Factsheet 01/07

Cane fruit

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Sucking insect pests of cane fruit crops

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This factsheet provides growers with key information about the biology of, and the damage caused by, 'sucking insect' pests of cane fruit crops and offers some guidance on how best to manage their control. It deals primarily with aphids, capsids, shield bugs and whitefly.

Introduction

The cane fruit industry has been resurgent in recent years, resulting in a large increase in the area and volume of production of both fresh market raspberries and blackberries. A very large percentage of the crop is now produced under protection, a system of production which lends itself to attack from 'sucking insect'pests. This group of pests has great economic significance for growers. Damage arising from their presence and feeding on the crop can lead to financial losses through loss of fruit quality, reduction in marketable yield and decline in crop health and yield potential.

Given the small number of non-specific insecticides currently approved for use in cane fruit and the difficulties involved in managing and maintaining both introduced and naturally-occurring predators, these pests assume a prominent role. Growers now encounter further difficulties in that some of their major supermarket customers demand raspberries with no detectable pesticide residues, making it even more difficult to manage control strategies effectively.

Aphids

Aphids are the most important members of the 'sucking insect' group, primarily due to their ability to act as virus vectors. In the UK, the large raspberry aphid *(Amphorophora idaei)* is often the most common species.

Large raspberry aphid *(Amphorophora idaei)*

Biology

With adults sometimes exceeding 3–4 mm in length, this is one of the largest aphids found on raspberry. The adults are pale-green, have long legs and long, frequently backward-facing, antennae (Figure 1).

Eggs laid the previous autumn hatch in March/April and develop into asexual female aphids which feed on the tips of developing buds and laterals, often those located on the tops of the fruiting canes. At first they can be very difficult to detect due to their small size. As the summer progresses the spring adults give rise to several generations of wingless aphids, initially feeding on the fruiting cane. Just prior to harvest, winged aphids appear and migrate onto primocanes (Figures 1 & 2) under the fruiting cane and to other feeding sites within the existing and other nearby plantations. It is at this time

Photo supplied by Scottish Crop Research Institute

1 Large raspberry aphids *(Amphorophora idaei)* on underside of raspberry primocane leaf

that populations normally peak. In late summer/autumn males and females are produced and, after mating, eggs are laid close to the base of the current season's primocanes. In some years, large populations can build up on the foliage of susceptible varieties such as Glen Ample, Glen Prosen, and Tulameen.

Damage

This aphid rarely produces any visible damage to leaves and stems. The most obvious evidence of attack is the presence of sticky honeydew on leaves, laterals, flowers and fruits positioned immediately below aphid colonies. The aphids can become so numerous that they colonise the main stems of primocanes (Figure 2). Dense colonies are usually very restless and aphids are easily detached from plants during harvest. They can then readily contaminate the harvested fruit. In other years, aphid numbers remain low, but can still be found on the undersides of leaves, close to the main veins.

Virus transmission

The large raspberry aphid is a potential vector of four viruses affecting raspberry (See Table 1). Aphid feeding can give rise to rapid virus spread. The virus can either be symptomless or produce obvious symptoms, depending upon the variety.

Aphid strains

Four strains (or biotypes) of the large raspberry aphid are known to exist. Two genes (A_1 and A_{10}) have been used by breeders to confer resistance. The A_1 gene confers resistance to two strains of this aphid whilst the A_{10} gene confers resistance to all four strains. However, by the early 1990's, 77% of field populations of aphids in the UK had developed resistance to the A_1 gene and some recent evidence indicates that resistance is now developing to the A_{10} gene (HDC Project CP 14). As a result, the spread of virus in UK raspberry plantations is likely to increase and it is increasingly important that growers gain control of aphid populations. Table 2 provides information on the resistance incorporated into modern day raspberry varieties.

