CLIVIA



9



Photo: Tessa Nel

Clivia miniata 'Marzelle' Breeder: Chris Welgemoed Grower: Tessa Nel

Front cover: *Clivia miniata* 'Salmon Magnum', Breeder: Edgar Fevrier, Photographer: Gordon Fraser

Back cover: *Clivia miniata* 'Pat's Profusion', Grower: Pat Gore, Photographer: Gordon Fraser

Preparation and treatment of outside cover pictures: Claude Felbert

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Editorial

To own a bit of ground, to scratch it with a hoe, to plant seeds and watch their renewal of life – this is the commonest delight of the race, the most satisfactory thing a man can do.
Charles Dudley Warner

We are sure that all keen clivia growers will agree with these sentiments – no wonder gardening is the most popular pastime in the world. Just communing with nature, pottering about with our plants, watching them grow and finally flower – their renewal of life - can be *very* satisfying.

Another of our commonest delights is to dream, and *Clivia* lovers well know that *Clivia* seeds are "dreams that come in small packets". Often what keep us going through dreary winters are sweet dreams of anticipation of flowers to come. 'The future belongs to those who believe in the beauty of their dreams', as Eleanor Roosevelt once said.

'The beauty of our dreams' is reflected in CLIVIA 9 by the large number of excellent photographs of luscious *Clivia* plants and flowers that have been submitted to us from all over the world. We feature clivias in USA, England, Australia and China, in addition to many in South Africa, from whence clivia-mania has spread far and wide.

The articles in this Yearbook take us from *the past* - Linnaeus, born 300 years ago, who proposed a naming system for all living things that is now universally accepted; four early clivia explorers of the 19th century; the unlocking of the secrets of DNA accumulated over millions of years to interpret relationships between some well-known modern clivia cultivars, to *the present* - reports by delegates to the 2006 International Clivia Conference on their impressions of the various post-conference tours and of their visits to clivias in the wild through to *the future* – articles on breeding the clivias of our dreams.

Visits with fellow clivia enthusiasts to see the different clivia species in their natural habitat are experiences to be treasured. We trust that the articles in CLIVIA 9 describing such visits will entice many more readers to make similar "pilgrimages" in future. Also, to be able to see clivias growing where they appear to be most suited is a large help when it comes to cultivation.



Photo: Gideon Schreiber

Clivia miniata in Habitat

Once again, we have an international spread of authors – from Australia, China, New Zealand, South Africa, United Kingdom and USA. We thank them, and those who sent us photographs, for their contributions. You have helped to make the Clivia Society's Yearbooks into highly regarded and sought after publications.

Four of the articles are transcripts of talks given at the 2006 International Clivia Conference held in Pretoria last September, including the talk 'Green Gold' by Xueguan Song, leader of an official delegation of Chinese *Clivia* growers from Changchun. This was the very first contact at this level with Chinese clivia growers. One of our South African authors, Hein Grebe, is a regular visitor to China and this Yearbook contains three articles by him which we are sure will generate even more interest in Chinese clivias amongst clivia lovers in the rest of the world.



Photo: Hein Grebe

Clivia miniata at a Chinese flower market

Our contact with the Orient is further developed by Helen Marriott who has drawn on her links with Japanese clivia breeders to tell us how they, and others with their material, are using *C. caulescens* to produce some extremely beautiful hybrids.

Cynthia Giddy's name is mentioned several times in this Yearbook. She was a cycad expert of world renown, the author of *Cycads of South Africa*, an accomplished photographer and a much sought-after national and international speaker, not only on cycads, but on many other plants, including *Clivia*. A founder member of the old Clivia Club, she had a very good *Clivia* collection and used to export offshoots of her plants all over the world. She had about 300 top quality plants from Mr Nakamura, with whom she had been corresponding for a long time and with whom she had exchanged many plants and seeds over the years. She and her husband both died as a result of a motor accident in mid-1998. Yellow clivias which originated from her have been used in breeding programs in many countries – an excellent topic for a future Yearbook article?

At the time of writing this Editorial interspecifics are in flower in Cape Town, attracting iridescent sunbirds that are a joy to watch, chattering away as they flit from plant to plant, looking for nectar, doing their cross-pollinating job in the process. As we look at our own *Clivia*, and at the many very beautiful blooms pictured in CLIVIA 9, it is hard to believe that flowers, with their stunning array of colours and shapes – and sometimes perfumes – were not created especially *for us* to enjoy. We may have selectively bred a few new varieties of flowers, but the humbling fact remains that plants put on their show, not for us, but for their pollinators...

The Photographic Competition has drawn 155 entries from a paltry 12 entrants. While the best photos are of a high standard the most notable factor is the lack of participation by photographers who nevertheless place excellent pictures on the internet.

The Clivia Yearbook editorial team bids farewell to John van der Linde and welcomes Roger Fisher as incoming lead editor. The Clivia Society has also had a change of leadership, with Prof. Johan Spies taking over as Chairman from Chris Vlok. Johan, who has recently been President of the South African Genetics Society, is both a keen *Clivia* grower and a geneticist – what a happy combination. He leads a team at the University of the Free State that is doing research on various aspects of the genus *Clivia* and has written several articles for recent Clivia Yearbooks. This year he and his team have given us 'DNA fingerprinting of *Clivia*'. We look forward to further reports on the results of their research.

A complicating factor in their research has been: which source and its associated DNA-profile should be linked to a particular name? Two plants collected from *exactly* the same locality ('Greykloof', to coin a hypothetical name) may superficially look like each other. Offsets from those plants may have been distributed and, in all good faith, have been labelled 'Greykloof Yellow' by their recipients. Yet, when those plants are DNA fingerprinted, they show up as genetically different. Which is then the 'official' 'Greykloof Yellow'? Consequently the authors emphasize that this article is a report on work in progress, and that a fuller picture will only emerge once the test results have been extended to include more orange-flowering *C. miniata*. After all, yellows are not a totally distinct group but mutations from orange.



Photo: Claude Felbert

'Paradise Gracious Goodness' A pastel bred by Felicity Weeden. Peach pollen on a 'Ghost type' *miniata*

The Naming of Clivia Plants

Roger Fisher, South Africa

Carl Linné, alias Carl von Linné, alias Carolus Linnaeus

Ossa Caroli a Linne – the bones of Carl von Linné - inscribes a stone slab above the type specimen of *Homo sapiens* – that is if one accepts that the entombed corpse of Linnaeus in Uppsala Cathedral is indeed that of the specimen Linnaeus chose to name our species!

He was born 300 years ago on the 23 May 1707 in Räshult, Sweden 'at one o'clock in the morning, between the month of growing and the month of flowering, when the cuckoo was announcing the imminence of summer, when the trees were in leaf but before the season of blossom', as Carolus Linnaeus himself later recorded. Why all the Latin and his Latinised name? And why does Linnaeus record his birth as part of the natural order of things?

Well, if it had not been that Linnaeus was born three hundred years ago there might not have been a natural order, or at least not an *orderly* system for classifying the natural order. As Linnaeus himself claimed 'God created, Linnaeus ordered', although he did this in Latin and not English, as if Latin, too, was the language of heaven. The binomial system – that is the giving of two names to signify an individual – is not unique. We all have it, for example, 'Roger Fisher'.

Before Linnaeus the living world was described in lengthy Latin texts alluding to all sorts of characteristics. Like Newton, Linnaeus believed that God-given laws governed the natural order, and he believed two of these were pre-ordained:



Carl Linné

(1) the genus, or a broad grouping of living organisms with shared characteristics – in the plant kingdom sexual characteristics, and

(2) species, the unique characteristics, again in plants – sexual – that a member of that genus displays.

These were the natural characteristics expressive of God's plan as manifest in His Creation.

Over and above this were Artificial Classifications – we use them whenever we resort to field guides – How big is that bird?

What is the colour of that flower? Is that a buck or a goat? Artificial systems rely on categorisation by traits which do not reflect in the natural order of the living thing, such as the ancient Chinese system, where, for example a class of animals might be 'All those belonging to the Emperor', or, as in field guides, 'All large goat-like mammals' or 'All yellow flowers'.

For the description of the unique natural characteristics Linnaeus developed the protologue, or manner in which living things are described, and for this he devised a unique style of Latin, avoiding verbs as far as possible. Here follows an example for *Clivia robusta*, the most recently described of the *Clivia* species, published in the *Botanical Journal of the Linnaean Society* (2004, Vol 146: pp. 369-374):

Clivia robusta B. G. Murray, Ran, de Lange, Hammett, Truter & Swanevelder sp. nov.

Diagnosis: *Clivia gardenii* Hook, *affinis sed qua habitu robustiore majoribus, apicibus foliorum apiculatis, staminibus et pistillis inclusis, habitatione silva palustri anteferenti, et ab omnibus aliis speciebus generis Clivia karyotypo chromosomatum et ordinationibus DNA indicibus differt.*

Translated as:

Clivia robusta determined by BG Murray, Ran etc. new species.

Description: Related to Major Garden's *Clivia*, but in condition more robust, with leaves pointed at the end, with the stamens and pistils enclosed, preferring marshy woods for habitat and differs from all other species of the *Clivia* varieties in respect of chromosomes and DNA.

Because of Linnaeus's focus on the sexual characteristics of plants we have introduced into botanical nomenclature terms as he used them, relating in particular to the flower of the plant, for example *anthera, corolla, petalum, pistillum* (in its declination *pistillis*), and *stamen* (in its declination *staminibus*). Had Linnaeus not resorted to Latin as a *lingua franca* or universal language and stuck to his Swedish, his system of classification would not have travelled! Yet travel was what his system of classification required.

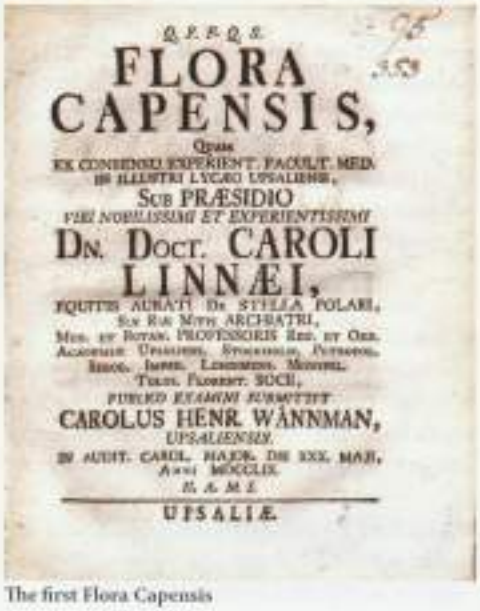
While he was comfortably ensconced in his chair as Professor of Medicine at the University of Uppsala (1740 until his death in 1778), he had his 'apostles' scour the new world for plants. Theirs was neither always an easy nor a happy lot, as Linnaeus observes:

> Good God! When I observe the fate of botanists, upon my word I doubt whether to call them sane or mad in their devotion to plants.

A choice comment for one who had enjoined that one of his apostles, Osbeck:

> ... take heed not to return without the choicest spoils, or we shall invoke Neptune to hurl you and all your company into the depths of Taenarum.

We in South Africa are indebted to at least two of these travelling apostles, the one Anders Sparrman, the other Linnaeus's successor to his post as professor at Uppsala University, Carl Thunberg. Hence many Cape plants were named and described by Linnaeus; for instance, more than a quarter of the species in the Cape Peninsula were originally named by him. Governor Ryk Tulbagh sent plants that J. Auge collected at the Cape directly to Linnaeus for study, and N. L. Burman took the important herbarium of Cape plants belonging to his father, Johannes Burman, from Amsterdam to Linnaeus at Uppsala for examination. Linnaeus and C. H. Wannman, one of his students, wrote the first



Q. F. F. Q. S.

FLORA CAPENSIS,

Quam

EX CONSENSU EXPERIENT. FACULT. MED.

IN ILLUSTRI LYCAEO UPSALIENSI,

SUB PRÆSIDIO

VIRI NOBILISSIMI ET EXPERIENTISSIMI

DN. DOCT. CAROLI

LINNÆI,

EQUITIS AURATI DE STELLA POLARI,

SUE REG. MAJ. ARCHIATRI,

MED. ET BOTAN. PROFESSORIS REG. ET ORD.

ACADEMIÆ UPSALIENSIS, SOCIETATUM, PATRONI,

HERED. IMPER. LEOPOLDINI, MONUMENTI.

TRIUM. FLORENT. SUCCI,

PUBLICO EXAMINI SUBMITTIT

CAROLUS HENR. WÄNNMAN,

UPSALIENSIS.

IN AUDIT. CAROL. MAJOR. DIE XXX. MAJI,

ANNO MDCCLIX.

H. A. M. S.

UPSALIÆ.

The first Flora Capensis

Flora Capensis (1759). With J. Printz, another of his students, Linnaeus wrote *Plantae rariores Africanae* (1760). Through this work and the writings of Thunberg and Petrus Bergius, who were also his students, he laid the foundations for the scientific nomenclature and taxonomy of South African plants.

(For the celebrations surrounding the 300th anniversary of the birth of Linnaeus see http://www.linnaeus2007.se)

Linnaeus's legacy – botanical nomenclature and taxonomy

Botanical nomenclature is the formal scientific naming of plants. It has a long history, going back even as far as Theophrastos (b. 370 BC, pupil of Plato) who authored *Historia Plantarum* in which he is the first to distinguish between mono- and dicotyledons. Plant descriptions flourished through the Middle Ages when Latin was the scientific language throughout Europe, and the apothecaries yard was the laboratory. The keystone event was Linnaeus's adoption of binomial or two-part names for plant species in his *Species Plantarum* (1753). This gave every plant species a name that remained the same no matter what other species was placed in the genus, and thus separated taxonomy – classification – from nomenclature.

In the nineteenth century it became increasingly clear that there was a need for rules to govern scientific nomenclature and initiatives were taken to formulate a body of laws. These were published in successively more sophisticated editions. For plants the key dates are 1867 (Louis de Candolle), 1906 (International Rules of Botanical Nomenclature, 'Vienna Rules') and 1952 (International Code of Botanical Nomenclature, 'Stockholm Code'). The International Code of Botanical Nomenclature (ICBN) currently governs the formal naming of plants.

Plant taxonomy is an empirical science, a science that determines what constitutes a particular taxon (taxonomic grouping, plural: taxa): for example 'What plants belong to this species?' and 'What species belong to this genus?' A botanical name is a phrase of one to three words, for example *Clivia* (genus), *Clivia miniata* (species) and *Clivia miniata* var. *citrina* (variety). The first part of the name is termed by taxonomists as the 'generic name', the second part the 'specific epithet.' A plant derives its name from the first of its kind to be formally described, termed the type or leptotype. The type is either a preserved specimen or an illustration. A specimen is a real plant, or one or more parts of a plant or a lot of small plants, dead and dried, kept safe, and curated in a herbarium.

The oldest surviving representative material of the genus *Clivia* is that lodged by Burchell's sister, Anna, with the rest of his botanical collection that is now conserved at the herbarium of the Royal Botanical Gardens, Kew. Burchell's writings record that he collected his first specimen on 28 September 1813, southwest of the mouth of the Great Fish River. The Kew record states that the preserved herbarium example was collected 'Between Riet Footein and the source of the Kasouga River Bathurst Division Oct 25 1813,' obviously an additional specimen that he collected. It appears that Burchell wished to name this plant *Cyrtanthus sylvatica*, or the forest cyrtanthus. Had this been done the genus name would of necessity later have been changed, since it is not a *Cyrtanthus*. But perhaps the specific epithet might have remained and what was subsequently named *Clivia nobilis* might have been anything from *Imantophyllum sylvatica* (Burchell), through the originally published spelling error without the 'n' *Imatophyllum aitonii* (Hooker) to *Clivia nobilis* (Lindley). It also means that the type specimen for the genus and species is neither the collected specimen of Burchell, nor the plant that Lindley depicted that he saw at Syon House, but the rendered depiction by Lindley published in the Botanical Register, and not that of Hooker's of the same plant published simultaneously in the Botanical Magazine. Such are the niceties of botanical taxonomy. Hence, this is a notable case of where an illustration serves as a type. One must further add that it is the original depiction and not the reproduction that is the type.



Herbarium specimen - *C. nobilis*



A botanical artist's sketch of *C. nobilis*



Carl PeterThunberg spent three years at the Cape

How do we know a plant is a species?

The concept of species is probably one of the most controversial in science. By definition, a species is the fundamental category of biological classification. A species in terms of morphology is defined as the smallest group of distinguishable organisms having constant morphological characteristics. However, natural variation may also cause morphological differences. What if we use compatibility during hybridisation (a concept of a biological species) to distinguish between species? The biological concept of a species defines a species as a group of individuals that produce fertile offspring when crossed, while remaining genetically isolated. Every *Clivia* species can be crossed, each with the other, and their progeny remain fertile.

Plant species are usually defined based on evidence that supports two or more concepts: Morphological difference – for instance the trumpet flowers of *Clivia miniata* in contrast to the tubular pendulous flower forms of all other *Clivia* species. Were this the only criteria there would only be two species of *Clivia*.

Infertility if cross-pollinated – if this were the determinant for *Clivia* there would only be one species in the genus.

Distinct difference between habitats – while all *Clivia* are shade loving, the shade afforded is in a variety of habitats – from the desiccated environment of Oorlogskloof to the perennial swamps of Pondoland. This has allowed for the relegation of the representative populations of distinctly differing habitats to separate species within the genus *Clivia*.

Genetic distinction – the analysis of DNA is playing an ever-greater role in determining the taxonomic place of plants

There is thus still debate as to the status as species of certain *Clivia*, for example that of *C. robusta*. Part of this concerns the type-specimen for *Clivia gardenii*. Hooker did not record where Major Garden had collected the plant, although he is known to have campaigned with the military in the Pondoland area. It is thus possible that the type specimen for *C. gardenii* may in fact be what is now termed *C. robusta*. Only DNA analysis of the type specimen will settle the matter.

Should taxonomists differ in opinion then more than one name may be in use for one and the same plant. Within any taxonomic viewpoint only one name can be correct, but others holding a different view may be committed to different taxonomic

nomenclature, since for them, too, only one name can apply. For example, in the case of *C. robusta* there are others who may take a broader view of species and who may accept more variation within what they recognise as a species, and who may prefer to call it the 'robust' or the 'swamp' form of *C. gardenii*. There are *Clivia* enthusiasts who do not wish to have the giant form known as 'Maxima' relegated to the species of *C. robusta*, but would rather have that form designated as its own species.

If confusion has to do with the name, for example if an older name is rediscovered, which thus has priority and so displaces a well-known name, as for example should it be discovered that Burchell had indeed prepared and published a third volume of his travels, and named the plant he had preserved *Cyrtanthus sylvestris*, then the older name would prevail. The Code offers the only means to set a standard.

If confusion is taxonomic (in other words, if taxonomists differ in opinion on the circumscription or the relationships of taxa), then only more scientific research can settle this. However, the ongoing debate as to the status of *Clivia robusta* – accepted by taxonomists as a perfectly valid name – does not solve the problem of how the plant itself is classified. It is we laymen who are looking for certainty; the professional taxonomists seem prepared to live with what we may consider as ambiguity.

Some *Clivia* etymology

Let us start with the generic name, *Clivia*, which is, as is known, the Latinisation of the surname 'Clive'. The surname itself is a derivative of 'cliff', which is a word come to English out of Old German, transliterated from the Latin *glubere*, meaning 'to peel'. Perhaps it is appropriate that the genus name is associated with cliffs, since the genus finds itself in the relictual forests that follow the scarp down from the high Drankensberg at Mariepskop in the far north, till where they peter out as dune forests at Alexandria. The pockets of the Oorlogskloof, habitat to the oldest of the species, is an exception, but still relictual of forests that once covered the continent before their recession as the grassland, and later still desert, encroached.

Then let us look at the specific epithets in the Genus in alphabetical order:

Caulescens – having a stem showing above the ground [Latin *caulis*, stem], which relates it to cauliflower, the flowering stem, and through its Indo-European root *kaul-* to all coles (Afr. *kool*), i.e. cole slaw, kohlrabi.

Gardenii – after Major Garden. 'Garden' derives from the full vulgar Latin phrase *hortus gardinus* meaning an enclosed garden, which relates it, through its Indo-European root *gher-*, to yard, girth, girdle and orchard.

Miniata – derives from the Latin "minium" through Spanish, for cinnabar, a naturally occurring mercuric sulphide, which was once adulterated with red lead oxide, now applied exclusively to that compound.

Mirabilis – meaning miraculous, derives from the Latin root *mirari*, to wonder at, from its Indo-European root *smei-*, allying it with words such as smirk or smile, as well as mirage, mirror and admire.

Nobilis – which means noble, derives from the Indo-European *gno-* meaning know or known,

which relates it to such words as, for example, gnome and prognosis.

Robusta – robust, derives from the Latin root *robur*, an oak and by analogy *robus*, the strength [of an oak]. Its Indo-European root *reudh-* means ruddy or red and relates it to words such as ruby and rubric, that being the title or initial letter of a manuscript, usually decorative and coloured red. Which neatly returns us to *minium*, the pigment used for painting these letters, from which then also the term 'miniature', the form of *Clivia* the Chinese seem to admire.

References:

In the writing of this article the following have served as source material and for quotes in text:

for biographical information on Linnaeus – Wilfrid Blunt (1971) *The Compleat naturalist. The life of Linnaeus* (Collins); and on botanical nomenclature William T. Stearn's appended essay 'Linnaean classification, nomenclature and method'.

for the South African connection, M. P. de Vos (1971/2) entry on Linnaeus in SESA Vol. 6 (Nasou);

for plant nomenclature and taxonomy, http://en.wikipedia.org/wiki/Biological_type and http://en.wikipedia.org/wiki/Botanical_nomenclature

for etymological information *The American Dictionary of the English Language* (1969).

Readers are referred to the article "What's in a name?" by Johan Spies in CLIVIA 7 *for more on the different approaches adopted by taxonomists in the classification of plants.* (Eds.)



A fine example of *C. nobilis*. Photo courtesy of the late Mike Christie.

DNA Fingerprinting of *Clivia*

Johan Spies, Anthia Gagiano and Liezel Herselman, South Africa

We often hear about forensic discoveries made possible by DNA fingerprinting. These methods enabled the identification of the remains of the Tsar and his family in Russia more than 70 years after their deaths, proved beyond doubt the innocence of death row inmates in the United States (Marvin Anderson, Ray Krone, Earl Washington, etc.) and became a major theme in many TV programmes, eg. "CSI", "Cold Squad", "Medical Detectives", etc. Can this tool be used to enhance our understanding of *Clivia*?

There are different DNA fingerprinting methods available today. These methods are usually known by their acronyms such as RFLPs (Restriction Fragment Length Polymorphisms), RAPDs (Random Amplified Polymorphic DNA), AFLPs (Amplified Fragment Length Polymorphisms), SSRs (Simple Sequence Repeats), STRs (Short Tandem Repeats), etc. We use the AFLP method because it is a very reliable method and presents a high level of variation between different specimens.

For the scientifically minded a diagrammatic presentation of this process is given in Figure 1. The question arises how can this highly technical process help me as a *Clivia* breeder? The following applications of this technique will be discussed:

- *The identity of a plant can be determined*
- *Most likely parenthood of a plant can be determined.*
- *The validity of anecdotes on the origin of a specific cultivar can be evaluated.*
- *The evolutionary development of different cultivars can be determined.*

Figure 1: Validation of cultivar origin

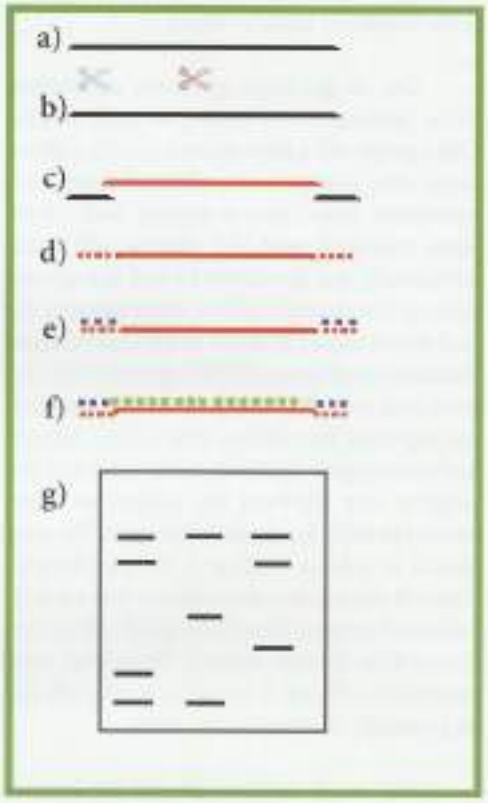


Figure1. Schematic representation of the procedures used during an AFLP analysis. The process consists of digesting DNA with two different restriction enzymes (a-c). The DNA fragments (red solid line) are then linked to the adapters (red dotted lines) (d). New DNA (green) is then generated (e & f) between specific primers (blue). These newly formed DNA fragments are visualized on a gel (g) and a comparison between the fragments of different lengths will indicate whether corresponding fragments occur in different plants.

Identity

The AFLP method can be used to identify a specific plant. Applications of this in forensic investigations are obvious for cases varying from misplaced labels to fraud.

One of the major problems confronting *Clivia* breeders is the validity of given names. Often people sell a plant under a specific cultivar name even though it was obtained from seed, sometimes even open-pollinated seed. With open pollinated seed the progeny will differ substantially and should not be sold as a specific cultivar. The identity (cultivar/strain name) of the pod-parent should be stated and it must be made clear that the offspring will differ morphologically. Even with self-pollinated seed the progeny may not represent the cultivar. Most *Clivia* cultivars are heterozygotic (split) for many traits and the progeny may represent the cultivar to some extent but differ for several other traits. The seed should be sold as 'Cultivar *A* F1, for example. This will make it clear to everybody that it is self-pollinated progeny from the original cultivar but it may differ in some respects. Remember, even two plants collected at the same locality will not be genetically identical (Spies, 2005).

The word cultivar should be limited to the original plant and clones of that plant (offshoots). Where a plant is propagated by seed and the progeny resemble the parent, the term strain should be used. We should limit the terms used in *Clivia* breeding to cultivar (meaning clone) and strain. The use of more terms confuses many people leading to the incorrect use of terms. We suggest that cultivar or strain registration should be accompanied by a standardised DNA fingerprint (a DNA fingerprint that is done with a specific protocol; using similar chemicals [enzymes, primers, adapters, etc] and procedures). This will ensure that it is really a new cultivar or strain that is registered and plants sold under registered names can be tested to determine whether they really represent that specific taxon.

Another problem is that someone may tell you that your plant looks like a specific named taxon and you start using that name as the name of your plant, although it may only represent a superficial morphological resemblance and not a real genetic similarity. Or even worse: an unscrupulous breeder may use a well-known cultivar name to obtain better prices for his/her own inferior stock.

Let us get practical and look at these implications. We used two 'Chubb Peach' plants from different sources during this study. The two plants differed morphologically and provided totally different DNA profiles (Figure 2). We doubt that 'Chubb Peach' 2 was related to 'Chubb Peach' 1 (the original cultivar obtained from Sean Chubb himself) in any way. This is a case where 'Chubb Peach' 2 was probably not even an open pollinated progeny of the original 'Chubb Peach'. Somewhere somebody exploited the name 'Chubb Peach'!

A few years ago the senior author obtained approximately 20 seedlings of 'Kirstenbosch Yellow' origin from Kirstenbosch Botanical Garden. Even without any DNA evidence it is evident that these plants differ greatly. The majority of these now mature plants have narrow tepals with approximately eight flowers per inflorescence (first flowering). One plant started its flowering life with more than double that number of flowers on the inflorescence. Three plants had very broad tepals and one represented the opposite spectrum with needle-like tepals. This clearly demonstrates the effect (variation) of using progeny (from

seed) from a cultivar. One of these 20 plants was used during this study and the variation between these individual plants may lead to a misinterpretation of the DNA data.

If we use another example: 'Vico Yellow' is one of the best known yellow cultivars in *Clivia*. The travels of this plant from South Africa to Kew Gardens to Switzerland to Japan are described in detail by Roger Dixon (2005). We obtained specimens of 'Vico Gold' (from Nakamura), 'Vico Gold' (from Smithers), 'Vico Yellow' (from Nakamura) and two different 'Vico Yellow – meristem' specimens. With the good breeding practices expected from these doyens in the *Clivia* world we would anticipate the two 'Vico Gold' specimens to cluster together whereas the three 'Vico Yellow' specimens should cluster together. AFLP analyses indicated that the specimens obtained from Mr Nakamura were genetically similar (Figure 2) and also corresponded to some extent to the specimen from Sir Peter Smithers, regardless of the Yellow or Gold in the name. These data suggested that 'Vico Gold' and 'Vico Yellow' may represent the same cultivar. In contrast the two 'Vico Yellow' meristem specimens deviate significantly from the "true cultivar". The 'Vico meristem' specimens were genetically different. These differences suggest that the original plants used for producing the meristem cultures were not 'Vico Yellow' and that the two plants used for these cultures are also not related to one another. However, more studies are necessary to determine the natural variation in a cultivar. An alternative explanation is of course that these two plants of non-Vico origin were simply labelled incorrectly, for whatever reason.

A last example is 'Floradale Yellow' obtained from two different sources. Once again the two plants do not represent the same cultivar. Both sources obtained their plants from the Floradale Nursery and subsequently named their plants after the nursery and the flower colour. These results clearly indicated that the nursery propagated plants from different sources. It was consequently incorrect of the buyers to name the plant after the nursery and the flower colour. The nursery did not provide the name, nor did they suggest that all yellow flowering plants in the nursery represent the same cultivar.

These case studies clearly indicated the necessity for a central DNA fingerprint database that should be linked to cultivar registration. This will safeguard the *Clivia* fraternity in the long run from innocent mistakes as well as from abuse by unethical sellers.

Parenthood

Clivia plants or seeds are often sold at very high prices. The price is often linked to the 'pedigree' of the parents. This AFLP DNA fingerprinting technique can determine which cultivars were probably used as parents for a specific plant. This will also help to determine if pollen from your plant was stolen and used by someone else.

We used three sets of parents with their known offspring in this preliminary study. The first case involved an interspecific hybrid between *C. caulescens* and *C. mirabilis*. The hybrid clearly displayed a combination of the parental fingerprints. The second set was 'Floradale Apricot' crossed with 'Umtamvuna', both *C. miniata* plants. In each set of results the two parents shared many similar fragments and the hybrids showed a mixture of these fragments. To test the effect of maternal influence a reciprocal cross between 'De Villiers Variegated Peach' and a yellow *Clivia* was used. Both the yellow (yellow x 'De Villiers



Figure 2. Consensus cladogram of the different plants used during this study. Blue represents Group 1 yellows, red Group 2, orange Peach and black unknown or other groupings. (See text for detail.)

Variegated Peach') and peach ('De Villiers Variegated Peach' x yellow) offspring produced fingerprints showing a combination of both parents. A section of the DNA fragment indicating the combined effect in the hybrids is shown in Table 1.

In order to do parenthood testing a young leaf of the hybrid and both parents should be provided. As the fingerprint database grows, leaf material of only the hybrid will be needed eventually.

and the plant she got from Cynthia Giddy flourished. On two separate occasions Mrs Höll sold plants to Fred Gibello. Mrs Höll had a son-in-law, Nico Frick. He eventually inherited her collection. After his death in a car accident, Fred van Niekerk bought the collection.

Thus the 'Natal Yellow' sold to Anna Höll became known as 'Giddy Yellow', 'Höll's Yellow', 'Swellendam Yellow', 'Fred Gibello Yellow', 'Frick Yellow', 'Jardine Yellow', 'Stella

C. caulescens	10110111111111010001111000011111001110110111100000100111001110100
C. mirabilis	11110010111111110011111110110000010111011011100110000100100111000000
hybrid	10110011111111110011111101011111101110110111001100000001001110100
Floradale Apricot	10110111111101111011111101111011111111010110111001101000001111110011
Umtamvuna	10110111111111011001111101111011111111010110111001101000001111111011
hybrid	10110111111101111011111101111011111111010110111001101000001111111011
De Villiers Var. Peach	10111011111111111101100000101011111111110111011101000001111110011
Yellow	10101011111111111001111000101011111111110110011101000001111110011
Yellow Offspring	10101011111111111001111000101011111111110110011101000001111110011
Peach Offspring	10111011111111111001100000101011111111110111011101000001111110011

Table 1: Characters (AFLP fragment present or absent) shown in a binary state. Blue indicates that the character was inherited from the pod-parent, red from the pollen-parent and black could be inherited from either parent.

Validation of cultivar origin

Many *Clivia* discussions are based on the origin of certain cultivars. The history of 'Natal Yellow' was conveyed to us by Fred van Niekerk in the following way: Cynthia Giddy collected plants in nature. She found only one yellow *Clivia* in nature and named it 'Natal Yellow'. She sold one of her 'Natal Yellow' plants to Mrs Anna Höll. Mrs Höll resided in Swellendam

Parish Yellow', etc. The only yellow *Clivia* produced through line-breeding by Cynthia Giddy was 'Cynthia's Best' (Van Niekerk, personal communication). All these plants, with the exception of 'Cynthia's Best', should consequently be identical. The other exception may have been Fred Gibello's plants, since it is not known whether he used these plants in any hybridisation process or just propagated them.

Unfortunately we did not have material bearing all these names, and we obtained material from different collectors. However, this study indicated that the two specimens labelled 'Natal Yellow' showed many similarities at DNA level with plants named 'Giddy Yellow', 'Höll'/'Frick' and 'Cynthia's Best' 1 (Figure 2). This may support the anecdote of the origin of this group to some extent. However, another 'Cynthia's Best', plant 2, was genetically different from this group. Once again the validity of the cultivar name 'Cynthia's Best' is questioned. Furthermore, some morphological differences occurred in this group; leaf tip die-back was observed in the 'Natal Yellow' specimens but not in the other specimens. The two 'Cynthia's Best' specimens differed in leaf morphology; 'Cynthia's Best' 2 shows the "wavy leaf margin" associated with this cultivar whereas leaves of 'Cynthia's Best' 1 exhibited normal straight leaves. Our conclusions are that 'Cynthia's Best' 1 is actually a 'Natal Yellow' specimen; Mrs Höll got a 'Natal Yellow' from Cynthia Giddy and these plants differed from 'Cynthia's Best' with respect to leaf tip die-back and some differences at DNA level. It is known that plants produced from seed of 'Natal Yellow' may produce normal leaf tips. It is consequently possible that 'Cynthia's Best' represents linebred F_1's or F_2's of 'Natal Yellow'. This will also provide a reason for the small differences at DNA level between these plants.



Photo: Mick Dower

Floradale Apricot — a plant that produces interesting breeding results.

More specimens of each "cultivar", including 'Cynthia's Dream' (a new cultivar developed by Fred van Niekerk), should be studied to get an unequivocal answer to this anecdotal history. Once again the validity of the names of the plants we used in this study may be questioned.

Evolutionary development

The last application of AFLP fingerprinting used in this study is the evolutionary relationships in a certain group. Evolutionary studies usually involve DNA sequences but we wanted to test the ability of the AFLP technique in this regard.

An interesting feature of the cladogram (Figure 2) is that Group 1 yellows frequently clustered together, as did Group 2 yellows (Van Niekerk, 2005). However, the clades containing Group 1 plants were spread throughout the cladogram as were Group 2 clades. This suggests that the mutations causing Group 1 or 2 yellows occurred several times in the history of *Clivia*. These findings should, however, be confirmed through DNA sequencing of several DNA-regions.

One of the most interesting clades was the 'Peach' clade, containing Chubb, Bonnie, Gill Hornby and Gail's Peach. The draw-back of our study was the fact that we received the leaves of many of the plants but no further information regarding the plants. Our initial

thought was that these peaches might have the same origin. However, information provided by Sean Chubb indicated that these four cultivars differed significantly on morphological level and originated from different geographical areas. So, in spite of clustering together, these peaches do not appear to have a common ancestor in the near past, as the cladogram suggested. Another peach, Mvuma Peach, was excluded from this clade, suggesting that the colour peach did not develop only once. It would consequently be wrong to give taxonomic status to the peach forms of *Clivia*.

Another limitation of this study was the exclusion of orange forms of *Clivia*. By including orange plants the validity of a monophyletic (a single forefather) clade for yellows (var. *citrina*) could have been tested. The inclusion of more specimens could also have improved the resolution of the cladogram.

Conclusions

This study clearly indicated that AFLPs can be used to determine the identity of a specific plant and can be used for this purpose in forensic studies. Most importantly, it can distinguish between different cultivars. It further proved that the same procedure might determine the parenthood of a hybrid and it can be used to test the validity of anecdotes on the origin of a specific cultivar. Although the technique has also been used to determine the evolutionary development of different cultivars, more studies involving DNA sequencing are needed to test the validity of the assumptions made during this study.

The most important contribution of this study is the recommendation that all new cultivar/strain registrations should be accompanied by a DNA profile. This is the only way in which we can ensure that newly registered cultivars/strains are "really new novelties" and that people do not misuse "high profile" cultivar names.

Acknowledgements

We would like to thank Sean Chubb, Mick Dower, Fred van Niekerk and John Winter for providing material used during this study. The knowledge shared by them is also gratefully acknowledged. Financial support by the University of the Free State is greatly acknowledged.

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Photo: Sean Chubb

Chubb 'Pretty Pink Mistress'

Four 19th Century Clivia Explorers
John van der Linde, South Africa

Southern Africa has been blessed by nature in many ways. We enjoy magnificent scenery, wildlife and flora. From very early on, visitors from Europe collected plants and seeds to be taken back to the Northern Hemisphere, where they were described and named by the leading taxonomists of the day. For example, the 'King Protea', *Protea cynaroides*, which today is South Africa's national flower, was being grown in London over three centuries ago (1698).

Four of those visitors from Europe are amongst those relevant to *Clivia* history; two of them civilians with botanical training, and two of them army officers who were also off-duty plant collectors. We have a likeness of



William Burchell at age 73 in 1854

only one of them, and know the most about him: **William John Burchell**. You may know of Burchell's Zebra, and the bird, Burchell's Coucal, and you may recognize two of the plants named for him, *Androcymbium burchelli* and *Burchellia bubaline*, but few people know about him and his *Clivia*.



Preparations for the Journey

Burchell's wagon

He was born in Fulham, London, in 1781, the son of a prosperous nurseryman. Having worked for a time at Kew, he was employed on the island of St Helena as a 'schoolmaster and acting botanist'. His fiancée sailed from England to marry him there but went off with the ship's captain instead. After that experience Burchell never married. He left for Cape Town in 1810. There he had a wagon specially built for him, and in June 1811 he trekked off into the interior, accompanied only by six 'Hottentot' [Khoekhoen] men and his span of oxen, on a journey that was to last four years. He recorded part of the journey in his two volume book "Travels in the interior of Southern Africa". Some of his rarely-seen paintings and etchings have been used to illustrate this article.

They set out from Cape Town accompanying a group of missionaries traveling inland, away from the beauties of the Cape

Floral Kingdom. They crossed the Berg River and rumbled inland towards the Roggeveld, literally at the pace of an ox, most suitable for viewing plants along the way. After the mountains came the endless open vistas of the arid semi-desert of the Great Karoo. Before this trip Burchell had never in his life eaten food cooked over an open campfire, let alone spent a night out in the open. He was a small, gentle man who hated to kill even a bird, so one of his men would go out and shoot for the pot.

Burchell and his team got their wagon across the great Gariep or Orange River to Griquatown and Kuruman in the north, where he collected the type specimen of the White Rhinoceros. They climbed over the Sneeuberge (Snow Mountains) and got as far south-east as Graaff-Reinet, and then Grahamstown. Their long journey took them as far as the mouth of the Great Fish River, and finally CLIVIAS!



Original drawing made by Burchell in 1811 when crossing the great Gariep river.

The earliest scientific record we have is that of a *Clivia nobilis* that Burchell collected on 28th September 1813, south-west of the mouth of the Great Fish River. The habitat photo below was taken in the area. It appears that Burchell may have intended to publish his specimen as *Cyrtanthus sylvatica*, i.e. the forest cyrtanthus, but he never got around to doing so. This would have preceded Lindley's description of *Clivia nobilis*, which was written a full 15 years later. Note the resemblance



Auriol Batten

C. *nobilis*, at first glance not unlike a forest cyrtanthus

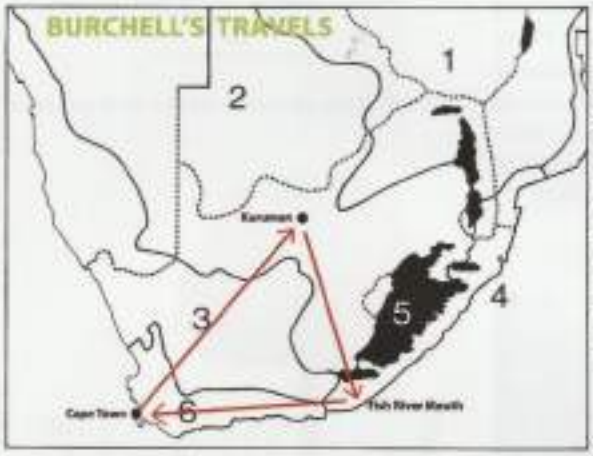


Auriol Batten

Cyrtanthus obliquus

between the flowers of *Cyrtanthus obliquus*, which Burchell collected in the mountains in the Somerset East district, and those of *Clivia nobilis*, both illustrated by Auriol Batten.

Around the time he collected the *Clivia nobilis* Burchell decided to head back towards Cape Town, stopping along the way at Port Elizabeth and at coastal villages en route. They eventually reached Cape Town in mid-April 1815, 4 years - and 7200kms - after setting out on their journey. Burchell had collected over 40 000 specimens.



Burchell's round trip took over 4 years

The next person to collect *Clivia nobilis* and send plants back to Britain was almost certainly an army officer serving in the Eastern Cape, asked to find plants by someone who had seen Burchell's specimens back in Fulham and who had found out from him where they had been collected. It was one of these plants that flowered at Syon House that the botanist Lindley saw and named for Lady Clive in 1828. It would appear that no record of this person's name exists today.

Meanwhile, back at Kew Gardens ... another *Clivia nobilis* had flowered, this time one of several collected for Kew by James Bowie, probably in 1822, and described as growing "on shaded spots, near Quagga flats, and more common in the Albany tracts, near the great Fish River". In the records, it is Bowie's name that has ever since been associated with *Clivia nobilis*.

James Bowie was born in London around 1790, the son of a seed merchant. He joined the staff of the Royal Botanic Gardens, Kew. After a period of training he was sent to Brazil in 1814 to collect seeds and plants for Kew. He arrived at the Cape from Brazil in November 1816, still only about 26 years old, as a professional plant collector. For the next 6 years Bowie sent many bulbous plants, succulents and seeds back to Kew, collected on his expeditions to the southern and eastern Cape, where he collected the *Clivia nobilis* that were taken back to Kew and also northwards to the Orange River. He was recalled to London in 1823.

Bowie found it hard to settle down in London, and he returned independently to the Cape in 1827, the year before *C. nobilis* was described. He worked as a professional plant collector and gardener until he died in Wynberg in 1869, when he must have been close to 80. He never married. His name is commemorated in the genus *Bowiea*.

James Bowie might have ranked among the great botanical collectors of the Cape, but he often gave wrong localities in the labels attached to his plants. This has made his collections of little use to botanists. He was possibly simply trying to put his competitors off

the scent. In fact, Bowie complained in writing about an army officer who sent 40 soldiers at a time out collecting for him. Competition among collectors is fierce, even to this day.

Throughout the period about which I am writing it was common for army personnel to make extra money by collecting and selling specimens from places where their army activities took them. As well as plants, they collected rocks, bird's eggs, seashells, snake skins, butterflies, seaweeds and small mammals and reptiles.

This neatly brings me to **Robert Jones Garden,** one of many plant-collecting soldiers who served in South Africa in the 19th century. He fought in the Frontier Wars in the Eastern Cape and from 1848 was based in Pietermaritzburg, Natal. He collected plants and other specimens, to be sent to England. *Clivia gardenii* was named for this many-sided man: professional soldier, a gifted and observant journal writer, a prickly personality; a talented amateur geologist, artist and plant collector of note. He is also something of a mystery, as is his *C. gardenii* …

I say this because there is no trace of him or of his parents in the birth records of England, Scotland or Wales; nor a record of where and when he died. As for his *Clivia*, all



Photo: Ian Coates

C. robusta growing on the bank of a stream

that we know is that it was found somewhere in Natal. Annoyingly, he did not record where he found it. We know from army records that he served for a short time in Pondoland, which is swampy *Clivia robusta* country. Who knows, maybe the plant he found and took to London was a *C. robusta* and not a *C. gardenii*!

Garden's name is commemorated in *Clivia gardenii, Albuca gardenii, and Streptocarpus gardenii.*

Perhaps the romance of those early days has gone, but *Clivia* exploration continues in the 21st century, across rivers and in difficult country. Plant collectors still go out looking for special plants in the wild, hoping to find *Clivia* as unique as 'Appleblossom' and 'Andrew Gibson'.



Photo: Ken Smith

C. nobilis



Photo: Sean Chubb

The unusual colour distribution of 'Andrew Gibson'

A Visit to the Home of *Clivia mirabilis*

Jim Shields, USA

Rashid Qureshi and I toured South Africa with our wives in September 2006. Near the end of our tour, we had the opportunity to go on one of Hein Grebe's famed Mirabilis Tours. We stayed up in the Bokkeveld, in Nieuwoudtville. We awoke early on the morning of Monday, 25 September 2006, to rain, where the rain is supposed to be only ca. 30 cm per year at this altitude (ca. 600 metres above sea level). Admittedly, rain falls here mainly in the winter, but this was spring… Our wives decided to stay behind at the guest house, so our guide Beate drove Rashid and me down to the meeting point in Vanrhynsdorp, some 50 km to the south-west of Nieuwoudtville, for the *Clivia mirabilis* habitat tour. We assembled at the guest house where most of the other tour members were staying. Down in Vanrhynsdorp, at an altitude of about 330 metres above sea level, it was sprinkling rain intermittently. We debated what to do.

We went. We boarded three vehicles and headed out to the farm where the clivia plants are growing in the wild. There were 10 of us, including Beate; since our wives did not come, she had the chance to join the tour. Beate isn't really a clivia person, but she is pretty game, and in better condition to climb around a rocky cliff than most of us! We drove for about an hour on asphalt and then dirt roads, under overcast skies and through more occasional rain showers, climbing into the mountains of the escarpment.

The two ordinary cars were then parked at the point where the dirt track started to climb sharply. The third vehicle, a 4-wheel drive that could comfortably carry 4 passengers, was used to shuttle us higher up into the mountains to the farm, situated in a secluded valley. At the farm house, we disembarked and found two ladies, Betsy and Erika, putting together the makings of a "braai," or cookout. We looked around while the 4x4 returned for two more loads of visitors.



Photo: Claude Felbert

The road to Mias's Farm

The farm is diversified. They run about 40 head of the native Nguni cattle as well as some sheep, and plant such things as rooibos, the small bush that is the source of Rooibos tea. "Rooibos" just means "red bush," and the bushes turned out to be very bright green, with scattered tiny yellow flowers. The very narrow leaves are pointed toward the tip of the shoot and pressed closely to the stem. At a distance, they looked almost like evergreen shrubs such as juniper or *arbor vitae*. The shoots are picked by hand and then dried. In the drying process, the red colour develops. It appears that the

green shoots are loaded with anthocyanins. Since it contains no caffeine at all, Rooibos tea becomes a natural caffeine-free beverage. On my visits to South Africa, I've learned to love Rooibos tea.

We then debated whether to go on to the *Clivia* site. The road from there was even narrower and steeper, and in worse condition. On top of that, it was wet and muddy and therefore slippery. Finally our host Mias, the farmer who owns this land, drove on in the 4x4 to try it out. He returned satisfied that he could get us there and back again safely.



Photo: Tony Barnes

A view of the terrain where *C. mirabilis* is found

Once at the habitat site, we climbed out of the 4x4 and Mias pointed out where the *Clivia mirabilis* were growing. They were on a west-facing slope almost filled with blocks of sandstone and granite rock that had fallen from higher up on the cliff walls over the centuries. There was an open thicket of small trees and bushes growing in the crevices between the rocks, and under them a sparse mixture of *Zantedeschia odorata* (what we Americans commonly call "Calla Lily" and in South African is commonly refer to as "Arum Lily") and, of course, the mature *Clivia* plants that we had come all this way to see. The blocks of stone were two to three feet on a side. We had to get down over the jumble of large rocks to see the *Clivia*. Climbing up and down over them was a bit of a challenge.

The *Clivia mirabilis* were large plants. Although some scapes were showing, we did not find any *Clivia* in bloom. The plants themselves were growing from cracks and crevices between the large blocks of stone. The leaves were erect and quite stiff. They seemed to be mainly narrow, though there were some broader ones to be seen. Those plants we saw that were exposed to a lot of sun were not in nearly as good condition as the vast majority of the plants, which were growing in shade – they were surviving, rather than thriving. I was told by someone who visited the site the next day that two of them had managed to lift a slab of rock next to a smallish plant, to see thick roots, much thicker than those of any other of the *Clivia* species, creeping below the rock.

We photographed the plants, and then clambered out of the rocky gully to the track that the 4x4 uses. On the other side of the 4x4 track, uphill from the *Clivia*, I could see very large, healthy-looking plants of *Haemanthus coccineus* as well as some more of the *Zantedeschia*. The *Haemanthus* appeared to be growing in better soil than the *Clivia*, with very few of the large blocks of stone seen where the *Clivia* are growing. Mias told us that the *C.*



Photo: Tony Barnes

Typical *C. mirabilis* habitat

mirabilis were confined to a strip of the hillside, from quite high up, down to the small stream at the bottom of the slope. They did not grow on either side of that strip, which he said overlay underground water seeping from a source near the top of the hillside. So it would appear that, despite the apparently harsh environment, the *C. mirabilis* and their companion plants obtained enough water for their needs.

After an excellent lunch back at the farm, a subset of the group, including Rashid and me, were taken out to a site at a lower elevation where some unusual small bulbs were seen. One of these was a pink flowered *Lachenalia* with a single leaf wrapped around the base of the flower stalk; I hope it doesn't turn out to be plain old *L. mutabilis*. Some others were a couple species of terrestrial orchids in the genus *Satyrium*, both *S. erectum* and the dwarf *S. pumilum*. Finally there was a small orchid that must be a *Disa*, but perhaps a new species. Specimens of the *Disa* were taken, with the farmer's permission, to send to the appropriate taxonomist at Kirstenbosch. I urged them to send specimens of the *Lachenalia* to Graham Duncan at Kirstenbosch as well.

This was a memorable outing, especially as having recently done the other habitat tours we were able to contrast the growing conditions of *C. mirabilis* with those of the other species. What an interesting genus we are dealing with! The trip was made even more memorable for all of us by our farmer host and his family who were so welcoming. A visit to the farm is an experience in itself! I would recommend this outing to anyone. These dates were the only time we had at the end of our South African visit to fit in this trip, but we saw the promise of what was to come. Two or three weeks later many of the *C. mirabilis* would have been in full and glorious flower. We nevertheless felt privileged to be able to visit these particular plants in their natural habitat, surviving so well in their specialised environmental niche.



Photo: Tony Barnes

C. mirabilis flowers different stages of opening



Photo: Claude Felbert



Photo: Tony Barnes

The rocky west facing slope where *C. mirabilis* grows

The Noble *Clivia nobilis* in Habitat

Tony Barnes, New Zealand

For some inexplicable reason I have always been drawn to *Clivia nobilis*. I don't really know why - perhaps it's because it was the first *Clivia* to be named, or maybe it's simply the name "nobilis", which all must agree has a certain classy air of distinction. Whatever the reason, after growing them from seed and waiting seven years for flowers (the first began flowering two years ago now), I was determined to see this species growing in the wild when I visited South Africa last year for the *Clivia* 2006 conference. Fortunately the enthusiasts of the Eastern Province Clivia Club were willing to plan a habitat tour, so I was quick to book in.

