn *Pseudopeziza ribis*

Symptoms

Initial symptoms appear from early June onwards, initially as dark brown or black shiny spots which are the size of a pinhead and usually occur on the upper surface of leaves. As the disease develops, the spots become so numerous they coalesce causing large sections or the whole leaf to turn brown, shrivel and fall prematurely (Figure 55). Early defoliation can lead to fruit shrivelling and reduced fruit bud development. This results in a substantial reduction in yield in the current and subsequent season. Winter hardiness of the affected bushes may also be impaired.

55 As spots become more numerous, they coalesce causing large areas of the leaf to turn brown

Spread

Conidia are produced from the leaf spots in wet conditions and are carried to new leaves by rain splash. Infection survives the winter as fruiting bodies called apothecia on leaf debris and in spring, ascospores are released and carried by air currents to infect new leaves. Initial infections tend to arise at the bush base. In mild winters, conidia also over-winter on fallen leaves, leading to greater infections.

Monitoring for gooseberry leaf spot

From June onwards, check the upper surface of leaves weekly or at least fortnightly, for the presence of pinhead size spots. Examine leaves low down and in the centre of bushes, where higher humidity favours infection. Such leaves also take longer to dry following wet weather, making them more conducive to infection.

Control of currant and gooseberry leaf spot

Environmental and cultural control

The majority of gooseberry varieties are susceptible to infection. However, where growers employ polythene tunnels, covering from early bud break until the end of harvest is likely to reduce the levels of foliar infection by this disease. Special care should be given to venting to avoid the build up of humidity.

In autumn and winter, the rapid removal or decomposition of old infected leaf debris from the alleys and beneath the bushes in the crop rows is likely to reduce the over-wintering of this disease. However, for many growers, this is impractical.

Biological control

No means of biological control are currently available for gooseberry leaf spot.

Chemical control

A list of currently available active ingredients and products can be found in Table 3 in the crop protection products section at the back.

It is important that the first applications of fungicides are made early and in most years as close as possible to bud break. This is especially the case where a variety is known to be susceptible, the disease has previously been a problem or the spring weather is wet. Thereafter the routine application of a range of fungicides (to avoid resistance occurring) up until fruit set will usually provide control.

Gooseberry or white pine blister rust (*Cronartium ribicola*)

Symptoms

Symptoms more commonly appear late in the season when yellow to brown rust pustules appear on the undersides of leaves (Figure 56). By late summer, thread-like growths are produced on gooseberry leaves to produce spores which infect the overwintering host (*Pinus* spps such as Scots pine). Severe infection can lead to premature defoliation, which weakens the bush and can result in poorer yields in subsequent seasons.

56 Development of rust pustules on the underside of a leaf

Spread

This rust species requires two hosts to complete its life cycle as it cannot survive over winter on gooseberry leaves. There is a succession of spore types. It over-winters in cankers which develop on pine trees over 2-4 years and remain as a source of infection. Spores on pine trees are spread to gooseberries and blackcurrants by wind and have been known to travel distances of 100 miles. After the spread by aeciospores from pines to currants and gooseberries, the disease produces urediospores throughout the summer infecting further leaves of the *Ribes* hosts via leaf stomata. Development of this disease is favoured by wet warm weather. In the autumn, other spore types are produced and carried back to pine trees.

Monitoring for gooseberry rust

From early summer onwards, check the undersides of leaves throughout the bush every fortnight for the presence of yellow/brown rust pustules.

Control of gooseberry rust

Environmental and cultural control

Given that spores of this pathogen can travel long distances in the wind, little can be done to avoid them. Production of gooseberries under the protection of polythene clad tunnels may help to reduce the incidence of this disease by providing drier conditions.

On outdoor crops, humidity levels can be reduced by good bush management. Cross branches should be reduced and branches spaced evenly to improve air circulation. In bush grown crops, an open bush will help to achieve this. Avoid overuse of nitrogen fertilisers which will lead to excessive growth and vegetation which can lead to increased humidity.

It is also worth checking sites for infected pine trees to determine if they are a source of infection.

Biological control

No means of biological control are currently available for gooseberry rust.

Chemical control

A list of currently available active ingredients and products can be found in Table 3 in the crop protection products section at the back. Fungicides are normally only applied for the control of this disease when plants are found to be infected.

