

# Clivia Newsletter Volume 1 Number 1 2021



Clivia Nimbicola

A new beginning in Clivia education, at least, in small doses. You may find articles have been duplicated from articles within the Reference Book Series. Rather than carry around a large Reference Book, this Newsletters and others to follow will make Clivia subjects easier to find.

As a Clivia beginner and enthusiast knowledge is very important especially in learning how to care for Clivias. After buying an adult Clivia that has just flowered, one subject that comes to mind is pollination, that is, passing on the plant's pollen onto another Clivia's flowers, "how do I do this transfer", "what do I do if I wish to store my new plant's pollen for the future", questions, questions and more questions arise.

Clivia adult plants are sometimes very expensive, especially the hybrid varieties of Clivias, to purchase and you need to know how best you can care for my investment.

Learning about Clivias takes time and I trust that these Newsletters can solve some of those Clivia mysteries.

**Tips for growing Clivias,** Home and Garden USA

**Clivias, the first 12 months,** Peter Haeusler, Melbourne

**Fertilising Clivias,** Lisa Fox, Clivia Market, Melbourne

**Clivia Spraying Guide,** Growing Clivias for Beginners

**Neem Oil General Fact Sheet,** NPIC, USA

**NPK Definition**

**Mealy Bug Fact Sheet,** Nursery and Garden Industry, Australia

**Clivia Pests and Diseases,** Frikkie Marais, Clivia Society

**Pests and Mineral Deficiencies affecting Clivias,** Clivia Society

**Diseases affecting Clivias,** Clivia Society

**YouTube Clivia Video Selection,** Manie Maree Clivias4africa

## Tips for growing clivias from planting to pruning and more

Clivias are a hardy, shade-loving plant that can survive almost anywhere. Here's how to keep your clivia plants happy for years to come.

### HOME AND GARDEN

Clivias are making a comeback. Lying low in gardens, unheralded for years, they have suddenly become all the rage with gardeners.

These wonderful, evergreen perennials grow under the shade of trees in quite tough conditions and almost always perform well. Over recent years they are enjoying a resurgence in popularity with the introduction of new flower colours and exciting leaf forms.

The most desirable colours are yellow, cream, apricot and pink. Deep, red-flowered forms and varieties with broad leaves are also highly sought after.

The craze for clivias is worldwide, reaching Japan, the United States, Europe, China, South Africa, Australia and New Zealand. Leaf shape and leaf colours determine favourites in Japan, while in Australia collectors go for cream and yellow flower tones.

Currently, prices for the new-coloured clivias range from about \$20 up to hundreds of dollars. But be aware when buying your clivias that many plants sold as cream, pink or yellow turn out to be another colour entirely, especially when grown from seed.

Plants that will be reliably coloured are grown as off-sets from a plant with a known flower colour. The only sure way to know you are buying what the label promises is to buy a named variety, or a plant in flower. In order to ensure you get beautiful blooms in the desired colour, buy a plant in flower or a named variety.

### QUICK CLIVIA FACTS

**Plant type:** Flowering perennial

**Height:** Up to 60cm

**Width:** Up to 1m

- Part shade
- Can be grown in pots
- Needs frost protection



## CLIVIAS ARE SHADE TOLERANT

The popularity of clivias coincides with more gardeners seeking out evergreen plants to cover the ground en masse with the added bonus of flowers.

Gardeners are always looking for plants that flower in winter when there is a lack of colour.

Landscapers and designers love to use clivias, as they are generally trouble-free plants for that difficult, shady spot.

- *Clivia caulescens* has narrow, tubular-shaped flowers, soft-red in colour with green tips, and very long leaves, often reaching 1m or more. This species flowers in spring.
- *Clivia gardenii* has tubular-shaped red flowers with a green tip and narrow leaves about 75cm long. *C. gardenii* flowers from autumn to spring.
- *Clivia nobilis* features pendulous, green-tipped tubular flowers that bloom in mid-winter to spring, with spot flowering at other times.
- *Clivia miniata* is the best-known species to be grown in gardens, offering clusters of lovely salmon-coloured open flowers.

## COLLECTABLE CLIVIAS

It is with *Clivia miniata* that the most exciting colours and forms are to be found.

Some interesting forms of *Clivia miniata* include yellow, cream and the Belgian hybrids, known for their deep red flowers, protruding stamens and broad, thick leaves.

## BUYING CLIVIA SEEDS

Despite the number of colourful clivias around, named varieties can sometimes be difficult to find.

Most clivias are sold simply by colour so your best bet is to buy them in nurseries when they are already in bloom, so you can be sure of the colour that you're getting.

Clivias are sold as plants by nurseries and specialist growers. The price of clivias depends on the pot size and the variety.

The familiar salmon-orange *Clivia miniata* sell from \$5–\$8.

The desirable cream, pink, yellow and Belgian varieties start at \$20–\$30 a pot for seed-grown plants. Named varieties are usually more expensive and may be \$50–\$100 or more.

## HOW TO GROW CLIVIAS

Clivias are easy to grow, but their position is vital. Early morning sun or dappled shade is best, with protection from midday and afternoon sun. Clivias planted out in the open will become scorched and unsightly on the first hot sunny day.

In cold climate areas, clivias will need protection from frost. The far-reaching canopy of a deciduous tree over the top of a clivia patch will drastically reduce the likelihood of frost damage.



Clivias are tough plants that grow in any type of well-drained soil. Their fleshy roots benefit from organic matter dug in at planting time or when plants are being lifted and divided.

Although clivias are drought-hardy, needing little additional watering, they will respond to extra watering in their growth period from spring to summer.

Feeding at this time with a liquid fertiliser applied every couple of weeks will help growth but hold off from autumn onwards when the plant is resting up before its next flowering period in late winter and spring.

## HOW FAR APART SHOULD CLIVIAS BE PLANTED?

Clivias generally grow to about 30cm in width, so spacing your seedlings 30cm apart should be sufficient.

## HOW TO PRUNE CLIVIAS

Once flowering season is finished, cut back the flowers right at the base of the stem. It is also a good time to clean up the rest of the plant by removing any yellowed, brown or damaged leaves. Clip leaves right at the base.

You may also want to prune back clivias to prevent them from becoming overgrown or unruly. Never prune more than one third of the plant within a 12 month time span.

## GROWING CLIVIAS IN POTS

Potted clivias look lovely on a patio or decorating a shady courtyard.

In pots and containers, clivias like to be pot bound and can be left undisturbed for many years. My grandmother grew them beautifully for more than 20 years without ever disturbing the roots by repotting.

Do not over-water them when in pots, nor have them sitting in saucers of water, as their fleshy roots can rot if they are over saturated.

## CAN YOU GROW CLIVIAS INDOORS?

Potted clivias can be moved around and used as colourful accents at flowering time, or even brought indoors for several weeks of colour. The flower spike also makes a lasting cut flower in a vase or mixed arrangement.

## HOW TO PROPAGATE CLIVIAS

To be sure of getting a plant that's true to the colour of the parent plant, grow clivias by division. This is best done when the flowering period has finished in late spring or early summer.

Clivias also grow readily from fresh seed. Clivia seed is ripe when the seed pods change from green to red or yellow.

## CLIVIA DISEASES AND PESTS

Slugs and snails always like to sneak around the base of clivia foliage, especially during a moist winter, so keep a check and use bait, or go on a night hunt on a wet evening.



Possums can also eat the ripening seed pods, so you will need to be extra vigilant against these marsupials if you plan on collecting the seed for propagation.

## TREATING CATERPILLARS ON CLIVIAS

A recent pest problem is the native lily caterpillar. This yellow and black striped caterpillar attacks clivia leaves, feeding down into the base of the plant. Fungal rot follows a lily caterpillar attack.

Control the insect with a registered insecticide as soon as damage is visible. To prevent rot, drench with a good phosphorus-based fungicide.

## FUN FACT

Clivias are named after Lady Clive, the Duchess of Northumberland, who was the granddaughter of Robert Clive, an early British imperialist in India.

## CLIVIAS GARDEN DESIGN

The key to success with clivias is to mass them under trees, as a garden edging or along a shaded fence.

Even when not in flower, the leafy clumps are an attractive green ground cover.



A cluster of clivias (bottom left) have been planted in the shade of jacaranda tree in this [multi-functional family garden](#) . Photo: Martina Gemmola

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## CLIVIAS, THE FIRST 12 MONTHS: FROM SEED TO SEEDLING

**Peter Haeusler**

Clivias are basically hardy, tolerant plants, and will cope with remarkably diverse conditions. There is no single, absolute, or perfect path that I or anyone can say you must follow to get results. We are all constantly learning, and it is through innovation, experimentation, sharing our knowledge and experiences, and above all through careful reflection on practices and outcomes that we gain new insights, increase our understanding, and hopefully achieve great results with our Clivias.