Tight schedules didn't allow time to drive from Durban via East London down to Port Elizabeth, which was a disappointment for me, as I was keen to visit the Kei River area, north-east of East London. But after a quick flight from Durban to Port Elizabeth, our small group was warmly welcomed by local club members, bundled into a couple of cars, and headed straight off up the coast to visit nobilis at its seaside home.

I had read about *C. nobilis* habitat in Yearbooks, but was still thrilled and amazed when we stopped at the small settlement of Kleinemonde, about an hour's drive north-east of Port Elizabeth, past Port Alfred but before the Great Fish River, and found mature flowering plants of *C. nobilis* happily growing in the natural scrub that made up the gardens of these mostly holiday houses. Only a hundred metres or so from the stunning white sand beach and rolling surf, these plants were thriving under a virtually impenetrable 2 metre high cover of wind-blasted vegetation. The plants were short and stubby, and although some on the edge of the scrub, which obviously received a considerable amount of sun, were a slightly bleached green, many were flowering wonderfully, in varying shades from pale apricot pink to mid-red, all with the characteristic green tips.

In this fragile coastal dune area it is so pleasing to find that, despite the inevitable human habitation, natural vegetation is left untouched as much as possible and precious plants such as these can continue to thrive here as they have done for thousands of years. It was an extra thrill to be close to where William Burchell must have found and collected his *nobilis* way back in 1813.



Photo: Tony Barnes

The Nobilis Coast



Photo: Tony Barnes

Typical Habitat



Photo: Gideon Botha

Charl Malan and the tour party

The next day we headed inland to Grahamstown, and after an exciting bouncy trip in the "bakkie" up to the heights of Featherstone Kloof Reserve, hiked for almost an hour to reach a remnant of bushveld wood. Here, in the cool deep shade alongside a tiny stream, we found *C. nobilis* in its woodland residence. The leaves of these plants were much longer and deeper green, many showing the distinct pale median line along the midrib, as we were to see on the *C. mirabilis* plants in habitat a week or so later. Plants tended to be single, but often in "family" groups of differing age and size.

We were all especially awed to find an enormous clump that had eleven umbles, one of them with seventy one flowers (yes, we counted!). Needless to say there were a huge number of photos taken of this beauty, despite it being in a more open situation with dappled sunlight making photography difficult. While we were groveling around on all fours under the thorny bushes trying to get close enough for that perfect shot, this granddaddy of a plant was probably laughing at the antics of these idiotic humans!

Other highlights of this nobilis tour for me were.....

- seeing mature 100 year old plants of *Oldenburgia arbuscula* growing on rocky bluffs at Featherstone Kloof (I planted a small one of these at home two years ago).
- staying with Wimpie Maas and his lovely wife Lydia and their family.
- Having a great braai at Charl Malan's home and viewing his superb *Clivia* collection.
- seeing Gideon and Esther Botha's wonderful garden, and especially the flowering *Cyrtanthus*.
- attending the Eastern Province Clivia Show.

Overall, this was an experience of which I have many wonderful warm memories and a few reasonable photos. I would recommend to anyone the thrill of viewing these noble plants. Thanks to everyone at the Eastern Province Clivia Club who helped make it happen.



Photo: Tony Berries

C. nobilis in Habitat

The 2006 Kwa Zulu - Natal Clivia Tour

M. Paskert, U.S.A.

After returning from the spectacular Caulescens Tour only the day before, two small buses of intrepid *Clivia* addicts set out for Pietermaritzburg from Pretoria. This was to be the *C. miniata* and *C. robusta* leg of the tour in KwaZulu-Natal, a province in the mid-eastern part of South Africa. I could hardly wait! To see the plants that I collect where they evolved half way around the world was so exciting. My personal quest was to gather as much information as possible to duplicate *Clivia miniata* growing conditions at home, so interspersed in this article will be cultivation notes. Those of you who are very experienced growers may find this redundant but this was all new to me! As with the previous tour, the South African landscape was astonishingly varied and beautiful; dry brown winter plains backed by mountains, as we traveled southeast - more mountains, then rolling hills. The long drive to Pietermaritzburg provided Cultivation Note #1: *the winters in this part of the country are cool and dry.*



Photo: Ian Coates

The Tour Group

Shortly before Pietermaritzburg our bus driver Ollie stopped at Howick Falls. To see so much water in such an arid landscape was spectacular. Local women were washing clothes at the top of the falls. Our stop here was brief but we would return here several days later. After the waterfall our group was dropped off at two different hotels only to meet again a few hours later for a fantastic braai (barbecue) at the home of Etzel and Brenda Nuss. This was one of the most outstanding meals of the entire trip! Thank you so much Etzel and Brenda for your hospitality.

Saturday, Day 2 of the tour, found us up early at the KZN Clivia Show at the agricultural showgrounds in Pietermaritzburg. To go to a *Clivia* show in South Africa is indeed heaven: so many beauties, so little time! Marie van der Merwe's green-centered peach took first place, 1st runner up was Val and Roy Thurston's pastel 'Ndwedwe Eureka' and 2nd runner up Sean Chubb's Broadleaf Orange. One highlight was when Emmy Wittig, of 'Wittig's Peach' fame, arrived with a huge jar of multi-coloured *clivia* seedpods. The nominal price was for a handful... needless to say they quickly evaporated! Tour members dispersed for the early afternoon, some going to private collections, sightseeing, etc. Kelvin Lew and William McClelland stayed behind to assist Henriette Ströh in measuring and catalouging all the show winners.



Photo: Marilyn Paskert

Emmy Wittig

On Saturday afternoon we reassembled for a tour of the KwaZulu-Natal Botanical Gardens with curator Brian Tarr. The Gardens specialise in the conservation of eastern grassland plants, including *Kniphofia*, *Watsonia*, and *Dierama*. The *Clivia* are grouped with other plants from their same habitat. For those of you who have never met Brian, he is one high-energy fact-spewing machine, so here come some cultivation notes; Note #2 *Clivias from the Midlands area in KZN show little variation but by line breeding an astonishing amount of variation will present itself.* Note #3 *The KZN miniatas are mostly in semi-deciduous forest with sandstone substrate on east- or south-facing slopes. (In the northern hemisphere think north). There is good drainage, both air and water; the sun is low but the increased light under the almost leafless trees in winter initiates blooming.* Note #4; *The pH of these habitats is usually 5.5 to 6.5.* An entire book could be written on Brian's insights on many plants, not just *Clivia*...the Gardens are indeed lucky to have such an enthusiastic spokesman! After our tour of the Gardens, Brian took us behind the scenes to the *Clivia* shadehouse. Besides the usual flowerpots, advantage was taken of every support post by hanging geofabric bags from them and growing *Clivias* in them; they certainly had excellent drainage! It was already getting dark when we left the garden and after dinner another big event, the KZN Clivia Club auction. This was a smaller venue than the auction in Pretoria but lovely plants commanded steep prices: Val and Roy Thurston's 'Ndwedwe Msubo Wow' *C. miniata* fetched R5000 as did one of Marie van der Merwe's green-centered peaches. Another short night's sleep before Day 3 but no one complained!



Photo: William McClelland

Growing bags

Sunday morning Brian Tarr joined our group as we revisited Howick Falls. He told us that the area had been a large *C. miniata* habitat but local people had decimated the population by chopping the plants up for "muti", tribal medicine. Muti would be made fresh and whatever didn't sell that day would be thrown out. On a more positive note, miniatas can grow in the very misty conditions found in this area... so here's Cultivation Note #5; *Clivia miniata grow well in humid areas with excellent drainage.*

After leaving Howick Falls, we enjoyed morning tea at the beautiful home and garden of Glenn and Liz Boyd in Karkloof. Liz's shade house was a stunning sight, a breathtaking shock of colours, we just felt so privileged to be able to see this! Outside, under trees and



Photo: Graham Osborn

Liz Boyd's shadehouse



Photo: Graham Osborn

Brian Tarr looking at the *Clivia* in Habitat

shade cloth Glenn had large plantings of habitat miniatas from their property. Our group hiked back into the Karkloof Reserve where more wild miniatas were growing on rocks and leaf debris. Surprisingly we even saw one growing epiphytically up in a tree! Little yellow crabs scampered underfoot in the creek bed. It started to rain but no rest for our international group of *Clivia* addicts; next on the agenda was an old farmhouse that had been in the Burdon family for over 3 generations. Time apparently had stood still on this charming farm; habitat miniatas were clumped on the periphery as they probably were over 100 years ago. We were told by the Burdons that the last seven years' *C. miniata* blooming had been poor due to lack of chill but that this year they had had at least five days of frost: Cultivation Note #6: *Bloom is improved by several days of chill but not freezing in the winter.*

By now, Sunday afternoon, the rain was persistent and our group was more than ready for lunch. Luckily for us we had a short drive to the outskirts of Greytown to the rolling hills of the Gem Wild Flowers farm where we were greeted with a home-cooked lunch and the special hospitality of the Van Rooyen family that made us feel like we had always belonged there! Pieter and his son Francois guided us through the shade houses where many of us found treasures to buy or at least photograph. I enjoyed visiting with Ginny, Francois' wife, who turned out to be from Texas in spite of her at this time very strong (to my ears!) South African accent. The warmth of this family, the stunning display of clivias... it doesn't get better than this! It was a long day already but little did we realize the adventure in store for us...

Did I mention it was raining? Well the unpaved road allowed only one car out...Tino Ferero and family joined us at the Van Rooyens and departed first. By the time we left the road had turned into deep impassable mud. Our futile attempt to push the bus only resulted in spinning wheels with, you guessed it... us covered in mud! I was in the first bus and we all decided to hike out to the main road over rolling grassland. The second bus managed to escape our fate. After our bus was pulled out of the muck with a tractor, both buses turned back and took a long alternative route. As we waited for the bus in the rain we were welcomed into the hut of a woman who was cooking dinner over an open fire inside. There were other structures on the property where we took refuge from the rain and smoke. Since this day I have thought back often of the generosity of this woman who had so little to all these strangers who didn't even speak her language. By the time the bus arrived

we were cold and wet, but it wasn't too long before we were back in our warm rooms to eat and catch some sleep.

Monday, Day 4, and our destination was the coastal area. The further east we drove the ever more tropical the scenery became with papaya and banana farms. At Umtamvuna Nature Reserve we had a long hike down into the gorge. *C. miniata* were growing under the riparian canopy and the silence was shattered with screams from unseen baboons - only in Africa! I was surprised to see so much clivia seed scattered about. Something clearly liked the pods but not the seed… pretty resourceful evolution tactic for the clivias! From here we traveled to Kawa Zami farm, a banana farm with a swampy tree-covered depression between the fields. In this swamp *C. robusta* were thriving. OK, at this time disregard the miniata cultivation notes as the bases of the robusta plants were indeed sitting in water and thriving! Our afternoon ended with a drive through the resort city of Durban and the opportunity to touch the Indian Ocean and wash some robusta swamp mud off our feet before heading back to our hotel.

We saw more miniatas on Tuesday, the last day of our trip, than all the other days put together! First we were greeted by the Chubb family at their farm. To see the beautiful plants Sean Chubb is breeding is exciting and humbling at the same time. Many of us found treasured plants to buy, a veritable clivia shopping frenzy! As if we hadn't seen enough (can one ever see too many clivias?) then it was on to Roly Strachan's dairy farm with acres, yes, acres of habitat miniatas in full bloom! Due to the sheer number of plants many exciting hybrids such as 'Roly's Kaleidoscope' have evolved on this farm which leads to Cultivation Note #7: *When breeding plants it is indeed a numbers game: the more plants the more chances!*

The Strachan family invited us in for a delicious farm lunch prepared by Mrs Strachan. Great bags of seed were for sale. Following this, the last stop on the tour, plants and seed had to be cleaned before bedtime for the trip home or – for the lucky few – to take with them on the Cape and Mirabilis tours. The hotel acquired quite a bit of soil in their garden beds before we were through!

The KZN tour was over now except in our memories but what an adventure! I will never forget the fun and colourful group of fellow tour participants, the scenic vistas of the South African countryside, but most of all, the hospitality and kindness of the people! If this tour is offered again in 2010 do whatever it takes to be there. It is *so* worth it!



Photo: Graham Osborn

The Group strung-out, with Ilie Gaceu and Ken Smith at the front, heading for the Umtamvuna Gorge

The 2006 *Clivia caulescens* Tour

Rex Williams, New Zealand

After deciding in 2004 to take part in the Fourth Clivia Conference to be held in Pretoria I was excited to see that post-conference *Clivia* habitat tours, organised by James and Connie Abel, were once again offered. This was an opportunity not to be missed and so we booked well in advance to be sure of getting seats. As it turned out, the 2002 *C. caulescens* tour was so enjoyed that we had four repeat attendees in 2006!

The week immersed with domesticated *Clivia* was contrasted by our visit to the untamed versions in habitat, although both were equally enjoyable. Departing Pretoria at 8am in an air-conditioned luxury coach we left the highveld and travelled through bushveld with short shrubby trees punctuated by impressive colonies of euphorbias and aloes. On route Wynand Malan gave us a very informative talk on South Africa's political history.

After a quick stop at Magoebaskloof to unload luggage and check into very comfortable accommodation with views down bush-clad valleys of the upper Drakensberg it was off to our first *C. caulescens* habitat. Travelling over forestry tracks through tall rainforest and pine plantations it was hard to believe we were in South Africa and not the New Zealand King Country.

A short trek over dipping rock faces took us into the bush. At last! Wild *Clivia* - and hundreds of them! Although only a few were in flower many more were pushing scapes. Just being amongst them was a dream come true. The dry climate was a surprise, it not having rained for approximately three months. The *C. caulescens* grew in a southeasterly aspect to take advantage of mists that rolled in early morning. Despite the mists the soil and leaf litter were tinder dry. A few plants were seen growing on a creek edge in boggy conditions, though the water was well aerated and constantly moving. It certainly was an eye-opener to see the extremes to which these plants have adapted.

Up early the next morning for a magnificent breakfast, and then we were off to visit Margot McNeil, widow of the late Gordon McNeil, a legendary early *Clivia* breeder. We travelled through eucalypt forests, avocado,



Photo: David Olsen

Green tipped orange - red *C. caulescens flowers*



Photo: Ian Coates

C. caulescens in habitat with insect damage to a flower

mango & banana plantations as well as an abandoned tea plantation till we reached the entrance to the Lekgalameetse (meaning 'The place of much water') Nature Reserve. Here we transferred to pick-up trucks for the 5 km drive up dirt tracks and over several fords to the 'Shack' which the McNeil's had made their holiday home. Set in a valley with sheer rock outcrops, with a cool stream running through the property, the location alone was breathtaking. Exotic trees provided shade for us as well as a large planting of *Clivia*, mainly *C. miniata*, including the 'Four Marys' group. Many thanks to Margot for her talk about the McNeil collection. After more photos and some purchasing of plants it was off for a quick visit to see the spectacular geological formations at Blyde River Canyon and Bourke's Luck Potholes. The bus trip was enlivened by Christo Topham, who gave an interesting history of the local people, as well as a running commentary on the region's plants and geology.



Photo: Ian Cooles

Clivia caulescens growing on moss covered rocks

After a night in Graskop, a small town on the edge of the Drakensberg escarpment, it was day 3 and off early to 'The Pinnacle'. The landscape here is truly spectacular with sheer-sided valleys punctuated by a monolithic monument to Nature's magnificence. From our viewing area we could see *C. caulescens* growing atop the Pinnacle as well as on the sheer rock cliff we were standing on. The plants did show signs of stress (leaf tip dieback) but again this plant's tenacity amazed me.

Next stop was at 'God's Window'. This had to be the habitat highlight: postcard views, easy access and *C. caulescens* the dominant forest floor plant. The site is at an altitude of 1500 metres in the mist-belt with an annual rainfall of up to 3 metres.

Many of the *C. caulescens* were lithophytic with leaves up to 75mm in width and 1.5 metres in length. Several beautifully variegated plants were seen. I can't help but wonder if these plants still exist in the habitat today. There were only a few plants in flower. James informed us that roughly 15% of the plants flower every year. It would be interesting to monitor the number of leaves grown annually by individual plants and to see what effect carrying a full head of berries has on future flowering. An umbel of 55 flowers was counted. We also saw a scape sporting secondary pseudo-umbels.

We travelled to Barberton via the Nelspruit Lowveld National Botanic Gardens, which is reputed to have the largest Cycad collection in South Africa. Substantial collections of *Clivia* are also grown, including many *C. miniata* from the Coromandel strain, as well as accessions from the Bearded Man.



Photo: Rex Williams

Casual visitor or pollinator?

Collections of *C. nobilis*, *C. robusta* and *C. caulescens* are also cultivated. A painted reed frog nestling inside a Coromandel hybrid attracted a lot of interest.

At the end of day 3 we enjoyed a traditional braai (barbecue) at the Cockney Lix Hotel. This was a good time to catch a breath and compare notes with the rest of the group. Chris Welgemoed treated us to a display of Tipperary Peaches in the Hotel social area. My appetite was whetted and so my wife Deirdre and I made the decision to forfeit the tour to Bearded Man and to instead visit Chris the next day.

Chris was very generous with his time, collecting us from Barberton and driving us to his property in Nelspruit. We were both impressed by the diversity of Chris's collection, with reds, green throats, pastels, ghosts and variegates, to name but a few he has bred. Of course the Tipperary peaches were outstanding, the best of which were delicate pink shades with ice-green centres, absolutely mouth watering.

Knowing of my interest in horticulture, we were shown trees of interest in the area on the way to a friend of Chris's who has an outstanding collection of cycads, *Cussonia* & succulents. From there we drove to the Agricultural Research Council (ARC) where Chris is a nursery manager for the Institute of Tropical & Subtropical Crops (ITSC). Here we sampled all manner of exotic fruits and saw plants I had never heard of before - a really educational visit.

In 1996, while working for the ITSC, Chris had visited Rory Niven, the then owner of Tipperary Nursery to discuss the grafting of Macadamia nut trees. It was during this visit that Chris saw his first peach *Clivia*. A request for pollen resulted in an invitation to breed *Clivia* for Rory. There were 14 peach plants of which seven had different colours and leaf forms. Chris's aim is to breed a variegated, short broad -leafed, broad-tepaled, green centred ghosted, bicoloured peach! He is half way there with a variegated broad-leafed, broad-tepaled green throat peach. Our time with Chris was brief but one of the highlights of our South African trip.

All good things come to an end and after a quick stop at a local nursery we were reunited with the tour bus for the trip back to Pretoria. I can thoroughly recommend the Caulescens Tour, should it be offered, to anyone contemplating attending the next International Clivia Conference.



Photo: Helen Marriott

(C. miniata x *C. caulescens)* x self — hybrids of these species have often produced interesting results

Clivias from Bearded Man

Roger Dixon, South Africa

On Day 3 of the 2007 Caulescens Tour we awoke to a beautiful day, well rested after a good nights sleep in Barberton, and boarded our bus for what was for me the highlight of our tour – a visit to the much spoken of Bearded Man Mountain, home of *C. miniata*, *C. caulescens* and *C. x nimbicola*.

Situated in the Barberton Centre of Endemism, the 1337 m Bearded Man Mountain is on the border of Mpumalanga and Swaziland. This area marks the northern limit of *C. miniata* and the southern limit of *C. caulescens*, and as far as I know is the only region in which the two species occur together. The bus took us up to the forestry station, much to our tour planner's surprise, and then our guide, Johan Schoeman, accompanied by Attie le Roux, showed us the next level of comfortable travel – an enclosed truck with a few small windows high up! A few of us were not so brave and accompanied the guides in their vehicles, and so our procession went through the forests on extremely dusty roads right to the edge of the forest where our quarry lurked.

At this altitude the northern slopes are mainly scrubby bush or grassland, with dry forest tending towards the southern slopes. The trees in these forests are not overly large, getting larger in the more sheltered areas. I was in the first group that went into the forest, heading towards the *C. x nimbicola* site.

As we entered the forest, the forest floor was covered with dry leaf litter. *C. miniata* were the first plants encountered, growing in the humus layer, with shallow, surface roots. There were a few scattered rocks. Most of the plants were single specimens, with little sign of clumping. We followed the path further in and started upwards around the mountain. Here it began to get steeper and rockier, and some *C. miniata* plants displayed distinct aerial stems, and then we were in *C. caulescens* habitat. We noticed a number of freshly uprooted plants on the path, and wondered how they got there. The slope abruptly became extremely steep, and the *C. x nimbicola* site was pointed out to us – downwards. These plants were growing horizontally out of the steep slope which plunged at a very steep angle, more than 70°. There was less tree cover here than on the shallower slopes, and the plants were also at the end of their flowering period.



Photo: Roger Dixon

View from the west towards Bearded Man. The Eucalyptus plantations are on the left and the south facing indigenous forest on the right

At this spot we saw that one of the plants, with a very long trailing stem, had recently had a portion amputated and had been treated with a sealant! Obviously the source of the loose plants on the path was related to a recent collecting trip – the sealant was most probably to ensure the plant would survive for future harvesting. This is worrying as harvesting by locals for muti (traditional medicine) would start with the easiest plants at the edge of the population, not at one of the most inaccessible places. There is no access to this site for visitors except via the forestry gate that has strict security. However, we were shown roads leading from adjacent gold mine properties that led directly up to Bearded Man, and were told that it was not possible to control traffic from that source. There were very few *C. x nimbicola* – we saw maybe ten plants at this locality. Depending on who you talk to there are possibly three or four more localities, all with very few plants. It would appear that "collectors" are about, illegally removing plants from private property.

While the hybrid was nearing the end of its flowering period, with only a few heads of dark red flowers left, the *C. miniata* plants were just beginning to come into flower, with only a few scattered individuals in full bloom. The *C. caulescens* plants were only starting to push scapes. This struck me as a bit odd – if the *C. nimbicola* were truly hybrids surely they should have characteristics intermediate between the two parents? In addition, all the hybrid flowers we saw were very similar to each other.

Even though there were not many plants in flower, members of the party explored both the forest and the grassland and a pleasant time was had by all. But I was not satisfied with the lack of *Clivia* flowers, and arranged with Johan to come back at the beginning of October when the flowering of the other two species would be more advanced.

The day arrived when I returned with Johan, but this time in my own comfortable car! This time most of the *C. miniata* plants were in flower. The umbels tended to have a low flower count, but the flowers were large and beautiful. Their throats were mainly white, with a distinctive star shape, with yellow limited in most cases to the anthers. The flower colour varied from light pastel orange and pink to darker orange. The *C. caulescens* had not yet begun flowering in any numbers here at Bearded Man, which according to Johan was



Photo: Roger Dixon

C. miniata in full bloom at Bearded Man in October. The low and open nature of the canopy allows in lots of light



Photo: Roger Dixon

C. x nimbicola. The two stems are one plant. The older rear stem shows the distinctly caulescent nature of the taxon.



Photos: Roger Dixon

C. miniata from Songimvelo, further to the West. Note the typical star-shaped throat and large size, as at Bearded Man.

due to the cold weather recently experienced, but he said that further along the mountain ridge towards the west they would be in flower, as it was a bit lower and warmer.

We proceeded to travel towards the Songimvelo Game Reserve, along the steep incised mountain terrain with many habitats suitable for clivias but very inaccessible. After once again travelling through plantations that are eradicating vast tracts of indigenous bush, forest and grassland, we came to another habitat.

Once again, the *C. caulescens* plants were found mainly on the rocky outcrops that formed the higher, steeper parts of the slopes.



Photos: Roger Dixon

C. miniata from Songimvelo, further to the West. Note the typical star-shaped throat and large size, as at Bearded Man

Here the well-drained humus rich soil is present in pockets between the rocks and the more open canopy lets in a lot of light. The *C. miniata* plants tended to occur where there were fewer rocks. The *C. miniata* flowers were very similar to those at Bearded Man, with possibly a higher flower count, but still very attractive. The *C. caulescens* was in full flower here and the blooms were magnificent. When viewed *en masse* in the dappled shade under the canopy they presented a very tranquil and pastoral scene, quite different to many other places I have been to where only remnants remain, due to the zealous and avaricious "collectors" who are too impatient to wait for a seed to grow.

I would like to thank James Abel for his organisation of the entire 2007 Caulescens Tour and the enthusiastic organisation and guidance that was provided by Johan Schoeman and Attie le Roux at Bearded Man, and the management of the Sappi Forestry Station for their generous assistance with access and transport. A most enjoyable trip and one I will always remember!



C. caulescens from Songimvelo. These plants are very robust and have a beautiful colouration

Competition Winners

Best Photograph



Best Photo in Competition
Parentage 'Vico Yellow' x 'Vico Orange'

Photographer Gordon Fraser Breeder Edgar Fevrier



Winner *C. miniata* Section 'Pete' Photographer Tessa Nel

Below Right: Second Runner-up Single Flower, 'Peaches and Cream' Photographer and Breeder Mick Dower

Below: Runner-up Single Flower, 'Pure Joy'
Photographer Gideon Scheepers





Runner-up *C. miniata* Section
'Julia D'
Parentage 'Floradale Apricot' x
'Oribi Gorge Yellow'
Breeder and Photographer
Mick Dower



Below: Winner Single Flower An Interspecific

Photographer Helen Marriott





Winner Pendulous Section A yellow *C. canaliculata* Photographer Helen Marriott



Runner-up Pendulous Section
Title: Close Friends
Photographer Gordon Fraser



Second Runner-up
Pendulous Section

Photographer
David Olsen



Winner Interspecific Section 'Patsy'
Photographer Helen Marriott



Second Runner-up Interspecific Section 'Pastel Bells'
Photographer Helen Marriott



Runner-up Interspecific Section 'Spring Bonnets'

Breeder: Yoshikazu Nakamura
Grower and Photographer Mick Dower



Below: Runner-up Habitat Section
C. caulescens
Photographer Gideon Scheepers



Above: Second Runner-up Habitat Section
C. nobilis
Photographer Gideon Scheepers



Winner of the Habitat Section. A typical *C. caulescens* habitat showing plants high-up on top of moss covered rocks.
Photographer Gideon Scheepers

Clivia mirabilis Hybrids

John Winter, South Africa

The discovery of *Clivia mirabilis* in the Mediterranean climate of the Northern Cape in 2001 rates as a major botanical find, considering that the distribution area of this new species occurs 800kms west of the previously known distribution of the genus. Although not the most spectacular of the species of the genus *Clivia* it is unique for a number of reasons.

Clivia mirabilis has adapted well to winter rain and dry summers with vegetative growth occurring during the winter months. The rapid development of the seeds within 4 months in early autumn allows for germination to take place when the winter rains commence. Two distinguishing features are the prominent white stripe on the upper surface of the leaf of some plants and the carmine-maroon base of the leaves that form the leaf sheath.

In September/October of 2002 orange and yellow forms of *Clivia miniata* were pollinated with pollen from *Clivia mirabilis*. Later that year *Clivia caulescens* was also pollinated. The seeds matured in 4 months and were sown in March/April 2003.

Typical of hybrids, the young seedlings grew well displaying vigour. These hybrids have been re-potted regularly each year to encourage rapid growth. In September last year some of the orange *Clivia miniata* crosses flowered for the first time. None of the other crosses have flowered as yet.

The majority of the hybrid seedlings are easily distinguished by the deep carmine-maroon coloured stem-base. The leaves of some of the plants do display a faint white stripe down the centre of the upper side of the leaf.



Photo: Claude Fehert

Even mature *mirabilis* hybids have a pigmented base.

The peduncle is strong and supports the inflorescence of 22-26 pendulous flowers set well above the leaves. The colour of the flowers range from orange to dark orange as can be seen from the illustrations.

With the flowering I have pollinated these hybrids with *C. miniata* plants ranging from dark to light orange, yellow, multi-tepal as well as pollen from one of the hybrid siblings. Reverse crosses have also been made using pollen from *C. mirabilis* hybrids onto various *C. miniata* plants.

Considering what Mr Nakamura has achieved with interspecific *Clivia* breeding another species in the mix will certainly provide us with exciting expectations for the future.



Photo: Helen Marriott

Note the yellow throat and green tipped tepals



Photo: Mick Dower

Above: *C. miniata* (orange split for yellow) x *C. mirabilis*
Below: *C. miniata* (orange) x *C. mirabilis. First flowering*



Photo: John Winter

Clivia caulescens and its Hybrids

Helen Marriott, Australia

Until recently I had been wondering what to make of *C. caulescens*. Charl Malan had earlier described *C. nobilis* as being the "Cinderella" of *Clivia* species (Clivia 7, p.45) but where did that leave *C. caulescens*? *It* does not commonly appear on the various publicly-available seed lists and we hardly ever hear of anyone discussing a particularly superior form of it. In contrast to *C. gardenii*, *C. robusta*, *C. nobilis* or even *C. mirabilis*, it has been unusual to hear reference to variation in the colour of *C. caulescens*, flower count or flower shape. The prominence given to *C. caulescens* in the recent Clivia News 16:1 was therefore most welcome, especially the cover photograph of Fred van Niekerk's spectacular specimen from the Blyde River Canyon, with 54 flowers. This reference followed the naming and publication of the natural hybrid from Bearded Man Mountain involving *C. caulescens* and *C. miniata*, *C.* x *nimbicola*, in Clivia 8 (2006). The natural hybrid at the Kirstenbosch National Botanical Gardens in Cape Town is shown at the end of this article.

Local and overseas participants on the 2002 and 2006 Caulescens tours organised by James and Connie Abel (cf. Clivia 5, 61-62; Clivia News 16:1, 14-17) observed considerable variation in the growth habit of plants across the different *C. caulescens* populations (*see The Caulescens Tour and Bearded Man articles in this issue*), even if many plants were not in flower at the time of the tours. In the case of this species, the tall stem that sometimes displays considerable elongation is a notable characteristic, and is one that also occurs in the intermediate forms of *C. miniata* found in the same area in the Bearded Man Mountain.

Despite relatively little discussion of the colouration of *C. caulescens*, from time to time reference is made to a yellow-flowering form that appears to have been found in at least several different South African locations (including God's Window and the Soutpansberg area). One major South African grower has made offsets available for sale in recent years. However, the breeding outcomes of hybridization of this yellow form with Group 1 or 2 yellow-flowering *C. miniata* are reportedly unknown at this stage. Crosses by George Mann have produced seedlings with pigmented bases, but as we know with other interspecific hybridisation, this may not be indicative of the flower colour.



Photo: Helen Marriott

'Gay Delight' shows the potential of *caulescens* crosses

In an earlier period of his breeding, Yoshikazu Nakamura used *C. caulescens* in his interspecific hybrids and produced many exquisite F1s and F2s. One of his own favourites is *C.* 'Tricolour', the name chosen in reference to the three colours of orange, yellow and green



Photo: Helen Marriott

A yellow form of *C. caulescens*

found on the flower's broadish tepals. *C.* 'Day Dream', bred from (orange *C. miniata* x yellow *C. miniata*) x (*C. caulescens* x yellow *C. miniata*) is an elegant, semi-pendulous flower from Nakamura's breeding. Despite *C. caulescens* being only one of the four plants used in its background, 'Day Dream' is a large and vigorous plant that flowers twice yearly. 'Mandala' is a recently named *C. miniata* x *C. caulescens* of Nakamura.



Photo: Shigetaka Sasaki

A Nakamura interspecific 'Mandala'

In much of his breeding, Nakamura 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.

Among other collectors who have accessed seed of *C. caulescens* from various areas of South Africa and also used them in their breeding programs, is Keith Hammett from New Zealand. An example of *C. caulescens* growing in his garden is shown in the photo below. Hammett has meticulously kept records of his hybridization, something all serious breeders must do. Using *C. caulescens* either as the seed or pollen parent, he has produced a range of F1 and F2 generation crosses. For instance, shown



Photo: David Olsen

C. caulescens growing in Keith Hammett's garden

below is an F1 *C. caulescens* x *C. miniata*, where the latter parent was a pale yellow *C. miniata* received as seed from Kevin Walters (Australia). Hammett then made sibling crosses. From this population, a seed grown and named by Rex Williams is



Photo: Keith Hammett

C. caulescens x *C. miniata*



Photo: Rex Williams

'Delilah' ((*C. caulescens* x yellow *C. miniata*) x self)

'Delilah'. An F2, 'Golden Nugget' consisting of ((*C. caulescens* x *C. miniata*) x self) is another recent naming. Hammett reports on segregation of forms with increased *miniata* flare emerging in the F2 populations. At the same time, he has observed more tubular flowers arising in the F2 generation, along with some yellow flowering forms as well.



Photo: David Olsen

'Golden Nugget' ((*C. caulescens* x *C. miniata*) x self)

Shigetaka Sasaki has made a number of observations about *C. caulescens* interspecific hybrids. Firstly, he notes that due to hybrid vigour, *C. miniata* x *C. caulescens* seedlings grow quickly, and that the seed actually germinate quicker than any other hybrid (so much so that they often germinate in the berry without being peeled).

Secondly, in relation to flowering, Sasaki reports that while *C. miniata* require six new leaves in order to produce a flower, like *C. nobilis*, *C. caulescens* require only four leaves, and that this pattern is also found in the interspecific hybrids of *C. miniata* x *C. caulescens* and in *C. miniata* x *C. nobilis*. Consequently, if the *C. miniata* x *C. caulescens* hybrid makes eight to 10 new leaves in one year, two flowers typically appear, sometimes in mid-summer and in mid-winter.

Thirdly, Sasaki says that to flower under normal conditions in spring, *C. miniata* needs a cold treatment of about one month (5-10 degrees C), and that if this cold treatment does not occur, the flower stem often does not elongate but flowers down low between the leaves. He also thought that in South Africa, because the flowering period for *C. caulescens* is soon after that of *C. miniata*, it too would need a sufficient cold treatment for it to flower and to produce an adequately long flower stem. However, he observes that *C. miniata* x *C. caulescens* hybrids produce a flower stem of the same length and with a similar number of flowers, whether it flowers in winter or in mid-summer. To him, this fact indicates that *C. miniata* x *C. caulescens* hybrid does not require a cold treatment in order to flower but, rather, that it is the number of leaves which is important for flowering. If it is the case that *C. caulescens* does not require any cold treatment, then in places such as Hawaii, it could be enjoyed as a pot plant.

As a fourth point, Sasaki stresses that *C. miniata* x *C. nobilis* hybrids also flower twice a year, but when they flower in early summer or autumn the stem may not elongate well, or the flower appears down low between the leaves or even sometimes rots. This suggests that a strong cold treatment is necessary for the flower stem of

C. miniata x *C. nobilis* to extend. As a plant which does not require a cold treatment, which flowers twice a year, and which produces a flower stem that is much longer than for any other hybrid, the *C. miniata* x *C. caulescens* hybrid is eminently suitable for the cut flower market.

Most importantly, for breeding purposes, Sasaki reports that even small differences among habitat species (for instance, *C. caulescens* or *C. gardenii*) can result in a big range of variation when used in breeding. For instance, Nakamura has frequently used a small *C. caulescens* flower that has roundish tepals in his breeding, and when combined with *C. miniata* has resulted in very round tepals in the interspecific hybrid. While a majority of *C. caulescens* flowers are rather straight, some are slightly flared at the tips, with this feature becoming more pronounced in the interspecific cross.



Photo: Rex Williams

Note the tendency toward rounded tepals

Among those who have grown numerous Nakamura interspecific hybrids of *C. miniata* x *C. caulescens* x self from seed, Laurens Rijke (Melbourne, Australia) has selected out a number of superior plants from this F2 generation, many of which he has named. There is considerable variation in the shape and colour of the flower, but a large proportion of the plants that he has grown are highly attractive. 'Clementina' was one of the early ones to flower for him (*Some of these can be seen in Yearbook 8*). Nick Powell (Queensland, Australia) has named another Nakamura interspecific as 'Moulin Rouge', while Geoff Wilson (Melbourne, Australia) owns a yellow interspecific, also from Nakamura's *caulescens* breeding. In addition to frequently selfing his F1 *C. miniata* x *C. caulescens*, Nakamura has also sometimes backcrossed his F1s to yellow *C. miniata*.



Photo: Helen Marriott

'Moulin Rouge'

These interspecific hybrids typically flower around August in Melbourne, overlapping with early *C. miniata* flowers, or just before them, and then may re-flower in early summer; however, occasional flowering seems to occur throughout the whole year.

Variegates of *C. caulescens* in the habitat seem to occur only very rarely, but two were seen by some Caulescens Tour spotters in 2006 (cf. Clivia News 16:1, 15). Interspecific variegates are also uncommon to date, but include the exquisite plant bred by Chris Welgemoed using variegated *C. miniata* "Tipperary peach strain" x *C. caulescens*.

As with the majority of other interspecific hybrids, it has been common to utilise *C. miniata* as a parent, typically as the seed parent. However, breeding among the



Photo: Keith Hammett

C. nobilis x *C. caulescens*

pendulous species themselves has produced some outstanding hybrids. Using plants given to him by Nakamura in the early 1990s, Hammett has crossed *C. nobilis* x *C. caulescens* to produce a very attractive interspecific, with strong *nobilis* characteristics observable in the leaves, colour of flower stem and the floriferous character of the umbel. Hammett has also grown from Nakamura seed a very vigorous hybrid, *C. gardenii* x *C. caulescens*, which he has called "Woodland Glory" (a collective, not a cultivar name, *see below*). He reports that this hybrid produces flowers throughout the year, which, in turn, give rise to fruit at all stages of development. Its leaves are long and relatively broad, and could therefore be used in floristry.



Photo: Keith Hammett

From the 'Woodland Glory' Group

John Winter's recent cross of *C. caulescens* x *C. mirabilis* (*see this volume*) has produced vigorously growing seedlings, with observable median stripes coming from *C. mirabilis* as the pollen parent, and we look forward to the flower with much interest.

By combining the pendulous species themselves in his breeding, in early 2007 Rudo Lötter produced *C.* 'Pink Baby', bred from *C.* 'Pink Sensation' F2 (((*C. miniata* x *C. gardenii*)) x ((*C. nobilis* x *C. gardenii*))) x *C.* 'Ballerina' F1 (*C. miniata* Giddy yellow x *C. caulescens*). Lötter observes that while still semi-pendulous, this new hybrid has inherited the flower shape of the Giddy yellow and the salmon pink flower colour from 'Pink Sensation' on the outside of the tepals and cream white on the inside. (cf. http://users.iafrica.com/c/cl/Clivia/Gallery.htm photo no.26).

Rijke used one of Nakamura's F1 (*C. miniata* x *C. caulescens*) and crossed it with the Australian yellow/cream *C. miniata* 'Aurea'. From this cross, he has obtained a number of excellent plants, with larger, shapely flowers which display considerable variation.



Photo: Helen Marriott

'Patsy' ((*C. caulescens* x *C. miniata*) x 'Aurea')

While the seed count from *C. caulescens* and its interspecific hybrids may be lower than in some of the other species and hence make it less commercially profitable, by flowering twice annually, extra seed can be obtained. Furthermore, with these and other interspecific



Photo: Helen Marriott

'Madeline'

hybrids in our collections, buds or flowers can be found throughout the full year.

This text is an enlarged version of a contribution to the NZ Clivia Club Newsletter 5.1 Summer 2007. My thanks to those who have contributed content, photos or both.



'Princess'

Photo: Helen Marriott



The beautiful peachy pink hue of a natural hybrid from the Bearded Man.

Photo: Claude Felbert

Brooklyn Botanic Garden Clivia collection

Karla Chandler, USA

Clivia have had a place in the collection since nearly the start of Brooklyn Botanic Garden (BBG), which was founded on an ash dump in Brooklyn, New York, in 1910. It was spread out upon 21 hectares (52 acres) and was divided up into many small gardens, including a rock garden, a rose garden, a world renowned Japanese Hill and Pond Garden, and - a first of its kind – a Children's Garden. In order to fulfill the goal that it be an educational garden, a conservatory was subsequently added.

The conservatory consisted of one large glass house with six wings. The main house was called the Economic House, which held such tropical necessities as banana plants, a bread fruit tree and tropical palms The six wings were named and used accordingly as: Instruction, Research and Propagation, Orchid and Tropical Dicotyledons, Cacti and Synoptic Collection, Cycads and Cool House Dicotyledons, and Bryophytes and Tropical Monocotyledons. The *Clivia* must have been housed - although I have not found the records - either with the Synoptic collection or the Cycads, due to the presumed temperatures of those wings.

The earliest recorded *Clivia* was a plant that was documented as a herbarium specimen of the BBG collection in 1921. It was collected by one, Margaret Burdick, who was an assistant to the assistant curator at the time. It was a *C. miniata*, and could possibly be the parent plant of the clump of *C. miniata* that is still in the collection today.

The Steinhardt Conservatory, built in 1987, consists of three pavilion-shaped glass houses, and an entry glass house with two wings.

At the time of this great project two important people, Dr. Elizabeth Scholtz and Dr. Steven Tim, were already in place. Betty, as everyone here calls her, hails from Pretoria and had been the Director of the Garden since 1972. Dr. Tim, also originally from South Africa, was head of the Science Department. Their significance to BBG was and is monumental and relevant to this *Clivia* history account. Betty Scholtz supported and helped curate our South African collection along with other plant collections. Dr. Tim helped to ensure that the three pavilions stayed congruent in their theme; each one displaying plants from three major climate type regions: Tropical, Desert and Warm Temperate. The title 'Warm Temperate' serves as an umbrella term for many types of climate, some differing markedly from the other, such as: the forests of south



Photo: Karla Chandler

One of the Glass Houses at the Brooklyn Botanic Garden

eastern China and the more dry places north of the Cape in South Africa. As the Gardener / Curator of The Warm Temperate Pavilion I am delighted to work with such a broad palette, from which the native flora is the most beautiful and interesting in the world. If the theme were to include only Mediterranean-type climates then I may not have had the honour of taking care of our small but special *Clivia* collection, not to mention the other special plants from the eastern part of South Africa.

From the opening of the Steinhardt Conservatory in 1988 there have been about six different gardeners/curators of what is officially called The Helen Mattin Warm Temperate Pavilion. Each curator cared for and added to the *Clivia* collection we have today.

Most of the stories about our *Clivia* acquisitions are somehow linked to Betty Scholtz, who is widely known for her scholarly wisdom of the botanic world. Equally, she is well known for being well known, having a friend, a connection, or a plant affiliate in just about every corner of the globe. She joined the Garden in 1960 in the Instruction Department, and was appointed Director of the Garden in 1972. She retired in1986, but stayed on at BBG as Director Emeritus. Along with coordinating and guiding horticultural tours around the world, Betty is a mentor, a source of knowledge and a plant 'liaisor' for all of us. Our *Clivia* 'Vico Yellow' was given to us in 1990 through Betty, by her friend, the creator of the hybrid, Sir Peter Smithers. The three hybrids: C. 'Roisin', C. 'Sylphide', and C. 'Gitane' were purchased by Betty Scholtz at a meeting with Margot McNeil, at Ms McNeil's South African estate.

These three hybrids have yet to flower, but they have been promised to be a nice red, a pink and green, and a pink and yellow. Our collection also includes 15 plants that were grown from seed given to the Garden by MrYoshikazu Nakamura from his collection of mixed hybrids, whose heritage was *C. miniata*, *C. gardenii*, *C.x cyrtanthiflora* and *C. nobilis*. The seeds were irradiated by Mr Nakumura with cobalt 60. The plants from these seeds have flowered, and I have only recently started keeping some records. None of the flowers, as I remember, have been anything to shout about. However, I was advised at the 2006 Clivia Conference that it is the next generation of these plants that needs to be watched.

Our rather special *Clivia* 'Sir John Thouron' was purchased at a rare plant auction in 1997 by Judy Zuk, the garden's





Two blooms from the Brooklyn Botanic Garden

Photos: Karla Chandler

then President. Although Ms Zuk paid a hefty price, it wasn't nearly as extravagant as when the plant was first introduced by White Flower Farm Nursery, located in the state of Connecticut. For the details on this story, Ms Scholtz referred me to her friend Steve Frowine. Mr Frowine was the Vice President of Horticulture at White Flower Farm Nursery during the height of the 'Sir John Thouron' buzz. He is now a well published horticultural author. He remembered asking Sir John Thouron, a knighted, ex Major of the Black Watch in World War II, turned gardener, if the flower he had bred and cloned could be introduced to the public. A few years went by before Sir John would agree to Mr Frowine's proposition. Meanwhile, the flower was winning awards year after year at the Philadelphia Flower Show in Pennsylvania. Sir John Thouron had given one of the first clones to Queen Elizabeth II, a few to close relatives, and several to Longwood Gardens, a public garden built on an estate which was purchased by his wife's prestigious family, the DuPont's, in 1906. It was 1994 when the press release in the New York Times announced that the divisions of the precious plant were to be sold for the first time at White Flower Farm Nursery. Sir John agreed with Mr Frowine to name his *Clivia* after himself and introduced forty of the plants to the market, under the strict guideline that they would only be sold one per customer. The first press release quoted $495.00 per one division. The reception and the inquiries to this offer made Mr Frowine confident that he could safely raise the price to $995.00. He was more than right. The reaction to the sale could be described as frenzied. Famous people such as Ralph Lauren were calling, and others were sending people to Connecticut in helicopters to pick up the coveted treasure. One person went so far as to sneak his sister in as a buyer so that he could procure two plants for himself. It is no wonder that this *Clivia* received such attention, with its large butter cream yellow inflorescence and broad leaves. This spring our specimen of the special plant flowered perfectly, a fitting tribute to its breeder who recently passed away this last February. He is best known in the United States for founding The Thouron-University of Pennsylvania Fund for British-American Student Exchange.

The only *Clivia* that has been acquired so far during my seven years as curator is a *C. mirabilis*. This plant was entrusted to me by John Winter, former curator of Kirstenbosh National Botanic Garden, while I was in South Africa for the Clivia Conference last year. Again, this transaction was made possible by Mr Winter's friendship with Ms Betty Scholtz!



Photo: Claude Felbert

A *C. mirabilis* in John Winter's Kirstenbosch shade house. Note the non-typical bloom colour.

Along with these highlighted plants we have several other *Clivia* hybrids which were either purchased by, or donated to, the Garden. A number of these are listed in the Appendix below. So far, little emphasis has been placed on the breeding of *Clivia* since, as a Botanic Garden in the north-eastern United States, our contributions to the hybrid world have centred on plants that are hardy to cool temperate climate regions. However, my predecessor, Mr Scott Canning, did create a cross with a large flowered form of *C. miniata* and our *C. miniata* 'Vico Yellow.' We are still waiting to see the flowering results of this cross.

My understanding and appreciation for *Clivia* flowers has been an ongoing process. I must admit that when I first took over this collection, they were just an orange blur, as I was pretty overwhelmed with the rest of the plants under my care. I made sure the mealy bugs didn't eat them alive and that they got the proper water, food and temperatures in their glass home. Each spring, as a few more plants bloomed my interest grew, but nothing was as inspiring as the International Clivia Conference of 2006 in Pretoria, South Africa. Even if you hated the flower you had to like the people - and I fell in love with both! Now I am counting tepals, measuring inflorescences and planning hybrids. I saw so many amazing plants and learned so much on my visit, as my amazing host Danie van Vuuren shuffled John Ingram of California and me around to every grower in the area. The growers I met, and all the speakers at the conference, were so generous with their knowledge and their hospitality. I can say that it was truly a wonderful trip for me and that the small but elegant *Clivia* collection at Brooklyn Botanic Garden has an enthusiastic caretaker and a hopefully bright future.

Appendix:
Currently there are thirty specimens growing in our greenhouse, labelled as follows:

Clivia miniata 'VicoYellow'
Clivia miniata – red form- x C. x cyrtanthiflora
Clivia 'Sylphide' (pink and green)
15 *Clivia* hybrids — these seeds were irradiated with cobalt 60 1.0 kr/h. They are mixed hybrids of *C. miniata, C. gardenii, C. x cyrtanthiflora* & *C. nobilis*
Clivia miniata -yellow flowered form
Clivia miniata x *Clivia gardenii*
Clivia miniata 'Flava'
Clivia miniata
Clivia miniata 'Sir John Thouron'
Clivia miniata 'Grandiflora' x 'Vico Yellow'
Clivia miniata var. *citrina*
Clivia 'Roisin'
Clivia mirabilis
Clivia nobilis
Clivia 'Gitane'



Photo: Karla Chancler

An Interspecific from the Brooklyn collection

Two Classic Clivia and their Progeny

John van der Linde, South Africa

Classic clivias grown at Kirstenbosch and a look at some of their progeny.

Two yellow *C. miniatas* frequently mentioned in early Newsletters of the old Clivia Club are 'Kirstenbosch Yellow' and 'Natal Yellow'. The purpose of this article is to describe these historic plants, which are on display in the 'Glasshouse' at the Kirstenbosch National Botanical Garden in Cape Town, and to mention some of the exceptional progeny that have been bred from them.



Photo: SANBI

'Kirstenbosch Yellow'



Photo: Mick Dower

Giddy 'Natal Yellow'

The first reference to them that I have come across is in an article by Graham Duncan, published nearly 22 years ago in the September 1985 quarterly issue of "Veld and Flora", the journal of the Botanical Society of South Africa:

"The Kirstenbosch bulb collection contains two distinctly different forms of *C. miniata* var. *citrina*, both of which are highly attractive and have large horticultural potential. The first of these was obtained in October 1951 from the former Reed's Nursery, in Wynberg, Cape, but unfortunately no details of their origin are available. It is a very slow-growing form, and the two plants which were originally received had increased in number to only five by 1979. It has broad, fairly light-green leaves and blooms in September. The light yellow flowers have well-reflexed petals, and the base of the segments is a deep yellow, RHS colour Chart 12D and 13A respectively.

The flowers have a sweet fragrance reminiscent of azaleas, while the bright yellow fruits are small, and contain up to four seeds each. I have not come across this form anywhere else, and in order to distinguish it from other forms, the cultivar name 'Kirstenbosch Yellow' has been applied to it. The plants seen at Kew Gardens and at the New York Botanical Garden would appear to be most similar to 'Kirstenbosch Yellow', but their background information is also very scanty.

The second form in cultivation at Kirstenbosch is also *ex hort*, having been kindly donated by Mrs. Cynthia Giddy of Natal. *Mrs. Giddy gave this plant to Graham when he visited her at her nursery in Pietermaritzburg in the early 1980s. He used the term* 'ex hort *in his article, because it came from her nursery,*

though it may well originally have been collected in the wild. (Eds.)

Also very attractive, it differs from 'Kirstenbosch Yellow' in having narrower, dark green leaves. It produces suckers vigorously once established. Its unscented flowers have a more tubular shape and are a different shade of yellow, again having a darker shade at the base, RHS Colour Chart 16D and 16A respectively. It blooms slightly later than 'Kirstenbosch Yellow', being in full flower in mid-October. The bright yellow fruits are large and contain up to eight seeds. The cultivar name 'Natal Yellow' has been applied to this form.

Seedlings of both 'Kirstenbosch Yellow' and 'Natal Yellow' are due to flower within the next two years, the results of which should prove interesting. A cross between these two forms is also due to flower soon and possibly the fragrance of 'Kirstenbosch Yellow' combined with the vigour of 'Natal Yellow', could produce a satisfactory garden plant".

Graham reported his results in a 1992 article in "Herbertia", the journal of the International Bulb Society. This article was reproduced in November 1995 in Volume 4(5) of the Newsletter of the old Clivia Club, the predecessor to the Clivia Society. He wrote "All the seedlings of 'Kirstenbosch Yellow' have turned out yellow, all those of 'Natal Yellow' are orange and the cross between the two, although quite superb, is orange!"

