Growing Clivias

A Reference Book on growing Clivias for Beginners and beyond

World renowned Authors, Breeders and Growers who have graciously allowed their articles to be published here for the betterment of everyone who wishes to go to the level in growing Clivia.

(in no special order)

- Helen Marriott, Australia
- Carrie Kruger, RSA
- Professor Mark Laing, RSA
- Graham Duncan, RSA
- Greg Anderson, Australia
- Clivia Society, RSA
- Bill Morris, Australia
- Alick McLeman, New Zealand
- Michael Barrett, Australia
- Yoshikazu Nakamura, Japan
- Tony Barnes, New Zealand
- Michael Loh, New Zealand
- Eddie Pang, Australia

Yoshikazu Nakamura

One of the most influential individuals in the international Clivia community is undoubtedly the Japanese breeder Yoshikazu Nakamura whose interest in Clivia spans approximately over 40 years.

Harold Koopowitz, Author of CLIVIAS [2002] aptly describes Nakamura as an “international ambassador” for Clivia, exposing and introducing Japanese Clivia in their myriad forms, flower colours, and plant shapes to other growers around the world.

Nakamura is considered to have the best collection of Clivias in the world.
Name: Monica Conquest
Species: Clivia miniata
Color: Yellow
Other traits: Green Throat;
Raiser: Kevin Walters
Breeder:
Ref: y2/2000
Country: Australia

Description: a Kevin Walters hybrid yellow that shows some green in the throat. Bred from ['Aurea' x Kewensis orange]

World renowned hybridist, Kevin Walters who passed away in 2012 was given his first Clivia by his grandmother when in primary school, was dux of his college, a founding member of the international Clivia Society in 1992 and later awarded life membership. Kevin was described as a specialist and champion of Clivias by the top Japanese Clivia breeder Yoshikazu Nakamura and was an associate of Dr Keith Hammett from New Zealand and Nick Primich from South Africa. A Clivia seed takes seven years to flower. In Kevin's own words "In 1979 I made another fortuitous cross — Aurea x a Kewensis orange. The Orange had been grown from seed abducted in a handbag from Kew Gardens. This cross gave 33% yellows which were, in the main, an improvement on Aurea in size and width of petals. One had a green throat and was later named Monica Conquest'
Welcome

to the 2nd Edition of the Reference Book for growing Clivias for Beginners and beyond.

This Edition is different from the 1st Edition in that more emphasis has been made on how Clivias are grown in different countries such as New Zealand, China and Japan.

As a Beginner or as a Learned Clivia grower, I hope that the information provides you with more enthusiasm to learn more about this special Species of flora that has engaged many of us for many years now and beyond.

My special thanks are extended to the many Authors within every Edition of the Reference Books. Spreading the love and information on the Clivia genera is beneficial to everyone with a green thumb.

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**Mealy Bugs**

*My sincere thanks to all Authors, above, for allowing me to publish with permission their expertise and knowledge and professionalism so any Beginner in growing Clivias is armed with the appropriate knowledge, to begin or extend their journey with Clivias and Interspecifics hybrids.*

*On behalf of everyone who downloads this edition, thank you.*

*Gary Conquest, Growing Clivias for Beginners and beyond.*
Bacterial Soft Rot of Clivias
by Mark Laing

Professor Laing is the Professor of Plant Pathology at the University of Kwazulu-Natal, Pietermaritzburg

Causal Organism:
A bacterium called Erwinia carotovora pathovar carotovora

Hosts:
The bacterium has many hosts, attacking any fruit or vegetable with a juicy, sugary head or stem. Commonly, this bacterium attacks cabbage, cauliflower, broccoli, lettuce, chicory, Swiss chard, carrots, parsley and celery. Another strain attacks potatoes, causing potato blackleg. It also attacks the bulbs of many Amaryllidaceae, especially if another agent such as the Amaryllis worm, has already attacked the bulb and made a wound into which it can enter. This year (2000) was extremely wet in summer, and several of my Clivia which were in a dense growing medium, have succumbed to this bacterium. The symptoms are initially a yellowing of one or two of the bottom leaves. On investigation, one finds a dark, watersoaked lesion (wound) at the base of the plant. This may spread right up infected leaves. As the disease progresses, it often completely dissolves the base of the plant and the root crown, so that the plant falls over, leaving the bundle of leaves lying horizontal (see photos overleaf).

It is a very serious pathogen of Arum lilies (Zantedeschia species), being transmitted in bulbs, cuttings and even tissue cultured plantlets. This year I also isolated it from the heads of Agapanthus flowers, in the bud stage, just before and after the bud opened up

Epidemiology and Disease Cycle

Ideal Weather Conditions:
Hot :30-40°C, and wet : summer rainfall

Carryover: The bacterium lives in the soil or in plant debris in between attacking hosts. It may also be carried in the gut of insect and snail vectors.

Infection process: It usually infects hosts through wounds made by insects, nematodes (eelworms), snails, birds or people. However, under ideal weather conditions, it infects without the need of injuries.

Vectors: (agents of movement): It is moved from plant to plant by insects (especially houseflies), snails, birds and people. It is also commonly moved on pruning secateurs or a knife for harvesting vegetables. Houseflies are perhaps the most efficient of its vectors. When this bacterium rots a plant, it does so with external enzymes (extracellular cellulases and pectinases), creating a smelly, soft, watery rot, to which flies are very attracted: a rotting cabbage really stinks. The flies feed on the semi-digested
plant, then fly off and settle on a nearby plant. There they clean themselves, which involves a regurgitation process, depositing thousands of bacteria on that plant, and initiating another infection process.

When snails feed on infected plants, they ingest copious quantities of the bacterium, then having moved onto fresh plants, defecate there. Their faeces may contain thousands of bacterial cells, which again initiate another infectious process.

I would guess that the *Amaryllis* worm can vector this bacterium, carrying the bacterial cells in its gut from the stage of caterpillar to adult moth, to transmission at egg laying. However, it is unlikely that it carries through into eggs.

Raindrops also splash-disperse bacteria between plants. This form of disease spread is usually over a distance of 1-2m, but in a heavy rainstorm, aerosols can form, carrying bacteria up to a one kilometre.

**Control on Clivias**

It can be difficult to control, if conditions suit the bacterium, i.e., under hot, wet conditions.

1. For outdoor plants, use a very porous growing medium so that no waterlogging ever occurs, even when heavy rains occur repeatedly. Waterlogging is probably the single biggest cause of this problem, creating a stressed plant, with roots dying from lack of oxygen. For indoor plants, make sure that one does not overwater the plants.

2. Have adequate shade levels, ideally under trees. Shade cloth does provide shade, but increases heating, especially black shade cloth, and this favours soft rot.

3. Control *Amaryllis* worm with weekly sprays of a pyrethroid insecticide such as alphamethrin or cypermethrin (Ripcord is available in South Africa in 100ml quantities for the home gardener). This spray will also control houseflies. Spray diseased plants with a pyrethroid to stop further disease transmission by houseflies. For example, this year I stopped the spread of soft rot of *Agapanthus* flowers by spraying cypermethrin onto *Agapanthus* flowers and buds, killing the flies that were moving the bacterium between plants.

4. Control snails with regular applications of snail bait.

5. Eliminate other diseased plants, and their debris from the garden (especially vegetables with soft rot). Compost the debris in a deep compost stack which gets hot. This will eliminate the harmful bacteria. Move compost heaps well away from *Clivia* plants.

6. This bacterium prefers plants with a high nitrogen fertilization, and high sugar content. Altering the fertilization regime is therefore an important part of controlling it in vegetable crops. The trick is to increase the ratio of calcium, magnesium and potassium to nitrogen
Close-up example of soft rot (Erwinia)

being applied. The first three
elements make for stronger cell walls,
making it harder for the bacterium to
break them down. Dolomitic lime is a
source of both calcium and
magnesium, and potassium can be
applied as potassium chloride or
potassium nitrate, or by using a 3:1:5
fertilizer (3N : 1P : 5K).

7. When using knives or secateurs to
harvest, prune or cut plants, the
cutting implements must be
sterilized between plants. Use a 70%
alcohol (use methylated spirits
diluted 7:3 with water), or Jik (3%
sodium hypochlorite) diluted 1:3 with
water to sterilize cutting surfaces.
This is clumsy, slow and difficult to
do in practice. But it is worth it if the
bacterium is present.

8. Where a Clivia plant becomes lightly
infected, remove the infected leaf or
leaves using a razor blade or scalpel.
Sterilize the blade between cuts using
one of the above sterilants. Doctor
the wound site directly with sulphur
dust or copper oxychloride dust.

9. Where the plant is severely infected
and has fallen over, remove it from its
pot. Remove any soft or dead tissue
from the base of the plant. Dust with
sulphur dust or copper oxychloride
dust. Plant into sharp silica sand
(swimming pool sand). Treat it like a
plant cutting, giving it frequent light
watering, and keeping it under 60-
70% shade. Clivias are remarkably
tough, and they recover quite well.
CLIVIA IN NEW ZEALAND – Part One

New Zealand has often been called “A Nation of Gardeners”, and there are several obvious reasons why.

By far the majority of N.Z.’s colonising settlers came from the British Isles during the mid to late 1800s, many of them from working class rural backgrounds seeking a better life with opportunities for improvement. There were also, however, members of wealthy families who bought huge tracts of land and built large country houses and surrounded them with large gardens, importing the plants they were accustomed to remind them of home. So the British love of plants and gardening, and the idea that it was an art form and part of their culture, was brought to NZ, while those with money, accustomed in their former homeland to having access to the wealth of new plants being discovered and introduced to the West at this time, continued to seek these, and bring them into their new country.

Stretching between 35- and 46-degrees latitude, NZ generally enjoys a temperate maritime climate with the majority of the country seldom experiencing summer daytime temperatures higher than 26 C or below 10 C in winter. Corresponding night-time temperatures are 15 C and 0 C. Rainfall is regular and year-round, with the wetter west coast of both islands receiving between 2500mm and 1500mm annually, while the drier east coasts receive about 750mm. We have a very high uv light intensity, lots of sunshine year-round, and fairly good soils, tending slightly to the acidic in most places.

So, for coastal parts of the South Island, and much of the North Island except the mountainous central area, summers are moist but not too wet and humid, and winters are mild and often frost free. Even within cooler parts of the country, most gardens have a sheltered, warm north facing spot with a microclimate that enables relatively tender plants to be grown. I have seen Clivia gardenii growing happily outside on a north facing slope in Dunedin, despite the fact that Dunedin receives brief winter snowfalls a couple of times a year. And Clivia miniata has been growing happily outside for decades against a north-eastern wall of the palm house at the Christchurch Botanic Gardens, suffering only light frostng of leaves in some cold winters.

In short, it is easy to garden in NZ, with a very benign climate, few extremes of either temperature or rainfall, reasonably good soil, and a history and love of gardening in our ancestry, along with the urge to be adventurous and try something new.

The first record I have been able to locate of Clivia being offered for sale in NZ is in an 1892 nursery catalogue of David Hay, whose Montpelier Nursery in Remuera was Auckland’s leading nursery for many years. Hay was an excellent plantsman, and also frequently corresponded with the great American plant hybridiser Luther Burbank, of Santa Rosa, California, from whom he may well have sourced plants.

“Clivia nobilis. A splendid bulb for pot culture. Produces a profusion of large crimson flowers. Highly recommended. 2/-.”

Listed under “bulbs and tuberous rooted plants”, it is interesting to speculate exactly what this plant was. The word “bulb”, and the “large crimson flowers” description are slightly off putting when thinking of clivias. My guess is that it was actually the miniata x nobilis hybrid Cyrtanthiflora, which has been sold in NZ for decades as C. nobilis, the misidentification only being recognised and rectified in the last twenty or so years.

Another reason for thinking the plant listed was in fact Cyrtanthiflora is that in Remuera/Parnell, the affluent suburb of Auckland where Hay had his nursery, very old clumps of both miniata and Cyrtanthiflora are relatively common. Miss Harrison-Smith, a 93-
year young gardener and member of our NZ Clivia Club, lived the first half of her life at her grandfather’s property in Remuera, close to where Montpelier Nursery was. She clearly remembers the nursery on Shore Road, and also recalls well established plants of both Miniata and Cynanthiflora in their garden when she was a child. I have found these two varieties in large old gardens, both public and private, in Tauranga, Hawkes Bay, Taranaki, Wanganui, Wellington, Nelson and Canterbury.

To the best of my knowledge, C. nobilis was not actually in NZ until imported by Keith Hammert and Terry Hatch, about twenty years ago. Lyndale Nurseries of Auckland imported seed of C. nobilis from Cape Seed and Bulb Co in South Africa in 1998 and sold approx. 1000 2yr plants to various growers around NZ. As far as I am aware, this crop is the only quantity of nobilis that has been sold commercially in NZ. I have never seen mature plants of nobilis growing in gardens, they have always proved to be Cynanthiflora, or occasionally gardenii.

The most widespread clone of miniata, both here and in Australia, is a narrow leaved, fairly rapidly clumping form, with soft apricot-orange flowers that have rather narrow gappy petals. It is undeniably attractive, but as the saying goes, familiarity breeds contempt, and it is often scathingly referred to by Clivia enthusiasts as “C. crappiata”. This form, along with Cynanthiflora and possibly gardenii, probably reached our shores via Australia over 100 years ago and would have been spread around the country largely by divisions swapped between keen gardeners.

Interestingly, the 1899 catalogue of David Hay did not list Clivia again, and in fact despite searching literally dozens of old nursery catalogues dated between 1895 and 1930 I have not located any other listings of Clivia. This would seem to suggest that they were not readily available, or greatly esteemed. Perhaps, because they are a slow growing and slightly tender evergreen perennial, they did not easily fit into the production techniques of either of the two main types of nursery (i.e. tree and shrub, or hardy bulbs and perennials). Maybe the fact that Clivia had lost popularity in Britain and Europe had something to do with it, or even because of their ease of cultivation in NZ they were not considered enough of a challenge to grow.

With gardening listed as the country’s number one pasttime from the 1920s right up until the 1990s, (when walking took over as No 1), every rural and urban community was awash with horticultural and gardening clubs, all holding seasonal shows where members vied enthusiastically with each other to win the cup for the biggest, brightest, healthiest and best grown chrysanthemum, dahlia, gladiolus, daffodil, iris, aster etc. People WANTED plants and flowers that they could lavish time and effort on, which would reward the grower with bigger better blooms. Clivia simply didn’t fit the bill.

So, for most of the 20th century Clivia lurked in dark corners of old gardens, forgotten and neglected.

R.E. Harrison’s bulb and perennial nursery was established in Palmerston North in 1920, and he was respected as NZ’s leading expert in this field for almost 50 years. His comprehensive “Handbook of Bulbs and Perennials for the Southern Hemisphere”, published in 1953, mentions miniata, nobilis, and “a most desirable yellow-flowered variety, deeper in colour at the throat, that is known as C. miniata ‘Aurea’”. Was this form already in NZ or had Mr Harrison seen it overseas, or perhaps simply read about it? It would seem the latter, as in his pictorial companion volume “Know Your Garden Flowers...Bulbs and Perennials”,

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published in 1967, he states..."Clivia miniata is usually found in this part of the world in the salmon-apricot-coloured form, but a range of other shades from pure yellow through orange to deep red is also grown abroad".

The October 1950 and June 1955 issues of The NZ Gardener magazine contained articles about them, the latter, more comprehensive one authored by R.E.Harrison, who encouraged the importation by airmail of different coloured forms by importing seeds from US and UK catalogues.

A few passionate plantmen scattered around the country, such as Dr Ray Freeman, and Max Goodie of Auckland, imported seeds from Schenkel in Germany, and caulescents from Gordon McNeil, about 30 years ago, while Felix Jury and Jim Schumacher of Taranaki and Stevens Nurseries of Wanganui appear to have done the same in the late 1950s or 1960s. Donald Odering of Oderings Nurseries in Christchurch tells me that he was importing seed from Hurst Seed Co in London during the 1960s, but that because they were slow plants to grow, and demand was not large, they didn’t do many, and few of his nurserymen colleagues could be bothered with them. Dave Austin of Kaitaia and David Thorns of Nelson both imported seed from Santa Barbara in California in the 1960s, and hybridised and sold plants locally for many years.

Clivia were seldom offered for sale (an old gardening friend in Taranaki, Mrs Gwen Masters, recalls purchasing her first three miniata plants from Pettigrew’s Nurseries in Stratford in the early 1940s), but tended to be swapped and exchanged among interested plant friends more as a curiosity than a plant of any value or real use. However, as society changes, so do peoples’ tastes in plants.

During the 1960s, 70s and 80s Dow Seeds of Gisborne, were importing seed from European growers, Antonia nurseries in California, and various sources in South Africa. At a similar time, Ken White of Parva Plants was obtaining Californian seed for his mail order plant business. Ken mentions going over to visit his Clivia breeder, who was very sick, and being given all sorts of “special” plants. However, Ian Duncalf, who bought Parva Plants from Ken a few years later, saw these plants and doesn’t recall them being anything special. Ian was given two plants, a red called “Volcano”, which flowers low in the plant, and a green throat.

Peter Lees, working for Barry McKenzie’s Topline Nurseries in the mid-late 1980s, was importing up to 50,000 seeds a year for a short time from Miyaki in Japan, and these were shared with North Shore Nurseries (Bryan King) and Model Nurseries (John Davies) of Auckland. These were broad-leaved, deep orange/red, and sold around NZ as Clivia “Grandiflora” when 2 years old. They were retailing at between $15 and $20 which most gardeners considered expensive at the time for a smallish plant. John Davies tells me that a couple of batches of variegated seed were also brought in, but germination was poor, and none were offered for sale.

Topline closed down soon after, but Peter Lees tells me that North Shore Nurseries have continued to source seed from Miyaki right up to the present, to provide plants for the Kings Plant Barn chain of garden centres New Zealand experienced a gardening boom and frenzy from the mid 1980s to the late 1990s, with three weekly gardening programmes on television, several gardening magazines, and a myriad of new nurseries opening to supply the seemingly insatiable demand for plants. Many plants that had been traditionally difficult to propagate,
and hard to obtain were tissue cultured, and suddenly available in large quantities. Everyone had to have a garden, even those who till now had not been remotely interested in knowing the difference between a protea and a pansy!

Keen gardeners began to break away from the historical European temperate style of gardening, seeking new and different plants, pushing the limit with subtropical plant types, and generally being more adventurous with plant associations and garden design. At last New Zealanders were developing a style of their own, fusing traditional plants and designs with the much brighter, luxurious and often flamboyant flora that would grow in our warmer conditions.

It was about now that nurserymen and plantspeople began to take a real interest in Clivia, especially the hybrid forms offered by overseas nurseries. I believe this happened more because they were not widely known or grown, and so regarded as “new”, than for their intrinsic beauty and easy care qualities, which have only really come to be appreciated about a decade later, after the bubble of gardening enthusiasm burst, and people realised that they’d been conned - gardens DID entail some work after all. Drat. Let’s forget the roses and pansies and look for plants that take care of themselves. Clivias!

It was at this time, too, that the clone named “Redgrove” appeared on the NZ market, one of the few named varieties to be marketed in NZ and also the first to be tissue cultured. There is a story attached to this, but for now let’s just say the planned release coincided with the demise of Topline, and that “Redgrove” was not a particularly noteworthy variety, merely one of the best available at a time when there wasn’t much around.

At this stage of the story many different people enter, and integrating the strands becomes tricky, rather like weaving a tapestry, or hybridising a line of plants. I think for clarity’s sake, (and my sanity), I will outline the broad picture, then tell you in greater detail later about individual Clivia personalities involved and where their stock came from. In the first part of this article (The Gardener’s Journal Issue 2) we looked at the history of Clivia in NZ, and how these beautiful South African plants were relatively unknown and unappreciated.

We continue the story at a time when their beauty and easy-care qualities are becoming recognised and generating a worldwide resurgence of interest and demand. Yellow Clivias were first offered commercially in quantity by Bruntwood Nurseries, who were supplied with plants by Ian Duncalf of Parva Plants. These were basically Solomone yellows, imported from Joe Solomone, California, USA. They hit the market in 2001.

Around the same time Keith Hammett began marketing his “Moonglow”, “Fireglow” and “Sunset Glow” strains, launching an ambitious growing and marketing strategy partnership to ensure a plentiful supply to meet the rising demand. Terry Hatch of Joy Plants had Clivia available, and Tony Barnes was selling a few hundred reds and Australian yellows annually from his Taranaki garden, Ngamamaku. Suddenly Clivia were the “in” plant, gaining good media exposure, and the gardening public were scrambling to obtain them.

When the NZ Clivia Club was formed, many other addicts who had been playing with their Clivia in isolation emerged. There was a focal point now, and these scattered individuals linked up and pooled knowledge and enthusiasm. Only since the Club’s inception, and with the help from the South African Clivia Society, have the gaps in our knowledge about the
plant been filled, and expanded. The club has been very active, bringing overseas speakers out to NZ, holding non-competitive shows in different parts of the country, initiating and funding some research into flower pigment, doing displays at various horticultural shows, organising social events and generally promoting and building up awareness of Clivia to the gardening public.

The NZCC has at present just under 200 members, and I don’t foresee this increasing dramatically soon as our population is small, and to the uninitiated Clivia do offer limited variation. However, this may change as interspecific hybrids become available, spreading the flowering season, and range of flower shape and colour.

