USING

Trichogramma Wasps

FOR THE BIOLOGICAL CONTROL OF

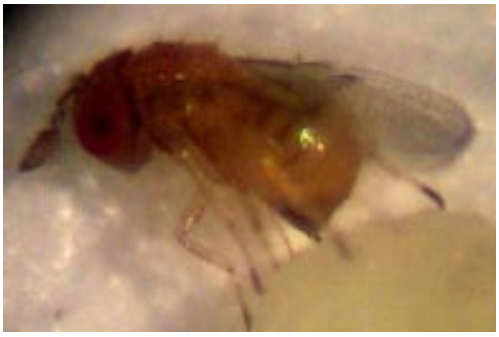
Lightbrown Apple Moth

(*Epiphyas postvittana*)

BUGS FOR BUGS

TRICHOGRAMMA is the generic name for an important group of naturally occurring microscopic wasps found throughout the world. Female Trichogramma wasps lay their own eggs into, or parasitise, the eggs of moths.

If present in sufficient numbers, Trichogramma wasps can effectively control caterpillar pests such as lightbrown apple moth, codling moth and heliothis in horticultural crops. Although Trichogramma are found naturally in virtually any crop where there are moth eggs and where insecticide use has been low, their numbers are typically low and not sufficient to control horticultural pests. However, their numbers can be boosted through the introduction of commercially reared wasps. This increases wasps numbers to levels that are able to make a significant impact on the number of moth eggs producing larvae.



At less than half a millimetre long Trichogramma wasps are just visible to the naked eye.

.
DOT SHOWS ACTUAL WASP SIZE

Trichogramma have been reared and released overseas for many years. Over one million hectares of crops are treated worldwide annually. In Australia, increased use of products which do not disrupt crop ecology (e.g. pheromone mating disruption, *Bacillus thuringiensis*, insect virus products and some insect growth regulators), instead of conventional chemical insecticides, provides a new opportunity to incorporate Trichogramma into integrated pest management programmes.

Further, increased restrictions on the use of chemical insecticides many weeks prior to harvest, especially in wine grapes, makes it wise for growers to adopt biological means of pest control wherever possible.

Development of a capsule delivery and release timing system enables growers to liberate large numbers of Trichogramma wasps into the crop to coincide with peak flights and egg laying of lightbrown apple moth.

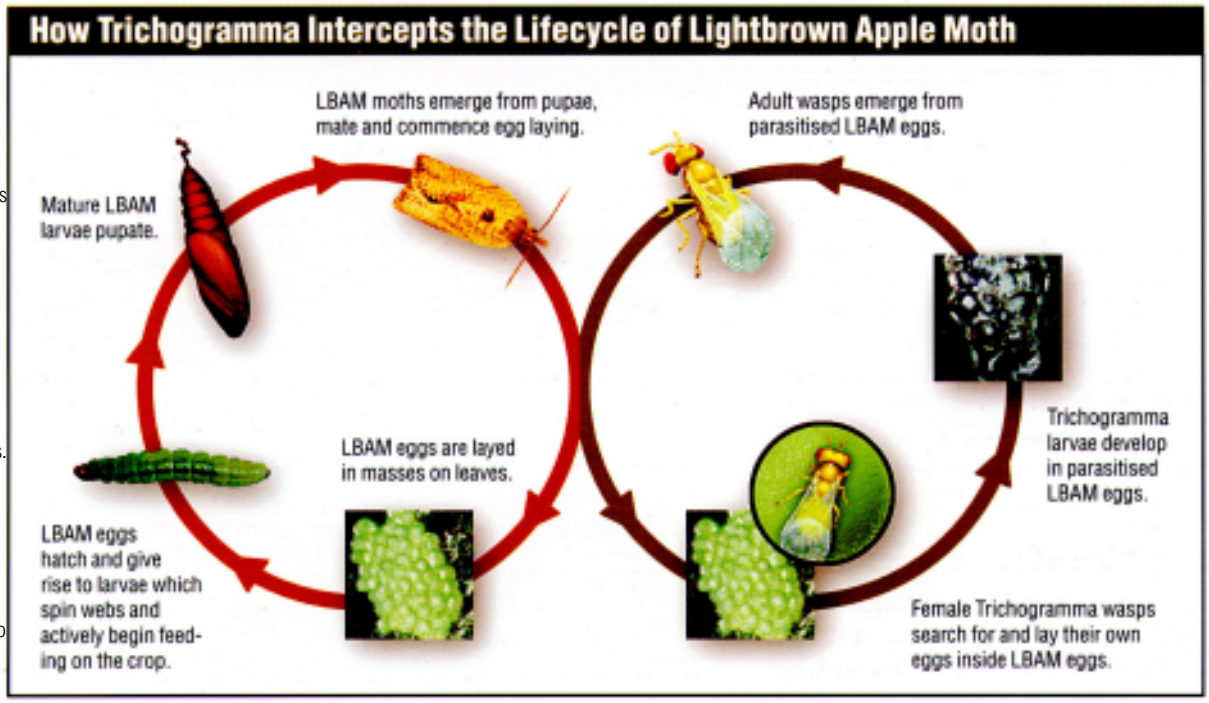
Bug for Bugs provides a telephone technical support service so that growers can get fast, reliable advice on the best use of the product.