As we now know, 'Kirstenbosch Yellow' is a Group 1 yellow, whilst 'Natal Yellow' is a Group 2 yellow, and crosses between the two groups invariably produce orange flowered plants, because 'Natal Yellow' contains a mutant allele at a different locus from that in many other yellows, including 'Kirstenbosch Yellow'. Graham found that fragrance was indeed inherited, but only where 'Kirstenbosch Yellow' was used as the mother plant, suggesting that, in this case anyway, fragrance was maternally inherited. Incidentally, this result – the maternal inheritance of fragrance from 'Kirstenbosch Yellow' – has since been confirmed by other breeders.



Photo: SANBI

'Kirstenbosch Supreme'

One of the orange-flowered offspring from the cross was so special that it was given the cultivar name 'Kirstenbosch Supreme' by John Winter. This plant has subsequently been crossed with 'Noyce's Sunburst' a Group 1 yellow, to produce a range of very showy seedlings of prize-winning quality. These are both orange and yellow flowering, since 'Kirstenbosch Supreme' has the recessive 'Kirstenbosch Yellow' genes in its genetic mix. Selected offspring from the original cross were sibling crossed amongst each other, to produce what might be called the 'Kirstenbosch Supreme' strain.

In following years Graham made crosses between 'Natal Yellow' and the few other yellows available to him at the time. One of these plants was one that had been found in 1988 growing in "The Wilds", Johannesburg, by the horticulturist in charge, Rodney Saunders. When he noticed its rich yellow flowers he removed it and brought it down to Graham at Kirstenbosch. Rodney named this cultivar 'Butter Yellow'. Graham crossed 'Natal Yellow' onto 'Butter Yellow' and seedlings from this cross eventually flowered, and yes, much to Graham's delight, they were yellows. 'Butter Yellow' was obviously also a Group 2 yellow and thus bred true when crossed with 'Natal Yellow'.



Photo: SANBI

'Noyce's Sunburst'

Seedlings from this cross, now confidently known to flower yellow, were made available to the public at the Kirstenbosch fund-raising plant sales held in March each year, along with rare cycads and other eagerly awaited and scarce special releases. Pat Gore, a well-known Pretoria member of the Northern Clivia Club, came down to Cape Town for one of these sales. He was one of the many who queued outside the sales area to be sure of being among the first through the gates when they opened. He made a bee-line for the *Clivia* sales area and got one of these special, and then still rare, yellow *Clivia* that were on sale. When his plant bloomed back in Pretoria later that year Pat's purchase turned out to have a large umbel of over 20 magnificent, rich, butter-coloured flowers. We know his plant today as 'Pat's Gold'. Sean Chubb considers the cultivar 'Pat's Gold' to be the best of all the Group 2 yellows he has come across.

Another yellow to which Graham Duncan had access in those early days was a 'Watkins Yellow' sent to him by Brian Tarr, his colleague at the Natal Botanical Gardens in Pietermaritzburg. According to Brian, this is a robust free-flowering plant which has a compact head of well formed flowers carried well above the leaves. Graham pollinated it with 'Butter Yellow'. To thoroughly shake up the genes John Winter put pollen from one of the resultant seedlings (JW37) onto a Kirstenbosch 'Natal Yellow' (JW11). The resultant seedlings grew strongly, all with green stems. In due course they flowered and John selected out one beauty, which he named 'Golden Fleece'. Due to the late-flowering influence of the Group 2 yellow genes that this plant carries, it flowers too late for any of the annual shows; otherwise it might walk off with an award or two!

At this point it is worth emphasizing that the plant called 'Natal Yellow' at Kirstenbosch may not have come from the plant which Cynthia Giddy *herself* called 'Natal Yellow', and which, since it also suckers profusely, has over the years been widely distributed – picking up a



Photo: Claude Felbert

'Golden Fleece'

variety of names along the way, I may add! The plant from her nursery that she gave Graham Duncan to take back to Kirstenbosch may well be one from her 'Cynthia's best' strain. Johan Spies and his team did not have access to DNA from the plant in the 'Glasshouse' for their ongoing DNA fingerprinting work - described elsewhere in this Yearbook, so we will have to wait a while for its appropriate identification.

'Kirstenbosch Yellow' has now been at the Gardens for 56 years. The two original plants from Reed's nursery have been divided, intercrossed and selections made. They and their offspring have been distributed far and wide. It is more correct to term all of these plants as from the 'Kirstenbosch Yellow' *strain*. The broadish light green leaves, distinctive well-reflexed petals, protruding stamens and stigma and full ball-like umbel are typical of the strain and are immediately obvious.

The emphasis at Kirstenbosch changed dramatically in the early 1990s. As John Winter wrote in the March 1994 issue of Veld and Flora, "We are encouraged to generate funds at every opportunity and plants with horticultural promise are seen as potential money-spinners for the future". In line with the change in policy John began a *Clivia* breeding venture to raise funds for what is now known as the South African National Biodiversity Institute. Seedling sales from the crosses he has made, including 'Kirstenbosch Supreme' x 'Noyce's Sunburst' have raised significant sums for SANBI over the years. John of course is a renowned *Clivia* breeder in his own right.

Mick Dower and Ian Brown, also in Cape Town, have also used plants of 'Kirstenbosch Yellow' origin in their breeding programmes. Mick has a plant, selected by John Winter for its broader leaves. He pollinated it with pollen from a Transkei wild-collected *C. miniata* with pinkish



Photo: John van der Linde

'Kirstenbosch Supreme' x 'Noyce's Sunburst'

flowers, to produce a range of seedlings with very attractive flowers. In fact, one of them was chosen to grace the front cover of CLIVIA 8.



Photo: Mick Dower

'Kirstenbosch Yellow' x 'Transkei Pink'

John Winter put pollen from 'Appleblossom', a really beautiful and well-known wild-collected Transkei *miniata*, onto a selected 'Kirstenbosch Yellow'. The seedlings from the cross have bloomed with lovely full umbels – but all a bright, bright orange! Ian Brown had a similar result when he crossed his Kirstenbosch plant with his 'Powderpuff'. John Winter has also flowered a very attractive interspecific cross between a 'Kirstenbosch Yellow' *miniata* and a Ngome yellow *gardenii*.



Photo: John van der Linde

C. miniata ('Kirstenbosch Yellow' x 'Powderpuff')

Experience over the years has shown that where 'Kirstenbosch Yellow' is used as the mother plant the resultant seedlings are slower-growing than those from a reciprocal cross, so these days breeders are tending to rather use it to pollinate other plants, which it generally does very well, producing excellent seed sets and more vigorous seedlings.

The origins of these two historic 'classic clivias' on display in the 'Glasshouse' may be uncertain but, to my mind, what is far more important than where they came from is the heritage they have given us in terms of the superb offspring that have been, and will continue to be, bred from them.

Of course, other magnificent seedlings have been bred, by Sean Chubb and other South African breeders, using both 'Cynthia's Best' and the plant she named 'Natal Yellow'. They are beyond the scope of this article, but would merit an article in their own right. The special qualities of these plants have also been recognized in other countries. For example, the 'Natal Yellows' have flower buds and newly opened flowers that are tinged with green. Toshio Koike in Japan has used this attribute to breed a range of green flowered yellows, a particularly striking one being 'Hirao', pictured in Bill Morris' article in this Yearbook, "How to breed green *Clivia miniata* flowers", and also on the back cover of CLIVIA 7.

What struck me in my researches is the almost exponential progress that has been made over the past 22 years – four or so *Clivia* generations - in understanding *Clivia* genetics and in identifying the breeding habits of particular plants. The main protagonists in this story have also moved on.

In 1985, when Graham Duncan wrote his article, he was a young man in his twenties, at the start of his career. Today he is widely recognized as an expert on South African bulbous plants, awarded the prestigious Herbert Medal of the International Bulb Society. He is no longer closely involved with breeding *Clivia*.

John Winter, former Curator of the Kirstenbosch Gardens, has been retired for some years now but still curates part of the *Clivia* Collection, mainly the wild-collected plants. He is as enthusiastic as ever about stimulating interest in *Clivia* and encouraging the general public to grow native flora. Amongst his other *Clivia* activities John is doing pioneering work involving crosses between *C. mirabilis* and the other *Clivia* species.

See the article by John Winter in this Yearbook.

(Eds)

I would like to thank Graham Duncan, John Winter, Johan Spies, Sean Chubb, Mick Dower and Ian Brown for their comments on earlier drafts of this article.

Breeding for Colour in *Clivia miniata*

Rudo Lötter, South Africa

Introduction

I am a horticulturist and plant breeder, more specifically a *Clivia* breeder – I am not a geneticist. I observe my plants and the results of my breeding and try to draw conclusions from them. In this I am assisted by the knowledge passed onto me by my father, Wessel Lötter, from the more than 30 years of work he has done on *Clivia*. I have written this article as a tribute to him, to build on what he has taught me, and specifically to elaborate on his article '*Clivia* mutations and colour variations' published in CLIVIA 1, back in 1999.

This article relates to *Clivia miniata* only. In what follows, the word '*Clivia*' is used throughout as short-hand for *Clivia miniata*. I begin by discussing the colour pigments in *Clivia*; firstly the primary colours, then the distribution of the pigments chlorophyll and carotene in the mesophyll - the inner layer of the petal. Next, I deal with the anthocyanin pigments that are found in the epidermis, or outer petal layer, and their colours, and the distribution and concentration of pigments in the cells that contain anthocyanin. Then I move on to dilute mutations, anthocyanin absence due to recessive mutations, a discussion of how secondary colours are formed, and the influence of pattern genes as they affect the distribution of colour in *Clivia* flowers. I conclude by speculating on some possible new colours that could be produced.

Colour pigments in *Clivia* flowers

There are basically four *primary* colours in a *Clivia* flower, namely red, yellow, green and white (Figure 1). These primary colours are the result of three pigments contained in the cells; anthocyanin (red), carotene (yellow) and chlorophyll (green). White, the fourth colour, is the result of cells that do not contain any of the above three pigments and which thus reflect white light to the eye. These primary colours, in combination, make up the *secondary* colours that are what we actually see in the *Clivia* flower.

Figure 1



Figure 2



The pigments in the mesophyll

The mesophyll is the spongy inner layer of cells that underlies the epidermis. It contains the chlorophyll and carotene pigments in what almost looks like little grains of sand. The shade of green or yellow that we see may vary with the distribution of either of these

pigments. The more sparsely they are spread the lighter the shade will appear. For example, a sparse distribution of carotene will show up in the flower as a cream colour. Conversely, a denser distribution will cause the green or yellow to be more intense. Thus, more tightly packed carotene-containing cells will give a darker yellow colour. On the other hand, a lack of these pigments in these inner cells will show up as white or cause them to appear colourless. Because those in the epidermis overlay these inner colours I term them *background colours* (Figures 3, 4).

Figure 3

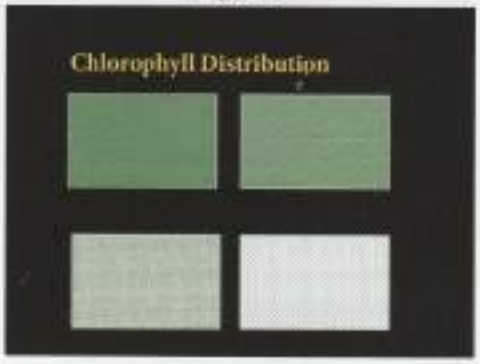


Figure 4



Through selective breeding it is possible to select plants with no chlorophyll and no carotene in the underlying mesophyll. Now if, in addition, there were no anthocyanin in the epidermis, the flower would appear to us as white. It is, as we know, not a difficult task to get rid of the anthocyanin within two generations by crossing our selected plant with a suitable yellow. I understand that white *Clivia* have already been bred in China. Of course, in any normal *Clivia*, there will always be a little of both pigments, usually more carotene than chlorophyll, but in rare cases the reverse may apply. Then, if there is no anthocyanin present, the otherwise yellow flowers will appear distinctly lime coloured. On the other hand, if anthocyanin is present, and in good quantity, the overlay of red pigment in the epidermis, over the predominant green in the mesophyll, will result in flowers that appear bronze or even brown.



Photo: Courtesy Rudo Lötter

The cream and green colours of 'Charl's Green'

A yellow and green *miniata* of Rudo Lötter



Photo: Courtesy Rudo Lötter

The pigment in the epidermis

The layers of the tepal on either side of the mesophyll are thin and are made up of large cells containing only one pigment, anthocyanin. Anthocyanin gives the last of the primary colours in the *Clivia* flower - red. However, we do not see the flower as red. Rather, our view of the flower is similar to that obtained by placing a red-tinted transparency over an underlying piece of paper, coloured green, yellow or white, as described in Figure 5. An orange *Clivia* flower appears orange to us because of the overlay of red pigment over a yellow background.

Figure 5



Anthocyanins are water-soluble and are distributed through the cell sap. The distribution of these coloured cells will create lighter and darker shades of red and what we see will thus vary in colour and intensity. Figure 5 illustrates this point. The denser the distribution, the darker the shade of red; sparser distributions of anthocyanin-containing cells result in pastel, peach and pink colours.

The concentration of the coloured cells can be so reduced that it is theoretically possible – and I am certain that such plants do exist – for the flowers to appear peach, and also yellow. It will be impossible to tell these peaches and yellows apart from those that are mutations, and breeding with such plants will be interesting.



Photo: Courtesy Ilado Luther

'Elroy' with its low anthocyanin concentration

If a *Clivia* with a low anthocyanin concentration is cross-pollinated with a *Clivia* with a higher concentration, the result will be a flower with an intermediate concentration. This is termed 'intermediate inheritance'. It is important, however, to remember that



Photo: Claude Felbert

This bloom shows colour from mid-orange to pastel orange, as well as peach and pink near the edges. Near-white can also be seen.

in a recessive yellow *Clivia* mutation the concentration of anthocyanin-coloured cells is still present, even though the colour is not expressed. If such a yellow is crossed with a pastel the result could be flowers that are orange, rather than a colour intermediate between the colours of the two parents. It would thus be preferable to cross a plant with *C. miniata* 'Appleblossom'-like colours with another of similar colouration, in order to develop a line of plants with colours like those of the parents.



Photo: Courtesy Rudo Löffler

Clivia miniata 'Appleblossom'

Some rare colours

Let us first move to the other end of the anthocyanin spectrum. Very dark red or true red *Clivia* are extremely rare. It is in fact almost impossible to obtain red *Clivia* through selective breeding. The ones that do exist are more likely to be the result of an anthocyanin mutation.



Photo: Claude Felbert

A true red

Another rare colour in *Clivia* is true apricot, which is different from a pastel arising from a sparser distribution of cells containing the normal red anthocyanin. Breeding results suggest that apricot arises from a recessive mutation that changes the colour of the anthocyanin to orange. In order to establish that the anthocyanin in such a flower is indeed orange you would have to peel the epidermis off a petal and lay it on a piece of white paper. If that thin outer layer of petal remained orange when viewed over the white paper then you would know that you were dealing with a very special plant!

True pink flowers exist but are also extremely rare. Furthermore, it is difficult to distinguish pink from pastel or peach because the pink in the epidermis overlays the carotene in the inner tepal layer, to produce a flower that looks pastel or peach. The pink can only show up properly if there are in fact no yellow pigments in the underlying mesophyll.

At this stage let me summarize - there are three possible causes of unusual colours:

1. Those due to changes in the way normally coloured pigments are distributed;
2. Those due to mutations in pigments; e.g. red anthocyanin to orange or very dark red; and
3. Those involving a combination of the above two causes.

Dilute mutations

These may involve mutations that cause partial blocking in the pathway for the production of anthocyanin, whereby the end result is not the normal red pigment but a diluted version, because only a little anthocyanin is produced. We see this for

example in the Chubb and Tipperary peaches. In both cases these are recessive mutations, though each arises at a different stage in the anthocyanin production pathway.

These dilute mutations are recessive to the normal orange colour, but Chubb peaches generally breed intermediate shades when crossed with Group 1 yellows. One of their characteristics is that they open almost yellow and then flush with colour from the dilute anthocyanin as the flowers mature.

Breeding with *Clivia* where the anthocyanin colour has been altered can initially be difficult. Because it is a mutation, the inheritance of the mutation first needs to be determined. Is it dominant over, or recessive to, the normal orange colour? What colour will arise when a plant is self-pollinated, or when it is crossed with a Group 1 or 2 yellow?

In the case of the lighter colours, the mutation could be recessive but almost impossible to distinguish from other known mutations. Anthocyanin, which is so dilute that it appears colourless, will always result in a yellow *Clivia* that looks like any other yellow *Clivia*.

Anthocyanin absence

We now know that a yellow *Clivia* may be the result of no coloured cells in the tepals; the cells may be present but the anthocyanin in them is colourless, or the anthocyanin is so diluted that the flower appears to be yellow.

A fourth type of yellow is obtained when there is a mutation in the anthocyanin pathway that completely blocks the production of red pigment. There are many positions in the pathway where such a blocking mutation could occur. For example, Group 1 yellows have a block at a different position from that giving rise to the Group 2 yellows. These two mutations are not compatible. If a yellow *Clivia* with a mutation on position A is crossed with one with a mutation on position B, all the offspring will be normal orange *Clivia*. The reason for this is that the one mutation corrects the 'mistake' in the other one. Since each mutation is recessive, the orange offspring will be split for both yellow groups.

Both Group 1 and Group 2 yellows are true-breeding *provided* they are crossed with other yellows *within* their group. Group 2 yellows can sometimes be identified by the red spots on the tepals and berries. There is also a yellow mutation with red berries.

How secondary colours are formed

We can now add all the pigment colours together to see how the different colours in *Clivia* are obtained. If there is a yellow (carotene) background under a red (anthocyanin) overlay, the flower colour is seen as orange. If there is a white or very pale yellow background colour beneath the red outer layer, the colour of the flower will appear dark orange or red. In pink, peach and pastel *Clivia* the chlorophyll and carotene are reduced and the anthocyanin is also less intense. To create a bronze, much more chlorophyll is needed in the background and more anthocyanin is needed in the overlay.

Pattern genes

Some of the most interesting *Clivia* to me are picotees, and those with bi-coloured or bleached flowers. Pattern genes are those genes responsible for the distribution of anthocyanin to certain parts of the petal but not to others. In normal *Clivia* anthocyanin is distributed to about one half of each petal, giving the impression of a yellow throat, the shade of which depends on the carotene content of the inner petal layer. In extreme cases the throat

can be enlarged. The 'Ramona' and 'Bull's Eye' *Clivia* are nice examples of flowers with a large yellow centre. It seems that flowers like this can only be obtained through selective breeding.

The distribution of colour in the tepals can also be affected by mutations in the pattern genes. Some cause normal anthocyanin to be distributed to only the very edge of the tepals. Such flowers are called picotees. Another mutation affecting the distribution of anthocyanin gives rise to bi-coloured flowers.

Anthocyanin is normally broken down as a flower ages, but bleached flowers are curious because they open normally and then start to bleach away more quickly than usual as the flower matures. The anthocyanin seems unstable and thus fades faster in certain parts of the flower.

Conclusion

In conclusion, there are five ways in which nature can produce yellow *Clivia* by altering the anthocyanin in the flower:

1. There can be so few cells containing anthocyanin that the flower appears yellow.
2. The anthocyanin may be colourless.
3. The anthocyanin may be so dilute that it appears colourless.
4. There are recessive mutations that cause anthocyanin not to be produced or to be produced erratically.
5. Finally, there are yellows that are the result of mutated pattern genes, so that anthocyanin is not distributed to where it is supposed to be.

It is important for the breeder to understand not only how colour in *Clivia* flowers is produced and distributed, but also which variations are mutations and which can only be obtained through selective breeding. Compatibility, and how the different colours and forms inherit, are of crucial importance in creating new cultivars.

More mutations in the anthocyanin pathway can open the door to a larger spectrum of colours. A mutation causing blue anthocyanin is a real possibility. Even with blue anthocyanin in the outer petal layer, a blue *Clivia* will be hard – but not impossible – to breed because of the green chlorophyll and yellow carotene in the inner petal layer. Certainly, if we can add blue to the spectrum, some new *Clivia* colours will emerge.

(Blue anthocyanin – pelargonidin – was detected in the flowers of Nakamura Crimson, a dark red miniata, as described by Keith Hammett in his article "Pigment Surprise" in CLIVIA 8. Eds.)



Photo: Claude Felbert

An orange *Clivia* flecked with white, belonging to Ian Brown, shows where anthocyanin and carotene are present in sufficient quantity, you will see orange but where absent you see white.

Breeding Green Flowers

W. Morris, Australia

Shigetaka Sasaki in his CLIVIA 7 article "New developments in clivia breeding in Japan" refers to the breeding of green flowers. The article below is a simple "how to do it" guide, using plant material that is reasonably easily available.

(Eds.)

In the past decade there have been illustrations of green *C. miniata* flowers in the Clivia Society Yearbook and on the internet, most of which have been bred in Japan. I suggest the following method to obtain them, other than by chance.



Photo: Shigetaka Sasaki

C. miniata 'Hirao' as seen on the back cover of YB 7

We have all seen *C. miniata* flowers with green throats. Red, orange or yellow cultivars sometimes have green throats which at times are quite deep green. What is needed is to get the green colour throughout the whole flower. The only flower that I have seen that is decidedly greenish throughout is *Clivia* 'Natal Yellow' which opens a definite greenish yellow. However, this green tint fades in a few days and the flower becomes simply yellow. What is required is to keep that green tint over the whole flower and not just in the throat, and to intensify it. The easiest way to do this is to cross it with a plant which *already* has green throughout the flower, and then to select from the offspring.



Photo: Ken Smith

A 'Natal Yellow', Grower Fred van Niekerk

I suggest the following two successive crosses as suitable. *Clivia* 'Natal Yellow' is one parent; the other is a strongly green-throated flower, such as a bronze flower e.g. *Clivia* 'Bertie's Bronze'. Bronze flowers are a bronze or brownish orange because the normal orange or red pigment in the external layer (epidermis) of the flower is underlain by green chlorophyll in the deeper tissues. Breeding for deeper and deeper brownish flowers is really only breeding for more and more chlorophyll in the deeper



Photo: Claude Felbert

A dark bronze green throat



Photo: Victor Murillo

A yellow with a persistent green throat

tissues, and this chlorophyll is not destroyed over time, as it is in 'Natal Yellow'. Now the offspring of a bronze x 'Natal Yellow' cross (the F1 generation) will be orange/red as the yellow colour is recessive, but the colour will be bronze or brownish orange/red in 50% or so of the seedlings. The chlorophyll is in the chloroplasts in the deeper layer and the chloroplasts are inherited from the mother plant, therefore the bronze flower plant should be used as the pod parent.

Next, the seedlings with the best bronze flowers should be selected and crossed with each other (sibling crossing) and, because they carry the recessive 'Natal Yellow' genes, these F2 plants will give around 25% non-orange flowers (yellow).

These flowers will vary, but most should be deeper green than 'Natal Yellow' and most should hold the green colour (as the bronze flowers do). Thus the green flowers will occur in the second generation and through further line breeding and selection, one will be able to intensify the green colour. In the F1 generation all the seedlings will have pigmented bases. However, in the F2 generation the green, greenish-yellow and yellow flowers will have unpigmented bases and will all be Group 2 plants.

One further comment is that I believe the production of green chlorophyll in *Clivia miniata* is temperature sensitive. In my climate, green throats in orange or yellow *Clivia miniata* flowers will occur in some years and not others, and never as regularly as in colder climates like Toowoomba, Queensland. I am near the coast in central New South Wales (just near Newcastle) in a frost-free area and by our flowering season, the winter cold has gone. So it seems likely that green flower breeding will be easier and the colour better, at least to begin with, in places with a cool spring.

The advantage of this suggested method, rather than line breeding of 'Natal Yellow' with its progeny, or the line breeding of green throated yellows, followed by selection in both cases of more greenish flowers, is that this suggested method should produce green flowers in only two generations.

The flowers that will result from the breeding outlined in this article, though green, will be perfectly normal in every respect. They are totally unlike the long-lasting green flowers which occasionally - due to a developmental mutation - occur on some plants. In such cases the flower segments and reproductive parts are not normal, and characteristically these flowers do not open fully. Their thick and stiff green petals sometimes have some orange in them.

Another benefit of this approach is that, if the bronze parent has broad leaves, then some of the green, greenish yellow and yellow-flowered progeny will also have broader leaves than the 'Natal Yellow' parent. (Eds.)

Victorian Peach and New Clivia Creations

Victor Murillo, USA

Let me begin by telling you a little about myself: where I work, and how I first became involved with *Clivia*. In 1996, when I was 21, I started working at Sunlet Nursery in Fallbrook, near San Diego, California. Sunlet Nursery is a wholesale nursery that produces a wide range of flowering plants for the wholesale trade, retailers and chains of garden centres all over the United States. Most of our material is shipped to customers outside California. Having grown up in the nursery industry family, this was nothing new to me. I immediately became involved in the breeding of *Alstroemerias* and also *Clivia*, which remain my favourites.

I had to learn about *Clivia* on the job, as I took over the existing *Clivia* breeding program started by my boss, John Kister. He had been developing a salmon/peach range and asked me to continue developing peach colours. By 1998 I was breeding with a mission. The start of the peach breeding program included a Belgian peach and two high quality yellows given to John by Eric Anderson, which originally came from the Vic Daniels collection. They produced a group of original peach-flowering plants, with which I then began to work.

Each blooming plant used in the breeding program was assigned a unique identification number such as 98-12. I still use this numbering system, although I occasionally started to name a favourite here and there. In my breeding program I began to take careful notes and pictures of both parents for future breeding. What I wanted to know was: What would happen if I crossed two particular peach-flowering plants? Would some or all of the offspring also flower peach? If so, would the colour be the same as that of the parents or would colours differ? And would the resulting seedlings have the same characteristics as the parents with regard to features like leaf width, flower count, etc?

My first crosses bloomed in three years, thanks to a good fertilisation program. The first seedling to bloom flowered on January 22, 2001 and is still one of my favourites. The actual cross is 98-12 x 98-13. It has a nice compact habit, a dark peach colour, broad leaf width, and good flower count. Seedling after seedling that bloomed was peach. Peach *Clivia* were blooming consistently in light, medium and dark forms. The years of work put into the program had begun to pay off.



Photo: Victor Murillo

A multi-tepal Peach

We began to select for characteristics such as large flower heads with large flowers, multiple blooming periods per year or multiple spikes at each blooming, and also broad leaves. We knew that our plants were of a much higher quality than generally available to the public. Also, my breeding results indicated that we had great material to produce a stable and high quality line of peach-flowering plants. Based on this, we made the business decision to go into

full production, using the parent plants that we had to create our own line of peach *Clivia*. For a successful commercial introduction a name would be needed for our 'new product'. Many names were considered until Janet Kister, my boss, suggested that since the plants were my 'babies', the name of the strain should be 'Clivia **Victorian** Peach'. The name of the strain was then trademarked and a special label was created to identify each and every peach from that strain as 'Clivia Victorian Peach'.

The range was introduced to the public in 2001 at Plant Tour days – an annual nursery event in Southern California, attended mainly by large customers from other States. *Clivia* 'Victorian Peach' includes a range of peach colours from light to dark shades. They have broader leaves than all other peaches I have seen. Both landscapers and hobbyist breeders have found them to be full and vigorous plants that breed true from seed. 'Clivia Victorian Peach' made an impact and has been featured in specialist gardening publications such as *The Pacific Nurseryman Magazine*, *Grower Talks Magazine*, and in more widely read newspapers – *The Los Angeles Times* of April 2004 and the *San Diego Union Tribune* of April 2005. The plants have often been mentioned on the *Clivia* Enthusiasts discussion group on the internet, resulting in sales as distant South Africa, Australia, Japan, and of course, all over the USA.



Photo: Victor Murillo

A dark 'Victorian Peach'



Photo: Victor Murillo

A light and a medium 'Victorian Peach'



Photo: Victor Murillo

In 1994 while still working with 'CliviaVictorian Peach' at Sunlet Nursery, I also set up my own company and 'boutique' breeding program, called 'Murillo's Exquisite



Photo: Victor Murillo

'Victorian Peach' Seedlings

Clivias'. Many of you are familiar with M.E.C and some of my recent named *Clivia*. My main goal is to continue to create some of the best *Clivia* in the world. For example, using some of my best green-throated yellows my aim is to develop a stable strain of green-throated yellows with good flower form. In addition



Photo: Victor Murillo

Attractive Green-Throat

to peach, yellow and cream colours, I am also working with variegated pastels and pinks and with different leaf forms, including broad leaves and compact Daruma types, incorporating variegation in various colours.



Photo: Victor Murillo

A variegated Pink

Pen Henry once told me, "Victor you're a creator now." Since then I admire every plant that I work with. I look at my breeding as a work of art, creating a living thing that people can enjoy in their gardens. Watching an inflorescence form in the centre of a crown, then slowly rise while developing its buds that will soon turn into flowers, is truly a breathtaking experience - especially after waiting three to four years for this to happen. Once the first, the second and the third flower start to open, you can release that breath and truly enjoy what you've created to share with *Clivia* lovers worldwide. Keep in mind that there's always something hidden in a breeding program. This is what makes breeding plants so unique and exquisite.

Acknowledgements: I would like to thank Sunlet Nursery, John and Janet Kister for giving me the opportunity to work with Victorian Peach and for teaching me the aspects of what a 'well respected' nursery truly is; Dave Conway for being there for me when I had questions about *Clivia*. I will never forget his laugh. (Was he laughing at me or with me? Probably at me!) Last, but not least, I would like to thank my wife Danielle for being there for me from day one. She had to hear about every new *Clivia* that bloomed for me. Till this day she supports my *Clivia* addiction, she traveled halfway around the world to be with me at the Clivia Conference. Isaiah, my son and my best bud, I love you, the future of *Clivia* lies in your hands.



Photo: Claude Felbert

A South African owned 'Victorian Peach'

Some Show Photographs

Northern



Above: Best on Show — Grower: Chris Vijoen

Below: Third best flowering plant on Show — Grower: Bets Rossouw





Above: Grower: Danie van Heerden

Below: Grower: Ernie Hobbs





Above: Grower: Wimpie van der Walt

Below: Grower: Pat Gore



All photos on these three pages are courtesy of the Northern Clivia Club

Joburg



Above and Below: Best on Show and Runner-up

Grower: Glynn Middlewick





Above and Below: Gold Medal Winners Grower: Ken Fargher



All photographs in the Joburg section are by Gideon Scheepers



Above: A near white. Grower: Ken Fargher Below: Second Runner-up 'Berties Bronze.' Grower: Chris Viljoen



Waterberg



Above: A Gold Medal Winner at the Nylstroom Show — Grower: Piet van der Merwe

Below: — Grower: Piet van der Merwe





Above and Below: Grower: Bets Rossouw



Photographs in the Waterberg Section: Rina van der Merwe

KwaZulu-Natal



Above: Best on Show

Grower: Marie van der Merwe

Below: First Runner-up 'Eureka' Roy and Val Thurston





Above: Best Any Other Colour Grower: Brenda and Etzel Nuss

Below: Second Runner-up Grower: Sean Chubb





Best Pink on Show

Photographs in the KwaZulu-Natal section: Clive Graham

Cape



Above: Best on Show — Grower: Ian Brown

Below: Runner-up — Grower: Gerrit van Wyk





Above: Reserve Runner-up — Grower: Johan Botha

Below: Best Narrow Tepal — Grower: Johan Botha





Above: Pastel Apricot — Grower: Ian Brown

Below: Best First Time Flowerer — Grower: Riel Lötter



Accent on Single Flowers



Photo: Mick Dower



Photo: Claude Felbert



Photo: Jesse Nel



Photo: Gideon Schoepers



Photo: Gideon Schoepers



Photo: Gideon Schoepers

Photo: Gordon Fraser



Photo: Mick Dower



Photo: Helen Marriott





Photo: Claude Felbert



Photo: Claude Felbert



Photo: Felicity Weeden

Pleasant Surprises

Michael Jeans, U.K.

Over the years, I have enjoyed many pleasant surprises when *Clivia miniata* seedlings flowered for the first time. Whatever the plant, the first flowering of a carefully bred seedling is always awaited with great anticipation, sometimes only to be followed by disappointment. However, *C. miniata* is a plant that is frequently generous to the breeder and occasionally manages to pull the completely unexpected "out of the hat". In this article, I shall discuss a few of the more unusual flowers that have appeared in my collection of *C. miniata*.

As time has gone on and my facilities have become ever more stretched, I have tried, and usually failed, to follow certain self made rules as to what I should grow on. I am very appreciative of *Clivia* plants that have a good form and look tidy. When in good condition and with fairly broad dark green leaves, *C. miniata* makes an attractive foliage plant and, if grown in a conservatory, earns its keep for those 11 months in the year when it does not have any flowers. From nothing more than personal observation and without any formal investigation, I think that a good tidy plant with broad leaves is far more likely to have a good head of well shaped flowers with reasonable tetal overlap, than a narrow leafed untidy plant. Another personal observation, again unfounded on any formal investigation is that when a batch of seed is sown, the last plants to flower often have the best flowers. As it generally takes from three to five years for my plants to flower from seed, the last to flower are often somewhat neglected and in need of potting on by the time they win me over with their superior flowers!

My breeding goals are now limited to attempting to produce two good seed-grown strains of *C. miniata*, giving good robust plants of tidy form with full heads of flowers carried well above the leaves on strong stems. One strain has orange, red or darker pastel flowers, and the other strain is centred on Group 1 yellow flowers and pale pastel colours. In both cases, I favour flowers with a good degree of tepal overlap. My hope is that *Clivia* growers will add their own favourite plants to a gene pool produced from these strains and consequently have a unique gene pool which is being continually improved. New plants added occasionally should improve the genetic quality of the pool and contribute to the general health of the seedlings as well as adding interest as the unique gene pool develops.

Since *C. miniata* only flowers at a set time every year, it is worth sowing seed at the earliest opportunity. About 6 months after pollination, the umbel of fruit can be picked and hung upside down by its stem (peduncle). After a month, the seed should be ready to sow and this can gain a few months over waiting for the fruit to change colour to indicate that it is fully ripe. Sometimes this can make all the difference in helping the plant to flower a year early. I tend to use the whole umbel in a cross pollination and tie a label to the umbel to show the cross that has been made and the date on which it was made. It is also worth mentioning that seed bought from a breeder is a year ahead of ones own pollination, and offers an additional route to building up an effective gene pool and breeding program in a reasonable time.

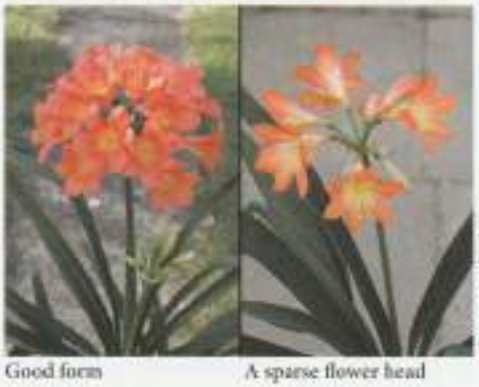
My orange and red strain of *C. miniata* is being produced from a wide range of *miniata*, including some old named cultivars and a wide variety of plants that have been obtained at various times. Since the usual orange *C. miniata* has been bred for over a hundred years in Europe, there are quite a few nice plants to choose from. On a couple of occasions, I have seen a single very dark red flowered *C. miniata* amongst a large display of *miniata* offered for sale at a garden centre. On both occasions, I have bought the plant to include it in my gene pool. The plants, grown in mainland Europe, are always in a peat substitute growing medium. Controlled release fertiliser is always added to the pot that, even by European standards is much too small for the plant. The following year when the plant is in a less acid growing medium and a larger pot, the dark red of the flowers is replaced by a dark orange colour. The very dark red flowers are usually very small, and to date I have failed to transpose the dark red colour onto a plant with larger flowers. The picture below shows an old cultivar 'Westonbirt Perfection' which often gives its fully rounded flower



Photo: Mike Jeans

The attractive flower head of 'Westonbirt Perfection'

shape to its progeny. The next two pictures are progeny of 'Westonbirt Perfection'. The first shows a typical head of nicely formed flowers held well above the leaves on a strong stem. As



Photos: Mike Jeans

Good form A sparse flower head

a contrast, the picture shown alongside it is a rather delicate and ethereal seedling that makes an attractive foil to the more robust flowers usually associated with broad leafed *C. miniata*.

'Salmon Sensation' the picture below, with fruit, is a dark salmon *C. miniata*, and which had lost its labels by the time that it first



Photo: Mike Jeans

'Salmon Sensation'

flowered and is therefore of unknown parentage. The next two photographs show a couple of seedlings from 'Salmon Sensation' with different yellow *miniata* seed parents. However both have inherited the attractive flower form and 90–100mm. flowers from 'Salmon Sensation'. Some of the surprises in the darker strain are plants that should have been yellow flowered but

finish up with orange flowers, often well formed and brightly coloured. There are relatively few surprises in this group, probably because most of the plants have been selectively bred in Europe over many generations and have straightforward genetic inheritance.



Photo: Mike Jeans

A 'Salmon Sensation' offspring



Photo: Mike Jeans

A 'Salmon Sensation' offspring

It is in the group of the pale flowered plants that most of the surprises occur. Heading the next column is a Group 1 yellow *miniata*, originally from Cape Flora Nursery and



Photo: Mike Jeans

Note the tepal overlap

described as 'Dr. Hirao x Nakamura' strain. With its funnel shaped flower giving good tepal overlap and a much more consistent yellow than usual, I thought that it should make a good seed parent. Many of its progeny have flowers of a more realistic yellow than that typically found in yellow *C. miniata*. In some of the crosses, I used pollen from a (meristem) 'Vico Yellow' in an attempt to increase flower size. The first time flowerer, shown below, is an attractive yellow seedling from this cross, with good shape. The first picture on the next page shows a



Photo: Mike Jeans

An excellent dark yellow colour

seedling with tepals 38mm wide. As the picture opposite indicates, the unexpected is never far away and the near-white flower has the same parents. The 100mm. flowers had most of the things that I sought, and opened exactly the same colour as it had when the flower was going over. The last picture shows a yellow spider flower over 130mm. across. As I do not have any spider flowers in my *Clivia* collection, it is as difficult to imagine the genetic heritage of that plant also with the near-white flower. My collection has a few *C. miniata* 'striata', but only one of them has yellow flowers and it has poor random variegation and very poor split flowers. The 'striata' seedling shown opposite has attractive, well shaped, yellow flowers and reasonable leaf variegation. Unfortunately, it is another casualty of my poor labelling, having lost its identity on the way to flowering.



Photo: Mike Jeans

Wide tepals

Although there are more surprises in a poorly labelled collection, there has to be less control and slower progress if successful crossings cannot be repeated because the parents cannot be identified. I realise that there is absolutely no merit in poor labelling and am making a determined effort to improve my labelling. The labels are probably lost in 'potting on' as I have them in the soil rather than tied to the plant.

Many genera can only be bred professionally because thousands of seedlings are required to get perhaps a single plant with any commercial value. Not so with *Clivia*. My experience over about ten years of flowering home bred seedlings is that quite frequently seedlings appear that are of superior quality to both parents. Many of the plants illustrated cannot be compared to their parents as they are very different from them and I am unable to see anything in my gene pool that can be responsible for some of their characteristics.



Photo: Mike Jeans

A near white flower head



Photo: Mike Jeans

A variegated yellow



Photo: Mike Jeans

A yellow Spider

It is immensely satisfying to find a stranger flowering in the midst of one's collection, far more so than buying a plant from a nursery, even if it is in flower!

A Trilogy of Chinese *Clivia*

Hein Grebe, South Africa

Part One: The Beijing *Clivia* Scene



Photo: James Forsyth

South African tourists at Tiananmen Men Square

Beijing is a huge metropolis with many ultra-modern skyscrapers and an ever-changing skyline. It is home to more than 15 million people, which is a third of South Africa's population. With tourist attractions like the Great Wall, Forbidden City, Summer Palace, Tower of Heaven, Ming Tombs, Ghost Market and many other historic places, it is seen as the cultural capital of the Peoples' Republic of China. The Far East's two top universities, Tsinghua and Peking Universities can also be found here. It is a city of many opportunities even for those *Clivia* growers more than 1000 km away.

Every spring festival is a huge opportunity for flower growers. Hundreds of thousands of flowers in pots get placed in strategic places or planted in gardens alongside roads and highways so as to make the capital city beautiful and create a spring atmosphere. Many of these plants are grown on a 100ha site, which consists of thousands of glass houses. You need more than a week to visit most of the glasshouses. Unfortunately only a few *Clivia* of ordinary Chinese standards can be found there.

When visiting Beijing for the first time in 2004, I heard on the radio that 1,2 million tourists had visited Tiananmen Square on the first day of October that year to see the flower displays and other attractions. Tiananmen Square is in the centre of the city and the biggest city square in the world. Tourists visiting Beijing during the first week of October 2004 spent more than 4 billion RMB or Rand. The Chinese sometimes refer to the first week of October as the Golden Week, because most Chinese go on holiday during that week and billions are being spent. In 2005 Beijing's nominal GDP was 84 billion USD (compared to SA's total GDP of 200.5 billion USD for 2006), a year-on-year growth of 11.1% over the previous year. Its GDP per capita was 44 969 RMB or Rand, an increase of 8.1% over the previous year and nearly twice as much as the GDP for 2000.

To find *Clivia* in Beijing is not that easy. I had heard stories of overseas Mandarin speaking *Clivia* enthusiasts visiting Beijing in the hope of buying *Clivia* plants without finding any. The easiest way to find a *Clivia* or two is to walk in an old suburb where plants are being grown



Photo: Hein Grebe

Pagoda Flower Market and a 'special' *Clivia*

on balconies. You are guaranteed to find some there, but to communicate with the owners is another story, because more than 99.9% of the older generation cannot speak English.

In my case, things were much easier. During all three visits to Beijing I was staying with the Qi family. Mr Qi Yonghe and his son, Biao, are bonsai specialists who have won numerous prizes with their plants and displays. They belong to various botanical societies and know the entire flower growing areas and flower markets.

For a person who is interested in buying *Clivia*, a flower market is the most important place and the only place where you will be able to buy high quality *Clivia* plants - at a good price if you have superior negotiating skills.

A flower market is a place where you can buy many things. It is mainly a place where specialist plant growers sell their plants and florists sell all types of fresh and artificial flowers. It is also a place where you can buy ornaments, pets, insects, jade, paintings and many other valuable articles.

Price haggling or negotiation was something new for me as most things for sale in South Africa are priced, but in China only the supermarkets usually price their goods. There are several things to keep in mind before you buy plants in China. If you are a European they will think you are rich and have lots of money to spend. If they see you are buying more than one plant, they will know that you are a tourist and not a foreigner working in Beijing. They will also know that every day you stay in the city will cost you money, that the good flower markets are hours away from each other, and that you are likely to give in to higher prices.



Photo: Hein Grebe

After tough negotiations mixed feelings reflect on the face of the seller of this compact multitepal.

On the other hand, most of the sellers come from cities far away. It costs them money to get to Beijing and stay there. Their families expect them to bring money back which they can only do so if they sell their plants within a few days, as Beijing is an expensive city if you cannot stay with relatives. This means there is a sort of balance between buyer and seller, but if you visit commercial growers that balance is disturbed and everything is in the favour of the seller as he has nothing to lose, only his time. The balance is only in your favour if you find a seller with only a few plants left. If you make him a reasonable offer for the lot, he will most probably accept your offer, because he can then return home immediately.

To buy a bargain you must not look too interested in the item. Rather suggest you want to buy it as a gift for someone. On the other hand you must not insult the seller with too low an offer. Then you can forget about buying anything. This happened to me last year when I tried to buy pollen of a variegated LOB. The more I explained that I could not afford the plant but was willing to pay a good price for the pollen - which meant that he had nothing to lose as the buyer would hardly notice that a few pollen grains are missing - the more upset the seller became as he was only interested in selling the plant. After a few minutes he refused to communicate with me.

To prevent this you must have knowledge of the product you are buying. *Clivia* must be one of the most difficult plants to grow and sell in China. The more I interact with Chinese *Clivia* growers, the more respect I have for them and the more I admire them. Most commercial growers are perfectionists.

They grow their *Clivia* in the harshest conditions with outside temperatures that vary between minus 20°C to plus 35°C or more. In the summer months there is the threat of fungal diseases and in the winter the freezing of plants or low light. Sometimes there is no light for days when the glasshouses must be covered with straw mats so that ice is not formed on the glass roofs. The change in light conditions and hours of sunlight make it extremely difficult to grow perfect plants with all the leaves the same length and width. They have mastered the technique of manipulating the growth of every leaf on the plants in their glass houses. These growers eat and dream *Clivia* and it is impossible for someone to convince them that you can find better *Clivia* than theirs.



Photo: Hein Grebe

An Anshan glasshouse and an unexpected snowfall

After three years of hard work, most of the plants will be flowering size. A good quality plant that is professionally grown and planted in a beautiful pot can fetch R250 or more in Beijing's flower markets. If the flower or leaves are damaged you can expect a big discount of up to 50%.



Photo: Hein Grebe

Inside the glasshouse of Huang Qiuyi we see a display of numerous awards he has won for his *Clivia*

The most expensive and popular *Clivia* on the market is the "crinkle face" (guolan) with a good pagoda style and leaf form as well as variegated and miniature types like Jade and Swallow. Many sellers at flower markets display photos of their glasshouses in the background as well as the different prizes their *Clivia* have won in competitions. This is an easy way to convince prospective buyers of the quality of the *Clivia* they are buying. The general public however is not so much interested in the breeding quality of the plant, because they simply wish to put something with a flower in their house or shop. Many *Clivia* end up in the rubbish bin when the flower is gone or when they find a more interesting replacement, because space is the main consideration in Beijing. It is common knowledge that Beijing has on average some of the smallest dwellings in China, because land is very expensive.

Most *Clivia* sellers at the Flower Markets are middle men, who buy plants from commercial growers as soon as they start to



Photo: Hein Grobe

Zhao Baoyi's display in a modern Beijing flower market

push flowers, travel to a big city like Beijing with the plants

and sell them there. Not all sellers traveling with plants to Beijing are successful in hiring a space in a Flower Market. The reasons are obvious. There are only a few Flower Markets and the selling space in each market is limited and is most of the time taken. Apart from that, you must have a license to trade, which also costs money and is not so easy to obtain if you are not a Beijing citizen.

Some flower growers and sellers overcome this problem by arriving early on a Saturday morning in Beijing, traveling to the Flower Market with their goods before sunrise. They then bargain with licensed sellers to buy all their plants at irresistible prices, which vary from 10% to 20% of the going price inside the Flower Market. Those with better plants get their plants sold first and the other might have to drop their prices further to get them sold so as to be able to take the train back home in time.

Mr Qi told us this secret and in October 2004 we woke up very early one Saturday morning to reach the Pagoda Flower Market before sunrise when everything was still closed. The Pagoda Flower Market is famous for good *Clivia* and many top growers from Anshan, Changchun, Shenyang and elsewhere sell their *Clivia* there. It is also the place where I bought the best *Clivia* in Beijing. Some prominent Beijing *Clivia* growers regularly pay a visit to the Pagoda Flower Market on a Saturday morning to look for quality stock plants or to have a chat with growers from other towns to swop information or ideas.

When we arrived at the market, we saw people transporting all types of goods, from furniture to pets to plants. We found several people selling *Clivia*. Most of the *Clivia* were of inferior quality, but luckily I found one trader who was selling promising young broad leaf Daruma seedlings. I bought 10 plants for R250, with one of the plants having a leaf that was already 120 mm wide.

Later, when the market opened, we went inside and could clearly see the price difference inside and outside the market. Obviously when the market opens, no one is allowed to sell their goods outside, especially without a license. There is thus no chance to compare the quality and prices before you buy. The only plants I bought that day were the ones outside the market.

October is a perfect month for buying *Clivia* as the weather is perfect and it is the last month growers from far travel to Beijing to sell their plants, because in November it starts to snow and it is very risky to transport *Clivia* in freezing weather, as I had experienced myself in China previously.

In 2006 I visited China to celebrate the Chinese New Year with the Qi family and also to see Chinese *Clivia* in flower. Unfortunately for me the winter of 2005/2006 was an extremely cold one, which delayed the flowering season. I was told that February is the time when you can



Photos: Hein Grebe

A 15cm Broad Leaf with all leaves the same width

find thousands of flowering *Clivia* on the Flower Markets, because most people buy one to put it in their houses for the coming Spring Festival. We visited a few Flower Markets, but could not find many flowering *Clivia*. Average quality flowering plants were selling for R250 a plant, plants I would hardly purchase for R50 a piece.

One Saturday morning I asked Tracy Qi and her father to take me to the Pagoda flower market. I was expecting high quality plants with beautiful flowers and maybe one or two with a rare flower. When we arrived there, we looked around, but could not find a single *Clivia*. Mr Qi asked around and one person explained that it was too cold to sell *Clivia*. The Pagoda Flower Market is one of the oldest markets in Beijing and does not have any central heating inside the building, such as the modern Flower Markets do. Later on we found out that there were a number of growers trying to sell *Clivia*, but that they were hiding close to the market in their hotel rooms. Most of them were from Anshan and, for obvious reasons, did not bring their best *Clivia* to the market. They had been trapped inside their rooms with their plants for almost a week now. One cold spell outside their rooms and the leaves of the plants would get damaged by frost which would leave them with nothing to show for their 3 years labour. We had a chat with them, took photos and returned back home. I had been in Beijing now for a couple of weeks and had not bought a single plant.

Then I got the bright idea to visit the commercial growers in Anshan, Shenyang and Changchun. There I would see thousands of flowering *Clivia* and could pick the very best, as I had done in the past. I convinced Tracy and Yuanhau to go with me, because I was not confident enough to go on my own. We decided to travel by train this time, as it would be safer and quicker, because we could sleep in the train if we departed late in the evening. We arrived on a sunny morning, but another disappointment awaited me. After greeting some old friends and eating and drinking together, the *Clivia* expedition started. After visiting a few glass houses, with thousands of *Clivia*, I hardly saw a *Clivia* in flower. Yuanhau's father explained to us that as soon as a *Clivia* pushed a flower, it gets covered with a newspaper to delay the flowering process. Every day buyers came to buy plants to sell on the Flower Markets. They selected only those with flowering stems, as they would be the easiest to sell. As soon as the plants are sold, they return to collect more. I could only see a few breeding plants in flower. The cold winter had also delayed the flowering season here.



Photos: Courtesy Hein Grebe

Hein receives a valuable gift from Zhao Baoyi of a Painted Face Daruma

As we visited growers, I bought plants, because I knew there would not be time for revisits. It amazed me that everyone still remembered and recognized me from my previous visit almost two years ago! The next day a snowstorm arrived. Everyone covered their glass houses with straw mats to prevent the ice being formed on the glass and to keep the cold out. No more visits, because everything was covered in darkness. Yuanhau's family helped me to pack the *Clivia* I bought in a box. We decided to go further north and to visit Mr Zhu in Shenyang the next day. When we woke up the next morning the snow was already more than 150 mm deep. There was no train to Shenyang that day and we would have to take a bus. Only after an hour did we find out that there was no bus going to Shenyang, because the highway was closed as result of the heavy snow.

We walked around in the snow for hours trying to find someone to take us to Shenyang. I was getting worried about the *Clivia* in the box, because it was very cold outside and the box was getting wet despite me regularly removing the build-up of snow. At last Tracy found a taxi driver mad enough to take us to Shenyang. I decided to keep the *Clivia* on my lap to keep them warm. Wherever we went, we found closed roads. However, like a good taxi driver, he knew all the back roads and it was not too long before he found a way out of Anshan en route to Shenyang.