I estimate that currently there are about 60,000 Clivia sold annually in NZ, with seed still being imported from South Africa, Europe, and USA as well as utilising NZ sourced material. Seed is generally sown in June, and seedlings sold by liner nurseries in 5cm pots at ten months old, for $1.20. At retail level, a 2-year plant in a 2-litre pot sells for about $12.00. Some plants are grown to flowering size, retailing at $25, but premium priced product is not in high demand.

There is currently a glut of Clivia available, brought about by overly optimistic estimates of the size of the market. While yellows were new, obviously demand was high, but there is now little premium for yellow plants as the novelty is gone, and large sales numbers have declined accordingly. Commercial nurseries need to work on space rental economics, and currently it is simply not profitable to grow Clivia to flowering size when the public are not prepared to pay a realistic price. Perhaps when the 2-year flowering strain from Belgium is introduced this may change.

The general public merely want a plant that looks pretty, or one that will do a job. They are not interested in breeding or background, and don’t seem to like orange, preferring red. There is general interest in pastels, peaches, green throats and variegates, but these are not yet available in retail outlets, and the few offered by specialist growers/breeders are quickly snapped up by collectors. Rare and novel plants are in demand, but the connoisseur market is extremely small, and not lucrative.

A few years ago, two yellow clones were successfully put into tissue culture by Sandra Simpson of Multiflora Laboratories. She found that good pupping varieties also multiplied well in tissue, but that others were very slow. Plants ex tissue had to command a high price, which was economic briefly, but now that demand for yellows has dropped, and the price of seed is also low, it is far more economic to grow from seed than tissue. Opportunity still exists to tissue exceptionally good plants, but only if there is a strong demand for that particular clone.

There is little enthusiasm among Clivia breeders and growers here to formally name plants. Because demand is not great, and clonal division would be so slow, it is not considered worth doing. I personally believe that unless a plant or flower is not different enough from others like it to be noticed from the back of a galloping horse, it does not warrant a name.

Who knows what the future of the Clivia is? Things will change radically within the next five years due to the huge increase of diversity in the gene pool. Seeds have been sourced by enthusiasts from all around the world, and amateur hybridists are frantically cross pollinating here just as they are in Australia, Japan, USA, South Africa and UK. Undoubtedly some
wonderful material will emerge from all these places, and yet the popularity of these glorious plants still depends upon the whim of the public at large.

The busy, instant, technological society of today is detrimental to general horticulture, and all the specialist plant societies are fading away. Folk don’t have time to garden any more, and many don’t have space either. Children find television, computers, mobile phones, and ipads more interesting than plants. They are not taught or exposed to the simple satisfaction and pleasure of growing things and being close to the natural world, because parents themselves have become too busy to garden. Very sad for society, but very good for the long neglected Clivia. A plant that is non-demanding, looks tidy and attractive all year, doesn’t quickly outgrow its allotted space, has beautiful flowers, and is a survivor. Perfect for the low maintenance garden of the future. Yahoo!! The Clivia makes a comeback and this time, I think, is here to stay!

Because of its favourable growing climate, New Zealand now has a number of introduced plants that have “escaped” from cultivation and established themselves in the wild to become serious noxious weeds. Many of them were originally ornamental garden plants, such as Agapanthus, and Tradescantia (commonly called Wandering Jew). Until recently it was relatively easy to import plant material into NZ, despite a strict quarantine requirement. This enabled a steady flow of new material to enter the country, and NZ plant breeders have a history of developing new plant varieties, many of which have generated great income for the country’s economy, e.g. Kiwifruit and Zantedeschia (Calla) lily tubers and flowers.

Courtesy of Tony Barnes, Taranaki, NZ. Email: tony.john@xtra.co.nz  
Clivia miniata

Common name: Natal Lily, Bush Lily, Kaffir Lily, Clivia, Fire Lily, the South Africa Lily

Family: Amaryllidaceae

Clivia miniata

Distribution and habitat:

*Clivia miniata* is a species of flowering plant native to damp woodland habitats in South Africa as well as in Swaziland. They are always found under tree cover in evergreen forests, growing in well-drained leaf mould rich with humus between boulders on slopes, but occasionally they may be found growing in the fork of a tree. The habitat may vary from subtropical coastal forest to ravines in high altitude forest. The *Clivia miniata* grows in dappled shade, often in large colonies.

Description:

*Clivia miniata* will develop into impressive plants, but only if they are given a cool winter rest. They grow to a height of around 80cm (31 inch) with an underground fleshy stem consisting of a compact rhizome, which only rarely becomes aerial when plants are very old. Their dark green, strap shaped leaves, which vary in width from narrow to over 8cm (3 inch), fan out from a leek like base consisting of a thickly layered leaf based. The spread of a single plant can exceed 90cm (35 inch).

Roots are so tick and flashy that they quickly fill the pots, and some will appear on the surface of the potting mixture. In late winter thick flower stalks up to 45cm (18 inch) long begin to push up between the leaves – always slightly off-centre and each stalk will carry up to 15-20 trumpet-shaped flowers, each 5-8cm (2-3 inch) long, in the early spring, but sporadically at other times of the year. Flower colour is usually a combination of yellow and bright orange red, but pure yellow and apricot coloured varieties are occasionally seen. The flowers are reported to have a faint, but very sweet perfume.

*Clivia miniata* are slow growers, so expect approximately 2-5 years for full maturity. Each stem produces one flower stock and over time produces multiple clumps, creating a magnificent
Clivia miniata

flower display that lasts for weeks. The fruits are bright orange when ripe (or golden in the case of the yellow flowered plants). The pulp should be removed from the seed when are prepared to be sown. The seeds are large with a pearly sheen and should be sown fresh for best results.

**Houseplant care:**

*Clivia miniata* is a familiar house plant, long lived and fairly easy to grow and maintain. When it is in bloom, do avoid moving the plant. Wipe off the leaves with a damp cloth to keep them dust-free and shiny.

Flower trumpets fall as they fade, leaving behind embryo fruits. Remove these with a razor blade to prevent them from developing. If the embryo fruits are allowed to remain, they will grow large and absorb so much of plant’s energy that the *Clivia miniata* will be unlikely to flower the following spring. When the flower stalk begins to walter, pull them out from the cluster of leaves.

**Light:**

A window position that gets bright light with early mornings or late afternoon sun is ideal for cultivation of *Clivia miniata*. Midday sunlight can scorch the leaves. Too little light can result in a lack of flowers. They also enjoy a period of time outdoors at summertime in a shaded position and protected from the heavy rain.

**Temperature:**

Though *Clivia miniata* thrive in warm rooms during the active growth period, they must be given a short early winter rest period – six to eight weeks – ideally at a temperature slightly below 10°C (50°F). If this is not possible, they may be forced into premature bloom, with flower stalks failing to rise above the foliage. Too much warmth also shortens the life of the flowers. Avoid mist spraying these plants to keep excess moisture off the leaves.

**Watering:**

During spring and summer water plentifully, as much as necessary to keep the potting mixture thoroughly moist, but gradually reduce the amounts in the autumn and keep *Clivia miniata* almost dry during the rest period. When flower stalks appear towards the end of the winter, begin a gradual increase in quantity and frequency of watering. Over-watering will cause root rot and kill the plant.

**Feeding:**

Give *Clivia miniata* applications of a liquid fertiliser once every two weeks, beginning when flower stalk are half developed and continuing until a month before watering is curtailed.

**Potting and repotting:**

Use a soil based potting mixture. Repot *Clivia miniata* only every three to four years; they flower best when pot bound. Move a *Clivia miniata* plant into a bigger pot only when the roots fill the pot. Top dress in years when plants are not moved into bigger pots. Make sure to pack the potting mixture firmly around the thick roots and leave 5cm (2 inch) between the surface of the potting mixture and the rim of the pot, because the growing roots will force the potting mixture
Clivia miniata

upwards. These plants can become top heavy, so it is best to use clay, not plastic pots. As a plant develops, it can be moved progressively into pots that are about 5cm (2 inch) larger.

When maximum convenient size – probably 25cm (10 inch) – has been reached, top dressing every year is advisable. Carefully scrape away about 5cm (2 inch) of the old potting mixture and replace it with fresh potting mixture which have been enriched by sprinkling of a substance such as bone meal. Both repotting and top dressing are best done in late winter, just as flower stalks begin to develop.

Gardening:

*Clivia miniata* grow well outdoors in a mild frost-free climate. These plants are frost-sensitive and may be damaged if in a position that is exposed to cold winds especially. It takes a long time for the damage to grow out if this happens, so it is best to select a sheltered site.

The dark green, strap like leaves of *Clivia miniata* plants are attractive all year round and they slowly expand to form an excellent, low-maintenance groundcover in difficult shady spots. After flowering, remove spent flower stems near the base, unless seed is required.

Position:

*Clivia miniata* plants thrive in shade, even quite deep, dry shade; in fact, their foliage and flowers will suffer if grown in too much sun. Protect them from milder frosts and hot sunlight by planting them under a tree or shrub canopy.

Soil:

Good drainage is essential for *Clivia miniata* plants. Before planting them into the ground, improve the soil incorporating in some well-rotted compost and a small amount of slow release fertiliser. *Clivia miniata* planted in beds will benefit from a thick layer of organic mulch such as well rotted compost, annually.

Irrigation:

*Clivia miniata* appreciate watering in spring and summer during dry spells in their early days but are tough and undemanding once established. Twice a week deep watering is enough for these plants during the active growth period and do not water them during the winter. Once they are established, they are remarkably drought hardy.

Fertilising:

Feed immediately after flowering with a general-purpose fertiliser. Generous amounts of slow release organic fertiliser (such as blood & bone) applied regularly from early Spring to mid-Summer achieves maximum growth.

Propagation:

To propagate, use the offsets that emerge through the tangle of the roots. Make sure to detach each offset carefully at the point where it meets the parent plant. Use a long, sharp knife. The best time to detach an offset is immediately after the last flowers of the season have dropped.
Clivia miniata

off. but not before the offsets comprises at least three leaves 20-25cm (8-10 inch) long. Plant it
in an 8-12cm (3-5 inch) pot containing an equal parts mixture of peat moss and coarse sand or
perlite and keep it warm in medium light. Water it sparingly, enough to make the potting mixture
moist, but allowing the top two-thirds of the potting mixture to dry out between watering. When
roots appear on the surface of the mixture, move the young plant into a soil based potting
mixture in a pot one size larger and treat it as an adult Clivia miniata. It will generally flower
about a year after being detached from the parent plant.

When propagated from seed can take up to three or five years for plants to flower and may vary
in colour. Seed will germinate in six to eight weeks at a temperature of 21°C (70°F), sown just
under soil surface (not deep), singly in 8cm (3 inch) pots of moistened standard seed mixture.
They may remain in these initial pots for up to two years before they are large enough to plant
on. Old plants can also be broken into separate crowns with the aid of a stout knife and potted
up in 10 or 12cm (4-5 inch) pots. In doing this be careful not to damage the fleshy roots.

Problems:

When grown outdoors. slugs and snails can destroy the leaves and flowers.

**Treatment:** These pests are controlled using an appropriate molluscicide, both pellet and liquid
forms or by hand pick at regular inspections.

The **black and yellow striped amaryllis caterpillar** (also known as the lily borer) can cause a
lot of damage to the whole plant in a very short time and should be dealt with promptly.

**Treatment:** Use a suitable pesticide following the instructions on the label. They can also be
picked off by hand and destroyed.

Conspicuous tufts of white, waxy wool appearing on the leaves indicates an infestation of
mealybug, which may be troublesome.

**Treatment:** Use appropriate systemic insecticides. Alternatively, remove mealybugs with an
alcohol saturated cotton swab or wash plants with soapy water.

Watch for infestations scale insects and spider mite.

**Treatment:** If infestation is localized, remove scale insects by wiping affected areas with a
cotton swab dipped in rubbing alcohol or dipping the plant in a solution of soapy water and
alcohol. Control spider mites with a suitable acaricide.

**Aphids, white fly and thrips** will cause a lot of damage if they are plague numbers.

**Treatment:** Use a systemic insecticide to disrupt their life cycle. Follow the instruction on
insecticide label.

**Nonflowering** can be due to inadequate feeding, over-watering that leads to water logging or
under-watering.

**Treatment:** To check, knock the plant out of its container. Any dead or rotten roots should be
Clivia miniata
cut away and sour, waterlogged compost replaced. It is best to err on the side of dryness for the health of the plant.

*Brown patches on leaves* may be due to scorching. This can occur when light is refracted through windows or water droplets collect on leave surface.

Where plants *flower on short stalks and the blooms are hidden by foliage*, the cause is likely to be an insufficient cool period over the winter. During the winter period keep plants at a temperature of 10°C (50°F).

**Toxicity:**

*Clivia miniata* contains small amounts of lycorine, making it poisonous. Ingested in large amounts can be dangerous.

**Companion plants:**

The lively colour of *Clivia miniata* flowers combines well with other hot coloured blooms of mid-late winter and early spring which grow in part-shade, such as Camellia japonica (red camellias), Abutilon, Tropaeolum species (nasturtiums) or Justicia rizzinii (golden shrimp). The startling and unusual flower of the Scadoxus puniceus (South African paintbrush lily) appears at exactly the same time as the *Clivia miniata* and enjoys the same garden conditions. The colour of the *Clivia miniata* is also an effective partner to shade-tolerant blue or purple flowers, such as Hyacinthoides non-scripta (blubells), Brunfelsia species or Streptocarpus saxorum (sometimes called the nodding violet). In small gardens, the same colour combination can be achieved by growing *Clivia miniata* in a bright blue pot.

Grow *Clivia miniata* with Cryptanthus (earth star), Dieffenbachia species (dumb canes) and Schefflera elegaantissima (false aralia) in pots or plant it with Ficus benjamina (weeping figs) and Peperomia obtusifolia (blunt leaf peperomias) for at least three shades of green in one vignette.

**Uses and display:**

*Clivia miniata* are popular as garden plants where the climates conditions allow. These plants are extensively planted as border plants in beds or used as mass plantings. Both their leathery, deep green leaves and their showy flowers have esthetic impact in landscape. Also, they are spectacular container subjects for indoor or on shaded patios.
### CLIVIA Spraying Guide – Fertiliser/Insecticide/Fungicide/Systemic solutions

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>BRAND NAME</th>
<th>QUANTITY</th>
<th>DOSAGE</th>
<th>PEST</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regel Imidacloprid 200SC Systemic Insecticide</td>
<td><a href="http://www.specialistsales.com.au">www.specialistsales.com.au</a> Toowoomba Qld</td>
<td>1 Litre</td>
<td>Free Postage - a ‘Confidor’ equivalent</td>
<td>Thrips, Mealy Bug, Aphids</td>
<td>Systemic Insecticide</td>
</tr>
<tr>
<td>Thrive All Purpose Soluble Fertilizer</td>
<td>Yates</td>
<td>500gms</td>
<td>2 spoons = 9 Litres</td>
<td></td>
<td>Fertiliser</td>
</tr>
<tr>
<td>CONFIDOR</td>
<td>BAYER</td>
<td>200ml = 60 Litres</td>
<td></td>
<td>Mealy Bug</td>
<td>Insecticide</td>
</tr>
<tr>
<td>Insect Destroyer (Natural Pyrethrum)</td>
<td>KENDON</td>
<td>250ml</td>
<td>20ml/1 Litre</td>
<td>Mealy Bug</td>
<td>Insecticide</td>
</tr>
<tr>
<td>SUCCESS Ultra (Insect Control)</td>
<td>Yates</td>
<td>200ml</td>
<td>5ml/1 Litre Makes 40 Litres</td>
<td>Caterpillars, Thrips</td>
<td>Insect Control</td>
</tr>
<tr>
<td>FUNGUS GUN (Systemic Fungus Control)</td>
<td>Yates</td>
<td>750ml</td>
<td>Prepared ready</td>
<td></td>
<td>Systemic Fungicide</td>
</tr>
<tr>
<td>CHARLIE CARP (All Purpose Fertilizer)</td>
<td>Charlie Carp</td>
<td>1 Litre</td>
<td>1 Litre = 300 Litres</td>
<td></td>
<td>Fertiliser</td>
</tr>
<tr>
<td>LIQUID Potash (Fruit &amp; Bloom Booster)</td>
<td>Searles</td>
<td>250ml</td>
<td>Makes 500 Litres</td>
<td></td>
<td>Fertiliser</td>
</tr>
<tr>
<td>MAXGUARD (Systemic, Contact &amp; Residual Insecticide Concentrate)</td>
<td>Scott Defender</td>
<td>1 Litre</td>
<td>50ml = 1 Litre</td>
<td>Mealy Bug</td>
<td>Systemic Insecticide</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>BRAND NAME</th>
<th>QUANTITY</th>
<th>DOSAGE</th>
<th>PEST</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NITROSOL (Liquid Plant Food)</td>
<td>Amgrow</td>
<td>1 Litre</td>
<td>Makes 250 Litres</td>
<td></td>
<td>Organically enriched Fertiliser with Blood and Bone</td>
</tr>
<tr>
<td>MANOZEB</td>
<td>Searles</td>
<td>200gms</td>
<td>20gms = 10 Litres</td>
<td>Black Spot, Leaf Blight, Rust, Downy Mildew</td>
<td>Fungicide</td>
</tr>
<tr>
<td>ECOPEST OIL</td>
<td>Multicrop</td>
<td>3 Litre</td>
<td>Ready to Use</td>
<td>Mealy Bug</td>
<td>Insecticide</td>
</tr>
<tr>
<td>PYRETHRUM</td>
<td>Yates</td>
<td>200ml</td>
<td>30ml/1 Litre</td>
<td>Mealy Bug</td>
<td></td>
</tr>
<tr>
<td>ANTI ROT (Phosacid Systemic Fungicide)</td>
<td>Yates</td>
<td>500ml</td>
<td>5/10ml = 1 Litre</td>
<td>Crown Rot, Collar Rot</td>
<td>Systemic Fungicide</td>
</tr>
<tr>
<td>PEST OIL</td>
<td>Yates</td>
<td>500ml</td>
<td>30ml/1 Litre</td>
<td>Mites, Aphids, Mealy Bug</td>
<td>Insect Control Spray</td>
</tr>
<tr>
<td>BAYTHROID Advanced</td>
<td>Yates</td>
<td>50ml</td>
<td>Makes 125 Litres</td>
<td>Mealy Bug, Lace Bug, Aphids &amp; Caterpillars</td>
<td>Insecticide</td>
</tr>
<tr>
<td>ECOFEND</td>
<td>Searles</td>
<td>250ml</td>
<td>15 – 30ml = 1 Litre</td>
<td>Aphids, Thrips, White Fly, Mealy Bug</td>
<td>Insecticide (Potassium Salts of Fatty Foods)</td>
</tr>
<tr>
<td>WHITE OIL</td>
<td>Hortico</td>
<td>750ml</td>
<td>Ready to Use</td>
<td>Scale, Aphids, Mites, Mealy Bug</td>
<td>(Petroleum Oil 20g/L)</td>
</tr>
<tr>
<td>NEEM OIL</td>
<td>Various</td>
<td>Various</td>
<td>Various</td>
<td>Aphids, Scale, Caterpillars, Mites, Mealy Bug, Thrips</td>
<td>Synthetic Insecticide</td>
</tr>
</tbody>
</table>

© Growing Clivias for Beginners March 2020
Systemic Insecticide:

What is a Systemic Insecticide? Plants absorb systemic insecticides much like they absorb miracle-gro plant food. It then renders the plant’s parts, the roots, stems and leaves poisonous to invading organisms.

Systemic Fungicide:

A Systemic Fungicide is a compound which is taken up by a plant and is then translocated within the plant system, thus protecting the plant from the attack of pathogenic fungi, or limiting an already established infection.

Neem Oil: 12 Tips for Using Neem Oil Successfully in Your Garden

1. Always use a high quality of cold-pressed organic Neem oil.
2. Don’t try to mix Neem oil with cold water. Always use warm water with the dish soap or insecticidal soap already mixed in.
3. If making a big batch, mix up the Neem oil in a small container of warm water and soap first, then add it to the larger container of water.
4. You can mix up your spray in a separate container and then pour it into the sprayer or mix it in the sprayer.
5. Shake your mixture periodically as you work to prevent the oil and water from separating.
6. Use all of your spray solutions within eight hours of mixing.
7. If you have solution left over after you finish spraying, use it as a soil drench to get root-knot nematodes and other soil-dwelling pests under control and improve the condition of your soil.
8. Neem oil can become semi-solid at cool temperatures, so be sure to create your mixture indoors or on a warm day. If you are doing all this and your Neem oil remains semi-solid, try adding a little more dish soap or insecticidal soap to help dissolve the oil.
9. When applying a Neem oil spray, be sure to coat all surfaces of the plant thoroughly. Get the topsides and undersides of leaves and all stem, stalk and trunk surfaces. Apply extra in bends and crooks as pests like to hide in these natural crevices.
10. If it is very sunny, windy or if it rains, you will need to reapply your Neem oil solution.
11. If you are concerned the spray may injure some plants, do a test in a small area before spraying the entire plant. Put a small amount of the solution on a small part of the plant and check back in 24 hours to see if there have been any adverse effects. If not, go ahead and treat the whole plant.
12. Pure Neem retains its potency much longer if stored at about 40 degrees F in low light and in a dark container.
Japan Clivia Tour 2013

By Heidi Nerurkar

In March of this year I had the great opportunity to be part of the Clivia Tour ‘Visiting famous growers in Japan’ organized and arranged by Shigetaka Sasaki. Our group included Kerrie McElroy from Australia, Andre Swart from South Africa and myself. We all met for the first time on Tuesday, 19th of March at the Centre Hotel in Narita, where we stayed for the night and tried unsuccessfully to get at least a few hours of sleep.

