

Pests of Swedes and Turnips – Their management and control

Technical Note

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Summary

- Insecticide options are being reduced for pest control in swedes and turnips
- Adoption of mesh covers significantly aids protection against some pests
- Cabbage root fly is the major pest of crops in Scotland

Introduction

The review of anti-cholinesterase pesticides (mainly organophosphate insecticides) initiated by the government in 1998 has led to the withdrawal of 17 insecticides, the majority of which were used on UK horticultural crops. A further 21 insecticides (some of which are used on UK horticultural crops) are currently under review within the EU, and are under threat of withdrawal due to human health and/or environmental reasons. Until a specific off-label approval (SOLA) was granted for the use of chlorfenvinphos on swedes and turnips until December 2003, the UK crop would have had no insecticides available for the control of cabbage root fly in 2002/2003.

Consequently, management of insect pests of field vegetable brassicas, especially those of shopping swedes and turnips has changed significantly in response to the reduction in available insecticides. The pests and their management have been brought up to date in this technical note.

Cabbage root fly

Cabbage root fly (*Delia radicum* L.) is probably the most serious pest of swedes and turnips, the white grubs feeding on the roots causing wilting/death of plants, or damage to the swede/turnip itself (Fig. 1 & Fig. 2).



Fig. 1. Symptoms of damage by first generation cabbage root fly larvae



Fig. 2. Damage to swede by second generation cabbage root fly larvae – one larva in situ

The pest overwinters in the soil as pupae at the site of a previous brassica crop, oilseed rape or where brassica weeds were prevalent. The flies emerge from the pupa in early-mid May. The flies resemble small houseflies, are 5–7 mm long, grey-black in colour and after emergence initially mate and feed on nectar from wild flowers in hedgerows before they migrate to swede/turnip crops to lay their first batch of eggs. The flies lay their oval white eggs (about 1 mm in size) at the base of the plants from mid-May onwards, and the eggs hatch after 3–7 days, the larvae feeding on the root 2–3 cm below the soil surface (Fig. 2).

Adult female cabbage root flies are adept at locating their host plants, as they can detect the smell of a potential host-plant from up to 20 m away. Volatile chemicals released by the leaves of swedes and turnips (as well as other brassica host plants) act as attractants for cabbage root fly. Once the flies are close to a plant, visual stimuli, specifically the contrast of the green foliage against bare soil provide a further cue that elicits a landing response. On landing on the plant, the female fly uses contact stimuli from the chemicals on the leaf surface to decide whether it is a suitable host-plant for the larvae. If the plant is suitable, the fly will walk down to the soil surface and lay eggs just below the soil surface, at the base of the plant. This stereotypical host-plant location and egg-laying

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behaviour has been targeted as a potential target for managing cabbage root fly.

The larvae feed on the roots for 3–4 weeks, reaching up to 8 mm in length before they leave the root zone to pupate. This pupal stage lasts for 2–3 weeks before the 2nd generation of adult flies emerges from Mid-July onwards, and the cycle is repeated, with a partial 3rd generation of flies often occurring in September. However, most pupae of the 2nd generation will diapause over the winter months to give rise to the 1st generation of flies the following year.

Damage from the larvae of the 1st generation of cabbage root flies is typically a severing of the lateral roots of plants, leaving a spindly tap root that is poor at taking up nutrients and water. Often the tap root itself can be severed, and dead or wilting plants can be seen along the rows.

Second generation larval damage does not usually lead to death of the plant, but the feeding of the larvae on the swede/turnip root allows pathogens to gain access to the root leading to soft rots. The scarring of the swede/turnip caused by larval feeding also affects the quality of the harvested product (Fig. 2).

Another root fly, turnip root fly (*Delia floralis* Fall.) appears during August. This fly is locally common in Scotland, and often appears in-between cabbage root fly generations in July-August. Turnip root flies only have one generation a season, and their larval damage is different from that of cabbage root fly, as the larvae tend to burrow deep into the heart of the root, whereas cabbage root fly tend to graze on the outer surfaces of the root.

