



Queensland Fruit Fly

Queensland fruit fly (*Bactrocera tryoni*) is a serious pest of most commercial fruit crops and many native plants. Its range extends throughout eastern Australia, from Cape York to East Gippsland and into the Northern Territory.

There are several strategies which, when combined and carried out diligently can provide excellent control of fruit fly in commercial or domestic crops:

- the application of protein bait to attract and kill female fruit flies;
- the use of fruit fly traps to allow monitoring of male fruit fly levels;
- the use of male annihilation technique (MAT) cups to attract and kill male fruit flies; and
- the use of orchard management practices to discourage fruit fly breeding opportunities and proper disposal of infested fruit.

This brochure outlines these strategies, as well as providing an overview of the biology and life cycle of the Queensland fruit fly.

About fruit flies

Fruit flies are some of the most significant pests of fruit and vegetables throughout the world. The fruit flies that cause damage in our orchards are known as tephritid flies. They are quite different to the drosophilid flies that many people will know as small brown flies that hang around decaying fruits in a fruit bowl. The drosophilid flies are not agricultural pests and are mostly only a nuisance where fruit and vegetables are stored. Australia has very many tephritid fruit fly species but the most well known and damaging are Queensland fruit fly and Mediterranean fruit fly. Queensland fruit fly occurs in eastern Australia through much of Queensland and New South Wales. Mediterranean fruit fly is present in Western Australia.

In this brochure, the term 'fruit fly' refers to Queensland fruit fly although management techniques are similar for most of the tephritid group.

Life cycle and damage to fruit

Queensland fruit flies have been recorded from around 250 species of native and introduced fruits.

Female fruit flies lay their eggs into healthy, ripening fruit on the tree. Eggs are often laid up to eight weeks before the fruit is mature. Around six or more white banana shaped eggs close to 1mm long are deposited just beneath the skin. The sting sites show as discoloured, often blackish spots, which may exude distinctive blobs or filaments of gum.



Queensland fruit fly - biology, life cycle and damage to fruit

Eggs hatch within two to three days. The maggots (larvae) tunnel and feed within the fruit, passing through three stages (instars) before they reach maturity. This usually takes between seven and ten days, by which time they are about 13 mm long. The larvae are creamy white, legless and taper towards the front end. They have paired fine black mouth hooks for tearing at the fruit tissue. As the larvae tunnel and feed, a localised rot develops. Infested fruit will usually drop to the ground, and very heavy losses can be incurred if control measures are not taken.

Each fully-fed larva leaves the fruit with a characteristic jumping motion and burrows into the soil, where it forms a brown barrel-like shell out of its own skin and pupates. The larval and pupal stages can take between nine days and several weeks, depending on temperature. A new adult female usually takes about a week to find suitable protein food before she can develop eggs. Provided host fruit are available, she will then continue to lay eggs throughout her life, which may last two or three months.



Queensland fruit fly larvae and fruit damage caused

Photo: Dan Smith

Biology

Adult Queensland fruit flies are about 7 mm long and are reddish-brown with yellow markings. The female has a pointed abdomen with a needle-sharp retractable egg laying organ (ovipositor) at the tip.

Adults are very mobile and over several days or weeks can fly many kilometres. As with many species of tephritid flies, the males are strongly attracted to specific chemical compounds.

The female fruit fly must feed on a source of protein before her eggs will mature. She must then wait about five days before she can begin laying eggs.



Gummy exudate from fruit fly egg-laying in lemon

Photo: Dan Papacek

A female fruit fly only mates once in her lifetime, and adult flies usually mate and feed in the host tree. Flies are most active from dawn through the first few hours of the day.

Fruit fly threat is greatest while susceptible fruit are available, the weather is warm and conditions are moist. Hot dry weather will keep hatch numbers and fly activity down. Rainfall and the subsequent drop in temperature usually signals greater hatch numbers and stimulates fly activity. During cold winter weather fruit fly activity may cease entirely.

Adult fruit flies' food sources are varied and include nectar, plant secretions, fruit juices, bird droppings and bacteria from fruit and leaf surfaces. Four or five or more overlapping generations may develop during spring, summer and autumn in warm coastal areas if suitable fruits are available. In colder southern areas, fruit flies cannot survive winter and are reintroduced in spring. Any overwintering population consists mostly of adults that shelter in quiet situations. As the

Queensland fruit fly - biology, life cycle and damage to fruit

weather warms up in spring, activity increases and developing fruit can be stung. During spring, other hosts are important in building up the new season's fruit fly population.