Bugs for Bugs Trichogramma wasps provide Australian growers with a new tool for IPM programmes and will reduce dependence on chemical control methods.

Female Trichogramma wasps lay their own eggs into, or parasitise, the eggs of moths. The wasp eggs hatch and the resultant larvae devour the developing caterpillar inside the moth egg.

When mature, the wasp chews a hole in the moth egg and emerge ready to parasitise other moth eggs. This process takes 7 to 20 days depending on temperature.

A female wasp can parasitise over 50 moth eggs in its adult life of 5 to 20 days.



Using Trichogramma for the Control of Lightbrown Apple Moth

Lightbrown apple moth (LBAM): female (left) and male (right).

Lightbrown Apple Moth is a major pest in numerous crops. These include: Pome and stone fruit, grapes, citrus, strawberries, raspberries and blueberries.

In the recent past, chemical insecticides have been the standard control measure but in the last few years Isomate pheromone mating disruption products, the bacterial insecticide *Bacillus thuringiensis* (B.t.) and selected insect growth regulator products have come into use. These products are harmless to beneficial insects and so enable the mass release of parasitic Trichogramma wasps as part of an integrated pest control programme for lightbrown apple moth and other related pests.

Seasonal Behaviour of Lightbrown Apple Moth

Lightbrown apple moth is tolerant of low temperatures and remains active at a low level during winter, responding to increasing temperatures in the spring with a distinct moth flight and an egg laying peak approximately one week later. The first major moth flight appears roughly the same time each year for a given district. This is followed by another generation six to eight weeks later and so on depending on temperature.

The importance of each generation to the grower will vary from crop to crop and area to area.

Lightbrown apple moth larvae can be controlled with conventional insecticides but the broad emergence peaks make accurate timing of sprays difficult.

Well developed larvae within leaf rolls, between fruit in clusters and in grape bunches are protected from contact with chemicals. High levels of control are often possible only with repeated applications of insecticide.

The biological insecticide *Bacillus thuringiensis* requires accurate timing because of its specificity for very small larvae and its short field life.

Breaking the Cycle of Chemical Use

In districts with cool winters, natural populations of Trichogramma are usually slow to increase in spring. Their activity will be further limited if applications of chemical insecticides are made. This locks the grower into a cycle of chemical use because Trichogramma and other beneficial insect species do not get an opportunity to increase to useful levels.

The introduction of mass reared Trichogramma can break this cycle of dependence on chemical insecticides by boosting Trichogramma numbers at critical times during the season when they will have the maximum effect on lightbrown apple moth development.

Trichogramma for Tree and Vine Crops

The species selected for use against lightbrown apple moth is *Trichogramma carverae*. Field trials in grapes, apples and citrus have clearly demonstrated that this species has the ability to find and parasitise lightbrown apple moth egg masses in dense foliage and tree tops.

Pre Release Monitoring

Approximate peaks in moth flights for various districts are listed in the table below. This is a guide only, as peak flights may occur two weeks either side of the norm. If past records for your property are available these will be useful in determining the best time for Trichogramma releases.

LBAM pheromone traps or port wine traps (4.1 ratio of water to port wine) should be in place at least three weeks before the expected moth flight. Moth catches should be noted at least weekly.

Degree day models, where available, are another useful tool for prediction of moth flights.

Timing of Releases

Releases of Trichogramma during the early stages of a moth flight will ensure a plentiful source of host eggs for the wasps and will enable a carry over of wasps for the next month or longer.

For districts that have two or more distinct peaks in LBAM flights, it is recommended that a release be made in the early stages of each of these flights.

