



Gumleaf Skeletoniser

(Uraba lugens)

A Guide to
Managing the Pest
in New Zealand



Introduction:

The gumleaf skeletoniser (*Uraba lugens*) is a member of the family Nolidae. It is an Australian insect pest, which defoliates a large number of *Eucalyptus* species. It was found in the Auckland region during August 2001. Driven by concerns around the potential ecological impacts of this pest, the Ministry of Agriculture and Forestry (MAF) mounted an eradication response. But by June 2003 it was decided that eradication was not technically or economically feasible.

MAF then embarked on a facilitation programme to develop tools and information to assist forest managers, landowners and regional authorities faced with on-going pest management. Research programmes, supported by Biosecurity New Zealand, have developed control measures to slow gumleaf skeletoniser spread, and investigated biology, defoliation impacts, pheromone, biological control and spray effectiveness.

This booklet summarises the practical findings of the research programmes. Information is current as at January 2008, but may change as further research is carried out. Updated information will be available on www.biosecurity.govt.nz.

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New Zealand

SCION 

HortResearch 





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Scion quarantine facility in Rotorua where much of the gumleaf skeletoniser research was carried out.

Meet the gumleaf skeletoniser



What is gumleaf skeletoniser?

Gumleaf skeletoniser (*Uraba lugens*) is an Australian insect that causes damage mainly to gum (*Eucalyptus*) trees by eating the foliage. It is native to all states in Australia, except the Northern Territory.

The young caterpillars 'skeletonise' gum leaves by eating the green parts of the leaves, avoiding the veins. Older larvae are capable of eating whole leaves, thus increasing damage. Repeated defoliation can slow tree growth or, in severe cases, kill individual trees.

Caterpillars can easily be identified by a number of distinguishing features:

- A body covered with many long hairs.
- Pale yellow colour with black and grey markings.
- Often have what looks like a black 'hat' on the head.



Gumleaf skeletoniser caterpillars have hairs that can cause itching or a rash on skin contact. People handling affected plants should wear protective clothing.



How did it get here? ---

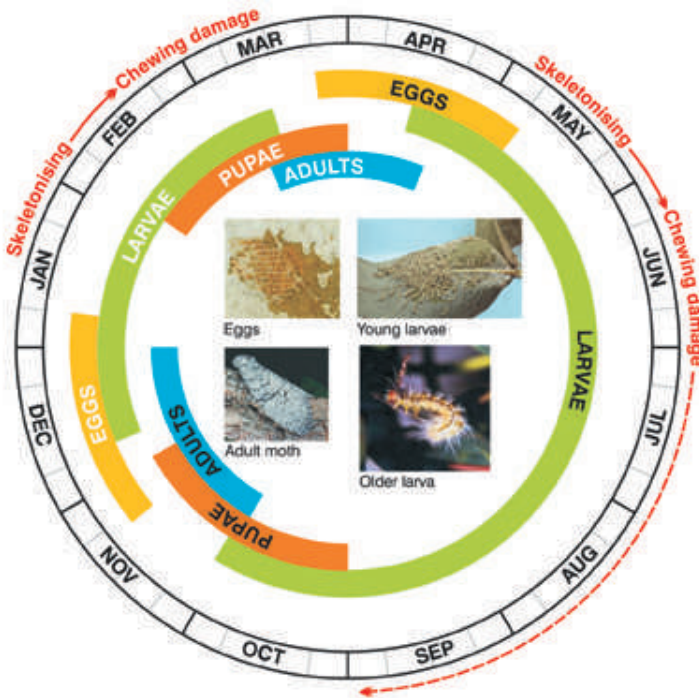
It is not certain how gumleaf skeletoniser arrived in New Zealand. Leaf debris inadvertently locked into shipping containers provides a common pathway for many exotic pests. Although many of these pests are intercepted at the border, gumleaf skeletoniser may have entered New Zealand as eggs, larvae or pupae.

Gumleaf skeletoniser was first detected in Tauranga in 1992, where it was recognised as a serious risk and successfully eradicated. The pest was discovered in Auckland in 2001, but the population was too well established for an eradication campaign to be effective. Gumleaf skeletoniser is now spreading to other regions and efforts are being made to minimise its impact as part of a long term management programme.

Eucalypt trees, which are common in parks and gardens, are the preferred food of gumleaf skeletoniser.