Management of cabbage root fly

Traditionally, cabbage root fly used to be reasonably well controlled by the use of insecticide granules at planting to combat 1st generation larval attack, followed by insecticide drenches for 2nd generation attack. However, due to the revocation of virtually all insecticides for cabbage root fly control, many swede growers have now invested in the use of mesh covers to act as a physical barrier to prevent access of flies to the crop (Fig. 3). This is a substantial investment for growers, and only pays its way if the mesh can be reused over several seasons. Many growers have expressed satisfaction at their use of covers, but there are pitfalls to the use

of crop covers. The main problem is the potential for cabbage root flies that have overwintered on brassica weeds or oilseed rape to be trapped under the covers when they emerge. These flies will mate and lay eggs under the mesh and the grower may be unaware of the damage occurring under the mesh as the season progresses. Other pests may also be trapped under the mesh: slugs, flea beetles, cutworms and there is also the barrier that the mesh may provide to ingress by natural enemies of pests such as staphylinid and carabid beetles, and hymenopterous parasitoids. Also the role that mesh may play in the levels of crop disease has yet to be clarified.



Fig. 3. Mesh used to protect crops as an alternative to insecticides

The only insecticide that can still be applied to swedes and turnips for cabbage root fly control is chlorfenvinphos (Birlane 24), however this is a specific off-label approval (SOLA 3402/2002), restricted to 4 applications a season, and runs out at the end of 2003.

In order to accurately time the sprays for 1st and 2nd generation root fly larvae in uncovered swedes/turnips, or to time removal of the covers, monitoring of the appearance of the adult flies using water traps is recommended. Getting the timing of insecticide treatment wrong by just a few days can be very costly, especially as only 4 applications of Birlane 24 are allowed. Alternatively, egg-traps can be used where sand placed at the base of plants can be scooped up and washed to note the appearance of eggs, and insecticide timing fine-tuned accordingly.

Many growers have tried alternatives to synthetic insecticides such as several products based on garlic, however, results have been inconsistent and trials carried out by SAC suggest that getting the

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right timing of applications, coupled with the right soil moisture conditions are essential for these products to have any significant effect against cabbage root fly.

SAC trials where swedes have been undersown with clover have led to a reduction in the levels of cabbage root fly damage, mainly due to disruption of their egg-laying behaviour and by an increase in the levels of natural control by predators and parasites.

SAC has just begun a study to look at the potential for novel sprayable barriers to control cabbage root fly and other pests on swedes, which may lead to new non-insecticidal products being available for cabbage root fly, aphid and other pests in the future.

Flea beetles

Flea beetles (*Phyllotreta* spp.) are named due to their powerful hind legs, which gives them the capacity to 'jump like fleas' when disturbed. There are two distinct types of flea beetle: striped flea beetles where there are distinct yellow bands on their wing cases (e.g. *P. nemorum* L.), and beetles which are all one colour, usually black (e.g. *P. cruciferae* Goeze). The beetles range in size from 1.5–3.0 mm in length, and it is the adults that cause problems to crops rather than the larval stage (Fig. 4).



Fig. 4. Flea beetles on young turnip leaf

The adult flea beetles tend to overwinter in hedgerows and field edges, feeding on weeds, moving into crops in April/May when temperatures rise and when the weather is dry. The adults feed on the emerging shoots, cotyledons and leaves of seedlings, giving rise to the typical 'shot-holing' of leaves (Fig. 4). Damage is more severe if soil conditions are dry; flea beetles are less active in

the wet. The adults will lay eggs in soil from late-May onwards, and the larvae feed on roots or as leaf miners, however damage from larvae is seldom serious. A new generation of beetles emerges in August, however damage from these is superficial.

Management of flea beetles

The use of mesh covers adopted for cabbage root fly management will also protect crops from flea beetles providing there are no gaps to allow the beetles access under the mesh. In uncovered crops, the insecticide deltamethrin (e.g. Decis, Bandu, Pearl Micro and others) can be applied at crop emergence if shot-holing by flea beetles is affecting crop establishment and conditions are forecast to remain dry. It is essential that flea beetle damage is not confused with that from slugs: slugs tend to eat larger holes out of leaves and leave slime trails visible on leaves in the morning after a night's feeding during damp soil conditions.

Butterflies and moths

Caterpillars of several butterfly and moth species can damage swedes and turnips during the growing season, although they tend to be more important on leafy brassica crops such as cabbage.



Fig. 5. Caterpillar of large cabbage white butterfly



Fig. 6. Caterpillar of small cabbage white butterfly

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Caterpillars of large and small cabbage white butterflies (*Pieris brassicae* L. and *P. rapae* L.) can often be seen feeding on the leaves of crops (Fig. 5 & Fig. 6). In exceptional outbreaks they can skeletonise leaves and significantly affect the yield of crops, however in most seasons they seldom cause significant damage.