Table 1 Viruses transmitted by aphids in raspberry in Europe (after A T Jones, 2003)

Virus vector species	Virus
Large raspberry aphid *(Amphorophora idaei)*	Black raspberry necrosis virus (BRNV) Rubus yellow net virus (RYNV) Raspberry leaf mottle virus (RLMV) Raspberry leaf spot virus (RLSV) – Figure 3
Small raspberry aphid *(Aphis idaei)*	Raspberry vein chlorosis virus (RVCV)

Photo supplied by Scottish Crop Research Institute

2 Part of colony of the large raspberry aphid on raspberry primocane stem

Photo supplied by Scottish Crop Research Institute

3 Raspberry leaf spot virus (RLSV) infected raspberry leaf

Table 2 Currently grown raspberry cultivar resistance to the different strains of the large raspberry aphid in the UK

Resistance Gene	Cultivar
Susceptible	Malling Jewel
Minor genes	Glen Clova
Gene A_1	Glen Moy, Glen Prosen, Glen Ample, Glen Shee
Gene A_{10}	Glen Rosa, Glen Doll, Leo, Julia, Gaia, Octavia, Malling Juno, Autumn Bliss, Autumn Britten, Valentina
Unknown	Joan Squire, Joan Irene, Joan J, Himbo Top (one parent had A_{10} resistance), Tulameen (one parent had A_{10} resistance)

Small raspberry aphid *(Aphis idaei)*

This is the only other important virus vector species of aphid that colonises raspberry. Although it is commonly found in southern England, it is only occasionally found in Scotland and usually only in raspberries grown in warm, sheltered conditions. It may become more important in the north with the increased use of tunnels for field crops.

Biology

By comparison with the large raspberry aphid this species is small (1.8 mm in length) and is pale or yellowish green in colour with a waxy powdery covering. In the spring, dense colonies can build up on developing fruiting laterals.

Later in the summer, generations feed on the primocanes, while winged aphids migrate to adjacent raspberry plants or to other plantations. The progeny of these winged aphids are smaller and pale cream in colour and are usually found singly between the veins on the undersides of leaves. The small raspberry aphid often remains on the crop foliage until late autumn or even early winter on protected raspberry crops. They lay eggs in the axils at the bases of buds, in the upper section of canes (Figure 4).

Damage

The dense colonies that appear in spring can cause extensive leaf curling on primocanes and developing fruiting laterals (Figure 5). Ants may be found associated with colonies of this aphid, feeding on the copious honeydew the aphids produce and defending the colony from attack by predators and parasites.

Virus transmission

Like the large raspberry aphid, this species is a virus vector, but transmits only raspberry vein chlorosis virus (RVCV). None of the varieties currently grown in the UK have any resistance to this aphid, so frequent use of insecticides to control aphid populations is vital to prevent the spread of this virus.

Potato aphid *(Macrosiphum euphorbiae)*

The potato aphid can often be found in large numbers in the spring, feeding on young shoots and developing leaf petioles of raspberries and hybrid berries. Protected crops are particularly vulnerable to attack. It is a large aphid, adults being up to 3.6 mm long, and therefore, without due care, the green forms could easily be confused with the large raspberry aphid.

The adult aphid of this species is usually pale yellowish-green, green, or sometimes pink in colour. It has long antennae and very long, cylindrical siphunculi (two dorsal tubules at the rear of the aphid). It sometimes has a darker green band that runs longitudinally along the centre of its upper body.

Wingless aphids appear initially, but by late spring/early summer, winged individuals are present and start to disperse to other host plants. Potato aphid causes little direct feeding damage to the crop, however large numbers (producing honeydew) can cause serious leaf and fruit contamination.

Potato aphid is not considered to be an important virus vector.

Peach-potato aphid *(Myzus persicae)*

The peach-potato aphid is confined primarily to protected raspberry crops. The adults are small, green, or occasionally reddish green in colour (Figure 6). This aphid is found feeding on the undersides of raspberry foliage during the spring months, later dispersing to a wide range of other host plants including many weed species, and crops such as potato, sugar beet and oilseed rape. It is not considered to be a major virus vector of raspberry.