In the course of the following paragraphs I will outline the approach I have taken in that crucial first 12 months, when we take each Clivia from little more than potential – a seed – through to a robust seedling with several leaves and well on the path to realising that potential. Over the past five years I have germinated about 700-800 seeds each year, with an overall germination rate consistently around 95%. On average I would, in all honesty, lose less than 10 seedlings each year – touch wood!

There are several inter-related goals when it comes to propagating Clivias, and these underscores the importance of your management practices.

These goals include: Maximizing your germination rate, achieving at the same time relatively quick germination;

- i. Achieving a good, consistent growth rate post-germination;
- ii. Minimizing losses through insect attack, rot and fungal disease; and ultimately,
- iii. Growing strong seedlings, with good leaf colour (and lustre), and healthy root systems.

### **Preparation**

As with so many areas of endeavour, sound preparation and consistent effort bears fruit. You need to think carefully about your seed germination arrangements, with different methods having their strengths and limitations. By all means experiment as you work out what suits you and do take into account the time you can commit to this stage as some propagation methods will be more demanding of your time than others. Shelter, yet good ventilation and sunlight are essential ingredients. As always, the mix you use must be well aerated and well drained, and you must manage carefully the amount of water your seeds are getting. Finally, the need for sound hygiene cannot be over-emphasised. This last aspect often fails to get the attention it deserves, yet it is a crucial element.

### **Propagating box**

I have built my own propagating boxes (Fig. 8). Essentially, it's a simple box arrangement built around a heated, thermostatically-controlled propagating tray (Garden Express at Monbulk sell single, double and four tray models). The propagating box has a simple hinged lid, with a clear corrugated polycarbonate sheeting (Laser lite) cover — the corrugations allowing a good amount of air circulation, but the overall effect of the lidded box arrangement is still to retain a good deal of warmth and humidity (the temperature remains set at 23°-25°C).



*Fig. 8 Propagating box.*

You can, of course, germinate your seeds without the aid of a heated propagating system. Several years ago, I compared seed grown in my heated propagating boxes with seed that I germinated without heat (the latter were outside in pots, but still under clear Laser lite sheeting to control the amount of water). I found that I got *noticeably better germination* with the heated tray arrangement and faster early growth. However, I also found that by the time the seedlings were 12 months old I could see little overall difference between the heat-assisted and non-heat-assisted batches. If, however, you are spending money on good seed and scarce or unusual crosses then maximising germination and early growth is vitally important, in which case some form of heat-assisted propagation is desirable.

### **Cleaning pots**

It is essential that your pots are perfectly clean. Where I am re-using pots, I always scrub them thoroughly in a trough of warm soapy water (using sugar soap, a good general-purpose cleaner), and then rinse them in a bleach solution. They are then put on a table outside to dry in the sun.

### **Propagating mix**

I use Debco's propagating mix which has a bit more body (including a good proportion of coarse grit), than some of the commercial "seed raising" mixtures. It is professionally produced, clean and free of pathogens, very well drained — which is essential — and I have found it to be of a very consistent standard over the years. It has no added wetting agent or fertilizer. The last thing you need is a wetting agent at this stage, and I don't apply any fertilizer until about the 3-month stage (more on that later) as the seeds already contain the nourishment needed for their initial growth.

### **Seed preparation**

In the case of my own seeds, after removing them from the berries I simply wash them in lukewarm water to which I have added a few drops of dishwashing detergent, rinse them, and then let them dry on a paper towel. I do not immerse the seeds in a fungicide solution, nor do I soak them in Seasol or such. I am a great believer in relying on the goodness and vigor that is bound up in the seed itself. If your seed needs all manner of such additives to kick-start life then it is not worth growing, and the resultant plants will in all likelihood only cause you grief later on.



In terms of seed that I purchase, providing it looks well cleaned with no traces of plant matter then I simply plant the seeds without further ado. If, however, the seed looks a bit 'spotty', feels sticky, or hasn't been well cleaned I will wash it in warm soapy water, then soak the seed in a fungicide solution (e.g. Mancozeb) for say an hour. Then, when the seed is dry, I'll plant it up. *However*, my experience with seed which is a bit spotty and/or sticky is that even when treated in this manner I still seem to experience problems with the seedlings down the track in terms of fungal infection. I do not continue to deal with any grower who sells me seed which is 'suspect' in such ways, or indeed seed which is otherwise 'scrappy'. There are good reputable sellers out there and if you are unsure about who to buy seed from then seek advice from some of the experienced members of the Group.

### **The first three months**

#### **Planting seeds and germination**

I like to start my seed planting in July after the Winter solstice. The days are slowly beginning to lengthen and, as we know, plants everywhere start to respond to those early signals that Spring is coming. Any seed that I receive prior to this time is kept in a cool area out of direct light until I am ready to start planting – making sure that if they are stored in plastic bags there are a couple of holes for aeration. The pots I use for seed propagation are 80mm square and 100mm deep. Twelve of these fit neatly into a 290mm X 350mm plastic tray (with slotted, not solid, base), and these in turn fit neatly into the heated propagating trays I mentioned earlier.

Each pot is filled to close to the top with the propagating mix. I put up to about 6 seeds per pot, always keeping the one cross to a pot so that I can keep a good sense of how the cross is proceeding, variation in pigmentation, leaf form and so forth. Details of the cross are recorded on a plastic label inserted into a slit on the pot rim. This includes: the cross; the breeder; the date the seed was planted; and, number of seeds planted (if I have, say, 12 seeds of the cross I will record the number of seeds as 6/12 which reminds me that there is another pot of 6 seeds of this cross).

There seems to be a lot of discussion about how to 'situate' the seed in the mix. Basically, I sit it on the mix and press it down lightly, with the top half of the seed still visible. If I can see an 'eye' (the bud or germination point) then I will point that roughly downwards. While this was something, I was anxious to 'get right' in the early days, I am now less fussed as seeds are, unsurprisingly, adept at 'getting it right' themselves. In addition, sometimes the

'eye' is not easy to locate in which case I will generally put the smoother rounded surface of the seed facing up. Once I have put the desired number of seeds into the pot, I then barely cover them with a mix made up in equal parts of coarse sand and the propagating mix. This is a bit heavier and doesn't wash about easily when watering, thereby helping hold the seed firm as it germinates.

Germination will generally occur between 4-6 weeks, even up to 8 weeks (I have found some varieties to be consistently slower than others, so patience may be needed). The radicle (primary root) develops, followed by the first seedling leaf. You need, however, to watch the seeds as they germinate, as sometimes the radicle will push the seed right up out of the mix. In such cases I have a screwdriver at hand and simply make a bit of a hole and pop the seed into it, root first of course, taking care not to fully bury the seed. Then just firm the mix – ever so carefully – around the root and seed.

So, just to be clear, I do not germinate my seeds in sphagnum moss. Time is at a premium for me, so seeds are put straight into the pots (and mix) that they will germinate in and indeed remain in for up to the first 10-12 months of their lives. This minimises handling and disturbance. Moreover, the approach has borne very good results in terms of germination, plant development and overall health. Even if I had more time, I would not now change this method. The (individual cross-based) community pot approach also affords a good sense of how each cross is developing and allows easy assessment of pigmentation results for instance.



*Fig. 9 Interspecific of Shige Sasaki's breeding (TK Yellow x Hirao) X (Gardenii x Hirao). Flowered this year at 3.5 years*

You can, of course, use larger community pots for larger numbers of seeds. Be very careful, however, about the size of your pots as a large quantity of mix can translate to a wet and cold mass, leading in turn to fungal and other problems. The other advantage of the smaller pots such as I use is that each cross has a degree of isolation from the others. If a fungal problem emerges that cross can be readily isolated from the others and treated.

### **Watering and humidity**

While they remain in the propagating boxes, I water my pots of seed twice weekly. On the weekend when I have a bit more time, I remove the trays of pots and dampen (not saturate!) the matting underneath. Then I put the trays of pots back in place and water the actual pots. This helps generate some humidity – you will see the condensation on the underside of the Laser lite on cool days and evenings – which makes for a good growing environment.

BUT be very careful not to create an overly warm and overly humid environment otherwise you will soon have fungal problems in your seedlings, and at this age it is nigh on impossible to save a seedling once afflicted. This is very definitely a case where prevention through careful management is better than cure!

For the watering I use a 1.5 litre soft drink bottle with a plastic rose type of watering fitting screwed on (these bottle top waterers can be obtained from The Diggers Club). This is a gentle way of watering the seed which doesn't wash the mix away from around the seed.

### **Pest and disease management early on**

Rather than insect pests, it is rot and fungal disease that you particularly need to guard against early on. If fungal infection takes hold it can cause a great deal of damage quickly as emerging seedlings have little capacity to fight infection, unlike a mature plant. For this reason, rigorous attention to the pillars of good preparation – clean pots, good clean mix, clean and healthy seed – is vitally important. If you start to encounter something like damping off then, yes, apply an appropriate treatment such as Fongarid. But, remove affected plants immediately – on no account leave seedlings you are treating alongside healthy plants.