After half-an-hour's drive, things started to look worse. It kept on snowing and I was praying for a safe arrival, thinking back to a visit near Tibet to Dali in 2004. Tracy and I had decided to travel on a metal rowing boat with a Dutch couple to an island on the other side of a very big lake. An old couple was willing to take us there in their boat. A few kilometers from the shore they complained that they were too tired to row any further and that we would have to help them. Luckily we made it to the island, but on our way back a storm came up and caused huge waves on the water. Suddenly I started to think of the consequences if the boat overturned … our cameras gone and we might not be able to swim the 10 km back in the icy waters. I was thinking of the story of Jesus who calmed his disciples who were in the same situation on a stormy sea many years ago. That afternoon I prayed all the way back to the shore and - thank God - we arrived safely on the other side.

Now we were in the same situation again and so many things could go wrong - the car could slide off the road, the engine could die and suchlike - then we would die in the snow because no one would expect people to travel in these conditions on a lonely road. Luckily for us the driver was very experienced and did not try any tricks on us. He did not recognize Shenyang's streets, because everything was white. Only the main routes were in use. We contacted Mr Zhu and he said that he would wait for us along the main road, because the road to his house was not accessible any more. We found him and when I opened the boot to remove our luggage I saw that it was frozen. I



Photo: Hein Grebe

Zhu Jifu in a glasshouse with some of his *Clivia*

had made a very good decision not to put the *Clivia* in the boot. We walked in the snow to Mr Zhu's house. In some places the snow was almost knee deep. Inside Mr Zhu's house it was very warm, we exchanged *Clivia* news, had a look at his plants of which some were in flower. I bought a couple of his famous variegated Daruma. Apart from giving me pollen of his best plants, Mr Zhu gave me a very expensive gift – 4 line bred miniatures. We went to a good restaurant and enjoyed a wonderful meal and drinks. Mr Zhu managed to find train tickets for us to return to Beijing. He accompanied us to the station and on the way to the station the driver of the mini bus taxi lost control and we slid off the road, first missing a tree, then a huge stone, before crashing into a bank of snow. It was dark outside and we were lucky no one was hurt. Most of us got out of the taxi and pushed it back onto the road again. Luckily we arrived in time at the train station and we could not wait to be in Beijing again with all the luxuries, comfort and heat.

Back in Beijing I visited more flower markets. Suddenly we saw plants with stunning flowers; multi-petals, bi-colors, large white centers, green centers, ghosts and plants with light colored flowers.

Unfortunately I could not buy any more plants, because I bought too many in Anshan and Shenyang. My luggage was already overweight. But now I know that many Chinese plants have flowers that can compare with the best in South Africa. At one flower market I saw a selection of plants with particularly beautiful large flowers that reminded me of Eric Heine's plants. I found out that the grower, Mr Zhao Baoyi, was from Beijing. We visited him one day when everything was still covered with snow. I was stunned with his beautiful collection of broad leaves, variegated and Light



Photo: Hein Grebe

A bloom seen at a Beijing flower market

of Buddhas. He showed us shed after shed, at least 10 of them, each with an estimated 10 000 to 15 000 *Clivia*. His collection is the biggest I have seen in China.

Many of his plants were in flower and I asked him for the pollen of a beautiful broadleaf painted face Daruma. The next moment he asked someone to bring the plant to him and gave it to me as a gift! He also gave me a semi miniature and showed me his breeding plants behind a barred area, full of seed heads. From the pod colours I could see that the flowers must be of a wide colour range. He invited me to take some of the pods. After I explained that I had already got more than I wished for, he picked a few seed pods and gave them to me. We returned home very happy after I promised Baoyi that I would return with plants of my own.

Apart from visiting a few other Beijing growers, we also visited Mr Huang Qiuyi. He is a second-generation grower and specializes in growing 'crinkle face'. He has won numerous prizes and medals with his *Clivia* and also has a collection of other *Clivia*, like yellow flowering *Clivia* which includes a yellow multi-petal from Japan and some of China's original unimproved *Clivia* that were grown in the

Chinese Emperor's palace. He gave me seed of a good quality 'crinkle face' stock plant and afterwards we looked at the flowers of some of his plants on his computer. I saw a photo of a very broad leafed plant with the widest leaf of 180 mm, but also with some 160 and 170 mm leaves. I asked him who the owns this plant, because I had been hunting for a super broad leaf for several years. He explained that the plant belonged to his father, but that he was now the new owner. When we left I explained to Tracy that she should try to buy the 180 mm broad leaf for me. She had known Qiuyi for more than a year by then and would do a better bargaining job than me. Approximately six months later she told me the good news that I was now the new owner.

In Beijing I had seen quite a number of super broad leaf plants, including China's number 2, a plant with a widest leaf of 186 mm! But my search and hunt for super broad leafs is another long story.

In October last year some of the biggest role players in the production of *Clivia* in Beijing invited me to an informal meeting at the house of Mr Zhao Baoyi. He is undisputedly recognised as the biggest *Clivia* grower in Beijing with an estimated 150 000 *Clivia* (my own estimate). I have also met Mr Guo Qiang who founded the Beijing Clivia Association in the 70s. He is the second biggest grower with 12 *Clivia* sheds or green houses as they are named



Photo: Hein Grebe

A Beijing flower market where *Clivia* are being grown in fish bowls complete with cold water fish to fertilise the plants. Note the special plastic trays that support the plants.

in Beijing. He told me that he specialized in a type of semi-miniature with long flower stems, which he had developed himself. I have not seen his plants or sheds. It was in the 70s that professionals like Mr Guo Qiang, Mr Liu Mingde, Mr Sui Yongyi and others first introduced excellent *Clivia* cultivars from Changchun as a flower crop to Beijing. Presently there are approximately 30 commercial growers based in Beijing with approximately 1000 *Clivia* club members. Some of them buy seedlings and grow them on for a year or two for placing on the flower markets. They grow their *Clivia* in an estimated 65 to 75 green houses that vary in size from 50m^2 to 1700m^2.

Only a few of the *Clivia* green houses are located in Beijing City. Most of them are on the outskirts of the city, which means that you can visit only one grower on a given day if you are lucky to find his address. In 2004 Mr Qi undertook to take Tracy and me to a grower they had visited a few months before my arrival. We spent the whole afternoon trying to find him, but had to give up when it started to get dark. The problem is that in many of the country areas the streets do not have names and all the houses look the same. Privately owned *Clivia* sheds are traditionally half underground in Beijing and are called *Clivia* cellars. Many of these *Clivia* cellars are used for provisional cultivation before selling, as many *Clivia* are transported to Beijing every year.

Beijing *Clivia* growers have been unknown until recently. In late 2006 I met Mr Pang Chunquan who started a web site with Mr Ma Xiaohai to unite Beijing *Clivia* growers and make communication between members easier. Mr Pang worked overseas for a number of years and can speak English fluently. The web site also introduces Beijing *Clivia* growers and their activities to the world and will make it easier for overseas *Clivia* enthusiasts to make contact with Beijing *Clivia* growers.

For overseas enthusiasts who are interested in buying Chinese *Clivia*, Beijing is the ideal destination. Almost all the different types of *Clivia* are being grown there. Accommodation and transport are freely available as well as the services of CITES and the Beijing Customs Department to arrange for a phyto certificate for your plants.

As a luxury potted flower, *Clivia* is widely used in hotels, restaurants, ceremonies, banquets and conferences. It is a regular decoration for the National People's Congress (NPC) and the Political Consultative Conference. Every second year the Hortiflorexpo China which is the largest floricultural and horticultural expo in the East is held in Beijing with the next one in 2008 being named Green Olympic, because the Olympic Games also takes place the same year in Beijing.

The future of *Clivia* growers and *Clivia* or junzi-lan as it is named in China looks bright in Beijing. Junzi-lan is being widely appreciated not only for its appearance, but also for its inner beauty. The wax-like green or coloured leaves with their delicate quality, the straightness and regularity of the plant shape and its longevity is being viewed as dignified, poised and elegant, just like the temperament of "Junzi" – a person who is honest, morally upright, tolerant and widely admired.

Note:
Special thanks to Yuanhao, Tracy and her father Yonghe and brother Biao who spent days of their free time to take me around and assist me in communicating with *Clivia* growers and sellers. Without them this article would not have been possible. Thanks are also due to Chunquan who supplied me with important information about the Beijing Clivia Club, thereby making this article more complete.

Part Two: Zhu Jifu's New Babies – Line Bred Swallow and Jade

Mr. Zhu Jifu is without any doubt China's most famous *Clivia* breeder. You can mention his name to any Chinese *Clivia* enthusiast and they will know who he is. He has been on National TV several times, is the author of two *Clivia* books and is busy working on his third book, which he says will be the best *Clivia* book China has ever seen.

As the deputy president of the China Clivia Association with more than 24 000 members and the Executive Chairman of the Shenyang Clivia Research Institute, he regularly comes into contact with China's best growers and the latest development and technology to improve *Clivia*.

Mr. Zhu has become famous for breeding variegated Darumas. He has done this by line breeding selected long-leaved variegated plants with a 14 cm green (i.e. non-variegated) broad-leaved Japanese Daruma which he bought for R40 000 many years ago. The selected off-spring of these plants were then line bred to obtain a good quality variegated Daruma. Some of his 2nd and 3rd generation variegated plants already have leaves wider than the original pollen parent.



Photo: Hein Grebe

Zhu Jifu with his photographer and a large *Clivia* picture

From the offspring of the 2nd and 3rd generation variegated Darumas, miniatures started to appear. Typically, their leaves are wider than they are long, approximately 6 to 7 cm wide and 6 cm long. They seldom flower, but when they do the pollen of these miniatures can be used to make the leaves of the more regularly flowering Darumas shorter.



Photo: Hein Grebe

A Zhu Jifu dwarf

To line breed this type of plant is extremely difficult. In 2006 Mr. Zhu explained that the behaviour of these miniatures could not be predicted. It was almost as if some of them were stupid and did not know how to behave like normal *Clivia*. Some are very slow growing, some will never flower, some will flower out of season, most of the time with flowers between the leaves because of a shortened flower stem, some will multiply by offsets while others will never multiply.

In 2004 I saw only a few of these plants in Mr. Zhu's collection, but their numbers had grown remarkably by the time of my visit in 2006. Mr. Zhu explained that he bought a certain plant at a very high price from a friend and used this plant extensively to accelerate his breeding program of miniatures.



Photos: Hein Grebe

Zhu Jifu Daruma seedlings

During my 2006 visit Mr. Zhu surprised me with four of these plants, two green leaf and two variegated plants. He explained that these plants, when fully grown, would be very highly sought after in China. They are the first line-bred miniatures in China. I have now had these plants in my collection in South Africa for more than a year, and although they grow in a completely different environment and under different conditions, their leaf width/length ratio has stayed the same, i.e. a maximum 6 cm long and 7 cm wide. The plants have a very strong root system and grow at the same rate as a normal *Clivia*. Next year they will be fully grown and it will be interesting to see whether they will be more productive in South Africa.

These four miniature *Clivia* are the most prized *Clivia* in my collection and I will be forever thankful and in debt to Mr. Zhu who gave me almost 10% of his line bred miniature collection, before even starting to exploit their financial potential.



Photos: Courtesy of Hein Grebe

A meeting of *Clivia* minds

Part Three: Futuristic Clivia with Paintings on their Leaves

In 2004 I visited China to search for the famous Anshan Light of Buddha (LOB) grower. He had amazed the *Clivia* world by creating a new type of variegated *Clivia* with leaves that changed colour from a light green or yellow to a dark green, as they get older. Many *Clivia* growers, including some in China, believed that the plants were grown artificially by covering the young leaves with aluminium foil or paper to keep them yellow.

It took us almost two days to find the original LOB grower. He had two glasshouses or sheds as they are called in Anshan, stacked with LOB plants! More than half were flowering size plants. After enquiring about his prices, I decided to shop around first, because I had noticed that many growers had a few LOB plants in their glasshouses.

The following day I was introduced to a grower from whom I bought a 12 cm broad-leaved LOB for R1800. He invited me to visit his house and glasshouse in the afternoon. There I got the biggest surprise of my life. He showed me a collection of approximately 30 variegated LOB with the most amazing colours, stains and patterns on their leaves. His plants were far more advanced than anything I had seen so far. I never could have thought that plants like these could ever exist. It was like seeing these plants in a dream. Unfortunately the prices were out of my reach and so I decided to return the following year with enough money to buy some of these plants.

But when I returned in 2006 I was in for a big shock. The owner had sold all the mother plants I had admired so much. Fortunately, I saw some variegated LOB seedlings in a corner and negotiated to buy the whole lot.

They in fact looked of better potential than the mother and father plants. Now, with the introduction of Zhu Jifu's variegated Darumas as well as Starlight and X-ray LOB, my plan is to create a new 'type' of *Clivia*, which I will call the *Painted Leaf Strain*. I already have plants in my collection whose leaves resemble paintings. One characteristic of these plants is that not a single leaf has the same pattern on them. Each plant is a living work of art. Every time a new leaf is formed, it is a new painting created by nature. This 'painting' also changes as the leaf matures. Each plant can be seen as a book and the leaves as the pages of the book. You can see all the different paintings created by nature by "paging" or lifting up the leaves to inspect the patterns and colour combinations on it.

The plants in my collection are only the starting point. Years of breeding and hybridising still need to be done. Variegated LOB, Fukurin LOB, Mandarin Duck LOB, Tiger LOB, X-Ray LOB & Starlight LOB will be used to create the different lines and figures on the leaves; Bubble Leaf and Painted Face will be used to create a special effect or background; *C. mirabilis* can introduce red for sunrises or sunsets and Zhu Jifu's variegated Darumas will be used to create the 'square paper' effect. Different colours can be introduced to the leaves by using his Five Coloured Orchid and his other plants with multi-coloured leaves

Fortunately, the results of crossing different plants can be seen in the second year and selection of potential breeding material will hopefully be easier than breeding for flowers. On the other hand it can take more than a lifetime to create a living "Picasso"!



A variety of leaf colours and patterns demonstrates Hein's contention that each leaf is like a painting made by nature. All leaves shown above are different types of Light of Buddha except for the first leaf in the second row which is a Painted Face.

All Photos by Hein Grebe



A variegated *C. nobilis* leaf



An X-Ray Light of Buddha

Green Gold — Clivia in Changchun

Xueguan Song, China

The contents of the address by Xueguan Song, head of the delegation that attended the 2006 International Clivia Conference are summarized below. (Eds.)

Our delegation from the Changchun Clivia Miniata Society feel greatly honoured to visit the beautiful country from which *Clivia* originated and to attend this meeting and share in its proceedings. Thank you for this opportunity to tell you about our ongoing development of *Clivia miniata*.

There is a good market for *Clivia* in China, a market that has been booming since 1996. *Clivia* are produced commercially in about 30 cities in China, including Anshan, Dalian, Beijing, Zhengzhou, Changsha, Shanghai, Guangzhou and Nanjing. *Clivia* have been grown in the city of Changchun, in the north-east of China, for over 70 years. Changchun, from where we come, is the cradle of Chinese *Clivia* and thus has an outstanding position in the Chinese *Clivia* market .Some important factors contributing to our success are:

Large-scale production:

Total plantations are about 300,000 square metres, with up to 100 million seedlings, young plants and mature *Clivia* under cultivation, of which about 500,000 are fine quality ones. Our association has about 2000 smaller growers, each with over 10,000 plants, and 20 with very many *Clivia*, and they account for the rest of the production.

Scientific support:

The development of our operations is largely dependent on local scientific support. In Changchun we have universities, institutions, enterprises, *Clivia* associations and flower farmers. There are about 1000 scientists, technicians and other specialists working on sorting out problems relating to genetics, breeding and fertilization, whilst others are responsible for spreading and sharing information throughout our *Clivia* community.

The profitability of the business:

Clivia, as a crop, is relatively less investment-intensive than others crops and profitability per square metre is much higher. The total income of *Clivia* plantations in Changchun can be R400 million per year, some 5-8 times higher than from planting fruit and 10 times higher than from vegetables. We regard our *Clivia miniata* as "our green gold".

Employment:

The *Clivia* industry in Changchun employs 50,000 people and generates work and employment for related industries like suppliers of flower pots, growing medium and fertilizers.

Beautiful products:

We have always striven to produce high quality *Clivia*. Changchun *Clivia* are characterized by fine glossy leaves, with good leaf vein contrast and well-balanced proportions between length and width of leaves, and flowers in good taste, held on sturdy stems.

Our experience and "know-how":

Changchun has long been regarded as the homeland of Chinese *Clivia*. We have developed more than ten good strains of *Clivia*,

including Dashengli, Youjiang, Ranchang etc. The National parliament normally orders our products. Our *Clivia* breeders are known throughout China as leaders in three important areas: good strains, quality, and *Clivia* "know-how": since *Clivia* have been grown in Changchun for many years, we have built up a lot of experience and are always trying to improve.

Location:

In addition to the factors mentioned above, we have the advantage of an ideal geographic location. Changchun is located at 43° 05' N and 124° 18' E, in the middle temperate zone with a continental monsoon climate, and varying temperature. This environment is ideally suited for *Clivia miniata*.

Transport:

The location is also ideal for transport. Changchun is near the sea ports of Yinkou and Daliang, and the borders of North Korea and Russia lie to the north. In addition, we have an international airport with air links to Hongkong, Japan, Korea and Russia. A new airport project has already been launched which will make it even more convenient to connect to the world and communicate with more than 180 countries.

Our plans for future development:

Our philosophy is to follow the laws of nature, using science to achieve beneficial results by producing plants that people will wish to own. The aim of our association is to assist our *Clivia* producers and to bring about advances in employment, if necessary by expanding *Clivia* planting. We put effort into maintaining Changchun's status as the centre for breeding good strains of *Clivia* in China. We believe that our developments also improve our city's charm and its attraction for tourists. The government supports us with good policies that promote our *Clivia* industry. We expect that by 2010 *Clivia* plantations in Changchun will cover 700,000 square metres with up to 500 million *Clivia*, including seedlings and young plants, and total employed workers reaching 100,000 in number.

We invite all our international *Clivia* friends to visit Changchun and see our *Clivia* plantations. Thank you and best wishes for a successful conference.



The Chinese Delegation — with Roger Fisher at the Northern Clivia Show

Clivia are so loved in Changchun that in October 1984 Clivia miniata *was made the official flower of the City. The fascinating story of how clivias first reached Changchun can be read in "The great Chinese* Clivia *Bubble", by John van der Linde, in* CLIVIA 3.

(Eds.)

The Pretoria Clivia Auction

John van der Linde, South Africa

The Northern Clivia Club held an auction of selected *Clivia* on the Saturday evening of their Show, which followed the International Clivia Conference. There was a full house at the indoor lapa of the Forensic Science Laboratory, an ideal venue, with everyone being close to the action. It was a great evening, very professionally and slickly handled, and excitement ran high as prices were bid up and up… Not only was there an excellent catalogue but as each plant came up for auction its picture was flashed up onto a big screen for all to see. Let us look at some of those pictures and at some facts and figures: they may be boring – but they tell a story.

There were 58 plants on offer, with 20 coming from NZ, Holland, Australia, USA, Belgium and Japan, 7 from KZN, and 3 from the Eastern Cape. The remaining 28 plants were put up for sale by Joburg CC and Northern CC members, and included the Best on Show plant, which the owner decided to put on the auction. In addition, there were 3 magnificent photographs which Ian Coates, a UK *Clivia* grower and professional photographer, who was a speaker at the Conference, donated to be auctioned. The photos realized a total of R5800.



Lot 11 Chris Viljoen - 'Lobster'



Lot 35 Pierre de Coster - Belgian Multicolor

At the end of the evening 8 plants remained unsold as the highest bids were below the sellers' reserve prices and were not accepted by the sellers. The 50 plants that were actually sold realized R208250. The top price of R32000 – *nearly nine times* the average of R3600 for the rest of the plants – was paid by a South African buyer. The plant he bought was the well-known 'Charl's Green', an interspecific from Charl Coetzee of Port Elizabeth. I think Charl was as surprised as the rest of us as the bidding went up and up…and up. I have written a separate article about this plant, and why it might have been in such demand.

There seems to be a general impression that overseas buyers are prepared to pay more than us locals, but is this really the case? What do the auction statistics show? Firstly, I think one must exclude the price paid for 'Charl's Green' as this was so exceptional. Of the remaining 49 plants sold, 11 went to overseas buyers at an average price of R3709 per plant, only 4% above the average price of R3564 paid by South African buyers for the other 38 plants. I don't think that this difference is significant at all. Of course, if you want to include 'Charl's Green', the average price paid by "locals" is pushed up to R4294, which is 16% *above* the average price paid by the visitors!

Looking at the overall results of the auction, I could not help noticing how many of the *sellers* – 11 in total – were also *buyers*, reinvesting part or all (or even more!) of their proceeds to buy some of the really interesting plants on offer.

Have yellow *miniatas* lost their attraction? Out of 58 plants there were only two of them on offer. A yellow *caulescens*



Lot 57 Dawie Strydom - 'Peggy's Peach'

was not sold as the highest bid was below its reserve price (R6500) and was not accepted. A yellow *gardenii* was sold for R6000, even though this was below the reserve of R10 000 originally put on it by the seller. Compare this with the R1250 paid for an Ngome yellow *gardenii* at the subsequent SANBI/CCC internet auction!

Live *Clivia* auctions are fun. The adrenalin flows, and I enjoy being there - but I prefer to sit on my hands!



Lot 22 Gem Wildflowers - 'Gem's Malachite'

Charl's Green :- The coolest Clivia you've ever seen

John van der Linde, South Africa



Can you imagine anyone paying R32000 for a *Clivia*? Yes, this was the top price paid at the Pretoria Auction of the Northern Clivia Club. The plant was an interspecific put up for auction by Charl Coetzee of Port Elizabeth. This was an offset of his well-known 'Charl's Green', a plant that Charl had grown from Nakamura seed that he had bought from Charl Malan of Grahamstown.

Well, what is so special about this plant? Have a look at its picture. Firstly, the colour of the flowers is very unusual; secondly, although it is an interspecific the flowers almost look like those of a *C. miniata*; and thirdly, and most importantly, this plant is regarded by Prof. Harold Koopowitz as possibly being a stepping stone on the way to breeding a genuinely white *Clivia*.

In his view, one of the main problems in breeding whites is to get rid of the yellow carotenoids, the pigments that give even the palest near-white *Clivia* a touch of yellow in the petals. 'Charl's Green' does not express the carotenoids as such, although they are probably still present but are trapped in the chloroplasts that we see as green. If you look carefully towards the edges of the petals in any of the many 'Charl's Green' photos that are available you will see that the petal blade is white. The flower may almost be described as white with a large green throat. Because the plant is self-fertile Harold believes that one should be able to get some offspring with considerably less green in the throat. Of course, others may be even greener.

It may take several generations to get the desired flowers, but he believes the experiment could be worth it and could pay off handsomely. The plant may also be useful in producing good clear pinks, because it is the yellow pigments normally present that are turning them apricot or peach.

It would be interesting to know what plans the buyer of this plant has for it.



Auction Lot 23 Charl Coetzee - Charl's Green

NB Colour difference in the two pictures of Charl's Green are due to the photographs being taken in different light conditions (Eds)

The Clivia Society

www.cliviasociety.org

The Clivia Society caters for *Clivia* enthusiasts throughout the World. It is the umbrella body for a number of constituent Clivia Clubs and Interest Groups which meet regularly in a number of South African cities and towns. In addition, the Society has individual members in many countries, some of which also have their own Clivia Clubs. An annual Yearbook and regular Newsletters are published by the Society. For information on becoming a member and / or for details for the following Clivia Clubs and Interest Groups contact the Clivia Society secretary or where appropriate, the International Contacts, at the addresses listed below.

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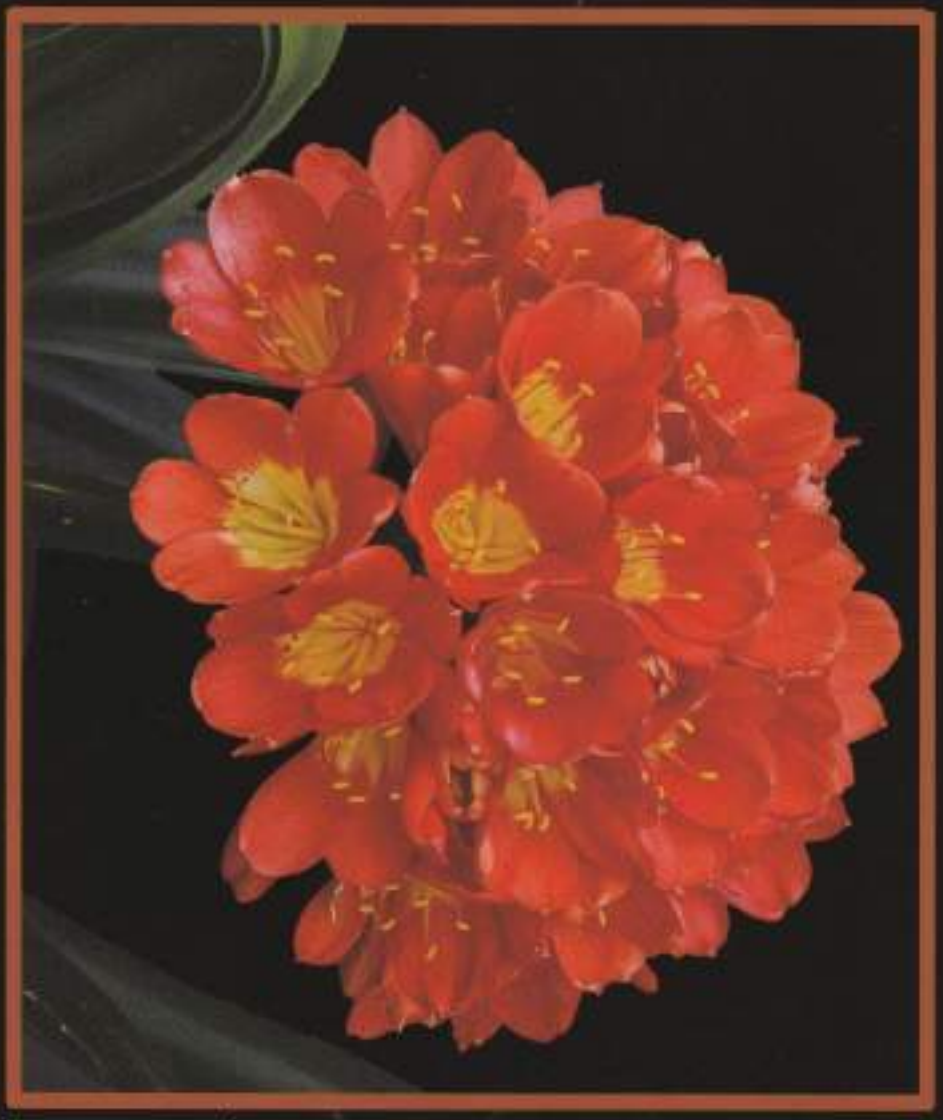
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INTEREST GROUPS: Border, Lowveld, Northern KZN, Overberg, Waterberg, Zoutpansberg.



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Green Gold — Clivia in Changchun

Xueguan Song, China

The contents of the address by Xueguan Song, head of the delegation that attended the 2006 International Clivia Conference are summarized below. (Eds.)

Our delegation from the Changchun Clivia Miniata Society feel greatly honoured to visit the beautiful country from which *Clivia* originated and to attend this meeting and share in its proceedings. Thank you for this opportunity to tell you about our ongoing development of *Clivia miniata*.

There is a good market for *Clivia* in China, a market that has been booming since 1996. *Clivia* are produced commercially in about 30 cities in China, including Anshan, Dalian, Beijing, Zhengzhou, Changsha, Shanghai, Guangzhou and Nanjing. *Clivia* have been grown in the city of Changchun, in the north-east of China, for over 70 years. Changchun, from where we come, is the cradle of Chinese *Clivia* and thus has an outstanding position in the Chinese *Clivia* market .Some important factors contributing to our success are:

Large-scale production:

Total plantations are about 300,000 square metres, with up to 100 million seedlings, young plants and mature *Clivia* under cultivation, of which about 500,000 are fine quality ones. Our association has about 2000 smaller growers, each with over 10,000 plants, and 20 with very many *Clivia*, and they account for the rest of the production.

Scientific support:

The development of our operations is largely dependent on local scientific support. In Changchun we have universities, institutions, enterprises, *Clivia* associations and flower farmers. There are about 1000 scientists, technicians and other specialists working on sorting out problems relating to genetics, breeding and fertilization, whilst others are responsible for spreading and sharing information throughout our *Clivia* community.

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Changchun has long been regarded as the homeland of Chinese *Clivia*. We have developed more than ten good strains of *Clivia*,

CLIVIA



10



Growers: Brenda and Edsel Nuss — The Winner of the Akebono / Light of Buddha class at the KZN Show
Photograph courtesy of Clive Graham

Front cover: *Clivia miniata*, *'September Success'* The Photograph is the overall Winning picture in the Photographic Competition and Winner of the *C. miniata* section. Breeder, Grower and Photographer: Felicity Weedon

Back cover: The previous nine Year Book covers

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CLIVIA
10



An exceptional head of flowers tightly packed and with lots of peachy pink colours

Editors

Roger Dixon
Roger Fisher
John van der Linde
Claude Felbert

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Editorial

Mick Dower, one of the original editor's of the CLIVIA YEARBOOK, published then as CLIVIA YEARBOOK 1998 reminisces:

I was overseas in 1997 and visited Mike Jeans in the UK and later Kees Sahin in Holland. Mike had remarked that the Newsletter was comprising too much that was of local South African interest only and that more photographs would be welcome. Kees passed a remark about the Newsletter being "mickey mouse" and gave me a copy of the Delphinium Yearbook published by the Delphinium Section of the RHS (his wife was a Council member) as an example of what should be aimed at. I showed it to John Winter when I got back and then raised the challenge with the powers that be in Pretoria at the time and landed in deep boiling water when I reported Kees' remark. However, the 1998 International Conference in Cape Town made the necessary articles easily available so I pulled John and Claude in, we found a graphic designer (first choice David Davidson, who did that sort of thing for Kirstenbosch, was not available because he was at Chelsea) and persuaded Pretoria to let us give it a go. Later I persuaded Chris [Vlok] to let us print the covers for the following year's newsletters as part of the Yearbook print order to improve quality at a lower cost and to provide more sources of comment in the Newsletters based on the photographs on the covers.

Claude continues on the Editorial team, John has attempted to retire as editor but has been co-opted to do duty, Roger Dixon is part of the team and Roger Fisher takes over as lead editor in this issue.

It seems fitting that in this, the tenth volume of the CLIVIA YEARBOOK we revisit some of the contributors to the very first issue. This has literally been done by members who have taken time and paid good money to visit breeders and growers in distant climes. Dries Olivier visits those growers of the Low Lands in Europe, and catches up with Pierre de Coster in Belgium while using the opportunity to make the acquaintance of Dirk Lootens of ID'flor Nursery, as well as paying a visit to another regular contributor, Aart van Voorst.

George Mann (South Africa) takes us on a visit to some Japanese growers and breeders and we revisit Yoshikazu Nakamura, who we first met in CLIVIA YEARBOOK 1998. Marilyn Paskert (USA) fills us in on some other Japanese growers, and Shigetaka Sasaki tells us of some recent developments in the breeding of Clivia in Japan, with the focus on leaf form and variegation there.

Through contributions by Paul Michael de Meglio (USA) and Helen Marriott (Australia) we visit the collections of older breeders, Roly Strachan in South Africa, and Laurens Rijke, of Dutch extraction, in Australia respectively.

John Craigie (Australia) tells of his experiences in breeding for polytepalous (multitepal) *Clivia* plants and Hannes Robbertse (South Africa) brings a botanists understanding of the morphology and genesis of the *Clivia* flower and the hormonal control of the formation of the different flower parts, but concludes that more research is needed to explain the polytepalous phenomenon.

We enter the annals of *Clivia* history where John van der Linde (South Africa) looks at some named cultivars from the 19th Century. Even the recent past becomes history and some of the founding members of what was then the Clivia Club, James and Connie Abel (South Africa), Keith Hammett (New Zealand, also a contributor to the first volume of the CLIVIA YEARBOOK) reminisce about the first Clivia Show held at the National Botanical Gardens in Pretoria in 1992.

Sean Chubb (South Africa) introduces pastel habitat forms of *Clivia miniata* in the Heritage Collection and Val Thurston (South Africa) adds a story of a particular rescued form, while Alick McLeman (New Zealand) tells of his breeding with some of these forms. Lisa Mannion (New Zealand) tells of her breeding for wide leaved forms of the yellow *Clivia*.

Roger Fisher (South Africa) reviews the second edition of Graham Duncan's 'Grow Clivia' and reflects on the dramatic additions that the last ten years have brought to the world of *Clivia*. With all this we believe we have met the challenges set by that very first issue of the CLIVIA YEARBOOK ten years ago in giving an international cover to our very localised genus, the *Clivia*.

This issue – CLIVIA 10 – has a number of contributions by collectors and growers of habitat plants. Over the years legislation has changed and we urge all those wishing to collect or grow this material to familiarise themselves and comply with the current legislation. It is also imperative that *Clivia* conservation be vigourously persued and herbarium specimens be officially prepared and lodged with one of the recognised National Herbaria.

We think that here is an appropriate place to publish the objectives of the Society so all may remind themselves of what we stand for.

THE OBJECTIVES OF THE CLIVIA SOCIETY

1. To coordinate the interests, activities and objectives of constituent Clivia Clubs and associate members;
2. To participate in activities for the protection and conservation of the genus *Clivia* in its natural habitat, thereby advance the protection and conservation of the natural habitats and naturally occurring populations of the genus *Clivia* in accordance with the laws and practices of conservation;
3. To promote the cultivation, conservation and improvement of the genus *Clivia* by
3.1 the exchange and mutual dissemination of information amongst Constituent Clivia Clubs and associate members;
3.2 where possible, the mutual exchange of plants, seed and pollen amongst Constituent Clivia Clubs and associate members; and
3.3 the mutual distribution of specialised knowledge and expertise amongst Constituent Clivia Clubs and associate members;
4. To promote the progress of and increase in knowledge of the genus *Clivia* and to advance it by enabling research to be done and by the accumulation of data and dissemination thereof amongst Constituent Clivia Clubs and associate members;
5. To promote interest in and knowledge of the genus *Clivia* amongst the general public; and
6. To do all such things as may be necessary and appropriate for the promotion of the abovementioned objectives.

The following contents will hopfully be enjoyed by you the reader and advance your knowledge of all things *Clivia*.

The Editors – July 2008

Has Anyone Seen Mrs. Laing?

John van der Linde, South Africa

According to the Journal of the Royal Horticultural Society, Volume 11 (1889) the RHS awarded a silver Banksian medal to a Mr John Laing of The Nurseries, in Forest Hill "for several named varieties of *Clivia;* 'Louise Cremer', 'Mrs Laing', 'Sulphurea', 'Madame van Houtte', and 'B.S. Williams', the latter excellent." John Laing was also awarded a first class certificate for a *Clivia miniata*, "a magnificent variety bearing a strong spike of brilliant orange-scarlet flowers of large and fine form".

What has happened to these plants, and many of the other magnificent *C. miniata* bred in Britain and on the continent of Europe in the final quarter of the 19th century?
We have only a few illustrations to go by. Harold Koopowitz, writing about some of these great clones in his book 'Clivias', says "the quality of the flowers was stunning, equal to some of the most modern standard hybrids".

One of the best known of these early clones, which created a sensation when it was first exhibited, is *Clivia miniata* 'Lindeni'. "The flowers were very large, approximately 100 mm in natural spread. The floral segments were slightly narrow by modern standards, but their size and arrangement on the umbel made for a spectacular display. The umbel itself was nearly 310 mm in diameter and reputedly carried up to 39 flowers" (Koopowitz). Lindeni was among the first *Clivia* plants with wide leaves and, judging by its painting, it would still rank among the best.

I mention 'Lindeni' particularly because it, and 'Mrs Laing', are two of the *C. miniata* mentioned in the plant catalogues for 1886 and 1889 of John Laing and Co., who describe themselves as "nurserymen, seedsmen and new plant merchants".



Clivia miniata 'Lindeni'

The asking price for 'Lindeni' in 1886 was one guinea, i.e. one pound one shilling (to those of us old enough to remember pounds, shillings and pence!). 'Mrs Laing', on the other hand, was on offer at "*from* two guineas", i.e., *at least double* the price of 'Lindeni'. Does this price difference imply that 'Mrs Laing' was an even more exceptional plant? To put these prices into perspective, the *weekly* wage of a gardener in those days was probably not much more than *half* a guinea!



C. miniata 'Marie Riemers' originally named *Himantophyllum miniatum* var. *Marie Riemers*

The catalogues do not state the number of plants on offer or whether the plants listed were of flowering size or were smaller, or whether these were seedlings or offsets of named clones. A possible clue is provided in the article "History of the Clivia in Belgium", in the 1998 CLIVIA YEARBOOK of the Clivia Club, the predecessor to the Clivia Society. The well-known Belgian *Clivia* breeder Pierre de Coster wrote "From 1879 onward, the seedlings of the *C. miniata* 'Lindeni' variety were very much in demand. Some of the seedlings reflected the type in its purest form, while other divergent specimens gave us numerous new varieties with large umbels, large flowers and/or broad leaves." This statement leads one to suspect that the plants that John Laing and Co. were offering for sale may well have been seedlings rather than offsets. Incidentally, those prices, expressed in 2008 terms, are around £94 and £188 respectively, significantly lower than the prices at which some special plants change hands these days, reinforcing the suspicion that the catalogue prices refer to seedlings.

At this stage we know nothing about the mysterious and desirable 'Mrs Laing', other than that customers were asked to pay at least twice the price of 'Lindeni' for one. Perhaps someone reading this article may be able to throw light on this highly rated *Clivia*. One thing that can be said with reasonable certainty is that the original 'Mrs Laing' would have been bred from outstanding parents. The early plant collectors who went into the wild would have collected the pick of the bunch. They would have chosen to take only the best. So the early *Clivia* breeders in Britain and on the continent of Europe would have had a top-class starting genetic base with which to work.

Harold Koopowitz, in his book 'Clivias', says about these early introductions "The unique feature ... was the enormous truss of bright orange flowers, often a foot or more in diameter, held in an almost globular umbel on an erect inflorescence. There was considerable colour variation between different clones, from the intensity of the orange colour to the shape of individual flowers to the extent of the contrasting yellow-cream throat."



Clivia miniata 'M^me^ Van Houtte' originally named *Himantophyllum* var. *M^me^ Van Houtte*

Did John Laing (1823-1900) breed this special plant and name it for his wife, or did someone else? It seems that his *Clivia* collection included plants bred in Europe ('Louise Crèmer' and 'Madame van Houtte') as well as 'Sulphurea', 'Robustum' and '*miniatum superbum* '. As a horticulturist he must have been highly regarded by his peers, as he was recognized with the top award of the RHS, the Victorian Medal of Honour.

His dear wife, on the other hand, not only had a *Clivia* named after her, but also a hybrid perpetual rose, 'Mrs John Laing'. Her *Clivia* may have slipped from view but her name has lived on, because the rose named for her in 1887 is one of the very few old roses that is still popular. It was introduced by one Henry Bennett, originally a cattle-breeder who applied his understanding of genetics to roses and became a notable rose breeder of the late 1800s. One wonders whether he also tried his hand at breeding *Clivia* plants?

Regarding the other people for whom plants mentioned in this article were named, I have found out the following:

Madame van Houtte was probably the wife of Louis van Houtte, the eminent Belgian nurseryman and publisher of the richly illustrated horticultural magazine, *Flore des Serres et Jardins de l'Europe*. She not only had a *Clivia* named for her, but also a rose and a clematis.

Mr B. S. (Benjamin Samuel) Williams of Victoria and Paradise Nurseries, Upper Holloway, London, was an orchid collector of note.

I have not been able to trace *Louise Cremer*, though Pierre de Coster has found a reference dating back to around 1883 to the plant named for her.

'Lindeni' may have been named for *Jean Linden* (1817-1898) who published lithographs of some of the selected clones in *L' Illustration Horticole*. According to Koopowitz, quoting Pierre de Coster, this plant was bred by Theodore Reimers, the chief gardener for a Mrs Donner, who lived in Ottenhausen near Hamburg, in Germany.



Clivia miniata var. M^me^ *Legrelle Dhanis*



Clivia miniata var.
M^me^ *Alice Rodigas*

All scans in this article are courtesy of the following: Paul Michael de Meglio, Ken Smith and Johan van Scheepen.

Fashions change, even in the naming of plants. I cannot think of many well-known modern *Clivia* plants named in this rather formal way, as was the custom amongst the Victorians of the late 19th century.

According to Michael Jeans, a UK Clivia breeder, many of the named clones in private hands in Britain would probably have been lost in the Second World War, as just about every able-bodied person was employed in the war effort. Additionally, fuel was rationed and glasshouses would have lost their heating, as well as most of their plants, through cold and neglect of plants, which could have been important for the re-establishment of a post war horticultural industry. Many important plants were exported to the USA. One of the biggest problems that caused the loss of important plants was bomb damage to glass, which was essentially irreplacable during the war. However, one can hope against hope that *at least some* of these special plants still exist somewhere in the world, even though their labels may have been lost and those special people for whom they were named may no longer be remembered. We know that some of the plants were used for breeding. Their genes almost certainly underlie many of the top-class modern *Clivia* plants.

A search of the internet has found that one of the plants for which John Laing was awarded a silver medal is listed in the International Plant Names Index as *Clivia sulphurea* Laing. This plant was exhibited at a flower show in the Belgian city of Ghent in 1888.This is the very first record of a yellow-flowered *C. miniata* (Dixon, 2005). Clearly, there were already good contacts between British and Continental *Clivia* breeders at that time. 'Sulphurea' may well still exist somewhere, and also others.

My hope is that the present article will stimulate readers to find the missing 'Mrs Laing', and other top plants like it, and to search out more pictures of stunning *Clivia* plants of the late 19th and early 20th centuries. I would like to thank all those who assisted me in my research. They include the staff of the Lindley Library at the RHS in London, who assisted me during my visit in 2007; Ian Coates, Michael Jeans, Lourens Malan of Kew Gardens and Gary Dunlop (all UK), Johan van Scheepen (Holand), Ken Smith (Australia), Pierre de Coster (Belgium),Alberto Grossi (Italy), and Keith Hammett (NZ).

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A Botanical Watercolour of a *Clivia miniata* Polytepal Green Throat grown by the Author

Clivia Fun – 15 Years Ago

Connie and James Abel, South Africa

In September this year (2008) Pretoria will hold its fifteenth *Clivia* show. We thought that a few reminiscences about the first show in 1994 might be of interest. As far as we know, it was the first *Clivia* show and/or conference to be held in the English speaking world.

As most readers will be aware, the Clivia Society started in 1992 with the "Friends of the Clivia" newsletter, conceived and produced by Nick Primich, from Johannesburg. The first edition was mailed to his circle of *Clivia* and bulb friends around the world, many of whom contributed articles, and the membership swelled from there. It is fruitless but interesting to speculate on how, if at all, *Clivia* organisation would have developed if it had not been for that initiative of Nick's. The range of activities broadened, and 1993 saw the first meetings, garden visits and habitat tours.

It was all great fun, and as momentum increased in 1994 it was obvious that we should 'spread the message'. A 'wish' list soon developed. Since our hobby concerns a beautiful plant, we naturally decided that we had to have a show (with rosettes), so that prize specimens from many collections could be admired alongside each other and the owners could brag a bit. We also decided that we had to have a photographic exhibition so that our far-flung friends could show their special plants. And if a show, why not also a conference so that we could share knowledge? And sales so that collections could be started and expanded, and funds generated. A visit to see *Clivia* in habitat was a natural. Memorabilia – of course. And the Sunday could be devoted to several garden visits. The obvious venue was the Botanic Gardens, fortunately available to us, and *Clivia* shows were held there for several years subsequently. With the bravado (rashness?) of first-timers, the 'wish' list became a 'must do' list!

Every aspect was a new challenge, but they were tackled vigorously. With no track record, publicity was of prime importance, and we were able to arrange coverage from local and national press as well as several talks on radio. The illustrated poster was spread as widely as possible - were the entry fees really so low? At current rates, R2 = US$0.25! The reason for the 'one o'clock' restriction was that most of us "specialists" would be tied up in the conference until then. Of great importance

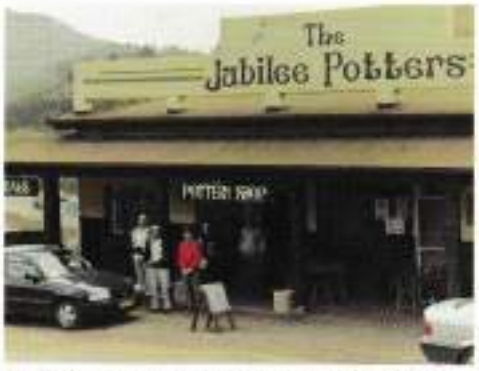


The Show Poster

was the fact that Nick was able to make it truly international with the attendance of Yoshikazu Nakamura from Japan, Keith Hammett from

New Zealand and Pen Henry from Australia. Of the South Africans, the best known and a helpful team member was Wessel Lotter, who has done so much for interspecific *Clivia* breeding.

Proceedings started with a trip to *C. caulescens* country. God's Window was covered in mist/drizzle, but when the South Africans apologised for the poor weather Keith assured them that it was a privilege to experience the range of conditions that are a regular part of the natural environment in which *Clivia* occur.



Keith Hammett (NZ), Yoshi Nakamura (Jp), Adri Haxton (SA), Pen Henry (Au) & Nick Primich (SA) in Pilgrims Rest.

Until that Saturday morning we remained uncertain as to the level of interest that would be shown. Our relief and delight on the day can be imagined when we were overwhelmed with the number of members of the public streaming in. A queue started forming early in the morning. The gates of the Botanic Gardens are perhaps ½ km from the venue, and when they opened at 09:30 there was a rush as the enthusiasts tried to be first to get to the plants. They came not only from Pretoria and Johannesburg, but also from KwaZulu Natal, the Cape and elsewhere.



The crowd and the show area

For the conference, besides contributions from our international delegates, we were able to arrange a good day's programme with presentations on fertilization, use of *Clivia* for traditional medicinal and spiritual purposes, other subjects, and even a paper mailed in from Australia on the potential for the use of neem oil as an insecticide (to a South African, what on earth was a 'neem'!). An interpreter had been arranged for Yoshi, and when it was time for his presentation,



Best on Show 'Ella van Zijl' - grower Toy Jennings

there was consternation since, due to language misunderstandings, we had left his slides behind at our home where he was a welcome guest. No problem – Keith was quickly press-ganged into taking over the chair, the next presentation was advanced, the slides were hurriedly fetched and Yoshi's talk was greatly appreciated. For most of us it was a wonder to start perceiving the esteem in which *Clivia* are held in the Orient.

The show was a great success, with many entries Best-on-show was awarded to Toy Jennings for her 'Ella van Zijl', as popular then as it is now. This was particularly poignant, since Ella was a close friend of Toy's who had placed the plant in Toy's care, from where it became widely admired – offsets have been distributed worldwide.

The photographic exhibition, with the inclusion of mouth-watering specimens from as far as Australia and the USA, was very successful. Later these photos were laminated and they were exhibited at a number of shows, impressing many thousands of show goers.

Sales were also very popular. Mistakes were made – the show and sales took place in the forecourt under indigenous trees which we soon realized were mainly deciduous and the shade was quite inadequate. For subsequent years we moved to the carports where there was adequate shade. Many sellers were apprehensive about committing themselves to a fixed rental for a stall, since we had no idea how strong the demand would be. To avoid having a fixed charge payable in advance and perhaps not recouped, we decided that we would charge a percentage of sales for club funds. The sales took place through a twin sales point, and were a real hassle to manage. In later years we relied on an honour system for the payment of commission on sales, and soon after that we again changed, this time to a fixed rental per stall, payable in advance.



On Show in the Forecourt

Support was received from several other provinces, and Jim Holmes's presence from the Cape with a bakkie (van) load of yellow *C. miniata* for sale was a highlight – at that stage they were still rarities. Our son Duncan, with a friend, took charge of the two cash registers for the sales. It was not long before the 'pressure of business' forced them to abandon the carefully planned ringing up of each sale (in those days tills were still mechanical) and simply start stuffing the proceeds into the open drawers while giving change as best they could! And that while baking in the hot sun under the bare trees!

Having the conference and the show/sales on the same day was a definite mistake, because the enthusiasts who had contributed so much to setting things up had to miss one or the other! Toy and Connie were so busy with the show and sales that they did not get to the conference hall at all! Although the subsequent conferences in Cape Town and then Pietermaritzburg also had their show and sales held on the same day, when it was again Pretoria's turn in 2006 it was decided to hold the conference on the Wednesday and Thursday, allowing the locals time on the Friday to set up for the holding of the show/sales on Saturday and Sunday, and so

they were able to participate in every activity. We are sure that this pattern will be adhered to for following conferences.

Sales at a *Clivia* show are essential for several reasons. There are often long queues of enthusiasts waiting at the gates for Saturday's opening, so that they can be among the first to see what is on offer and perhaps secure that special plant of their dreams. Part of the importance is fund raising. For those early years we had very little money, and the newsletter could be photocopied in black and white only – colour remained a dream. The entry and sales fees from that day were very welcome, but still not sufficient. It was only in 1998 that we had sufficient funds to produce the Clivia Review, a forerunner of the Yearbooks, for distribution to all members. It was a modest 8 pages, with 19 photos.


Clivia Club

The Clivia Review '98

The Clivia Review is published as a supplement to the Clivia Club newsletter. Its purpose is to illustrate named clones, winning exhibits and other interesting forms, many of which will have been described in the quarterly newsletter. Contributions from all Clivia enthusiasts are welcome. Photographs which best illustrate interesting forms of Clivia will be published, but all will be retained by the Club to form a reference library.

P O Box 74866, Lynnwood Ridge, 0040, South Africa. Tel/Fax 27-12-991-2663

Scan courtesy of James Abel

The First Colour Production

It was all a great few months and lots of fun, meeting so many other enthusiasts and facing so many challenges. The memorabilia included the proceedings of the conference, and T-shirts were essential, as can be seen! We were very fortunate in having Michael and Renee Stevenson on the committee – they held senior positions in a large retail group, and most of the credit for organizing that first great day is due to them.



The organisers, at the Nick Primich's home left to right: James Abel, Connie Abel, Nick Primich, Renee Stevenson, Michael Stevenson, Adri Haxton, Toy Jennings, & Wessel Lotter

With the benefit of hindsight, we regret that we did not make any special arrangements for a photographic record, which would have been invaluable in prompting further recollections. James Haxton, Adri Haxton, Toy Jennings, Keith Hammett and Lena van der Merwe kindly searched for and contributed the photos featured here.

A final reason for all of the activity was to expose more people to the wonders of the genus and to recruit them as members. The increase in momentum that was achieved on that day in 1994 has spilled forward into growth for the Society and the establishment of clubs, first in Pietermaritzburg, then Cape

Town and then elsewhere in South Africa and internationally. Many members of the public who attended that first show to see what the fuss was all about were successfully 'hooked' and became active members, making their own important contributions to *Clivia* organisationand enthusiasm.

A few recollections from Keith Hammett

First shows and conferences are often the most exciting, as they are a step into the unknown. It was a privilege for me to attend and I gained much from both the conference and associated tours.

En route to South Africa, I visited Joe Solomone in the USA and so was able to alert people outside of the USA to his work with the genus, at the conference. It was great to be able to spend time in South Africa with Yoshikazu Nakamura whom I had visited previously in Japan. I attribute much of the current heightened interest in Clivia to his extraordinary generosity with high quality seed and plants.

Before and after the conference I was able to travel with Nick Primich, Yoshikazu, Pen Henry and Adri and James Haxton to see various Clivia species growing in the wild where they had evolved over millions of years. For me this was a near religious experience, which fundamentally altered several of my paradigms.