Diamond-back moth (*Plutella xylostella* L.) can be damaging if they attack young swede seedlings, where they can skeletonise leaves and significantly hamper crop establishment (Fig. 7). Later damage



Fig. 7. Diamondback moth caterpillar



Fig. 8. Turnip moth caterpillar ('cutworm')

also has the potential to affect yield by lowering the photosynthetic potential of the leaves.

Cutworms (e.g. turnip moth, *Agrotis segetum* Den. & Schiff.) are moth caterpillars, which initially feed on the lower leaves of plants before dropping to the soil and feed on the roots and lower stems just below the soil surface (Fig. 8). Damage to swedes and turnips may not become apparent until harvest, when cavities in the harvested roots are seen.

Management of butterfly and moth pests

Cutworm moths, diamond-back moth and other occasional moth pests such as silver Y moth (*Autographa gamma* L., Fig. 9) can be monitored



Fig. 9. Caterpillar of silver Y moth

through the use of pheromone traps. Pheromone trapping can be used to gauge when the moths are likely to be laying eggs on crops, and assessing crops for eggs and/or young caterpillars, followed by an insecticide treatment with deltamethrin (e.g. Decis, Bandu, Pearl Micro and others) can prevent any problems arising. However, in practice these pests, along with the cabbage white butterflies seldom cause serious problems on swedes and turnips in Scotland. The adoption of mesh covers reduces the risk of problems even further, although there is a risk of cutworm pupae overwintering in a field which subsequently gets covered by mesh, trapping the emerged moth underneath.

Aphids

The most common aphid species seen on swedes and turnips is the cabbage aphid (*Brevicoryne brassicae* L.), also known as the mealy cabbage aphid (Fig. 10). These aphids are very distinctive, due to the grey-white mealy wax covering their bodies. Aphids tend to overwinter as eggs on

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Fig. 10. Cabbage aphids

brassica weeds or overwintered brassica crops (including oilseed rape), and after hatching in March, fly into newly planted crops from May onwards. The first signs of aphid infestation are a bleaching and yellowing of infested leaves, and on the leaves cast aphid skins, wax and honeydew will be apparent, with sooty moulds forming on the honeydew.

Aphid infestations tend to be 'patchy' within a field, often arising from one individual initially landing on the plant. As cabbage aphid is primarily a serious pest of leafy brassicas, its impact on swedes tends to be less important, and measures to control cabbage aphid are only necessary if early infestations are affecting crop establishment.

Management of aphids

Of greater concern than cabbage aphid perhaps is crop infestation by peach-potato aphid (*Myzus persicae* Sulz., Fig. 11). Whilst this pest is less damaging than cabbage aphid, in recent seasons in Scotland insecticide resistant clones of this aphid



Fig. 11. Peach-potato aphids

have been detected, and these are resistant to either or both of the main insecticides applied to swedes for aphid control: deltamethrin (e.g. Decis, Bandu, Pearl Micro and others), pirimicarb (e.g. Aphox, Phantom and others), and product mixtures of the two (e.g. Evidence, Patriot EC). To avoid exacerbating the threat of insecticide resistance in this aphid, growers should only apply an insecticide for cabbage aphid control where strictly necessary, and should monitor crops after treatment to see whether any peach-potato aphids have survived. If this is the case, any further treatments for aphids should be with nicotine (e.g. No-Fid, Nico Soap) to reduce the risk of insecticide resistance.

The adoption of crop covers will reduce the threat of aphids in swedes and turnips, as aphids will be unable to gain access to the crop.

Slugs

Slugs can be damaging to the crop at crop emergence and also throughout the season, particularly if they target the swede and turnip root. The use of crop covers aggravates the threat from slugs as the use of molluscicide pellets is constrained, as they can only be applied prior to putting on the crop cover. Also the covers hamper natural control of slugs by birds and predatory beetles. If covers are to be used, metaldehyde molluscicide pellets (e.g. Luxan Metaldehyde) should be applied prior to covering. Regular checks for signs of slug activity under covers should be carried out throughout the season.

On uncovered crops, slug activity should be monitored by regular checking, or the use of slug traps. Metaldehyde slug pellets should be applied if slug damage is evident on seedlings and later on in the season to the swede itself.

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