Above all, look carefully at your practices and try to get to the underlying cause of your problem. If numerous seedlings across different crosses are „falling over’ due to fungal infection, then the chances are that there is something in your practices that needs to be changed. Perhaps you are over-watering, or the seed-raising environment is too humid. In such cases seek advice from a couple of experienced growers.



*Fig. 10 ‘Everton Green Goblin’ breeding from Val Thurston.  
First flowered last year at 3 years.*

In terms of insect pests, I have not experienced insect-related problems while seedlings are at that early stage in the propagating box. Quite a few growers talk about the adverse impact of fungus gnats. I do get very small fly-like insects darting around the propagating boxes but have never seen any sign at all that these are having a harmful effect on the seedlings (either leaves or roots). However, as a precaution I locate several insect traps in each box. These stiffened plastic sheets are about 100mm X 200mm, bright yellow (the yellow is said to be insect-attracting), and very sticky. They are designed to control for thrips among tomato plants for instance (Bunnings sell a version, but I obtain mine from Muir & Sons in Silvan). I certainly find that a large number of these tiny flies get trapped on the sheets so in that sense they are very effective.

### **After three months**

#### **Hardening off**

When the seedlings are about 3 months old the pots are removed from the propagating box, although I try and avoid doing this during a cold spell. I tend to be guided very much by the size of the seedlings, and as we know different crosses will develop at very different rates. Essentially, I am looking for the seedlings to be about 75mm high before moving them out. For a couple of weeks, the pots being removed are left in trays on top of the propagating boxes where they will still derive a little heat (note that my propagating boxes are in an outdoor area which is semi enclosed and itself has a Laser lite roof, with shade cloth pulled across when the weather heats up). Easing the seedlings out in this way serves to harden them off somewhat.

## Location for young seedlings



*Fig. 11 Seedlings*

When my community pots of seedlings are moved out of the propagating area, they are then located in a special area within one of my shade houses (Fig. 11). In addition to the shade cloth cover this special seedling area has a clear Laser lite roof (never use the darkened polycarbonate roofing as this will block too much UV, leading to poor leaf colour and weak growth). This means that I can continue to control the amount of water the seedlings get which I believe is particularly important while they are getting established and developing their root systems.

My seedlings stay in this area until I am ready to pot them into individual 100mm pots at 10-12 months. This area where I keep them remains relatively cool even in the hottest parts of summer. There are a couple of large deciduous trees nearby. This, in combination with the shade cloth structure (the cloth only goes down to the shelf height, about 45cm above ground level), means a reasonably bright, generally airy, yet sheltered and cool aspect. This, I believe, provides an excellent growing environment. Plants develop nicely with great root and leaf development, and I barely lose a seedling once they are out in this setting.

### **Watering and fertilizing**

From this stage onwards, the seedlings are watered weekly, and twice weekly in the summer. It is a generous watering (using a fine rose head) to the point that the water runs through the bottom of the pots. Seedlings need to be kept moist, but on no account should they be growing in soggy conditions. This, once again, is why it is so important to have a well-drained mix. On no account should your pots of seedlings be sitting in trays or situations where the water may lie around the base of the pots.

Only once seedlings reach the 3-month mark and are moved out of the propagating box do I apply fertilizer. Rather than chemical fertilizers, my strong preference is for organic products such as Seasol and Power Feed (or something like Charlie Carp) which I feel are easily absorbed and “softer” on the young plants. These are applied roughly fortnightly at half strength.

## Pest and disease control



*Fig. 12 Seedlings at 3 months, 12 months and 2 years.*

As always, you need to watch for signs of fungal infection. Mancozeb is not overly “heavy duty” and I prefer to use it if the need arises. If, in the summer months, we get a spell of particularly humid weather I may spray the seedlings with Mancozeb as a preventive, otherwise I spray plants only on a need basis.

## Twelve months, and beyond

By the time your seedlings reach 10-12 months old they should be a good height (15cm plus), with up to 4 leaves, and nicely developed root systems (see Fig. 12 of seedlings at 3 and 12 months, and a 2-year-old plant). Of course, there will be considerable variation depending on the cross. Some seedlings will be lower and spreading, with perhaps broad leaves. Others, such as *Clivia gardenii*, *Clivia robusta* and interspecifics can be much taller with amazingly developed root systems. At this stage I pot them up into individual pots (100mm) using a well-drained, moderately coarse, and above all well-composted mix. And for the first time I will apply a chemical fertilizer, a slow release fertilizer (I use 8-9-month Osmocote Exact which has added micro nutrients).



*Fig. 13 Interspecific flower of Sean Chubb's breeding.*

*First flowered last year at 4 years.*

*Has had a magnificently elevated umbel last year and again this year!*

If you have grown your plants well from day one, they will reward you and power along now. Moreover, time and again I see that seedlings which have got off to a great start are less prone to fungal and rot problems later. Most of my plants potted up into 100mm pots at 12 months are literally bursting out of these pots a year later, at which time they will be moved on to 150mm pots. But that's another story!

**Courtesy of Peter Haeusler, Melbourne Clivia Group and well known Clivia enthusiast.**





## Fertilizing Clivia

Clivia love fertilizer. Fertilizing your plant will result in darker green leaves, more growth, a better root system and better flowers. I have often seen plants in need of a good fertilizing and the leaves have taken on a more lime green colour. Nothing looks better than a healthy plant with dark green leaves and new leaves developing. I use a slow release fertiliser that lasts for 12 months on my plants. A small amount is mixed throughout the potting medium and a handful is sprinkled around the top of the pot. I also give my plants a liquid fertiliser once per month. These are plants in pots. Plants in the garden would also benefit from a slow release fertiliser and the occasional watering can of liquid fertiliser.

The following fertilisers are the most popular ones used at present. There are many better fertilisers not listed here but I have not had experience with the others.

### Seasol

Seasol is not a fertiliser. It is more of a tonic. I find it great to give to a stressed plant or when I have just repotted a plant. I use it on plants that seem to have a problem or have dried out too much. It

is reported to be good for root growth. I use it diluted in water and watering it in with a watering can.

### **Charlie Carp**

Charlie Carp is a very smelly liquid fertiliser. I have heard some experts say that it is not as good as others such as Aquasol due to the carp living in fresh water and not sea water. I have used Charlie Carp extensively and find it great, however be aware you will need a shower afterwards. I also like the thought that we are helping to get rid of the carp in our rivers.

### **Thrive**

Thrive is also a great fertiliser. I find that it is great for the growth of the leaves and not so much for inducing flowering. I use it at times on my seedlings.

### **Osmocote**

I love Osmocote but to buy it in the quantity I need, it is too expensive. There is a similar product available called Multicote which has the same properties as Osmocote and is a great slow release fertiliser. The one I use lasts for 12 months.

### **Powerfeed**

This product is made by the same company as Seasol. I use this on my young seedlings as I find it is not too strong and encourages growth. I use this as a foliar spray.

## Seamungus

This product I also use on seedlings. It comes in a pellet form or a crumble form. I find this not too strong and very good for the young plants.

Courtesy of Clivia Market [www.cliviamarket.com](http://www.cliviamarket.com)



## CLIVIA Insecticides / Fungicides / Fertilisers - Australia

### CLIVIA Spraying Guide - Fertilizer/Insecticide/Fungicide/Systemic solutions

THRIVE All Purpose Soluble Fertilizer	YATES	500gms	2 spoons = 9 Litres
CONFIDOR	BAYER	200ml = 60 Litres	
Insect Destroyer (Natural Pvrethrum)	KENDON	250ml	20ml/1 Litre
SUCCESS Ultra (Insect Control)	YATES	200ml	5ml/1 Litre
FUNGUS GUN (Systemic Fungus Control)	YATES	750ml	Prepared ready
CHARLIE CARP (All Purpose Fertilizer)	Charlie Carp	1 Litre	1 Litre = 300 Litres
Potash Liquid (Fruit & Bloom Booster)	Searles	250ml	Makes 500 Litres
MAXGUARD (Systemic, Contact & Residual Insecticide Concentrate)	Scott Defender	1 Litre	50ml = 1 Litre
NITROSOL (Liquid Plant Food)	AMGROW	1 Litre	Makes 250 Litres
MANOZEB (Fungicide)	Searles	200gms	20gms = 10 Litres
Tomato/Vegetable Dust (Insecticide & Fungicide)	YATES	500gms	Sprinkle On
Tomato Spray (Insecticide & Fungicide)	BRUNNINGS	750ml	Prepared ready
ANTI ROT (Phosacid Systemic Fungicide)	YATES	500ml	5/10ml = 1 Litre

### What is neem oil?

Neem oil is a naturally occurring [pesticide](#) found in seeds from the neem tree. It is yellow to brown, has a bitter taste, and a garlic/sulfur smell. It has been used for hundreds of years to control pests and diseases. Components of neem oil can be found in many products today. These include toothpaste, cosmetics, soaps, and pet shampoos. Neem oil is a mixture of components. Azadirachtin is the most active component for repelling and killing pests and can be extracted from neem oil. The portion left over is called clarified hydrophobic neem oil.