Approximate Peaks in the Flights of Lightbrown Apple Moth

District	1st	2nd	3rd	4th
North Coast NSW	Aug	Oct	Dec	Mar-Apr
Cobram/Shepparton	Early Sept	Early Dec	Mid Jan	
Sunraysia	Mid Sept	Mid Nov	Jan	April
Harcourt	Mid Sept	Late Nov	Jan	Mar-Apr
Yarra Valley	Sept-Oct	Late Nov-Early Dec	Feb	Apr
Mornington Peninsular	Late Sept	Late Dec	Feb	Mar-Apr
Coonawarra	Oct	Early Nov	Dec	Jan
Launceston	Nov	Mar-Apr		
Huon Valley	Nov	Mar-Apr		
Batlow	Late Nov	Late Dec	Early Feb	Late Mar

Methods of Release

Trichogramma wasps are delivered in the form of parasitised grain moth eggs enclosed in small cardboard capsules. These are designed to be stapled to foliage and distributed evenly through the crop. The capsules provide the parasitised eggs with some protection from general predators like ants and beetles which are common in orchards and vineyards. The capsules also provide protection form rain and irrigation.

For larger areas, loose parasitised eggs can be distributed in special liquid mixture via specialised dosing equipment.

How Many Capsules to Apply

Field trials* have shown that a release rate of 120,000 parasitised moth eggs per hectare of vine or orchard crops is sufficient to achieve a moderate to high level of parasitism against LBAM throughout the release area.

The recommended release rate for a moderate infestation is 120 capsules per hectare, with each capsule yielding over 1,000 wasps. Two releases a week apart is recommended.

A clear vial containing parasitised eggs from an earlier batch is included with every package of Trichogramma. These wasps will emerge one day before the eggs in the capsules. The capsules should be placed in the crop when the first wasps emerge in the clear vial.

After emergence from the capsules, the wasps will gradually disperse down wind from the release points over their lifetime. Make sure that the windward side of the crop is well treated by placing any extra capsules on the boundary. The wasps will live for around two weeks in cool conditions and a week in hot conditions. The natural dispersal of the released wasps into surrounding areas may provide a buffer around the crop while good wasp activity in autumn is likely to reduce overwintering LBAM.

Crops Treated With Isomate Pheromone Mating Disruption

Crops treated with Isomate for LBAM (apples or grapes) will benefit from Trichogramma releases around the borders. The perimeters of such crops are susceptible to the inward movement of mated female moths. The standard rate of 120 capsules (or 120.000 wasps) per hectare should be applied to a band 20 metres wide around the crop.

Sources of LBAM adjacent to the Isomate treated areas should also be treated to reduce the risk of immigration of mated female moths.

Trichogramma carverae also freely parasitise the eggs of oriental fruit moth and codling moth.

Post Release Monitoring

Trichogramma activity can be measured by collecting LBAM egg masses, keeping them in a warm place, and watching to see how many masses contain eggs that go black, i.e. that are parasitised. If the majority of egg masses are parasitised, and the pressure is not extreme, then further action is not usually required. The surviving larvae will be at the mercy of other beneficial species including larval parasites, lacewings and spiders.

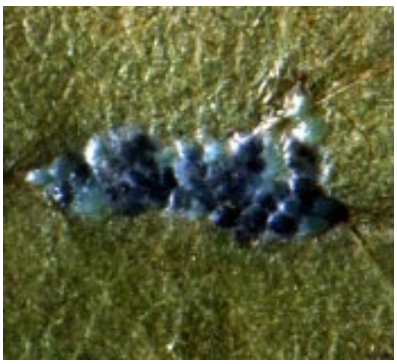
Integrated Pest Management

The appropriate IPM programme for LBAM in a given crop is determined by a combination of factors: LBAM pressure, tolerance for damage, market requirements, and the philosophical approach of the fruitgrower.

Depending on these factors, integrated programmes incorporating Trichogramma may range from one or two releases at the base rate, through higher and more frequent release rates to combinations of Trichogramma and other compatible products such as Isomate and *Bacillus thuringiensis*.

Regardless of the programme used, it is important to monitor flights of moths and subsequent larval infestation in the crop and if necessary intervene with a compatible larvicide such as *Bacillus thuringiensis* while the larvae are small.

Contact a Bugs for Bugs advisor to discuss a suitable release strategy for your crop and location.



Unparasitised egg mass of lightbrown apple moth (left). 'black' parasitised eggs (right).

*Trials conducted in grapes by DeAnn Glenn, LaTrobe University and grapes and tree crops by Richard Llewellyn, BioProtection P/ L.
Photo of LBAM moths courtesy South Australian Research and Development Institute, Northfield, S.A.

Trichogramma wasps are produced by:
Bugs for Bugs
(Integrated Pest Management Pty Ltd)
Mundubbera Qld 4626

Enquiries and orders should be directed to:
Richard Llewellyn, BioResources Pty Ltd,
PO Box 578 Samford Qld 4520
phone 07 3289 4919 fax 07 3289 4918