The next morning we travelled on the high speed train ‘Shinkansen’ to Nagoya, where we changed to a rented car and drove to the Baijyuen Nursery of Mr. Hattori in Aichi prefecture.

On arrival, Shige introduced us to Mrs. and Mr. Hattori. We also met Mr. Masami Uno and his wife, who were already in the nursery and looking for some special plants to add to their collection. As expected, the huge greenhouse was full of plants with extraordinary flowers and none of us could resist buying at least a few plants. Mr. Hattori’s plants are mostly compact plants and he is famous for his blushed Yellows, Picotees, Bronze and Red Clivias.

On Thursday the 4 of us left Nagoya by car again to visit Mr. Koike’s greenhouses in Gifu prefecture. Every Clivia enthusiast knows the green flowered ‘Hirao’ and the ‘TK Original’ Group 2 Yellows with green throats. Of course Mr. Koike’s greenhouses are full of outstanding plants and he also has very beautiful interspecifics in various colours.

The same afternoon we returned via train to Narita, because all the other breeders on our list are located in Chiba prefecture.

Friday morning we went to meet the legendary Mr. Nakamura on his ‘Clivia Breeding Plantation’.

High speed train ‘Shinkansen’
He showed us around in his greenhouse where quite a few of his famous plants were in flower. I already own a few of his plants, but I have to admit that my collection of Mr. Nakamura’s plants has increased in size after this visit. Mr. Nakamura was very generous and presented us Clivia books, photos and as a very precious gift we received a few seeds of crosses he made.

After we left the ‘Clivia Breeding Plantation’ we drove to Shige’s greenhouse with his vast collection of clivias from all over the world. You can find almost every plant you have ever heard of in his greenhouse and of course Shige additionally has a lot of the most extraordinary plants of his own breeding to show.

The first on our list for 23rd of March was Mr. Mitsuhashi. He can show off the prettiest multitepal Yellows you can ever dream of and is also known for the ‘Tiger’ and the even more rare ‘Southern Cross Tiger’, which not only has the horizontal pattern, but shows in addition Shima variegation.

Later in the day we went to Mr. Tsuruoka’s nursery filled up with the best Akebono Darumas and variegated Darumas. Mr. Tsuruoka also has a remarkable collection of Clivias with exceptional pretty flowers.

The last breeder of our schedule was Mr. Nakayama, who is the ‘specialist’ for multitepal Clivias. He and his wife own the most beautiful multitepal Clivias in all sorts of shapes and colour shades you can think of. Except depicted on photos, I had never seen such beautiful plants before, but this applies to everything I have seen on this trip. A ‘once in a lifetime’ experience, not only for me but for every Clivia lover - if you are a breeder or only an ordinary collector of these plants.

Before visiting these Japanese specialists I have been to different nurseries in the Netherlands and in Belgium. Similar to the nurseries in Japan, most of the European Clivia breeders are not only specialised in the cultivation of Clivias, they also grow other plants like Zantedeschia, Azaleas etc.. The only exceptions I know of are Pierre De Coster and Cady Poelman, who exclusively breed Clivias. When I was at Dynaplant in the Netherlands they were growing compact orange Clivias with green leaves in big numbers in unbelievable huge greenhouses. If a seedling is variegated it is immediately removed, because it is too slow growing and does not fit in the standard production. The Belgian growers have as well mostly orange flowering plants, but they also own variegated plants (Akebono and striata) and other colours like yellow, apricot, yellow green throat, versicolour etc.
Mr. Koike showing us a plant bred by Shige

Plants from Mr. Koike

From left: Mr. Nakamura, Kerrie McElroy, Heidi Nerurkar and Andre Swart
Plant from Mr. Nakamura

The non-orange clivias may be less than 5% of the total number of plants.

If you ask these breeders why they grow only orange Clivias, they will tell you that people in Europe will buy nothing else than orange Clivias, they simply do not seem to appreciate special colours or variegated leaves. For comparison: In Japan I visited a garden center and they had Clivias in red, peach, yellow etc. for sale and even interspecifics were on display, in garden centers in Germany I have never seen a single Clivia in another colour other than orange.

In Europe we have mostly plant mass production also because the regular customer is not willing to pay more than 10-15 Euros for a Clivia. I assume, that such highly specialised nurseries like the Japanese breeders might not survive very long with their businesses in Europe.

A most remarkable adventure has come to an end and we three participants want to thank all the breeders we visited for their friendliness and hospitality.
Plant from Mr. Nakamura

Plant from Shigetaka Sasaki

Plant from Shigetaka Sasaki
Clivia caulescens x mirabilis from Shigetaka Sasaki

Plant from Shigetaka Sasaki

Multitepal Yellows from Mr. Mitsuhashi

Multitepal Yellows from Mr. Mitsuhashi
Southern Cross Tigers (Mr. Mitsuhashi), photos by Shigetaka Sasaki

Plant from Mr. Tsuruoka

Mr. Tsuruoka's plants
A special ‘Thank you’ of course for Shige, who made all this possible and invested a lot of his personal time and energy in us and our well being.

ありがとうございます

Note: If you want to know more about new developments in Clivia breeding in Japan, please have a look at the articles by Shigetaka Sasaki in Yearbook 7, page 86 - 90 and Yearbook 10, page 59 - 64. I am only a hobby grower and not an expert breeder, so this article is merely some sort of ‘touristic’ story with photos.

A few other people who have visited Japan before have already published interesting articles and I did not want to repeat again, what they have already written ▼
Cultivation of Clivia

The basics

All enquiries to info@cliviasociety.org
A SHORT GUIDE TO THE CULTIVATION OF CLIVIAS

Species: There are six species of Clivia which are indigenous to South Africa. One of the species has upright flowers, Clivia miniata and the other five species have pendulous flowers - Clivia nobilis, Clivia gardenii, Clivia caulescens, Clivia robusta and Clivia mirabilis.

Cultivation

The following recommendations apply to all the Clivia species, however here we will concentrate on the spectacular miniata species.

Position

In the natural habitat Clivia plants grow in dappled shade, often on top of rocks, obtaining their nutrition from the leaf litter. For the successful cultivation of Clivias we need to recreate the natural conditions for optimal growth. Fortunately, the Clivia, in addition to being drought tolerant and relative hardy, except to severe frost, is very forgiving to a large variety of potting media and garden soil mixtures. Planting in positions receiving the afternoon sun will result in scorched leaves. The early morning sun does not damage the Clivia leaves and is an acceptable position. Dense shade may result in the Clivias not flowering.

Planting Media

Clivia roots need a lot of air around them and they do not like to stand in water. The soil must be well drained. A Clay soil is not suitable for growing Clivia as the water will not drain away from the roots. A sandy soil is also not suitable as there will be too little moisture for the roots. A well composted coarse pine bark mix provides the ideal growing medium. Commercial Clivia mixes are available. Garden soil is very variable in composition and adding good quality compost and coarse potting mixtures for good drainage is the most suitable way of preparing the garden soil for Clivias.

Nutrition

A slow release fertiliser such as 3-1-5 fed in Spring and Autumn is ideal for the Clivia plants.

Watering.

Water liberally in Spring when there is evidence of growth. Decrease the amount of water in winter as the growth rates are slower or have stopped. If the soil in which the Clivia is planted is well drained, watering will not result in a problem, such as root rot.

Seed propagation

Once your Clivias have flowered, you may wish to increase the numbers by pollination. This is an easy way of increasing numbers, but there is a three to four year wait for the plant to flower, usually after it has at least twelve leaves. Clivia miniata flower in September but may flower at any time and even surprise you in winter with a flower. Pollination is achieved by placing the yellow pollen of the anthers on the stigmatic lips of each flower. There are six anthers with pollen and one single stigma in the centre of each flower. Pollinate in the early morning for a few days while the stigma is still sticky and fresh looking. A berry will develop if the pollination was successful.
Leave the berry on the flower stalk/peduncle/scape until the colour changes from green to orange or yellow. Harvesting the seed before the colour change occurs may be unsuccessful. Harvesting the seed from July onwards in the Southern Hemisphere ensures successful germination.

**Germination of the Seed**

The berry should be opened, and the seeds exposed. A fine membrane surrounding the seed should also be removed. Wash the seed pulp in a mixture of a teaspoon of dishwasher liquid in a litre of water. This makes the removal of the slimy tissue surrounding the seeds much easier and acts as a "sterilising" agent. After the seeds are clean, wash off the soapy solution and soak the seeds in a freshly mixed up solution (use the recommended strength) of antifungal mixture. Fungi are the main enemy of germinating seeds.

The seed may be germinated in a damp paper towel sealed in a zip lock bag or between paper towels in a sealed plastic container and should be kept in a warm place, or on top of the fridge. Keep the paper towel only moist and not too wet. The seed may also be pressed down in seedling soil to the depth of half the seed height, then keep the soil moist in a shaded protected area. A covering of oak leaves or newspaper or glad wrap may be used to keep curious animals out of the tray.

Once the radicle projects from the seed or when the root is 2cm long, place the seeds in communal seed trays and keep moist. When the plants have about eight leaves they may be planted in individual small pots. Don't use too large a pot for the transplanted seedling.

While the seedling has the seed attached no feeding of the plant is necessary. Seedling fertiliser or foliar feed may be started once the seeds fall off the seedling. You may add some pelletized chicken manure to the bottom half of your seedling mix, so that nutrients are available once the roots reach that depth.

**Multiplying by division**

Clivia plants in pots need to be divided when there is no healthy potting soil left in the pot. Clivias in the garden need only be divided when the clumps grow into each other and the overall qualities of the blooms deteriorate.

Lift the whole Clivia plant out of the ground or out of the pot. Before dividing an offset make sure that there are roots attached to the offset. Use a sharp clean knife and divide the offset. The offset may often break off quite easily. Cover the open wounds with an antifungal solution e.g. Chlorothalonil (Bravo.) Don't overwater the newly planted offset.

**Pests and Diseases**

**Pests:**

The main pests of the Clivia plant are the Amaryllis caterpillar and the Leaf Miner. The snout beetle does cause a problem in some areas. The leaf miner causes leaf disfiguration. Control the leaf miner with Imidacloprid (Confidor/Kohinor/Bandit). The lily borer/amaryllis caterpillar develops from eggs laid by moths on the underside of the leaves. The larvae of these lily borers burrow a channel down the leaves into the growth stem of the Clivia. The main fan may die, but usually offsets grow from the main rhizome of the plant. The best insecticide for the amaryllis caterpillar is Cypermethrin (Ripcord) or Dimethoate (Aphicide).

Mealy bug is another pest that occurs when plants are overcrowded and there is poor ventilation between plants. This pest is well controlled by imidacloprid (Confidor).
Diseases

The diseases affecting Clivia include viruses, bacteria and fungi. By far the biggest problem here is with fungal infections.

Viral infection of Clivia gives the leaves a mosaic pattern and the flowers may have split colours. As there is no cure for a virus infection, destroy the plant, and prevent further spread of the disease.

Bacterial diseases can cause stem rot. This gives a characteristic foul smell when present. Scrape out the rotten part of the plant. Pour dilute bleach over the area and wait for the area to dry. Keep the soil relatively dry until the bacterial rot has cleared up. Bacteria usually cause damage following on some previous physical injury to the plant.

Fungal infections cause brown marks on Clivia leaves. These are particularly common in warm and moist conditions. Remove the damaged and discoloured leaves. Spray with chlorothalonil. (Bravo) or a systemic fungicide. E.g. prochloraz (Octave ).
From left to right and from the top downwards:
Clivia nobilis, Clivia miniata, Clivia mirabilis
Suspected viral infection of leaves, Clivia gardenii, Clivia flower arrangement
with freesias Clivia robustus, "Frats" Clivi a, Clivia caulescens Clivia miniata,
Clivia mirabilis, Clivia miniata multitepal
Dweller in the mist

Clivia x nimbicola - natural hybrid in the genus Clivia

The epithet nimbicola means ‘dweller in the mist’, and refers to the mist belt habitat in which this hybrid and its putative parents are found. Clivia x nimbicola is intermediate between Clivia caulescens and Clivia miniata with regards to rhizome, leaf, umbel and flower morphology. Flower colour ranges from pastel orange to pastel pink, with green tepal apices in some specimens. Flowering is erratic, occurring all year round, mainly from July through to December, with some specimens flowering twice yearly-February to May. This long flowering period connects the flowering periods of the two putative parents in the Bearded Man Mountain locality, namely October- November in C. miniata and October-December in C. caulescens. The extended flowering period of C. x nimbicola is regarded as further evidence in support of the taxon’s hybrid origin. The formal description of C. x nimbicola is also supported by the observation that the hybrid plants bear berries in the wild, thereby inferring fertility and the possibility to maintain populations by means of subsequent breeding among hybrid plants. The holotype of Clivia x nimbicola was collected on the Bearded Man Mountain near Barberton, on the border between South Africa and Swaziland. In this area these natural hybrids are quite common (50 or more individuals) in sympatric stands of C. miniata and C. caulescens. Judging by plant sizes and the height of aerial stems, original hybrids are as old as their putative parents. Toppled plants with long aerial stems, from either parentage of hybrid, freely produce suckers when in contact with the soil. Seedlings, when present, were usually distributed around its putative parent. The natural distribution range of C. x nimbicola is confined to the Barberton Centre of Endemism, the only known region in which the distribution ranges of C. caulescens and C. miniata overlap.

Germination of Clivia seed by Harry Erasmus

Each Clivia grower has his/her own growing methods, which work best for their nursery, and the following is an example of my procedure.

The life of a healthy seedling starts after the pollination takes place on the plant and the seed sets and starts to develop. The seed will grow to maturity over a period of 7 months to one year on the plant and must be fed constantly during this time to create a viable fertile seed. The food supply for seed is exendospermous, which means that it is a separate food supply for the embryo plant and is stored outside the cotyledon. The seed will need a lot of energy to shoot the radical and to develop the embryo plant to the first leaf in its first few weeks and later months.

It is therefore important to feed the plant with the basic fertilisers and the necessary trace elements in this period at least once a month. If the seeds do not have an ample supply of sugars, trace elements and mineral salts they will develop slowly and could possibly not be viable.

To start, you have to remove the seed from the berry coating and the inner membrane of the fruit-wall. This membrane must be removed to prevent the seeds becoming infected with bacteria or fungi. Wash the seeds with dilute, 1ml to 1 litre, dishwasher detergent, and rinse with clean water. Please note this operation mechanically removes spore, fungi and bacteria but does not actually, kill the organisms.

After this operation the seeds should be dried for at least 7 - 10 days in a clean open container before germination. Dust them lightly with fungicide or rinse with Sporekill (1ml in 5 litres of water). After the drying period, rinse the seeds with clean water and place the moist seeds in Ziplock bags to stimulate germination. Place the bags in a dark, temperature-controlled area between 18 - 23°C and wait for them to germinate. The Ziplock bags must be sealed to keep the moisture in and fungal spores out. If you see any problems in the bag, e.g. rotting seeds or fungus, remove the seeds with these problems and put a knifepoint of fungicide in the bag.

In general, I do not like to germinate my seeds with fungicides but use it as a precautionary measure if problems occur. Receiving seeds from sources other than your own is always a risk because you do not know the quality of the food supply during seed-set and growing, or even details of other hygiene criteria in use by the supplier. This is one of the main reasons why I stick to seed suppliers I know and only cross the line for very special seed. I will add photos of seeds that I received from my dear friend Keith Rose where you can still see healthy seeds on seedlings in their third leaf stage. When you receive seeds from other sources treat them with the same procedure as you would for your own seeds but give them at least one additional mechanical wash and rinse with Sporekill, after which place them directly in the Ziplock bags for germination.

Ask the supplier, before ordering seeds, for the history regarding feeding during seed-set to maturity. This will guide you to determine whether to purchase from that supplier or not. Once the seeds show a reasonable growth of root - 25 mm/1 inch - plant them into containers using a good friable seedling mix with enough space to grow on for at least one year to 18 months before transplanting them into individual pots of 10cm to 12.5cm in size, i.e. 4 to 5 inches. Even in warmer and more humid
Germination of Clivia seed by Harry Erasmus

Just in case you can successfully use this method, it will adequately handle bacteria and fungi but requires regular inspection of the seed during the germination period.

When trouble arises, prompt action is what will possibly save your seeds. Please remember wash your hands very thoroughly before handling seeds and after they have been sanitised, it is preferable to put them onto a paper towel in your hands and not onto your bare palm. Obviously if you can work with latex gloves it's always better. Also, never cough or sneeze over your seeds as, like it or not, your breath contains horrors beyond belief! Be very careful of the root sprouting from the seed since any mechanical damage to it will sound its death knell.

I know this method will help you achieve very high percentages of germination and seedling maturity and although it does seem rather long and complicated it's well worth the effort.

Good luck with your germination.

Harry Erasmus

harryerasmus@hotmail.com
Golden Bengal

When I first started out growing clivias about 4 years ago, I was looking out for a nice yellow clivia. I have also just joined the Clivia Club then. Being a TradeMe junkie, I found a listing of Peter Gray who also a member of NZCC selling his yellow clivias. I went on a road trip to Tauranga to visit Peter to pick out the clivias. When I was at Peter’s, at this stage I didn’t know much about clivias, I saw a yellow clivia in the back corner of the shade house with one last flower on the umbel that had 8 tepals with deep yellow colour. Peter told me it was Yellow Tiger. I just knew I had to buy that plant and I left Peter’s place that day with two yellow clivias, the other was a Moonglow strain.

The plant, a few weeks later, decided to throw out a second umbel for the season and I was thrilled that I didn’t have to wait another year to see what the umbel was like. When the flowers finally opened I was quite impressed with the depth of the colour. I pollinated the flowers and the berries started to swell. I noticed there were stripes on the berries which was unusual as the plant wasn’t variegated. I asked around and found that the Yellow Tiger is a cultivar group bred by Ian Duncaif. The information I got from Ian is as follow, “Yellow Tiger is bred from Striped Pod crossed with a Solomone yellow. Striped Pod is good dark yellow tulip shaped flower, compact, broadleaves and late to flower for a miniata but mostly the seed pods are consistently striped yellow and green.” Ian also mentioned that he has flowered quite a number of offspring but have not seen the striped pod in the seedlings back in 2010 when I emailed him, which makes this plant even more special.

The flowers are improving each year as the plant matures and it is definitely one of my favourite clivias. The berries of the plant are also very decorative but it doesn’t produce variegated seedlings. The plant is an outstanding clone of Yellow Tiger and I have chosen the name Golden Bengal for it in keeping with the Tiger theme and not confused with the tiger variegation from Japan. I am using Golden Bengal in my breeding goal for even deeper yellow clivias and compact habit. By Michael Loh

Striped berries of Golden Bengal

Side by side with Keith’s near white Iceberg (2013)
Growing the miracle clivia

by Graham Duncan, Kirstenbosch

The newly discovered miracle clivia from the arid north-western Cape. Clivia mirabilis flowering at Kirstenbosch. Photo: Graham Duncan.

The new Clivia is thought to be a survivor from a previous climatic period in which a subtropical regime prevailed over what is now a semi-arid region.

The recent new addition to the genus Clivia brought about a great flurry of excitement among ardent followers of clivias. The new species was discovered by game guard Johannes Fikrika in a nature reserve in a remote canyon of the Bokkeveld escarpment near Nieuwoudtville in the north-western Cape. It was brought to the attention of botanists at Kirstenbosch by Wessel Pretorius, officer in charge of the reserve.

The region where it was found is semi-arid, with a Mediterranean-type climate, very different from the subtropical environment in which the four other Clivia species (C. caulescens, C. gardenii, C. miniata and C. nobilis) are found in eastern and north-eastern South Africa. Numerous geophytic (a broad term encompassing plants with subterranean storage organs) genera have speciated extensively in the semi-arid southern and western parts of the subcontinent, and the new Clivia is thought to be a survivor from a previous climatic period in which a subtropical regime prevailed over much of the region. Its discovery was truly a miracle, and most appropriately, it was named Clivia mirabilis, the ‘miracle clivia’, by Dr John Rourke in 2002.

At first sight, C. mirabilis conjures up an image of a somewhat broad-leaved, robust form of C. nobilis, to which it is most closely related, with a flower head reminiscent of C. caulescens, but close inspection reveals its unique distinguishing features of long arching pedicels (flower stalks) that are dark red or brownish-red at flowering time and subsequently turn bright green during the fruiting stage, and its unusual irregularly-shaped berries. The species is further recognized by its reddish-orange, tubular pendulous flowers with yellowish tips, its sub-erect, leathery leaves with a conspicuous, dull white central striation, and its leaf bases that are suffused with purplish-maroon. (The latter two features are also seen in certain forms of C. nobilis.) The central striation in C. mirabilis is most prominent in younger leaves, becoming less obvious with age. Mature individuals develop a thick mat of unusually thick, fleshy roots, able to store large quantities of water and sustain the plant over the long and dry, harsh summer. The rounded seeds of C. mirabilis are relatively small and similar to those of C. nobilis.

The flowers of C. mirabilis cannot realistically be described as being any more attractive than the best forms of the three other tubular-flowered species C. caulescens, C. gardenii and C. nobilis, and its most appealing features in my view, apart from the reddish-orange perianth, are the long, dark red arching flower stalks and bright orangy-red ovaries. Flowering rather late in the year, from mid-October to November, the berries ripen rapidly in only four months by mid- to late March, just before the onset of the first autumn rains.