### What are some products that contain neem oil?

Neem oil and some of its purified components are used in over 100 pesticide products. They are applied to a wide variety of crops and ornamental plants for insect control. Neem oil can be [formulated](#) into granules, dust, wettable powders or emulsifiable concentrates.

Always [follow label instructions](#) and take steps to avoid exposure. If any exposures occur, be sure to follow the First Aid instructions on the product label carefully. For additional treatment advice, contact the Poison Control Center at 1-800-222-1222. If you wish to discuss a pesticide problem, please call 1-800-858-7378.

### How does neem oil work?

Neem oil is made of many components. Azadirachtin is the most active. It reduces insect feeding and acts as a [repellent](#). It also interferes with insect hormone systems, making it harder for insects to grow and lay eggs. Azadirachtin can also repel and reduce the feeding of nematodes. Other components of neem oil kill insects by hindering their ability to feed. However, the exact role of every component is not known.



### How might I be exposed to neem oil?

People can be exposed to chemicals by eating them, breathing them in, through skin contact and eye contact. Since neem oil is used on a variety of crops, people are mainly exposed to neem oil in their diet. People who apply neem oil may also be exposed if they inhale the mist or dust, let the product touch their skin, or fail to wash their hands before eating or smoking. However, the label includes directions for [keeping exposure low](#). For example the label might require applicators to wear protective clothing.



### What are some signs and symptoms from a brief exposure to neem oil?

Neem oil can be slightly irritating to the eyes and skin. Azadirachtin, a component of neem oil, can be very irritating to the skin and stomach. The remaining portion of neem oil is made of fatty acids, essential oils and other substances that are commonly eaten in a normal diet. These substances are generally recognized as safe (GRAS) by the United States Food and Drug Administration.

In other countries, neem oil has been used on cats for flea control. Some adverse reactions have been reported. Symptoms include feeling sluggish, excessive salivation, impaired movement, trembling, twitching, and convulsions. Some of the cats died. However, most of them recovered within 1 to 5 days.



### What happens to neem oil when it enters the body?

Clarified hydrophobic neem oil (without azadirachtin) is made of fatty acids and glycerides. These substances are commonly found in food. When they enter the body, they are broken down, used for energy, and incorporated into cells.

In one study, scientists injected insects with azadirachtin. They found 90% of the dose in the insects' feces within 7 hours. The remaining portion lingered in the insects' bodies for 24 days after the injection.

### Is neem oil likely to contribute to the development of cancer?

No. People have been exposed to neem oil in many ways for hundreds of years. During this time no association with increased [cancer](#) risk has been found. Studies showed that neem oil did not alter or damage genes. In laboratory tests, animals were fed neem oil for 90 days. They did not have increased cancer rates.

Further, one study found that certain components of neem oil caused cancer cells in hamsters to stop growing or die. Another study looked at prostate cancer cells from humans. Researchers found that neem leaf extract was able to slow their growth.

### Has anyone studied non-cancer effects from long-term exposure to neem oil?

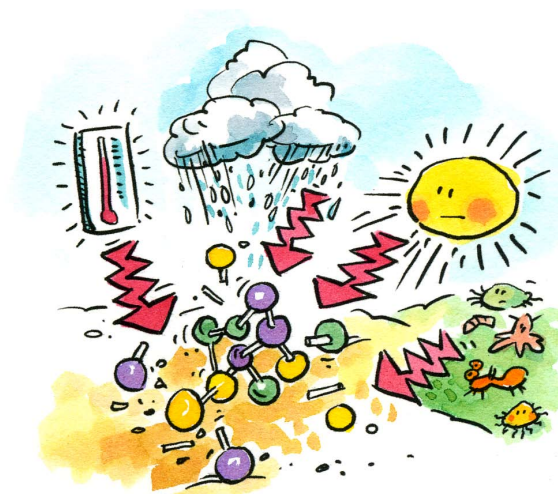
In rat studies, no effects were reported when the rats were fed either azadirachtin or clarified hydrophobic neem oil throughout their lives.

### Are children more sensitive to neem oil than adults?

In general, [children may be especially sensitive to pesticides](#) compared to adults. When rats were fed neem oil in one study, their pregnancies ended. In another study, rats were fed azadirachtin in their diet throughout their lives. No effects to their offspring were found. Additionally, neem oil is used in toothpaste, cosmetics, soaps and traditional medicines around the world. Therefore, people of all ages are commonly exposed to neem oil. No data were found to show that children are more sensitive than adults to neem oil.

### What happens to neem oil in the environment?

Azadirachtin, a major component of neem oil, is rapidly broken down. Microbes and light break down the pesticide in soil, water and on plants. The [half-life](#) of azadirachtin in soil ranges from 3 - 44 days. In water, the half-life ranges from 48 minutes to 4 days. It also rapidly breaks down on plant leaves; the half-life is 1 - 2.5 days. The remaining components of neem oil are broken down by microbes in most soil and water environments.



### Can neem oil affect birds, fish, or other wildlife?

Neem oil is practically non-toxic to [birds, mammals](#), bees and [plants](#). Neem oil is slightly toxic to fish and other aquatic organisms. Azadirachtin, a component of neem oil, is moderately toxic to fish and other aquatic animals. It is important to remember that insects must eat the treated plant to be killed. Therefore, bees and other pollinators are not likely to be harmed.

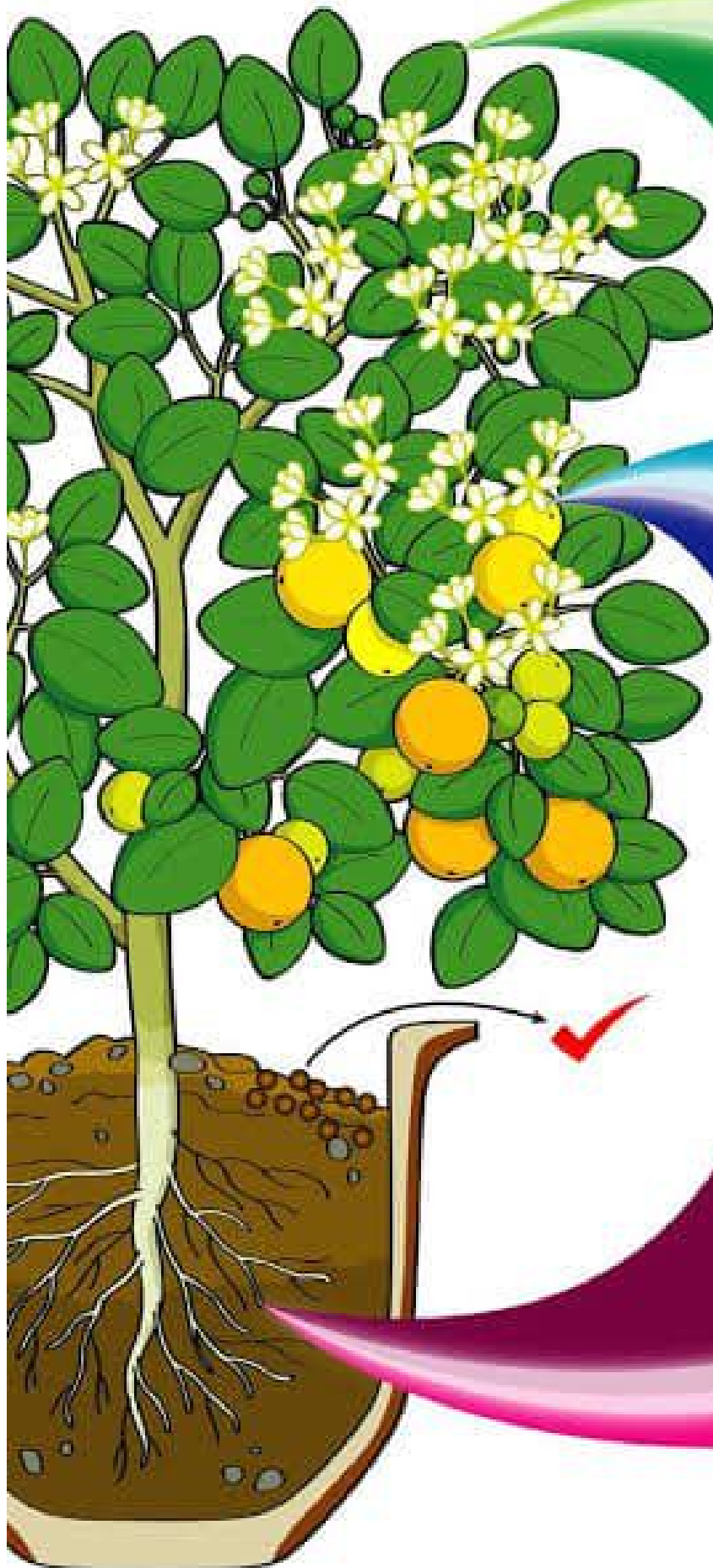
### Where can I get more information?