Photo supplied by Roger Umpelby

4 Small raspberry aphid eggs

Photo supplied by Scottish Crop Research Institute

5 Distortion of primocane caused by colony of the small raspberry aphid *(Aphis idaei)*

Photo supplied by ADAS

6 Colony of peach-potato aphid *(Myzus persicae)*

Other aphids

The melon and cotton aphid *(Aphis gossypii)*, is a very polyphagous species and is increasingly found on protected crops including soft fruit. This species is small (adults do not exceed 1.8 mm in length), and it forms dense colonies on stems and leaves. Adults vary in colour from pale yellow through all shades of green to almost black. Although this species is a very efficient virus vector in many crops, its status as a virus vector on cane fruit is not well documented.

Three other aphids are found on cane fruit crops in the UK, but are confined to blackberry. The commonest of these are the blackberry-cereal aphid *(Sitobium fragariae)* and the rubus aphid *(Amphorophora rubi)*, which is morphologically indistinguishable from the large raspberry aphid, but has a different number of chromosomes. The permanent blackberry aphid *(Aphis ruborum)* by contrast, is only occasionally found feeding on blackberry crops.

Incidence of aphids and varietal susceptibility

- The incidence of the large raspberry aphid and other species has increased due to increased reliance upon raspberry varieties such as Glen Ample and Tulameen which have little or unknown aphid resistance. Another factor is the widespread use of protected cropping which provides favourable conditions for these pests and can restrict natural predation and parasitism.

- The small raspberry aphid (vector of raspberry vein chlorosis virus), is readily found in both field-grown and protected crops.

- To date, peach-potato and potato aphid infestations have been confined to glasshouse and tunnel crops.

- Both summer and autumn raspberries vary in their susceptibility to aphids. In general, those varieties with A_{10} gene (see Table 2) are resistant to the large raspberry aphid although one strain has been identified which can overcome this.

- In contrast, varieties such as Glen Ample with limited gene resistance are rapidly and repeatedly colonised by this aphid each year and succumb readily to the viruses it transmits, substantially reducing the life-expectancy and yield of plantations.

Capsids and other bugs

A range of capsids and other bugs can be found in cane fruit crops. The two most commonly found species capable of causing damage or contamination of the crop are the common green capsid and the tarnished plant bug. In addition a number of species of shield bugs, eg the forest bug, *Pentatoma rufipes*, do feed on cane fruit crops and can cause damage and contamination.

Common green capsid *(Lygocoris pabulinus)*

With the gradual withdrawal of approved broad-spectrum insecticides for use in cane fruit, this pest has started to assume a greater importance in damage to raspberry, black and hybrid berries. As with aphids, the increased use of crop covers has added to the problem.

Biology

The adults are 5.0–6.5 mm in length, long-legged, bright green in colour with a dusky yellow pubescence over their bodies (Figure 7). They are very active often running over foliage or flying or flitting from plant to plant during sunny weather.

This capsid over-winters as an egg, hatching in April or early May. The nymphs feed on young foliage around primocane tips and on extending fruiting laterals. In southern England they may migrate in late spring/early summer to alternative host plants, or, particularly in more northern areas, they may continue to feed on raspberry throughout the season. The adults always return to raspberry, blackberry or other woody hosts in the autumn to feed and lay eggs.

Damage

Feeding by the common green capsid initially gives rise to small reddish or brown spots, and on leaves, these later extend into puncture marks and ragged holes. The growing points of primocanes are often damaged (Figure 8) resulting in branching, rendering canes useless or less effective for crop production the following year. Affected fruiting laterals may suffer distorted growth and in some instances the fruit can also be distorted to the extent that a significant percentage of the crop will be unmarketable. Fruit distortion is a particularly common form of damage in blackberries.