Cultivation

Clivia mirabilis has been in cultivation at Kirstenbosch for only three years but it has responded very well here, and two adult plants flowered successfully in November 2003. Although the plants are more sun tolerant than the other Clivia species and are exposed to full sun for a portion of the day in habitat, they should not be regarded as being subjects for very hot, all-day full sun positions under cultivation. Positions receiving morning sun and afternoon shade - a little more sun than those in which C. nobilis thrives - should be ideal. Plants grown in full shade at Kirstenbosch have performed well, but the flowers tend to look rather washed out.

According to former Kirstenbosch Curator John Winter, this species can be grown in a range of media, as long as it is very well aerated and drained. A humus-rich medium such as equal parts of finely milled bark or finely sifted compost, and coarse river-sand seems to suit it best, and the addition of the non-burning, organic fertilizer Neutrog Bounce Back to the surface, or mixed in, provides a full balance of nutrients that do not leach rapidly. As with the other Clivia species, it is essential that the rootstock is not planted too deep, but rests just below soil level.

Unlike C. miniata, I'm quite certain that C. mirabilis would not be able to stand up to the rigours of the average
garden where indiscriminate watering is the norm, and the plant is thus best suited to cultivation in containers, preferably under cover in areas with heavy winter or summer rains.

Due to its vigorous root system, 30-35 cm diam. containers are the most suitable in which to maintain sub-adult and adult plants, respectively, and once established, like the other clivias, they should be left undisturbed for many years. As for watering procedure, the plants appear to thrive on heavy drenching about once per week or every ten days throughout the year. Allow the medium to dry out between drenches, and never let it become waterlogged for an extended period. This long-lived plant could prove to be more cold tolerant than the other Clivia species, but this has yet to be tested.

Regarding pests and diseases, the leathery leaves of Clivia mirabilis, like those of C. nobilis, appear to be too tough to fall prey to the devastating exploits of lily borer caterpillars, but a close watch should be kept on mealy bugs that would certainly make themselves at home among the leaf bases. Excessively moist conditions will result in fungal rotting of the roots.

Like C. caulescens, C. gardenii and C. nobilis, C. mirabilis will probably remain a subject for the specialist grower, and not become a general garden plant as is the case in C. miniata, but one looks forward to seeing it in the specialist horticultural trade, and who knows what exciting hybrids may result within the next decade or two from its introduction into the Clivia breeding gene pool.

Propagation

As mature Clivia mirabilis plants are solitary and do not form offsets, the only practical method of propagation for the home gardener is by means of seed. The flowers of Clivia mirabilis are at least partially self fertile, and produce viable seeds following hand pollination among flowers of the same flower head. The seeds are ready for sowing once the fleshy outer pulp of the berries has turned dark red. While the berries of C. gardenii and C. miniata can take up to twelve months to mature, and those of C. caulescens and C. nobilis up to eight months, those of C. mirabilis are remarkable in reaching maturity in just four months. One to several seeds are produced per berry and should be removed from the berry and washed with water, and sown in the same manner as other clivias, in a well aerated, humus-rich medium such as equal parts of milled bark or finely sifted compost, and coarse river-sand.

While it is often suggested that Clivia seeds be sown on top of the soil surface, I do not advance this practice simply because the seeds tend to shift position when being watered, and the developing radicle has difficulty in reaching and penetrating the surface. Instead, I recommend pressing the seeds into the medium so that they rest at or just below soil level. Sow the seeds individually in seed trays or pots and allow them to complete a full year's growth. The seeds germinate within one month. At the beginning of the second season, seedlings can be potted up individually into black plastic nursery bags or pots, and be grown on for a further year before planting out into larger containers. The sowing medium should be kept moist but never waterlogged, be watered with a fine rose and placed in a semi-shaded position. Seedlings of C. mirabilis are fast-growing when compared with those of the rather sluggish C. nobilis, and will almost certainly reach maturity before the latter species. I estimate the juvenile period for C. mirabilis to be about five years, under ideal conditions.

How to acquire seedlings

Seedlings of C. mirabilis grown at Kirstenbosch by John Winter will soon be available via mail order, through the South African National Biodiversity Institute's website (www.sanbi.org), on behalf of the Northern Cape Nature Conservation Department. Get your order in now, as orders close on 31 January 2005.

Below left: The irregularly shaped berries of Clivia mirabilis at various stages of ripening. Below right: The stiff, leathery leaves of Clivia mirabilis with their characteristic dull white central striation. Photos: Graham Duncan.

Further reading

Rourke, J.P. 2002b. The miraculous Clivia, an astonishing new species from the arid northern Cape. Clivia 4, 5-12.

December 2004 VeldsFlora 149
INTERSPECIFIC CLIVIAS

The name interspecific Clivia is not well known to the general public, although grown and collected by most Clivia growers all over the world. Interspecifics are crosses with Clivia miniata as pod parent and a specie Clivia as pollen parent, or vice versa. The resulting plant is then called an interspecific. In other words, interbreeding with different species of Clivia. This is a new trend in breeding clivias which can flower at different times of the year. The flowers are pendulous, but larger and more open than those of the wild species. In F2 generations flowers become larger with more flared or open flowers. These plants can flower any time between May and September yearly, with the main flowering time in July when we have small interspecific shows and displays to promote these plants. They are robust, fast growing and more resistant to pests and diseases. Make sure to add one to your collection and it will bring some colour into your garden over the winter months.

We also have some of Rudo Lotter's finest interspecifics which his father Wessel Lotter has bred. We also use these extensively in my breeding programme. They include registered hybrids like, Cinderella, Moondrops, Ginger Bells, Ruben, Sunrise Surprise, Brown Eyed Girl, Rosy Cheeks, Pink Baby and his best interspecific called Chanel.

Interspecifics flower when little else is flowering in your garden. We have bred and acquired some wonderful plants in the last few years of which Secret Desire is a prime example. This plant won best Interspecific on show in PE in 2009 and is by far more superior to most others in colouration and flower shape.
Interspecifics – Carrie Kruger Utopia Clivias

Solar Flare X Rosy Cheeks

5 STAR VERSI

BRILLIANT

© 2020 Courtesy of Carrie Kruger Utopia Clivias
Interspecifics – Carrie Kruger Utopia Clivias

GALAXY

SECRET DESIRE

SECRET HOPE

© 2020 Courtesy of Carrie Kruger Utopia Clivias
Interspecifics – Carrie Kruger Utopia Clivias

SECRET LOVE

The “Secret” Series

- These plants were bred from the same cross. Stella Parish Miniata x 5 Star (Gardenii x group 1 yellow)
- They are all the most beautiful pink F2 interspecifics with large, open recurved flowers.
- I am currently line breeding with these plants and the first F3 plants flowered in 2016.
- I have found the F3 flowers larger with softer pink shades.
- These plants have all been registered on the International Clivia Register

The “Dream” series

- These are all selfed seedlings of a Nakamura bred interspecific, grown from seed.
- The first selfing of this plant only produced about 8 -10 seeds which grew into these magnificent plants.
- The flowers are large and semi-open.
- These plants all have flowers with picotee-type edging, and semi to broad leaves, up to 90mm.
- We are line breeding these plants as well as using them in other crosses.
- I started with some experimental crosses between the “Secret Series” and the “Dreaming” range of plants.
- The first one flowered last year. A soft pastel with darker pink outer petals and darker pink blush on inner petals

© 2020 Courtesy of Carrie Kruger Utopia Clivias
MY GOLDEN DUSK STRAIN  Alick McLeman

In pursuing my clivia hobby, one of my pet interests has been the recovery of colour patterns inherent in the genetic material available to me. A plant which interested me was a hybrid miniata from the Ndewde area of KwaZulu Natal found by KZN grower Val Thurston and named Thurston Ndewde Pink Champagne. I had obtained some seed from Val where she crossed her Pink Champagne with her Thurston Beta Yellow, the result of which were a number of orange siblings.

Ndewde Pink Champagne

At the time it was thought that Ndewde Pink Champagne had been lost to a stem rot, which made the recovery all the more challenging. (The plant was subsequently saved from a small piece of the stem by Sean Chubb and I am hoping to see it in the flesh when I am in KwaZulu Natal for the conference in September)

The first of the sibling cross to flower I named and registered as ‘Golden Dusk’ and to my mind it has the best flower form of the plants I’ve produced thus far. A lovely open flower with wide petals displaying the unusual colouring at its best. A feature of Golden Dusk is that it opens a very pale pastel with pink tones, but as the flowers age the anthocyanins respond to the light and the red pigments become more prominent.

I have since flowered a number of Golden Dusk siblings and all have this same trait in that they open a pale pastel and then deepen in colour over the life of the flower.

Golden Dusk Sibling #1

Golden Dusk Sibling #2

Golden Dusk Sibling #3

Golden Dusk – initial colouring

Golden Dusk – later colouring

Perhaps the most striking of the siblings is one that I have named ‘Chameleon’ because of the remarkable difference in colour between younger and older flowers, as well illustrated in the photo below.

As can be seen from the photos there is some difference in the flower forms, some having quite narrow petals. However the flowers are fairly small and there is lots of room for improvement in flower size.
**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.
“Pink Flamingos” was a pink seedling from Alick McLemans’ F2 Orange Wittig’s Pink x ‘Alick’s Peach’. It seems that the F2 Wittig’s Pink was heterozygous for Type 1 Yellow and therefore somewhat compatible with ‘Alicks Peach’, a Type 1 Peach, therefore giving approximately 50% Pink/Peach types although in fact the number of reasonable pinks was small compared to peach tones. I guess ‘Wittig’s Pink’ original has had a small influence on colour two generations down the line. The interesting point is that in ‘Pink Flamingos’ we now have a Type 1 Pink!

It should be noted that in early attempts to breed quality pinks many of us crossed Wittig’s Pink strains with Type 1 Peach strains resulting in orange progeny which may be disappointing to some but I see these as a great ‘Stepping Stone’ on the way to producing quality pinks.

Seeing the potential in ‘Pink Flamingos’ we crossed ‘Blushing Bride’, a Type 1 Vico soft pink/peach with a full umbel and reasonable flower form on to it with the pictured first flowering results, quite good form and a range of colour depth, although not clear pink they are on the way to producing some great blooms.

-From a conversation with Rex Williams
POTTING MIXES FOR CLIVIAS
Rae Begg - Melbourne Clivia Group

Why do we need to use potting mixes in pots?
Because Clivia, and any other plants grown in pots, need well drained media which has the capacity to hold enough water and nutrients for healthy growth.

How long do we want our potting mix to last?
Most people will say ‘years’ or ‘as long as possible’. For potting mix to remain stable for a long time, consideration must be given to the materials used.

Physical properties of Potting Mixes

Physical properties mean:
Shape, size and density of individual particles and the way particles stack together, the stability and whether or not there is internal pore space e.g. stone or sand vs perlite or bark.

These properties then determine
The proportion of air and water in the mix when it is drained
The ease with which the roots can extract water.
The bulk density or weight of the mix.

Weight is considered necessary to keep containers stable.

Mixes must contain a high proportion of readily available water so watering can be infrequent. Thus, the formula for potting mix needs to balance air filled porosity and water holding capacity.

Effects of particle size
Pores between large particles are larger than the pores between small particles.
The smaller pores will be filled with water the larger pores will be filled with air. Water in the largest of the smaller pores will be readily available to the plants.
Water in the tiniest pores will be unavailable.

Therefore:
The proportions of air and readily available water in a mix will depend on the proportions of pores of different sizes.

- Many large particles should give much air in the mix
- Many small particles should give a high ability to hold water.

The recommended air-filled porosity for Clivia is about 20% or more i.e. 20% of the volume of mix should be air.

Air filled porosity of composted coarse mixture of pine bark (0.5mm-5.0mm) is approx. 48%.

Water released from the same coarse mixture of pine bark (0.5mm 5.0mm) is around 3%.

Add sand at a ratio of 2 parts bark to 1-part sand
- the air-filled porosity is approx. 15%
- water released is approx. 20% Using very fine sand
- reduces the air-filled porosity to around 7%
- reduces the water released to around 13%
- Using very coarse sand increases the air-filled porosity to around 28% and reduces the water released to around 13%.

**Add sand at a ratio of 10 parts bark to 1-part sand.**
- The air-filled porosity is approx. 28%
- Water released is approx. 12%
- Using very coarse sand increases the air-filled porosity to around 40% and reduces the water released to around 8%.
- Using very fine sand increases the air-filled porosity to around 33% and reduces the water released to around 9%.

**The most common materials** used in potting mixes include peat, composted bark, sand, perlite, coconut fibre and vermiculite.

**Peat** holds more readily available water than any of the others listed but has a much finer particle size, so it is not suitable for use in Clivia potting mix.

**Coconut fibre** has:
- an air-filled porosity of approx. 12.5%.
- water holding capacity approx. 88%.

**Perlite** allows higher air-filled porosity than similar sized particles of other materials due to the porosity of the material. **This can be used for Clivias, but other materials are cheaper.**

**Coarse grades of perlite:**
- Increase air-filled porosity and decreases readily available water.

**Finer grades of perlite:**
- Decreases air-filled porosity and increase readily available water.

**Particle shape** of different materials varies so the way they sit together also has an effect.

**Mixes with a good balance** between air filled porosity and the ability to supply readily available water will have approx. 20% fine particles (0.1 - 0.25mm range).

**Higher proportions of very fine particles** (like very fine sand or clay particles) will decrease the proportion of readily available water.

**Materials:**

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<tbody>
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<td>Pine Bark - 1</td>
</tr>
<tr>
<td>Pine bark: sand - 2:1 to 4:1</td>
</tr>
<tr>
<td>Pine bark: sand: peat moss - 4:4:1</td>
</tr>
<tr>
<td>Pine bark coarse: fine bark: sand - 3:2:1 (the commercial mix I use)</td>
</tr>
</tbody>
</table>

**Poor mixes**
- soil: pine bark: sand - 7:3:1
- loam: sand: sawdust - 3:2:1

**USING POTTING MIXES**

When potting plants, don't press the potting mix down. This reduces the air-filled porosity. Normal watering is usually enough to settle the mix and stabilise the plant.
Garden soil, compost and other organic and animal fertilisers are not desirable in potting mix. They quickly break down into small particles reducing air filled porosity and causing drainage problems and attract fungus gnats.

Often pathogens in the soil which are under control in the ground become a problem in containers.

References:

Growing Media for Ornamental Plants & Turf
K. Handreck & N. Black NSW University Press revised edition 1989

Cultivation of Clivias by Lena van der Merwe, Hannes Robbertse, Bossie de Kock

© Courtesy of Rae Begg - Melbourne Clivia Group 2020
The Chinese standard of appreciation and approval of Clivia plants and hybrids

By Sakkie Nel

The notes that follow were arrived at, by the author, mainly from photographs of Chinese Clivia plants over a period of 16 years. It is therefore possible that I am trying to put words in the mouths of Chinese Clivia breeders! The statement that “beauty is in the eye of the beholder” is especially true when one looks at a royal and noble Clivia plant bred in China by their many dedicated breeders.

1. Brightness of the leaves

Since the early twentieth century, Chinese Clivia enthusiasts have appreciated the leaves and appearance of the Clivia plant so much so that the flower of the plant scores a maximum of three points out of 100 at show time!

This is easily understood when one accepts that a plant with beautiful foliage gives 12 months of enjoyment compared to one which has lovely flowers for less than a month, and then only at the end of their harsh winters. Brightness to them means the degree of reflection from the surface of the leaves, while other leaves may have a very dull or matt appearance.

When cleaning and appreciating your Clivia plant’s leaves, be very careful to distinguish whether the leaves should be wiped or touched at all. Certain leaves can be severely damaged by wiping or touching them. Most (all?) variegated plants do not re-act well when their leaves are being touched or wiped, or even touched by other Clivia leaves in the shade house.

Brightness in the Chinese mind-set is determined by:

i. Brilliance
ii. Glittering
iii. Just a little bright
iv. Very light bright
v. Dark bright
vi. Matt bright

Just as varied as the many flower colours and flower types, you will find much variation in the leaves of different Clivia plants. Especially is this true in China where they breed their royal and noble plants.

The leaves of some plants have a matt appearance which is not unattractive as such. Others seem to have been painted with a layer of stain, with no veins or patterns whatsoever and they shine like the boot tip of a very proud soldier! The texture, veins and patterns on most leaves enhances their brightness and makes them so much more appealing.
3. Rigidity of the leaves

Dwarf, miniature and short-leaf hybrids bred with leaves < 300 mm prove to be much more rigid and erect than those of the six different species in collections or in the habitat. These hybrids “present” their rigid leaves much better than the plants of the six species. It is not possible to indicate the micron thickness of the leaves because they vary too much within each species as well as in the habitat or in your collection. Such measurement will not necessarily apply to any other plant of the same species. To describe the type of leaf of the different species and hybrids in terms of the ratio of length and width of the leaves is just as impossible. To say they are long, pendulous, sub-erect, narrow, stiff, erect, leathery or arching actually means nothing because you may find all these types of leaves within every one of the six species. In collections, plants may even differ from breeder to breeder.

4. Veins and patterns on the leaves

Mutations or a combination of rare genes are the sources of novelty leaves in Clivia. The leaf veins take on a particular significance. Clivia plants often have prominent veins and Chinese breeders have succeeded in selecting and breeding for exaggerated veining, and some very good vein patterns have been developed. They have bred plants with veins sunk below the surface of the leaf or raised. The regularity and spacing between the veins is just as important as the regularity of cross-vein spacing. The veins must run into the tip of the leaf. Forms with a yellow background with deeper green veins on the leaves have proved to be very sought after.

5. Categories of leaf length

The following were the standards for length and length that the Northern Clivia Club in Pretoria decided upon in February 2003 under the guidance of the late Ammie Grobler.

<table>
<thead>
<tr>
<th>Mature category</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwarf or miniature leaf</td>
<td>&lt; 200 mm</td>
</tr>
<tr>
<td>Short leaf</td>
<td>201 – 350 mm</td>
</tr>
<tr>
<td>Medium leaf</td>
<td>351 – 600 mm</td>
</tr>
<tr>
<td>Long leaf</td>
<td>&gt; 600 mm</td>
</tr>
</tbody>
</table>

6. Categories of leaf length

The following were the standards for width and width that the Northern Clivia Club in Pretoria decided upon in February 2003 under the guidance of the late Ammie Grobler.

<table>
<thead>
<tr>
<th>Mature category</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra narrow leaf</td>
<td>&lt; 25 mm wide</td>
</tr>
<tr>
<td>Narrow leaf</td>
<td>25 – 50 mm wide</td>
</tr>
<tr>
<td>Semi broad leaf</td>
<td>51 – 75 mm wide</td>
</tr>
<tr>
<td>Broad leaf</td>
<td>76 – 100 mm wide</td>
</tr>
<tr>
<td>Extra broad leaf</td>
<td>101 – 110 mm wide</td>
</tr>
<tr>
<td>Super broad leaf</td>
<td>&gt;110 mm wide</td>
</tr>
</tbody>
</table>

A Clivia plant in flower or with eight leaves or more is considered to be a mature plant. The Chinese enthusiasts do not favour plants with leaves longer than 150 mm. They are very fond of the very short leafed Monk and Monk Daruma because of the much greater brilliance and very distinct veins. Other favourites include Crinkle Face or Mallan, Light of Buddha, Aleborno from Japan and Sparrow.
7. Scape or peduncle shape

These must preferably be 100% upright, healthy and rigid to present the umbel above the canopy of the leaves, without any added support. The centre of the plant must be in the centre of the pot and the pot must be the right size to complement the entire presentation. From when the scape is first visible until 50% of the flowers are open takes about 38-42 days. This will vary depending on the weather and especially how cold it is. During this period the plant should be placed in an area with enough light and air, so that the stalk can develop upright and the flowers will show the deepest colours when opening.

Unlike the other species, C. mirabilis produces a very thin and very long peduncle, but the seeds are ripe and fall off within three months when the peduncle is already drying out. It seems to be a mechanism of the plant to “protect itself” in the harsh conditions of the North Western Cape sun.

The width, length and thickness of the different stalks need to be studied in order to understand why they differ so vastly from species to species.
8. Seat shape of the plant
The Chinese favour plants where the leaves are short, broad and stacked horizontally above each other in two opposite ranks. They turn the plant 180° every three days between North and South to obtain this perfect balance in the leaf growth, so avoiding growth in the direction of stronger light.

The structure of the leaves from the centre of the plants can differ dramatically and it is not solely a matter of the amount of light on the plant which enables it to grow symmetrically. Some of these plants are formed so beautifully and perfectly that painters will quickly reach for their palettes and brushes!

9. Umbel shape and flower count
The umbel of flowers must be as big as possible with as many flowers as possible on it. The flowers on the umbel must be arranged in such a way that there are a minimum of openings between the individual flowers. For show purposes, it is necessary that 50% of the flowers on the umbel should be open when the plant is judged in South Africa. The balance of the umbel and the canopy of leaves must be perfect and preferably the umbel must protrude above the leaves. Breeders tend to discard plants with a very low flower-count but if the flower proves to be a noble and royal specimen like 'Appleblossom' or my 'Griet', to date nobody can bring themselves to do it!
10. The auxiliary conditions like a scape with ripening fruits

A bunch of ripening berries on top of an orange, red, pastel, yellow, peach or variegated plant’s peduncle is always a very eye-pleasing sight for its proud owner. Clivia lovers worldwide seem to find an endless stream of aspects about the Clivia plant and its flowers that capture their attention completely.

All photos published with the kind permission of Eddie Pang of Australia.
There has often been much debate over the ideal time to harvest your *Clivia* seed. Suffice to say there are probably no hard and fast rules. Seed that has spent 6 months developing inside a still green berry will in most cases germinate successfully however it is likely to require resourceful techniques and artificial heating if it is to be nurtured through the colder months. Without this help your seedlings may germinate but it is likely they will lack the necessary vigour to develop quickly into strong healthy individuals.