Life cycle and behaviour



Life cycle of the gumleaf skeletoniser showing two generations in one year - the green sections of this diagram indicate the periods when gumleaf skeletoniser can become a problem to forest growers.

Gumleaf skeletoniser undergoes 11-14 larval instars, depending on climate. Larval instars are the growth stages of the caterpillar that occur between moults of the skin.

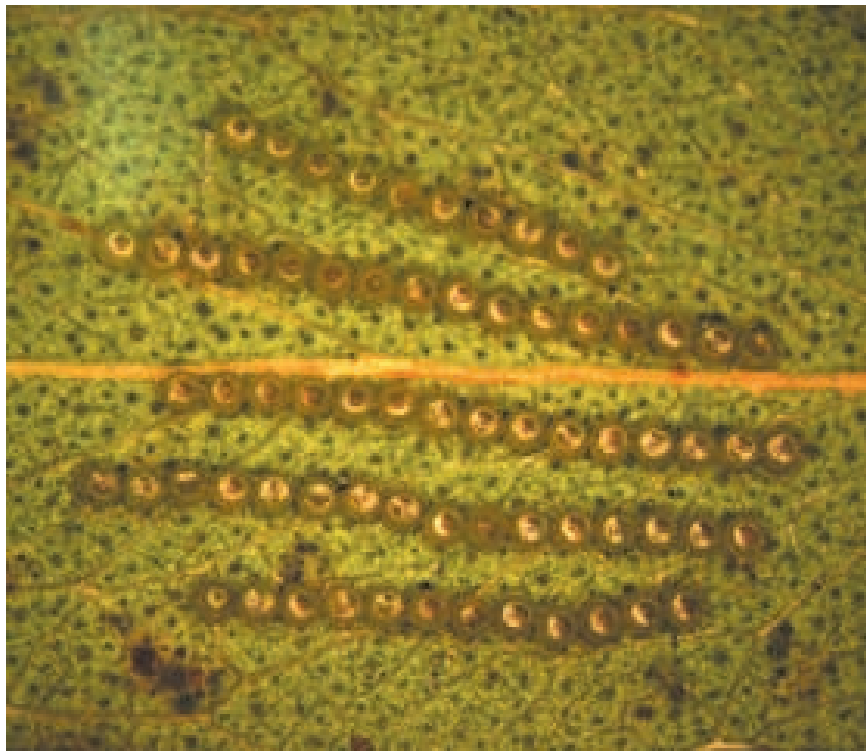
In Auckland, gumleaf skeletoniser has two generations each year, with larvae (caterpillars) present from about January to March (summer generation) and May to October (winter generation). This two-generation life cycle is shown in the diagram at left.

Cooler regions of New Zealand would support only one generation per year. In cold areas it is likely that only one batch of eggs would be laid during the late-summer period, and caterpillars will feed slowly through the winter months.



Recognising gumleaf skeletoniser

Eggs are about 1 mm in diameter and are laid in groups of 100 to 200 in neat, parallel rows on young leaves. The eggs are yellow-green at first and turn brown as they develop. In warm regions where there are two distinct generations per year, these eggs are laid from March to May, and again in November to January.





Caterpillars are hairy and coloured pale yellow with black and grey markings. The hairs are stiff, hollow, and can cause itching or a rash on the skin if touched.

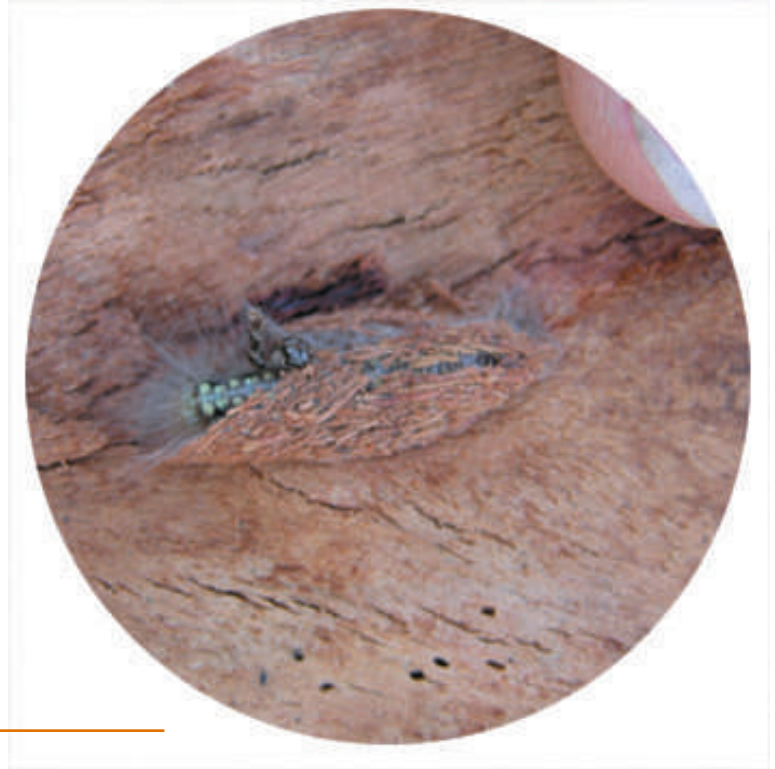
Caterpillars often have a distinctive 'hat' on their heads formed by shed head capsules. Hats are taller on older caterpillars. In their natural environment, caterpillars rear up when under attack and use the hat to help ward off parasitic wasps, which are their natural enemies.