For more detailed information about neem oil please visit the list of [referenced resources](#) or call the National Pesticide Information Center, between 8:00 AM and 12:00 PM Pacific Time (11:00 AM to 3:00 PM Eastern Time), Monday - Friday, at 1-800-858-7378 or visit us on the web at <http://npic.orst.edu>. NPIC provides objective, science-based answers to questions about pesticides.

**Date Reviewed: March 2012**

NPIC is a cooperative agreement between Oregon State University and the U.S. Environmental Protection Agency (U.S. EPA, cooperative agreement # X8-83458501). The information in this publication does not in any way replace or supersede the restrictions, precautions, directions, or other information on the pesticide label or any other regulatory requirements, nor does it necessarily reflect the position of the U.S. EPA.

# NPK Definition



## THE LEAF MAKER

### NITROGEN

**N**

- Production of new cells and enzymes.
- Production of green pigments.
- Responsible for leaf and stem growth.
- Helps plants with rapid growth.



## THE FLOWER INDUCER / FRUIT MAKER

### POTASSIUM

**K**

- Encourages uptake of water.
- Essential in the development of flowers and fruits.
- Increases plants resistance to diseases.
- Helps plants make better use of light and air.



## THE ROOT MAKER / FLOWER INDUCER

### PHOSPHORUS

**P**

- Encourages root growth and blooming.
- Essential part of the process of photosynthesis.
- Involved in the formation of all oils, sugars and starches.
- Helps with the transformation of solar energy into chemical energy.





# Mealybugs

## A pest of a different scale

### Background

Mealybugs are a specific type of scale insect from the family Pseudococcidae. They often secrete a thin covering of mealy wax across their body, hence their common name. Like other scale insects, mealybugs are sucking pests that can be present across all of Australia on many host plant species. Some species of mealybugs are very serious pests of particular plant species, others are not. Some species may feed on a large number of host plant species, others only on a small number. Mealybugs are most often present on leaves and stems, particularly in tight, protected spaces. However, some mealybugs feed on roots. For information on other types of scale insects, refer to the [scale insect factsheet](#) available on the NGIA website.

There are a number of mealybug species that may be commonly encountered in production nurseries; these include longtailed mealybug (*Pseudococcus longispinus*), obscure mealybug, (*P. affinis*), citrus mealybug (*Planococcus citri*), ground mealybugs (*Rhizoecus* spp.) and many others. Some native mealybug species are common problems on native plants, e.g. *Melanococcus albizziae* can kill *Acacia* and *Australicoccus grevilleae* can cause significant damage to *Grevillea*. It is likely that at least one mealybug species will feed on most plant species found in a production nursery, at least from time to time. It is beyond the scope of this factsheet to detail the biology and host range of every mealybug species that could be present in production nurseries across Australia. This factsheet is necessarily general, providing information typical across the group; exceptions will occur. It is recommended to have mealybug species that are encountered in your nursery identified to facilitate the management of the pest more specifically. Identification is particularly important when the infestation is widespread, when management actions have failed or when they reoccur frequently. Furthermore, some species of mealybugs are serious pests overseas, but are not present in Australia.



**Fig. 1.** Adult, egg masses and immature citrus mealybug individuals, photo by the United States National Collection of Scale Insects Photographs, bugwood.org.



**Nursery & Garden Industry  
Australia**



**Nursery Production  
Plant Health &  
Biosecurity Project**

BUILDING INDUSTRY CAPACITY & MANAGING RISKS



Horticulture Australia



**Queensland  
Government**



## Description

Mealybugs are small, oval, soft-bodied insects that are often covered in a white powdery wax. The powdery wax sometimes extends off the body as long marginal filaments. While most species of mealybugs are white, off-white or light grey, some species are yellow, pink or orange. The mouthparts of all mealybugs are hair-like, being extremely long and thin. If individuals are carefully removed from plants when they are feeding, these mouthparts can be observed under a microscope.

Adult females are similar to nymphs, but larger. Females are often about 3-6 mm in length. Females lay egg sacs or masses that are covered by cottony secretions, similar in appearance to cotton wool. Adults generally have longer marginal filaments than nymphs, however they can be broken off naturally. Eggs within the mass tend to be yellow to orange. However, not all mealybugs lay eggs, longtailed mealybug produces live young (crawlers). In most instances, only females and nymphs will be observed on plants. Males, when they occur, are small gnat-like insects (about 2 mm long), with two pairs of wings.

Upon hatching, first instar nymphs (crawlers) are very small, often less than a millimetre long, and are reasonably mobile. Crawlers have the least amount of wax present on their bodies and are the most vulnerable to mortality from pesticides and environmental conditions.

## Life cycle

Mealybugs are slow moving and feed on plant sap. Mealybugs tend to live in aggregations, often on the underside of leaves, on stems around petioles and branches and other concealed areas, e.g. in dense foliage, where fruit are touching or leaves overlap and near flower buds and growing tips. Mealybugs feeding on grasses and grass-like plants are often present under the leaf sheath. Some species may be on above ground parts and on roots, other species are solely root feeding (see section below on root feeding mealybugs).

Unlike most other scale insects, subsequent nymphal stages and adults have functional legs, and are generally able to move short distances. Nymphs are similar to females, but smaller, and will moult through three to four nymphal instars. However, male nymphs can be more elongated than female nymphs and have four to five nymphal stages. Males also have a pupal stage before emerging as an adult.

Generally, mealybugs complete their life cycle in 1-3 months, depending upon temperature and host plant. Cooler temperatures increase the generation time (slow it down), warmer temperatures decrease it (speed it up). Therefore, 4-10 generations can occur each year. Temperatures of about 25°C and high relative humidity are optimal for many mealybugs. Mealybugs tend to be present continuously, but may be less active in relatively cool conditions. Their populations often reach peaks in spring and autumn and it is common to see all stages on a plant at the same time (e.g. egg masses, nymphs and adults simultaneously).

Male mealybugs do not feed and only survive for a few days to mate with females. However, many species of mealybugs do not have males; females reproduce asexually. Females of most species lay their eggs into a waxy mass with at least 50-100 eggs, some species may lay up to about 600 eggs in their life time. Females of some species can survive for 10-20 days without a host plant. Eggs tend to hatch in 5-10 days, but may be



**Fig. 2.** Citrophilus mealybug (*Pseudococcus calceolariae* - above - photo by USDA ARS, Bugwood.org) and *Pseudococcus* sp. mealybugs on hoop pine.



longer during unfavourable environmental conditions. Crawlers may remain under the egg mass for some time before moving away, perhaps up to several weeks.

### Damage

Feeding may occur on all plant parts. High populations slow plant growth and cause premature leaf or fruit drop and twig dieback. At first, plants may appear to lack vigour, leaves then yellow and may drop. Feeding on growing tips and buds can cause distorted growth as they inject toxins into the plant. At high populations plants can completely wilt and die. The white fluffy growth can also cause plants to be cosmetically unsaleable. Furthermore, mealybugs produce honeydew, a sticky, sugary solution, on which black sooty mould grows and can be unattractive. Ants often attend mealybugs to harvest the honeydew. This may cause mealybug infestations to be even more troublesome as it may reduce predation and parasitism by natural enemies.

### Root feeding mealybugs

The most common root feeding mealybugs are from the genus *Rhizoecus*, although others occur. They can remain undetected on roots for quite a long time without specific monitoring. These species appear as cotton-like masses on infested roots. Their bodies do not have long wax filaments, like that of many foliage feeding mealybugs. Their biology is similar to mealybugs discussed above, however, crawlers are the main source of spread between plants. Crawlers may move out of drainage holes with water, and they may be dispersed with plant debris and on equipment.

Damage from root feeding mealybugs is similar to those above ground. However, they are often very difficult to detect at low populations and therefore build to high populations. Highly infested plants must often be thrown out. Note that root mealybugs can sometimes be present on weeds in pot plants, but not on the actual nursery plant. Therefore some discernment is required, as such situations do not require plants to be discarded.

### Mealybugs as virus vectors

Mealybugs are known vectors of several plant viruses, including *Banana streak virus*, *Grapevine leafroll associated virus* and *Pineapple mealybug-wilt associated virus*, all of which occur in Australia. Other viruses vectored by mealybugs also occur overseas. They are not particularly good vectors as they crawl, rather than fly, from plant to plant, unless they are distributed by wind currents or ants. Consequently, spread of virus from mealybugs tends to be slow; these viruses can be spread through other means.