Coral spot (*Nectria cinnabarina*)

Symptoms

This fungal pathogen can lead to the death or die-back of gooseberry branches. Small, salmon-coloured pustules develop on dead branches (Figure 57) and later, dark red fruiting bodies may be produced. It is very often a secondary pathogen, indicating that the bush has been weakened first by other factors. However, in some situations, it can be a primary pathogen causing the rapid demise of whole branches under favourable wet, warm growing conditions.

57 Small salmon-coloured pustules symptomatic of coral spot infection

Spread

This is a weak pathogen and often only enters the bush through existing wounds, pruning cuts or where shoots have naturally died back. The pathogen invades the water conducting tissue, leading to wilting.

Monitoring for coral spot

Throughout the season, check bushes for dead or dying branches. Look for signs of salmon or dark red coloured pustules developing on dead branches within the bush.

Control of coral spot

Environmental and cultural control

As this is often a secondary pathogen, which infects and invades weak or damaged bushes, it is essential to produce a strong, healthy bush to avoid infection. Choosing the correct site and soil is vital to be able to grow a strong bush. Where infection does occur, infected branches should be pruned out and removed immediately after harvest, when pruning cuts are expected to heal rapidly. Trellis grown gooseberries appear to be less prone to infection.

Biological control

No means of biological control are currently available for coral spot.

Chemical control

There are currently no fungicides available for controlling this disease.

Gooseberry root rot (*Phytophthora* species)

Symptoms

Infected bushes initially display leaf yellowing and wilting. The symptoms become progressively worse over one or several growing seasons until the whole bush dies. Affected branches fail to break bud in the spring and unlike Eutypa, there is no growth from the base of dead bushes (Figure 58).

58 Typical symptoms of Phytophthora infection displaying weak growth and bush die-back

Spread

A range of soil inhabiting *Phytophthora* species can infect gooseberry. Motile zoospores are produced from resting spores in the soil and swim in water in soil pores to attack gooseberry roots. Spore-bearing structures called sporangia are formed on the outside of the root and release more motile spores to spread the pathogen. The pathogen grows within the vascular system of the roots and the roots are weakened and gradually die, giving rise to wilting and death of the branches above ground. Spread of the pathogen is favoured by periods when soil moisture levels are very high, often but not exclusively as a result of planting crops in heavy, clay textured, or poorly drained soils.

Monitoring for gooseberry root rot

Throughout the season, look out for symptoms of yellow or wilting leaves. Watch for branches that die out and for others which don't break bud. Where such symptoms appear, check to see if there is any new shoot growth emerging from the base of the bush.

Control of gooseberry root rot

Environmental and cultural control

Growing crops on light, free-draining soils can help to reduce the spread of infection in gooseberries. Drainage can be further improved by growing on a raised bed or ridge. Where clay textured soils are used, the incorporation of high quantities of organic matter will help to improve soil texture and drainage.

Biological control

No means of biological control are currently available for gooseberry root rot.

Chemical control

There are currently no fungicides available for controlling this disease on gooseberry.

Eutypa (*Eutypa lata*)

Symptoms

Leaves on affected branches first become pale and stunted, before shrivelling and dying where they may hang on the bush. A 'dead arm' develops as cankers progress along the branch back towards the main stem. The cankers can be V-shaped in cross-section. Over a period of 1-2 years, further branches die out, leading to complete death of the bush (Figure 59).

59 Eutypa infection leads to successive die back of branches over a period of 1-2 years

Spread

The fungus enters the vascular system of the bush at wound sites, commonly after winter pruning. Wounds remain susceptible for about two weeks after pruning. The fungus survives in diseased wood and produces perithecia in old, cankered tissue. Ascospores are discharged from perithecia soon after rainfall, leading to dispersal of the pathogen and infection of wounds.

Monitoring for Eutypa

Monitor bushes over the season for signs of pale growth, shrivelling or dying leaves and branch or bush dieback. Check also for the presence of new shoot growth emerging from the base of the bush.

Control of Eutypa

Environmental and cultural control

As this fungal pathogen enters the vascular system of the bush at wound sites, pruning during the growing rather than dormant season may help to reduce the spread of infection. At this time of year, pruning cuts heal more quickly, thus reducing the available time for infection to occur. This can slow the spread of the disease.