Unless otherwise stated all photos in this article are courtesy of James Haxton.



Photo: Pen Henry

The clouds and mist rolling in at God's Window

Just one of the magnificent views that so many *Clivia* lovers have enjoyed on one of the many tours lead by James Abel (Eds.)

Clivia Research

Johan Spies, South Africa

The Department of Genetics at the University of the Free State is engaged in a number of research projects on *Clivia*. The projects can be subdivided into four different groups, i.e. *Clivia* diseases, genetic variation in *Clivia*, cultivar identification and flower colour formation.

Clivia diseases

We are currently studying two "new" diseases in *Clivia*. The first is a virus causing yellowing of the leaves. This disease was first observed in the *C. caulescens* population at God's Window during the 2006 Caulescens tour. A drastic increase in the number of affected plants was observed during the 2007 tour. Plants showing symptoms of this virus infection were also observed at Wonder View and Mariepskop. Leaves collected at the site indicated that this virus and the way in which it affects the currently being studied and a report will be published in CLIVIA 11.

The second disease is rotting of the flower stalk, the pedicels, the flower itself or the berries. This disease was observed by Chris Vlok in the second flower of a plant and in the young berries of some plants by Francois van Rooyen. Plants with these problems were grown in our green house and we have seen either the original problem in subsequent years or dying back of the flower stalk. It is not known yet whether this is the result of a "genetic weakness" of the plant or if an organism similar to crown rot is present. We are also studying environmental factors as possible causes for this phenomenon.

Unfortunately this type of study takes a long time to complete. Firstly, the plant must develop the disease and then one can look at the consequences. One also has to allow the plant to form off-shoots to study their behaviour in different environments to determine whether environmental differences cause the disease. As soon as the results are available, they will be published in either the Clivia Society quarterly Newsletter or in the Yearbook.

Genetic variation

At this stage the main focus of our research is on determining the genetic variation in different natural populations. For any species to survive in nature a lot of genetic variation is needed. With the decline in the number of different populations and the number of individuals in natural populations we urgently need to know the degree of variation. We also need to develop a strategy to conserve the existing variation. This variation is not always visible. Therefore it is necessary to begin a study of this nature with a conservation strategy.

The delimitation of species is also an important issue to *Clivia* lovers. This study should indicate the boundaries of the different species and whether each species really represent a different taxonomic status as a separate species. With an increasing number of reports on "new species" received constantly, we need to clarify the situation. I have received claims for at least five new species in the past two years. In my opinion none of them really represent "new species", but rather different ecotypes or in one instance it may be an interspecific hybrid.

Suzanne Stegmann is studying the genetic variation in *C. caulescens* and *C. x nimbicola*. We received a lot of material from different

localities but the extreme northern distribution area is poorly represented. We would appreciate it if somebody could help us with material from that area. We are still waiting for permission from the Nature Conservation authorities to collect leaves from Bearded Man. Our application was submitted approximately six months ago! Hopefully we will get permission and this study should be completed by the middle of 2009.

Carmari Breyl has made a start with *C. gardenii* and *C. robusta*. A lot of work must still be done. Material from the area west of Pietermaritzburg is still lacking in our collection. This study should be completed during 2010.

Hesmari van der Westhuizen is working on *C. mirabilis* and *C. nobilis*. We have a very complete collection record of these species and we appreciate the help received from many people in East London (especially John Roderick and Stella van Gass). On the *C. mirabilis* side we thank Hein Grebe and Gerhard Faber for their help. This study will include approximately 40 *C. mirabilis* specimens and the obvious morphological differences indicate that this species contains a lot variation. The study should also be completed by June 2009.

Cultivar identification

The longer I am involved with *Clivia* the more I become aware of the urgent need for cultivar identification. It really is a pity that so many *Clivia* growers seem to be either totally ignorant in connection with cultivar names, or else are unscrupulous dealers. I am convinced that the Clivia Society should play a bigger role in the naming and policing of already named *Clivia* cultivars. The whole *Clivia* fraternity will eventually suffer from the misrepresentation of named cultivars.

A first step is keeping records of all cultivars. In this respect we thank Ken Smith for his efforts and we encourage all *Clivia* breeders to register their cultivars. At the same time the Clivia Society will have to monitor the misuse of names. We have therefore embarked on a study to fingerprint different cultivars. The pilot project on some yellow flowering cultivars of *C. miniata* was published in CLIVIA 9. Now we have to build a database. This is a very time-consuming exercise. Think of our results as being represented by a barcode for each specimen. We cannot come to any conclusion by doing one additional specimen. However, by studying hundreds of barcodes we can start grouping them together. Eventually these groups may make sense. If an additional one is added at that stage, we will be able to fit it into the larger picture. So for all the people becoming frustrated by the present lack of feedback, please be patient. We simply cannot analyse each record. We need to build our database and analyse it to get the complete picture. Then we can slot further samples into this big picture. By adding only one piece of a jigsaw puzzle you still do not see the whole picture!

Paula Spies is steadily building the database and should complete her study by the end of 2010.

Flower colour formation

This very interesting aspect forms the last part of our research projects. Marius Snyman is currently studying the genes involved with the formation of anthocyanin in *Clivia*. He has already isolated the first two genes in this pathway and is now busy determining the variation in these genes and their expression in different *Clivia* cultivars. He should complete his study this year. Another student will then have to study the next set of genes.

Frank Maleka and Bernice Jackson have recently begun their studies on the carotenoid genes in *Clivia*. Their studies should be completed during 2011 and 2009 respectively.



A double seedling

Summary

A great deal of research on various aspects of *Clivia* is under way at the University of the Free State. The results from these studies will hopefully contribute to the *Clivia* fraternity. Sometimes these results will impact upon people such as unscrupulous sellers of misnamed cultivars, but most people should benefit. We wish to thank everyone again for their contributions to enable these different projects to go ahead.



We have previously published a picture of *Cryptostephanus vansonii*, *Cryptostephanus* being the closest species to *Clivia*. Here is a picture of *Cryptostephanus haemanthoides* courtesy of John Ingram

A Short Note on the Clivia Inflorescence

Hannes Robbertse, South Africa

It is well known that that the type of inflorescence found in *Clivia* plants is an umbel. Weberling (1989) describes the umbel as follows: "The umbel (or sciadium) is distinguished from the raceme by the compression of the rachis which is compensated here by the fact that the pedicels of the flowers, which now radiate from one central point, are greatly elongated". It is also well known that the growth of the *Clivia* plant is sympodial (Robbertse (2003) in CLIVIA 5). Looking at the *Clivia* umbel, it would seem that inflorescence is determinate, meaning that the inflorescence axis ends in a terminal flower and that the number of flowers per inflorescence is pre-determined. However, we also know that the number of flowers can vary, depending on the age and vigour of the plant.The question is: what is the real structure of the inflorescence and what determines the number of flowers?

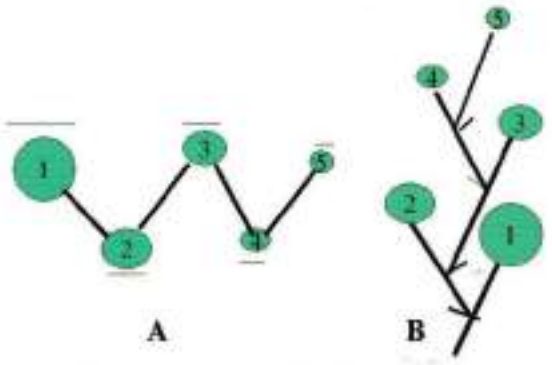


Photo: John Ingram

A tightly packed Inflorescence

The pictures on the next page were taken from a very young *Clivia* inflorescence that was dissected from a mature plant, and show separate cincinnae, that form the basic parts

Müller-Doblies (1978) worked on the inflorescences of *Amaryllidaceae* and found that the inflorescence of *Clivia* is actually a compound inflorescence made up of sympodial 'branches' or 'partial inflorescences'. The 'partial inflorescence' is classified as a 'flat cincinnus' as illustrated in Figure 1.



Cincinnus A - Plan, B - Side view

1 - 5 Succession of flower initiation

Fig. 1 Cincinnus, or synopodial branching system forming part of the Clivia inflorescence (umbel) with flower buds in axils of bracts, starting with the oldest flower (1) to the youngest flower (5)



Photo: Courtesy Hannes Robertse

Fig. 2. Back and front views of a very young, flattened *Clivia* inflorescence showing two cincinnae (1-5 and a–d) in A and B as well as a third cincinnus (x-y). The cincinnae are reduced, sympodial "branches" composing the umbel. Note the bracts subtending flower buds 4 and d

of the umbel. Buds always develop in axils of leaves of bracts (reduced leaves) as shown in figure 1. The young inflorescence depicted in Fig. 2 was enveloped by four bracts, suggesting four 'branches' in the umbel. In Figure 2 there are only three branches (cincinnae), but in other inflorescences four were seen.

The indeterminate nature of the cincinnae explains the fact that the number of flowers in the *Clivia* inflorescence can vary from a few to many and also that the flowers of the same inflorescence are not all of the same age and do not open simultaneously. The oldest and probably the strongest flower in the inflorescence (1 in Fig. 2A and B) is also the first flower of the 'basal' or first-formed cincinnus and is usually the first flower to open.

Hannes Robbertse is associated with the Department of Plant Production and Soil Science, University of Pretoria. (Eds.)

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The Phenomenon of Polytepalous (Multitepal) Clivia Flowers

Hannes Robertse, South Africa

Introduction

Before dealing with the topic itself, it is necessary to clarify a few terms.

In the heading above, I refer to *Clivia* **flowers** and not to *Clivia* **florets.** The term floret is used to refer to the small flowers composing the flower-like inflorescence, called a flower head or capitulum, found in some plant families such as the *Asteraceae* (sunflowers and daisies) and *Proteaceae*. These 'florets' are small and often do not contain all the structural parts of a full flower such as the perianth, stamens and pistil as is typical of a flower. In the case of *Clivia* the relatively large flowers are arranged in an inflorescence, called an umbel. They contain all the essential parts of a flower and should therefore be called flowers and not florets.

Multipetal, multitepal or polytepal?

The term 'perianth' (*peri* meaning around and *anthos* meaning flower) is a collective term referring to the two whorls of flower parts outside or surrounding the stamens and pistil. The stamens and pistil are regarded as the 'essential' parts of the flower responsible for sexual reproduction. In flowers of dicotyledonous plants the perianth consists of a distinct outer whorl of flower parts called the **calyx** and an inner whorl of flower parts called the **corolla.** The calyx is made up of a number of **sepals** (usually green), while the corolla is made up of a number of **petals** (often brightly coloured). In monocotyledonous flowers, as in the case of *Clivia*, the parts of the outer and inner whorls of the perianth look very similar and so as to distinguish them from sepals and petals they are called **tepals.** Flowers of monocotyledonous plants are trimerous (whorls consisting of three parts each). The perianth of a typical *Clivia*, therefore, consists of three **outer** and three **inner tepals**. Flowers having more than six tepals should therefore could be called **multitepalous.** However, in botanical terminology, when referring to many petals or sepals in the same flower, the prefix **poly-** is used instead of **multi-** and terms such as polypetalous and polyandrous are used. I am not sure who coined the term multitepal, but to be in line with botanical terminology, it would be more appropriate to use the term **polytepalous.**

The origin of flower parts

Except for roots, all plant parts such as leaves, stems and flowers are produced by the apical meristems or apical domes of buds. During the vegetative stage of the *Clivia* plant, the apical dome of the terminal bud produces leaf primordia, one at a time and in alternating positions on either side of the apical dome. The leaf arrangement (phylotaxis) of the *Clivia* is therefore alternate and distich (in two rows - see van der Merwe *et.al.* (2006) for more detail). After having produced a number of leaves, the apical dome switches to the reproductive phase and gives rise to an inflorescence bud. The latter then produces a number of bract (reduced leaves) primordia and in the axil of each bract it produces a flower bud primordium. Initially flower bud primordia are globular in shape, but soon become flattened at the top. Instead of producing one leaf primordium at a time as in the vegetative bud, primordia of flower parts are produced in whorls and in the case of *Clivia*, whorls of three at a time (Figure 1).

The first or outer whorl of three primordia will become the outer tepal whorl, followed by the inner tepal whorl, two whorls of stamens and one whorl of carpels. A typical *Clivia* flower therefore consists of six tepals, six stamens and a pistil consisting of three carpels.

The formation of the flower parts is controlled by genes, as stated by Ronse De Craene (2007): "The differentiation of the flower rests on the ABC-model, in which identity of organs in each whorl is determined by a combination of three classes of MADS-box organ identity genes: A genes are responsible for sepal formation, A + B function determines petal identity, B + C function specifies stamens, and C-function determines carpel development. The model has been subsequently extended to include D- and E-class genes that also play a role in floral organ development". Another citation from the Max Plank Institute reads "That means that petals and stamens require two genes for their development and that changes from the one flower circle (whorl) to the next is based on the successive turning on of the respective switch". Most of the research on genes that control flower development was done on dicots like *Arabidopsis* and *Antherrinum*, but presently researchers also look at monocots like maize, lilies and tulips. I am not a geneticist and do not want to dwell on the genetic details of flower development, but the above citations provide an idea of the complexity of flower development and also the lack of information regarding polytepals.

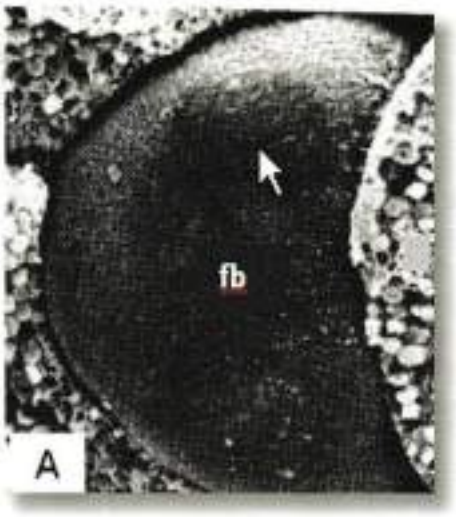


Figure 1 a

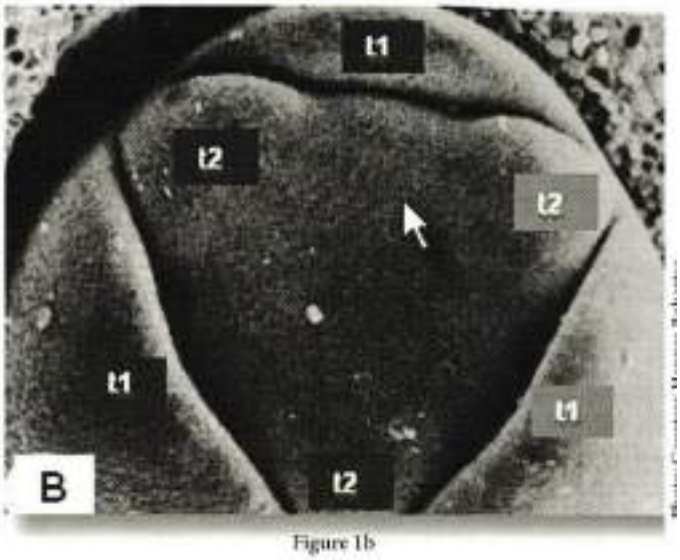


Figure 1b

The morphology of polytepal formation

Figure 1 shows the formation of the three members of the outer tepal whorl and the beginning of the second whorl in the young flower bud of a monocot plant. In the following whorls, the three tepals of the inner whorl

as well as the two whorls of stamens and one whorl of carpels, will position themselves in the 'vacant' positions between the members of the previous whorl. The reason being that the apex of each new primordium produces hormones that inhibit the formation of a new primordium in the direct vicinity of the previous one. The result is that members of the next whorl of primordia are formed a bit closer to the dome apex and in alternating positions exactly mid-way between two adjacent members of the preceding whorl. If more than two whorls of tepals or stamens are formed, they will follow the same sequence.

In his contribution on 'Breeding for Polytepalous *Clivia*' in this volume, John Craigie states that "polytepal plants can have flowers on the same scape with four, six, seven, eight, ten, twelve and even fourteen sepals". Since *Clivia* flowers are trimerous, and the flower parts are formed in successive whorls, multiplication of the flower parts like the tepals should also occur in multiples of three which means either six, nine, twelve or fifteen tepals per flower. Due to constricted space between tightly suppressed leaf bases where the *Clivia* inflorescence and flower buds develop, it is possible that one or more of the primordia may abort before developing into a tepal or stamen, resulting in the numbers observed by John Craigie. Figure 2 shows three *Clivia* flower buds on part of a flat inflorescence bud that was dissected close to the growing point of a mature plant. On the youngest buds on the left, the one outer tepal is more pronounced than the other two.

The question remains 'Why would the plant produce flowers with more than the normal number of tepals or stamens?' Considering the genetic control mechanisms mentioned above, it could be that the 'switch' from tepal formation to stamen formation is delayed for some reason such as the improper interaction between A and B genes or the interference of specific genes. Carpel formation is controlled by C-genes and this might explain why we still get three carpels in polytepal flowers. This is, however, merely speculation and we will have to wait for the results of proper research to supply the answers. In the mean time selection as proposed by John may be the best way forward.



Photo: Courtesy Hannes Robbertse

Figure 2

Hannes Robbertse is associated with the Department of Plant Production and Soil Science, University of Pretoria. (Eds.)

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A Selection of Photographs from some Clubs and Interest Groups

Eastern Province Clivia Club:



Eastern Province Clivia Club Show Winner Grower: Charl Malan



Eastern Province Clivia Club Show First Runner-up
'Obama' Grower: Charl Coetzee



Eastern Province Clivia Club Show Best Novice
Grower: Gideon de Kock



Eastern Province Clivia Club Show - Second Runner-up Grower: Neil Ellis
All EPCC photographs by Charl Coetzee

Garden Route Clivia Club:



Garden Route Clivia Club Show Winners
See Opposite Page: The Garden Route Show venue is a school and the Learners drew pictures of Clivia for the display


C.J. Wepener Saal/Hall



Garden Route Clivia Club Winners





Garden Route Clivia Club Show Team

Left: A Close-up of a stamen by Piet Theron



Clivia miniata — Grower: Bets Rossouw and the Late Cor van Niekerk



Clivia miniata — Belgium Hybrid — Grower: Piet van der Merwe



Clivia miniata Apricot — Best in Class at Nylstroom Show — Grower: Piet van der Merwe



Clivia miniata — Belgium Hybrid — Grower: Bets Rossouw
All photographs in this section by Rina van der Merwe



Best on Show — KZN 2007 Sean Chubb



First Runner-Up — KZN 2007 Little Falls Farm

All photographs in the KZN section by Clive Graham



Second Runner-Up — KZN 2007 Liz and Glen Boyd



Best Apricot / Salmon Brenda and Edsel Nuss — KZN 2007



Clivia gardenii Any Other Colour — First in Class — Liz and Glen Boyd



C. gardenii Pink — First in Class — Gem Wild Flowers



Second *C. gardenii* Any Other Colour — Brian Tarr

C. gardenii Orange / Red — First — Gem Wild Flowers

First *C. robusta* orange — Val & Roy Thurston







The Winners from the Cape Show



An Apricot Clivia Grower Johan Botha



Clivia miniata Best Orange on Show Grower: Eric Heine



Clivia miniata 'Ghost' Grower: John Winter

Breeding for Polytepalous Clivia

John Craigie, Australia

Polytepal *Clivia* are both fascinating and challenging. They all vary because this trait exhibits the indicia of being recessive irregular inheritance. My first polytepal seed purchase was from the master breeder, Mr Yoshi Nakamura, and these plants have produced some of the best polytepal flowers.

Knowledge about polytepals appears to be limited. It is only through discussions with others and the limited number of years invested in breeding for polytepals that I am now starting to get a better understanding about them and about breeding with them. This article is not scientifically based and provides a general introduction into breeding polytepals. For further information on polytepal breeding see the article by Shigetaka Sasaki of Japan in CLIVIA 6.

The polytepal trait is recessive, variable and unstable

The science of plant breeding tells us that plants that have been self-pollinated and selected for type for many generations become homozygous at almost all gene loci and produce a uniform population of true breeding progeny. However, what happens if one crosses one homozygous plant with another? The scientists tell us that a cross between two different homozygous plants produces a uniform population of plants that may be heterozygous for many gene loci. However, a cross of two plants each heterozygous at a number of gene loci will produce a population of plants that differ genetically and will not be uniform. And so the cycle goes on!

Polytepal *Clivia* are not homozygous. From discussions with a number of enthusiasts, it would appear that the gene or genes responsible for the polytepal trait seem(s) to be very weak. The trait's variable expression and irregular inheritance suggests that it may take several generations to achieve higher levels of stability. However, for the reasons outlined above I doubt that homozygous polytepal *Clivia* plants may be achieved, at least within my lifetime.

The irregular inheritance suggests that the gene or combination of genes responsible for the polytepal trait is recessive to six tepal flowers. An added complication is that there appears to be a significant lack of uniformity in its expression (polytepal *Clivia* can have flowers on the same scape with four, six, seven, eight, ten, twelve and even fourteen tepals). It is highly probable that there may be multiple gene mutations in polytepal *Clivia* that exhibit a high lack of uniformity in tepal expression.

In the pursuit of creating a good red wine, there are good and bad grapes (genetics, climate, soil types, vinyard practices, etc. play a role), good and bad winemakers and some good old fashion luck. So it is with breeding polytepal *Clivia*. Firstly, one has to identify whether the *Clivia* plant in question actually has the polytepal trait. Climatic and other conditions under which a plant is grown may mask the expression of this trait. Secondly, it is important to have some understanding of the genetic history of the plants being used in a breeding program in order to have some feel about the extent to which the polytepal trait may be expressed in subsequent generations. Just because the plant is polytepal do not assume that it will produce many polytepal offspring. Thirdly, one needs to identify the objectives of a breeding program. Once this has been identified

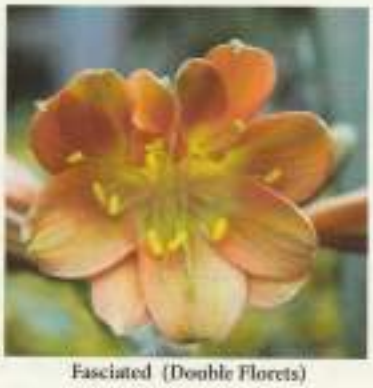
it is then possible to make plant selections and to develop a plan to breed offspring, for example, with higher levels of uniformity in expression. For that example objective, one would select polytepal *Clivia* with more uniform expression and a history of producing higher percentages of polytepal offspring in preference to those that exhibited extreme variability of expression or low percentages of polytepal inheritance. If the objective is to produce monster polytepal umbels then the selection process would include at least one monster polytepal *Clivia* irrespective of the level of variability in its trait expression.

Mistakes can occur each time plant cells divide and these mistakes are called mutations. These mutations may result in a change in the expression domains of the structural genes. We know that the polytepal trait is recessive and because of the significant lack of uniformity in its expression (polytepal plants can have flowers on the same scape with four, six, seven, eight, ten, twelve and even fourteen tepals), it is highly probably that it is the result of a mutation.

The gene or genes responsible for the trait seem to be very weak and its variable expression and irregular inheritance suggests that it may take several generations to achieve higher levels of stability. Knowing the genetic background of polytepal plants is a crucial first step to understanding the extent to which they may produce offspring with higher levels of uniformity in expression. Just because the plant is polytepal do not assume that it will produce many polytepal offspring

Identifying a polytepal

Clivia that have fasciated (double) flowers that are usually fused at the base of the pedicles are *not* polytepal. Sometimes polytepals just occur and these may be called "spontaneous" polytepals. In the first year of flowering there may be one or two polytepal flowers but in subsequent years the number of polytepal flowers may increase in some plants. In others, the number of polytepal flowers remains the same from year to year - one to two. An umbel that has only one or two polytepal flowers may not be genetically polytepal. Look at where they are positioned in the umbel. If these polytepal flowers appear in the centre of umbel and the other flowers only have 6 tepals then it is highly probable it is not a true polytepal. Further flowering may prove otherwise if more than two florets are polytepal.



Fasciated (Double Florets)



Non-Polytepal

If the *Clivia* plant is not a true polytepal then the polytepal flowers are not expected to have any different genetic information



True Polytepal

than the 6-tepal flowers so there is little point in using pollen from them in a breeding program. With a true polytepal each of the flowers including 6-tepal ones carry the same polytepal genetic information.

Polytepals only show their full potential when they are vigorous, mature plants. The trait expression is influenced by environmental conditions. For example, with plants grown under stress, there is a decline in the degree of the polytepal observance. Also, plants flowering for the first time may show no or limited polytepal expression, so do not discard them. Expression of the trait improves with successive flowering and maturity.

Often the polytepal trait is associated with strong green throats. Green throats are due to the presence of chlorophyll and this is present in the plastids within the cytoplasm of the plant cells. This would suggest that many of the early polytepals may have come from maternal parents with green throats. The gene or genes responsible for the polytepal trait does not appear to be linked to the genes that influence the other colours observed in flowers. There are a lot of true polytepals that do not have green throats. However, there may be a link between green throats and the ability to produce stable (normal) flowers.

It was thought that there was a link between yellow and peach polytepal material and narrow leaves but some breeders like Shigetaka Sasaki have short and broad leaf polytepal types.



Polytepal Hopeful



Green Centre



Non-Green Centre

It would be beneficial if polytepals have the same number of tepals and stamens in each flower. However, as the trait is unstable it is possible for flowers to contain additional layers of tepals although they retain their normal number of 6 stamens and a 3-lobed stigma. Other variations are also possible. Often polytepal flowers may have more than 3-lobed stigmas (for example, flowers with 8 tepals will often have 4 stigma lobes). Stigma lobes are a reflection of the general overall ratio of floral parts. They are fairly closely linked but their importance should not be overemphasized. Sometimes the style is spiral shape. Also a plant may exhibit a combination of polytepals and a modification of some of the stamens into petaloids.

Importantly, if the umbel has a majority of eight, ten, twelve, etc. tepals in the flowers then this would be a true polytepal and, as previously mentioned, any of the flowers (six, eight, ten, twelve, etc. tepals) could be used to breed for polytepals, either as the maternal or pollen parent.

Genetics of polytepal *Clivia*

I cannot emphasize enough the importance of knowing the genetic background of the polytepal *Clivia* to be used in a breeding program. Just because a *Clivia* plant has a polytepal umbel one should not expect it to produce 100% polytepal offspring. The expression of the trait is recessive and variable. Knowing the genetic history of polytepal *Clivia* may assist in predicting whether they may produce 30, 50 or some higher percentage of polytepal inheritance. A polytepal *Clivia* plant that has a genetic background of polytepal x polytepal may be preferred to one that has polytepal x non polytepal if one is, for example, seeking to produce higher levels of inheritance of the trait. Whilst further generational improvement may enhance the inheritance of the expression, this is not guaranteed. This has also been found to be the case with polytepal expression in some other ornamental plants.

Beyond polytepal *Clivia*, there have been many success stories in breeding doubled-flowers in other ornamental plants. Shigetaka Sasaki of Japan in CLIVIA 6 referred to results of breeding doubled-flower *Hippeastrum* cultivars by Nobuyuki Katsuyama. Other information on breeding doubled-flower *Hippeastrum* can be found on the internet, for example, "Trends in Modern *Hippeastrum* Hybridizing" by Charles Hardman. These and other articles suggest that crossing a doubled-flower with a single flower *Hippeastrum* would produce no or a very low percentage of doubled-flower F1 progeny, but crossing two doubled-flower *Hippeastrum* may produce up to 50% of the resultant seedlings that would have some doubled-flowers. Also crossing the F1 non doubled-flower progeny may produce higher levels of doubled-flower *Hippeastrum*.

Whilst one should be cautious about applying genetic results for one plant type to another, even though in this case they both belong to the *Amaryllidaceae* family, the work done with doubled-flower *Hippeastrum* provides some useful insights. From our own experiences, crossed or selfed polytepal *Clivia* grown from seed that we acquired produced less than 50% polytepal. No doubt the genetic background, if known, would have helped explain this outcome.

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Other variations are also possible. Often polytepal flowers may have more than 3-lobed stigmas (for example, flowers with 8 tepals will often have 4 stigma points). Stigma points are a reflection of the general overall ratio of floral parts. They are fairly closely linked but their importance should not be overemphasized. Sometimes the style is spiral shape. Also a plant may exhibit a combination of polytepals and a modification of some of the stamens into petaloids.

Objectives of a Breeding Programme

The objective of a breeding program may be as simple as breeding for uniformity or as complex as breeding the hottest polytepal *Clivia* plant ever conceived. You know the one, it includes the following traits:

- Longitudinal and non longitudinal variegated foliage;
- Short but ultra broad leaves;
- Leaves that grow completely in a plane with the previous leaf to create a perfect fan shape with leaf tips that gradually arch to a rounded apex;
- A soccer ball umbel with 40 plus flowers;
- Flowers with layers upon layers of very broad "blue" particoloured tepals!

Unfortunately, the more desirable traits one includes in a breeding program, the lower is the probability of achieving the combined outcome.

To breed for uniformity, it is recommended to select polytepal parents that have the greatest percentage of uniform flowers and crossbreeding with them. Such breeding may lead to polytepals with greater stability and beauty, for example by crossing between the F1 generation, F2 generation, etc. or between the parents and subsequent generations. If only one polytepal *Clivia* plant meets your criteria then self pollination may be a better strategy than crossing it over another polytepal that is less than desirable.

In my opinion umbels which have a



Polytepal

mixture of eight, ten, twelve, etc. tepal flowers are less preferred than ones that have uniform polytepal expression. But which tepal version is preferred? Connie and James Abel have suggested that the aim should be to breed *Clivia* with well-rounded 8-tepal flowers. I agree that an umbel of uniform flowers of eight tepals, eight stamens and a 3-lobed stigma would provide an impressive display.

Polytepal *Clivia* now come with yellow, pastel and peach flowers. A lot of patience is required to breed new polytepal colours if using orange flowering polytepals as the foundation. Pollinating an orange flowering polytepal with pollen from a yellow flowering *Clivia* plant is expected to produce no or little progeny (F1) with the observed polytepal trait. If you want to create good quality polytepals from these F1 progeny use only the best F1 plants. Intercrossing these F1s may produce some



Pastel Polytepal



Count the tepals in the Polytepal Bud



A Cream Polytepal

percentage less than 25% with an observed polytepal trait. Crossing the best F2 progeny should improve the number of offspring that have the polytepal trait and with some good luck some of the polytepal progeny may have yellow flowers.

"Super" polytepal *Clivia* also exist. In these



Yellow Polytepal

plants the flower appears to be a combination of polytepals and a modification of some of the many stamens into petaloids creating some very



A Nakamura Polytepal

Photo: Courtesy Shigetaka Sasaki

full polytepal flowers. So then how does one go about breeding for a "super" polytepal type? Most of us may never get access to *Clivia* that exhibit a combination of polytepals and petaloids. Those that have them are probably well-advanced in

striving to produce more uniform and stable plants. In the absence of having one of these plants, what does one do to start the long journey for breeding a "super" polytepal type with limited resources of *Clivia* plants like polytepal, polytepal with keeled tepals, six tepal flowers but with keeled tepals or one with stamen petaloids? Once it was thought that plants with keeled tepals might hold a key to the development of petaloids but with limited history available it would appear that the two might be unrelated.

We have pondered on how to breed "super" polytepal *Clivia* plants and have embarked on a long journey of crossing a *Clivia* plant with stamen petaloids with a polytepal *Clivia* plant. A big assumption in our plan of action is that the stamen petaloid trait is recessive to the polytepal trait so the progeny of the initial cross would be backcrossed over the *Clivia* plant with stamen petaloids. From this new population we intend to discard plants that do not show polytepal and petaloid traits, to self the remainder and to continue a program involving backcrossing and selfing. Like all plans one must be prepared to modify it if it is not delivering on expectations. Different strategies would be adopted if it is found that the two traits are co-dominant or the polytepal trait is recessive to the petaloid trait.

And as for the finished product, that may well be many CLIVIA Yearbooks away! In the interim, enjoy your polytepals!

All Photographs are courtesy of John Craigie unless otherwize stated. **(Eds.)**



Photo: Claude Gilbert

A Nakamura Polytepal - Grower Ian Brown

Focus on Heritage *Clivia miniata* with Unusual Colourations

Sean Chubb, South Africa

The source of all genetic diversity in *Clivia* is to be found in our natural habitat populations of *Clivia*. The conservation of these natural habitats and the preservation of the diverse gene pool within them is paramount to the future of *Clivia* cultivation, for without preservation, the genetic diversity essential for the future cultivation of *Clivia* and the ability of *Clivia* to adapt to changing environmental conditions may be lost. Genetic diversity as represented in habitat heritage plants, must be conserved and protected if *Clivia* cultivation is to have a secure future.

The Heritage collection is an effort to conserve these precious genetic resources in a living collection in their original form in which they occur in the natural habitat. In this article I will focus on some of the more unusual colourations displayed in the Habitat Heritage collection of *Clivia miniata*. The outward expression of flower colour variation is only one of the phenotypic variations, which displays the genetic variation of *Clivia*.

The colours focused on in this article are Splash, Versicolour, Blushed Yellow and Pastel Pink.

Splash

An example of Splash colouration in the Habitat Heritage collection is Andrew Gibson. Andrew Gibson is a Heritage plant originally collected by Andrew Gibson in the Karkloof forests outside Howick. The original date of collection is unknown, but is estimated to be in the 1980s or early 1990s. This plant displays a very unusual splash colouration.



Clivia miniata 'Andrew Gibson'

A line breeding program has been running for some years using Andrew Gibson selfed seedlings and a similar plant called Candy Stripes. The F2 generation seedlings being produced have colouration remarkably like the parent Andrew Gibson. These plants are being marketed by Thurlow Flora as Chubb Splashes.

Andrew Gibson is still an extremely rare habitat clone with only a few offsets having been released to *Clivia* enthusiasts.

A clone of Andrew Gibson in flower was sold at the *Clivia* Society auction held in conjunction with the 2006 International conference for a price of R9500.00.

Versicolour: *(Contrasting inner and outer tepal colouration)*

Sikwebizi Versicolour was originally collected by Kobus Sreenkamp as a small-unselected seedling in the Sikwebizi river valley whilst on a botanic trip with Prof Nat Grobbelaar to view the Encephelartos natalensis form endemic to the Sikwebizi River



Clivia miniata 'Sikwebizi' Versicolour

system. The area is extremely inaccessible and as a result very little human activity occurs in this area leaving the *Clivia* populations in a pristine condition. Sikwebizi Bi-colour joined the Habitat Heritage collection in December 2004 by kind donation of Kobus Steenkamp and the help of Louis Lotter.

In 2004 the plant was already mature. This robust plant flowers with very large umbels held well above the foliage and is particularly striking due to its impressive flower colouration. The reproduction of this clone from seed has been only marginally successful with very poor seed set when selfed and on a subsequent flowering soft rot infection in the flower peduncle.

Soft Pink Pastel

There are two examples of this colouration in the Habitat Heritage collection namely Ndwedwe Ngidi Pink Champagne and Mpochocho Pink Pastel.

Ndwedwe Ngidi Pink Champagne was originally collected by Roy and Val Thurston in 1995 in the Ndwedwe area. Ndwedwe Ngidi Pink Champagne is predominantly Yellow but suffused with pink on both sides of the tepals. A full story of this plant is written by Val Thurston for this publication. (See Page for Article)

Mpochocho Pink Pastel was collected by myself in 2003 in the greater Port St Johns area of the Transkei Wild Coast. The plant was found at the base of the Mpochocho waterfall and was a large clump; an offset was removed for the Habitat Heritage collection. Mpochocho Pink Pastel is sensitive to both light and water stress in that if too much light is allowed the plant flowers considerably darker and the same occurs if it undergoes water stress at the time of flowering. This is an elite clone and an asset to the Heritage Collection.



Clivia miniata 'Mpochocho Pink Pastel'

Blushed Yellows

This mutation group seems to occur more regularly than the previously described colour forms. There are 6 separate clones of this colour form in the Habitat Heritage Collection. This colour variation also seems to be light sensitive with more blushing occurring with increased light intensity.

Ruby Stewart

This is a robust clone with fairly broad long pointed leaves. Ted and Ruby Stewart collected this clone on their farm in the Stanger area many years ago. The cloneflowers freely with impressive umbels held above the foliage. It is a deep yellow with pink flecking and spotting on the outside of the tepals with more concentrated colouration on the midrib of the tepals. This colouration is more pronounced with high light intensity, flowered indoors it appears yellow. The fruit ripens red.



C. miniata 'Ruby Stewart'

Three blushed yellows

Collected in the early 1940s, by Mr. Potterill on the farm Kingston-'The Precipice, Mattersons Hill, Raisethorpe, Pietermaritzburg. This clone has fairly small flowers with a distinct blushing on the back of the tepals, with more colour concentrated in the tepal midrib. This clone is also light sensitive. It offsets freely. At this stage no seedlings have been flowered from it and so the breeding potential is still unknown.



Clivia miniata 'Potterhill' Blushed Yellow



Clivia miniata 'Mrs. Male'

DNA has proved that Mrs. Male Blushed Yellow [Greendale /Peacevale] and Celtiskloof Squibby Yellow are very closely related to Potterill Blushed Yellow and the likelihood is that they all originated from the same habitat colony. Judging by the quantity of plants of both these clones that there are in collections they are very old habitat collections and probably collected much the same time as Potterill Blushed yellow. However there is at this stage no historic proof to confirm this.

Mrs. Male Blushed Yellow is very similar to Potterill Blushed Yellow but differs by having a green throat but has the same blushing on the back of the tepals. The flower of Celtiskloof Squibby Yellow is almost identical to both clones described above except the blushing is not displayed until the flowers are completely spent. All 3 of these clones produce red fruit.



Clivia miniata 'Celtisklooof Squibby Yellow'



Clivia miniata 'Msubo Nguni'

Msubo Wow and Msubo Nguni

Both these Blushed clones were collected by Roy and Val Thurston in the Ndwedwe area.

Msubo Nguni was the first of the 2 clones found in the Waterfall Area of Ndwedwe in August 2001. The flowers were badly sun damaged and the colouration was not easy to identify. When it flowered the following season the bloom was a good shade of yellow with dark orange speckles or splashes on the underside of the tepals.

The leaves are of average width and length and similar to most of the plants found in this pocket of indigenous forest. The plant offsets well. The blooms self and cross pollinate well. The berries are orange in colour when ripe.

In September 2002 the second clone was found close to the location of the first plant. This was named Msubo Wow. The colouration of the blooms is very similar to those of Nguni but there is a slight difference in the shape and size of the tepals. Both clones have small hooks at the end of each tepal. The leaves are narrower than those of Nguni and there is a white stripe down one leaf on every plant. The seeds ripen orange and the plant offsets freely.

There are many more Habitat clones with unusual colouration and an attempt to categorize them, confirm their histories and conserve them is an ongoing process by the KZN Clivia Club.

All Photos in this article are courtesy of Sean Chubb



Clivia miniata 'Msubo Wow'



A comparison of 'Msubo Wow' on the left and 'Msubo Nguni' on the right

The History of Ndwedwe 'Ngidi Pink Champagne'

Val Thurston, South Africa

This plant was found in the Upper Tongaat area of Ndwedwe in 1995 by a partially blind Africa man who lives in the Ndwedwe area who said it was a 'yellow' clivia and had it growing in his house in the sun. It was badly sun damaged and the umbel was bruised and crushed but one could see that it was in fact a yellow with pinky markings which I then thought was caused by sun and handling damage. No seed set that year. In 1996, it flowered in the base of the leaves and rotted off before the bloom could open. In 1998 it again flowered in the base of the leaves.

As most of my plants never flowered in Westbrook Beach at the coast, I decided to send the plant to Des Andersson in Pietermaritzburg for a 'temperature shock' in 1999. Success at last, the flower spike pushed up to beyond the leaves. When in bud the colour of the outer side of the tepals was yellow/orangey pink. As the bloom opened and matured it turned a pale-pinky yellow with a bush of darker pink on the upper and under side of the reflexed tepals. The bloom has a slight scent and produces a large amount of pollen.

The plant was selfed, crossed with Pat Quin's Nakamura Yellow, and Ndwedwe Beta – a wild yellow. All the seeds set and ripened orange. When we moved most of my plants were mixed up when settling them under the trees, labels were misplaced and so forth. So it was a matter of wait and see what flowers where, and then check the name on the bag! Fortunately all the Ngidi crosses were labelled on the bag but are scattered around the garden and mixed in with other crosses.

Disaster, in December 2001 the plant rotted at the base. When I discovered there was a problem, the rot had already travelled right up the centre core of the leaves so there was no chance of saving what was left. I scratched around in the soil and found a small pieces of root stock about the size of a 5 cent coin. I tried to grow some but failed. I decided to give the biggest piece to Sean Chubb and said "save it, if you can – you have more of a chance up in the cooler area of Eston than I do with the coastal humidity".

Months went by – I was too depressed and anxious to even ask how the rootstock was doing – I took a chance in a moment of mental strength, and was delighted to hear that Ngidi had started to send up the tiniest shoot. I did not hold my breath – and left things for another couple of months. Over many months, she grew and grew and eventually it looked like there was a good chance of saving the plant. Sean planted Ngidi in an earthenware pot that he had inherited from his grandfather – his lucky pot – as he called it. Over the next five years Ngidi flourished – still in the same pot – Sean was terrified of transplanting it in case it took another dive. Each time I visited him I went and had a look – it was a very exciting time as I just could not wait for her to flower once more.

Great excitement, the day had arrived - Sean phoned in September of 2006 to say that Ndigi was now in bud. Well, the rest is history – she flowered – was photographed and once again admired by Sean and myself in amazement at what was once a small piece of rootstock and 6 years was now a flowering size plant.



Clivia miniata 'Ngidi Pink Champagne'

In 2007 Sean informed me that Ngidi was bursting out of 'grandad's' pot, and had cracked it open. Sorry Sean. It was duly repotted into the heaviest earthenware pot Roy has ever tried to pick up and is now re-united with the rest of my plants. Needless to say, Ngidi has never produced a sucker so I am still living a life of fear in case the the rot returns.

All I can say is an enormous and extremely grateful 'THANK YOU' to Sean for saving this very beautiful and precious habitat plant of *Clivia miniata* for the gene pool.

We hope that the first sucker produced goes into the KZN Heritage Collection (Eds.)

A example that is not yet fully open of Alick Mc Leman's 'Gold Dusk' (See next Article for information and a further picture)



Ndwedwe 'Ngidi Pink Champagne' The New Zealand Connection

Alick Mc Leman, New Zealand

Prior to emigrating to New Zealand for family reasons in 2000, I had the privilege of associating with the KwaZulu-Natal Clivia Club and leading growers such as Sean Chubb, Brian Tarr and others who stimulated my interest in *Clivia*. I envy their advantage of living right in the heart of *Clivia miniata*, *C. gardenii* and *C. robusta* country where over the years they have had access to wild accessions and many natural mutations.

In particular, Val and Roy Thurston really aroused my interest. They have a great partnership. Val grows the plants and Roy follows his passion for 'bundu bashing' (exploring the countryside) in the wilds of KZN, finding interesting specimen habitat *Clivia* and bringing them home for Val to propagate. And so over the years Val has acquired plants like her 'Alpha and Beta Yellows', her 'Gamma 'Peach, the 'Ndwedwe Ngidi Pink Champagne' and others.

While I lived in South Africa I was always going — but never did get to see Val's collection. These fabled plants have always been a particular interest because very little has been done with them in the way of hybridisation. Thanks to the wonders of emails I have maintained my friendship with Val and over the years have acquired crosses of these rare plants. For instance by sibling crossing her 'Alpha Yellow' x 'Chubb Peach', I have been able to recover a lovely F2 yellow with very small flowers. Perhaps this is the recovery of the 'Alpha Yellow'? Similarly, from a F2 sibling cross of Val's 'Ngidi Pink Champagne' x 'Beta Yellow', I flowered last year something really special, that I have registered as 'Golden Dusk'. 'Golden Dusk' is a yellow with pink overtones. Initially the red anthocyanin pigments reflect themselves in the fringes of the tepals only but deepen in colour and distribution as the flowers age. Surely this is the recovery of the 'Ngidi Pink Champagne'?



Alick Mc Lemon's *Clivia miniata* 'Gold Dusk'

The resemblance to 'Ngidi Pink Champagne' is very obvious and it will be interesting to see whether future crosses and self crosses continue to produce similar flowers. Perhaps Alick will supply some material for DNA testing as compared to 'Ngidi Pink Champagne'

(Eds).

A Visit to Belgium and the Netherlands

Dries Olivier, South Africa

On 25th March, 2008, I left OR Tambo Airport in Johannesburg, on my way to exhibit at a steel wire and tube trade exhibition in Dusseldorf, Germany where no private individuals are allowed to attend. The exhibition is held biennially and South Africa has a national pavilion to market our product and we used to buy flower arrangements at exorbitant prices to use as decoration. In 2006 I started useing *Clivia* from Pierre de Coster to use as decoration. This was very well received - so much so that people from all over the world asked for plants when the exhibition was over and a number were even pinched during pack-up time. The exhibition this year was attended by 100 000 industrialists from 84 countries.



The S.A. stand with *Clivia* as decorations

After a connecting stop at Frankfort, my first destinationstop was Amsterdam. Aart van Voorst collected me at the airport and took me to the nursery where he works and keeps his *Clivia*. A number of his ploidy conversions (triploids and tetraploids) were in flower. What beautiful plants and flowers! I was amazed at the size of the flowers and leathery feel of the tepals. And the brightness of the colours!



The View of Aart's Collection of Plants

The following comments were made by Aart van der Voorst on the status of his work and his expectations of the road ahead.

Polyploidy is the presence of more than the usual two sets of chromosomes in an organism.

It can have a big impact on floricultural crops. In many crops all commercial hybrids are polyploids (mostly triploids and tetraploids). Examples are *Narcissus*, *Freesia*, *Alstroemeria* and Daylilies (see CLIVIA 5 p.33). Because of superior characteristics such as bigger flowers, stronger stems, polyploid hybrids replaced those of the diploid varieties in these cultivars.

Clivia is just at the beginning of its polyploid revolution. The first tetraploids are now being artificially bred. It will take some generations to restore fertility to that of the original diploid strain.

The large number of *Clivia* plants for sale commercially are produced by seed lines that flower early. These seed lines are selected

for flowering after two and three years from germination. Breeding within the tetraploid seed lines is difficult. It is an open question whether tetraploid seed lines will ever be commercially available. Most polyploid crops are therefore propagated vegetatively. This is not an option for *Clivia*. Propagation by offsets is very slow and is not possible to achieve the quantities of plants needed (hundreds of thousands) for a viable commercial venture. Tissue culture is not an option either. The multiplication rate of *Clivia* in *in vitro* culture is low, and after the hardening phase *ex vitro* growth is relatively slow. This means that the production costs of tissue-cultured material are relatively high and will not readily equal the costs of seed propagated material. Special techniques of tissue-culture such as somatic embryogenesis are successful in some crops, but the research costs are very high and probably not of interest for *Clivia* propagation. Hence tissue culture will only be profitable for special hybrids (regardless of their ploidy level).

Special hybrids may certainly arise from polyploid breeding. In polyploid material multiple genomes can be present and characteristics that benefit from the accumulation of alleles will be prominently visible (e.g. flower size and colour). So in the world of *Clivia* lovers polyploids will have a future.

To increase the number of polyploids it is important that more people get involved in the breeding of polyploid *Clivia*. Some enthusiasts may be able to convert material to tetraploids themselves (see CLIVIA 6 p.43). Exchanging material may be a good way to increase the gene pool of tetraploids. John Craigie from Pine Mountain Nursery may have some tetraploids that arose from the Belgian material he has obtained.

An unexplored part of polyploidy enhancement may be unreduced gametes. These gametes with the double number of chromosomes are sometimes formed in special breeding combinations - for example interspecific crosses - or under special environmental circumstances. In *Clivia*, interspecific crosses are easy to make and till now no hybrids with unreduced gametes have been identified. On the other hand,only a few types have been researched, so potentially unreduced gametes remain a possibility. Unreduced gametes can give rise to more variation than gametes from artificially made tetraploids. The fact that no tetraploids have been found in natural populations or in crosses with interspecifics indicates that a high level of 2n gametes in *Clivia* should not be anticipated. However the phenomenon is not well enough researched to pass final judgement. I have, in fact, one example of an unreduced gamete in my own breeding: I have a tetraploid interspecific that arose from a cross with *C. caulescens* as a mother with one of my tetraploids. One of the two resulting plants turned out to be a tetraploid; the other is expected to prove to be a triploid (they have not yet bloomed). The most reasonable explanation is that the *C. caulescens* produced an unreduced gamete. It would be an interesting research project for a student to examine the occurrence of unreduced gametes in the genus *Clivia* (wild and hybrid material) Perhaps Johan Spies may be interested, although I have not raised the matter with him.

Many types have been treated with colchicine , but in the near future some proven superior crosses (e.g. those carrying Vico genes) could be used for chromosome doubling. This is important because diploid breeding might otherwise be too far evolved in comparison with tetraploid breeding to really make use of the benefits of polyploidy.

Aart obtained the following details of *Clivia* sold on Dutch auctions over the past 6 years (courtesy of Vakblad voor de Bloemisterij)



I hired a car in Amsterdam and took a 3 hour drive to Ghent where I arrived at 18:00 on 26th March 2008. I was met by Dirk and Christine Lootens and we drove to Pierre de Coster's nursery. Unfortunately Pierre and Isabelle were away on holiday in Croatia, but his son was tasked beforehand to show us around the nursery and to hand over some plants I had arranged to collect. It was near the end of the flowering time but many plants still displayed their wonderful flowers. The most outstanding yellows, peaches, reds, bicolours, variegateds and many more were standing everywhere. I collected three nice yellows, some bicolours and a few offsets that Pierre left for me.



Aart in his Laboratary

News and Views from Pierre de Costa

In my nursery we have not changed much in the way of breeding of new lines. We instead have been breeding to improve our strain, or more specifically, parts of our strain to earlier flowering in the season (November, December), but not all of them, because, for instance, the prices this year were not so favourable in that period. Are there other growers that plan to have a significant quantity available in that period? Normally the prices are high for the first *Clivia* placed on the market. So you will see that it is important that we spread the period of production.

I continue to improve the yellows, breeding for short leaved plants and nice full flowers and as deep a yellow as possible. Yellow *Clivia* can have only commercial success when plants are bred to be more compact and have a nice flower head, but it will remain hard to make a profit with them. There are also efforts towards breeding for some peaches, but that will take a number of years.

I also need to plan my retirement. None of my sons will continue the nursery. They always can if they want but not at the same

location. What I will breed will in future will be as a hobbiest. For the moment I enjoy my collection and for me that is adequate.

In Holland you now have big players in the breeding of *Clivia* in the market, such as Dyna Plant. The market for *Clivia* in Europe was quite good this year. The prices were stable on a not too high level. In fact, to compensate for the higher energy price, labour, potting medium, plastic pots, transport trays (packaging) and the higher transport of *Clivia* plants prices must go up.

Today I received a phonecall from a Dutch *Clivia* amateur who calls me every year regarding something about *Clivia*. This time he told me about his visit to a Royal palace (I'm not sure where in the Nederlands) where a room was decorated with a big terracotta pot filled with a dozen flowering *Clivia*. It was a magnificent sight and he asked where they came from. The staff in attendance told him that these plants were descendants of plants given as a gift from the King of Belgium, Leopold II, who offered a basket of flowering *Clivia* as a present for the wedding of Queen Wilhelmina from the Netherlands in 1901. These plants remain in good hands until this day!