Many growers prefer to wait until at least the start of spring when the berries are well coloured up and the seed can rely on the naturally warmer conditions in order to germinate and grow successfully. I think it all comes down to what suits you and the level of 'support' you are willing (or able) to provide. In my situation I find it convenient to harvest my seed in two separate batches (the 1st in late June & the remainder in October).

For my 'early' crop I select from those berries that are showing some signs of growing maturity (either just beginning to change colour or the outline of the growing seeds is becoming more prominent. The above image shows the progress of September pollinated berries in mid-May).

Late June fits nicely in with the increasing daylight after the winter solstice and with the aid of a heated germination box I can have the new seedlings growing well and in need of only minimal attention by September (when I am too busy pollinating and preparing plants for show or sale etc). I have my germination box positioned in an area with good diffused light and protected from the cold westerly winds. It has a clear polycarbonate lid that protects the seedlings from the worst of the elements while the corrugations allow for ample air flow and is based on similar boxes designed for the purpose by Peter Haeusler in Melbourne.
The remaining berries are left on the mother plants until they are well coloured up (or if they start to soften). The scape is then cut off about halfway, and on an angle to allow moisture to drain away and reduce . The berries are left intact on the cut off portion which is stored until October when I can harvest the seeds and set them down for germination in more natural weather conditions. Some growers are concerned that if they leave them in the berries too long some of the seeds can start to shoot but I have rarely found this to be a problem, with any 'shot' seeds tending to perform on a similar level with their siblings.
With the germination process behind you, your freshly emerged *Clivia* seedlings will need a growing media that gives them access to a balanced amount of water and oxygen. They will not however require any added nutrients for the early part of their growth provided they remain attached to a healthy seed.

The seeds themselves will deliver precisely all the nutrition necessary for strong growth. It is now that the value of good sized, firm seed with a bright outer coating shows its true value. One of the pleasures I derive from monitoring my seedlings is when you find those that are visibly drawing out every last bit of goodness from the mother seed and leaving only

![Image of a deflated seed shell](image)

a deflated shell at the end.

It is at this time when you can begin to apply some nutrition in order to keep them growing vigorously. In cases where the seed is of lesser quality and deteriorates quickly you will need to start fertilizing much earlier.

I like to start out with a mild rate of one of the organic type liquid fertilizers, increasing to label rates after a few months. I alternate between fertilizer applications and a good drenching with straight rainwater as even the organic fertilizers are likely to contain some levels of salt. A deep watering will help to flush these salts out of the mix.

No matter when you choose to germinate your seeds, if you can get your first-year seedlings through the worst of summer in strong condition they will likely reward you with vigorous growth as they approach the cooler days of autumn.
Mid spring brings us vibrant clivias in bloom.

The "contemporary" or "landscaped" look is to block plant in a single colour so you may have a swathe of orange clivias with the yellow ones segregated in a different area. This is not our style, in a garden where we strive for far more of a naturalistic, woodland look – "enhanced nature" seems to be the latest descriptor for this style though it is not a term you are likely to see me using often. We like to blend our plantings and combine the clivias with ferns, astelias, bromeliads and any and all of the other plants we use as the understorey in our shady areas.

This completely confused a self-described Auckland landscaper I once took around the garden.
The season of the Clivia in New Zealand

This must have been back in the 1990s when ambitious but unqualified young people who, in a previous generation would likely have done an apprenticeship, discovered they could earn more money by dispensing advice and services to the growing wealthy of our largest city. He patronised me all the way around the garden – landscapers, you understand, rated themselves further up the social scale than mere gardeners – and at the end pronounced his surprise that we didn’t grow any clivias. I may have been a little tart when I pointed out he just hadn’t noticed them, for they are there in abundance.

Clivias are one of those plants that attracts aficionados and there is a 독사리 못이 기적 등. I am not sure what these people are called – cliviaphiles (in the manner of snowdrop nuts who are called galanthophiles?) or would they be the less classy cliviaholics? Whatever, it is in part these Clivia enthusiasts who are bringing us the expanded range, particularly in colour.

The soft yellows are still a recent introduction but already widely grown, readily available and making a huge contribution in gardens.

Extending the colours into peach tones is well underway and of late the combination of white and green in clivias represents another development. One can, when all is said and done, have too much orange in the garden (NABOC syndrome – Not Another Bloody Orange Clivia) whereas the option of other, softer shades can bring welcome variety and interest. If you covet red clivias, you need to be aware that they open orange and age to red. Do not be like the gardener I heard of who bought a swag of large red Clivia plants at considerable expense. When the first ones opened orange, she dug them all out.
The season of the Clivia in New Zealand

Considering the easy-care nature of clivias, you may wonder why they are often relatively expensive to buy.

It is all to do with time because they are slow to get established and to reach flowering size. In these days of instant gratification, most gardeners want plants that will perform and be showy in the garden from day one. In the case of clivias, be prepared to pay because it costs nurseries money to hold slow growing plants much longer to reach saleable size.

Clivias are easy to lift and divide if you have a big enough clump, although it will take a few years for smaller divisions to re-establish and reach flowering size. It doesn’t seem to matter what time of year you do it, though it is advisable to avoid the heat of summer.
The season of the Clivia in New Zealand

1. Clivias are wonderfully adaptable plants for mild climates. Their ability to thrive in hard conditions, even in relatively deep shade and with a regime of near total neglect makes them an obliging garden plant, once they are established. They don't like frost, but woodland conditions will protect them. The reason they are seen as expensive and choice is because they take years to reach a saleable grade, not that they are difficult. However, given time, clumps can get very large and yield many divisions for replanting.

2) It doesn't seem to matter when you divide them, though it would probably pay to avoid dry mid-summer. Like most perennials, they respond well to lifting, dividing and being replanted in ground which has been freshly dug over. The clumps can be large and heavy but this one was small enough to get out as one. Get as much of the root system with it as you can.
3. I hosed the clump, so it was easier to see and to show what the base looks like, but this is not necessary. The fleshy base is easily cut with a garden knife or a spade. It is easier to control what you are doing with a knife and to make sure that each division has roots attached. If you try and pull them apart by hand, you are more likely to end up with a tuft of leaves and no base.

4. It pays to reduce the volume of foliage – this reduces stress on the plant which has undergone considerable disturbance and root damage. I took off about half the leaves where the root systems looked small.
5. I dug over the area where the clump had been growing before replanting, incorporating the leaf litter that was lying around. Fertilise lightly if you wish and spread compost to enrich the soil and act as mulch.

They are understorey plants in forest or bush so well able to cope with both low light levels and root competition. We can vouch for their ability to grow away even if you just spread the roots out on top of the ground and cover them with a thin layer of soil or even leaf litter. What they won’t take is wet feet or frost. They were not named for Clive of India, as I assumed. Apparently, it was for Queen Victoria’s governess, the Duchess of Northumberland whose maiden name was Charlotte Clive. I don’t think she would ever have grown any in a Northumberland garden.
The season of the Clivia in New Zealand

There are only six different species of clivias and some hybrids between these – called interspecifics – but the showiest one that is most commonly seen in gardens is C. miniata.

Most of the others have flowers in the form of tubular bells that hang loosely from the stem whereas miniata has bigger heads of clustered flowers in a truss form. If you have clivias in your garden, you may have noticed that they set seed quite readily. You will have more success if you pick the ripe seed and sow it in seed trays. It is handy to know that orange and red clivias set red seed whereas yellow clivias set yellow seed. They also cross freely amongst themselves so you will get variation, though not all will be uniformly good.

To the vexing question of whether the pronunciation is cliv-vea or clive-ea, we go with the latter, but I have heard NZ enthusiasts use the former.
The season of the Clivia in New Zealand

Orange seed will flower orange or red, yellow seeds will flower yellow

Courtesy of

Tikorangi The Jury Garden
Mark and Abbie Jury
THE TWO SIRS – Sir John Thouron and Sir Peter Smithers

by Michael Barrett

The history of Clivia cultivation in Western horticulture is filled with many names and events. Publications by the Clivia Society provide accurate details of personalities of importance. Such resources can be referred to by newer enthusiasts, who share an interest in history. However, in the process of sharing information on the Internet, including the Clivia Forum, Yahoo groups and Facebook, some Clivia history is retold in a casual manner and, on occasions, inaccurately. Such is the case of Sir Peter Smithers and Sir John Thouron. These two gentlemen share many similarities; both men were of the same generation, with world events and shared passions shaping their lives. From time to time the two men are confused for each other, with mistakenly credit for an action mistakenly ascribed to the inappropriate person, or the two lives blended into a hybrid of achievements. Some psychology research (Fiske et al) suggests that when people confuse or "misname" one person for another, it is because one shares the same relationship mode with the other who is misnamed. Here, it may be that both individuals of the same gender, generation and class and are similar in significance in the history of Clivia miniata cultivation. When a contributor is adding content to an Internet site, they may know well the two individuals concerned, but misname them, typing and thinking of the other, however newer enthusiasts may read this information as trusted and authoritative. Often with the chatty nature of posts and forums, errors are quickly corrected. It is in this context that I wished to present here a brief biography of the two gentlemen and their distinct roles and immense importance to the advancement of Clivia, particularly yellow/cream miniata.

It is important to put the rarity of yellow Clivia miniata into context. While we now enjoy relatively easy access to cream and yellow Clivia, it was a very different story 35 years ago yet alone before then. The earliest record of yellow Clivia is from 1888 when a plant was displayed in Europe. About the same time a plant was discovered in Eshowe, KwaZulu-Natal. It was formally described as Clivia miniata var. citrina in 1899. This plant, from this same area, was sent to Kew gardens around 1893 and is known as 'Eshowe Yellow' (Dixon, 2005).

Fig. 1 Sir John Thouron

John Rupert Hunt Thouron was born in 1907, Cookham, England to an American father, with Huguenot (French Protestants exiled in the 17th century) roots and a British mother. His father's
nationality would influence his later life and achievements. His father served and died in WWI. In 1930 John Thurouon married Lorna Elliot and they had a son. John and Lorna divorced in 1939. In 1940, Mr. Thurouon enlisted into the Gordon highlanders as a 2nd lieutenant and was commissioned to the Black Watch (Lewins, 2014). Later he was made a captain and served in the Special Operations Executive at Bletchley. His role was to assist with the establishment of resistance movements and sabotaging enemy communications. He also ran “House to House” fighting courses. Towards the end of the war, Thurouon joined the Special Allied Air Reconnaissance Force and made many parachute jumps behind enemy lines to foil attempts to massacre prisoners of war (Lewins).

In 1953 John Thurouon married Esther du Pont from the famous du Pont dynasty. The cooperation of the UK and USA forces in the Second World War had left an immense impression on Mr. Thurouon. Together with his wife, in 1960 they established the Thurouon Award to foster Anglo-American friendship through an academic exchange scholarship at the University of Pennsylvania. This award has assisted 1,000 students, two-third British, to study at the University of Pennsylvania or for US students to study abroad in their chosen field. Mr. Thurouon was awarded a Companion of the British Empire in 1967 in recognition of his support and leadership of the Thurouon Award program. In 1976, on the visit by HM Queen Elizabeth II to Philadelphia to mark the bi-centenary of American Independence, Sir John was made a Knight of the British Empire.

Sir John and Lady Thurouon lived on a magnificent 220-acre estate called Doe Run. Located in the Brandywine Valley, Pennsylvania this extensive garden and horse stud was internationally highly regarded. Sir John was assisted in presenting Doe Run by a Scottish head gardener, Jock Christie, a very modest and humble man and an excellent gardener. Jock worked at Doe Run in the mornings and in the afternoon would work next door at Runnymede that belonged to the Wister family. Jock's son, John Christie, is presently in charge of the gardens at Doe Run. (L.T.Tran, personal communication, 2014). The gardens included alpine and herbaceous boarders. Sir John also had a series of glasshouses that contained a wide variety of rare plants and an extensive orchid collection. In 1985, when Prince Charles and the Princess of Wales stayed at the British Ambassador's residence, Sir John played an important role in providing unusual fresh flowers to fill the residence and he and Lady Thurouon attended the Ambassador's dinner held in the honour of the Wales (Blakely 2014).

Sir John would participate in the internationally famous Philadelphia Flower Show (PHS) held annually in early March. Regarded as the largest indoor flower show in the world, specimens would be judged in various categories. One plant that would cause great interest, and was awarded blue ribbons annually in its class, and on one occasion was overall Best Plant of Show was a cream Clivia miniata belonging to Sir John. When Jock Christie was interviewed for The New York Times in 1994 and said he had no idea where the plant originated, only knowing that it was at Doe Run before he arrived in 1963 (Raverse, 1994). Sir John was a generous man, and first shared offsets of this special cream Clivia with special friends, including neighbors Pamela du Pont Copeland and Diana S Wister (Tran). Diana Wister, an heiress of the Campbell Soup fortune is well known as a flower judge and for her success at the PHS in her own right. However, two acts of generosity by
Sir John allowed his special cream *Clivia* to become better known, and eventually accessible to people outside his circle of friends.

*Fig. 2 'Sir John Thouron' owned by Mike Riska*

The Delaware Center for Horticulture had held annual plant sales for a number of years before 1981, the year of their 25th anniversary. It was in that year that Sir John donated an offset of his famous yellow *Clivia*. The board of directors, delighted with this donation of such a precious gift, decided to organise their first rare plant auction. Details of that first auction will be recounted later in this text. The auction has been held annually since that year raising funds for urban agriculture, education and greening neglected inner-city spaces. Access to this event is tiered, with the highest being 'Clivia level' guest at $600 that includes a luncheon and exclusive preview of plants at Longwood Gardens. For a number of years, the auction logo was a stylized yellow *Clivia*. (Fig. 3)

The year 2015 marks the 35th Rare Plant Auction. The catalogue for this year’s event pays tribute to the origins of its success as follows:

*Fig. 3 A cut umbel of 'Sir John Thouron'- photo courtesy of L.T. Tran*
Clivia miniata
'Sir John Thouron'

Our 35th anniversary wouldn’t be complete without the centerpiece that launched the Rare Plant Auction—the magnificent Clivia miniata ‘Sir John Thouron’. Its elegant beauty has made it a bidding sensation throughout the years, and we are pleased to offer our signature plant for this special occasion. Originally brought from Britain to Philadelphia in the 1950’s by the late Sir John Thouron, a legendary local plantsman, this Clivia was notable for its formal, upright habit and unusual flower color. The funnel-shaped flowers are a clear, soft primrose yellow that deepens slightly at the throat. Fruits ripen to yellow for a second display against the strong, strappy foliage. (2015 catalogue page 47)

![Clivia miniata](image)

Fig. 4 Delaware Centre for Horticulture logo –
http://www.thedch.org/activities-events/rare-plant-auction/history-rare-plant-auction

Annie Raven (1994) recounts the events of the first Rare Plant Auction and White Flower Farm’s sale of the yellow Clivia in an article in The New York Times. The first yellow Clivia donated by Sir John was the prize lot of the evening and sold for $1700 to a New York real estate executive, MacRae Parker Jr. (Raven). When interviewed, Parker said he had been growing orange Clivia for 50 years. When news came that a famed yellow Clivia was to be auctioned he begged, almost daily, to attend the event, which was a sit-down dinner for members of the Natural History Museum. When a cancellation allowed him to attend he was delighted. The auction was intense, and he lowered his hand in near defeat until a woman lent over to him and said, "I thought you came to buy that plant". He continued to bid and finally won the auction. In subsequent years that plant produced many offsets and Mac Rea Parker Jr. has donated offsets to other auctions. Raven, in the same article, also describes the events that brought that special yellow Clivia to wider availability. Mr. Frowine from White Flower Farm nursery in Connecticut approached Sir John on two occasions. He proposed to Sir John to donate his highly desirable yellow Clivia to Longwood Gardens and White Flower Farm, with a percentage of proceeds from the sale of plants to go to the Thouron Award. Longwood Gardens received 90 plants to grow on to flowering size. Half of these were presented for sale in 1994, at $950 each, with a limit of one per customer. It was Longwood Gardens that named the plant ‘Sir John Thouron’ in recognition of his generosity (Raven).
Ester du Pont died at their winter home in Florida in 1984. Sir John lived another 23 years to reach 99 years of age and also died in Florida in 2007. The generosity of Sir John made this special yellow *Clivia* within reach of enthusiasts over a period of time. This plant is held in various collections around the world, often a part of a *Clivia* narrative, holding special significance and sentimental value in addition to its beauty and value in hybridising programs.

In contrast to the private life of **Sir John Thouron**, the life and achievements of **Sir Peter Smithers** are well documented and accessible via a number of pathways. He does receive mention in the famous Who's Who. Sir Peter also provides an autobiography of his life in his book *Adventures of a Gardener* (1995). Sir Peter furthermore supplied a personal history of his life with plants when he was awarded the Herbert Medal from the International Bulb Society in 1997. A number of obituaries appeared in various UK papers, contextualizing and detailing his political and horticultural contributions. His wide interest and contribution towards a number of plant varieties, such as tree peonies, *Nerine* (ex-Rothschild’s famous Exbury strain), *ilium* and *Clivia*, mean his name is part of the cultivation history for each plant genus. For the benefit of the reader, a very brief biography is provided here.
Peter Henry Berry Otway Smithers was born in 1913, son of Lt. Col and Mrs. H Otway Smithers in Yorkshire, England. Sir Peter Smithers describes his early years as follows. As a child his parents were away with war service, and young Peter was raised by a nanny who shared a love of gardening and nature. As he grew he would shadow gardeners on his parents' and his aunt's properties, and they taught him skills including germinating seeds, growing and displaying potted plants. At 13 he was sent to Harrow for his education, and here fell in love with lilies in a big way. At this time, he also persuaded the Royal Horticultural Society (RHS) to admit him to the Chelsea Flower Show, the first child to be given permission to attend. School was uninspiring until a new master sparked Peter's interest in history and politics. Young Peter started at school a plant index to record his plants, which continued until 1993 with 32147 entries, (by which stage, the man, Sir Peter, embraced computer technology to record his plants). After Harrow, young Mr. Smithers went to Oxford University to study history, and was awarded a doctorate with his study of 18th century essayist, Joseph Addison. He then went on to study law.

Mr. Smithers joined the Royal Naval Reserves in 1939. He contracted measles, and this was to change the course of his life. Via friends of friends, he came to the knowledge of Ian Fleming and was summoned for an interview (The Telegraph 2006). He then was recruited to Naval Intelligence and MI6. It was his association with Fleming that later led to flattery in some obituaries that he was an inspiration for James Bond (The Telegraph), while other dismissed this account.
as pure fancy (Roth 2006). Friends would jest that he was "more green fingers than goldfingers" *(The Telegraph)*. In Naval Intelligence he was posted to Mexico and Washington. In 1943 he met and married Dojean Sayman. Later he and Dojean had two daughters and raised them with Dojean's son from a previous marriage.

After the war Mr. Smithers was elected to the UK parliament. He had his greatest domestic success with stopping plans to create a vast 4000-acre gas storage facility under Winchester Cathedral *(The Telegraph)*. In 1960-62 he was a delegate at the United Nations, and Under Secretary of State from 1962-64. He went on to be Secretary General for the Council of Europe from 1964 to 1969. He was nominated to a peerage, but members of his own conservative party opposed it. He was not considered Tory enough, being pro-American and the wrong sort of pro-Europe (Roth). He was later knighted in 1970. However, Smithers was becoming more disillusioned with Britain and accepted an offer of Swiss citizenship from the President of the Swiss Confederation, Will Spiihler *(The Telegraph)*.

The relocation from Britain to Switzerland gave Sir Peter yet another opportunity to design a garden and grow new plants. He built a house inspired by Caribbean and Japanese architecture above Lake Lugano, at Vico Morcote *(The Telegraph)*. Smithers, in *Adventures of a Gardener* praised the location for providing an ideal environment to grow a wide range of plants. Here he created a garden that was filled with *Magnolia, Rhododendron* and *Wisteria*. *The Financial Times* named it among one of the 500 greatest gardens since Roman times (Martin 2006). He created hybrids of nerines, liliums, and peonies by "pollen dappling" (Smithers).

![Nakamura 'Vico Yellow' original photo by Helen Marriott](image)

However, significantly for our interest, Sir Peter also went on to cross pollinate three *Clivia x 'Kewensis'*, one a cream and two orange from the same group that he acquired from Mr. Russell at Castle Howard (Smithers) in 1971 (Dixon). These *Clivia x 'Kewensis'* plants trace their origins back to Charles Raffle, and a slow program of yellow gene recovery, where habitat yellow were crossed with improved orange plants (Dixon). Sir Peter describes that he grew these seedlings on under the stage in his greenhouse, but the parent cream died before the seedlings matured. When one cream plant eventually flowered Sir Peter thought it to be an improvement on the parent. In due course he sent an offset to his friend Dr. Shuichi Hirao in Japan. Sir Peter believed
that a plant was not truly enjoyed until shared (not exchanged) with a friend. In Japan this particular plant was referred to as 'Smithers Yellow' (Smithers p. 146) and was featured on the cover of the Japanese Horticultural Society newsletter. Sadly, Hirao died prematurely. A couple of years later Sir Peter received a letter from Yoshikazu Nakamura. In this letter Nakamura told Sir Peter that he had received from Hirao's widow the yellow Clivia and asked for permission to use 'Smithers Yellow' for breeding purposes. Sir Peter wrote that he was astonished and replied that he was free to use the plant as he wished, but perhaps could call it 'Vico Yellow' (p.146). This name had earlier been suggested and accepted by David Brundell in New Zealand, where Sir Peter said it indicated both colour and place of origin (Dixon). This Clivia was the first to be commercially micro propagated by tissue culture by Miyoshi & Co. for commercial distribution. The results of this asexual reproduction have had mixed results in terms of identical clones of the original. Nakamura has been careful to refer to the true offsets as 'Vico Yellow' original to distinguish it from the tissue culture plants. Nakamura and Melbourne Clivia Group member, Shigetaka Sasaki, have extensively used the pollen from 'Vico Yellow' original in their breeding as the pollen is rich with good seed set and gives excellent results, particularly large well reflexed tepals (Dixon). Sir Peter was a member of the early Clivia Club that became the Clivia Society (van der Linde, p.25).