Biological control

No means of biological control are currently available for Eutypa.

Chemical control

A list of currently available active ingredients and products can be found in Table 3 in the crop protection products section at the back.

Photographic credits

The HDC is indebted to all those individuals and organisations that provided images for use in this publication. A full list of images included and their source are listed below.

Figure	Image	Source
Cover	Green gooseberry	Kraege
1	Windbreak on soft fruit farm	W.B. Chambers & Son
2	Bush fruit plantation on a raised bed	W.B. Chambers & Son
3	Rokula	R.W. Walpole
4	Xenia	Meiosis Ltd
5	Pax	Meiosis Ltd
6	Careless	ADAS
7	Invicta	R.W. Walpole
8	Leveller	ADAS
9	Whinham's Industry	R.W. Walpole
10	Martlet	Meiosis Ltd
11	Captivator	R.W. Walpole
12	Gooseberry aphid egg	Roger Umpelby
13	Gooseberry aphid damage	Roger Umpelby
14	Currant-lettuce aphid	Roger Umpelby
15	Vein-banding caused by gooseberry-sowthistle aphid	Roger Umpelby
16	Anthocorid adult	ADAS
17	Common green capsid adult	Roger Umpelby
18	Common green capsid nymph	Roger Umpelby
19	Common green capsid leaf damage	Roger Umpelby
20	Woolly currant scales	Roger Umpelby
21	Woolly currant scale eggs and crawlers	Roger Umpelby
22	Woolly currant scale infestation in blackcurrant	Roger Umpelby
23	Ladybird adult	Roger Umpelby
24	Gooseberry sawfly larvae	Roger Umpelby
25	Gooseberry sawfly eggs	ADAS
26	Gooseberry sawfly larvae on leaf	Roger Umpelby
27	Gooseberry sawfly damage to bush	Roger Umpelby
28	Parasitised angle shades caterpillar	Roger Umpelby

Figure	Image	Source
29	Tortrix caterpillar	Roger Umpelby
30	Tortrix caterpillar damage on blueberry	Roger Umpelby
31	Winter moth caterpillar	Roger Umpelby
32	Winter moth caterpillar – grey form	Roger Umpelby
33	Currant clearwing moth adults mating	Roger Umpelby
34	Currant clearwing moth pupa in stem	Roger Umpelby
35	Currant clearwing moth stem damage	Roger Umpelby
36	Currant clearwing moth hole and break in stem	Roger Umpelby
37	Hoverfly larva	Roger Umpelby
38	Summer forms of two-spotted spider mite	ADAS
39	Two-spotted spider mite damage to foliage	ADAS
40	Lacewing larva	Roger Umpelby
41	*Amblyseius cucumeris* adults	ADAS
42	*Phytoseiulus persimilis* adult	ADAS
43	*Feltiella acarisuga* larva feeding	FLPA Images of Nature
44	Adult vine weevil	James Hutton Institute
45	Vine weevil larvae in soil	James Hutton Institute
46	Adult vine weevil damage to blueberry	Roger Umpelby
47	Devil's coachhorse with vine weevil larva	Roger Umpelby
48	Vine weevil infected by *Metarhizium anisopliae*	University of Swansea
49	Adult vine weevil and clay-coloured weevil	James Hutton Institute
50	Carabid adults	Roger Umpelby
51	Botrytis sporulation on gooseberry	ADAS
52	Powdery mildew causing distortion of blackcurrant shoot	ADAS
53	*Podosphaera mors-uvae* on gooseberry	James Hutton Institute
54	American gooseberry mildew – white and brown mycelium	ADAS
55	Gooseberry leaf spot	Michigan State University
56	*Cronartium ribicola* on blackcurrant	James Hutton Institute
57	Nectria coral spot on redcurrant	ADAS
58	Phytophthora bush death in gooseberry	ADAS
59	Eutypa bush death in gooseberry	ADAS

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Crop protection products

Horticulture Development Company

Stoneleigh Park
Kenilworth
Warwickshire CV8 2TL
T: 0247 669 2051
E: hdc@hdc.ahdb.org.uk
W: www.hdc.org.uk

HDC is a division of the Agriculture and Horticulture Development Board

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