Newly hatched caterpillars are very small, less than 1 mm in length, and they grow quickly. Mature caterpillars generally reach a length of 20-25 mm.



Cocoons are usually hidden under bark or in leaf litter. Their excellent camouflage means the cocoons are very rarely seen. Pupation lasts for about two weeks.

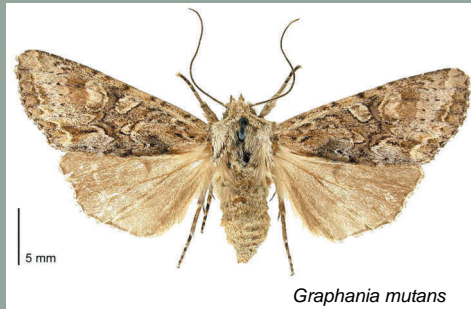
Moths are silvery-grey with no distinguishing features to the untrained eye. The adults survive for at least a week, with their main activity occurring at night. The moths do not feed. Focused solely on the business of propagation during their short adult life, the females are capable of producing up to 600 eggs, which are laid in separate batches of 100 - 200 eggs.



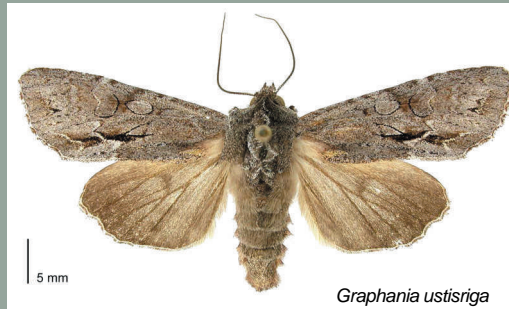
How to identify the moth

Gumleaf skeletoniser moths (Figure A) are in the Nolidae moth family. They are grey, about 12mm long with short, broad and subtriangular forewings with two dark irregular transverse lines. Their antennae have two rows of 'hairs' either side. Gumleaf skeletoniser moths can be confused with similar brown Noctuid moths found in New Zealand such as *Graphania mutans* (Figure B), *Lepidoscia protorna* (Psychidae) (Figure C), and similar geometrid and crambid moths (Figure D).

Figure A: Gumleaf skeletoniser moths on sticky trap bases with grey broad subtriangular forewings, dark irregular transverse lines.



Graphania mutans



Graphania ustisriga

Figure B: Similar Noctuid moths (*Graphania* spp.).

Photos from New Zealand Arthropod Collection (Robert Hoare, Landcare Research).



Figure C: Similar psychid moths (*Lepidoscia protorna*) on sticky trap base

(left - HortResearch) and from New Zealand Arthropod Collection (right - Robert Hoare, Landcare Research).