Photo supplied by Roger Umpelby

7 Adult common green capsid *(Lygocoris pabulinus)*

Photo supplied by East Malling Research

8 Distorted primocane tip caused by common green capsid *(Lygocoris pabulinus)* feeding

European tarnished plant bug *(Lygus rugulipennis)*

The European tarnished plant bug tends to forage on developing flowers in all cane fruit crops and is associated with fruit malformation and distortion. These insects are slightly smaller than the common green capsid (approximately 4.5 – 5 mm in length) and the adults are dusky brown in colour and often have a distinct inverted pale triangular mark behind the pronotum. (Figure 9).

Shield bugs (various species)

Shield bugs are found widely throughout the UK and occasionally on raspberry. As their name suggests, the adults are characteristically shield-shaped, up to 15 mm in length, green to reddish or bronzy-brown in colour, often with prominent stripes or spots on their backs (Figure 10). Most are plant feeders, but some will feed on other insects such as caterpillars. The damage they do to plants is normally insignificant, but they often contaminate fruit at harvest and also produce a sticky, strong smelling secretion when disturbed. Although they have a quite distinct shape, juvenile shield bugs are sometimes confused with ladybirds.

Incidence of capsids/ other bugs and varietal susceptibility

- As with aphids, increased use of protection for raspberry and other cane fruit crops has created ideal conditions for these pests.
- Weedy plantations, or those with 'tumble-down' (ie naturally regenerated swards containing grass plus broad-leaved weed species), are favourite locations for this pest.
- All varieties of raspberries are susceptible to attack by common green capsid. Some appear to be more attractive to the insect than others, eg Leo and Joan Squire, whilst others like Glen Ample and Tulameen can suffer greater severity of damage.

Photo supplied by ADAS

9 Adult tarnished plant bug *(Lygus rugulipennis)*

Photo supplied by Roger Umpelby

10 Adult shield bug

Leafhoppers (various species)

Biology

Most species are small slim insects, less than 4 mm long (Figure 11). They vary in colour from almost white through to bright green, some having distinct stripes or spots. The insects are very active, either running rapidly on the foliage or flitting rapidly, by flying or jumping, amongst the foliage.

Damage

Leafhoppers are common throughout the UK with wild blackberries being a favoured host and therefore a reservoir for infestation of commercial crops. They feed mainly on leaves and cause small distinct white or silver fleck marks about the size of a pin-head (Figure 12). Leafhopper damage can

Photo supplied by Roger Umpelby

11 Adult leafhopper

Photo supplied by Roger Umpelby

12 Leafhopper damage to raspberry leaf

be confused with damage caused by two-spotted spider mite. Leafhoppers do not produce honeydew and their feeding does not cause distortion. Leaf damage is often most severe in the autumn.

Virus transmission

Leafhoppers are good virus vectors on many crops, but on cane fruit they have only been confirmed to transmit the rubus stunt virus.

Incidence of leafhoppers and varietal susceptibility

- All types of cane fruit are attacked by leafhoppers. Recent observations suggest that tayberries, loganberries and the blackberry variety Loch Ness can be particularly susceptible to leafhoppers and the rubus stunt virus that they transmit.
- Some leafhopper species thrive on protected crops and may cause extensive damage, whilst other species are most common on unprotected crops.

Whitefly *(Trialeurodes vaporariorum)*

Biology

Although the glasshouse whitefly can survive outdoors in summer, it is almost exclusively a pest of protected crops. The adult whitefly is about 1 mm long and appears almost pure white in colour (Figure 13). The adults have 'lazy' flight compared to leafhoppers and tend to only fly when disturbed. They mainly occur on the leaves and very young shoots. Whitefly populations are generally low in the winter, but increase rapidly through the summer before decreasing again in late autumn. Unlike most other sucking insect pests, the larvae are sedentary for most of their life. The larvae are flat scales and whitish or pale yellow in colour (Figure 14).

Damage

No leaf or shoot distortion is caused by whitefly feeding, but both adults and larvae produce copious amounts of honeydew. When whitefly populations are high, the honeydew contaminates both leaves and fruit reducing crop vigour and making fruit unmarketable. On the foliage the honeydew eventually becomes infected with the sooty mould fungus and turns black (Figure 15).

