NSW DPI primefacts
PROFITABLE & SUSTAINABLE PRIMARY INDUSTRIES www.dpi.nsw.gov.au
DECEMBER 2005 PRIMEFACT 17

Management of psyllids in NSW Christmas bush plantations

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Key facts

Christmas bush psyllids:

- cause economic damage by rolling the young leaves of infested plants;
- are difficult to control effectively because they are protected by rolled leaves and have several generations per year;
- encourage the growth of sooty mould on leaves;
- provide hiding places for other insects and spiders—these may be pests of Christmas bush or may cause problems in meeting quarantine standards;
- are largely a problem of well watered and fertilised cultivated plants, rather than of plants in the wild, as they preferentially attack young, actively growing shoots.

The problem

Psyllids are a serious insect pest affecting the NSW Christmas bush. The pest causes damage to the new growth by rolling the leaves (Photo 1), thus causing the cut stems of Christmas bush 'flowers' to be considerably less marketable. The damage can also stunt growth and decrease production. The Christmas bush psyllid is a relatively new pest of economic importance and there is limited information on its management. The information in this Primefact is the best available at the time of writing.

Photo 1. Rolling and curling of Christmas bush leaflets due to Christmas bush psyllid.

The host

Christmas bush, also known as Festival bush (*Ceratopetalum gummiferum*), is an Australian native flowering shrub to small tree with small white flowers which grow in clusters during late spring. After flowering, the sepals are retained and begin to grow and change colour from white to pink and then red in the most commonly grown varieties. This display of colour usually coincides with Christmas in the Sydney area, giving the plant its common name and commercial desirability. Christmas bush has become a major export crop, with large volumes selling in overseas markets such as Japan and North America.

What are psyllids?

Psyllids are a type of insect that infest many Australian native plants. The adults are small sap-sucking insects, with two pairs of wings held roof-like over the body. They are related to aphids, whiteflies and mealy bugs and are weak flyers. Adult psyllids of various species range from 2 to 10 mm in length. They are free-living and are able to move freely over the surface of foliage. They often jump when disturbed and return to the foliage by flight. In this way they are able to disperse over short distances but they can also disperse widely by wind-assisted flight.

Psyllid nymphs (juveniles) are generally free-living, but in some species secrete a solid covering (lerp), and a few are gall-forming. Psyllids damage their hosts by penetrating the phloem tissues and sucking up plant juices. They extract amino acids and other nutrients from the sap and excrete much of the balance as a sugary waste called honeydew. The honeydew provides nutrients for the growth of sooty mould, and is also often consumed by ants and other insects. Psyllids such as the Christmas bush psyllid may also inject compounds in their saliva (probably auxins) that cause the new leaves to roll. Severe infestations reduce plant growth and can cause new growth to distort, discolour and die back.

Psyllids are considered host-specific—they are usually associated with one host species or a group of closely related host species. For example, species of psyllid that occur commonly on other non-related hosts, such as lilly pillies or eucalypts, will not attack Christmas bush, and vice versa.

The Christmas bush psyllid

Psyllids were reported as a pest of the Christmas bush by Kerruish (1997), who noted that they may damage new leaves of nursery and mature plants. This psyllid, apparently specific to Christmas bush and its near relations, has been assigned to the genus *Cerotrioza* (G. Taylor et al., in press 2005). *Cerotrioza* belongs to the family Triozidae, within the superfamily Psylloidea. Other psyllids belonging to this family include *Trioza*, found on *Syzygium* (lilly pilly), and *Schedotrioza*, which forms galls on eucalypts. It is typical for closely related (but different) species in these genera to occur on closely related hosts (as is the case for lilly pillies).

The body of the adult psyllid is about 2 mm long, and with the wings included it is about 3 mm long (Photo 2). When adult psyllids (with wings) are resting they position themselves on stems with the head down and the body at an angle of about 45°, and ‘waggle’ or oscillate their abdomen once or twice a second, the rate increasing as the temperature increases. They fly away fast when disturbed. They also have a distinctive wing pattern (Photo 3).

The feeding activity of the Christmas bush psyllid causes the leaves to curl, protecting the nymphs from predators and many pesticides (Photo 1). Both outer margins of the leaflet curl over to meet at the mid-vein on the upper side of the leaflet.

Photo 2. Adult Christmas bush psyllid. Psyllid is approximately 3 mm long.

Photo 3. Adult psyllid on a sticky trap. The wings that are normally held above the body have become glued to the trap. Note the distinctive markings on the wings. The psyllid is about 3 mm long.

The whole curled leaf may also become crescent-shaped. This effect is typical of Christmas bush psyllid, and may be used as a diagnostic tool because no other pest or disease is known to produce similar symptoms. Black fungus growing on the honeydew of the psyllids is also often present on the leaves of infested plants, although other sap-sucking insects can also cause this symptom.