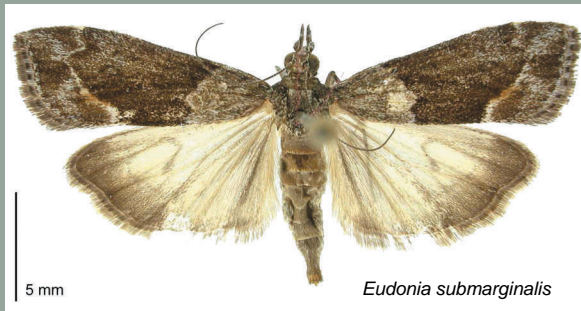
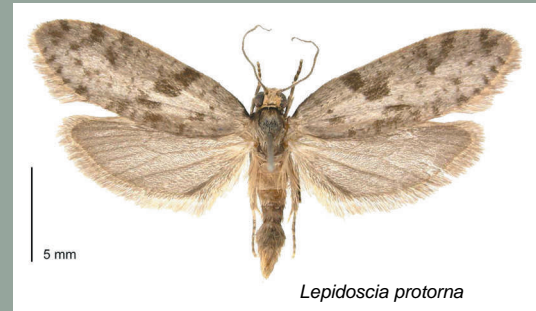


Figure D: Similar moths in the Geometridae (left) and Crambidae (right) families.

Photos New Zealand Arthropod Collection (Robert Hoare, Landcare Research).

Larval feeding patterns



Gumleaf skeletoniser caterpillars have two different feeding modes. When the first instar larvae hatch they tend to feed as a group under a light protection of silken threads. Early instars (1st to 5th) skeletonise foliage by chewing the greener portions of the leaves, leaving the veins untouched.

The larvae from each egg batch feed in close proximity to where the eggs are laid. This leads to distinctive damage patches in the canopy, with several leaves showing the characteristic skeletonised pattern.

The cooler temperatures experienced by the winter generation of gumleaf skeletoniser slow larval growth, development and food consumption compared with the faster developing summer generation.

Due to these changes in feeding behaviour, seasonal differences are likely in larval responses to insecticide exposure. See page 18 for more information on chemical control.



Older caterpillars are solitary feeders that chew entire leaves.



Natural enemies

In their native habitat of Australia, gumleaf skeletoniser larvae are preyed on by a number of parasitoid insects. This parasitism tends to keep populations at low numbers, except in outbreak conditions. All immature stages of gum leaf skeletoniser are prone to being parasitised, with larval parasitoids killing caterpillars from the third instar onwards.



Although none of these specialised parasitoids are present in the New Zealand environment, a number of local species have developed a taste for gumleaf skeletoniser. The impact of these opportunistic parasitoids is currently unknown.

The white cocoons next to these dead caterpillars belong to the parasitoid *Dolichogenidea eucalypti*, a species that attacks gumleaf skeletoniser in Australia. The tiny adult wasp, which is less than 3 mm in length, is shown on the left.

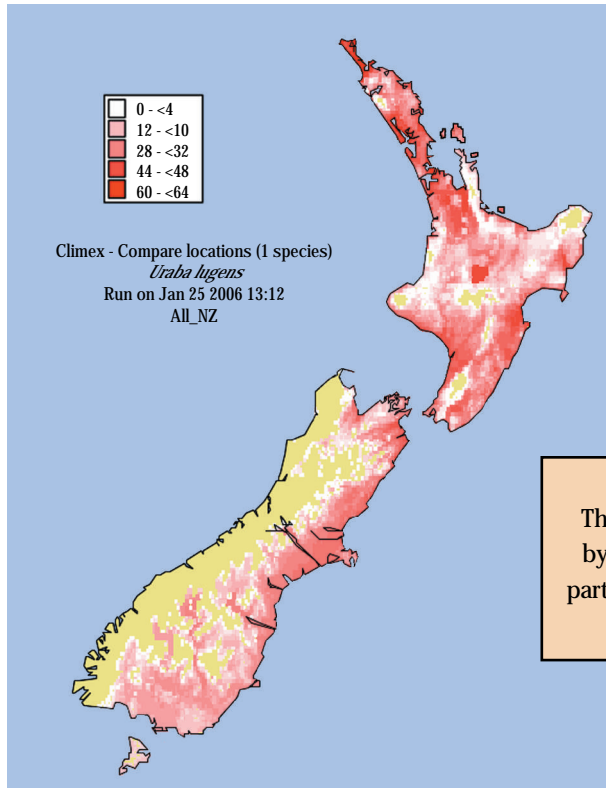
Gumleaf skeletoniser - Impact in New Zealand



How far is it likely to spread?

Gumleaf skeletoniser has the potential to disperse throughout all areas of New Zealand where eucalypts will grow. It has the ability to survive throughout the North Island, up to the tree line, and in most of the South Island.

The insect is unlikely to thrive in dry areas of Otago, and the Southern Alps, which are too cold. Areas of New Zealand that experience high levels of rainfall are unlikely to support gumleaf skeletoniser in significant numbers.



