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WEEVILS ON APPLES AND PEARS

Weevils, or snoutbeetles, belong to the insect family Curculionidae. Beetles in this family are characterised by their mouthparts that are elongated to form a snout.

Weevils are generally hard-bodied beetles, and are very variable in size. A number of indigenous weevils occur in apple and pear orchards in South Africa, namely:

Eremnus atratus	Black weevil
Pantomorus cervinus	Fuller's rose beetle
Phlyctinus callosus	Banded fruit weevil
Sciobius tottus	Sciobius weevil

The banded fruit weevil, *Phlyctinus callosus*, is the most common fruit-damaging weevil in apple orchards. It was previously known as vine snoutbeetle or V-back snoutbeetle. Feeding by adults also causes economic damage to nectarines. This weevil is flightless and is primarily active at night.
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ECONOMIC DAMAGE

Only adult weevils feed on fruit trees. Leaf damage by weevils is only economically important in nurseries and young plantings where small trees can be completely defoliated.

Banded fruit weevil
Feeding damage to fruit can cause severe economic damage on apples by rendering fruit unsuitable for export, but it is rarely of economic significance on pears. Weevils chew away the bark of fruit stalks, which results in premature wilting and dropping of fruit. Most economic damage is done when weevils chew away the skin and underlying flesh of the apples, resulting in characteristic shallow lesions with a scooped-out appearance. Apples damaged early in the season develop corky callus tissue in the lesions. The damaged area swells faster than the rest of the fruit and fills up the cavity. As the fruit grows bigger, the corky scar tissue breaks up, resulting in typical russet-like blemishes (Fig 3). When fruit is damaged later in the season when they are almost full size, the damaged areas do not swell out completely, resulting in typical shallow, scooped-out, corky cavities (Fig 4). Feeding damage shortly before harvest does not develop corky callus tissue (Fig 5).

Weevils are also considered to be a phytosanitary pest by many export markets. This means that there is no

Fig 1
Banded fruit weevil *Phlyctinus callosus* (Schönherr)

Fig 2
Weeevil feeding damage on leaves

phytosanitary tolerance for weevils that sometimes hide in the stem and calyx ends of apples. Weevil damage to fruit is rarely of economic importance on pears, but the presence of weevils in cartons of pears poses a serious phytosanitary risk. If weevils are found during fruit inspections, the whole consignment is summarily rejected. This has serious economic implications for both producers and exporters.

Fuller's rose beetle often occurs in very high numbers in certain fruit orchards, including apples. It feeds on leaves, but does not cause direct damage to fruit. Adult populations peak around December. When populations are high, considerable problems with micro-irrigation systems can be caused when females lay egg packets in the micro-jets, causing malfunction or failure.

Sciobius weevil has become prevalent in some apple orchards. It appears earlier than banded fruit weevil. It feeds on developing buds, blossoms and leaves only and does not cause economic damage, except when populations are very high or in very young trees which can be defoliated.

POINTS OF INFESTATION IN THE PRODUCTION CHAIN

- Adults hide in the calyx and stem ends of apple (Fig 6), and during harvest are then often carried from the tree to the bulk bin, and thence to the packstore.
- During harvest: Weevils hiding under loose bark or in crumpled leaves on the trees are disturbed by the activity and some may fall into bulk bins. Some weevils hiding in the leaf litter or cover crop may also crawl into bulk bins during harvesting. Bins left overnight in orchards can become infested with weevils which are then transferred to the packshed.
- During packing: Despite sprayers sometimes being mounted in the packing line to remove debris and insects, some weevils remain on the fruit and may be missed by the fruit cullers, thus ending up in the carton. Packing materials can become infested during storage in winter when weevils take refuge in the grooves of the cardboard boxes. Weevils hiding in discard bins may contaminate fruit on the packing line.

BIOLOGY OF BANDED FRUIT WEEVIL

Although eggs are sometimes laid in the soil or leaf litter, weevils prefer to lay eggs in confined hollows in stems of certain plants, or in confined spaces at the base of the plants where they are well protected from the environment and possible insecticide sprays. Examples of preferred hosts for oviposition are Italian ryegrass (*Lolium multiflorum*), narrow-leafed ribwort (*Plantago lanceolata*), hairy wild lettuce (*Hypochoeris radicata*) and Paspalum grass (*Paspalum dilatatum*). Eggs are also found in dead hollow rhizomes of Kikuyu grass and hollow stems of fresh white clover (*Trifolium repens*).