The nymphs are about 1–2 mm long and are always found under the curled leaves. Generally, hard, semi-spherical, shiny white globules of solidified honeydew are found under the curled leaves with the psyllid (Photos 4 and 5). Nymphs are readily identified by their shape and their red eyes, which become relatively larger with each instar. Other insects, especially aphids, may be found cohabiting with the psyllid.

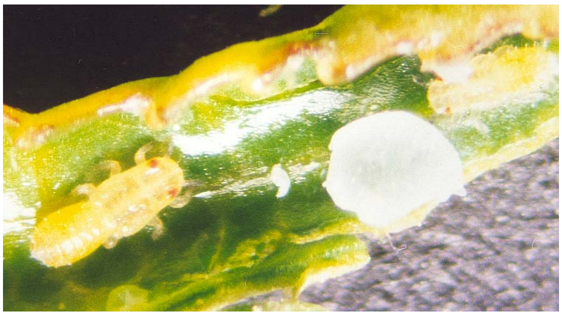

Photo 4. Psyllid nymph and globular honeydew (with top of leaf removed).

Photo 5. Psyllid nymph

Heavy infestation causes the Christmas bush to be unmarketable. This damage also reduces the growth rate of affected plants. Even a low level of infestation can cause serious economic loss, both through downgrading of material and through greatly increased grading costs. Infestations appear to be spreading beyond their natural habitats in NSW and Queensland, by natural dispersal and as a result of infested plants being planted in new areas.

Other insects, notably aphids, can also shelter in the rolled leaves and produce honeydew. Aphids sheltering with the psyllids can be attended and spread by ants, but ants do not appear to spread Christmas bush psyllids. Both the psyllids and other arthropods (including spiders) that shelter with them can cause serious disinfestation problems in meeting quarantine standards. Most of the standard disinfestation methods are not 100% effective so it is important for levels of both psyllids and damaged foliage to be as low as possible before harvest.

The Christmas bush psyllid can also infest Coachwood (*Ceratopetalum apetalum*), which is closely related to Christmas bush. Both Christmas bush and Coachwood often occur in native forests adjoining areas where Christmas bush is cultivated. However, both usually do not occur together. Coachwood usually grows in subtropical rainforest, with the Christmas bush usually growing on the margins. It is not known if the Christmas bush psyllid can infest the other three species of *Ceratopetalum*. However, these only occur largely in rainforest in northern Queensland, especially on the Atherton Tablelands, and their natural range does not overlap with either Christmas bush or Coachwood.

The psyllid lifecycle

The typical lifecycle of psyllids commences with an egg which is inserted by a short stalk (pedicel) into the host tissue. The egg obtains moisture from the host tissue via the pedicel, and if the plant host dies, the egg fails to develop. The larva that emerges from the egg passes through five larval instars, with a moult between each. Generally each instar can be identified by differences in size, relative size of the red eyes, and increasing development of wing buds. Their rate of development and consequent generation time is temperature dependent and there are a number of generations each year. In tropical and subtropical climates, generations often broadly overlap, so that all life stages can be found at any one time. This appears to be the case for the Christmas bush psyllid and there may be five or more generations per year. In temperate climates, there are usually three generations per year, with a distinct winter generation and two summer generations.

In psyllids, the final moult results in the emergence of a winged adult, which is able to disperse to new host plants (psyllid nymphs do not have wings and can only move very short distances by crawling). Adult psyllids live for between a week and several months, depending on the species and conditions. Fecundity is highly variable between species, and in some species each female can produce over 500 eggs.

Adult Christmas bush psyllids are present all year round in the Central Coast and Mid North Coast regions of NSW. Traps indicate that populations are greatest from autumn to early spring, with few adults present in summer.

Factors favouring psyllids

Psyllids are rare in the wild, even on Christmas bush and Coachwood close to infested plantations. The spread and growth of similar psyllids is favoured by young vigorous growth high in nitrogen, and high humidity. Cultivated Christmas bush that is irrigated and fertilised to achieve maximum growth rates appears to provide ideal conditions for the psyllid.

The level of infestation of psyllids is partly controlled by the weather, with growers reporting ‘good’ and ‘bad’ years for psyllids. Psyllids prefer cool, moist weather—Christmas bush psyllid is no exception, with maximum numbers of adults occurring from autumn to spring, peaking in cool, moist weather.