Pierre's Nursery, near to the Entrance

After only 1 hour in Pierre's mecca, we had a wonderful Flemish dinner at a restaurant. The next morning at 08:30 Dirk picked me up from the guest house and we visited ID'flor, the first of four venues where Dirk grew *Clivia* and also where he has his office. The number of plants were unbelievable. Colours ranged from yellow to red. White Lips, pastels, green throats in red, bronze and yellow, green flowers, new strains, interspecifics one could die for, and many more.

Dirk Lootens had the following comments on *Clivia* in Belgium:

- In Europe people are not really interested in special *Clivia* colours.
- When we bring them to the market in traditional fashion it is very difficult to get "high(er)" prices
- We sell *Clivia* to a Canadian grower. He sells his plants with our label in the USA.

Now, back to ID'Flor :

- Lines: it is too early to mention details. I really want to wait as long as possible before informing the market as to breeding trends.

However:

- We produce for the broader consumer market, orange *Clivia* in a pot of 130 mm. The most important issues for us are - fast growing, early flowering, high flowering percentage, with average broad up to wide leaves. Plants should be around 450mm up to a maximum of 550 mm high (including the pot and measured with leaves erect)
- We have bred the White Lips (see Clivia News Vol 15 No. 2 Cover + p. 7)
- White Lips is a sowing line that produces between 50 and 90% "White Lips" although not yet 100%.
- Of course we have yellows, let's say around 5% of total amount produced.



'White Lips' an outstanding clone from ID'Flor



A Belgium Akebono

- We have beautiful individual plants
- In the future plants will be bred to be more compact with slightly broader leaves
- We have bred Belgian Akebono's and 'Hot Lips' + green flowers.
- We have done work for the better marketing of *Clivia* - these are branded in our marketing as 'The Strength of Africa'. We have developed pot-covers, labels and sleeves, garden-cards following this branding.
- I believe that ID'flor has the most professional marketing material I have ever seen.



Concerning marketing special plants around the world

- The opportunity is to spread special plants around the world, to be in contact with *Clivia* enthusiasts, to spread the love for *Clivia* around the world.
- The problem is that this is very time consuming, therefore the need is to work with local enthusiasts who want to place group orders.
- A second problem is that transport/ export costs are huge! This also calls for the grouping of orders so as to cut costs.
- A threat is: we have to focus on our core business namely the production of large quantity of *Clivia* 'Florid Orange' of a high quality to be marketed at affordable prices for the broader consumer market. If we also try to meet the "market of the enthusiasts", we could loose our focus!

Our pride plants

- Q 08
- the interspecific with the yellow inner and the orange on the outside
- some of our Tricolors
- one of our 'Hot Lips'

Many people visit many growers in many countries in the world. My personal opinion is that Belgium and the Netherlands must have *Clivia* of the highest quality and quantity that is

at least on par or sometimes even superior to what anyone can offer. Furthermore, I was highly impressed by the friendliness and knowledge of the growers in these historic cities in the lands of our ancestors!



An outstanding Belgium Interspecific. Note the open flowers with rich yellow on the inside and the contrast of Orange on the outer Tepals

Endnotes

[1] Somatic embryos are formed from plant cells that are not normally involved in the development of embryos, i.e. ordinary plant tissue. No endosperm or seed coat is formed around a somatic embryo. Cells derived from competent source tissue are cultured to form an undifferentiated mass of cells called a callus Plant Growth Regulators in the tissue culture medium are manipulated to induce callus formation and subsequently changed to induce embryos to form from the callus.



All photos in this article are courtesy of Dries Olivier



Another of the special Belgium *Clivias*

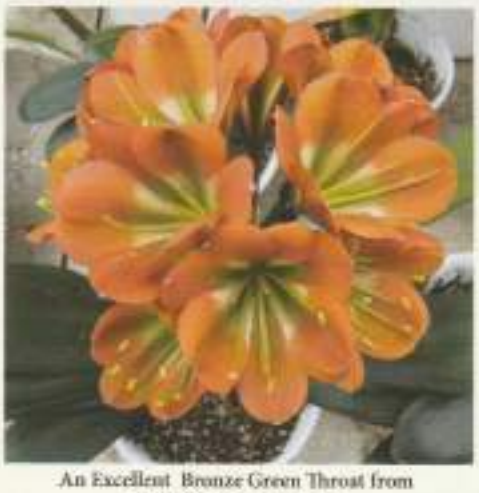
'Hot Lips'

A Visit to Japanese Clivia Breeders

George Mann, South Africa

I still remember as a small boy, about 10 years ago, admiring the beautiful photographs of Mr Yoshikazu Nakamura's *Clivia* plants in the first CLIVIA YEARBOOK. Never in my wildest dreams could I have imagined that I would one day have the wonderful opportunity to travel to Japan and have the privilege of meeting the legendary Mr Nakamura.

Wayne Haselau, Andy Forbes-Harding and I departed from Johannesburg's O.R. Thambo Airport on 18th March 2008, around midday. We then flew on via Hong Kong to Narita Airport where we were to meet up with David Brundell and Tony Barnes from New Zealand, to start our six-day Clivia Tour of Japan, organized by my good friend Shigetaka (Shige) Sasaki. Upon arrival at Narita Airport we were met by Shige, who immediately took us to the Centre Hotel Narita, where we tried to recover from severe jetlag. That night Shige took us to an amazing restaurant, where we were treated to some genuine Japanese sushi.



An Excellent Bronze Green Throat from Shige Sasaki's collection

Early the following morning we set out from the hotel to see Shige's green houses. There we found his plants to be in their prime, with magnificent blooms. I was especially impressed by the Vico hybrids, originally bred by Mr Nakamura, some with flower diameters of well over 100mm. I was also surprised by some of the best examples of bronze *Clivia* flowers that I have ever seen. In my opinion Shige has by far the greatest selection of plants in his three glass houses; his diverse collection includes plants from all over the world, ranging from Victorian Peaches and Solomone Broad Leaf Yellows from the US to some of the best examples of Pretty Pinks and Tipperary Peaches that I've seen from South Africa! He also had a very nice selection of TK Yellows. Later that afternoon we traveled to the Clivia Breeding Plantation, where we had the wonderful opportunity of meeting Mr Nakamura. Most of Mr Nakamura's plants were still in bud, but we marveled at the selection of variegated *Clivia* plants, which ranged from the newly-developed Tiger variegated plants to yellow Akebonos. He also has a great selection of some of the best Light of Buddha plants that I have ever seen. Mr Nakamura was very generous and gave each of us some *Clivia*-related books and other momentos. We were also very fortunate to each receive some seed as a gift. Because



A Vico Pastel Hybrid

of his severe arthritis Mr Nakamura is no longer able to do much pollination. (For more information on Mr Nakamura and his *Clivia* breeding refer to Helen Marriott's article in CLIVIA 8, "Nakamura's Contribution to Clivia Breeding".)

On Friday we traveled to Mr Matsumoto's cut flower production nursery, where we had the opportunity to see how they harvest and pack cut flowers for the flower market. Amongst the plants grown for cut flower production we saw *Leucocoryne, Ornithogalum* and *Helianthus* but what especially impressed me most was their *Zantedeschia* and *Sandersonia* production. He probably has more *Sandersonia* tubers in his one glass house than are left in the whole of South Africa, where they are being seriously depleted by the traditional medicine ('muti') trade. After viewing all Mr Matsumoto's green houses, we were kindly invited to have lunch at his home with his family. Mrs Matsumoto and Mrs Matsumoto Snr prepared a most delicious lunch for us. Mr Matsumoto has a magnificent traditional Japanese house and garden.

The following day we received a wake-up call from Shige at 04:00 in the morning, as we had to leave early to travel to Mr Koike's nursery in Gifu Prefecture, a full six-hour drive when there is little traffic. As luck would have it, there was an accident on the freeway that morning causing a two-hour delay. However we had a spectacular view of the ocean along the way and were also able to take some great shots of the famous volcanic Mount Fuji. We were met by Mr Koike and by my good friend Mr Masami Uno and his wife. Needless to say, Mr Koike is the breeder of the famous green-flowered 'Hirao' (CLIVIA 7). Mr Koike has also bred miniature yellow *Clivia* plants, as well as peach interspecifics, where he has used *C. gardenii* pollen on group 2 yellow plants. Mr Kioke is also breeding a new strain of picotee-like plants. Mr Uno brought some amazing Appleblossoms (grown from seedlings purchased from South Africa) along to show to us on that occasion. After admiring Mr Koike's magnificent *Clivia* plants and harvesting Mr Uno's Appleblossom pollen, we were taken to lunch, accompanied by Mr and Mrs Uno as well as Mr Koike. After lunch Mr Koike allowed us to begin cleaning our plants on his property. We departed around 18:00 and only arrived back at the hotel after midnight.



One of Mr Koike's Green Plants



Mr and Mrs Uno, Mr Koike and Shige Sasaki our Guide



A Picotee from Mr Koike's breeding

Mr Matsumoto arrived early the following morning and took us to his house, where we, with the help of his wife and mother, finished cleaning the plants that we had purchased. Later that morning Mr Matsumoto took us to the nursery of one of the most famous bulb breeders in Japan, Mr Komoriya. I could not believe my eyes. I absolutely love *Amaryllidaceae*. Mr Komoriya had the largest collection of species of South African *Amaryllidaceae* that I have ever encountered. He also had thousands upon thousands of *Lachenalia*, ranging from the original species to the most amazing hybrids that he himself has bred. We also saw a large selection of *Hippeastrum* species and hybrids. To me, seeing all these *Amaryllidaceae* was truly one of the highlights of the trip. Mr Komoriya has made some amazing breakthroughs in creating intergeneric hybrids by using South African *Amaryllidaceae* on other *Amaryllidaceae* genera from across the world. He is also a great fan of *Gloriosa*.

That evening we decided to pay one last visit to Shige's green house, just to see if anything new might have opened and we were surprised by a beautiful 'Andrew Gibson' in flower as well as a 'Four Marys'. Once again we only got to bed after midnight.

On Monday 24th we left early to visit Mr Nakamura. We traveled along the coast, and saw some beautiful forests. It was just a pity that we were too early in the season to see the cherry trees in full bloom. Mr Nakamura specializes in the breeding of polytepal *Clivia* plants. His plants were all in full bloom and we were able to admire some magnificent specimens, including some rose-like polytepals that were unfortunately not for sale. Mr Nakamura then accompanied us to the nursery of Mr Tsuruya. He was not available but MrsTsuruya was there to show us around. At this nursery we were able to obtain some amazingly good quality *Clivia* plants at very reasonable prices. These included some exceptional Negishi-fu, Daruma, and Akebono plants.

The last nursery we visited was the nursery of Mr Tsuruoka. He is the vice-president of the newly-formed Japanese Clivia Society and specializes in the breeding of Akebono Daruma *Clivia* plants, but also has some remarkable Daruma and miniature *C. nobilis* plants.

On our last morning we said farewell to Tony and David as we left to collect our plants at Mr Matsumoto's house. From there we traveled to the airport to obtain the necessary paperwork to take the plants we had bought back to South Africa. Helen Marriott met up with us at the airport and we had lunch together before our departure back to South Africa.

We wish to express our appreciation for the assistance and hospitality that we received from all concerned.

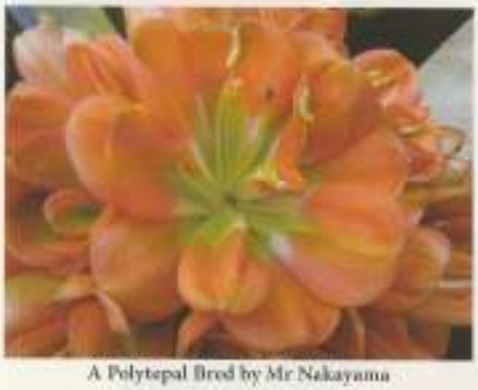


A Pastel from a Vico Hybrid that I managed to obtain while in Japan

Mr and Mrs Nakayama's Polytepals

Marilyn Paskert, USA

One of my favorite clivia destinations in 2007 and again this year was the farm of Mr and Mrs Nakayama. A large farm that has been in the family for many generations on the outskirts of Kamogawa City, the Nakayamas can only be reached by driving over a narrow twisting bridge of land between two rice paddies! It was as wide (or narrow) as the wheel base of the van, it was a relief that Shige is such a skilled driver! At the Nakayama farm one feels instantly transported to the rural past of Japan — only a few miles, but centuries away from the metropolis of Tokyo. Waterbirds were standing in the paddies and the fields were golden with daffodils.



A Polytepal Bred by Mr Nakayama

Mr and Mrs Nakayama invited us into their green houses. With Helen Marriott as translator, Mr Nakayamura welcomed us. He explained that he is now 72 years old and has been breeding clivias for over 50 years. Although in Japan much emphasis has been on leaf forms from the very beginning Mr Nakayama was occupied with creating new flower forms from his *miniatas*, as well as breeding a beautiful leaf structure. Now, 50 years later, the results speak for themselves;



Mr and Mrs Nakayama

the Nakayamas have created the most stunning polytepals including 'Hanyae', a rose-like bronze with green throat and 'Kiyou No Mai', a deep orange even more chimeric rose-like polytepal with large flowers on a compact wide-leaf plant. There were more surprises to come. Hidden behind a curtain in one of the greenhouses were the latest and greatest polytepals waiting a future release — well, I can hardly wait!

The Nakayamas could not have been more welcoming. They served us an assortment of beverages and Japanese sweets. Mrs Nakayama is heavily involved with the clivias and helped us knock our new acquisitions out of their pots for the journey overseas. After all debts were settled, the Nakayamas took us to a small traditional Japanese country restaurant where we sat on the floor in a private room. The great food and company distracted us from the discomfort of our stiff Western legs. Although I don't speak Japanese and they don't speak English, the warmth these two people exude make them excellent *Clivia* ambassadors for Japan. I'll always be grateful that they opened their farm to us.



An interesting selection of Mr Nakayama's Polytepals that cover open flowers with up to twelve tepals to *Chrysanthemum* lookalikes

Photos in this article courtesy of Marilyn Paskert









Recent Developments in Clivia Breeding in Japan

Shigetaka Sasaki, Japan

In previous articles I have introduced the work of some important Japanese breeders, namely Yoshikazu Nakamura (CLIVIA 3) and his interspecifics, and Toshio Koike (CLIVIA 7) with his green 'Hirao'. In this article I would like to report on the discovery of a new kind of variegation in Japan, together with its combination in mixed variegates. In addition, I will describe a dark bronze colour found in another breeder's *Clivia miniata*.

Tiger variegation

In CLIVIA 3 I outlined seven types of variegates in Japan. Recently, however, a new *Clivia miniata* variegate has appeared. Here I would like to introduce the breeder Hiroshi Mitsuhashi who is responsible for the new rare variegation called Tiger. Mitsuhashi owns a nursery in Chiba prefecture where he sells mainly *Clivia* and *Zygocactus truncatus*, both of which he commenced breeding and growing in 1977. He has enjoyed a good friendship with Professor Harold Koopowitz, James Comstock and Ilie Gaceu for quite a while. He has often visited California and obtained many *Clivia* plants from Joe Solomone and the late David Conway. More recently, he has visited China as well and now sells the Chinese Sparrow *Clivia*, Light of Buddha and some other rare Chinese *Clivia* to Japanese *Clivia* enthusiasts.



Hiroshi Mitsuhashi

Mitsuhashi came across the Tiger variegation among his seedlings in 1990. According to his records it emerged from a cross between Japanese daruma and a Belgium hybrid. Photo 2 shows his first Tiger variegate. Tora or tiger variegation, as seen in the example of 'Tahihou', already existed in Japan



Tiger variegation bred by Hiroshi Mitsuhashi

and at the time it was thought that the leaves had markings that resembled a tiger pattern. The variegation that is found in 'Taihou' is

thought to be viral but it does not spread by seed or plant sap. However the Tiger variety that Mitsuhashi produced from this 1990 cross is really close to a tiger patterning

Mitsuhashi's Tiger variegation looks like a scab or welt on the surface of the leaf but the pattern can also be seen on the underside of the leaf. In



The Base of a Tiger leaf

cases where there is a deep purplish pigmentation under the leaves, reddish horizontal stripes appear because of the influence of the Tiger variegation (*see photo below*). If in the future Tiger appears with leaves like *C. mirabilis* where the undersides



The Base of a Tiger leaf

of the leaves are all a deep purplish pigmentation and the leaves are vertical, beautiful red horizontal stripes will appear and it will be a new strain.

For the first 10 years after Mitsuhashi's first Tiger flowered, he was unable to collect much pollen so could not do any hybridization with it. But then in the next spring he found that the plant had produced enough pollen and so he pollinated the Akebono Nishiki plant that was flowering next to it.

The fact that the Tiger patterning carries some paternal (through the pollen) as well as maternal inheritance (through the seed parent) suggested to Mitsuhashi that it may not be another kind of variegation but belong to some other category. The extent to which Tiger is maternally inherited is still unclear at this stage. Some young seedlings (with two or three small leaves) that are currently being grown by Yoshikazu Nakamura show about 10-20% inheritance of the Tiger pattern through the pollen parent but he does not know if the pattern will increase as more leaves develop.

Akebono Nishiki variegation

Above, I mentioned the use of an Akebono Nishiki plant. Here, the term 'Nishiki' in Akebono Nishiki refers to vertical stripes, so the leaves of this type of *Clivia* are a mixture of Akebono and Shima (vertical striped) variegates. That is to say, through hybridization, it is possible for the leaves of one plant to have mixed Akebono and Shima variegation.



Akebono Nishiki

There are three pattens for the leaves of such a plant:

1. Leaves with only Akebono variegation;
2. Leaves with only Shima (vertical stripes) variegation and,
3. Leaves with both Akebono and Shima variegation.

I do not know whether we should categorise such plants as either Akebono or Shima variegates, but recently I have had the experience of using a mixed Akebono and Shima variegated plant as the mother parent in a crossing. The first leaves which appeared in the seedlings after the seeds germinated belonged to (1) and (2) mentioned above. The seedlings are still young at this stage so I do not know if the mixed variegation will appear on some leaves as these seedlings grow. When we use Akebono as the mother plant in hybridization, 100% of the seedlings that emerge are Akebono, but in the case of this mixed variegation plant, the seedlings which emerge are either Akebono or Shima variegation, so this may suggest that such plants belong in a different category.

Both Akebono and Shima variegates have existed in Japan for quite a long time and they were probably crossed together. However, such hybridization has been done only by a small number of breeders so there are still only very few of these plants to be found.

Akebono Tiger and Southern Cross

(Southern Cross being Tiger with striped variegation)

When Mitsuhashi used the pollen of his Tiger on the Akebono Nishiki, as described above, the seedlings shown in the photos at the top of the next column emerged. As seen in the photos, the Tiger variegation can



Akebono Tiger



Southern Cross

be transmitted through its pollen, in other words, it possesses paternal inheritance, as described. Akebono Nishiki is already a mix of two kinds of variegation – Akebono and Shima, so when it was pollinated with the Tiger pollen, the seedlings displayed the characteristics of paternal inheritance and the two new types of *Clivia* variegation, described above, appeared. Mitsuhashi has labelled the mixture of Akebono and Tiger as Akebono Tiger (See photo top of next page) and he gave the name of Southern Cross to the mixture of Shima variegation and Tiger (*See photo top of next page*). The leaf of Southern Cross with its vertical and horizontal stripes is much clearer than the cases of Akebono Nishiki hitherto and even looks like a checkered pattern resembling tartan. It is important to note that Tiger, Akebono Tiger and Southern Cross are all strains, not single cultivars.



Akebono Tiger



Southern Cross

Mitsuhashi's Akebono is different from the one produced by Nakamura. In the case of Nakamura's Akebono, even the old leaves retain their white stripes, whereas the Akebono characteristic is weakish in Mitsuhashi's plants where it appears most strongly in the new leaves. By combining together both Tiger variegation and weak Akebono variegation, Mitsuhashi has been able to bring out the best of both kinds of variegation. Perhaps in the future we can expect to find Fukurin Tiger and Negishi Tiger emerging from among the mixed variegates involving Tiger. Mitsuhashi is now working on producing a new variety combining multitepal yellow and Akebono Tiger, so in the future we can look forward to a new *Clivia* plant.

Dark bronze

Another exciting development that has taken place is Japan is due to the work of Kazumi Hattori who has produced an early maturing variety of *C. miniata* , similar to the early Twins produced by the Sahin company in the Netherlands.

Hattori operates a nursery in Aichi prefecture called Baijyuen Nursery where in addition to *Clivia* he also handles *Brunfelsia australis*. In 1983 Hattori obtained some



Kazumi Hattori

Belgian *Clivia* seed through a Japanese seed company and commenced production. From these Belgian hybrids he selected out some promising early maturing ones and produced his own original variety. Grown at a temperature of 15-17 degrees centigrade, his early maturing variety will flower in approximately two and a half years and he reports that they will even flower in mid-summer.

Around 1995 a bronze and a deep red-coloured flower, both with green centres, emerged from his crosses and when he crossed

these together he obtained a large number of deep or darkish bronze coloured flowers. Hattori has named this strain as UQ.

Hattori's plants with bronze-coloured flowers are small so the flowers are also smallish, but in terms of the quality of the colour, his



The deep Bronze UQ strain

bronze flowers are among the best that I have seen. Furthermore, from among his crossings using these bronze flowers are some beautiful flowers that are closest to burnt orange (on the Cape Clivia Club Colour Chart) but which age to a much darker colour.

I have had the experience of seeing plants producing red and bronze *C. miniata* flowers in places such as California, where the ultraviolet light is strong. Those same plants have blooms with quite a light red colour when flowered in Japan. As a result, I expect that Hattori's varieties of dark red and bronze flowers that flower in Japan will become a much stronger red colour when grown in overseas countries where the ultraviolet light is stronger.

In the summer of 1998 Hattori used the pollen from a *Crinum amabile* in flower and crossed it with a *C. miniata* that was flowering in his hot house, and the F1 and F2 hybrids that



Hattori's Pastel

he obtained from this cross reveal a dramatic change in colour (*See photos on this page*). When you hear this story you probably recall Gordon McNeil claiming to cross *Tulbaghia*,



Hattori's Bi-colour



Hattori's 'Sakiben'

Hippeastrum and other flowers from the Amaryllidaceae family with *C. miniata*. Nakamura also used the pollen from *Amaryllis belladonna* on *C. miniata* and obtained seeds but he reports that the flowers were those of the usual *C. miniata*. So it would seem that intergeneric hybrids between *Clivia* and others from the Amaryllidaceae family have not succeeded to date. Hattori's cross was probably not an intergeneric hybrid either. But perhaps the pollen from *Crinum amabile* had some sort of influence on the *C. miniata*. Perhaps the fact that the pollination time was summer had something to do with the outcome but it is a fact that he was able to produce extraordinary coloured flowers from this cross.

When we consider Hattori's work with *Clivia*, there are two other strange phenomena which are of interest, both of which may be due to inbreeding. One case involves plants where the growth point stops. I myself am growing one of these types of *C. miniata* from Hattori and the growth point stops once the plant has flowered, but then the offset itself produces a flower a year later. When that flower is finished, the growth point stops again, an offset emerges and it flowers the following year. In other words, the pattern is repeated three times (*see below*). I have often seen similar cases in the photos of growers overseas where the plants have been grown from seed and they flower within a very short time. I think it is probably due to the influence of inbreeding where an abnormality occurs in the meristem, and that meristem becomes a floral bud and is not able to produce the next growth point.



A strange outcome

In the second case, during the growth period, the leaves become curled or bent on one side and the plant ends up as a strange shape with curved leaves. The curved leaves develop more strongly on such plants from about the third year and when they become a mature size the leaves will be completely lop-sided. Such plants will generally produce a flower but the flower stem will not elongate very much.



Curved leaves

If we engage in the mixed breeding of Japanese *Clivia* such as Hattori's deep bronze *C. miniata*, Koike's green 'Hirao', Mitsuhashi's 'Tiger' and Nakamura's interspecifics, perhaps one day we will be able to announce some new results to *Clivia* enthusiasts around the world.

GO Green



Clivia miniata 'Hirao' Grower: Mick Dower
There are many photographs of this *Clivia* being sent in to this publication as well as being shown on the Enthusiasts Group but few are as green as this clone.



'Green Genes' Photograph by Hugh Bollinger



An Ian Coates Photographic Composition



Green in the Pink. Photograph courtesy of Rina van der Merwe



An Interspecific that has very unusual colours
Photograph by Susan Kay



An Ian Coates Photograph



Gnoenang study - a photograph by Charl Coetzee



St. Patty's Day Bouquet photograph by Susan Kay





Top of Page on the Right:
A green *Clivia gardenii*
photographed by Mick Dower

Above Right:
Green tips and a blush colour
with green seed.
Photograph by Slang de Lange



'Gnoenang' owned and photographed by Charl Coetzee

Roly Strachan's Special Clivia

Paul Michael de Meglio, USA

Roly Strachan is a *Clivia* grower with a unique collection of named plants and with their outstanding and interesting colouration they are a step apart from the many other South African cultivars. Yet many of these special plants might have languished in obscurity, hidden from or lost to the *Clivia* world, had it not been for the visits of a neighbouring *Clivia* lover and enthusiast, Val Thurston. This article presents a concise history of these most special plants.



Roly and Barbara in their forest of *Clivia*

Roly's collection began with a simple start. He collected a few *Clivia* from the wild in the Ncalu bush near the farm where he lives with his wife Barbara, in the area of Ixopo in KwaZulu Natal. (This is inland of the sea and south of Durban) Roly planted these habitat *Clivia* under trees on his property. This was in or around 1978 (approximately 30 years ago – maybe more). According to Roly, these original 4 to 6 plants were fairly average orange flowering *Clivia miniata*. Left to themselves, they self pollinated, or perhaps cross pollinated among themselves, and produced seed. These seeds self-sowed and more plants grew. Over the years, the original plants and the mature seedlings all produced offsets and grew into large clumps. Roly began to divide these and plant them into the bushy areas under the fir trees along the 500 metre driveway on his property. He also gathered their seed, germinated them and planted the seedlings among the other plants. By 1990 the *Clivia* were fully naturalised under many trees all over his large property, and probably numbered in the thousands.

After several years Roly noticed that some of the *Clivia* had special flowers: pastels and other interesting colours. These had appeared in his garden sporadically among perhaps 10 000 plants growing under the trees. Roly joined the local KZN Clivia Club in 1998, and other *Clivia* enthusiasts started visiting his collection. He continued to divide more and more clumps until he had utilised every bit of shade on the large farm property around his home.



Roly's 'Chiffon' named by Val Thurston

Among the early visitors who came to admire Roly's collection was Val Thurston, a 'neighbour' from 170 kilometres away. She first visited Roly in 1999, after meeting him at a KZN Clivia Club meeting the prior year. Together they went to look at his *Clivia*, and walked the many lines of plants. Among the more common orange-flowering forms, they took note of the ones with unusual colour flowers. The first of these was a lovely broad petalled white throated orange *Clivia* - which Val asked to buy a sucker of on the spot. Roly said she may take the whole plant, as long as she returned him an offset. This she did. Val named this first clone 'Roly's Chiffon'. Walking further down the lines, Val selected others for her garden, making sure to leave some suckers of each one for Roly. Val suggested that he replant these special clones closer to his house, where they could be more readily enjoyed, and label them. He did so.

Although 'Chiffon' was prime among Val's first selections from 1999, many of which she named after fabrics, in 1999 she also obtained 'Organza' a very attractive creamy/ orange pastel, 'Chartreuse', a dark orange with green centre, and 'Taffeta', a pastel orange with green centre. 'Chiffon' is considered the best among these clones; it has the broadest tepals of the group, and has won first place award at the Conference 2002 Show Any Other Colour 2 umbels. A plant selected by Sean Chubb, 'Roly's Delight', which is a lovely creamy pastel orange with cream stripes down the petals, won Runner-Up to Best on Show at the KZN Miniata September 2005 Show. 'Organza' was also placed Runner-Up in 1999 at the KZN Newcastle Miniata Clivia Show.

Over the coming years Val and Roly continued to walk the lines together, and select out special *Clivia*. In most cases Roly replanted a division of each new found clone into his special collection by the house. In 2000 Val selected 'Harlequin' a narrow petal Picotee, 'Kaleidoscope', a small bloomed pastel with mixture of dark and light oranges and cream, and 'Muslin', a pastel with cream stripes running up the petals, returning to fabric-based names. These were followed by 'Denim', 'Crinoline' and 'Brocade' - in 2001. In 2002, the collection was supplemented by Silk, another creamy pastel and in 2005, 'Crepe', a very attractive pastel with lots of cream and a dab of orange from the middle to tips of the petals.



Clivia miniata 'Organza'



Clivia miniata 'Taffeta'



Clivia miniata 'Kaleidoscope'



Clivia miniata 'Harlequin'

As for the clones with creamy orange flowers with white stripes down the petals, Val believes that these all came from the seed of one plant, from which Roly collected the seeds and planted out the seedlings some years prior. As in those early years Roly did not keep records. It is unclear, but it is certain that all the clones are closely related.



Clivia miniata 'Crepe'

Around the time that Val selected out the named clones, Roly's involvement with the broader Clivia Society through the KZN Club led him to acquire many other *Clivia*: yellow flowering *Clivia*, broad leafed *Clivia*, peaches, et cetera. These he planted out into his garden along with his other plants. Over the subsequent years their genes were undoubtedly mixed into the collection by the wind, the birds, the bees — but after the initial named clones were selected out. By this time Roly had also stopped growing out and replanting the seedlings, and as many visitors had selected and removed the majority of the *Clivia* with interesting flowers, now the majority of the remaining plants have the normal orange flowers of the original wild-collected plants. Roly and Val continue to walk the lines, and on the rare occasion that they do find a *Clivia* with interesting colours they mark it, and Roly puts it under the shade cloth with his special collection where he lets them inter-breed.

The work with those first selected named clones continues to yield wonderful results. In addition to Sean Chubb's award winner, Val's 'Chiffon' crosses and selfings have produced some really nice F1 generation seedlings which she is now crossing back onto 'Chiffon', and also crossing with

'Chiffon', in hope to further bring out the broad-petalled white-throated colouring.

There are a few green throats within the named Clones, including 'Taffeta', but not a lot of breeding has been done with them yet. These green throats have a habit of being good one season and not very green the next. Perhaps the best among them is 'Chartreuse', which was very green when found, but unfortunately suffered rot and has not flowered again. It had a very dark green throat and stood out in his mass of plants.

Among the 'Chiffon' F1s of note, are 'Reflection' and 'Poise', bred by Val Thurston, and the aforementioned plant of Sean Chubb. I am sure much promising work with these clones lies ahead.



Clivia miniata 'Chiffon' F1 'Reflection'

Val Thurston was first introduced to *Clivia* when she saw them flowering at the home of her husband Roy in 1971 at Renishaw. She was given plants by her mother-in-law but her real interest was 'sparked' when she saw a yellow plant growing in the garden of a friend in Howick. This plant was identified as the plant



Val Thurston

that Cynthia Giddy found, namely 'Natal Yellow'. She was 'bitten' and just had to have a yellow *Clivia* and waited about 13 years before obtaining an offset. She also purchased an offset, at the then huge sum of R35 from a gentleman who had a small collection of yellows and was prepared to part with this rare colour. She then swopped a plant of this clone, for a 'yellow' from Sean Chubb, the now well-known 'Chubb Peach' clone.

The race was on. She then joined the newly formed KZN Clivia Club in 1995 and as more and more different clones of yellows, peaches and pinks appeared at the various Clivia Shows and meetings, so the addiction of this amazing and interesting genus *Clivia* grew.



Clivia miniata 'Chiffon' F1 'Poise'

Roly and Barbara Strachan have lived and farmed in the Ixopo area of KZN for the past 40 years. Here is what Roly has to say about his adventure with *Clivia* plants, "I have been propagating *Clivia* plants since my interest in the genus *Clivia* started during 1980. Since Val has taken an interest and encouraged me in this venture I have started selecting and marking

plants with special flowering features, I am now in a position to sell plants and seed on a large scale. This venture gives me a great interest and keeps me healthy and young for my 88 years."

Comments on 'Roly`s Chiffon' as a breeding plant by Sean Chubb.

On my first visit to the garden of Roly and Barbara Strachan I recognized that here was a gene pool of plants, which produced a fair percentage of unusually coloured flowers with very full throats. It was not until the second or third visit that I saw Roly`s Chiffon, the BEST "other colour" *Clivia* I had ever seen. With the generosity of Roly Strachan and the help of Val Thurston I had some material to work with.

I initially crossed 'Roly`s Chiffon' with herself and a habitat plant with a partially full throat from Eshowe called 'Joy'. At that stage I considered 'Joy' to be superior, full throat plants were very rare. By today's standards 'Joy' is only a little better that ordinary. A few year later the seedlings of 'Joy' x 'Roly`s Chiffon' began to flower with spectacular colouration. Even crossed onto fairly ordinary plants the resulting seedlings produce flowers with interesting colour cominations.



A 'Chiffon' Daughter Flower



Clivia miniata 'Joy'

Since these first seedlings many more crosses have flowered and they seem to be getting better all the time.

I have recognized the uniqueness of these plants and have a line-bred family of them in my Nursery. These plants are called 'Chiffon Daughters', all have superior colouration and have 'Roly`s Chiffon' as either berry parent or pollen parent. I cross these 'Chiffon Daughters' back to 'Roly`s Chiffon' and as a result of the concentration of genes they produce some excellent results.

The colouration of 'Roly`s Chiffon' is highly heritable and for this reason I believe 'Roly`s Chiffon' to be a superior breeding plant.

Photos in this article are courtesy of :
Paul Michael de Meglio and Sean Chubb



A Red and White '*Chiffon*' First Time Flowerer

Laurens Rijke
A Passionate Collector of *Clivia*

Helen Marriott, Australia

A collector at heart, when Laurens Rijke saw an advertisement for the yellow *C. miniata* 'Aurea' in an Australian garden magazine around 1976 he recognised immediately that this was a rare plant and became determined to obtain one. Having emigrated from Holland some years earlier, Rijke was very familiar with orange-flowering *Clivia* plants that were



Laurens Rijke with a polytepal

common on Dutch window sills but he had not previously heard of a yellow flower. As a result of following up this advertisement, Rijke bought his first *Clivia*, *C. miniata* 'Aurea' as well as *C. miniata* 'Ailsa Dearing' (an apricot colour, supposedly a cross between 'Aurea' and an orange-coloured *C. miniata*) from Fred Pollard, who was selling offsets of plants that he had originally obtained from James Dearing, the head gardener at Rippon Lea, a large estate in Melbourne. (See Ken Smith's article in CLIVIA 2 for further details.) Pollard rationed out plants at the time, and Rijke was only able to purchase one or two on any one occasion. At $25 each in the 1970s, the offsets were very expensive indeed. But this small beginning constituted the start of his passion, and he now has a very large and splendid collection of *Clivia* plants.

Throughout the 1980s, it was virtually impossible for Rijke to obtain other "rare" *Clivia* in Australia. However, as time passed a small number of people provided others with access to important plants or seeds. For instance, Kevin and Coral Larsen, in Queensland, sold some plants bred or selected by Kevin Walters that they had raised from seed. Through another Australian source in the 1990s Rijke obtained his first orange-flowering akebono as well a fukurin variegate, which had been imported from Yoshikazu Nakamura.



A Fukurin Variegate

In more recent years, the role of the internet has revolutionised access to seed and to a lesser extent, plants, in particular from South Africa, and as the breeding of *Clivia* plants has jumped qualitatively, so too, in some cases, have the prices. Rijke has been one of the people to take advantage of access to a variety of material from the latter half of the 1990s.

As a Dutchman, Rijke patriotically grows many Dutch hybrids, which he says are different from Belgian hybrids and also different from the Sahin Twins strain. The Dutch hybrids that he grows vary in flower shape and colour - sometimes with green centres appearing.



Dutch Hybrids



Dutch Hybrids

Many of these plants flower twice a year (two stems simultaneously, or one after another, or during different seasons), and the leaves are taller and broader than are the contemporary Belgian hybrids. In recent years he has sold some of these hybrids and occasionally some of his other stock at weekend markets.

Rijke has imported seed and occasionally plants from South Africa, The Netherlands, Belgium, China and Japan, building up a collection characterised by much diversity. Not only has he accumulated Nakamura orange and yellow hybrids, peaches from South Africa, and broad-leafed Chinese and Japanese darumas, but he has a very special collection of many variegates, including akebono, fukurin, Light of Buddha and others. Nevertheless, it is the plants grown from Nakamura seed that form the centre of his large collection. In 2000-2001, which may have been the peak in Nakamura's breeding, Rijke was able to purchase 49 of the 50 crosses on offer.

From this 2000-2001 seed from Nakamura are a large number of beautiful polytepals as well as interspecifics involving *C. miniata* x *C. caulescens*, *C. miniata* x *C. gardenii*, and *C. miniata* x *C. nobilis* or other combinations. Some of these interspecifics are truly splendid specimens: 'Clementina', a cross of (*C. miniata* x *C. caulescens*) x self, and named by Rijke, is probably Nakamura's outstanding interspecific (see CLIVIA 8, p.14), rivalling the beauty of 'Day Dream' (see CLIVIA 8, p.50) but quite different from it.



Interspecific *Clivia* 'George'

Rijke's own crosses that he made in recent years are now starting to flower. Utilising material obtained in the earlier years, he has often used *C. miniata* 'Aurea' as the seed or



Interspecific *Clivia* 'M Rose'



A Polytepal Daruma



C. miniata x *C. gardenii*

pollen parent, crossing it with *C. miniata* 'Twins', *C. miniata* 'Mammoth' or other material. The best to emerge to date are crosses between *C. miniata* 'Aurea' and an interspecific *C. miniata* x *C. caulescens* of Nakamura origin. Out of one cross he obtained a range of flower types, including the broad-tepalled 'Pansy' (see inside cover of CLIVIA 8), 'Patsy' (CLIVIA 8, p.15), and 'Primrose' with broadish leaves.

When a small *Clivia* show was held in Melbourne in September 2001, the plants that Rijke displayed were the prime attraction – in terms of both variety and quality of blooms.



C. miniata Yellow x *C. miniata* 'Helen'



C. miniata 'Ghost'

Regrettably, despite several attempts since that time, no active group of *Clivia* enthusiasts has continued in Melbourne, though new attempts are being undertaken in 2008.

Rijke's plants thrive in a large glasshouse that is light and warm, where he and his wife Ester keep the plants well watered. He believes that the secrets of his success are his home-made potting mix plus fertilizers, though the warmth, light and air movement must also be important factors, along with copious watering, contributing to the growth of his *Clivia* plants. Like many of us, Rijke has found that a *Clivia* collection soon becomes a time-consuming hobby. He hopes that his large collection will be looked after in the distant future by his granddaughters who are still quite young at this stage.

It is exciting to be a part of the *Clivia* movement at present but it seems as if there is still a considerable way to go before the general public, at least in Australia, can become familiar with the diversity and potential available within the genus *Clivia*.



This photo of Laurens Rijke with his granddaughters affords one a good view of his glasshouse

All photographs in this article are courtesy of Helen Marriott

Photographic Competition Winners

Best Photograph



Best Photograph in Competition and First Placed *Clivia miniata* 'September Success'
Breeder, grower and photographer Felicity Weedon
The plant is from a Les Brown *Clivia* 'Links 2' as the parent and was selfed by Felicity

This Years Competition drew a record number of entries with some magnificent *Clivia* Blooms to be seen. This always makes the panel of Judges selections difficult as this is a Photographic Competition not a Beauty Contest. We have to pick those images that have Photographic merit as well as look at the flower form. Congratulations to all the winners and because of the outstanding entries we received we have decided to print a number of interesting and meritorious images as well. The Habitat section is disappointing with only one entry and I encourage all who live close to Habitat *Clivia* to get out and take photos. For those that do not manage to get into print please try again for next year.

Miniata Section: 254 entries — 28 entrants, Single Flower Section: 52 entries — 11 entrants,
Pendulous Section: 37 entries — 11 entrants, Interspecific Section: 35 entries — 14 entrants,
Habitat Section: 9 entries — 1 entrant.

Claude Felbert

Clivia miniata Section



Second Placed *Clivia miniata* 'Autumn Splendour'. Grower and photographer Mick Dower



Third Placed *Clivia miniata* 'Tipperery Peach' with a green-throat.
Breeder: Chris Welgemoed
Grower: Piet van der Merwe
Photographer:
Rina van der Merwe





Habitat Section:

Winning Photographs:
All nine entries in this section came from Gideon Scheepers and it is difficult to split them so we decided to print the best three.



Pendulous Section





Winners Penduloss Section:

Left Opposite:
Winner: *Clivia caulescens*
Photo by Helen Marriott

Below Left Opposite:
Second Placed: *Clivia nobilis*
Photo by Gideon Scheepers

Right:
Third Placed: *Clivia mirabilis*
Photo by Mick Dower



Interspecific Section



Winner: An Interspecific *Clivia* with strong colours and an attractive flower head. Photo by Gideon Scheepers



Second Placed:
Interspecific *Clivia*
Photo by Gideon Scheepers

The time and effort invested in this picture with the composition, background and sharpness as well as the frame with vignetting make it an excellent submission.
(Eds.)



Third Placed: Interspecific *Clivia* 'Icecream' photo by Susan Kay

Single Flower Section





Winner Single Flower:
Above:
Clivia miniata with green throat
Photo by Gideon Scheepers

Second Placed Single Flower:
Left:
Clivia miniata 'Georgette'
Photo by Tessa Nel



Third Placed Single Flower::
Clivia miniata 'Gigi'
Photo by Tessa Nel

Interesting and Meritorious Photographs



Clivia miniata green-throat photo by Helen Marriott



C. miniata 'Volcano'
Photo by Tessa Nel



C. miniata 'Frangelico'
Photo by Tessa Nel



C. miniata 'Bruce'
Photo by Tessa Nel

Below:
C. miniata Vico Clone x Lotter Peach
Photo by Felicity Weedon





Clivia miniata 'Lovely Pink' photo by Felicity Weedon



Clivia *miniata* 'Ella van Zijl' type
Photo by Terry de Vine



Clivia nobilis photo by John Craigie



A Nakamura Interspecific *Clivia* 'Golden Dawning'
Photo by Mick Dower



An Interspecific *Clivia* 'Suikerbekkie'
Photo by Susan Kay

We follow these photographs with the popular Single Flower Gallery that has been extended to include a wider range of pictures from the Photographic Competition.



Photo by Gideon Scheepers 'Palomino Princess'



Photo by Gideon Scheepers 'Contessa'



Photo by Rina van der Merwe



Photo by Teresa Scheepers



Photo by Rina van der Merwe



Photo by Gideon Scheepers - Having a bath?







Above left photo by Claude Felbert

Above right photo by Gideon Scheepers

Centre right photo by Claude Felbert

Bottom left photo by Teresa Scheepers

Bottom right photo by Tessa Nel







Photo by Rina van der Merwe



Photo by Gideon Scheepers



Photo by Claude Felbert



Photo by Gideon Scheepers

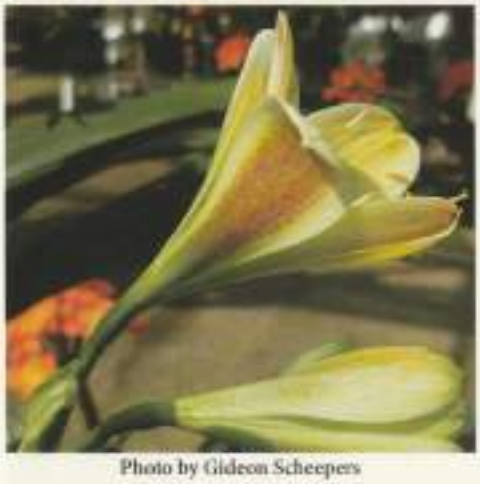


Photo by Gideon Scheepers



Photo by Claude Felbert

The Great Wide Yellow and other Clivia

Lisa Mannion, New Zealand

My first contact with *Clivia* was some twenty years ago when I was given a few seeds of a new hybrid by the late John Lesnie, then a prominent *Camellia* breeder. As I left his nursery he pressed a couple of seeds into my palm. I can't remember what became of those original plants, but I assume now that they must have been *Clivia* 'Hugh Redgrove'.

About 10 years ago I was living on a large bush block in the Waitakere ranges, west of Auckland. With a young family and needing an excuse to get out of the house I had established a small nursery, growing flowering perennials; however I was prompted to re-think my growing strategy when I quickly ran out of sunny clear space. The Waitakeres are a protected environment and it is illegal to cut down the large native trees that cover our property. Thinking shade, I remembered *Clivia* and went looking for seed. Now at this time I was unaware of the growing international interest in *Clivia* or the significant breeding advances, I was even unaware that a yellow strain existed.

I was directed to Keith Hammett by Jack Hobbs the curator of the Auckland Botanical Gardens. It was with some trepidation that I made the first phone call to Keith. His name has always figured in the horticultural worlds I have inhabited since specializing in nursery production at Massey University. Indeed, my first text on plant propagation was a Keith Hammett publication.

I didn't know what to expect when I rang him one evening out of the blue, but what I got was an invitation to help him pollinate his extensive collection. I can remember my baby son Tom, now 12 years old, sleeping in his pushchair under a tree at Keith Hammett's extensive property while I carefully pollinated flowers! I did this work over a number of weeks, and in return Keith gave me a solid introduction to *Clivia* breeding and a proportion of the high quality seed that resulted from our crosses. This was the beginning of my serious involvement with *Clivia*. At the same time I sourced seed from Australia; 'Walters Yellow' and 'Twins Orange' from Ken Smith and a large amount of Belgian and European hybrids from a commercial supplier. Although I have continued to buy small quantities of seed where it appeals, the above lines have formed the foundation of my nursery stock.

I have subsequently concentrated on line breeding to produce oranges that are deep enough to be called red, and yellows that have extra broad leaves. The original seeds from Keith were mostly of Solomone origin. As people know, these have a tendency in some cases to be wider-leaved than usual. I selected out the widest leaves from the original seedlings and have continued to cross these to develop a line of plants that I call 'The Great Wide Yellow' (GWY).



A 'Wide Leaf' Yellow

Of course it is important to not only have wide leaves but also have a good form; this has been a further selection criterion – wide leaves, short in length with a good flower. I will say that my experience when crossing two yellow plants with exceptionally wide leaves - say 100mm wide - is that the resulting seedlings will only have a proportion with distinctly wide leaves, while less than half will have leaves as wide as the parent plants.

I have my broad leaf yellows defined into GWY 'Silver' and GWY 'Gold', with only a couple warranting the title 'Platinum'. 'The Great Wide Yellow' was a name that came to me in the form of a letter written by a collector of *Clivia* and advertising man Garry Murphie of Sydney. About five years ago Garry wrote to me "in pursuit of The Great Wide Yellow". He had heard that broad leaf yellows were my specialty and wanted to buy seed. I loved the name and with his permission I have had labels and marketing material produced to promote my plants.

I now do all my growing in two 50m x 10m green houses that I lease in Whenuapai, still out west but not in the hills. I sell my plants primarily through two wholesale plant markets. I have established a strong client base of landscapers who say they like my plants especially because of their distinctive lush wide leaves. In New Zealand *Clivia* are recognized by the landscape trade as a high value plant suitable for difficult shade areas. They have had plenty of promotion over the past five years in gardening magazines and via the New Zealand Clivia Club Shows and regional exhibitions.



A broad-leaf yellow in bud



A broad but short-leaf form with a deep yellow bloom

Last year when I began to feel the nursery was getting too much for me to manage alone I had a friend offer to work with me two days a week during school hours. She is a former forensic scientist and has introduced a welcome sense of order and system to my establishment. We start the day with a strong coffee, have a large shared lunch under the pine trees and get an enormous amount of work done. Two certainly amounts to more than double the output of one.

Clivia have been an excellent plant to specialize in growing for me. The project began largely out of necessity, became a labour of love, and has now evolved into a business that still allows me time to continue studying and run around after family.



Lisa Mannion in one of her shadehouses showing off her broad-leafed yellow *Clivia* while still in pursuit of improving 'The Great Wide Yellow'

A Book Review of *Grow Clivias*

Roger Fisher, South Africa

Grow Clivias (Second Edition 2008)
Written by Graham Duncan for the Kirstenbosch Gardening Series and published by SANBI (ISBN 978-1-919684-51-2).

This is an extensive rewrite of the first edition and a 188 page tome (194 pages in total). Much as with the first volumes of the CLIVIA yearbook (Volumes 1-4), the first edition was a folded staple-bound booklet, while this is a bound, paperback book.

As the first issue of the CLIVIA Yearbook 1998 and the first edition of Grow Clivia (1999) are virtually contemporaneous it is worth quoting in full the observation expressed on page 19 of Graham's new Book:

Since the publication of Grow Clivias in 1999, our knowledge has grown exponentially. Two new species [*C. mirabilis* and *C. robusta*], *two new varieties* [*C. gardenii* var. *citrina* and *C. robusta* var *citrina*] *and one new natural hybrid* [*C. caulescens x C. miniata, C. x nimbicola*] *have been described. Numerous scientific studies ... have been undertaken, and numerous international conferences have taken place. The number of intraspecific and interspecific hybrids has increased markedly .... Pastel-coloured hybrids of C. miniata are slowly becoming more readily available to the public, and many new cultivars have been officially registered .... In addition, many highly successful Clivia shows continue to take place ...*

These developments fully justify the extensive revision of the original and Duncan is man to the task. The contents cover the full range of topics pertinent to the genus, from a historical overview, through general information of the plant and its habits to the taxonomy of the six described species, their cultivation, propagation and inevitably, that gory topic, 'Pests and diseases'!

The writing is clear, authoritative and accessible without pandering to current demands for populism or journalese. The book is extensively referenced, offering almost a current bibliography of the genus *Clivia*. It is pleasing to note that entries in the Clivia Society publications - the Clivia Yearbook, Newsletter and in-house publication Cultivation of Clivias are amongst those works cited. These works, along with the Harold Koopowitz book Clivias, make up the bulk of the published English Language knowledge of the *Clivia* genus and despite some overlapping they complement each other.

Illustrations are rich and varied and the illustration in coloured pencil of *C. mirabilis* by Sibonello Chiliza - South Africa's first black botanical artist - is premiered. There is the gremlin of digital images of too low a quality pixilating in print, but these are the exception.

The only question remains – who is the target readership? It is almost too weighty for the hobbiest and gardener, which the 'Grow' in the title suggests.

Perhaps it should be titled 'Know Clivias' for within it are nuggets even for the seasoned enthusiast. And since most of these are of the grey brigade, it is useful to be reminded of things once known but forgotten all contained in a single source, readily accessible through an extensive index. There is also a useful Glossary of terms appended to the text.

[*Grow Clivias* can be ordered from the SANBI bookstores or obtained at reduced price through various Clivia Clubs].



Front and Back Cover of Grow Clivias by Graham Duncan



'Henriettes Teaparty' Photo by Gideon Scheepers

The Clivia Society

www.cliviasociety.org

The Clivia Society caters for *Clivia* enthusiasts throughout the World. It is the umbrella body for a number of constituent Clivia Clubs and Interest Groups which meet regularly in South African and elsewhere around the world. In addition, the Society has individual members in many countries, some of which also have their own Clivia Clubs. An annual Yearbook and regular Newsletters are published by the Society. For information on becoming a member and / or for details for the following Clivia Clubs and Interest Groups contact the Clivia Society secretary or where appropriate, the International Contacts, at the addresses listed below.