### Host range

As a group mealybugs attack a very broad range of plants including fruits and vegetables, indoor plants and outdoor ornamentals like annuals, perennials, shrubs, palms, grasses and trees. In other words, almost all plant species present in a nursery can be fed upon by at least one mealybug species. Some mealybug species have a very wide host range and are more likely to be encountered in a production nursery. For example, citrus mealybug has been reported across plants from about 50 plant families and can be a pest on



**Fig. 3.** Mealybug infestation causing stunting of seedling avocado (above) and roots infested with *Rhizoecus* mealybugs (below - photo by USDA ARS, bugwood.org).

begonia, boronia, cactus, calathea, canna lily, citrus, coleus, croton, cycads, cyclamen, dahlia, eriostemon, narcissus, tulip and many other plant species. Long tailed mealybug is reported from about 30 plant families and can be a pest of bromeliad, bulbs, citrus, custard apple, fern, fuschia, grapefruit, grape, hibiscus, Japanese maple, olive, orchid, palm, passionfruit, pine, pomefruit, stonefruit, *Zamia* and many other species. Fortunately, not all mealybugs have a very wide host range. For example, *M. albizziae* has only been reported feeding on *Acacia* spp. and banana.

As stated earlier, it is important to have mealybugs identified. This will allow you to investigate the host range of the species, its biology and information known on specific management of the pest.

## Monitoring

Monitoring in nurseries is essential for all pests, diseases and general plant health. Monitoring provides essential information for making management decisions. In any given time, it will detect the presence and numbers of mealybugs, their natural enemies (predators and parasitoids) and other pests and diseases. Regular monitoring can be used to determine the change in numbers, i.e. whether populations are increasing or decreasing. This information is extremely valuable and informs how effective each management action has been.

Monitoring for mealybugs should include visual observations including turning over leaves, looking for black sooty mould and the presence of ants on plants. Plant beating (gently but firmly hitting foliage against a uniform coloured tray) can also be effective for species that can be dislodged from the plant. However, some species may not be monitored effectively in this way. Plants that have mealybug damage or are otherwise unhealthy, should be examined more carefully. Use a x10 or x20 hand lens where necessary and examine areas that mealybugs are likely to hide on the plant (joints between branches and other crevices). Detecting root mealybugs always involves taking plants out of pots and checking root health. This should be completed as part of regular plant health monitoring.

Once mealybugs have been observed, check for the presence of egg masses and crawlers. This is important as it indicates that populations will increase quickly if management actions are not taken. The proportion of different life stages present, most notably crawlers, may also change the exact actions taken; crawlers are susceptible to pesticides, but other stages are more tolerant.

## Management of mealybugs

Management of mealybugs should focus on preventing infestations and managing populations before they cause economic loss. Mealybugs are notoriously difficult to control once established as they hide in cryptic areas of the plants and tolerate many pesticides. Fortunately mealybugs can be managed effectively if nursery managers are proactive. These management actions include cultural, chemical and biological control options.



**Fig. 4.** Pink hibiscus mealybug (*Maconellicoccus hirsutus*) on stems and leaves of hibiscus, photos by Florida Department of Agriculture and Consumer Services, Buwood.org



Cultural management practices minimise infestations by mealybugs (and other scale insects).

- Always inspect new stock carefully, particularly host plant species that are prone to attack from mealybugs (and other pests and diseases). Inspect all plant parts, including roots for any signs of pests.
- Monitor plants regularly, including roots. Plant species that are prone to mealybugs (or other pests) should be monitored more consistently. Refer to monitoring section.
- Remove plants with heavy infestations, taking care to reduce spread of mealybugs while doing so. If infestations are limited to a particular branch and it can be pruned, remove this plant material and monitor closely to ensure the rest of the plant is clean.
- Remove crop debris and disinfest the growing area after removing a consignment of plants that have had mealybugs with a suitable product, e.g. farmcleanse, bleach or similar product. Mealybugs can survive for weeks on crop debris and in egg masses that have fallen off plants. This practice will also reduce other pests and diseases that may be lingering from previous crop cycles.
- When only a small number of plants are present with a low rate of infection, squash mealybugs and egg batches. Squashing large numbers of mealybugs may irritate skin, but can be avoided by using rubber gloves. The presence of a small number of individuals should prompt regular and rigorous inspections of the consignment.
- Avoid movement of infested plant material within the growing area.
- Avoid staff movement in areas known to be infested with mealybugs and other pests. If necessary, disinfest clothing and equipment after working in such areas.
- Provide an optimal growing environment, including appropriate nutrition, water, growing media and other conditions; weak plants are more susceptible to damage at lower populations of pests.
- Control ants as they spread crawlers and protect mealybugs from natural enemies.
- Thoroughly disinfest recycled pots to avoid transferring eggs and nymphs from crop to crop.
- Only propagate from clean mother stock plants. In other words, do not take cuttings from plants that have mealybugs (or other pests) present. Even one crawler on a cutting (which is virtually impossible to detect) will multiply the problem significantly.
- Keep the growing area and surrounds free of weeds.
- Ensure adequate plant spacing. This allows greater air movement and increases pesticide coverage. It also reduces ideal environments for mealybugs to develop and increases the ease of detection.

### Biological control

There are a number of natural enemies that can be used to manage mealybugs including commercially available predatory insects and naturally occurring parasitoid wasps and predators. There are also a range of fungi and bacteria that may infect and kill mealybugs, although these are less likely to substantially reduce populations unless they become very abundant. Almost all pesticides will negatively impact predator populations. It is recommended to seek advice from the biological control agent producer prior to releasing a predator for the first time so that their release is optimised. If pesticides have been applied, ensure that a sufficient time period has been elapsed before releasing predators. This information can be found online or from the biological control agent producer.



**Fig. 5.** *Cryptolaemus montrouzieri* larva (below) feeding on a mealybug (photo by Sonya Broughton, WA Ag, Bugwood.org).

### **Cryptolaemus - *Cryptolaemus montrouzieri***

*Cryptolaemus* (pronounced: Crip-toe-lee-mus mon-tro-zee-ee) is an Australian native ladybird that is widespread and feeds on a range of mealybug species. It is commonly known as the mealybug destroyer. Both larvae and adults feed on mealybug, and can be used to control mealybug infestations, hence its common name. Adults are about 4mm long, oval in shape with an orange head and black wing covers. Adults and small larvae only feed on eggs and very small mealybug nymphs; larger larvae feed on larger mealybugs including adults. Larvae are covered with white waxy filaments, making them very similar in appearance to mealybugs, but are more mobile and appear to have banding along their body. When carefully removed from the plant, they can be turned over to see their well-developed legs and chewing mouthparts. Females can lay up to 10 eggs per day directly into mealybug egg masses and up to about 500 eggs over their lifetime. The lifecycle of *Cryptolaemus* takes about 4-7 weeks from egg to adult, depending upon temperature and food source. They will also consume some soft scales when more preferred food is not available. It is commercially available from Bugs for Bugs.

### **Green lacewings – *Mallada signata***

The green lacewing has a relatively wide host range, feeding on aphids, spider mites, various scales, mealy bugs, moth eggs and small caterpillars as well as whitefly species. Pollen and nectar can also be ingested. Larvae, but not adults, are predacious. Adults have a green body and hold their transparent wings tentlike over their body and feed on pollen and nectar. Females live for 3-4 weeks and lay up to 600 eggs. Almost all lacewing species are predators and often lay their eggs on thin white stalks with a bulbous white egg at the end; most species lay multiple eggs in the same area, most often in a straight or roughly straight line or in a horseshoe arrangement. Green lacewing larvae grow to nearly 1 cm in length before pupating and typically place the remains of their prey on top of spines protruding from their back. In fact, research suggests that green lacewing larvae with trash-packages are more active and forage more efficiently, while those without trash-packages are more likely to become inactive. After about 12 days, larvae pupate and emerge as adults about 9 days later. Females must be about 7 days old before laying their first egg.

Green lacewing is well adapted to relatively warm conditions and very sensitive to persistent and or broad spectrum chemical applications, although reduced risk pesticides have a relatively minor negative effect on this insect. Green lacewing is commercially available from Bugs for Bugs.



**Fig. 6.** *Cryptolaemus montrouzieri* adult (above - photo by Dan Papacek), green lacewing adult (middle - photo by Sonya Broughton, WA Ag, Bugwood.org), green lacewing larva (below—photo by Dan Papacek, Bugs For Bugs).



### Citrus mealybug parasite – *Leptomastix dactylopii*

Originally from South America, this small brown wasp (about 3mm long) has distinctive, long antennae, similar in length to the rest of its body. It is a parasitoid wasp, laying its eggs in citrus mealybug only. This species is extremely efficient in finding and parasitising citrus mealybug, even at low densities, but will not attack other species of mealybugs.