Spread of fruit flies

The transportation of infested fruit is the main way the pest is introduced to a previously fly-free area. Larvae may leave fruit in transit or may pupate in packaging materials or vehicles, from which the adults later escape. As Queensland fruit fly is a major pest problem in fruit crops, other states have placed severe quarantine restrictions on interstate movement of fruit.

Fruit fly traps

Fruit fly traps are used for monitoring male populations of Queensland fruit fly. The trap contains a Fruit Fly Wick. Male fruit flies are attracted from up to 400 m and are killed upon entering the trap.

Fruit fly traps should be used in conjunction with a baiting program. This baiting technique will control female flies which cause fruit damage.

Suspend traps at head height within the tree canopy, free from twigs and leaves. The traps should be cleared at weekly intervals, or more frequently during periods of peak activity, and numbers recorded. The catches can be recorded as numbers of flies per day depending on the interval between counts. Catches do not necessarily reflect damage from egg-laying females but can give an indication as to general fruit fly activity. Wicks should be replaced every three months.

These traps do not catch female flies. Female traps are generally not very effective, although research is continuing to develop better female traps.



Adult fruit flies on citrus leaf

photo Dan Papacek



Fruit Fly Trap in citrus tree

photo Dan Papacek



Fruit Fly Trap with collect flies

photo Dan Papacek

WARNING: AVOID CONTACT WITH IMPREGNATED WICK. USE RUBBER GLOVES DURING INSTALLATION. KEEP OUT OF REACH OF CHILDREN.

Fruit Fly Wicks / MAT cups

Fruit fly wicks are supplied impregnated with a sex attractant (cue lure) and an insecticide (Maldison). They are used to replace expired wicks in fruit fly traps. Wicks will keep for long periods in the sealed plastic packet. Once opened they are effective for three months.

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Using traps and cups to monitor and control Queensland fruit fly

The fruit fly wicks produced by Bugs for Bugs are in a unique plastic housing designed to make them totally flexible for use in a trap or as part of an **area wide management** (AWM) program. The wick is protected from the elements for maximum longevity and performance. Our latest re-design allows improved airflow and diffusion of the pheromone from the wick while improving fruit fly access to the toxicant.

Fruit fly wicks can also be placed individually (without the trap) at densities of 10 to 20 per hectare to reduce male fly numbers as part of an area wide management strategy using **male annihilation technique** (MAT). When used in this fashion they are referred to as MAT cups .



MAT cup for Area Wide Management photo Dan Papacek

MAT cups are most effective when used over large areas or entire cropping regions. They do however compete with male fruit fly traps and can reduce the trap counts significantly making monitoring more difficult.

Orchard management techniques

Orchard management techniques which can be used to aid in the control of Queensland fruit fly include:

- removing or slashing/mulching all fallen damaged or infested fruit from the orchard or surrounding areas;
- removing from trees all fruit not to be harvested for use, with prompt and correct disposal of reject fruit;
- reducing the other host plants close to the orchard (i.e. in the garden or surrounding bushland) or looking after them in the same manner as the orchard trees; and
- good packing-shed hygiene, including thorough inspections to remove any fruit likely to be infested.

Baiting for fruit fly

Protein baits consist of a liquid protein mixed with a toxicant, which must be applied regularly to the foliage or trunk of the host tree. Baiting offers many advantages over the use of cover sprays, including that:

- it is much less harmful to beneficial insects, so is suitable to use in integrated pest management programs;
- considerably less material is used per hectare, so costs are reduced;
- it is more environmentally acceptable because of the much reduced pesticide usage and little drift effect;
- applications can be directed away from fruit to minimise fruit residue problems; and
- the hazard to the operator is considerably reduced.

Important points about fruit fly baiting

Baiting must commence early before a breeding population of fruit flies establishes in the crop to be protected. This should be at least two weeks before fruit first become susceptible to fruit fly damage. Regular treatments are essential for this method to succeed. More frequent baiting may be necessary during periods of high pressure from fruit fly.

Baits are susceptible to weathering and must be applied more frequently during periods of showers or rainfall. Thickeners can improve the life and efficacy of protein baits and are recommended during periods of high pressure. During periods of high rainfall it may be necessary to resort to cover sprays to achieve

Control of Queensland fruit fly using protein baits

adequate control, especially in high risk crops. At all times the crop should be closely monitored for signs of fruit damage, to determine the need for additional treatments.