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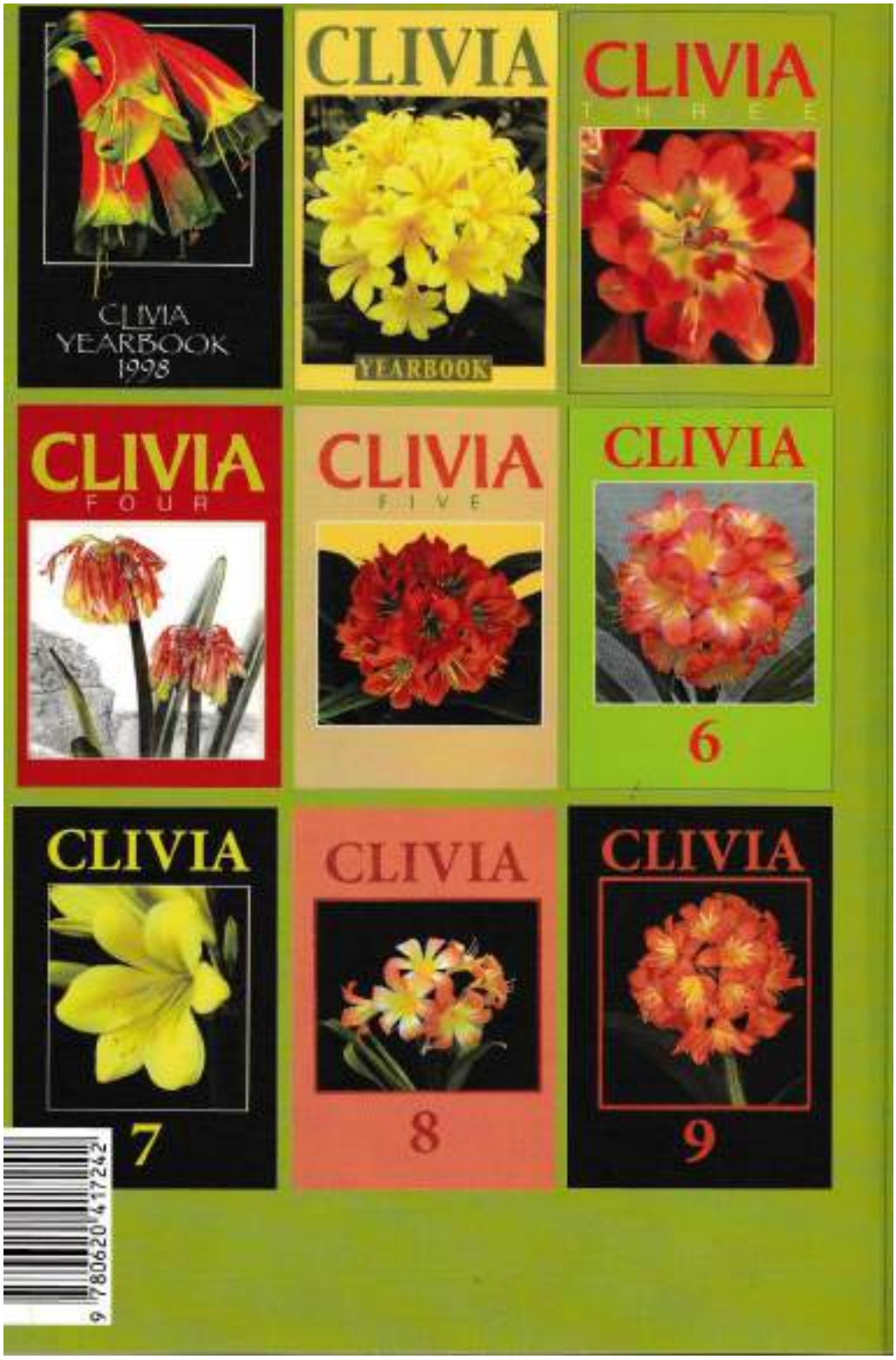
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INTEREST GROUPS: Lowveld, Northern KZN, Overberg, Waterberg, Zoutpansberg,


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CLIVIA 11



Photo: Felicty Weeden

Clivia miniata **Seedling from the Apple Blossom Complex — Grower: Felicity Weeden**

Editors

Roger Fisher
Claude Felbert
Roger Dixon

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Editorial

The year 2009 marks the bicentenary of the birth of Charles Darwin and the sesquicentennial of the publication of his Origin of the species and so gives pause for Greig Russell, a welcome new – and in this issue, generous - contributor to the CLIVIA Yearbook, to reflect on Darwin's achievements and whether in fact Darwin was a *Clivia* grower.

Hannes Robbertse, who has before visited the anatomy and physiology of the *Clivia* root in The nutritional system of *Clivia* [CLIVIA Four (2002), pp. 31-35] revisits the topic and comes to some interesting speculative conclusions as to a eutrophic relationship of mycorrhizal fungi with the roots of *Clivia*, a topic expanded on in a contribution by Joanna Dames, which all help our thinking of the co-evolution of species.

Johan Spies presents the observations of their research - in part funded by the *Clivia* Society - at the University of Free State, and speculates on the genus *Clivia* being in fact an ancient polyploidy.

James Haxton takes us on a photographic observation on the predation by lacewings on the eggs of the Amaryllis moth, a marvellous piece of microphotography.

We have two visits to *Clivia* in habitat. Ian Coates takes us on a tour of *C. mirabilis* in habitat, and as supplement, Gerhard Faber introduces surprising consequences of his hybrid breeding with the species.

Kerrie McElroy, also a welcome new contributor, formalises discussions that have been done on the Clivia Enthusiasts group for the breeding of what Mick Dower has termed a 'Universal Yellow', that is a hybrid *C. miniata* having both the recessive genes of both Group 1 and Group 2 Yellows.

Greig Russell presents a genus that is cousin to that of *Clivia*, namely *Cryptostephanus*, and in particular *Cryptostephanus* vansonii and notes on Georges van Son who introduced it to science.

Trevor Pearton and Attie le Roux take us to Bearded Man Mountain, the habitat of the naturally occurring *Clivia* hybrid, *C.* × *C. nimbicola*. While Trevor gives us the background to the discovery of these naturally occurring hybrids between *C. miniata* and *C. caulescens,* where these two species occur in conjunction, Attie le Roux discusses in layman's terms his observations over the years of the distinctions between the phenotypes of four areas of the naturally occurring hybrid, *C.* × *C. nimbicola*.

Greig Russel reviews the related literature to trace the introduction of the bred hybrid *C.* × cyrtanthiflora and offer us a revision of its introduction through the literature and proposes that *Clivia* × cyrtanthiflora is a nothospecies.

John Craigie helps the breeder wanting to grow for striation by recording the observations of their breeding programme at Pine Mountain Nursery, here presented.

Although not forming part of this Yearbook it cannot go unmentioned that next year is the Clivia Society's fifth International

Clivia Conference – the second to be held in Cape Town. While arrangements for speakers and their topics are well on their way, one of the interesting topics is on DNA testing of many different plants and species that was made at Kirstenbosch by Ferozah Conrad who will be presenting her findings at the conference. The Conference theme is to be Heritage of *Clivia* which must be of interest to enthusiasts. All *Clivia* Growers should make plans to attend. The activities will extend from the 21st September to the 26th September with the Conference taking place over the first two days. There will also be a number of tours arranged around the conference time including one to 'mirabilis country'.

This issue will have photographs from more Clubs and Interest Groups than ever before. We encourage all Interest Groups that are not submiting pictures to make arrangements to do so for next year. Although the entries for the Photographic Competition have diminished, the standard is still very high with many interesting flower images submitted.

This publication is not the usual vehicle for recording the passing of our members but as he has had much to do with the decision making on the financing and the volume for print runs of this publication it would be remiss of us as Editors not to pause and remember Bossie de Kock and perhaps when we look below, or at the cover of Yearbook 6, with the photograph of his *Clivia miniata* 'Deklan' we will all think of Bossie.

A moral standpoint for accurate descriptions of *Clivia* is something we all should agree and act upon. We take this opportunity to encourage everyone to use the Colour Chart II in photographs, particularly where they are going to be used to sell plants.

While the CLIVIA Yearbook is meant to be the vehicle for authoritative and scientific pieces offered in accessible language, we make space to give it a visual appeal. As always we present notes and images of visits to breeders and growers and the results of their breeding programmes, as well as the best that shows have to offer.

The Editors - July 2009



Clivia miniata 'Deklan'
Grower: Bossie de Kock

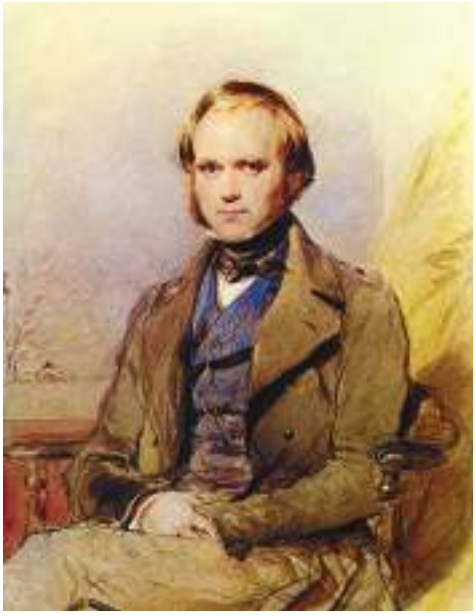
NB: All Photos are courtesy of the author of the article unless otherwise stated. Eds.

Charles Darwin — Clivia Grower?

Greig Russell, South Africa

Warning: Those readers who consider Darwin's work to be akin to the work of one of Lucifer's minions should forget this article and go and water their plants or something. Much as I do not consider the existence of a spherical earth to be a theory, so do I not consider evolution to be a theory - I see its effects all around me, every day.

Charles Robert Darwin was born on the 12th February 1809 - just two hundred years ago. I will not expand much here on his life; there are any number of biographical and interpretive works on the man available in any reasonable library. For a basic primer on Darwin see**: http://en.wikipedia.org/wiki/Charles_Darwin**



Water-colour portrait of Charles Darwin painted by George Richmond in the late 1830s. from *Origins*, Richard Leakey and Roger Lewin

Darwin attended the universities of Edinburgh (studying medicine) and Cambridge (studying divinity) and was then recommended to accompany Captain Fitzroy's scientific voyage on the *HMS Beagle* as a naturalist/geologist/companion. It was while on this five year long voyage that Darwin observed much, visited the Galapagos and also had time to reflect of what he had seen and experienced. He unfortunately probably also contracted Chagas disease (a South American form of sleeping sickness - trypanosomiasis) on this voyage, or perhaps some other disease, and although a healthy young man departed, a chronically ill man returned. Sufficient family money meant that he did not need to go out to work and he could thus get married, have a family and devote his time to study and a vast correspondence.

Darwin said that the works of Humboldt and John Herschel "stirred up in me a burning zeal to add even the most humble contribution to the noble structure of Natural Science" (Darwin 2004). This was something he did more than admirably. Over his relatively long life (he died in 1882) he considered and contributed to a wide range of scientific disciplines, the most famous of his vast output being the *Origin of Species* (1859 - so it is the sesquicentennial of the publication of this work) and the *Descent of Man* (1878), both works dealing with evolution of species through the mechanism of natural selection. Darwin's works gave huge impetus to the understanding of biology in its broadest sense. Modern biology only makes sense when organisms are viewed as the products of an

evolutionary process. It has been pointed out that Darwin's disease played a large part in his success, as it isolated him from the usual time-wasting activities of a job and social interaction, giving him so much more time to think, correspond and conduct studies to clarify the cloudy.

Darwin visited the Cape once; and it was the only time he ever set foot in Africa. Although the *Beagle* had travelled down the east coast of South Africa on the way to the Cape, landfall was never made there, and thus Darwin would have never seen *Clivia* in their natural habitat. I have made a special task of studying what Darwin wrote at this time and he apparently did not really enjoy or appreciate his sojourn at the Cape. But then he was already a sick man (his journal entry for Thursday, 9 June says nothing but "not very well", and for Saturday, 11 June there is no entry at all) and he had arrived at the wrong time of the year (lousy weather and no carpets of flowers). The nineteen days of his journal keeping at the Cape resulted in the writing of only 900 words; most of which deal with observed geology.

The *Beagle* arrived in Simon's Bay on the 31st May 1836. The following day, Darwin travelled (for many hours) to Cape Town, then a town of some 15 000 souls, and he stayed there in barely-adequate lodgings. He then organised a four day trip, taking in "Praal", "French Hoeck", the road to Caledon (Houhoek Pass) and "Sir Lowry Coles Pass" (sic). Back in Cape Town, he visited with Dr Andrew Smith at the Museum, Thomas Maclear (the Astronomer Royal at the Cape), Colonel John Bell (the Colonial Secretary), and Sir John and Lady Herschel (having earlier been greatly inspired by Sir John's writings, this was the highlight of his visit).


The Beagle - Painting by Conrad Martens

Now we can examine Darwin's association with *Clivia*. Bear in mind that he preferred to use the old genus name *Ima*(*n*)*tophyllum*, so when I quote him directly, this name is the one often used. One of Darwin's correspondents was John Scott, the foreman of the propagating department at the Royal Botanic Garden, Edinburgh. Scott tended to and had done some work with *Clivia*, and they are briefly mentioned in letters. In one letter dating to late November 1862, Scott said: "I am extremely sorry that I can afford you no information whatever on the relative fertility of varieties of plants. I may mention, here, however, though you may already be aware of it an experiment which I made in illustration of the fertility of hybrids. This was made upon *Clivia* cyrtanthiflorum, which was raised by crossing the *C. nobilis* with C. *miniata*. I find it to be perfectly fertile with its own pollen as well as that of either parent." (Darwin 1997, p. 542).

In early December, Darwin enquired of Scott: "I see few periodicals: when have you published on Clivia? I suppose that you did not actually count the seeds in the hybrids in comparison with those of the parent-forms" (Darwin 1997). Scott replied on the 6 December: "I have made no notice of *Clivia*, nor have I counted the seeds.

This I will now, have an opportunity of doing, as the hybrid & one of its parents are at present in flower." (Darwin 1997).

At this point there was a letter from Scott to Darwin which has unfortunately gone missing; but from Darwin's book, *The variation of animals and plants under domestication* (Darwin 1868) we understand that: "Mr. John Scott informs me that in 1862 *Imatophyllum miniatum*, in the Botanic Gardens of Edinburgh, threw up a sucker which differed from the normal form, in the leaves being two-ranked instead of four-ranked. The leaves were also smaller, with the upper surface raised instead of being channelled."

Darwin wrote to Scott on 16 Feb 1863: "Your case of *Imatophyllum* is most interesting; even if the sport does not flower it will be worth my giving." Darwin again wrote to Scott on the 2 May: "Let me hear about the sporting *Imantophyllum* if it flowers". (both Darwin 1999, p. 140 & 376)

That is the extent of this series of letters and nothing further came of it. I really don't understand the comment inferring that four-ranked foliage represents the norm in *Clivia*. Perhaps Darwin inverted what had been written originally?

Donald Beaton (1802–63) was a Scottish gardener who became an expert on hybridisation. Trained in Scotland, he eventually gardened for William Fowle Middleton of Shrubland Park, Suffolk, a pelargonium enthusiast. Beaton was a regular contributor to the *Gardener's Magazine* and the *Cottage Gardener*, the latter becoming the *Journal of Horticulture* after 1861. Beaton, although 'only' a horticulturist, was prepared to criticise scientists who he considered were purveyors of nonsense. Darwin did not like this lack of 'respect', and took on Beaton at every opportunity.



Photo: Clive Graham

Photo from the KZN Show — a double Umbel *C. miniata* — Grower Liz Boyd

In a letter to the *Journal of Horticulture* in January 1863, Darwin said: "About a year ago Mr. Beaton gave an analogous case, far more remarkable than any hitherto recorded, for he showed (if my memory does not deceive me) that the pollen of one species acted on the footstalk of the seed-capsule of another species, and caused it slowly to assume a position which it would not otherwise have acquired. I forget the name of the plant, and have vainly spent an hour in trying to find the passage, though I am sure I marked it." (Darwin 1999, p. 90).

Further research has shown that in an article on crossing flowers, Beaton (Darwin 1999, p. 91) reported as "the most curious thing I know of among plants", that the capsules of *Clivia miniata* stand erect as the umbels of flowers, and the capsules of *C. cyrtanthiflora* hang down as the flowers do. By crossing the two, the capsules of the former become as pendent as those of the latter. Darwin double scored this passage in the margin of his copy of the journal, so we can be fairly sure that Clivia were the plants to which he had been referring in the above letter.

Interpreting this one is not that easy. Unfortunately I cannot find a copy of Beaton's original article to check exactly what he said (it is always preferable not to work from secondary sources). What I believe was intended is that when *Clivia miniata* is self-pollinated then the pedicels remain erect, whereas when *C.* x *cyrtanthiflora* pollen is used on *C. miniata*, the capsules hang. It is impossible that the origin of the pollen would have any effect on the pedicel post-pollination. Although even the thinnest pedicels on my plants of *C. miniata* can support the largest capsules in an upright position, growing conditions in England are very different, and the plants were in all likelihood much softer, meaning that larger capsules may have caused pedicels to bend over. *C. miniata* is a species which is known to be somewhat sexually self-incompatible, meaning that selfed flowers would produce fewer seed than those that were crossed. Further, taking hybrid vigour into consideration, it is most likely that the capsules produced from the cross pollinations were larger and heavier and thus bent the soft pedicel over, whereas the selfed capsules do not. One would however have hoped that, if this were the case, Beaton would have pointed out the greater fullness of the pendulous capsules.

Darwin wrote a letter dated 26 October 1875 to William Turner Thiselton-Dyer, the then Assistant Director at the Royal Botanic Gardens, Kew. Thiselton-Dyer later became the third Director of this institution, but not before marrying the daughter of J D Hooker, the second Director, who himself was the son of the first Director, Sir W H Hooker - this all sounds like some early version of *Dynasty*? Darwin wrote because he wanted "*Imantophyllum* for crossing experiments" (Darwin 1994, p. 438). Darwin had long since (January 1863) had a 'hothouse' constructed at his home, "Down House", to house such treasures.

In Darwin's 1880 book *The power of movement in plants*, (Darwin 1880), in a chapter dealing with movements made by leaves; it says the following: "*Imatophyllum vel Clivia* (sp.?) (Amaryllideae). A long glass filament was fixed to a leaf, and the angle formed by it with the horizon was measured occasionally during three successive days. It fell each morning until between 3 and 4 P.M., and rose at night. The smallest angle at any time above the horizon was 48°, and the largest 50°; so that it rose only 2° at night; but as this was observed each day, and as similar observations were nightly made on another leaf on a distinct plant, there can be no doubt that the leaves move periodically,

though to a very small extent. The position of the apex when it stood highest was 0.8 of an inch above its lowest point."

This interesting little experiment was undertaken by Darwin in the 'hothouse' at "Down". I would suggest that this observation indicates that the stomata on the leaves of *Clivia* open when illuminated, causing loss of water and hence a reduction of the turgidity of the leaves; this is the cause of the change in the angle of the attached glass filament - and would take place daily on a cyclical basis.

One can thus surmise that Darwin's plea to Thiselton-Dyer had been fruitful, that he grew *Clivia* in his hothouse and had more than one of them (although he didn't know which particular species he had acquired - so much for "crossing experiments").

Hail Darwin, the *Clivia* Grower.

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Photo from KZN Show — Grower Liz Boyd
Best Yellow / Cream *C. miniata*



Photo: Clive Graham

Comparing Root Anatomy of Clivia

Hannes Robbertse, South Africa

Comparison of the root anatomy of different *Clivia* species with special reference to the velamen

Introduction

According to Dycus and Knudson (1957), the envelope around orchid root was discovered in 1835 by H.F. Link, but the name "velamen radicum" was suggested by Schleiden who studied the roots of a large number of orchids). Sanford and Adanlawo (1973) remarked that "… there is surprisingly little published information on the velamen, even on the number of layers comprising it, to say nothing about its development and structure".

Most of the work on the velamen was done on the roots of epiphytic orchids, but a velamen is also found in other Monotyledonous plants such as some Araceae and Amaryllidaceae like *Agapanthus* and *Clivia*. If there is "little" information available about the velamen of orchid roots, there is even less published information on the velamen of other plants. In a paper on "The Nutrition System of *Clivia*" (Robbertse in Clivia 4), I gave a brief description of the root anatomy of *C. miniata* but no reference was made to the other species. In this paper a comparison is made between the root structure of *C. mirabilis* and roots of the other species. A proper understanding of the structure and function of the roots may assist growers in optimising the fertilising programme of their *Clivia* collection.

Materials and methods

Roots of *C. mirabilis* were collected from plants in Sakkie Nel's collection that were obtained from the natural habitat. Roots of the other species, (*C. caulescens, C. gardenii, C. miniata, C. nobilis* and *C. robusta* were obtained from James and Connie Abel's collection. All these plants originated from natural habitats. The roots were fixed in a mixture of 50% alcohol, acetic acid and formalin and transverse hand sections were made of all the roots. The sections were stained in Toluidin Blue or Safranin and studied with a Leitz microscope fitted with a digital camera for taking micrographs.

Results and discussion

General structure and function of *Clivia* roots

All *Clivia* roots are relatively thick, which is characteristic of storage organs for storing water and reserve nutrients. All roots are covered with a multilayered epidermis, called the velamen, that develops from the young epidermis close to the growing point of the root. Cells of the outer layer of the velamen, also called the epivelamen, are converted into root hairs that stay on the roots even if they are very old. (Fig 1) Close to the root tip the velamen cell walls develop net-like thickenings (striations) (Fig 2) and become impregnated with suberin (corky

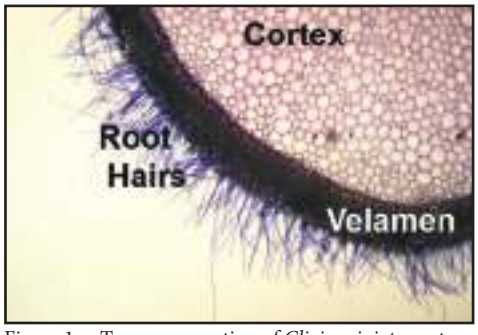


Figure 1: Transverse section of *Clivia miniata* root showing abundant root hairs.

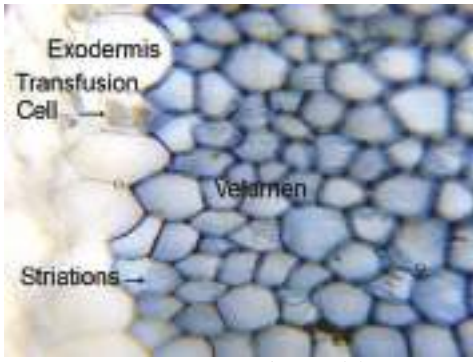


Figure 2a: Transverse section of *C. mirabilis*

substance). They loose their cellular contents and are therefore dead. The possible function of the velamen will be discussed later in this paper.

The exodermis, just below the velamen, is the outer layer of the cortex (Fig. 2) and consists of relatively large cells of which the outer cell walls become thickened and eventually die, except for some smaller cells that retain their cell contents and serve as passage cells (transfusion cells) forming gateways between the velamen and the cortex.

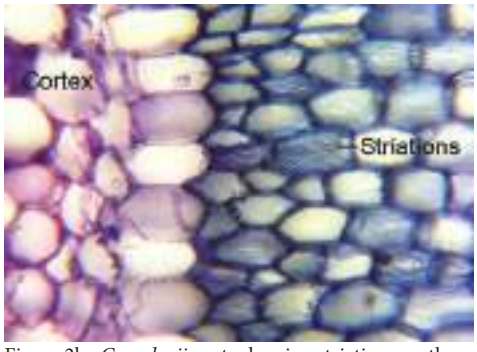


Figure 2b: *C gardenii* roots showing striations on the velamen cell walls

The rest of the cortex, up to the endodermis, consists of thin-walled parenchyma cells with intercellular spaces filled with air (Fig 1). The cortex serves as the storage centre of the root, but also serves as a passage route for water and nutrients taken up from the substrate by the root, to the vascular cylinder. An iodine test was performed to determine whether the roots are storing starch, but no starch grains were observed in the roots of any of the species, meaning that the roots are probably storing soluble substances such as sugars. In the roots of the species with pendulous flowers, small spherical bodies that stained violet-red with Toluidin Blue were observed in the cortex cells (Fig. 5). The composition and function of these bodies are unknown.

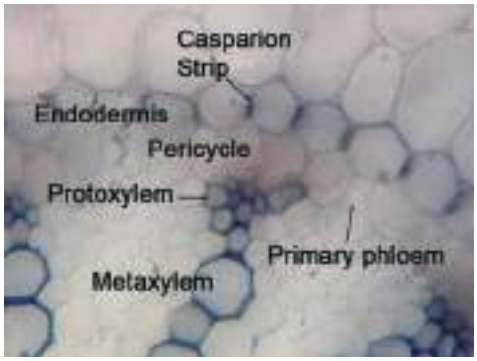


Figure 3: Section of *C. mirabilis* root showing Casparian strips in radial walls of endodermis cells, pericycle, primary xylem elements and primary phloem

The endodermis is the inner layer of the cortex (Fig. 3) and similar to the exodermis, consists of a single cell layer that also contains transfer cells. Characteristic of the endodermis are the Casparian strips in their radial walls The Casparian strips contain suberin which is impermeable to water and is responsible for blocking the apoplastic movement (movement of solutes through the cell walls) of solutes through the radial walls of the endodermis cells. Any solute entering the vascular cylinder has now to pass through the cell membranes of the endodermis cells which are semi-permeable and will only allow the passage of

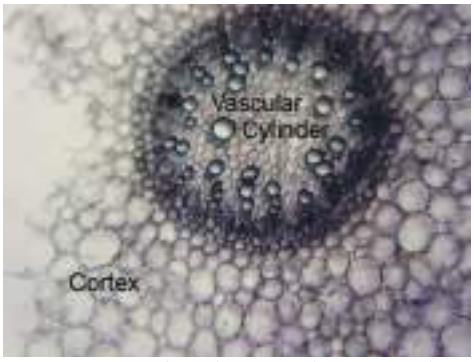
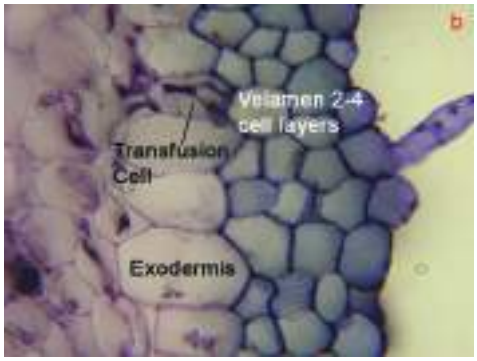


Figure 4: Section of *C. robusta* root showing vascular cylinder surrounded by cortex



Figure 5: Sections of mature (a) and young (b) roots of *C. mirabilis* showing thin (2-4 cell layered) velamen



water and mineral ions. The function of the endodermis is therefore to regulate the entering of substances into the vascular system.

The pericycle is the outer cell layer of the central cylinder and consists of thin-walled cells (Fig. 3) that retained their capacity to divide and they are responsible for the formation of lateral roots.

The rest of the central cylinder (Fig. 4) consists of alternating groups of primary xylem and primary phloem embedded in a parenchymatous ground tissue. The vessels of the primary xylem are responsible for transporting water and solutes taken up by the root, to the transport systems in the stem, leaves, flowers and fruit. The phloem elements of the primary phloem receive the products of photosynthesis (photosynthates) that were loaded into the phloem elements in the leaves, via the phloem in the stem. These photosynthates are then either consumed by the roots or stored in the cortex cells and ground tissue of the vascular cylinder.

Except for anchoring the plant in its substrate, the other functions of the roots are therefore:

- the uptake and transport of mineral ions from the substrate through the xylem system to other parts of the plant and
- receiving photosynthates via the phloem system and storing it in the cortex and ground tissue of the vascular cylinder

Comparing the root structure of the species

C. mirabilis: C. mirabilis has a massive, succulent root system and individual roots are up to 15-20 mm in diameter (See Rourke in Clivia 4) and therefore thicker than those of any of the other species where the diameter of the roots vary around 5-10 mm. The velamen is thinner than that of the other species and consists of about two to four cell layers (Fig 5).

It is covered with root hairs and stretches up to the very tip of the root, meaning that there is hardly any part of the root where live root hairs make contact with live cells of the cortex. The striations of the velamen cells are not as conspicuous as in most of the other species. The cortex contributes to most of the diameter of the root, indicating that the roots of *C. mirabilis* have become true storage organs (Fig 6). In the other species the rhizomes are thick and fleshy and are better storage organs than in the case of *C. mirabilis* where the rhizomes are not as thick and the roots have taken over most of the storage function.

Roots of the other species.

Roots of the other species are thinner (5-10 mm) than those of *C. mirabilis*. All the roots are densely covered with long, persistent root hairs (Figures 1, 6 and 7). The thickness and number of cell layers of the velamen vary amongst the species. In *C. nobilis* (Fig 6a) and *C. caulescens* (Fig 6b) the velamen is about 8-10 cell layers thick (about 0.27 mm to 0.3 mm) while in *C. miniata, C. robusta* and *C. gardenii* (Fig 7) it consists of only 5-6 cell layers and is only about 0.2 mm thick. The thinnest velamen of 2-4 cell layers (about 0.1 mm thick), was found in *C. mirabilis*. In a study of the velamen in orchid species, Sanford and Adanlawo (1973) found that the "presence of epivelamen, number of velamen layers and shape of the epivelamen and velamen cells are remarkably consistent within broad taxonomic groupings". The thick, multi-layered velamen of *C. nobilis* and *C. caulescens* on the one hand, the thinner velamen of *C. miniata, C. robusta C. gardenii* on the other and the exceptionally thin velamen of *C. mirabilis* are very striking, and relates to some extent to the cladistic relationship between these species that was reported by Conrad and Reeves (Clivia 4).

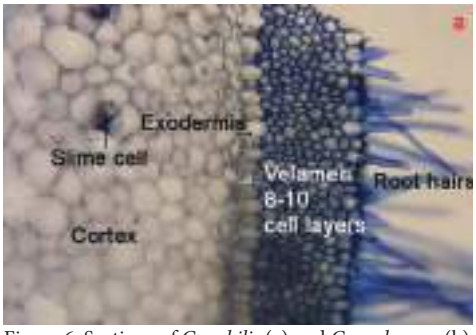


Figure 6: Sections of *C. nobilis* (a) and *C. caulescens* (b) roots showing thick (8-10 cell layered) velamen

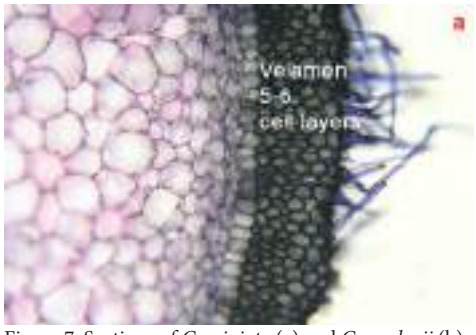
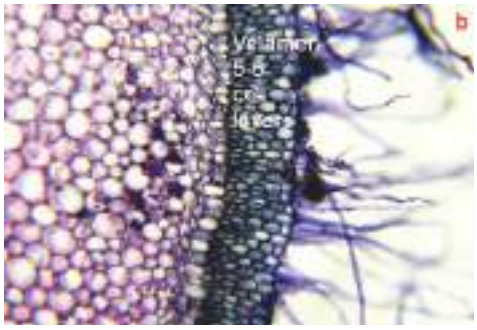


Figure 7: Sections of *C. miniata* (a) and *C. gardenii* (b) roots showing medium thick (5-6 cell layered) velamen





The striations or reticulate thickenings of the velamen cell walls normally do not occur on the root hairs, but in *C. robusta*, even the root hairs contained very prominent striations

Except for the thicker roots of *C. mirabilis* and variation in the thickness of the velamen, the roots of all the species look very similar, also having a similar function.

Function of the velamen

Research on the functioning of the velamen has been done exclusively on the aerial roots of epiphytic orchids. Dycus and Knudson (1957) came to the conclusion that the function of the velamen of epiphytic orchids roots is mainly for protection against water loss and that absorption is restricted to the adpressed portions where the roots make direct contact with supporting medium. However, they also mention that "The velamen cells and exodermis are modified if the aerial root enters the potting medium or affixes itself to a solid substratum. Absorption of water and nutrients can then occur and transportation to the cortex and stele is possible". *Clivia* roots are not aerial roots and are mostly found inside the substrate and should therefore be able to absorb water and nutrients. Considering the fact that *Clivia* have no other roots than those with a velamen and the fact that the velamen covers the root up to or very close to the root tip, there is no other alternative for absorption of water and nutrients except for via the velamen. This statement has, however not been properly researched and unless this is done as a matter of urgency we will never fully understand the nutrition of *Clivia*. Velamen cells are dead and dead cells can only allow apoplastic transport, but the problem is that the cell walls are impregnated with the corky substance suberin that does not allow for apoplastic transport! This leaves us in a difficult situation as how to proceed but we still do feed them and they do respond to nutrition.

The same kind of fungus illustrated in figure 8 was observed in most of the root sections. Could this be a kind of mycorrhiza? It is a well-known fact that mycorrhiza are associated with the roots of many plant species where they play a role in the uptake of nutrients especially phosphorus. This observation also requires further investigation.

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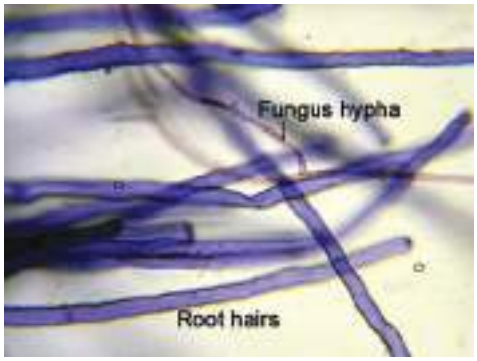


Figure 8: Fungus hyphae amongst root hairs of *C. miniata*

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Do Clivia have Roots?

Joanna Dames, South Africa

Plants do not have roots…they have fungal roots.

Soil is more than just an accumulation of sand and clay – it is a frontier where the battle for existence, food, space and resources wages continuously. Bacteria and fungi are just some members of this underfoot community and they congregate in and around the roots of plants that grow in the soil-forming microbial societies. Within these societies there are microorganisms that promote soil health, preventing the decay that becomes prevalent in an unruly society. A group of critically beneficial soil microorganisms are the mycorrhizal fungi. These fungi grow by producing straw-like filaments in the soil connecting plant roots to the soil and environment, similar to the network of cables connecting our world. The energy source required for these fungi to grow is obtained from the sugars that plants produce, a renewal resource resulting from solar power and carbon dioxide. In return for this energy plants have access to nutrients required for their own growth provided by the extensive fungal cable network. As in our own community, when the source of energy is affected chaos reigns and bad elements cause havoc. The undesirable microbes then cause disease which affects the growth of plants, causing stunting, wilting, decay and root rot.

Mycorrhizal means fungus root and closer microscopic examination of the majority of plant roots reveals that in undisturbed healthy soils the roots are more fungus than root. This symbiotic relationship occurs between plants and fungi and has existed for over 450 million years. The successful transition of plants from their aquatic to terrestrial existence is due largely to the presence of these fungi. These fungi live within the roots of plants and extend their fungal filaments into the soil environment where they search for nutrients such as phosphorus far beyond the plants own rooting zone. These nutrients are absorbed by the fungi and are transported back to the plant where specialised structures inside the root (Fig. 1) will allow these nutrients to be shared with the plant in return for energy. The branching tree-like structures seen within the roots are called arbuscules and characterise this group of mycorrhizal fungi as the arbuscular mycorrhizas.

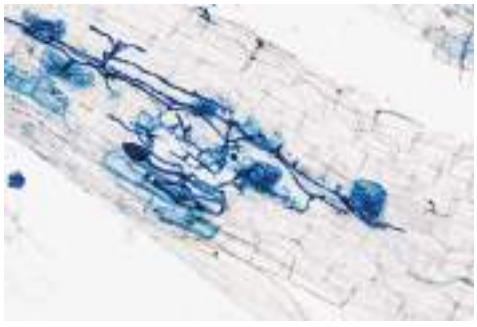


Figure 1: Specialised fungal structures within plant roots (stained sections) allow for nutrients to be transferred to the plant in return for energy in the form of sugars which are needed for fungal growth. Arbuscules are the finely branched tree-like structures.

It is estimated that for every one millimetre of root there is over a metre of fungal filament forming a network in the soil, which can extend beyond the plant roots. This ultimately results in the plant gaining access to nutrients that normally wouldn't be available to it. The mycorrhizal fungi form a secondary rooting system, which assists with plant growth. In natural undisturbed soils mycorrhizal fungi are common inhabitants. Soil that has

been degraded by over-fertilisation, particularly of inorganic phosphates, indiscriminate application of pesticides and physical disturbance, ends up with reduced populations of these beneficial fungi. Reintroduction of these fungi ensures that plants such as vegetables, shrubs, trees and grasses can take advantage of their numerous benefits. Plants belonging to the Amaryllidaceae family such as *Clivia* also benefit from this relationship. The benefits that you will see include improved plant growth, as is evident by the "little plant - big plant" syndrome.



Ian Brown's 'Ghost' Photo: Claude Felbert

The improvement in plant growth is due to improved nutrition of the plant and this indirectly enhances the plants tolerance to diseases and stress. Other benefits often ignored relate to the soil environment. The most important component of a healthy soil is the organic matter that in undisturbed environments is generated through falling leaves and decaying vegetation. Soil microbes work hard to release the nutrients bound up in the organic matter so that these can be recycled back to the plant, providing natural food. In an artificial environment organic matter can be supplied by applying compost and mulches. Humic acids are a breakdown product of organic matter and contribute between 2-5% of the soil organic carbon. Arbuscular mycorrhizal fungi produce a protein that is released into the soil. This protein is called glomalin and contributes between 6-14% of the soil organic carbon. This is a pool of soil carbon that we almost totally ignore and one that depends entirely on the presence of these mycorrhizal fungi. Inoculating plants with suitable mycorrhizal fungi can more than double the amount of glomalin in the soil. Glomalin has been called the superglue of soil, as it enhances the aggregation of soil particles allowing for better moisture holding capacity and improving the structure of the soil.

Ensure that your garden or nursery environment has the benefit of these amazing fungi and let them assist you with creating a healthy soil environment. At the root of every healthy plant are mycorrhizal fungi.

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Polyploidy in Clivia

Johan Spies & Hesmari van der Westhuizen, South Africa

Polyploidy appears to be a "magical" term for *Clivia* lovers. The term has even been used as a name for a specific cultivar, because "the cultivar is so easy to grow"! Artificial polyploids are produced by Aart van Voorst in the Netherlands and these plants are in high demand. But what is a polyploid and how will it benefit *Clivia* lovers?

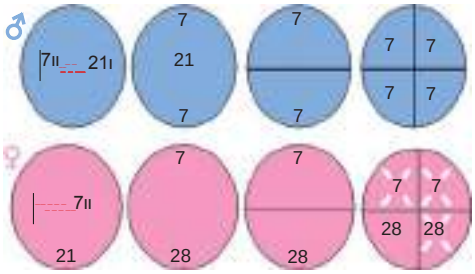
A polyploid is a plant containing more than two sets of chromosomes. In *Clivia* each cell contains 22 chromosomes. The plant receives 11 of these (or one genome) from the berry parent and 11 (another genome) from the pollen parent. A polyploid *Clivia* will consequently contain more than two genomes or sets of chromosomes. With the addition of each genome specific names are assigned to the plant: a plant with two genomes ("normal") is called a diploid; 3 genomes – triploid; 4 – tetraploid; 5 – pentaploid; 6 – hexaploid; etc.

It is necessary to define certain terms before we discuss this issue any further:

- **Somatic chromosome number (abbreviated as 2n):** This is the number of chromosomes observed in a body cell (somatic cell). It is used to indicate mitotic results. Please note that this is not a diploid chromosome number as suggested in many books! In approximately 80% of plants in South Africa the somatic chromosome number differs from the diploid chromosome number and unfortunately the incorrect name is usually used.
- **Gametic chromosome number (n):** This is the number of chromosomes observed in a male gamete (or pollen) of an individual. It is used to indicate results from a meiotic study. It is not always half the number of chromosomes in a somatic cell!

If we look at the example of the English dog rose *Rosa canina* (the whole process is schematically presented below), we see that with the formation of pollen seven pairs of chromosomes participate in meiosis in the normal way, forming seven bivalents on the metaphase plate and segregating normally during anaphase I. Another 21 unpaired chromosomes (univalents) is also present in the same position but these chromosomes do not segregate during anaphase I. During cell division these 21 univalents disappear and four pollen grains are formed, containing seven chromosomes each. Hence the gametic chromosome number is seven.

The situation on the female side differs significantly. With the formation of the embryo sac seven pairs of chromosomes participate in meiosis in the normal way, forming seven bivalents on the metaphase plate and segregating normally during anaphase I. Another 21 unpaired chromosomes (univalents) are also present in one pole of the cell. Meiosis I results in seven chromosomes in one pole and 28 in the other. The second meiotic division is followed by degeneration of three cells and an embryo sac containing 28 chromosomes is formed. This is not the gametic chromosome number! Fertilisation of the 28 chromosome embryo sac by a seven chromosome pollen grain restores the chromosome complement of 2n = 5x = 35 of Rosa canina. This is not the only exception and therefore the chromosome number nomenclature as described, should be used.



- **Basic chromosome number (x):** This is the lowest gametic chromosome number in a taxon.

In nature the overwhelming majority of plants will be on an even ploidy level, di-, tetra- or hexaploid. The reason for this is that uneven ploidy levels usually cause unbalanced chromosome segregation during meiosis, resulting in sterility. This phenomenon is often used by plant breeders to cross a diploid (2x) with a tetraploid (4x) to obtain a sterile (often seedless) triploid (3x). Even in *Clivia* this phenomenon can be used: cross a diploid with a tetraploid and sell the seeds. The resulting plants will be sterile and can only be propagated with vegetative reproduction (offsets) or tissue culture. In this way the original breeder has a perpetual market with his/her seed production and sales.

Another advantage of a polyploid is that the polyploid plant is usually larger than its diploid counterpart. The leaves will be thicker; flowers larger and even the pollen will be larger. Unfortunately the price for this increase in size is a slower growth rate. However, there are also disadvantages linked to polyploidy. It is difficult to breed with polyploid lines. If a recessive mutation occurs in a diploid plant and you self-pollinate the plant, approximately ¼ of the offspring will exhibit the mutation.

You start with a "normal" diploid plant with two copies of a certain gene, for example AA. One of these genes now mutates to a, thus your plant is now Aa. You self-pollinate the plant and obtain the following results in the F1 according to Mendelian genetics:

	A	a
A	**AA**	**Aa**
a	**Aa**	**aa**

However, if you get the same phenomenon in a tetraploid (4*x*) plant, the result is that no F1 offspring will exhibit the trait and in the F2 generation only 1/16 of the plants will show the recessive trait.

You start with a "normal" tetraploid plant with four copies of a certain gene, for example AAAA. One of these genes now mutates to a, thus your plant is now AAAa. You self-pollinate the plant and obtain the following results in the F1 according to Mendelian genetics (no plant exhibits the recessive trait):

	AA	Aa
AA	**AAAA**	**AAAa**
Aa	**AAAa**	**AAaa**

If the AAaa offspring is self-pollinated (remember, you do not know which plant carries this gene combination, so you will have to self-pollinate all the F1 offspring), only 1/16 will exhibit the trait.

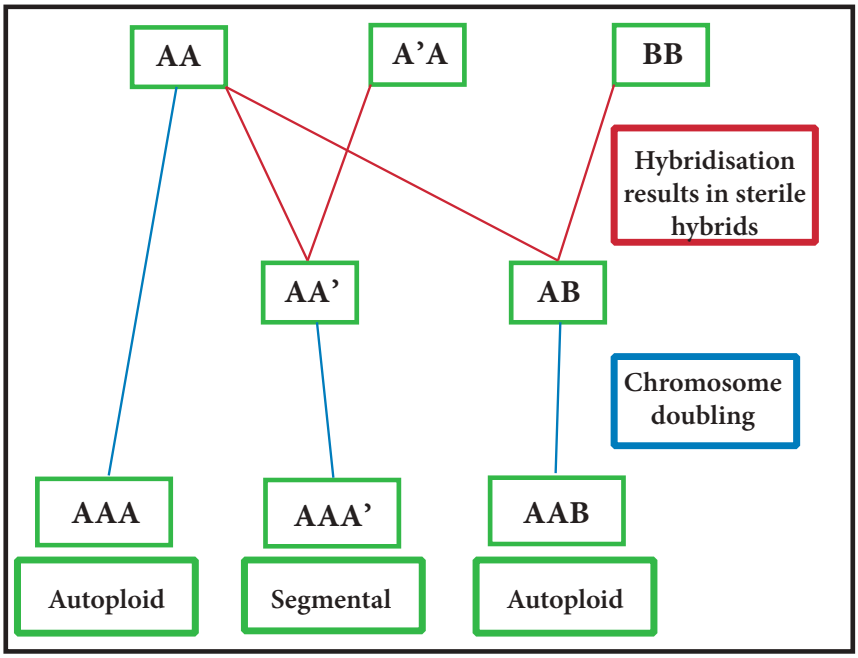
	AA	Aa	Aa	aa
AA	**AAAA**	**AAAa**	**AAAa**	**AAaa**
Aa	**AAAa**	**AAaa**	**AAaa**	**Aaaa**

The result is that you will have to propagate many (hundreds) of tetraploid offspring to obtain the same result as with a few diploids (tens of offspring).

Things can get even more complicated. Three different types of polyploids have been described. Autoploidy is where the same genome has been multiplied. The plant will contain four sets of chromosomes (genomes) which are very similar. This will happen for example if one uses colchicine to double the chromosome number. The existing chromosomes are doubled and no "new genes" are added to the plant. A study of meiosis in an autoploid plant will reveal that the different sets of chromosomes pair with one another and four chromosomes will pair instead of the two observed in diploids. The morphology of the chromosomes will place them in groups of four.

Alloploidy involves cases where two species have hybridised and the chromosome number of the hybrid doubled. If the chromosomes did not double the plant would have been sterile. This is an increase in chromosome number involving different genomes. Where the autoploid will contain AAAA genomes, the alloploid will contain AABB genomes and only two chromosomes will pair. During meiosis the alloploid will mimic a diploid plant and chromosome morphology will indicate groups of two chromosomes.

The third type of polyploidy is called segmental alloploidy and occurs when partially similar genomes are doubled. This implies that some chromosomes of the four genomes are similar while others differ, resulting in chromosome morphology that will group two chromosomes together in some cases and four in others. In addition to these three types of polyploidy various combinations of the different types occur.



In autoploids and segmental alloploids you get a tendency towards diploidisation, where the plant will act more and more like a diploid plant through time. The reason for this phenomenon is that "competition" for chromosome pairing occurs in autoploids. Since the initiation of chromosome pairing is random, you may get the formation of a quadrivalent (four chromosomes pairing), two bivalents (two pairs of two chromosome pairing) or even the formation of a trivalent (you have guessed it - three chromosomes pairing) and a univalent. Quite often a univalent will not participate in meiosis and the chromosome will get "lost" during cell division. This leads to reduced fertility. With a quadrivalent the orientation of this group of chromosomes will determine whether you get a 2-2 segregation (fertile) or a 3-1 segregation (infertile). So, through a process of natural selection, the number of plants which form more bivalents will gradually increase. Any structural changes to the chromosomes that cause them to form bivalents instead of multivalents will have an evolutionary advantage. Structural chromosome changes in plants are quite common. In a very extensive study on South African grasses we observed many inversions. One species, *Tribolium brachystachyum*, contains at least one inverted chromosome pair in every specimen!

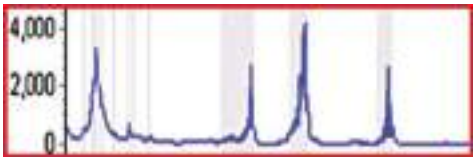
In nature autoploids are almost non-existent. Although some molecular studies suggest autoploid origins for some natural population, this is not backed up by cytogenetic studies. In nature alloploidy (increase of different genomes) or segmental alloploidy (increase of similar [but not identical] genomes) reigns. If we look at large plant families we see various basic chromosome numbers in each one. Usually you get x = 5, 6, 7, 8 and 9, as well as numbers like 11 (5 + 6), 13 (5 + 8 or 6 + 7), 17 (8 + 9), etc. The higher numbers can usually be derived from the lower ones. Remember, we are dealing taxonomically with plant groups (eg. families) based on what we observe today. In the past (10 000 - 100 000 years ago) each basic chromosome number could have represented a family. Due to hybridisation between them we now consider them to be one family because of morphological overlap. This is for example the case in families such as the Verbenaceae and Hyacinthaceae. In the early 80's Peter Goldblatt (Missouri Botanical Garden, USA) did a study on different basic chromosome numbers in families of flowering plants and concluded that all basic chromosome numbers higher than 9 were secondarily derived (as we indicated above with 11 = 5 + 6, etc.).

Following this line of thinking, the genus *Clivia* has a secondary basic chromosome number of x = 11 and is, by implication, a polyploid plant. However, we are dealing with an ancient polyploid (at least tens of thousands of years old). A well-known case where ancient polyploidy has been established is maize ($2n = 2x = 20$) that should actually be $2n = 4x = 20$. Chromosomal changes, however, of the duplicated genomes resulted in totally different looking chromosomes but almost all the genes are duplicated, although the sequence of the genes often differs.

So getting back to *Clivia*: we should look further for the closest relatives, if they are still alive! The link between *Clivia* (putative genomes AABB) and *Cryptostephanus* (putative genomes AACC) may be a pivotal genome (AA) present in both, with the other genome differing. If *Clivia* originated as an alloploid, the ancestors could be $2n = 2x = 10$ ($x = 5$) and $2n = 2x = 12$ ($x = 6$) {although this seems unlikely if we look at the different basic chromosome numbers of the Amaryllidaceae}. A combination of

these genomes (i.e. alloploidy) will not show similar chromosomes (autoploidy or pairs of four), but it will contain duplicated genes. With chromosomal evolution some of these genes may disappear over time. This may be the reason why it is so difficult to find normal Mendelian segregation in *Clivia*.

With the research done in our laboratory we have observed many indications of more than two copies of certain genes. Genes may be duplicated in a genome without polyploidy. But the number of genes where we find signs of duplication exceeds the number expected by "accidental duplication" of genes. Duplicated genes in the anthocyanin pathway of *Clivia* will be discussed in future issues of *Clivia*. Duplicated DNA areas leading to four copies of the DNA instead of two will also be discussed in future issues of *Clivia*. At this stage we just want to show an example of a microsatellite analysis of a *Clivia nobilis* specimen clearly showing four alleles instead of the expected two. In a diploid specimen a maximum of two peaks would have been visible.



Our conclusion at this stage is that *Clivia* represents an ancient polyploid. More genes should be studied and eventually we will have to use *in situ* hybridisation techniques (FISH) to determine whether these copies occur on different chromosomes. Within the next five years we should be able to present more evidence on the validity of this hypothesis.



Photo: Tino Ferero

David Brundell's Vico Yellow New Zealand Hybrids

Georges van Son's Cryptostephanus

Greig Russell, South Africa



The Young Georges van Son

Evidence from DNA phylogeny indicates that plants of the genus *Cryptostephanus* are the closest relatives of *Clivia*. Of the three known species in this genus, *C. vansonii*, although rare, is the one most commonly encountered in cultivation and thus there is a small, constant stream of comment about this species in the *Clivia* literature and on related Internet groups and forums. Most of this comment deals with sources of material, and ideas regarding the culture and hybridisation potential of this plant. Little is available in the popular literature dealing with the history of this species or the origin of its name. In Koopowitz's *Clivia*, this aspect received scant attention; all that was said is that "It was named for a Mr. Van Son who flowered a plant in his garden near Pretoria, South Africa, and the species was described in 1943". The beautiful origin of the genus name was also not explained by Koopowitz in his work. Duncan (2002) offered more regarding the history and naming of this plant. The point of this piece is to fill in and expand on this subject.