Photo supplied by FLPA Images

13 Adult whiteflies

Photo supplied by Biological Crop Protection Ltd

14 Whitefly scales

Photo supplied by Roger Umpelby

15 Honeydew produced by whitefly adults and larvae becomes infected with a sooty mould fungus which turns black

Incidence of whitefly and varietal susceptibility

- Only protected crops are at significant risk of whitefly attack. Crops in glasshouses or in fixed tunnels are more at risk than crops which are only protected for part of the year.
- All types of cane fruit are attacked by whitefly, but raspberry, generally having a softer leaf, is most prone to attack.
- No variety is immune from attack, but infestations are generally worst on the varieties with a soft leaf texture.
- The severity of attack tends to be worst in hot seasons.

Crop monitoring for sucking insects

Aphids

- Check all plantations weekly or at least fortnightly from bud burst until early autumn, looking initially in the unfolding leaves in the tips of fruiting canes and primocanes and later under all the foliar canopy when the aphids should be on the underside of fully and expanding foliage.
- For the large raspberry aphid, the current suggested threshold for control for non-A_{10} resistant raspberry varieties is one juvenile or adult aphid per young or mature leaf on fruiting canes or primocanes. Check at least 50 leaves per plantation or a sample area of 1 ha.
- To date, there have been no thresholds developed for the other aphid species that can affect raspberry, although a similar method could be applied to the small raspberry aphid.
- In the case of potato and peach-potato aphid, an estimation of the insect's population and its potential to cause crop contamination should be used to determine whether or not specific control measures are needed.

Common green capsid

- Check the young leaves and primocane tips on a weekly basis from early April onwards.
- Adult capsids or nymphs can be difficult to detect, as they hide when disturbed. However, look for puncture marks or distortion in shoot tips.
- Adults and nymphs 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.
- Adults and young can be more easily detected by 'beating' the cane over a white tray. The insects detach from the foliage and can easily be seen in the tray.
- Canes should be checked for this pest in at least 20 and preferably 50 places at random within plantations.
- If damage to primocanes or fruiting laterals is found, then in the majority of cases, control measures will be required.

Tarnished plant bug

- Check open flowers from first flower onwards. A threshold has not yet been established for its control, but control measures should be considered if presence of the pest has caused damage in previous years.
- As with the common green capsid, beating is the easiest way of detecting this pest.

Leafhoppers

- Check foliage throughout the season for signs of feeding damage. There is no threshold for treatment, but a reduction in crop vigour, and therefore potential yield, is likely if more than 10% of the leaf area is damaged.
- Adult leafhoppers can easily be monitored using yellow sticky traps (see below under 'whitefly')

Whitefly

- Whitefly can be monitored on the plant, but the most effective monitoring method is to use yellow sticky traps.
- Traps should be hung near the top of the canopy and secured to reduce movement.
- Traps should be dated, assessed weekly and changed at least every 3 weeks.
- Trap catches should be recorded to plot the changes in the pest population.

Control of insect sucking pests

Predators and parasites

There are a range of both naturally-occurring and introduced predators and parasites which can be relied upon to reduce numbers of aphids. Some naturally-occurring predators, such as anthocorids, feed voraciously on white-fly larvae, but they are rarely present in sufficient numbers to give good natural control. There are however effective and affordable introduced bio-control agents available. However, the options available to control capsids and other bugs with predators and parasites are very limited.

Naturally-occurring predators of aphids (Figure 16) include ladybirds, in particular the seven-spotted ladybird *(Coccinella septempunctata)* and the two-spotted ladybird *(Adalia bipunctata)*. Lacewings *(Chryospa* and *Chrysoperla* spp.*)*, hoverflies *(Syrphidae)* and predatory midges *(Aphidoletes* spp.*)*, can all significantly reduce aphid numbers if their populations increase early enough in the season and are not adversely affected by the use of pesticides. Small parasitic wasps, eg *Aphidius* spp., are very useful and occur naturally, or can be introduced to crops under protection. They lay their eggs in the larval stage of the aphid and these develop into so called 'aphid mummies' (Figure 17).