Managing psyllids

Pesticides

Christmas bush psyllids are difficult to control effectively, especially with pesticides that have a contact action only (see Non-systemic pesticides), because they are often protected from direct contact by the curled leaves of the host plant. Under the tropical and subtropical conditions of the main production areas on the North Coast of NSW and in southern Queensland, there will be many generations of the pest each year. As a result, pesticide sprays for psyllids may not greatly reduce foliage damage unless they are applied at the right time and frequency and the correct chemicals are used. For example, if only one application of a contact pesticide is made, subsequent new growth will not be protected, and this new flush will be susceptible to damage by any psyllids that survive the initial spray, or migrate from untreated plants to plants that have already been treated.

No treatment can restore damaged foliage—the foliage remains distorted until it is pruned off or replaced by new growth. Infestation lower down the stem will also often result in new growth becoming distorted, even if it has no psyllids living on it. Leaf rolling may also continue to occur for some time after the psyllids have been removed due to residual levels of auxins in the leaf. It is also very important to keep the level of psyllids in the field at a very low level to reduce the chance of any survivors of disinfestation treatments after harvest.

Broad spectrum systemic insecticides may seem an attractive management option as they are especially effective where pests are protected from direct contact by the host tissues. However, these chemicals also kill a wide range of other insects and can harm natural enemies. Pesticides with a narrower range of efficacy, or which are 'softer' on the environment due to their low residual toxicity, are more desirable for managing psyllids. These pesticides may have to be applied several times during the growing season to protect the Christmas bush against the next generation of psyllids. It is of concern that many growers may be relying exclusively on one chemical—sustained use of one chemical can lead to the development of resistance in the psyllid. Other growers may be using less-effective products, which allow survival of some of the psyllid population.

Systemic pesticides

Systemic pesticides are pesticides that are absorbed into the plant and then distributed through the plant, so they are active throughout the plant and not just at the application site.

Advantages of systemic pesticides:

- The chemical can reach pest organisms already in the plant.
- The whole plant surface does not need to be treated—the spray can be applied anywhere on the plant, or as a drench to the soil to be absorbed through the roots.
- New developing foliage can be protected from the pest.
- Once applied, the pesticide is not washed away by rain or irrigation.
- These chemicals are especially useful against sucking insects.

Disadvantages of systemic pesticides:

- They are not necessarily distributed evenly within the plant.
- They may persist in the plant for a long time, affecting withholding periods. The residues cannot be removed by washing the plant.

Non-systemic pesticides

Non-systemic pesticides are not absorbed into the plant and are only effective at the site of application. An example of this is a contact pesticide, which kills the insect by being absorbed through the insect's body.

Recommended pesticides

Some insecticide efficacy trials have been carried out to determine the most appropriate chemicals for growers to use in managing Christmas bush psyllids. However, further trials are needed to determine if newer chemicals now available would provide a commercially acceptable level of control.

Table 1 lists chemicals which are registered for control of psyllids (lerp insects) or plant bugs on ornamental crops in NSW. Growers should always check the label before using any pesticide and are advised to trial new products on a small area of the crop first, in order to monitor efficacy and any possible side effects such as phytotoxicity (damage to the plants).

Psyllids are technically 'bugs', and some product labels state more generally that the product is registered for use on ornamental plants against bugs.

Other arthropod pests

The effect of those pesticides (chosen to control psyllids) on other pest species and non-pest species that occur on Christmas bush will also need to be considered. Pesticides effective in controlling psyllid may or may not be effective against these other pests, and vice versa. Listed below are some of the more common pests:

- **Monolepta beetles** have been found in northern NSW, swarming in spring and early summer.
- **Leaf roller and webbing caterpillars** are found infesting growing tips, binding young leaves together.
- **Fruit tree borer** (Oecophoridae, Lepidoptera)—caterpillars produce webbing of the leaves, and frass at the junction of twigs or branches.
- **Longicorn beetle** (Cerambycidae, Coleoptera) larvae may tunnel in trees weakened by regular and severe pruning.
- **Aphids and thrips** can attack new shoots and cohabit with the psyllid under the curled leaves. They also exude honeydew on which fungi grow, causing blackening of the leaf. Ants, in large numbers, can also tend these and other pests, facilitating their spread, protecting them from enemies, and causing an infestation problem themselves.
- **Scales**, including olive brown scale, white palm scale and black scale, are often found on young plants.
- **Thrips** (plague thrips—*Thrips* sp.) suck the sap from calyces which brown and fall, preventing the development of the red bracts.

The effect on non-pest species that may be an issue for quarantine, for example spiders, should also be considered.

It is essential that any control program for the Christmas bush psyllid should be part of an overall integrated pest and disease management (IPDM) system. For example, even the fungicide iprodione can cause significant mortality of the Christmas bush psyllid.