Reducing the spread

The spread of gumleaf skeletoniser can be minimised by avoiding transportation of all bark or leaf material, particularly during October/November or February/March when the pupae are living in the bark.

For more information on current geographical spread, see www.biosecurity.govt.nz



Which tree species does it eat?



Gumleaf skeletoniser caterpillars have an appetite for many of the eucalypt species growing in New Zealand. Among the eucalypts to be attacked most severely are *E.nitens*, *E.globulus*, *E.nicholii*, *E.obliqua* and *E.cinerea*.

Despite its reputation as a eucalypt specialist, gumleaf skeletoniser has also been found to live successfully on other related Australian trees, such as *Lophostemon*. In New Zealand, the insect has also been detected on silver birch (*Betula pendula*), and can damage some oak species, copper beech and plum.

Gumleaf skeletoniser is not generally attracted to New Zealand native plants, but can feed on them when they are growing in very close proximity to eucalypts. In the rare case that caterpillars may occur on native species, damage is not usually significant. The majority of larvae hatching on the leaves of native plants will die within 2 weeks of feeding on the plant, or will attempt to move off in search of a more suitable host.

A full list of known hosts is listed on the Biosecurity New Zealand website - www.biosecurity.govt.nz

Gumleaf skeletoniser feeding on silver birch



How much damage can it do?

In its native habitat of Australia, gumleaf skeletoniser is considered to be an “outbreak” species. This means that the insect generally occurs in low numbers, but under certain conditions the population can explode causing damage of plague-like proportions to crops and plantations. Such periodic outbreaks in Australia can lead to extensive defoliation of eucalypt forests, sometimes over areas as large as 150,000 ha.

Pestilence of this kind is uncommon in New Zealand, possibly due to our more temperate climate. Although it is unknown whether gumleaf skeletoniser populations will follow the same pattern in this country, it is feasible that insect populations within eucalypt plantations could increase to damaging levels following two good seasons for larval survival. Such conditions may include a moderate winter, combined with a calm, dry summer. In an outbreak situation, caterpillar numbers could increase rapidly, since the New Zealand environment is relatively free from natural enemies.

Field surveys in Australia suggest that the pattern of damage caused by gumleaf skeletoniser will largely occur around the edge of plantations (about a 50 m zone). Young eucalypt plantations up to the age of seven years appear most suitable for the insect. Although most eucalypt species are naturally hardy, repeated defoliation of very young trees can have a significant impact on wood production at the end of the rotation.



In older stands where there is canopy closure, the incidence of gumleaf skeletoniser is markedly reduced. Because of the usual open habit of amenity (street) planting in towns and cities, trees older than seven years may be defoliated in these situations.

Typical skin reaction following touching gumleaf skeletoniser caterpillar hairs. A rash can form almost immediately and often become itchy. Symptoms can be relieved by applying ice packs. If you become concerned about a skin reaction from the caterpillars you should visit your doctor. Caterpillar hairs can still cause a rash even after being shed. People handling affected plants should wear protective clothing.
(Photo: Michelle Watson - Scion)



Protecting your trees



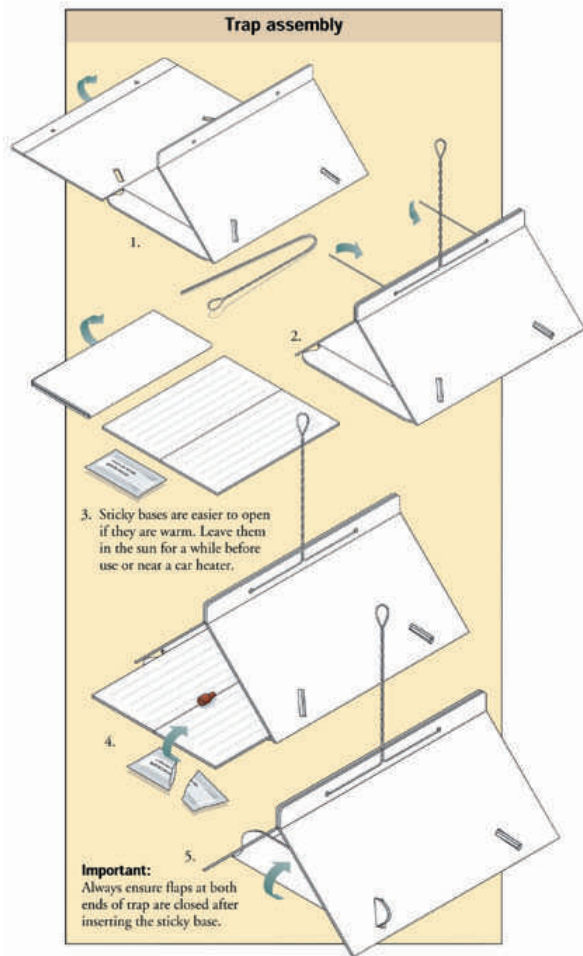
Forest growers and regional authorities are advised to monitor for the presence of gumleaf skeletoniser in eucalypt plantations and amenity plantings. This can be achieved through visual inspection, or by pheromone trapping.