Adults live for about a month and can lay about 80 eggs over her lifetime. Females lay their eggs in large mealybug nymphs or adults that have not started to lay eggs. Larvae develop inside mealybugs, which probably stop feeding and will not lay eggs to be laid once parasitised. Eventually, the mealybug changes to a 'mummy', being oval, bloated and legless. Adults wasps emerge from mealybugs after about 2-3 weeks, starting their life cycle over again. This species is available commercially from Bugs for Bugs.



Fig. 7. *Leptomastix dactylopii* adult

### Chemical control

Mealybugs are difficult insects to manage using pesticides alone. Contact products tend to slough off their waxy body and they may be tolerant to systemic products. If pesticides are to be used to manage mealybugs it is recommended to apply contact products only when there is a high proportion of crawlers present. Crawlers are very susceptible to many pesticides, including oil-based products. If high populations of large mealybugs are present a systemic product will be required, perhaps combined with an oil or detergent-based product if this will not cause a phytotoxic reaction to the plant. Also, consider modifying the way that pests are managed, such that monitoring is conducted more frequently; increase the use of cultural management options.

Consecutive weekly pesticide applications will almost always be required if using pesticides to manage mealybugs. Even then, total control may not be achieved. It is always recommended to rotate between active ingredients from at least three different mode of action groups. This will reduce the likelihood of inducing pesticide resistance substantially.

Pesticides will almost always significantly reduce predator populations. Some products can be active against predators for months after application, but have limited or negligible impact on pest populations after the initial application. Therefore, carefully consider whether it is necessary to apply pesticides, particularly when they have a long residual impact on predator populations. Cryptolaemus and green lacewing are very effective predators that should be considered instead of applying pesticides.

With that said, there are a number of insecticides that are registered against mealybugs relevant to production nurseries. Some products have a general nursery stock registration, others may only be registered on a subset of species grown in the nursery production sector. Table 1 summarises products specifically registered against mealybugs. However, mealybugs are scale insects. Therefore products registered against scale insects may be legally applied to mealybugs (refer to the [scale insect factsheet](#) available at the NGIA website). Always ensure that you read the label and that it fits your exact situation; not all active ingredients listed in Table 1 are registered in all states or on all nursery plants. Refer to the nursery [pesticide application best practice manual](#) for more information.

### Further reading

Llewellyn, R. (Ed). 2000. *The Good Bug Book*, second edition. Integrated Pest Management Pty Ltd., Richmond, NSW.

Goodwin, S., M. Steiner, R. Parker, L. Tesoriero, G. Connellan, E. Keskula, B. Cowper, A. Medhurst, and C. Rodriguez, C. (2000) *Integrated Pest Management in Ornamentals: Information Guide. Horticulture Series: Agrilink, your growing guide to better farming*. Manual. Agrilink Series QAL0004, Queensland Horticulture Institute. Brisbane, Queensland. Available at: <http://era.daf.qld.gov.au/2208/6/005-ipm.pdf>



**Table 1.** Active ingredients registered against mealybugs relevant to Australian production nurseries. Also see general registrations against scale insects in the scale insect fact sheet.

Mode of action group	Active ingredient	Example product name	Registration information	Mobility <sup>1</sup>	Toxicity to beneficials <sup>2</sup>
1A	Carbaryl	Bugmaster	Mealybugs on raspberry only	C	H – 4+ weeks residual
1B	Chlorpyrifos	Lorsban	PER14547 Pseudococcus mealybugs on persimmon only; PER14240 all mealybugs on bananas; mealybugs on apples and pears, coffee, duboisia, pineapple, cucurbits and grapes, citrus mealybug on citrus. Labels vary.	C	H – 2-4 weeks residual
1B	Diazinon	Diazinon	All mealybugs on nursery plants.	C	H – 2-3 weeks
1B	Fenthion	Lebaycid	All mealybugs on ornamental crops.	S	H – 2-4 weeks, probably longer
1B	Methidathion	Suprathion	All mealybugs on ornamentals, trees and shrubs in nurseries, also selected fruit crops.	C	H – at least 3-4 weeks
1B	Methomyl	Lannate	Citrus mealybug on citrus only.	S	H – at least 1 week, probably much longer
1B	Omethoate	Folimat	All mealybugs on selected ornamentals and native plants.	S	Probably H, probably with a moderate to long residual period
2B	Fipronil	Regent	PER12983 Root mealybugs on non-food nursery stock. Drench or granular formulation.	S	H – at least 2 weeks, probably longer
3A	Beta-cyfluthrin	Tempo	Mealybugs on azaleas, hibiscus, pelargoniums and roses only	C	Probably H with at least 2-4 weeks residual
3A	Bifenthrin	Fivestar	Longtailed mealybug on Carnations and other ornamental plants and pears; labels vary	C	Probably H with at least 2-4 weeks residual
4A	Acetamiprid	Crown	Citrus mealybug on palms, orchids and other ornamental plants; PER13831 Mealybugs on date palms only as drench or foliar application	S	H – probably for 2-4 weeks, perhaps longer
4A	Clothianidin	Samarai	Longtailed and tuber mealybug on apples and pears.	S	H – probably for at least 3 weeks.
4A	Imidacloprid	Confidor	PER13794 all mealybugs on date palms and ginger only; all mealybugs on shrubs, plants and ornamental trees; citrus mealybug only on ornamental plants. Labels vary.	S	Foliar spray: H – at least 2-4 weeks Drench: L – no residual
4C	Sulfoxaflor	Transform	Certain mealybugs on citrus, grape and pome fruit.	S	Not known
9C	Flonicamid	Mainman	Tuber mealybug on apples only.	S	L – no residual
16	Buprofezin	Applaud	PER14769, all mealybugs and scale insects on nursery stock and non-bearing fruit trees	T	L-M – 2-3 weeks residual for <i>Cryptolaemus</i> , no residual for green lacewing or <i>Leptomastix</i> .
NA	Paraffin/petroleum oil	Various	Specific mealybugs on particular crops. Labels vary.	C	L-M – no residual
NA	Potassium salts of fatty acids	Natrasoap	All mealybugs on most nursery plants	C	Not known, probably L-M with a short residual period

<sup>1</sup> C = contact, S = systemic, T = translaminar; L = low, M = moderate, H = high.

<sup>2</sup> Information was obtained from the [Kopert](#) and [Biopest](#) side effects website and Llewellyn (2000).

This document was prepared by Andrew Manners and John Duff (Agri-science Queensland, Department of Agriculture and Fisheries, Ecosciences Precinct, GPO Box 267, Brisbane QLD 4001) as part of NY11001 Plant health biosecurity, risk management and capacity building for the nursery industry in 2015. Thanks go to Lindy Coates for helpful comments on previous versions of this factsheet. Photographs in this factsheet have been taken by DAF staff unless otherwise acknowledged.

## **Pests and Diseases**

### **Pests and Diseases**

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#### **APHID**

Small delicate pear-shaped insects with soft bodies and long legs and antennae. Usually greenish or black, with or without transparent wings. Found in small colonies sucking sap of tender growths or flower buds. Often attended by ants. Transmitters of viral diseases.

#### **Treatment:**

Chlorpyrifos (Chlorpyrifos, Dursban) as a full cover application when necessary.  
Mercaptothion (Malathion, Malasol) as a full cover application when necessary.

#### **LILY BORER**

Black caterpillar with yellow bands. Feeds on leaves and tunnels into leaves, stalks and bulbs of various lilies and amaryllids.

#### **Treatment:**

Cypermethrin (Garden Ripcord) as a full cover application when pest is noticed.  
Deltamethrin (Decis) as a full cover application when pest is noticed.

#### **MEALY BUG**

Small 3mm long oval-shaped light-pink bodied stationary insect covered by waxy threads with 2 long threads protruding. Found on tender growth. Heavy excretion of honeydew can cause growth of mould. Often attended by ants. Transmitters of viral diseases.

#### **Treatment:**

Chlorpyrifos (Chlorpyrifos, Dursban) as a full cover application when necessary.  
Mercaptothion (Malathion, Malasol) as a full cover application when necessary.  
Pyrethrin/Fatty acids (natural insecticide) as a full cover application when necessary.

## **RED SPIDER MITE**

Minute reddish-brown "spiders" with four pairs of legs of equal length and oval body. Weave a web on the underside of leaves. Eggs creamy white. Cause yellowing and bronzing of the leaves.

### **Treatment:**

Chlorphenapyr (spidermitespray) as a full cover-application.

Chlorpyrifos (Chlorpyrifos, Dursban) as a full cover application when necessary.

Tetradifon (Red spidercide) as a full cover application when pest is noticed. Kills eggs and sterilises females

## **SLUGS AND SNAILS**

Greyish-brown slimy legless soft-bodied creature. With (snail) or without (slug) coiled shell. Leaves a shiny trail of viscid secretion. Feed on young succulent growth of a great variety of plants. Active only under damp conditions.

### **Treatment:**

Metaldehyde Carbaryl (Snailbait) scatter bait around.