As soon as the eggs hatch, the young larvae go into the soil and feed on plant roots, especially of certain weed species. The larval stage (Fig 7) lasts 3 or more months, depending on the time of year. Pupation takes place in the soil and the emerging adults crawl to the soil surface to feed on plants. Weevils generally prefer broad-leafed plants to grasses. At least four months are required to complete the life cycle.

Adults are active at night. During the day they hide in cracks, under loose bark, in curled-up leaves, in the stem and calyx ends of apples, in leaf litter or just under the soil surface. They are flightless and can only access trees by crawling up the trunk or branches touching the ground or cover crop. Weeds or grass growing into the canopy, pipes, wires or trellising poles also provide access to the tree.

Fig 3
Damage caused by weevil feeding early in the season

Fig 4
Young fruit damaged by weevil feeding

Seasonal occurrence

The banded fruit weevil can have one or two generations per year, depending on the cultural practices in the orchard. Whole-orchard irrigation creates a wet summer microclimate. This allows immature stages to develop throughout the summer, resulting in two generations per year. Eggs laid during autumn give rise to the first phase of first generation adult weevils to emerge during spring (November). Overwintering adult females lay eggs in spring, from which the second phase of first generation weevils emerges in December / January. The first phase of the first generation lays eggs in December / January and the moist soil conditions created by irrigation allow these eggs to develop into a second generation of weevils which emerges from February/March over a period of up to 3 months. Second generation females start ovipositing between March and April. These eggs hatch and the larvae that develop during winter give rise to the first generation in the next spring. When the leaves start to drop, adults leave the trees to overwinter in the cover crop.

Orchards irrigated only in the drip area and with cover crop only in the interrow, subject weevils to conditions similar to natural conditions of the South-western Cape, namely hot, dry summers and wet winters. Under these conditions virtually all eggs are laid in the dry interrow and very few larvae develop during summer, resulting in one generation per year. Because of the dry conditions in the interrow, eggs laid by females of the first phase of the first generation only hatch when the first autumn rains fall - eggs that do hatch earlier, do not develop. This results in a small to absent second generation. Eggs laid by the first generation females in autumn will develop during winter and give rise to the first generation of the next season to emerge in spring.

MONITORING

Start monitoring early in October. Tie a band of corrugated cardboard (15 cm wide) around the stems of 5 trees in the middle of the block with corrugations against the trunk (Fig 8). Inspect weekly and apply control when the first weevils are observed (Fig 9). The first signs of feeding damage on the water shoots are also a very good indication of the emergence of the first generation of adults.

CONTROL IN THE ORCHARD

Reduce weevil numbers

Control weed hosts preferred for ovipostition and feeding, like narrow-leafed ribwort (*Plantago*). Use herbicides or straw mulch to keep tree-rows weed free, particularly during autumn and winter.

Methods to keep weevils out of trees

- Apply sticky, non-toxic trunk barriers (glue on a plastic backing, e.g. Enviroband) around trunks (Fig 10).
- Apply batting trunk barriers (200g/m^2 "Britbond A14" from Brits Textiles, Atlantis) treated with 5 ml/L fenvalerate. Cut batting into strips 10 cm wide and pull apart lengthwise to give two barriers (Fig11). Dip barriers in insecticide until soaked (use gloves), allow to dry and staple to trees with fluffy side facing outwards. Batting is only effective if it complies with the specifications given above – if it is not sufficiently fluffy, weevils will walk over it (Fig 12).
- Reduce 'ladders' into the trees: control the height of the cover crop/weeds, prune low-hanging branches and remove pruned branches that lean against the tree.