Fig. 10 Japanese Horticultural Society newsletter

Sir Peter enjoyed success with his photography of his flowers. He purchased his first Leica in 1932 (The Telegraph). His skill earned him eight gold medals from the RHS. The President of the RHS, Sir Simon Horby, wrote that, "Sir Peter may have some equals round the world as a gardener, but probably none as a plant photographer" (Smithers). The RHS also awarded Sir Peter one of its highest awards, the Veitch Memorial Medal.

Sir Peter Smithers had written about a desire to end his life like his hero, Joseph Addison, and wrote that his wish was to be "surrounded by beauty, which is my garden... As long as my memory lasts my garden will remain with me, like my own past life, a delightful dream which one I dreamed here on this mountainside". Dojean, Lady Smithers, passed away in early 2006. Sir Peter passed away aged 92 on 8th June 2006 (Martin).
While the biographies outlined above show these gentlemen to have had quite distinct lives, there are a number of similarities. Both were born British citizens but died in adopted countries. Both served in WW2 and were involved in military intelligence. Both married American ladies. Both created famous gardens and had specialist collections. Both were generous to other gardeners, and horticultural organisations. It was the act of sharing special treasured plants, in this case particularly good cream *Clivia*, which led to the wide distribution of those plants and their hybrids today. The *Clivia* fraternity is richer for their generosity and it is fitting that they are remembered frequently.

**References:**


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Courtesy of Michael Barrett, Melbourne Clivia Group, Australia
Unlocking the potential of interspecific breeding

Carrie Kruger

Interspecific Clivia flowers hold the added appeal of extending the flowering season. With the forming of the first flower, on crosses made four or five years previously, excitement is in the air. The hope that the flower will bloom in a way anticipated from your crossing, holds you in suspense and hope.

With all Clivia breeding there are good and disappointing results. Occasionally there are some outstanding results, which justify the time and effort spent hybridising the plants.

The range of colours found in the interspecific crosses, provides a treasure trove of hidden genetics. Most of the new and unusual colours found in clivia today originate from

Fig. 1 Star Green Destiny – Carrie Kruger

Fig. 2 ‘Ember Spirit’ – Carrie Kruger
the interspecific breeding programmes. The inclusion of the interspecific plants in a breeding programme, may be considered a ‘new age’ of clivia breeding.

As with many breeding programmes, patience is needed. Some of the F1 hybrids of interspecific crosses, provide pleasing results, but the largest improvement takes place with the second generation. Many of the F1 hybrids are tubular with a slight flare, which is not that spectacular. Many breeders may be discouraged by the appearance of the F1 hybrid flower, but will be rewarded when the F2 hybrids flower.

The interspecific breeding popularity is a relatively recent development. When I started breeding interspecifics, several years ago, the choice of plants was limited. Most of the plants available were mainly the tubular F1 hybrids. Selecting from these hybrids, for the best flower shapes and colours, I started our breeding programme. I now use the best of our F2 hybrids, making either sibling crosses or self-pollination.

Working with the interspecific plants has made me aware of the large gene pool involved in these crosses. As a result, the offspring colours are not always guaranteed. Ideally, I would grow all these plants to a flowering stage and then select the best. Unfortunately, like most breeders, I do not have the space to keep the plants until they flower.

Advice I can offer from breeding with interspecific clivia plants:

Start with superior F1 and F2 plants from the start. By doing this you will save a good few years in your programme, instead of starting from scratch.

We have bred some superior versi-colours flower plants from non-versi- coloured parents, for example ‘Ember Spirit’ Fig. 2. Versi-colour traits are carried over in the pollen as well as pod parent plants.

Avoid using miniata pollen, too often, on the interspecific cross. The repeated use of miniata pollen may result in an inferior looking ‘miniata’ type flower.
Results from self-pollinating F2 hybrids have often resulted in flowers that are superior to the parent. Consider self-pollination as an option when developing your interspecific plants. An example of this is ‘Planet Earth’ Fig. 3.

When you do decide to hybridise plants, know which groups your plants belong to, to avoid unwanted orange offspring.

To produce shorter leafed plants, use a compact plant as a parent. I have been working with a yellow Daruma plant as a parent, producing good results. ‘Mirror Beauty’ Fig. 6 is a good example of this type of cross.

Crossing your interspecific plants with either variegated or LOB type plants have resulted in beautiful plants. “Light of Africa” is an example of this type of cross. This cross was made by Francois van Rooyen.

Plants I used in breeding the various hybrids

Fig 1: ‘Star Green Destiny’ - F1 of ‘Star Green Original’ (‘Star Green Original’ is a F2 bred by Nakamura)

Fig 2: ‘Ember Spirit’ – ‘Carnival (miniata x gardenii) x ‘Secret Wish’ (‘Stella Parish’ miniata x gardenii) x Grp1 Yellow)

Fig 3: ‘Planet Earth’ – ‘Jupiter’ (gardenii x miniata) x (miniata x gardenii) x Self

Fig 4: ‘Lucid Dreams’- ‘Dreaming’ (Best Nakamura F1 x self) x sibling

Fig 5: ‘Over the Moon’- ‘Secret Whisper’ (‘Stella Parish’ miniata x gardenii x Grp1 Yellow) x ‘New Moon’ (Yellow F2 interspecific)
Developments and observations

The popularity of the interspecific hybrids has grown in the past few years and continues to attract many collectors and breeders. Many clubs now have exhibitions of the interspecific flowers. The advantage of the interspecific flowers is that they flower from the beginning of June up until the end of August in the Southern hemisphere. They often flower at odd times during the year, extending the flowering season of the *Clivia* plants.

Another advantage of interspecific flowers is that they are more disease resistant than the *Clivia miniata*. Interspecific plants grow faster and multiply well with some of the plants forming offsets before they have flowered.

The range of colours and flower forms are unlimited. These plants should be found in every collection.

I look forward to the next year’s variety of interspecific colours!

Fig. 6: ‘Mirror Beauty’ - (Yellow Daruma x *mirabilis*) x Yellow Daruma
Fig. 7: ‘Carnival’ = (*miniata* x *gardenii*)
Fig. 8: ‘Jupiter’ = (*gardenii* x *miniata*) x (*miniata* x *gardenii*)
Fig. 9: ‘Dreaming’ = (Best Nakamura F1 x self)
Since registering our original Vico Pink plants in 2016, collectors from all over the world want to add some of these beauties to their collections.

Our original Vico Yellow and Vico Peach plants were purchased from Charl Malan who obtained them from Mr Nakamura when he visited Japan in 1997.

In 2004, I crossed my Vico Yellows with the best Vico Peaches. In 2010, most have flowered very pretty pinks, peaches and a few yellows. From these plants, I selected only the best pinky peach flowers for further breeding. These plants were named, ‘Vico Pink Clouds’, ‘Vico Pink Explosion’, ‘Vico Pink Parfait’, ‘Vico Pink Vogue’ and ‘Vico Peach Kyla’. These siblings were crossed with each other, with the hope of producing even better pinks. The colour and shape of the flowers as well as the umbels, are important characteristics we look for. Most of these plants have beautiful umbels with large and sometimes, recurved flowers. The flowers are more pink than peach.

In the first generation, we still had about 25% yellows emerging.

The first flowers of the second generation started flowering in 2015 and 2016. We were amazed to see that this new generation produced no more yellows. It seems that the pink gene is now fixed and even when using a large yellow as pod or pollen parent to
improve the flower count or shape of the flower, it still only produced pinks and a few peach flowers.

Some very special ones have been named and will be used in our breeding programme, ‘Vico Baby Pink’ is a seedling of ‘Vico Pink Vogue’ and ‘Vico Pink Parfait’. Other special ones selected by us are ‘Vico Pink Butterfly’, ‘Vico Pink Giant’ and ‘Vico Pink Sky’.

We have also started using the Vico Pinks in our interspecific breeding to breed large pendulous peach or pink flowers. We have flowered one such plant bred by Charl Malan using Vico Peach on a yellow interspecific.

Over the years we have sold many of our Vico Pink and peach seeds to enthusiasts all over the world. We hope that they will flower as beautifully as the ones that have flowered here for us.
'Vico Pink Butterfly'

'Vico Pink Clouds' 2017
'Vico Yellow' and its spread: Some notes on terminology and associated cultivars

By Helen Marriott

The origins and naming of 'Vico Yellow' and 'Vico Gold' have been documented previously (Smithers 2000; Dixon 2005) and furthermore the use of 'Vico Yellow' (Fig. 1) in the breeding programs of Yoshikazu Nakamura in Japan and David Brundell in New Zealand have also been introduced (Sasaki, 2001; Dixon 2005, Marriott 2006, 2010). Commencing more than two and a half decades ago, the breeding programs of these individuals have been extremely important, especially that of Nakamura, because of the greater spread overseas of his seeds and plants which frequently have included crossings with 'Vico Yellow'.

As Dixon (2005, pp.81) claims "the influence of 'Vico Yellow' and its progeny emanating out of Japan has been enormous, and many modern clivias today include 'Vico Yellow' in their ancestry".

At a time when yellow-flowering Clivia were still quite rare to procure, Sir Peter Smithers (Fig. 2) dispatched a clone of the plant which was subsequently named as 'Vico Yellow' to Shuichi Hirao in Japan and it flowered for him in 1984. Following the latter's death in 1988, Nakamura (Fig. 3) grew an offset of this clone (with the remaining offsets promised elsewhere in Japan) and from then on it became the centre piece of his breeding. He began using this 'Vico Yellow' to improve the flower shape of the Clivia which were available at the time, and it has proved to be of lasting benefit, from many perspectives.

Fig. 1 Brundell's 'Vico Yellow'
Nakamura has always referred to this cultivar as 'Vico Yellow' original (Fig. 4) and, in turn, has distributed offsets of it domestically and internationally.

According to Sasaki (2001), in relation to the flower shape and size, Nakamura's 'Vico Yellow' hybrids produce large flowers with good forms, in addition to a well reflexed tepal (Fig. 5). Furthermore, he notes the fertile characteristic of 'Vico Yellow' pollen which leads to the production of good seed set and in my own experience, this also is the case with the hybrids. An interesting characteristic of 'Vico Yellow' seeds (especially when 'Vico Yellow' is used as the seed/pod parent) are their large size (and hence their few number in a berry), similar apparently to Transkei miniata. Sasaki has also observed the distinguishing circle which surrounds the radicle tip on the seeds from the "original" plant as well as from the tissue-cultured plants, but not, apparently, from the hybrids (Fig. 6). He also reports that sometimes the original 'Vico Yellow' plant displays a yellow margin at its leaf tip, which is thus a further distinguishing feature.

If one compares photos of Nakamura's flowers of 'Vico Yellow' and its offspring, much variation in the latter is apparent, ranging from long, narrow and sometimes twisted or rolled tepals right through to very broad, roundish tepals. Invariably though, the flowers are largish and sometimes, at least in the early years of a plant's maturity, there are fewer flowers.

A large number of excellent cultivars have been produced by Nakamura, many of which are unnamed but of his named cultivars, perhaps the most famous one is 'Chiba Lily' (Fig. 7), because of the size of its flowers (14 cm in diameter). 'Chiba Gold' (Fig. 8) is another cultivar with splendid broad petals, alongside of 'Chiba Yellow' and 'Chiba Orange'.

In the main, Nakamura describes seeds or plants bred from his 'Vico Yellow' original (usually used as the pollen parent) as 'Vico Yellow' hybrids, the majority of which are yellow-flowering plants. However (and perhaps unfortunately), in the past he has also used the general label of "best yellow" to describe these 'Vico Yellow' hybrids. Because Nakamura often crossed 'Vico Yellow' onto a heterozygous orange x yellow parent, sometimes orange flowers appear, and these he refers to as 'Vico Yellow' hybrid Orange. He also undertook more complex crosses, sometimes using his 'Vico Yellow' original twice, or else using superior hybrids. Pastels (Fig. 9) also emerge from his various crossings, as do Ghosts or other variations. His hybridization with 'Vico Yellow' and sometimes 'Vico Gold' or their hybrids has also involved crosses with 'Chubb Peach', multitepals (Fig 10), variegates – including Akebono (Fig. 11) and Light of Buddha variegates from China – as well as with the pendulous species to produce interspecifics. Further, he also crossed F1 interspecifics with these two cultivars (Fig. 12). Needless to say, Nakamura's 'Vico Yellow' hybrids are fairly well...
spread around various countries.

Also found in some Clivia collections in different countries are tissue-cultured plants from 'Vico Yellow'. According to Sasaki, the Japanese company Miyoshi commenced the tissue culture of this plant in conjunction with Shuichi Hirao in 1987, using the pedicel of the plant. The tissue-cultured plants were then released commercially by SAKATA NO TANE, another company, from 1995 when a 9cm pot sold for 12,000 yen (about US $14 at today's rates). While sales of these plants were only continued for a few years by this Japanese company, these plants have been spread around to a degree and offsets of the earlier tissue-cultured plants continue to be sold on a small scale here and there. Amongst them are some excellent flowering plants but poor ones are also to be found. (I can speak from experience as I purchased a seedling in Australia which some years later produced a very disappointing flower.) Nakamura himself has only rarely used a 'Vico Yellow' tissue-cultured plant in his breeding but on such occasions, he describes it as such. Like his hybrids from the original 'Vico Yellow', these tissue-cultured plants are also variable in their flower forms (which seems contrary to what I understand is often claimed about tissue-cultured plants), but in contrast to progeny from the original plant, not all will be desirable offspring, as explained above, and thus is it important for breeding purposes to know the actual parentage and background of one's plants.

Brundell (Fig. 13) also worked with a clone of the original 'Vico Yellow' which he obtained directly from Sir Peter Smithers in 1986 (Dixon 2005) and he, too, is well known for his exceptional 'Vico Yellow' hybrids. According to Barnes (2006: 84), "this ('Vico Yellow') has formed the basis of his (Brundell)'s breeding program, which aims to produce commercially viable strains in orange and yellow shades that are the best in the marketplace, with blooms that are bigger, bolder, brighter and better in all ways" (Fig. 14). Brundell's use of a fertigation system where the plants are constantly fed is believed to be a very important factor in his outcomes.

Brundell's own website, Gardenza, describes his hybridization with 'Vico Yellow' as follows:

In the first generation crossed with Vico Yellow, a galaxy of stunning yellow Clivia were developed using a single selected pollen parent of Australian origin. Plants in this F1 population have been vigorously rogued (i.e. eliminated from the population) and ranked over the years, with the kind help of many Clivia aficionado friends. This cross is characterised by their very large umbels and florets with wide petals along with broad leaves, strong plant vigour and (usually) a delightful scent. The cream-of-the-crop formed the basis of my Kings&Queens (KQ) range. The Top Ten have been given varietal names (KQ 1-10) and, in descending order, are Lunar Impact, Lunar Glow, Full Moon, Heaven Scent, Day Glow, etc. The 15 next-ranked plants (KQ 10-25) are still identified and pollinated individually and form 'Gardenza's Super Elite' group of Vico Yellows. The remaining plants, heavily rogued (eliminated), form the relatively uniform 'Gardenza's Elite Yellow' strain that is mass pollinated each year to produce many top-notch hybrids.

While not dominant for colour, Vico Yellow imparts characteristic plant vigour and large-sized umbels and petals to its progeny. Vico Yellow is also scented. It can be selected for green petal colour and green throats.
Using pollen from various types, a number of stunning hybrids have been produced, that range from dark to pastels, also with characteristically very large umbels and florets with wide tepals. Some have been named and include Apricot Sun, Mighty Sun, Wavy Sun, Cliveastrum, Mars Moonlight, Stella Vico, Bold Pink, Apricot Lace, Cherry Lace & Funny Face.

The next generation has taken these hybrids to another level, with even larger and wider petals. Green-throats are now appearing - and some remain so, to well after pollination, a breakthrough for these Group 1 Yellows. At this time, these have been grouped as 'Gardenza's Super Vico Yellow'strain.'

Fig. 15 shows Brundell having just received the Peoples' Choice trophy at the 2005 annual show of the New Zealand Clivia Club for his magnificent specimen of 'Heaven Scent' which displayed nine umbels at the time. 'Cliveastrum' (Fig. 16) flowered two years ago and Brundell thinks that this is probably his "best" yellow hybrid to date. He describes this flower as having "typically large, flat florets with characteristically prominent 'eye lashes' and with wide petals and especially sepals. Characteristic (of 'Vico Yellow') scent is a bonus" (personal communication). Another hybrid he describes as a "very full electric-orange hybrid" is yet to be named (Fig. 17). Brundell reports that he is also working to develop the incipient green throat tendencies of 'Vico Yellow' (Fig. 18). In addition, over the past three to five years, he has also been developing peaches and pinks from his 'Vico Yellow' hybrids in crosses with various 'Chubb Peach' hybrids from Sean Chubb. 'In the Pink' (Fig. 19) is one recently named hybrid. Because of his commercial distribution, Brundell's crosses are likely to be spread throughout New Zealand, in addition to smaller numbers being held by Clivia enthusiasts overseas.

From among the growers who have had the opportunity to observe together plants from the independent hybridization programs of 'Vico Yellow' by Brundell and Nakamura, Alick McLeman in New Zealand writes as follows (personal communication):
My own strain of Vico plants come from seed from Nakamura through the Clivia Society back in the 1990s and are very different to David Brundell’s Smithers strain. The umbels tend to have fewer flowers to the umbel but a lovely open flower form with wide tepals.

While I can only make guesses at this point in time, I wonder if several of the main factors contributing to somewhat different outcomes of using the same ‘Vico Yellow’ parent in the original F1s (and it or subsequent hybrids thereafter) would be the use of different seed or pollen parents – and hence different gene material – in the hybridization process, along with a rigorous fertigation system in the case of Brundell. We know that in Nakamura’s case, many of his early crossings were undertaken with a group of Isamu Miyake’s (orange x yellow) miniata which were used as the seed parents. Sasaki has noted that among these plants there was one with particularly large flowers and from which it is thought that ‘Chiba Lily’ was derived.

Because of the superior flower forms arising from Nakamura’s ‘Vico Yellow’ hybrids and access to them by growers of Clivia over the past 15 or more years, subsequent breeders have continued to use these plants in their own hybridization, and no doubt the same applies for Brundell’s plants, albeit on a smaller scale. For example, crosses by Shige Sasaki of ‘Vico Yellow’ hybrids with plants from other Japanese breeders or with special cultivars or habitat plants from South Africa feature in his hybridization. Indeed, it is not uncommon to find many growers (including breeders, collectors, enthusiasts or others) in South Africa, Australia, New Zealand, USA, Japan and elsewhere who grow ‘Vico Yellow’ hybrids and sometimes ‘Vico Yellow’ itself or the tissue-cultured plants. Frequently, however, in the past, I have seen seed lists referring to crosses of ‘Vico Yellow’ and occasionally ‘Vico Gold’, but I wonder whether it is actually these cultivars being referred to or progeny of them (i.e. a ‘Vico Yellow’ hybrid) or even a tissue-cultured plant. I am also unsure of the meaning when I see or hear the name of just ‘Vico’, but guess that in the majority of cases it is referring to a ‘Vico Yellow’ hybrid.

Other breeders have also been working with ‘Vico Yellow’ genes to develop peaches and pinks. For instance, Chari Malan in South Africa is well-known for his hybridization of
peaches and more recently, Carrie Kruger has shown photos of her pinks (Figs. 20 & 21) which derive from 'Vico Yellow' hybrids. She describes her developments as follows (personal communication):

Most of my Vico Pinks were bred from Vico Yellow (hybrid) x Best Peach. My best peach at that time (2004) was a Chubb's Peach x Vico Yellow (hybrid) obtained from Edgar Fevrier. So the pollen parent already has Vico influence in its genes. These crosses still produce a number of yellow seedlings as well. I select only the best pink peach flowers for breeding further. These siblings are crossed to produce even better pinks. The colour and shape of flower and umbel are important to me. Most of these plants have beautiful large umbels with some recurved flowers. The petals differ in that some are broad and some are less broad. The flowers are large and more pink than peach.

Kruger further states that some of her 'Vico Pinks' also come from Malan's breeding. She employs the name of 'Utopia Vico Pink' for the pinks which she has bred, and says that 'Vico Pink' is the name generally used by other breeders.

Subsequent to the emergence of 'Vico Yellow', Smithers flowered another yellow which he called 'Vico Gold' (Fig. 22) (which is not a darker colour, as is often assumed from the name) and he directly sent Nakamura an offset of this plant in 1993. Nakamura almost lost the plant from rot at one stage and this may partly account for why it has not been used as extensively in his hybridization and has had more limited distribution to date. Although some hybrid seeds from 'Vico Gold' crosses have been available from a small number of sources to date, it is more likely that when the name 'Vico Gold' occurs it is in reference to a 'Vico Yellow' hybrid (or a hybrid of a hybrid) or, on occasion, a tissue-cultured plant or even the original cultivar itself, and is thus related to 'Vico Yellow' rather than to 'Vico Gold'.