Naturally-occurring predators of capsids are limited to nabid bugs and other capsids.

Biological control

To be effective, biological control, whether by natural or introduced

Photo supplied by Defra

Ladybird larva

Photo supplied by Defra

Lacewing larva

Photo supplied by ADAS

Aphidoletes larvae feeding on aphids

Photo supplied by Roger Umpelby

Hoverfly larva

16 A range of predators can be relied upon to control aphids

predatory insects, must begin early in the season to prevent a large build-up of pests during the harvest period, thus reducing the risk of fruit contamination. This is not always possible when relying on natural control. Careful and thorough monitoring of the crop will be required to decide if natural control needs to be augmented by introduced predators.

There is currently a good range of biological control agents available for use in controlling aphids, one particularly reliable bio-control agent for controlling whitefly and one parasite for certain leafhopper species. However there are none currently available for controlling capsids and other bugs.

The rates of introduction of biological control agents recommended by different suppliers may vary considerably depending on the delivery system, the crop situation, the time of year and the level of pest infestation. For this reason the introduction rates quoted below should only be used as a guide and specific professional advice should be sought before using biological control agents.

Biological control of aphids

To be effective, biological control of aphids needs to be confined to glasshouse or fixed polythene tunnel crops, where climatic conditions suitable for the activity of the predators and their confinement within the crop can be ensured.

Small species:

- For small species, eg small raspberry aphid and peach-potato aphid, the parasitic wasp *Aphidius colemani* and the predatory midge *Aphidoletes aphidimyza* have been found to be effective.

- It is best to rely upon preventive programmes of predator introduction from early leaf development of the crop onwards (ie starting as soon as possible after the hatch of aphid eggs or as soon as the first aphid is seen).

- Introductions of *Aphidius colemani* at 0.2 per m² and *Aphidoletes aphidimyz*a at 0.25 per m² in alternate weeks can be useful. Where there are existing aphid infestations, the level of introduction may be increased to 0.5 – 1.0 per m² for *Aphidius colemani* and 0.5 – 2.0 per m² for *Aphidoletes aphidimyza*. Where there are 'hot-spots' of high aphid numbers the rate of *Aphidoletes* can be increased to 10 per m².

Large species:

- For larger aphids, ie potato and the large raspberry aphid, weekly preventive introductions of *Aphidius ervi* at 0.25 per m², (increased to 0.5 per m² where aphids are already known to be present) can be used, along with *Aphidoletes aphidimyza* (at the same rates as those used for small aphids – see above).

- As an alternative to *Aphidius ervi*, the parasitic wasp *Aphelinus abdominalis* can also be used against large aphid species. The voracious predator *Chrysoperla carnea* (common green lacewing) can be introduced for control of a wide range of aphid species. The latter can be introduced into lightly infested areas of the crop weekly at 5 per m², increasing to 10 or more per m².

- Great care and attention needs to be taken with regards to correct choice of pesticides and their application to crops inhabited by predatory insects.

Biological control of leafhoppers

The leafhopper egg parasite *Anagrus anotomus* is available in the UK, but it only parasitises the eggs of certain species of leafhopper. Therefore before deciding to use Anagrus, the leafhopper species must be identified correctly. Seek professional advice.

Biological control of whitefly

The limited choice of insecticides for control of the glasshouse whitefly in cane fruit combined with the pest's high levels of resistance to many insecticides, means that biological control may be the only option for this pest.

- The main biological control agent used for whitefly control is the tiny parasitic wasp *Encarsia formosa*.

Photo supplied by Scottish Crop Research Institute

17 **Parasitised large raspberry aphid on the underside of raspberry leaf**

- The adult wasp (Figure 18) lays eggs in the larva of the whitefly, the larva is killed and the scale turns black (Figure 19) before the new wasp emerges.

- *Encarsia* is quite slow-acting and is best used preventatively in crops prone to whitefly attack.