Control weevils in trees

Where serious infestation has become established in the canopy, apply a full cover spray with a registered pesticide. Products containing the following active ingredients are registered for full cover sprays on apples and are sold under a wide variety of trade names: acephate SP

Fig 5
Damage due to weevil feeding late in the season

Fig 6
Weevil hiding in stem end of apple

(50 g/100 L water); alpha-cypermethrin EC and SC (10 ml/100 L water); beta-cyfluthrin EC (10 ml/100 L water); beta-cypermethrin EC (310-440 ml/100 L water); chlorphenapyr SC (35 ml/100 L water); cypermethrin EC (10 ml/100 L water); deltamethrin EC (25 ml/100 L water); deltamethrin SC (12.5 ml/100 L water); esfenvalerate EC 50g/L (18 ml/100 L water); esfenvalerate EC 200g/L (5 ml/100 L water); fenvalerate EC (15 ml/100 L water); lambda-cyhalothrin CS (20 ml/100 L water); lambda-cyhalothrin EC (20 ml/100 L water); lambda-cyhalothrin WG (20 g/100 L water); permethrin EC (15 ml/100 L water); tralomethrin EC (21 ml/100 L water); zeta-cypermethrin EW (10 ml/100 L water).

Note:

- Ensure that the pesticide you want to use, is allowed in the country to which fruit is to be exported – check with your exporter or consult the MRL list compiled by DFPT.
- Full cover sprays with synthetic pyrethroids are very detrimental to natural enemies and for biological control of spider mites in particular.

PREVENTION OF INFESTATION DURING HARVESTING

- Do not leave bins on the ground or on trailers in the orchard overnight, as they can become contaminated by weevils which will infest the fruit as it is harvested.
- Raise awareness in pickers that weevils in stem and calyx ends will probably be transferred to the bulk bins in orchards. Bin sorters in orchards should remove any weevils seen on fruit or in the bin.

PREVENTION OF INFESTATION DURING PACKING

- Store apples in bins under low temperature of –0.5 °C and controlled atmosphere or regular atmosphere for 8 weeks before packing into boxes. This will greatly reduce the chances of live weevils and other live contaminants occurring in packed fruit.
- Install sprayers in the packing line as the apples come out of the flumes onto the rollers with sufficient pressure to dislodge weevils on apples. Although this will get rid of most weevils; some may still remain hidden in the stem or calyx ends.
- Replace water in the flumes if it becomes too contaminated with weevils.
- Ensure that packaging materials are free of weevils. Either assemble boxes on the packing line or fumigate assembled boxes, stored during winter, before use.
- Scrutinise apples for presence of weevils in the packing line – train packers to recognise and identify weevils and other phytosanitary pests.
- Packers should check that each box is weevil free before packing apples into it.
- Ensure that weevils removed from fruit or that fell out of fruit or bins cannot contaminate clean fruit: Remove discard bins from the packhouse at regular intervals and keep them away from freshly harvested fruit.
- Sweep the packhouse regularly to remove weevils that have fallen onto the floor.
- Do not leave discard bins contaminated with weevils outside the packhouse where weevils can get into empty bins or harvested fruit. Remove contents of discard bins to a dump and cover with lime or even an insecticide spray, if it is not going to be otherwise processed.

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Fig 7
Weevil larva

Fig 8
Cardboard band around trunk for monitoring

LITERATURE
Barnes, B.N. 1988. Banded fruit weevil, *Phlyctinus callosus*, in deciduous fruit orchards of the South-western Cape. 2. Adult emergence patterns. Deciduous Fruit Grower 38 (9): 324 – 330.
Barnes, B.N. 1988. Banded fruit weevil, *Phlyctinus callosus*, in deciduous fruit orchards of the South-western Cape. 3. Oviposition sites and preferences. Deciduous Fruit Grower 38 (10): 375 – 379.
Barnes, B.N. 1989. Different life and seasonal cycles of banded fruit weevil, *Phlyctinus callosus* (Coleoptera: Curculionidae), in apple orchards of the South-western Cape. Phytophylactica 21: 147-157.
Barnes, B.N. 1990. FFTRI Monitoring Manual for Orchard Pests. ARC Infruitec-Nietvoorbij, Private Bag X5026, Stellenbosch 7599.
Barnes, B.N., Knipe, M.C. & Calitz, F.J. 1995. Effective weevil control on apple trees with batting trunk barriers. Deciduous Fruit Grower 45 (9): 376 – 378.
Nel, A., Krause, M. & Khelawanlall, N. 2002. A Guide for the Control of Plant Pests. National Department of Agriculture, Directorate Communication, P/Bag X144, Pretoria 0001, South Africa.

Fig 9
Weevils hiding in cardboard band

Fig 10
Sticky trunk barrier (Enviroband)

Fig 11
Divide batting barrier lengthwise

Fig 12
Batting not sufficiently fluffy

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