Signs of chewing damage will become visible when the larvae are feeding, between the months of January-March and May-September. For more information on larval feeding patterns, see page 10.

Pheromone traps enable the detection of gumleaf skeletoniser moths and offer some idea of the population level to assist with decisions on control options. A synthetic pheromone has been developed by HortResearch to imitate the scent produced by gumleaf skeletoniser females. This pheromone can be used in a specially designed open-ended trap to attract male moths. The monitoring device, known as a GLS Desire pheromone trap, is available from HortResearch (Phone 09 815 8892).



Pheromone traps can be used to monitor for the presence of gumleaf skeletoniser. If trees are suffering visible damage, or if there are more than about five egg batches on recently planted seedling or saplings, then chemical control methods should be considered. The best time to spray is part way through the larval stage, with possible follow-up sprays required as the caterpillars mature.



How to use the pheromone trap

The pheromone scent is impregnated in to a rubber lure (pherocap) which is placed on a sticky base insert. Adult male moths are attracted to the scent from the pherocap and are caught on the sticky base of the trap. The pherocap should remain attractive to gumleaf skeletoniser moths for up to two months.

Trap assembly

Follow the instructions in the diagram at left. *Caution: The glue on the base is very sticky, so use gloves. Use forceps to handle the pherocap - do not use your fingers.*

Where to place the trap

An assembled trap should be placed about 2-3 m above the ground in a eucalypt or Lophostemon tree. Attach the trap to the tree trunk using a screwdriver, screw and washer. If there are low branches on the tree, the trap can be tied on.

Adult moths generally fly over two periods during the year. The first flight is in spring from the beginning of November to mid January. The second flight is in autumn from the beginning of March until the end of April.



Trap maintenance

Replace the pherocap and sticky base every two months.

What to do when you trap a moth

The first thing to do is confirm that you have caught a gumleaf skeletoniser moth. Details of similar species already in New Zealand can be found on pages 8 and 9, however it is unusual to trap moths other than gumleaf skeletoniser with the customised pheromone. Formal diagnosis is recommended.

Carefully remove the sticky base, avoiding getting the sticky material on hands or clothes. Wrap the base in plastic kitchen wrap, and send it to Scion Forest Biosecurity and Protection with the following information:

- Name, address, phone number, email address, trap location, and if possible GPS coordinates, date trap deployed and date trap retrieved.

For a map of current distribution, see www.biosecurity.govt.nz

Scion Forest Biosecurity
and Protection
Diagnostic Laboratory
Private Bag 3020,
49 Sala Street, Rotorua
Tel. 07 343 5899





Chemical control options

A number of broad-spectrum and selective insecticides are available for the control of lepidopteran pests in New Zealand, however no insecticides are currently registered for use on gumleaf skeletoniser. Current recommendations are based on extensive research carried out by forest biosecurity scientists at Scion.

Research has shown that spraying with *Bacillus thuringiensis kurstaki* (Btk), spinosad, organophosphates, or synthetic pyrethroids will provide effective control. Before making decisions about when to spray, it is important to note the feeding behaviour of the insect, described on page 10. Due to the different feeding patterns of larvae within the same generation, seasonal variation is likely in the efficacy of insecticides, particularly for products that act solely by ingestion. Avoid spraying during mid-winter, or if heavy rainfall is expected during the 2 - 3 days immediately following application.

Broadcast spraying of organophosphates or synthetic pyrethroids are likely to be the most effective form of chemical control in plantations. Organophosphates are not appropriate in sensitive areas, which is why pyrethroids are the preferred option for most forest growers. Systemic organophosphates are rapidly translocated through the plant and provide control for all larval stages.