Methiocarb (MesuroI) scatter bait around.

Carbaryl/Metaldehyde (Snailflo) apply evenly as a drench over plants and pots

## **THRIPS**

Minute insects with four long narrow fringed wings. Immature stages yellowish. Adults dark and very active, having the habit of turning up the abdomen. In order to feed they rasp the plant surface causing small silver blotches. Transmitters of viral diseases.

### **Treatment:**

Mercaptothion (Malathion, Malasol) as a full cover application when necessary.

Gamma BHC (Bexadust) as a dustable powder over plants and affected areas.

## **WHITEFLY**

Small four-winged insects. Wings and body covered by fine white powder. Larvae minute oval-shaped and covered with short white waxy filaments. Suck sap from underside of leaves.

**Treatment:**

Pyriproxyfen (Whitefly insecticide) apply as indicated

Cypermethrin (Garden Ripcord) as a full cover application when pest is noticed.

Deltamethrin (Decis) as a full cover application when pest is noticed.

**SNOUT BEETLE**

Brownish-black weevils, with the head elongated into a distinct snout. Feed mainly at night and damage leaves and bracts. Especially problematic in the Cape.

**Treatment:**

Mercaptothion (Malathion, Malasol) as a full cover application when necessary.

**FUNGAL AND BACTERIAL DISEASES**

Various pathogenic organisms externally present on the seed, plants or in the soil. They are the causes of diseases like seed rot, root rot, damping-off, rust, leaf spots and bacterial rot.

**Treatment:**

Copper oxychloride (Virikop) apply as a drench to soils 1.5l per square metre (for bacteria and fungus)

Furalaxyl (Fongarid) apply as a drench to seedlings and cuttings in pots or beds. (for fungus)

Zineb (Zineb) apply as directed. Controls various leaf spots. (for fungus)

**VIRUS**

Viruses are microscopic organisms consisting of pieces of nucleoprotein, which have to multiply in living tissue. Virus particles can be transmitted by seed, infected gardening equipment, soil and various insects

**Treatment:**

No treatment available

Suspected plants/propagating material should be destroyed.

**Frikkie Marais**



# PESTS AND MINERAL DEFICIENCIES AFFECTING CLIVIA

## PESTE EN MINERAAL TEKORTE WAT CLIVIA BEÏNVLOED



1. Scale. The white spots are immature insects / *Dopluis*. Die wit kolle is onvolwasse insekte.
2. Mealy bug / *Witluis*.
3. Whitefly on an impatiens leaf / *Witvlieg op 'n impatiensblaar*.
4. Leaf miner tunneling below the epidermis of the leaf / *Bladmyner tunnel tussen die boonste en onderste epidermis van die blaar*.
5. Loopers rasp away the upper side of the leaf / *Landmeters rasper die bokant van die blaar af*.
6. Tearing of the scape possibly caused by potassium deficiency / *Skeur van die bloeisteel moontlik as gevolg van kalium tekort*.
7. Leaf curled to the back possibly as a result of too frequent use of triazoles. a) Back view and b) front view / *Blaar krul na agter moontlik as gevolg van te dikwels met triasole gespuit. a) Agterkant en b) voorkant van blaar*.
8. Sun damaged leaf / *Sonbeskadigde blaar*.
9. Snail damaged root of clivia / *Slakbeskadigde wortel van clivia*.
10. Snail on underside of leaf / *Slak op die onderkant van die blaar*.
11. Snail damaged underside of leaf / *Slakbeskadigde onderkant van die blaar*.
12. Snail damaged flower / *Slakbeskadigde blom*.
13. Snail damaged seeds / *Slakbeskadigde sade*.
14. Damaged leaf in front of Grasshopper / *Sprinkaanbeskadigde blaar voor die stinksprinkaan*.
15. Leaf eaten by snout beetles / *Blaar deur snuitkewer gevreet*.
16. Leaves eaten by snout beetles / *Blare deur snuitkewer gevreet*.
17. Eggs and hatched lily borer larvae (black dots) on the underside of a leaf / *Eiers en uitgebroeide lelieboorderlarwes (swart kolle) aan die onderkant van die blaar*.
18. Damaged caused by hatched lily borer larvae visible on the upper side of the leaf / *Skade veroorsaak deur die uitgebroeide lelieboorderlarwes sigbaar aan die bokant van die blaar*.
19. Moth, pupa and larva of the lily borer bred in captivity. The preserved lily borer moth (right) showing the light colour of the second pair of wings and the dark spot on the front wings / *Mot, pupie en larwe van die lelieboorder in gevangenskap geteel. Die gepreserveerde lelieboordermot (regs) toon die ligter agtervlerke en die donker kol op die voorste vlerke*.
20. Larva of the lily borer eating between the epidermis of the upper and underside of the leaf / *Larwe van die lelieboorder wat tussen die boonste en onderste epidermis van die blaar vreet*.
21. Early season lily borer larva eating towards the rhizome / *Vroeë seisoen lelieboorderlarwe wat in die rigting van die risoom vreet*.
22. The smaller late season lily borer larvae / *Die kleiner laat seisoen lelieboorderlarwe*.
23. Lily borer feast / *Lelieboorderfees*.



# DISEASES AFFECTING CLIVIA SIEKTES WAT CLIVIA BEÏNVLOED



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18



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22

1. Close-up of rust affecting variegated leaves especially the chlorophyll deficient parts / Roes aangetaste streepblaar veral op die chlorofilarm dele.
2. Rust affected seedling / Roes aangetaste saailing.
3. Reddish-brown wart-like lesions on the upper and underside of older leaves can be possibly ascribed to (a) rust or (b) nitrogen deficiency / Rooibruin vrattagtige letsels op die bo- en onderkant van ouer blare kan moontlik toegeskryf word aan (a) roes of (b) stikstof tekort.
4. Untreated *Rhizoctonia* infested plant after three months / Onbehandelde *Rhizoctonia* geïnfesteerde plant na drie maande.
5. Possibly (a) amaryllis stalk spot or (b) insect damage / Moontlik (a) amaryllis stalk spot of (b) insekskade.
6. Lichen on leaf blocking out light preventing the leaf to photosynthesise / Ligene op blaar blokkeer lig en voorkom dat die blaar fotosinteer.
7. *Erwinia carotovora* smelling of putrefaction / *Erwinia carotovora* wat aan 'n vrotreuk onderskei kan word van fungi.
8. *Erwinia carotovora*.
9. Leaves die back possibly as result of (a) malnutrition caused by *Fusarium* damaged roots; (b) *Macrophoma agapanthii*.
10. Close-up of leaf die back possibly caused by *Fusarium* or *Macrophoma agapanthii* / Naby foto van blaarafsterwing moontlik veroorsaak deur *Fusarium* of *Macrophoma agapanthii*.
11. Seedlings affected by *Fusarium oxysporum* / Saailinge besmet met *Fusarium oxysporum*.
12. Seedling kept too wet resulting in (a) *Fusarium oxysporum* attack or (b) damping off fungi such as *Pythium* / Saailing te nat gehou met gevolglike moontlike (a) *Fusarium oxysporum* infestasie of (b) verwelksiekte fungi soos *Pythium*.
13. The circular spread of the affected lesion is typical of a fungal disease / Die uitkringende geaffekteerde letsel is tipies van 'n fungussiekte.
14. Leaf infected by *Colletotrichum* / Blaar besmet met *Colletotrichum*.
15. Leaves infected by *Fusarium oxysporum* / Blare besmet met *Fusarium oxysporum*.
16. Collar rot possibly caused by *Fusarium* infection / Stamvrot moontlik veroorsaak deur *Fusarium* infestasie.
17. Mycelium and fruiting bodies on the roots of a fungal infected plant / Miselium en vrugliggame op die wortels van 'n fungusbesmette plant.
18. Virus infected plant showing physical signs on the leaves and flower / Virusbesmette plant wat fisiese tekens toon op die blare en blom.
19. Close-up of the flower (18) clearly showing colour break caused by virus infection / Naby foto van die blom (18) wat duidelike streperigheid in die kleur van die blom toon.
20. Colour breaking in flower possibly ascribed to (a) genetics or (b) virus / Streperige kleur van die blom is moontlik as gevolg van (a) genetiek of (b) virus.
21. Leaves and flowers of a virus infected plant / Blare en blomme van 'n virusbesmette plant.
22. Virus and fungal infected leaf / Virus- en fungusbesmette blaar.



<https://youtu.be/6a1fvStxuT0>

## 7 Reasons why you must have Clivia Plants

Manie Maree Clivias4africa – 5.03 minutes



<https://youtu.be/QhwHhdE6NvU>

## Plant Feeding Tips

Manie Maree Clivias4africa – 8.56 minutes



<https://youtu.be/K3aiTGc0TZI>

## Replanting Seedlings

Manie Maree Clivias4africa – 8.03 minutes