If fruit flies are breeding in nearby areas, such as in rainforest or along watercourses, it is advisable to bait around the perimeter of the orchard on windbreak trees or other vegetation. For best results, fruit fly baiting should be carried out in conjunction with the use of MAT cups to suppress male fruit fly populations, and with good orchard management practices such as the removal of fallen and rotting fruit.

Cover sprays

Conventional insecticides are very disruptive and often lead to an upsurge of secondary pests such as scale insects and mites. Baiting has been used very successfully in a range of crops, often replacing cover sprays entirely. Only very occasionally has control been inadequate and this has invariably been due to a late start to baiting or to poor application techniques. Cover sprays should only be used as a last resort if all other measures fail.

Fruit Fly Lure

Fruit Fly Lure is an autolysed protein highly attractive to Queensland and Mediterranean fruit flies. The protein odours attract both male and female flies, but particularly immature females searching for protein food so they can develop their eggs. It is mixed with an insecticide and spot sprayed onto the foliage of fruit trees, thereby minimising the disruptive effects of conventional cover sprays.

The bait is applied as an attractant in small quantities and is highly effective in controlling fruit fly in avocados, citrus and passionfruit. Bait spraying in other crops that are highly susceptible to fruit fly (e.g. stone fruit and guavas) should be undertaken in conjunction with cover sprays.

Fruit Fly Lure does not contain salt and is therefore less likely to cause leaf and fruit burn than the earlier salt-based hydrolysed protein. However, fruit burn may still occur in some more sensitive crops, especially mangoes. Sensitivity will vary with the climatic conditions and varieties. Avoid contact of the mixture with fruit. Test on a small area first if unsure. The absence of salt also improves the attractiveness of Fruit Fly Lure when compared to salt based formulations.

Fruit Fly Lure contains:			
Solids	50%	Papain	0.2%
Protein	55%	Potassium sorbate	0.12%
Salt	nil		

Refer to separate downloadable .pdf for mixing instructions and to calculate seasonal Fruit Fly Lure requirements.

Application of Fruit Fly Lure

Apply as a coarse spot spray to the leaves of the host tree at 60 mL/tree or 15 - 30 L/ha for vine and trellis crops. It is not a conventional cover spray. Applications should be made at seven to ten day intervals from two weeks before fruit first become susceptible until harvest. During periods of wet weather, increase frequency to twice weekly. Baiting may be discontinued during cold weather when fruit fly traps indicate that fruit flies are inactive. Observe withholding period of insecticide used. Where possible, overhead irrigations should be timed so as not to conflict with bait applications. It may be necessary to recommence baiting soon after winter where late season varieties such as Valencia oranges are still hanging.

To avoid contamination of Fruit Fly Lure, reseal container after use and store in a cool, dark place. Refrigeration is not strictly necessary but will extend storage life and is recommended. Fruit Fly Lure should be used in the season of purchase.

Control of Queensland fruit fly using protein baits

Keltrol vegetable gum - for thickening Fruit Fly Lure

This material is a gel powder used in the food industry as a thickener and offers the potential to improve the present fruit fly baiting technique significantly. The gel causes the solution to thicken. When sprayed onto foliage the thickened solution adheres better, retains a globular shape and resists desiccation (drying out). It is also hygroscopic and will reabsorb moisture during periods of higher humidity (e.g. early morning). These properties make the thickened Fruit Fly Lure more attractive to fruit flies for longer and should improve rain-fastness.

Naturalure™ Fruit Fly Bait Concentrate

Naturalure™ is a protein and sugar based bait containing the active ingredient spinosad. The mixture is highly attractive to fruit flies, including Queensland and Mediterranean fruit flies. Female fruit flies can detect the bait from several metres away. Naturalure™ Fruit Fly Bait Concentrate is included by the Biological Farmers of Australia on the list of registered allowed inputs suitable for use in Australian Certified Organic farming systems. There is no withholding period required when used as directed.



Fruit Fly Lure thickened with Keltrol Photo: Dan Papacek

ALWAYS REFER TO PESTICIDE LABEL FOR REGISTERED USE REQUIREMENTS IN YOUR CROP.



*Application of fruit fly protein lure using a 4WD motorcycle
Photo: Dan Papacek*