Quarantine

It is thought that psyllids are readily spread through propagation material. This would explain the rapid spread of this pest into new cultivation areas. Some plantations have remained psyllid free, although they are in major growing areas, indicating that quarantine can be effective in preventing spread. Any new plant material introduced should be quarantined and sprayed with insecticide to kill all psyllids, especially if there are any rolled leaves. Even if there are psyllids already in the plantation, new sources should be excluded. There is a possibility that the new psyllids may be resistant to insecticides to which the existing population of psyllids are not resistant.

Psyllids are also readily transferred on cut material. Thus it is important not to bring cut material into the area without it first being treated. This is an important consideration for propagation material and for packing houses.

Monitoring psyllids

The level of infestation is indicated by the percentage of rolled leaves. The highest quality ‘flowers’ will have no rolled leaves. For lower grades, up to 5% or 10% of leaves may be rolled; however, there must be no live psyllids or visible black fungal growth. In the field the number of live psyllid nymphs and eggs may also be counted to determine relative levels of infestation.

Levels of infestation, as indicated by the number of flying psyllids, may also be determined by the use of yellow sticky traps (see photo 6), which are readily available commercially. Psyllids appear to be readily attracted to the colour yellow. The traps are left out for predetermined intervals, usually 1 week, and the number of psyllids counted. The psyllids are quite distinctive and easily identified. Maximum levels usually occur in spring and summer. Sticky traps may also be used to determine the level of other flying insects, especially thrips.

Photo 6. Yellow sticky traps placed at the shoot tips are an excellent tool for detecting psyllid infestations early.

Another possible indication of psyllids is the presence of large numbers of ants on the Christmas bush. Although they do not appear to be a direct factor in the spread of psyllids, ants do ‘farm’ aphids, which are commonly found in association with the psyllid under the curled leaves.

Biological control

Biological control has been successful for certain psyllid pests. However, in Australia natural enemies have not been effective in all cases. Psyllids can be attacked by chrysopids (predator lacewings) and several other insects, but until there is further research in this area, growers will need to rely on pesticides to manage this pest. Choosing a ‘low residual’ chemical will help conserve any beneficial insects that may be present in the crop.

In deciding which pesticide(s) to use, it is important to consider the following:

- **Effectiveness on pests.** The pesticide must kill a very high percentage of the psyllid.

- **Mode of action.** Systemic or contact.
- **Psyllid resistance.** If the psyllids become resistant to the chemical, then the chemical loses its effectiveness to kill them.
- **Toxicity to the plant.** The pesticide should not harm the host plant.
- **Toxicity to humans.** It is preferable to choose the least toxic chemical available.
- **Toxicity to the environment:** Residual effect: How fast does the pesticide break down? Does it affect non-target organisms and the psyllid predators (which could be developed as a biological control)?

Recommendations for further research

Further research is needed in the following areas:

- assessing and monitoring Christmas bush psyllid resistance to chemicals due to long-term use;
- screening of other types and groups of chemicals for control, both singly and in combination;
- finding an effective biological control;
- studying the life cycle of the psyllid to find the best times to apply pesticides.

Table 1. Chemicals for the possible control of psyllid. These are registered for use on ornamental crops to control psyllids (lerp insects) or plant bugs

Name of chemical	Systemic or contact	Effective against	Chemical group (for the purpose of resistance management)	Toxicity
Dimethoate, e.g. Rogor®, Unidime 400®	Systemic	Aphids, thrips, jassids, spider mites, leafhoppers, azalea lace bug, green vegetable bug, rutherglen bug, leafminers, greenhouse whitefly, wingless grasshoppers.	1B insecticide, organophosphate.	Toxic – schedule 6 poison. Marine pollutant. Dangerous to bees and fish. Do not contaminate streams, rivers or waterways with the chemical. **Warning:** Do not spray flowers as it has been reported to cause serious damage to them.
Imidacloprid, e.g. Confidor®	Systemic	Aphids, azalea lace bug, bronze orange bug, harlequin bug, citrus mealy bug, greenhouse thrips, fullers rose weevil, hibiscus flower beetle, longtailed mealy bug, psyllids, soft scales.	4A insecticide, chloronicotinyl. On perennial crops use a maximum of 3 sprays in any 12 month period; rotate with registered insecticides from other groups.	Moderately toxic to mammals and birds; low toxicity to aquatic organisms; highly toxic to bees.
Methidathion, e.g. Supracide 400®	Systemic	Aphids, armyworm, caterpillars, cutworm, grasshoppers, leaf hoppers, leaf miners, lerp insects, mealy bug, plant bugs, sawflies, scale insects, soft scales, thrips, weevils.	1B organophosphate.	Toxic—schedule 6 poison. Dangerous to bees and fish. Avoid contamination of waterways or water storages with the chemical.

Source: InfoPest, May, 2005 version.

Recommended reading and references

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ISSN 1832-6668

JOB NUMBER 5130

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