Individual trees can be treated using stem injection methods. Water soluble systemic insecticides can be injected directly into the xylem where it is translocated rapidly to the leaves through the vascular system of the tree. Herbivorous insects feeding on the leaves are killed by ingestion, not through contact.

Manufacturers' safety instructions should always be followed when handling chemicals.



Pesticide spraying

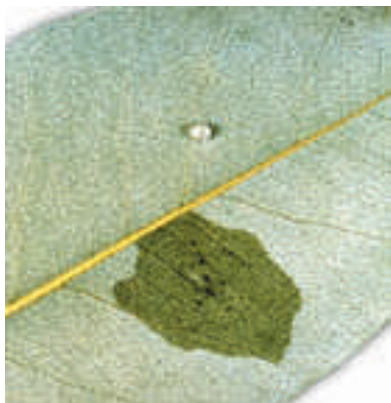


When used at the recommended rates, Btk will kill lepidopteran insects, including gumleaf skeletoniser, after they eat (ingest) the insecticide.

Btk should be applied when the caterpillar population is at its peak from mid-January to February, May to mid-June and September to October. Avoid mid-June to end of August because it is too cold. Mature caterpillars are the most likely stage to ingest the Btk, because they not only consume larger amounts of foliage but also eat the entire leaf, consuming veins as well as leaf lamina. In contrast, skeletonising larvae feed on just one surface of each leaf for considerable periods. Consequently, if insecticide coverage on the leaf is poor, then skeletonising larvae feeding on the underside may avoid exposure. For this reason, good coverage of the target area is required when spraying young caterpillars.

Broader spectrum control can be achieved using a synthetic pyrethroid, such as Deltamethrin, which will kill most insects on contact. While the timing and deposition of the spray operations are very important for Btk, researchers found that the synthetic pyrethroids and the spinosad formulations were highly effective against all stages of gumleaf skeletoniser larvae tested.

Research into the pesticide sprays described above showed that the efficacy of treatments was significantly affected by the eucalypt species on which larvae were feeding. Treatments applied to *Eucalyptus nitens* had reduced efficacy compared to *E. cinerea* or *E. fastigata*. These results are probably due to variations in leaf angle and leaf surface, which affect spray deposition, and chemical differences within the foliage that affect the resilience of the caterpillars. Higher than minimal application rates and increasing the wettability of the leaf through the use of adjuvants added to the spray mixture, may help to compensate for these inhibiting factors.



Cooler temperatures also reduce the effectiveness of chemical control insecticide efficacy, presumably by decreasing movement and food consumption by the caterpillars. For this reason, good coverage of the target area will be most important during the early winter larval stage of gumleaf skeletoniser, particularly when applying Btk products.

For advice on how to control gumleaf skeletoniser using chemical sprays contact:
Scion Forest Biosecurity and Protection – (07) 343 5899

Wet portion of leaf shows how addition of adjuvants into the spray mixture can increase the coverage of spray droplets. The single droplet shown above it contains no adjuvant. Greater leaf coverage will improve the efficacy of spray operations targeting juvenile caterpillars.



Stem injection

Stem injection of individual trees has proven to be a highly effective method of achieving prolonged protection against all herbivorous insects. This technique uses a water soluble systemic organophosphate that can remain active within the tree for up to three months, depending on injected rates. Although the products currently available in New Zealand are formulated for spray applications, they can be injected into the stem using standard chemical injection systems.

Researchers have identified which organophosphate products offer the best option for controlling gumleaf skeletoniser on trees in the Auckland region. Techniques for stem injection are still under development, so manufacturer's recommendations are currently unavailable.

For the latest advice on rates and methods for controlling gumleaf skeletoniser using stem injection methods contact:
Scion Forest Biosecurity and Protection – (07) 343 5899

Gumleaf skeletoniser factfile: _____

- Originally from Australia, this pest is now established in New Zealand.
- It can defoliate a range of eucalypts and closely related species.
- It has the potential to live in all areas of New Zealand where eucalypts will grow.
- The caterpillars have hairs that can cause itching or a rash if touched.
- A range of chemical control options are available.
- For more information see www.biosecurity.govt.nz

Different eucalypt species vary markedly in their susceptibility to insect attack. If you are considering planting eucalypts, seek advice from Scion or local growers regarding lower risk species suitable to your area.