From Vico Morcote in Switzerland, 'Vico Yellow' in particular has travelled well and has earned its reputation as an outstanding cultivar which is found in various hybrids around the world. Along with 'Vico Gold' the Clivia community is much richer because of the existence of these cultivars and we are indebted to Smithers for sharing them with us.
Fig. 11 Yellow Akebono, a cross with 'Vico Yellow' x 'Vico Gold'

Fig. 12 Interspecific x 'Vico Gold'
Fig. 13 David Brundell in his nursery

Fig. 14 Brundell's 'Vico Yellow' hybrids in the garden
Fig. 15. David Brundell having just received the People's Choice trophy at the 2005 annual show of the New Zealand Club

Fig. 16 'Cliviastrum'
Fig. 17 A yet-to-be-named hybrid

Fig. 18 Green-throated hybrid
Notes

1) Thanks to David Brundell, Alick McLennan, Yoshikazu Nakamura, Shigetaka Sasaki and John van der Linde for their help with the content and the supply of photos.

2) Carrie Kruger.

3) While it was not the purpose of these notes to consider the actual gene constitution of 'Vico Yellow' itself, this issue has been brought to my attention in the process. A careful reading of Smithers (2000) and Dixon (2005) suggests that this cultivar...
has both yellow and orange genes in its background. John van der Linde proposes that since Sir Peter Smithers says that 'Vico Yellow' was "recovered" from an orange-flowered Clivia it could be (Group 1/Group 2 yellow = orange) x self.

4) John van der Linde recalls that some seeds which Nakamura earlier sent to the former Clivia Club were labelled as "yellow x Vico Yellow". In other words, these were "Vico Yellow" hybrids.
References

Gardenza: http://gardenza.co.nz/?pg = 122

‘Wittig's Pink’ and the origin of pink in Clivias

This article has come out of my decision in 2009 to closely examine the two sets of analytical results of pigment analyses carried out previously (References 1 and 2). This was aimed at determining whether they agreed or disagreed - and if they disagreed to understand why. As this is a quite technical examination, I am putting it here in a separate section so that enthusiasts who are less interested in these aspects can skip it and go immediately results and conclusions section.

Technical discussion

There have been two articles published dealing with the chemical analyses of the pigments in clivia flowers. The first by Koopowitz, Griesbach and Comstock (in the Clivia Yearbook No.5, p.23-31) and the second by Hammett with the analyses by Markham (in the Clivia Yearbook No.8, p39-49).
These two articles had different aims and the analyses were carried out by Griesbach and Markham – two different, highly qualified and highly regarded pigment chemists and were conducted in two different laboratories using two different methods (HPLC and Paper Chromatography).

The analyses were reported differently: one by a set of graphs, the other in a table of numerical results – quantitative in part and relative in others - using pluses and sometimes letters (+ , w etc).

Also, both articles were written by different authors (who were not the analysts) and commented on by them. One article has a much fuller experimental section which gives the technical details whereas the other is only generally described by the author.

The different aims of the articles were, in the first instance, to identify the anthocyanins present in a few Clivia miniata plants – in their flowers, berries and stems and then somewhat similarly, Clivia nobilis and Clivia caulescens.

In the second article the aim was to survey a larger number of named Clivia miniata cultivars with a broad colour range (no examination of berries or stems) and included Clivia nobilis and Clivia caulescens flowers. Because of this broad-brush approach, the chemical identification of the anthocyanins was less and they were reported as "pelargonidin like" or "delphinidin like" and the sugar substituents only described as mono or diglycosides.

Thus the anthocyanins really require further analyses. In general, the second analysis set could have been constrained by a lack of funds, however they also looked at some co-pigments and acyl substituents – all of which yielded valuable results.

Results and conclusions

What conclusions can be drawn from comparing the two articles and what can be taken from them as a whole?

Not in order of importance, the following is apparent:

From the total anthocyanin concentration results in the second paper, it is obvious that the anthocyanins present decrease fairly rapidly from red to orange to pastel to peach to finally zero in Group 1 and Group 2 yellows. Contrary to this, the carotenoid concentrations show no regular change within the anthocyanin pigmented plants and only in the cases of deep yellow to pale yellow flowers is there an apparent relationship.

This again suggests that orange in clivias is not due to orange being a combination of red plus yellow. In contrast, the graphs of the first paper show the relationship between pelargonidin-3-glucoside and pelargonidin-3-rutinoside (p-3-g orange and p-3-r red) as the control of whether a flower is orange (when p-3-g predominates) or red (when p-3-r predominates). They also show that reds have much more total anthocyanin than orange – which is supported by the quantitative values in the second paper.

The important difference between the two papers is that the earlier paper found only two anthocyanins present in the red, orange and (one) peach flowers examined – whereas in the second paper three anthocyanins were found, labelled as Anthocyanin 1 and 2 (reported as "pelargonidin like" and present + + +). Anthocyanin 3 was present in Nakamura Crimson (+ +) and (+ or w) in three others. It is here where I think that more work (analysis) is needed.

From the naming of the anthocyanins in the later paper I believe that Anthocyanin 1 is the same as pelargonidin-3-glucoside. Anthocyanin 2 is probably pelargonidin-3-rutinoside, but I do not believe that Anthocyanin 3 is a delphinidin pigment.

It may be "delphinidin-like" – probably because it gave a bluish or blue-purple spot on the paper chromatography sheet, but I suggest that Anthocyanin 3 is probably cyanidin-3-rutinoside (c-3-r). This is the anthocyanin that the earlier paper reported in Clivia caulescens (flowers and berries), Clivia nobilis (flowers) and Clivia miniata (berries and stem). As c-3-r is capable of being present in all these Clivia species, I suggest it is also present in some Clivia miniata flowers (particularly in the darker flowers) – e.g. 'Nakamura Crimson' as reported
(++) in the second paper as Anthocyanin 3. As well as his, of the three major pigment types, pelargonidin types are usually an orange red, delphinidin types are usually purple/blue, while cyanidin types have a wide range from red to pink to mauve to blue- so are capable of mimicking both the other types.

However, pelargonidin orange red is called scarlet – while cyanidin red is usually called crimson (so note that the Anthocyanin 3 (++) plant above is called ‘Nakamura Crimson’).

So where do pink flowers come from?
They come from dilute Anthocyanin 3.
All the peaches, apricots, pale pastels, pinks etc are simply dilute mixtures of three anthocyanin pigments, plus carotenoids (responsible for yellow) and even green - which is another pigment (chlorophyll) which can vary independently of the other four and which can give rise to green flowers when all the other pigments are absent or extra low amounts and the green pigment is present in a more than the usual amount.

The flavonoid pathway is common to most pigments in most plants and gives rise to anthocyanin pigments as the last step in the process. However, anthocyanins are extremely variable from genus to genus and even within a genus. Also, detailed chemical analysis of plants, where 4,000 or more anthocyanins have been reported, probably does not reach 1% of the total number of flowering plants.

Again, of those done adequately, the great majority of analyses have been done on dicots with much fewer available on monocots. In fact, the most investigated monocots have been corn and other grasses (cereals) because of their value as crop plants – so one has to get information from wherever one can.

Other investigated monocots are orchids where cyaniding pigments far exceed the other two (96% to 3% delphinidin and 1% pelargonidin types), liliums and a few more.

A recent paper on lilliums (Ref 3) was interesting
in that while often the situation is complex with numbers of pigments, in lilies it appears quite simple.

The main pigment is simply c-3-r (the same as in clivias) and a minor pigment – a more complex form of c-3-r – is only present in the deeply coloured flowers. With those investigated (ten “Asiatic type” lilies, two “Oriental types” and Lilium longiflorum) as a white (albino) the colours ranged from lavender red, to orange red to orange, to yellow, to pink to white – and these colours had less and less c-3-r, then decreasing finally to pink, in the absence of yellow.

I suggest this is also what is happening in clivias where c-3-r is not the major pigment (the pelargonidin 2 types are) but as these two go down in amount, c-3-r can vary independently of them and of the carotenoids, so in the the few flowers where these are fading out (becoming less and less) if c-3-r is still present you start to see not crimson red (when c-3-r is high) but pink.

This is where ‘Wittig’s Pink’ comes in (source unknown).

We have the difficulty of flowering it pink - it is frequently peach and probably environmental and timing (developmental) conditions are important factors but its berry has been described as maroon which on my colour chart is a very marked purple-red (probably what in the lily was described as lavender-red).

Remember Christo Lotter described his peaches, originally from an orange x yellow cross, as first year flowering a pink then the following year an apricot and eventually he got his peach line from these plants. This is an example of developmental change as are green seedlings which are initially described as green but slowly pigment with time (again, a c-3-r time development) as a result of the anthocyanin pigment in the stem.

Once you get a pinkish flower, crossing it with another (preferably out of the same cross), line breeding will intensify the pink colour in subsequent offspring.

Conway reportedly was breeding ‘bluish’ flowers - which most of us assumed was just an ‘ageing’ flower effect – but it could easily have been a developmental appearance of c-3-r.

In conclusion, to ascertain the factors at play, I feel we must obtain an accurate analysis of Anthocyanin 3 from a ‘Nakamura Crimson’, a good pink flower and, if possible, a bluish fading flower.

References


Bill Morris, Australia
Yellow Daruma Surprise by Eddie Pang

It comes as something of a surprise to find out that my apparent yellow Daruma (Golden Sparrow) is not a true yellow hybrid! Golden Sparrow is a premium quality Anshan blush yellow Daruma with Sparrow genetics. In fact, it is a good example of a “Sparrow Monkey”. It has very dominant dwarf genetics and sparrow beak leaf tip like the common sparrow hybrids. However, its umbel does not emerge from the apical growing point, it flowers normally and will not end with growing point rot like common sparrows.

Unlike most of the Anshan blush yellow Darumas which would normally develop the blush color of various degrees between the 1st & 4th day of flower opening, my Golden Dragon (a green throat Anshan broad leaf blush yellow Daruma) shows the blush coloration even at bud stage. My Golden Sparrow started its first flower of the current season on Sept 26th. That first flower is over 10 days old now & is still rich yellow in color.

Most people who saw my Golden Sparrow during the last 11 days thought it is a yellow Chinese Daruma. However, a light pink color will develop along the petals' edge just before the flower drops! It is significantly different from all the Anshan blush yellow Darumas which I have seen in China. Sadly, I wish it was a yellow Daruma too!
The group photo of "He - Golden Sparrow & F1" shows the Golden Sparrow (bottom LHS), and in a clockwise direction, the "F1 (Golden Sparrow X Changchun Cream)"; "F1 (Golden Sparrow X US Yellow)" & "F1 (NM Cream X Golden Sparrow)". This group photo demonstrates the dwarf genetics of the Golden Sparrow, it produced F1 with leaf length at 200 - 300mm when Golden Sparrow was used as pod or pollen parent. The Changchun Cream, US Yellow & NM Cream have leaf lengths at 650 - 800+mm. It is also interesting to see that, apart from the flower size, the F1 of the 3 sample crosses produce flowers of consistent pink/pastel Picotee edges.

The flowers of my "F1 (Golden Sparrow X US Yellow)" have the pink Picotee edges from buds till now! No obvious change in the pink areas is observed. Blush yellow Anshan Darumas are beautiful by themselves, but their seeds should not be offered as yellow Chinese Darumas with the expensive price tag.

Therefore, all potential buyers who intend to purchase seeds of yellow Chinese Daruma from Chinese resellers should ask the resellers to provide a series of photos to confirm that there is no blush color development in the flowers throughout the flowering period, till the last flower drops. The resellers should have no objection in fulfilling this request because genuine seeds of this category are offered at extreme price, and if they are genuine! Apart from a few rich Chinese entrepreneurs who have acquired the expensive yellow Chinese hybrids from Mr. Wang Dian Chun as their prestige collection, there are only a handful of Clivia breeders in China who have genuine yellow Chinese hybrids. Hence, buyers should be more cautious about what’s on offer??

![Golden Dragon](image)
Clivia in China

The first clivias reached Japan from Europe in 1854. Early in the 20th Century Clivia had been brought to China (Qing Dao province) by a German missionary. Some reports state that this took place in the late 19th century. A second group of Clivia was taken to China by a Japanese by the name of Tamura after the invasion of China by Japan in 1931. After the 2nd World War these clivias remained at the Emperor's palace. In 1942 the Emperor's second concubine died and a clivia plant was displayed at her funeral. This plant did not return to the palace and remained at the temple. A monk at the temple then continued to cultivate this plant, which was named “Monk”.

From the plants at the palace two plants were given as gifts: one to the Chanchun Tung Hsing Dyeing Factory, which became known as “Dyeing Factory”, and the second to the Chanchun Sheng Li Park after the liberation, and which was fittingly called “Victory”. Until the 1950’s plants only became available as offsets (suckers). In the early 1960’s some growers started to pollinate plants and a cross-breeding union was established. In 1963 some plants (Monk) from the temple became available to the public and trade. During the 1976 Cultural Revolution, the Red Guards tried to destroy all remnants of the old society, including Clivia plants.

However, in 1980 it was estimated that about 150 000 families in Changchun still grew some clivias. The official flower of Changchun on 11th October 1984 the Clivia was named the flower of Changchun. After this some nationalised companies, private groups, and individuals came together and formed a large-scale society to research and enhance Clivia cultivation. This organisation soon had 24000 members.

The cultivation objectives were:

- Aesthetics - To have a plant that could be appreciated all year round
- Leaf - Viewing the leaf is better than the flower
- Flower - Beautiful leaf with a captivating flower
- Shape - Graceful style of clivia “Light of Buddha”
Clivia in China

First found in China by Mr. Wo Bo many years ago, the “Light of Buddha” was initially a plant with narrow leaves. About 15 years ago Mr. Bo started with a breeding program using a broad-leaf Japanese Daruma as pollen parent. At first the Chinese public did not want to buy the LOB as they believed that the plants suffered from a disease similar to a skin disease affecting humans! However, a large number of plants and seeds were purchased by Mr. Nakamura.

The characteristics of Light of Buddha plants are bright green shiny leaves with distinct cream / white bands. New leaves are always a bright yellow with very little green, turning green with age. The leaves have distinct veins. The Chinese concentrated their breeding of Light of Buddha plants on the leaf appearance. On some LOB plants the variegation appears to be the same as on Akebono. Considering its history this mutation could be from the same gene pool as the Japanese Akebono.

The Chinese refer to it as Akebono variegation using the Japanese word, but it still must be shown whether the two are physiologically the same or not. As with other forms of variegation, inheritance of the LOB variegation appears to be from the mother plant. LOB can produce up to 80% variegated seedlings, which show variegation at the 1-4 leaf stage. LOB variegation improves with age. About 8% seedlings can show normal variegation which could change to LOB as the plant grow older.

“Henglan” - Henglan was developed around 1992 by crossing Chinese Round Tip with Japanese Daruma. The leaf length should not exceed 150mm, and the leaf width to length ratio should be 1-1.5:1, with round leaf tips. Henglan is used as a pollen parent only, as it has very strong dwarf genes, and will reduce leaf length by approximately 1/3. At present when using Henglan pollen on variegated Daruma very few good quality variegated Henglan seedlings are obtained.

“Sparrow” - Sparrow Clivia were produced from an offset mutation from Chinese Clivia, about 12 years ago.
Clivia in China

"Broad Leaves" - Broad leaves are mainly achieved by crossing short leaf Monk with Japanese Daruma, with leaves reported to reach up to 180 mm wide. Growers with extremely good plants, however, are very secretive and release little information about them. Visitors who are trusted may have the privilege of seeing some of these unique plants, but almost 7 without exception they refuse permission for their plants to be photographed. Such plants are so prized that no price can be attached to them or insurance cover arranged! They are not such attractive plants as the leaves become too heavy and pendulous. To grow broad leaves the pot temperature should be maintained at 15-24 degrees C. Plants should not be allowed to carry seeds as this deforms the leaf shape.

With all their excellent tunnels and growing houses the Chinese, Japanese, Belgians, Netherlands and Americans are light years ahead of South African growers, as they can control all aspects within these houses, while our climias must "grin and bear it" with the elements in our shade houses.

In the controlled environments of Asian, European and American plant houses the plants build up little resistance to pests and plagues as these are not allowed in. Inside these plant houses humidity, temperature, feeding, irrigation, ventilation and light are controlled as in the intensive care unit of a heart hospital.

- "Monk" The width of the leaves is 90-110mm. The plants are classified into three groups, according to leaf length, with a ratio of length-width of 3:1-5:1: Long-leaf Monk - More than 450mm Medium-leaf Monk - Leaves between 350mm-450 mm Short-leaf Monk- Leaves less than 350mm

- "Daruma Monk" When the leaves are longer, they are narrower. The leaves have much more shine and more defined veins than other forms. As the leaves become shorter and wider, so does their habit - they are more upright, in contrast to the more normal pendulous habit. The leaf width of Daruma Monks is 90mm-150mm, with a ratio length- width of 1.5:1- 2.5:1 Long-leaf Daruma Monk - More than 250 mm Medium-leaf Daruma Monk - Leaves between 200 mm-250 mm Short-leaf Daruma Monk - Leaves less than 200 mm.
Clivia in China

Daruma plants were brought into China from Japan about 18 years ago. “Round Tip” Chinese Round Tip plants have been developed from Monk plants.

©These notes were made by Sakkie Nel from Andre van Rhyn’s presentation of "Clivia in China" to the members of the Northern Clivia Club in February 2004. Sakkie (I H J) Nel, Pretoria
It is well known that *Clivia* has won popularity in China. However, when one visits China, one is impressed by a lot of new experiences with *Clivia* plants and people there who have not been referred to in the related articles.

The places where *Clivia* is most remarkably popular in China are the three provinces of the North-Eastern region. In Changchun City of Jilin Province, people adore and enjoy *Clivia*, where it has secured a status as the flower of the city. People are involved in *Clivia* at various levels; aged people are seen to sell only a few *Clivia* seedlings on the street, while there are some who run a large glass greenhouse and a gardening supply store. Many kinds of cut flowers are seen to be sold at the gardening supply store, one after another - like hot cakes! When you look up at a tall apartment house building, *Clivia* are seen in the bay window of each household.

I occasionally visit a foreign country to observe local *Clivia*. Often I did not understand the local language or know my way around - of course in China too. Many of my Chinese friends, even on the occasion of our first meeting, warmly welcomed me and arranged my observation of *Clivia* in a vast glass greenhouse where visitors are not usually allowed to enter. Living facilities are built in a growing greenhouse. Although these friends usually entertained me at a splendid foreigners-only hotel or with local cuisine, I would have rather preferred to stay at such living facilities as in the greenhouses, so that I could have spent more time with *Clivia* and friends.

Pots for *Clivia* planting in China are all unglazed earthenware and the growing medium used is 100% leaf mold. To maintain foliage alignment, an aluminium foil is wound around a deformed leaf. We have to understand
makes me excited whenever I think of development potential of a new Clivia by the many enthusiastic Clivia breeders taking up the challenge, using the excellent genes available in South Africa. What impressed me most is the devotion to Clivia by Chinese people. I recommend you visit Changchun. Really, seeing is believing!

that the value of a small number of selected Clivia plants can be as much as a few hundred thousand rands! So you cannot take too much care of Clivia!

Breeding and growing techniques of Chinese Clivia are at the highest level and have almost reached the ultimate level. It seems, however, that they have had little experience in attempting interspecific crossing or crossing with yellows because, as in Japan, the emphasis is placed on leaves rather than on flowers. For my part, as I have given preference to hobby breeding rather than commercial breeding, my breeding objectives cover all ranges of Clivia, but in China, their breeding is concentrated only on foliage.

I know that an amazing Clivia plant was just bred in Changchun. It also
Perhaps a more appropriate title for this article would have been “Foolin’ around with Clivia”. I have no horticultural or scientific background. A banker in my other life, I have been ‘playing’ with Clivia for the past 18 years, ever since I first saw a lone C miniata in flower under a tree in a newly acquired garden in Johannesburg. At the time I didn’t even know what a Clivia was, but it was love at first sight and I snaffled the Clivia away from my green-fingered wife, Frances, who had excitedly discovered how easy it was to grow them from seed. Apologies therefore to the scientists in our ranks for my somewhat unscientific perspective.

(Variety is the spice of life and the incentive of Clivia hobbyists)

My hybridising of Clivia has been influenced by two fundamental concepts:

1. The first is Mendel’s theory, which I have come to interpret as “What you put in, is what you get out”. As I understand Mendel’s model if you breed for any genetic trait, that trait could re-emerge in the 2nd and later generations. It follows that one can set goals based on genetic characteristics in a first generation cross. To illustrate, if you set a goal of producing a yellow pendulous plant you could cross a yellow miniata with an orange gardenii as depicted in the table. In the first generation (F1) this would produce 100% orange, very similar, semi-pendulous, slightly flared flowers. If the siblings are then crossed (F2) 25% of the progeny will be yellow (depicted by the yellow block of squares) and 25% of these yellow Clivia will tend toward the gardenii form, 25% toward miniata, and 50% would be somewhere in between. You’ve now reached your objective of yellow, pendulous Clivia. But your goal could have been for other traits like plant form, leaf width, floret count, colour distribution, etc., etc. And the progeny will, of course, have inherited genetic traits other than your prime objectives as well.