- Introduce *Encarsia* every week from the start of crop growth in the spring, at a rate of 1 parasite per m².

- Where a whitefly infestation becomes well-established, the rate of *Encarsia* will need to be increased, in severe infestations perhaps to 10 per m².

- Other parasites and predators are available for whitefly control, such as the parasite *Eretmocerus erimicus* and the predator *Delphastus catalinae*. Seek professional advice before considering the use of these other agents.

Chemical control

Despite the varied options available for the biological control of aphids and whitefly, introduced predators and parasites can not always be relied upon to gain full control, even in protected cropping situations. It is therefore likely for both protected and field-grown crops, that some form of chemical pesticides will be required to keep the pests fully under control.

In the case of capsids and other bugs, there are currently few alternatives to chemical pesticides for gaining control.

The adoption of field crop covers has further reduced the already limited range of pesticides that can be employed for aphid control.

Table 3 (opposite) lists all of those chemical insecticides which are currently approved for use in cane fruit crops and which control aphids, capsids, leafhoppers and whitefly.

Those products that have a physical mode of action (natural plant extracts and dodecyl phenol ethoxylate) have no residual effect in the crop. This allows predatory insects to be introduced immediately following application. They are useful when regular introductions of predators are being made and can reduce pest populations either overall or locally, to a level where they can be controlled effectively by predators.

Application timing

Recent HDC trials (SF 74) have demonstrated that when suitable insecticides are applied in late September/early October to control large raspberry aphid in summer fruiting raspberries, both the number of eggs that are laid and the subsequent populations the following season, are substantially reduced.

Limitations in Chemical Use

- It should be noted that although not all of the sucking insect pests are listed as target pests on some of the product label recommendations, incidental control can often be gained. Be sure to check the column headed 'Pests controlled incidentally by use'.

- The organophosphate (OP) and synthetic pyrethroid (SP) insecticides listed in the table above have a very broad-spectrum of activity and are generally harmful to naturally-occurring and introduced beneficial insects and other predators.

- The damaging effects of synthetic pyrethroids can last between 8–12 weeks following application and this should be borne in mind when implementing an integrated control programme.

- To reduce the risk of pest resistance to specific or groups of products, a range of pesticides should be utilised where possible.

Photo supplied by ADAS

18 **Parasitic wasp *(Encarsia formosa)* adult**

Photo supplied by ADAS

19 **Parasitised and unparasitsed whitefly scales**

Table 3 Insecticides currently approved for use in cane fruit crops that offer control of sucking insect pests