<table>
<thead>
<tr>
<th>Open Orange</th>
<th>Pendulous Orange</th>
<th>Open Yellow</th>
<th>Pendulous Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Miniata Type</td>
<td>Open Pendulous</td>
<td>Open Semi Pendulous</td>
<td>Semi Pendulous Split yellow</td>
</tr>
<tr>
<td>Open</td>
<td>Pendulous</td>
<td>Semi Pendulous Split yellow</td>
<td>Pendulous Sem pendulous type yellow</td>
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<tr>
<td>Open Split yellow</td>
<td>Semi Pendulous Split yellow</td>
<td>Open Yellow</td>
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<tr>
<td>Pendulous Yellow</td>
<td>Semi Pendulous Split yellow</td>
<td>Semi Pendulous Yellow</td>
<td>Pendulous Gardeni type Yellow</td>
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Mendel’s Model
2. The second concept has to do with the pigments in the Clivia flower. In 2004/5 the New Zealand Clivia Club through Dr Keith Hammett sponsored an experimental pigment analysis of a range of Clivia flowers. This was first published in the club Newsletter Vol.3.1. of March 2005 and is reproduced in this issue. This helped me to appreciate the artists’ palette that we have to work with. As illustrated in the table below we have two pigments to work with, red anthocyanins and yellow carotenoids, the red pigments in the surface cells and the yellow in the fleshy cells behind. In effect we are looking through a red filter into a yellow background, hence the dominant orange coloring of Clivia.

But it is not like applying paint with a paint brush. The pigments are rather of the nature of the dot-matrix used in newsprint. The variation in colour is thus due to a change in intensity of pigment ‘dots’ and not a colour change, and this variation in intensity can occur in either the red or yellow pigments, or both. So red, orange and peach flowers all have the same red anthocyanin and yellow carotenoids, but the intensity varies. Flowers are yellow in the absence of red anthocyanins and white in a flower is due to the complete absence of any pigment in that part of the floret, the air in the empty cells appearing white in the same way as a waterfall appears white, because of the air bubbles.

<table>
<thead>
<tr>
<th>CLIVIA FLOWER PIGMENTATION ANALYSIS</th>
<th>Photo</th>
<th>Intensity</th>
<th>Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark red</td>
<td>8.2</td>
<td>1.6</td>
<td>5.1</td>
</tr>
<tr>
<td>Orange</td>
<td>3.2</td>
<td>0.35</td>
<td>9.1</td>
</tr>
<tr>
<td>Pastel (light orange)</td>
<td>4.2</td>
<td>0.21</td>
<td>20</td>
</tr>
<tr>
<td>Chubb’s Peach</td>
<td>4.8</td>
<td>0.07</td>
<td>68</td>
</tr>
<tr>
<td>Dark Yellow</td>
<td>9.6</td>
<td></td>
<td>68</td>
</tr>
<tr>
<td>Near White</td>
<td>1.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

So, you can draw logical conclusions to use in creating your masterpieces. The darkest reds have the highest intensity of anthocyanins, the dot matrix being so intense as to be opaque (and the analysis also detected blue pigments in the darkest reds, which adds another dimension); the peaches and pastels have low levels of red anthocyanins and a relatively high level of carotenoid, so you’re seeing a lot of yellow through a relatively transparent red filter; and the ‘near’ whites have a very low carotenoid level because you are looking mostly at empty air-cells; and if you then superimpose a low red anthocyanin filter over the latter the colour will tend to be pink. And so, the Clivia hybridist wields his artist’s brush in the combination of these two concepts.

**Breeding for colour:**
Colours of similar pigment intensity will tend to breed true. Crossing your deepest reds will tend to produce more reds but with some variation in the intensity, and in some the red may be even more intense than in the parents. This is how one would breed for more intense reds.
Similarly, crossing your deepest compatible yellows will tend to produce a few deeper yellows, and crossing your palest compatible yellows will produce a few that are paler, leading to near whites and ultimately, perhaps, the white Clivia.

(Note on compatibility: The genetic defect which resulted in the failure to produce red anthocyanin pigment in yellow Clivia can occur in different genes or at different levels in the chemical process, hence we refer to group 1 & group 2 yellows, and there are perhaps other yellow groups as well. All group 1 yellows will have the same genetic defect and if crossed with another group 1 yellow will produce 100% yellow progeny. The two plants are then said to be compatible. If crossed with a yellow of another group, the progeny reverts to orange. Most yellows in New Zealand will be compatible group 1 yellows)

There are however exceptions. Some peaches have arisen as natural mutations in habitat and in cultivation. Chubb’s Peach and some other peach strains are said to be ‘group 1’ and compatible with group 1 yellows, that is if crossed with group 1 yellows they will reproduce 100% peach or yellow progeny in the first generation. Most peach plants of this strain have already been crossed into yellow to improve the flower form and, in my opinion, tend therefore to behave as though ‘split for’ yellow.
Another group of peaches, which include Cameron’s or Tipperary Peach, the Californian Victorian Peach, etc., will also in my experience breed true, but if crossed with group I yellow or the Chubb’s Peach strain will revert to orange in the progeny. Similarly, pastels, which have similar pigmentation intensity to the peaches but have been produced by diluting red pigments through repeated crossing with yellows and are therefore split for yellow should reproduce pastel and yellow if crossed.

Recessive Genes/Recovery of colour & other traits:
Helen Marriot of Melbourne in an article on interspecific breeding stated:

“In much of his breeding Nakamura (a leading Japanese breeder) has commonly used orange and yellow forms of C. miniata, his notion being that use of different species and colours in combination could give rise to new mutations, including colour mutations”.

As already pointed out in the discussion of Mendel’s model, crossing a yellow with an orange will result in 100% orange progeny. However, the gene(s) responsible for the failure to produce red anthocyanin pigments in the yellow is recessive, and the orange Clivia is said to be ‘split for’ yellow. (The correct term is ‘heterozygous’, but I can’t even pronounce the word) The point is that plants can be split for traits/colours other than yellow and these traits/colours can then be recovered in later generations as per Mendel’s model.

A particular interest of mine has been to recover rare colour forms using this principle. So, for instance I have been able to recover the ‘nongroup 1 or 2’ Thurston Alpha and Thurston Beta yellows through sibling crossing seedlings where the Alpha or Beta were either an ovary or pollen parent.

The rare Wittig Pink is by all accounts sterile to its own pollen, but I’ve been able to recover the colour by sibling crossing Wittig Pink X Chubb’s Peach hybrids. Similarly, I have been able to reproduce in a plant I registered as ‘Golden Dusk®’ an extremely rare habitat plant colour, Thurston Ngidi Pink Champagne, again by sibling crossing a hybrid with the Ngidi Pink as one of the parents. At present I am aiming to recover the lovely Conway plant, Sunrise-Sunset, by sibling crossing Sunrise-Sunset/Twins Yellow hybrids, all of which
flowered orange. But recovery possibilities are by no means limited to colour. The same can be said for colour patterns, umbel, floret and foliage forms, variegations, Multipets, etc.

Breeding for Colour Distribution Patterns:
Another area of interest to me is the variation in colour distribution through the florets, resulting in bicolours and Picotee (where the red pigments display as a trim at the edges of floret), splashes (where the red pigments display as irregular blotsches of colour), white lips (a sort of reverse Picotee with a white trim displaying at the edges of orange to red florets), ghosting (a fading of the red pigments in the petals), watercolours/party-colours (a washed effect in pastels, similar to ghosting), and green throats (where chloroplasts occur in the florets).

In most instances the inheritance of colour distribution patterns will also be genetic and, for instance, in repeated crossings of bicolour forms some progeny will tend towards the Picotee form. A plant which some have found to be particularly effective in this form of hybridisation is Roly’s Chiffon, a plant selected for its deep white throat out of the large plantation of Roly Strachan in KwaZulu Natal. This is illustrated in a plant I’ve named ‘Chiffonoline’ produced from a cross between Roly’s Chiffon and Crinoline, another Strachan selection. Similarly, I produced KiwiKaleidoscope® through another Strachan plant, Roly’s Kaleidoscope. But I still have a way to go towards some of the lovely Picotees that have been produced internationally, such as Conway’s Ramona and the Japanese Kazumi Hattori Picotee in photo, but I’m working on it.

Breeding for Form of Florets and Umbel:
It may be desirable to cross plants with a view to improving the umbel or floret form through the selection of parent plants which have a high floret count (30 plus) or larger than normal florets, recurved petals, etc. Worthy of mention is Vico yellow, a plant which has been used all over the world to improve floret form. David Brundell in Auckland has done a lot of work with an original Vico clone gifted him by Sir Peter Smithers, improving not only yellows but other colours as well, producing plants with huge umbels and giant florets.
HYBRIDISATION STRATEGIES FOR THE HOBBYIST
By Alick Moleman
(Based on a slide presentation at a meeting of the New Zealand Clivia Club on 29th July 2009)

(John Meyer’s head in photo illustrates the size of the umbels).

Vico was later extensively used by Yoshi Nakamura in Japan and I have used some of his
genetic material in breeding for recurved petal florets, a form I find most attractive because of
the ‘eyelash’ appearance of the protruding anthers.

Similarly, plants are being bred for petal forms like multi-petals, keeled petals, and even
plants with no petals at all. Some find very wide petals attractive while others strive for a
spider form with narrow petals. It’s a matter of personal preference.

Breeding for Foliage Form and Appearance:
For years the Chinese and Japanese have been concentrating on foliage, striving to produce
ever smaller plants with leaves as wide as they are long and using the Japanese Daruma as
base.

Breeding for Foliage Features
Some have lovely variegated leaves with vertical stripes of white and pale green contrasting with the darker green of the leaf. There are even plants with attractive horizontal variegations of different types, referred to as Akebono in Japan or LOB (Light of Buddha) in China. Very little hybridising has been done with these plants in New Zealand and even in China and Japan not much has been done to improve the flowers and colour range. It would seem that variegation is passed on through the ovary parent, the vertical variegation being caused by a genetic defect in the meristem of the plant failing to produce chloroplasts. This defect then reflects itself as a stripe as the leaf grows out of the meristem, the width and number of stripes being dependent on the number of defective cells in the meristem. This defect/stripe can carry through to the peduncle & pedicles and on into the berries and seeds, producing another generation of variegates. It is generally accepted that ovary parents with pin-stripe variegations make the best mother plants.

**Inter-specific Breeding:**
This is the area of Clivia hybridisation which is stimulating so many around the world. All Clivia species will cross with one another. Although flowering at different times, pollen can be stored indefinitely in the freezer to facilitate hybridisation between the species with spectacular results. The Australasian Cyrtanthiflora, which is fairly common in various parts of New Zealand & Australia, was an early cross between miniata and nobilis dating back to the late 1800s.

![Breeding for Interspecifics](image)

Again, Mendel’s theory applies and ‘what you put in is what you get out’. Crossing different colour miniata with one of the pendulous species will produce attractive F1 progeny, all very similar, semi-pendulous, midway between the two species in form and in similar shades of pastel, orange or red, sometimes retaining the green tips of the pendulous species.
HYBRIDISATION STRATEGIES FOR THE HOBBYIST
By Alick Mcleman
(Based on a slide presentation at a meeting of the New Zealand Clivia Club on 29th July 2009)

These F1 plants are then split for the miniata colour which may be recovered in the F2 and later generations. It has been found that caulescens, robusta and gardenii lend themselves to quick-growing, robust progeny when crossed with miniata, with the former two species perhaps contributing to a higher floret count in the progeny. Many are tempted to cross the F1 back to miniata, but in doing so are diluting the genetic contribution of the two original parents, and I suggest that better results could be obtained by sibling crossing the F1 seedlings so as to exploit their genetic base to the full.

Sourcing Breeding Material:
So how do you acquire suitable breeding material? While some quality plants can be obtained at reasonable prices here in New Zealand, some of the really special stuff costs a fortune. For instance at an auction at the 2006 Clivia conference in South Africa a top price of R30000 (NZ$6000) was paid for green-throat yellow. The asking price for a very desirable Bronze green-throat, Bertie’s Bronze, is $2000. And these prices are far from unusual. Add to that the importation and quarantine costs and you’ll soon run out of money unless a millionaire.

The point is that this genetic material can be acquired by way of seed. My experience is that imported plants take a fair while to recover from the trauma of importation and, in some instances, the change from one hemisphere to another, so that flowering is sometimes delayed for a number of years. This makes seed grown plants a viable alternative. Here in New Zealand seed is made available from time to time though the New Zealand Clivia Club. The writer produces an annual international seed catalogue in February/March each year and anyone wishing to be placed on the emailing list can email me at clivia@xtra.co.nz. Otherwise there are numerous international growers of note who make seed available. This is a great way to build up your collection. And reading international Clivia publications will help you to identify desirable genetic material. And you will also find that established growers are very generous when it comes to making pollen available from their best plants.

The Future:

New genetic material is constantly becoming available. For instance, a group of miniata plants discovered in a Transkei habitat in the 1990s and appropriately named the Apple blossom complex (Q1; Q2; Q3; etc.) because of the colouring are now becoming more widely available. These have already been used to produce lovely pink colours. The new species C mirabilis was only discovered a few years back. Then we have the blue pigments found in Clivia like Conway’s Jean Delphine. All have the potential to add a new dimension to Clivia hybridising. The future has to do with what YOU are able to create with the resources at YOUR disposal.

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Courtesy of Alick Mcleman, New Zealand
Why do we breed with Interspecifics by Carrie Kruger - Utopia Clivias?

I consider interspecific breeding as the “new age” of breeding

- Most of the new and unusual colours in Clivias originate from interspecific breeding
- We at Utopia Clivias believe that the future of Clivias lie hidden in these genetics.
- The largest range of colours are found in interspecific flowers.
- From orange to yellow, pastel peach and pink, bronze and green and now multi colours and versi colours

Interspecific breeding through the years.

- The term “interspecific” says it all, interbreeding with different species of Clivia.
- The first crosses were made years ago between Nobilis and Miniata and were named “Cyrtanthiflora”
- Breeders have since crossed all the various species with miniata and vice versa.
- Some proven results of F1 breeding are that using miniata as a pod parent will give larger more open flowers in the first generation.
- We see the F1 generation of interspecifics only as a steppingstone to much better, more diverse flowers in the second and third generations.
- Advice to beginners: Start your breeding with a good F1.

Comparison between F1 and F2 generations

F2 flowers are larger and more open
F2 flowers have a larger array of colours
Plants flower at different times due to the larger genetic make up

About our breeding lines at Utopia Clivias:

The “Secret” Series

- These plants were bred from the same cross. Stella Parish Miniata x 5 Star (Gardenii x group 1 yellow)
- They are all the most beautiful pink F2 interspecifics with large, open recurved flowers.
- I am currently line breeding with these plants and the first F3 plants flowered in 2016.
- I have found the F3 flowers larger with softer pink shades.
- These plants have all been registered on the International Clivia Register

The “Dream” series

- These are all selfed seedlings of a Nakamura bred interspecific, grown from seed.
- The first selfing of this plant only produced about 8 -10 seeds which grew into these magnificent plants.
- The flowers are large and semi-open.
- These plants all have flowers with Picotee-type edging, and semi to broad leaves, up to 90mm.

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Why do we breed with Interspecifics by Carrie Kruger - Utopia Clivias?

► We are line breeding these plants as well as using them in other crosses.
► I started with some experimental crosses between the “Secret Series” and the “Dreaming” range of plants.
► The first one flowered last year. A soft pastel with darker pink outer petals and darker pink blush on inner petals

New Versi Colour Range

► We are breeding a new range of versi colours from different breeding material.
► They range from pink versi colours to dark red and brick brown versi colours.
► Versi colour genes are very dominant and are carried over to the next generation even as only the pollen parent.
► We have flowered some very special versi colour flowers last season.

“Star Green” breeding

► The famous “Star Green” is used in this breeding line.
► “Star Green” is truly a one of a kind flower with dark brick red outer petals and green inner petals which gradually change to a dusty pink as it matures.
► “Star Green” is not a very fertile plant and has to be pollinated at an early stage as the flower opens. The pollen stays viable for a day or two where you have to be prompted to harvest every bit of pollen as the sacks open. Thereafter, it becomes brittle, dry and unusable.
► It does not self-pollinate effectively, but in some instances a small number of seed has set on self-pollinations.
► We have done a variety of pollinations onto “Star Green” as well as using the pollen on many other plants.
► I think extremely exciting times lie ahead with this beautiful and unusual plant.

Cultivation and care:

► Interspecifics are no different to miniata when it comes to cultivation requirements.
► They require water once a week if it does not rain during the hot months.
► In winter we water sparingly and only if necessary.
► Our planting mixture consists of a well-drained mix of fine and coarse bark, filter sand, polystyrene and “Flexi Coat” slow release fertilizer.
► Mature plants are fed with Hyper Feed every 3-6 months
► Seedlings and young plants are fed with “Kick Start” every 8 weeks.
► Plants are treated with a systemic insecticide and fungicide once every 6 months

Conclusion:

► Interspecifics give us a longer flowering period as they start flowering from June to September.
► They are fast growing and more disease resistant than miniata.
► They multiply well.
► The range of colours and forms of flowers are unlimited, and they are therefore a must in any breeder’s collection.
► I hope I have inspired you all to include a few of these special plants in your collections.

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How we Pollinate our Clivia

After removing the paper wrappers, half and then quarter your straws

Quartered Straws

Bring the tip of the straw close enough to the flame so it just starts to melt

While still melted squeeze the straw between 2 fingers

Some burning of fingers can be expected as this is real heat molten plastic!

Squeeze and hold for a second or two

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How we Pollinate our Clivia

Best to do this when the flower buds just start to separate by themselves.

For the purposes of this, we are opening the flowers mechanically - take care as the flowers bruise easily.

Gently press down on the tip of the flower until it pops open.

Now the pollen sacks are exposed for easy removal.

Using a pair of tweezers gently remove the pollen sacks.

You should have at least 6 pollen sacks per flower so keep count.

The only exception is with Multipetal flowers. You should have one for every flower petal.

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How we Pollinate our Clivia

**Ideal to be removed at this stage**

Once they have opened you risk self pollination.

**Now cover the stamper with a straw and well 1 day for it to become receptive to pollen.**

**Stamper not 100% receptive to pollen note the green colour of the tips.**

**Stamper now receptive to pollen note the white colour of the tips.**

**Using a self tie label mark the date of flowering, flower count etc.**

Also note the pollination to be done, we use black & white paint markers.

**Tie the label around the penduntle of the flower.**

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How we Pollinate our Clivia

1. Stored Pollen in gel capsules
2. Remove the cap from the capsule.
3. Slide over the stamper so it makes contact with the pollen.
4. Twist and turn the capsule a few times, be gentle.
5. Remove the capsule, note the pollen sticking to the stamper.
6. Mark the flowers that have been pollinated with the relevant colour.

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How we Pollinate our Clivia

Cover the stamens with straws. Multiple pollinations can be done & are recommended.

For good measure and future use document the flower colour with a Clivia Colour Chart.

Pollinations are not always 100% successful. Keep the plant well watered and cool before during & after pollination. Seed may take from 6 to 9 months to ripen depending on the species.

Repeat all steps until all the flowers have been pollinated.

Note the difference in colour between the inside, outside & tips of the flowers.

With patience & the steps as listed above you can be certain of all pollinations as this leaves very little to no room for accidental pollination.

Provided you keep track of what you’re doing, Good luck!!

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Cleaning, Germinating & Sowing Clivia Seed

You will need:
- Yeast
- Mean Soil
- Container for cleaned seed
- Lid
- Measuring Cup
- Menhaden Spirits
- Measuring Spoon
- Container for waste
- Glove
- Tweezers
- Scissors
- Cutting Knife
- Sponge

Mark the lid for your container

Pour some bleach into your small container
(1-1 teaspoon for every cup of water)

Add water to the bleach cup approximately half full

You can also use lemon juice instead of bleach

Be careful not to cut the seed too deep as this may damage the seed

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Cleaning, Germinating & Sowing Clivia Seed

1. Remove any remnants of seed from the secondary membrane to enhance germination.

2. Try to remove all bits and pieces, don't leave any membrane on the seeds.

3. Soak your seeds in a solution for 24 hours.

4. Use aretval and a sharp knife to cut the seed coat.

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Cleaning, Germinating & Sowing Clivia Seed

1. Strain off the bleach solution and replace with deionized water.

2. After soaking for 24 hours, replace water in container and remove seeds. You will be looking for the eye of each seed for the seed to sprout.

3. Exposing the eye of the seed greatly increases germination rate and percentage.

4. After removing all the outerings that cover the eyes, arrange the seeds in shallow and well-fertilized soil.
Cleaning, Germinating & Sowing Clivia Seed

Seed usually germinate within a couple of hours after removing the skin from the eye.
Cleaning, Germinating & Sowing Clivia Seed

Depending on the size of your seed and the pot, three to four holes may be needed.

Using the tweezers, punch a hole in the lid so the seed can be easily pressed into the soil to prevent fungus.

Pressing seeds into the soil is not recommended. Three to four seeds per pot is best.

A growing medium at least 1 cm deep

From here seedlings are climatized and then transplanted in late March of the following year to individual pots.

The seedling reaches the lid when the dome is not needed. The dome is removed.

When the seedling reaches the lid, the dome is removed.

If you spot fungus, remove the dome immediately!!!

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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 (*Rhizoeus 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.
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. Long-tailed 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 *Rhizococcus*, 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
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, fuchsia, 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 disinfect 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, disinfect 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 disinfect 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 montrozien 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-zero-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.

**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. Cryptoaenus 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**


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.

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

1 C = contact, S = systemic, T = translaminar, L = low, M = moderate, H = high.

2 Information was obtained from the Kopert and Biobest side effects website and Llewellyn (2000).