Active ingredients	Typical products	Target pest on current label	Sucking pests controlled incidentally by use	Harvest interval	Max. number of applications, crop situation and other information
bifenthrin (Off-label approval)	Talstar 80 Flo Starion Flo	clay coloured weevil, two-spotted spider mite.	aphids (some species), capsids, leafhopper, shield bugs, whitefly (resistance common).	2 days	2 applications. Raspberry and blackberry – outdoor and protected crops. Harmful to predators. Synthetic pyrethroid pesticide (SP).
chlorpyrifos (Full approval – raspberry, Off-label approval – outdoor blackberry)	Equity, Lorsban WG	aphids, raspberry beetle, raspberry cane midge.	capsids, leafhoppers, shield bugs.	7 days	**Equity**: 3 or max 3 l/ha. **Lorsban**: 3 or max 1.8 kg/ha. Raspberry – outdoor and protected crops, but may cause crop scorch under protection. Blackberry – outdoor crops only. Harmful to predators. Organophosphate pesticide (OP).
deltamethrin (Full approval – raspberry, Off-label approval – outdoor blackberry)	Decis	raspberry beetle	aphids, capsids, leafhoppers, sawfly, shield bugs, whitefly.	Nil	Unlimited. Raspberry – outdoor and protected crops. Blackberry – outdoor crops only. Harmful to predators. Synthetic pyrethroid pesticide (SP).
dodecyl phenol ethoxylate (Full approval)	Agri 50-E	aphids, capsids, two-spotted spider mite, whitefly.		Nil	Unlimited. All cane fruit – outdoor and protected crops. Harmful to predators.
lambda-cyhalothrin (Off-label approval)	Hallmark with Zeon Technology	clay coloured weevil, capsids.	aphids (some species), leafhoppers, shield bugs.	21 days	2 applications**.** All cane fruit – outdoor crops only. Harmful to predators. Synthetic pyrethroid pesticide (SP).
natural plant extracts (Full approval)	Eradicoat Majestik	aphids, two-spotted spider mite, whitefly.	leafhoppers	Nil	Unlimited. All cane fruit – outdoor and protected crops. Harmful to predators.
nicotine (Full approval)	XL All Insecticide	aphids, capsids, caterpillars, leafhoppers, sawfly, whitefly.	shield bugs	2 days	Unlimited. All cane fruit – protected crops only. Harmful to predators. Full approval expires 31/12/07.
pirimicarb (Full approval – raspberry, Off-label approval – outdoor blackberry and hybridberry)	Aphox	aphids		3 days	Unlimited. All cane fruit – outdoor crops only. Only raspberry crops under protection.
pymetrozine (Off-label approvals)	Plenum WG Chess WG	aphids		12 weeks or 3 days **(depending on SOLA)**	3 applications. Plenum – all outdoor cane fruit crops. Chess – all protected cane fruit crops.
rotenone (Full approval)	Liquid Derris	aphids, raspberry beetle.	leafhoppers	1 day	Unlimited. All cane fruit – outdoor and protected crops.

Table continued…

Active ingredients	Typical products	Target pest on current label	Pests controlled incidentally by use	Harvest interval	Max. number of applications, crop situation and other information
thiacloprid (Off-label approvals)	Calypso	capsids	aphids, leafhoppers, whitefly.	3 days	Max ind. dose: 250 ml/ha. Max total dose: 750 ml/ha. All cane fruit – outdoor crops. Raspberry and blackberry – protected crops.

Note – All recommendations for use of insecticides are as a guide only. Growers should always check the product label before use. Growers using products under the 'specific off-label approval' (SOLA) system do so at their own risk and must have a copy of the SOLA before applying such a pesticide.

Action points for growers

- The use of protected cropping systems for cane fruit crops provides favourable conditions for the principal sucking insect pests; aphids, capsids, shield bugs and whitefly.
- Growers should ensure their relevant members of staff are acquainted with their appearance and damage they create (see also HDC Cane Fruit Crop Walkers Guide).
- Use all appropriate monitoring systems and aim to identify the appearance of the pests before significant populations develop.
- Where possible, employ biological and integrated methods to control these pests.
- Implement control measures early to avoid the need to use agrochemicals close to harvest.

Further information

Suppliers of biological control agents and sticky traps:

Agralan Ltd (Biobest products)
The Old Brickyard
Ashton Keynes
Swindon, Wiltshire SN6 6QR
Tel. (01285) 860015

Becker Underwood UK
Unit 1 Harwood Industrial Estate
Harwood Road, Littlehampton
West Sussex BN17 7AU
Tel. (01903) 732323

Biological Crop Protection (BCP) Ltd
Occupation Road, Wye,
Ashford, Kent TN25 5EN
Tel. (01233) 813240

Biowise
Hoyle Depot, Graffham, Petworth
West Sussex GU28 0LR
Tel. (01798) 867574

Fargro Ltd
Toddington Lane, Littlehampton
West Sussex BN17 7PP
Tel. (01903) 721591
(Agents for Syngenta)

Koppert UK Ltd
Green House, Hornefield Business Park
Hornefield Road, Haverhill
Suffolk CB9 8PQ
Tel. (01440) 704488

Syngenta Bioline
Telstar Nursery, Holland Road
Little Clacton, Clacton,
Essex CO16 9QG
Tel. (01255) 863200

Biocontrol agents and sticky traps can also be obtained through most horticultural merchants.

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