The older Georges van Son for comparison purposes

Cryptostephanus is a genus that was erected in 1878 by John Gilbert Baker (1834-1920), the Amaryllid expert at Kew; the name having been coined some years earlier in manuscript by Friedrich Welwitsch (1806-1872). Welwitsch was the man whose name has been immortalised in that weird, two-leaved, cone-bearing plant of the Namib; the one that appears more suited to the set of a sci-fi movie than real life - *Welwitschia mirabilis*. He is also noted for being the first important botanist to work in Angola, collecting there from 1853-1861 and discovering many hundreds of thenceto unknown species of plants and animals.

The plant for which the generic name was created, now known as *Cryptostephanus densiflorus*, is Angolan, but more recently it has entered the Namibian national plant list courtesy of Dr Peter Bruyns. It is known from less than a handful of herbarium specimens (mostly from the type collection) and living material is not apparently yet to be found in cultivation.

On close examination of the flowers, Welwitsch observed that hidden within the flowers of his plants, at the top of the

floral tube, there were six small appendages pointing outwards that look like a crown or corona. The genus name *Cryptostephanus* is derived from the Greek words κρυπτος (transliterating as 'kruptos') meaning 'hidden' and στεφανος (transliterating as 'stephanos') meaning 'crown' (the names Steven, Stephanie, Esteban, etc. all mean 'Crown'). The crown may be seen in all three currently-accepted species of *Cryptostephanus*, and in *C. vansonii* and *C. haemanthoides* this crown is even more elaborate, as each of the six processes is bifurcated towards the tip yielding a crown with twelve ornamentations. Crown-like structures can also be seen at the mouth of the floral tube in *Tulbaghia* (wild garlic) and *Cyrtanthus herrei* (a plant initially believed to be a species of *Cryptostephanus*). Contrary to what has been said, the species epithet does not commemorate "a Mr Van Son", but rather 'THE Mr van Son'. Georges van Son, who both first collected the plant and then later flowered it in his garden, was one of a handful of scientific greats working in South Africa in the middle of the 20th century. He is best known as the chief entomologist of the Transvaal Museum in Pretoria who primarily worked on butterflies; and aside from a whole slew of entomological papers, he wrote up his life's work in the four volume *The Butterflies of southern Africa* (1949-1979 - the last volume having been published posthumously).

Georges van Son was born at the Castle Gorodistsche, Narishkino in the province of Orel in Russia, about 200 km south of Moscow on the 1st October 1898 (or the 19th September by the Julian calendar if you prefer - which is how it would have been rendered on his birth certificate, as Russia only adopted the Gregorian calendar in 1902), He was the child of a French-born, Dutch diplomat, Henri Stéphane van Son, and a Russian Countess, Comtesse Nathalie Kamarowsky. His first-language was French and he was schooled initially by private tutor. He spent much of his childhood observing and studying nature on his family's estate, "Doubròva". His father was a keen amateur entomologist. At a young age Georges had learnt from the estate head gardener how to graft roses and fruit trees, but was unable to pursue his interest in gardening while enrolled at a military cadet school, followed by a period with the Marine Corp at St Petersburg. During this time, in the service of the Imperial Russian Navy, he visited China and Japan.

While he was on a cruise, the Russian Revolution of 1917 began; this altered the course of his life forever. His father was shot by a Bolshevik sniper in July 1918 and the family's wonderful estate was laid to ruin. Georges, together with his mother and sister, Eleonore (b. 1900), were imprisoned; but he was sometimes released to play the piano for a butcher's wife! With great hardship and some help from the Dutch Embassy (who apparently altered some details on Georges' father's diplomatic passport), Georges managed to flee with his mother and sister from Russia to France in 1921, and then on to Holland to his father's family.

In Holland, he learnt to speak fluent Dutch and he found employment firstly at the Zoological Laboratory in Utrecht, then the Colonial Institute in Amsterdam and finally the Rijksmuseum in Leiden. He also spent time in London learning entomological technique. He was then recruited by the Dutch-born Dr. A. J. T. Janse of Pretoria, as a personal assistant to work with Janse's private entomological collection and came out to South Africa at the end of 1923. In 1925 he was appointed entomologist at the Transvaal

Museum. Having no formal education, he studied as an extramural student through the University of Pretoria, gaining a B.Sc., M.Sc. and ultimately a D.Sc. in 1948. Some of his great attributes were his generosity, enthusiasm, excellent memory, an encyclopaedic knowledge of insects, his love of field work and his mastery of six languages; he often acted as translator for other museum staff. In 1936 he married a Miss Elfrieda Saunders (b. Johannesburg, 1910) and their honeymoon comprised a field trip to the northern Transvaal! They had three sons, born between 1939 and 1949. Georges van Son became a Fellow of the Royal Entomological Society, President of the South African Entomological Association and he was also President of the South African Biological Association.

His interest in botany and horticulture, rekindled after his arrival in South Africa, was expressed in collections of succulents and orchids. His interest in suculents derived from his participation in the legendary Vernay-Lang Kalahari Expedition of 1932. He was both entomologist and botanist on this expedition, emerging from the bush at the end of the expedition with, amongst others, 1 800 botanical specimens. In 1934 he made a trip to Europe where he swopped succulent seed for orchid plants which he brought home to Pretoria to cultivate. He seems to have been the first South African to have made and raised orchid hybrids.

Field trips to assemble a world-class butterfly collection for the Transvaal Museum allowed him to travel widely in southern Africa. On a trip in 1935 to the Vumba Mountains, a short distance south-east of Mutare (formerly called Umtali) in eastern Zimbabwe, he encountered and gathered non-flowering plants of an unknown amaryllid growing under trees and among rocks on a southern slope of these mountains at an altitude of about 1 700 m (5 500 feet). When plants were first seen by the staff of the National Herbarium, the growth-habit of was thought to resemble that of a *Clivia*. However, when flowers were finally produced in van Son's garden in October 1942, this assumption was proved to be wrong. This new species was described as *Cryptostephanus vansonii* in *Flowering Plants of South Africa*, vol. 23 of 1943, as plate 885; appearing in the same volume of this work as the first description of *Clivia caulescens* (plate 891).



The plate of *Cryptostephanus vansonii* (plate 885) accompanying the original description of this species in *Flowering Plants of South Africa*, 1943

Georges van Son died on the morning of the 29th of May 1967, at his home in Pretoria North, after a long period of ill-health. He has been commemorated in the names of a large number of organisms; there are species or subspecies with

the name *vansonii* in nine genera of butterflies, at least four genera of beetles, a wormlion fly, another fly, a lacewing, a leaf miner, a grasshopper, a spider and a solifuge. Van Son's Thick-toed Gecko and a subspecies of Yellow-fronted Canary are also named *vansonii. Vansonia* was a genus of pipistrelle bats which has not survived taxonomic scrutiny. Amongst the plants, there is a grass, a stapeliad (now sunk into *Orbeopsis lutea*) and, of course, *Cryptostephanus vansonii*. Plants somehow attract the attention of some of the most amazing people - and here, surely, we have a fine example of such a person.

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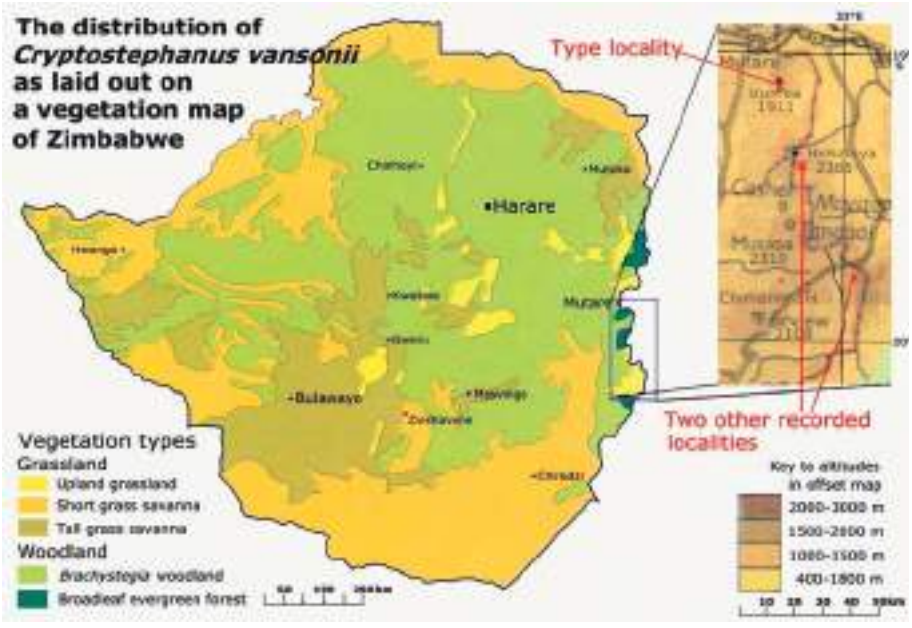
Other references commonly given, eg McNeil (1963), Bennett (1980) and Saunders (1998) contain no original information.

I have assembled some material on Georges van Son as a pioneer South African orchid grower, and have published a piece on him in *Orchids South Africa* **37:** 94-99 (2006), with my collection of material and a fairly comprehensive bibliography available on: http://pennypoint9.hostrator.com/vanson/

Thoughts on growing *Cryptostephanus vansonii*

(*Bearing in mind that I haven't yet attempted growing one of these myself*).

C. vansonii is a narrow endemic with a small range in the eastern highlands of Zimbabwe, south of Mutare. It has been found in the Vumba, in the eastern Chimanimani, and over the Mozambique border in the Himalaya Mountains (I bet you didn't know there were any Himalayas in Southern



This map indicates the distribution of *Cryptostephanus vansonii*, which occupies just the smallest corner of Zimbabwe; itself not a huge country.

Africa!). This distribution ranges along about 75 km of the escarpment. What is particularly interesting about these mountains is that they are all granitic.

Granite soils have particular characteristics. They are acidic, very low in calcium and phosphorus, high in potassium and able to hold onto some nitrogen. Plants of *C. vansonii* have been seen to grow in pads of leafmold atop granite boulders (Koopowitz, 2002, p. 62). This area gets about 65 cm (30 in) of rain per year mostly in the warm summer months, which is not a great deal in such a warm environment, and electric storms bring down some nitrogen in forms that plants can assimilate. It is also obvious that those common flying fertiliser-spreaders, birds, would contribute notably to the mineral nutrition of the plants, supplying quantities of calcium, phosphorus and nitrogenous compounds.

I would guess that these plants would do best in a fairly shallow tray (*ca.* 8-10 cm deep) well crocked with a layer of medium granite chips, in a compost of small granite chips, leaf mould and peatmoss (an expedition to the base of Paarl Rock may be useful for acquiring the granite chip component). The plant should not be over-watered, rather using the rule of giving water today if you think it will be totally dry tomorrow. If possible use rain water. Fertilise with bird manure (I like rock pigeon droppings the best - but that's because I have these pests living on and fouling my property), by placing a walnut-sized lump (per 2-3 litres of compost) on top of the compost, far from the plant, and letting physics and chemistry do the rest; repeating this about every four months.

The temperatures in this plant's natural range resemble those experienced in Pretoria in summer, but on average these localities are about 3º C warmer than Pretoria in winter; the plants should thus not be considered frost-tolerant. In late autumn place a suitably perforated piece of 20 mm polystyrene sheeting under the tray and top dress with a layer of dryish, mature, dark leafmould to help insulate the roots from the cold.



Cryptostephanus vansonii
Grower:
John van der Linde

Photo: John van der Linde

A Selection of Photographs from some Clubs and Interest Groups

EASTERN PROVINCE CLIVIA CLUB — 2008



Best on Show 2008 — Grower Annemarie Chalmers



Runner-up tp Best on Show:

Grower: Charl Coetzee



Winner first time flowerer — Grower Utopia Nursery



Winner first time flowerer — Grower Luke Kruger



Winner Any Other Pastel — Grower Willie le Roux



Winner Peach — Grower Ian Vermaak



Winners Eastern Province Show 2008

Eastern Province Photos courtesy of: Charl Coetzee

Garden Route Clivia Club — 2008





Above — Class Winner Grower Gerrie Brits

Left — 2008 Show Hall



Class Winner — Grower Piet Claasen





Garden Route Photos courtesty of: Gordon Fraser

Left — Class Winner
Grower Ricky and Noelia Jardin

Left Below — Class Winner
Grower Piet and Jeanette Theron

Below — Class Winner — Gordon and Yvonne Fraser





Above: Best Flower on Show
Grower: Fritz van Schalkwyk





Above middle: First Runner-up
Grower: Geoff Meyer

Above Bottom: Second Runner-up
Grower: John Handman

Right Top: Best Leaf Plant on Show
Grower: Paul Kloeck

Right Middle: Second Runner-up - Leaf Plant
Grower: Hilton Atherstone

Right Bottom: Second Runner-up - Leaf Plant
Grower: Roy Williams







Joburg Clivia Club — 2008



Joburg Clivia Club — Best on Show





Above: Joburg Clivia Club — First Runner-up

Left: Joburg Clivia Club — Second Runner-up
Joburg Photos courtesy of : James Haxton

Overberg Clivia Interest Group — 2008



Overberg Show Winners

From the left:
Carrie Krűger
Danie Meiring
Felicity Weeden





Above: *C. miniata*
Grower:
Piet & Rina van der Merwe

Left: *C. miniata*
Grower: Ernst Ferreira

Waterberg Photos courtesy of Rina van der Merwe



C. miniata — Grower Bets Rossouw





Above: C. miniata — Grower Bets Rossouw

Left: C. miniata — Grower Piet & Rina van der Merwe

Cape Clivia Club — 2008



Best on Show — Orange Broad Tepal — Grower Felicity Weeden



Winner — Orange Narrow Tepal — Grower John van der Linde

Cape Photos: Claude Felbert



Second Runner-up — Interspecific — Grower Ian Brown



Section Winner Cape Show



Section Winner — Grower Johan Schoombe



Best Own Breeding — Grower Ian Brown



Example from Cape Show



Example from Cape Show



Example from Cape Show



Winner Bronze — Grower — Ian Brown

KwaZulu-Natal Clivia Club — 2008



Best on Show — Grower Liz Boyd







Above Left: First Runner-Up — Gem Wild Flowers Grower Gem Wild Flowers

Above Right: Best Peach — Grower Liz Boyd

Left: Second Runner-Up — Grower Liz Boyd

KZN Photos courtesy of Clive Graham



Best on Show — Gardenii Show: Robusta Yellow — Grower SANBI



Second Runner-Up — Grower Gem Wild Flowers



First Runner-Up — Grower Gem Wild Flowers



Winner Gardenii Peach — Grower Gem Wild Flowers



Winner Gardenii Blush — Grower Little Falls Clivia

Clivia mirabilis in Habitat

Ian Coates, South Africa

I was privileged to visit three *C. mirabilis* habitat sites in November 2008 and spend a day at each, a hastily arranged trip which I found tremendously informative. Each site was different and therefore interesting for that reason alone, as they are three of only a few known sites where *C. mirabilis* is to be found. Although there are kilometres of seemingly suitable terrain I had to wonder why there are only these three small sites and two others known. Since the plant has adapted to these fairly diverse habitats, why are there not many more of them?
(In future other sites may still be discovered but as the area in question is somewhat remote - Eds)



Wow! *C. mirabilis* in all its glory

Site 1

The first site is only about 5 000 square metres in its entirety. It is near rectangular and *C. mirabilis* plants stop abruptly at its borders. It is situated at an altitude of over 750 metres and consists of large boulders, some several metres across, on a steep slope with plants growing in compacted shale and sandstone which has washed down or fallen from the decaying escarpment above and rests between the boulders.



A young seedling. Note the root which is partly on the surface and coarseness of the 'soil'

The site is densely populated by shrubs, which provide almost complete cover from the sun, and also falling leaves and twigs for some nutrition and surface aeration for the plants. Falling *C. mirabilis* berries will roll to the lowest point, which is usually against the next boulder a few metres downhill.

Due to the severity of the climate, seeds ripen much quicker than other *Clivia* species in order to germinate during the autumn rains. I got the impression at all sites that, whereas some plants had flowered the previous year and even possibly a few in mid-season, the majority flowered only every four years or so. Although many plants were growing in clumps, it appeared that this was merely because they were in a natural collection place for seeds. There was very little sign of plants forming offsets. The only evidence I saw of any pollinators on the plants were ants and earwigs



A mature *C. mirabilis* has taken root between boulders and fallen branches

Birds were friendly but seemed to show no interest in the flowers. Maybe they were waiting for the berries and there are more evident potential pollinators between sunset and sunrise.

Site 2

The second site is several kilometres away and is much further below the escarpment, next to a river at 440 metres in altitude. Like the first site, it faced South West.



The steeply sloping Site Two with *C. mirabilis* growing in the shelter of a bush

which seemed to enjoy nibbling the edges of the petals. There were a few well camouflaged butterflies around but none were seen on the plants.

Although again very steep, (see bottom right of image) there are no big boulders here and the shrubs are much thinner on the



Two of the few possible pollinators seen - an Ant and a Butterfly

ground. But it is now these shrubs which stop any seeds from rolling further downhill and Mirabilis grow from the heart of them thus obtaining some shade and nutrient. (circled area). The slopes probably average 45 degrees. It was from this site in the 1960's that the current farmer picked an umbel and gave it to his mother. She liked it so much that she sent him back for the plant but nobody realised its significance until this century. There are other stories of the plants being known to be grown in local gardens at even earlier dates.



C. mirabilis growing next to bushes at Site Three and partially exposed to the direct sun

Site 3

Site three was back high up near the escarpment at around 650 metres in altitude and several kilometres further away and, this time, facing South East. It was much larger than the others and displayed a combination of their characteristics - a mostly shrubby overgrowth with large boulders spread out on the steeply sloping ground of two small valleys, one of them with a small stream running through it. Seeds here are now mostly rolled to areas of level ground between the boulders and halted in their path by small stones or fallen branches. The farmer told me that later in the year there are quite a number of birds and they have been seen taking the berries. If any seeds are dropped, this is presumably within the local area and will aid the distribution.

At this third site, a few *C. mirabilis* grew right to the edge of the shrub cover and spent some of the day in direct midday sun at temperatures exceeding 35 Celsius. They did not seem adversely affected although none grew completely beyond the shrub cover. By contrast, it rained for most of a misty day at the first site and plants were covered with rainwater whilst in full flower.

Even heavy rain mostly ran off the compacted soil surface. It was noticeable that many plants at all three sites were near-surface rooting. I assume this was both because of the near impossible effort required to grow roots deeper and the need to get that surface moisture.



A *C. mirabilis* flower drenched after late seasonal rains



The exposed roots of *C. mirabilis* showing the hard soil below and the leafy detritus on top

Variation between plants

The plants at all the sites were fascinatingly variable. They have grown in probably ever diminishing areas for millions of years and the pressure of survival is still producing a wonderful variety of plants. It is well-documented that some plants have a median stripe on their leaves, whereas others do not, and some have a retuse tip.



A selection of leaf tips

Cross section of a leaf



The stripe can vary considerably in width and, in some cases, will split into several stripes. Even on the same plant, the stripe and retuse tip can be present or not according to the age of the leaf. A few plants have leaves significantly paler in colour and less tough materially, more like a *C. robusta*. Leaf length varies from around 60 cm to more than 160 cm in exceptional examples. Several plant leaves have blunt edges as shown in the sectional photograph. Some of the larger plants, but not all, were close to areas of concentrated animal droppings where it was evident that the increased nutrition resulted in increased plant growth.

However, most noticeable, was the variation in the flowers. The numbers of flowers on an umbel can vary from less than 20 to over 60. I believe all my observations were made on similarly mature plants so that they make a valid comparison. The colour of the peduncle and leaf base is variable and there is often considerable magenta colouring to them, but by no means always. The pedicel also varies in colour, as shown in the illustrations, but most striking is the variation in the flowers.



A typical overhead view of a *C. mirabilis* umbel

Regeneration

Very sadly, all was not good news on the sites. One of them had not a single plant under four or five years old. I was told that

dassie (a hyrax the size of a very large rat) were prevalent there and this was evident by a number of concentrated areas of animal droppings (middens). Apparently, they just love the berries.



Some plants show strong magenta pigmentation on their stems, leaf bases and peduncles



A dassie midden between boulders

The most shocking thing of all is my final illustration. Several plants at one site had leaves with markings on. I assumed from the one shown that alien pollen had been taken onto the site, possibly from a yellow Miniata and a Daruma. I hope I am wrong, but can see no other explanation. A single seed from this could, over time, contaminate the whole site. This is a protected habitat and I am horrified at the total irresponsibility of this action by a supposed plant lover. Such damage can never be undone.



Four umbels showing a range of flower colour and shape

I was also told that seed had been collected three years ago by man. Estimates vary greatly as to how much was taken. However, for me to not see even a single seedling in a full day, for whatever reason, was of great concern. Are we to lose another habitat? Thankfully, the second site seemed much healthier regarding seedlings and the third was thriving. The same birds seem to exist on all three sites so I do not think they can be responsible for the total lack of seedlings at site one.



A spectacle worrying in the extreme – introduction of alien genetic material into the habitat

My thanks must go to so many people but especially the farmers and their families for allowing me access and for their tremendous hospitality, and also the *Clivia* lovers in Pretoria and the Cape who helped and hosted me so generously. As I was leaving, I learned of another small, newly discovered site and hope to study this in 2010.

In closing, I would ask everybody to respect the privacy of the farmers and the future well being of all *Clivia* in habitat - especially *Clivia mirabilis*.



Photo: Claude Felbert

Clivia miniata 'Floradale Apricot' — Grower Mick Dower

'Floradale Apricot' was grown from seeds imported from New Zealand by Floradale Nursery, Beacon Bay. The source of these seeds and the breeding is unkown. The plant is an excellent plant to use for breeding and has produced many interesting hybrid flowers. 'Emma Leslie' and 'Katie D' and all the other siblings from this cross done by Mick Dower are outstanding. Emma Leslie can be seen on the back of Yearbook Five. Eds.

As Good as it Gets
Clivia mirabilis — 'Jadestone Angel'

Gerhard Faber, South Africa

Ever since the discovery of *Clivia mirabilis*, I was fascinated by this true wonder of nature. Dr John Rourke's article in CLIVIA 4, pp.5-12, started a passion and desire to learn about and understand these plants better. Being born and raised in the old Southwest Africa, I had a pretty good idea of the incredible harsh growing conditions of another marvel of nature, namely *Welwitschia mirabilis*. If, I thought then, *C. mirabilis* is anything like the miraculous *Welwitschia* then I just have to find, visit and investigate these plants in habitat.

My research took me on a year long emotional rollercoaster ride where sudden adrenalin injected excitement were followed by the lowest of lows imaginable. This all changed, however, when unlucky Friday the 13th became my lucky Friday the 13th October 2006 as all my efforts were justly rewarded when Mother Nature opened her arms for Karen and me and allowed us to share in her magnificence. I had the privilege and pleasure to photograph my dear wife, companion and friend, Karen, in amongst a newly discovered habitat on a farm in the Western Cape. It is extremely harsh terrain and conditions and to honour her I jokingly refer to my plants as *Clivia mirabilis Karensis*.



Karen Faber in 'Mirabilis Country'

I am extremely fortunate to legally own a collection of *C. mirabilis* under the necessary permit and also posses a license to breed and sell protected flora. Two plants that are morphologically identical look completely different to any other habitat *C. mirabilis* I have ever seen. These are compact plants with rigid, upright leaves between 50 and 60cm long and 4.5 - 5cm wide. The leaves have beautiful medial a-chlorophyll lines as well as outer a-chlorophyll edging. The leaf colour at the base is not the characteristic carmine but rather a nice interplay of green and carmine.

When the first one flowered they were very different and truly unique. Apart from the incredible colouration it is novel in that the tubular flowers flare at the mouth, uncommon in the species. The tepals, ovaries and pedicels have a strange mottled effect, especially where the anthocyanins are present. Roger Fisher speculated in Clivia News, volume16, number 2, p.8 that *C. mirabilis* 'Candy Carousel' is a plant to watch and that a hybridising program should yield interesting results. He was so right because next thing Leisl Brandt phoned me with the exciting news that she has got a green stemmed seedling of *C. mirabilis* 'Candy Carousel' X Self. On closer inspection I found that I also had green stemmed seedlings and George Mann confirmed that he also has one. The other seeds that I had given away did not survive and some seeds were confiscated in Australia so unfortunately we will never know

their outcome and progeny. On account of the results I do have, it looks as if Candy Carousel yields roughly 25% green stem seedlings. They grow very slowly but I hope to update you in a couple of years with a nice flower. [Picture of green stemmed seedling]

This year the Garden Route Clivia Club had



A 'Green Stemmed' *C. mirabilis* seedling

a display of *C. mirabilis* at their show and I decided to exhibit the other plant because it was pushing a flower that was two thirds of the way up. Those who visited our show will remember it very well. Although aware of the fact that Candy Carousel yields green stemmed seedlings, I never in my wildest dreams expected or was prepared for what was about to unfold before my eyes, a yellow *C. mirabilis*. The ivory, yellow and green flowers opened one by one with the same flaring mouths as *C. mirabilis* 'Candy



C. mirabilis 'Jadestone Angel'

Carousel'. The ivory white top of the peduncle sprouted ivory white pedicels that coloured to light green where they join the light green/yellow ovaries. The flowers maintained this colour for two weeks and then started turning a bright butter yellow colour which lasted until the flowers withered and dropped. In the last week of flowering the anthocyanins fought like crazy to come through and the ovaries and pedicels got a most desirable and spectacular light caramel mottled effect. All flowers resembled



C. mirabilis 'Jadestone Angel' with the anthocyanin effect showing

angels, complete with flaring skirts and glowing halos and the plant was aptly named *C. mirabilis* 'Jadestone Angel'.

Future breeding

My future breeding program with *C. mirabilis* will largely revolve around these two unique plants and another plant, *C. mirabilis* 'Karen's Blush', that is a *yellow C. mirabilis* that blushes right at the end of flowering. Unfortunately both yellows did not set a single seed with a variety of crosses and it looks as if there is a potential fertility problem. The pollen of both are male fertile but do not readily take on other plants. I have, however, been successful with some crosses and achieved a good seed set on certain plants. Although these plants have got the potential to revolutionise Clivia breeding, in particular interspecific breeding, only time will tell what they have in stall for us as a Clivia community.

Conclusion

I do think that yellow mutations are possible in *C. mirabilis* but doubt if they will ever be found in habitat. These plants need lots of protective anthocyanin in order to survive the brutal conditions under which they grow, especially when the seedlings are young and frail and at their most vulnerable. I lost some green stemmed seedlings in my greenhouse and really have to pamper the remaining ones to keep them alive and growing. I am convinced that yellow mutations will not survive in nature and yellow flowering forms of *C. mirabilis* will have to be produced by means of cultivation. For plants that originate from habitat I think that *C. mirabilis* 'Jadestone Angel' is about as good as it gets.

C. mimiata 'Karen's Blush' before the blush begins to appear. Note the butter yellow ovaries that enhance the flowers yellow tones.



The Early Discovery of *Clivia* at The Bearded Man

Trevor Pearton, South Africa

The wagon road from Barberton to Lourenço Marques (Maputo) that was used by Percy Fitzpatrick and his fellow transport riders passes over the Makonjwaan Mountains on the eastern flank of the peak known as "The Bearded Man" (elevation 1335 metres a.m.s.l.). The mountain gets name from its shape, which is that of a man's head facing upwards with a bearded chin (the indigenous forest on the southern slopes). The planting of eucalyptus plantations on the northern slopes has now spoilt that appearance. The old wagon road wound its way up from Swaziland crossing the mountain range at the site of the historical Kings Hotel on the Swaziland side of the border (the location is marked roughly on Google earth images – only the foundations now remain). Thereafter the road snakes its way northwards through the mountainous terrain down into the fertile farmland of Louws Creek, now the site of Louisville, the erstwhile capital of the Kangwane homeland.

The early access to these mountains resulted in explorers discovering a number of gold mines in the hills north of The Bearded Man. The mines, Crown, Maid O' The Mist, Clifford Scott, French Bobs and Daylight, all form part of the current Barbrook Gold Mine. Although discovered prior to 1900, the mines were worked intermittently and the depth of workings was shallow because the gold could not be extracted from the deeper ores. In 1939 African Geophysical first consolidated the various mines and mined out the oxide ores but they too had difficulty treating the deeper unoxidised ores. In the early 1960's Rand Mines acquired control of these mines and initiated a drilling campaign to explore the property fully. A geologist and naturalist by the name of Donald Macaulay was employed by Rand Mines to map out the gold reefs in the area. He noticed the beautiful collection of *Clivia* at the manager's house and mine offices which were situated in the mountains near the Clifford Scott mine. The plants had been collected by the mining entrepreneur E. T. Andrews from The Bearded Man. The locality was well known by the early English speaking residents of Barberton and coach trips were taken annually by the manager's wife and friends to see the plants in flower.



A view of the Bearded Man



Photo: Felicity Weeden

C. miniata from Bearded Man grower: Felicity Weeden

Rand Mines moved the mine offices to the valley and the old buildings were stripped of useful materials and the site left to decay. Only the foundations can be found today and then only by the few who know where to look. As part of the relocation, Macaulay moved plants from the mine offices to his home on the hillside above Barberton.



Examples of flowers from the Bearded Man



I joined Anglovaal (the mining company which owned ETC mines) and moved to Barberton in 1980 to join the exploration team set up to revive the search for new gold deposits in the mountain land. Macaulay also joined this team and, having similar interests, we worked together for 6 years learning much about both the geology and the plants of the mountain land. Although we talked about the *Clivia* on The Bearded Man, I did not visit the locality, probably because Donald was old and not fit enough to make the trip. When I left Barberton in 1987, Donald gave me a plant as a parting gift. When this plant flowered together with the few other plants that I had in Johannesburg, I noticed that the flowers were very pale but much larger than my other plants. It was only in about 2001 after I had made a few amateur hybrids of this plant, that knowledgeable *Clivia* enthusiasts informed me that the plant was special. By this time Donald Macaulay had passed away but his widow was very willing to give me suckers of a selection of plants from his collection. These have formed the main breeding stock of my collection and cover a wide variety of forms and colours. Among these plants was an interspecific which came from the area 'A' as described by Attie Le Roux. This plant was eventually described as new *Clivia* taxon in 2006 – *Clivia* x *nimbicola* (Swanevelder, Z.H., Truter, J.T. & Van Wyk, A.E., (2006). *Amaryllidaceae: A natural hybrid in the genus Clivia*. Bothalia, 36(1), pp. 77-80.). I visited The Bearded Man for the first time in 2002 and have made a number of trips to the area at various times of the year. On my first visit I collected at area 'A', a 15 cm piece of stem which had broken off at both ends (red ant damage) and which had two shoots 2 cm long with a distinctive pink colour at the base. This stem gave me two plants (one of which I swapped with Sean Chubb) which flowered as true nimbicolas with large pastel pink flowers.



Clivia growing in the Bearded Man habitat

A Layman's Observations of the Habitat of Clivia x nimbicola

Attie le Roux, South Africa

In 1969 Koos Nel and Elise Buitendag of the Lowveld Botanical Gardens went to The Bearded Man Mountain (a peak of the Sondeza Mountain range on the border of South Africa and Swaziland) to collect some *Clivia* plants for the then newly established botanical gardens. In 1985 Willem Froneman, horticulturist at the gardens, noticed that one of the plants was different to the other Bearded Man *C. miniata* in the garden. He spoke to Prof. John Rourke from the Compton Herbarium at the Kirstenbosch Botanical Gardens and John Winter, then curator of the garden, about this plant.



Attie le Roux at the Bearded Man habitat

Despite a number of attempts to locate the plants in habitat, nothing was found. In July 2000 Prof. Rourke, John Winter and Willem Froneman went up to the Bearded Man and found a few flowering plants at what I now call Area B. A few specimens were taken to Kirstenbosch Botanical Gardens.

In about 1983 Elise Buitendag told her brother-in-law, Johan Schoeman, also a plantsman from Barberton, about the habitat *Clivia* at the Bearded Man. Johan, a member of the commandos, a civil department of the South African army, did many patrols on the border of Swaziland and South Africa at that time. He found *Clivia* plants at various localities in the Sondeza Mountains.

In 1998 Johan found what was to be later described as *C.* x *nimbicola* at Bearded Man in the area which I now call 'Area A'. In 2004 I met Johan Schoeman and it was at that time I saw *C.* x *nimbicola* for the first time. In 2005, while arranging the *Clivia* tour with James and Connie Abel I met Steven van der Linde who is stationed at Mondi forest in the Sondeza mountains. Steven is a keen photographer of wild flowers in the veld. It is the locality at Bearded Man to which James Abel organised a Lowveld tour for the delegates to the 2006 the Clivia Conference where Johan and I acted as guides. At the time one plant was in flower, a special treat for all the visitors.



From Area A

In 2007 Steven told me that his two sons frequently hiked in the mountain had found a new locality of what might be *C.* x *nimbicola*. By now I was visiting the plants as often as possible so as to write up all the details I observed. We immediately arranged to visit the new site ± 1,5 km east of Area A, a very steep and rugged terrain. When I saw the plants I could not believe what I saw. There were 22 plants in flower. Thereafter I tried to visit all 3 localities every month.

In October 2008 we went to look at the *C. miniata* that were in full bloom by the thousands. It was a rainy day and everything was wet, but it did not stop us from going down the mountain slope into Swaziland and there, in a hollow on the slope we found *C.* x *nimbicola*, 22 plants in all with no flowers but with plenty of green fruiting umbels. We could not believe what we found. I have called this Area D. This had first been discovered by Trevor Pearton.



The Area D habitat

Only time will tell If there are more areas where *C.* x *nimbicola* are growing in the Bearded Man. Prof. Johan Spies was a member of the 2007 tour and collected samples for DNA analysis. Since then I have supplied him with samples of all these identified areas for DNA testing. The DNA study is not yet complete so that all that he could say to date is that it promises something different. The *C.* x *nimbicola* from the four identified localities are all of differing colours, leaf shape and the like.

Area A (± 12 plants)

This area is easily accessible to the side of the Bearded Man bush and has been much depleted of plants, with only a few plants left *in situ*. The first time it became known was in the 1950's when it was discovered by Mr. E. T. Andrews from Barberton. Flower colour is a salmon pink, with one known light pink colour. The leaves are up to 65 mm wide.



Bearded Man Area A habitat



A pink specimen from Area A

Area B (±25 plants)

This site has the greatest diversity in shape and colour of *C.* x *nimbicola*, from 80 mm lax broad leaves to narrow recurved leaves. Flowers range from dark orange to light pink. The area is about 200 square metres. In 2002 there was a mudslide that took half of the plants down the slope. I have yet to go to the bottom to see if there are any left growing there.

Area C (98 plants)

This area is located to the east of A and B all at the same elevation on a steep rocky ledge. The *C.* x *nimbicola* plants grow in light shade with a few plants growing on top of a rock

ledge in the full sun. The plants in the shade bear dark orange flowers while some plants have flowers with prominent green lips. The flowers of the plants growing on the rocks in full sun are a true red, a short plump flower with large mouth. The leaves are shorter and much more leathery. These plants flower all year around. The tree canopy at Area C is not as dense as in Areas A and B. They also flower 2 – 3 times a year, in a similar fashion to the *C.* x *nimbicola* plants in the Lowveld Botanical Gardens.



C. nimbicola from Area C decimated by Locust

Area D (22 plants)

There are very few plants at different altitudes elevations. The flowers range in colour from a salmon pink to a light orange. The leaves are not as wide as those plants in Area A, which they neighbour, some leaves presenting notched tips.

We hope in future to go and see if there are more areas of *C.* x *nimbicola* plants in the Sondeza mountain range and at The Bearded Man. Of significance in all areas is that all the plants are very old and that there are no young plants or seedlings. The seed of *C.* x *nimbicola* are normally small and when germinated the new roots or growth point are very thin and short. The first leaf of some of the seedlings



A pink *caulesces* from Area D

is so thin that it appears to be a shoot of grass. I think that for seed to germinate and survive in the veld the season must offer ideal conditions. In the Sondeza mountain range there are two or three other localities where *C. miniata* and *C. caulescens* grow in the same habitat but here there are no known natural hybrids or *C.* x *nimbicola*.



One possible pollinator from these areas

I wish to thank the following people: Steven van der Linde, Estate manager of Mondi (Sapico investment corporation); Willem Froneman, Lowveld Botanical Gardens; Johan Schoeman, Barberton; and Trevor Pearton, geologist and a director of Barbrook Mine.
(A goldmine adjacent The Bearded Man)

The Photographic Competition Winners

Entries for the Photographic Competition were down on last year but I am pleased that the winning standard was not. The choices were difficult ones and we include a selection including near misses after this section for you to see. No entry was received in the Habitat section.

Last year I mentioned that we judged both on photographic merit, that encompasses composition and technical correctness as well as flower form and balance. Once this is evident then the 'Wow' factor comes in – is there something about the photograph or flower that stands out above the other pictures.

I believe that the winning pictures all have this 'Wow' factor for both the flower form and the way the image has been presented. Many of the other pictures may have this impact in one or the other aspect but may just miss the boat in the other. Often this is just something small where attention to detail would have made the picture a potential winner.

Congratulations from the judging panel to the Winners and to all that participated. We hope to see your images again next year and ask you to be mindful of all the aspects we use to judge by.

Claude Felbert

BEST PHOTOGRAPH and WINNER of the PENDULOUS CATEGORY
***Clivia mirabilis* 'Jadestone Angel' — Photograph: Gerhard Faber** (See his article on Pg. 40)





Above: Second Placed Pendulous
***Clivia mirabilis* 'Jadestone Angel'**
Photograph: Gerhard Faber

The judges had a long debate about which of the two 'Jadestone Angel' images was the better and in the end it was so close that both images are included in the results of this section.



Right: Third Placed Pendulous:
Clivia caulescens
Grower: G Botha
Photographer: Bridget Randall

RUNNER-UP and the SINGLE FLOWER CATEGORY WINNER



Runner-up to Best Photograph — ***Clivia miniata 'Christo's Bouquet' — Photograph: Felicity Weeden***

Second Placed Single Flower:
Grower: Bets Rossouw
Photographer:
Rina van der Merwe







Above: Third placed Interspecific
Grower: Piet van der Merwe
Photographer: Rina van der Merwe

Left: Third Placed Single Flower
Grower: Joubert van Wyk
Photographer Joubert van Wyk

Below: Second Placed Interspecific
Grower: Piet van der Merwe
Photographer: Rina van der Merwe





First Placed Interspecific — Grower M Connellan — Photographer Bridget Randall



Second Placed:
Clivia miniata **from the Bearded Man**
Grower:
Felicity Weeden
Photographer:
Felicity Weeden



Winner — *Clivia miniata* 'Gordon's Gift' — Grower Gordon Fraser — Photographer Bridget Randall



Third Placed *Clivia miniata*
Photographer:
Michael E. Riska

A Selection of Competition Pictures





Above:
Clivia miniata
'Maria's Gold' —
Photographer:
Bridget Randall

Left:
Clivias miniata —
Photographer:
Joubert van Wyk



Clivia miniata (Yellow) *x Clivia nobilis*— Photographer: Helen Marriott



Clivia miniata — Photographer: Lisa Fox



Interspecific 'Gay Delight' Photo: Helen Marriott





Above:
Clivia miniata
'Stardust —
Photographer:
Gordon Fraser

Left:
Clivias miniata —
Photographer:
S Ferreira



Clivia miniata 'Ghost'— Photographer: Helen Marriott



Clivia miniata — A James and Connie Abel multipetal — Photographer: Micheal E. Riska



An Interspecific — Photographer: Rina van der Merwe



Clivia caulescens
'Snuggle Up'
Photographer:
Gordon Fraser



A Pendulous *Clivia* — Photographer: Bridget Randall



Clivia caulescens — Photographer: Bridget Randall

Cyrtanthiflora's Début

Greig Russell, South Africa

The ongoing state of uncertainty regarding the nomenclature of hybrids between Clivia nobilis *and* C. miniata *has failed to offer the grower a stable, correct label for such plants. The early history of these hybrids is here examined and the earliest valid name together with date, author attribution and reference located. A narrative account of this search, with ancillary information, is assembled here, followed by a list indicating the correct nomenclature and valid synonyms; and the consequences of this nomenclatural position have been considered. The concept of a "nothospecies" as it applies to* Clivia × C. cyrtanthiflora *is introduced.*

The 'Clivia Fancy' of the twenty first century is a new phenomenon, having only really come to the fore during the final decade of the second millennium. Before this, plants of the genus *Clivia* were widely grown, but more as part of a suite of general flowering greenhouse and garden plants. Now the fancy tends to resemble somewhat the heydays of the Dutch Tulip Craze!

Before the commencement of the Clivia Club/Society in 1992 with its Newsletters and Yearbooks, and the appearance of Thurston's *The Clivia* in 1998[16], Koopowitz's *Clivias* in 2002[1] and a few Japanese and possibly Chinese works, there was no specialist *Clivia* literature - what had been written before was lightly spread through the voluminous and often not readily accessible botanical and horticultural literature of the nineteenth and twentieth centuries.

Notwithstanding, Koopowitz and such authors as John van der Linde[2] and Pierre De Coster[6] have worked towards assembling a comprehensive history of the *Clivia*. Like all histories, agendas have some influence upon the final result, as does ease of access to a wide array of source material. The Internet in 2009 offers the most incredible access to information through various search engines and such resources as Google Book Search. Learning to ask relevant questions of search engines is really the only major obstacle to spectacular enlightenment.

Amidst the numerous facets of *Clivia* that I have interrogated over the last year or so, the history of *Clivia* × *C. cyrtanthiflora* (*C. nobilis* × *C. miniata*) is one that I have found wanting to the point of requiring comment. In this regard, the illustration and description of this hybrid in van Houtte's *Flore des Serres* of 1869-1870[18] (sometimes dated 1877 - which actually refers to the serial number of the plate illustrating this hybrid) is generally offered as the starting point of the history of this taxon. *Clivia* × *C. cyrtanthiflora* does, however, have a history predating this by some ten years, and it is an interesting one. Not wishing to repeat what has been written recently on this subject, I refer the readers to the works of Koopowitz (2002, pp. 32 & 33; 300 *et seq.*)[1] and van der Linde (2003)[2].

Louis van Houtte, Belgian horticultural impresario extraordinaire, was certainly the originator of this hybrid, the pollination having been performed by Charles Raes, a section head at the firm. Charles Raes was primarily responsible for the gesneriads at the nursery, but later worked with the begonias, successfully raising many new tuberous begonias including *Begonia* 'Charles Raes', This latter begonia, described as an improved *B.* ×*sedenii* (*B. boliviensis* x unnamed species

- Veitch 1870) was a single-flowered cultivar with deep vermillion flowers introduced in 1873 and was one of the earliest tuberous begonia hybrids - the breeding of this class of plants having only commenced in the late 1860's. It unfortunately did not contribute to further breeding as it was a sterile plant, this probably as a result of it being an unbalanced polyploid.

In 1869-1870, van Houtte recorded with a certain malicious joy that when first seen by a botanist, *Clivia* × *C. cyrtanthiflora* was assumed to be a new species and prompty named and described as such[18]. The literature from around 1859[12] records that it was in fact the famous British botanist and orchid specialist, John Lindley, who was to be lampooned here. The name "*Clivia cyrtanthiflora*" was coined by Lindley, although it was a manuscript name and was never published by him. Even Louis van Houtte admitted that Lindley was the originator of the name; the plate published in *Flore des Serres*[18] is captioned "IMANTOPHYLLUM CYRTANTHIFLORUM Lindl." A number of reports referring to *Clivia* × *C. cyrtanthiflora* (under variant names) dating from early 1859 [4, 9, 11, 12, 17] that will be discussed further on, suggest that the plant first flowered in van Houtte's greenhouses about that date. Lindley apparently saw it first when he was sent a plant in early 1859 for inspection by van Houtte. A search through the extensive Lindley papers in the Kew Archives should turn up more information on this, perhaps even the original manuscript description.

1859 is a very early date for this hybrid considering the fact that the one parent, *Clivia miniata* had only first been exhibited in 1854; although it had flowered in the two preceding years in the greenhouses of the introducer, Messrs Backhouse of York. Aside from the Backhouse plants, there are no other records of *C. miniata* being exhibited during the balance of that decade, so I can only conclude that van Houtte may have begged pollen from Messrs Backhouse, and he had had the hybrid made on his own plants of the old *C. nobilis*. The early reports of this hybrid are unclear as to whether or not *C. miniata* was used as the pollen parent. Koch and Fintelman state that *C. nobilis* was the pollen parent[7, 11, 12]; van Houtte's note suggests that *C. miniata* was the pollen parent[18].

'Cyrtanthiflor-' is a somewhat uncomfortable name. At first glance it appears to be unusable. Since the time of Linnaeus, botanical names containing mixtures of languages have been either much frowned upon or considered to be illegitimate. In this case, the Greek words κυρτος (kyrtos) means "crooked" and ανθος (anthos) means 'flower' and the Latin word *flora* means 'flower' - hence a 'crooked-flowered flower' in mixed languages! But, in fact, once a botanical name has been created, irrespective of its language of origin, it becomes a Latin word. The genus name *Cyrtanthus* is thus a Latin word. Therefore the only meaning of 'cyrtanthiflor-' is '*Cyrtanthus*-flowered', and it is a completely legitimate name.

Reviewing the spectrum of flower forms that occur within the genus *Cyrtanthus*, it is obvious that Lindley must have had one or other particular species of this genus in mind when he created the epithet 'cyrtanthiflora'. Although I am unable to track down any definitive information in this regard, it would seem to be likely that he was thinking of *Cyrtanthus obliquus*. An original plate of this latter species is reproduced here.



Plate 1133 from *Curtis's Botanical Magazine* of 1808, painted by Sydenham T. Edwards, illustrating *Cyrtanthus obliquus*. The amazing similarity between the architecture of this umbel and that of the relatively unrelated *Clivia nobilis* is a great example of parallel evolution acting to attract a similar pollinator. Image courtesy Missouri Botanical Garden. http://www.botanicus.org

Regarding the showing of *Clivia* × *C. cyrtanthiflora*, the first record of this that can be traced is its exhibition at the *Salon d'Hiver* (Winter Exhibition) of 5th March 1859 in Ghent (Gand), Belgium. Class 18 - for a "flowering plant, newly raised from seed in Belgium"(tr.) - was won by Louis van Houtte with *Imantophyllum cyrtanthiflorum* (in each case I give the actual name under which the plant was recorded), it garnering a silver medal in addition. No description was offered. The record of this was only published in 1861[17].

The first mention in print of this new plant is in an advert that was placed for the van Houtte firm in the *Gardeners' Chronicle* of the 12th of March 1859[3], which gives the following entry amongst others as extracts from van Houtte's List No. 76: ***Imantophyllum cyrtanthiflorum* Lindl., first prize at Ghent Exhibition last Saturday (5 March) as the finest of the plants gained this year by seed. --Louis van Houtte has lately sent the plant in flower to Dr. Lindley's inspection. It is a magnificent mule obtained from *Imantophyllum miniatum* and I. Aitoni (*Clivia nobilis*), splendid long leaves, large heads of flowers, like those of a large-flowered *Cyrtanthus*, shape of the most beautiful *Blandfordia*, fine colour. Very strong plants at 80s each. Sent out only now for the first time. Will soon appear in van Houttes "Flore".**

Fortunately and unfortunately, for various reasons, this does not constitute a valid description as there are no diagnostic characters listed - ie. specific characteristics that are unique, singly or in a combination, to this taxon.

On the 3rd April 1859 at the *Ausstellung des Vereines zur Beförderung des Gartenbaues* in Berlin, *Himantophyllum cyrtanthiflorum* was exhibited, this being reported on and the plant being described by Koch & Fintelman in their *Wochenschrift für Gärtnerei und Pflanzenkunde* of the 21st April[11]. As far as I can discover, this is the first validly published description of this hybrid. In the following issue of the same journal, a week later[12], these same authors expanded on the subject, offering a very comprehensive description and discussion encompassing some 965 words.

On the 16th May 1859, in the Parisian journal, *Revue horticole: journal d'horticulture practique*[9], Johannes Groenland described and discussed *Himantophyllum cyrtanthiflorum*, and an illustration of it was published, based on a plant that was flowering in the nursery of M. Rougier-Chauvière, Horticulteur, of the 11ème Arrondissement, Paris. This material is often cited as the original description of this hybrid, but as it appeared more than three

weeks after that of Koch & Fintelman, this is obviously not the case.

Others consider the van Houtte description of 1869-1870[18] to be the first one published, which is most obviously incorrect.



The fine illustration of *Himantophyllum cyrtanthiflorum* drawn by the French botanical artist, Alfred Riocreux (1820-1912), then illustrator for the *Revue horticole,* which accompanied Groenland's description of the plant[9]

In November 1859, a long article on *Himantophyllum cyrtanthiflorum* appeared in the *Journal de la Société Impériale et Centrale d'Horticulture*[7]. It was written by Pierre Duchartre, a freelance French botanical researcher, writer and editor, destined to become Professor of Botany at Sorbonne in Paris two years later. This work was based on the plants grown by Rougier-Chauvière.

On the 14th June 1860, Messrs E.G. Henderson & Son of Wellington Nursery, St John's Wood, London exhibited a plant labelled *Imatophyllum cyrtanthiflorum* before the Floral Committee of the RHS[4]. In January of that same year, this firm had been offering seed of *Imantophyllum cyrtanthiflorum* (note the different spelling) at 3s 6d/packet in an American gardening journal5, having obviously flowered it in 1859. (It is most strange that the price was rendered in sterling in a New York publication).

All of the above references dealt with plants originated from the van Houtte greenhouses. It has been suggested that the actual parentage of *Clivia* × *C. cyrtanthiflora* could be in doubt, but the work of Ran, Hammett & Murray (2001)[15] has shown that the parentage is as given, namely *C. nobilis* × *C. miniata.* Plastid DNA sequences of *C.* × *C. cyrtanthiflora* and various *Clivia* species (*trnL* and *trnF* with intergenic spacer) from Prof J. Spies and associates recently published on GenBank[8] create phylogenetic trees which demonstrate that the hybrid carries chloroplasts which are in all likelihood those of *C. nobilis*, making this species its mother as plastids are generally inherited only from the female parent.

Combining the various descriptions accompanying the references listed above[4, 9, 11, 12] one can arrive at the following as characterising this original cross:

It is in habit very like *Clivia nobilis*. It has leaves, 70cm in length, 3cm wide, lorate (with slightly wavy margins), less fleshy than *C. nobilis* and with prominent transverse nerves. Unlike *C. nobilis*, the leaf margin is not finely toothed. The leaf tip is bluntish, tending towards that of *C. nobilis*. The leaves are arranged in two rows (distichous), up to 7 on each side and cover each other at the bases so that they create a kind of trunk. Being elbowed at the base, they stand somewhat outward.

The double-edged scape is convex on the sides, erect, 2.5cm wide at the base, however only reaching the length of 40cm. As in *C. nobilis* the flowers are presented in a down-turned arrangement; compact as a result of their very short pedicels and their considerable number, this being 20 plus flowers.

The flowers have the colour, the size and somewhat the form of those of *C. miniata*, being quite large and bell-shaped, but are however less fully open, about 5cm in length, being drooping, slender and tube-funnel-

shaped, over-hanging on short pedicels and up to 2.5cm in width on completely opening. The colour seems closer to that of *C. nobilis*. At first it is more yellow, but provided with a glimmer of the colour of red lead; however, as the flower unfolds more and enlarges, the latter colouring increases especially on the side facing the light. Only the hooded tips of the flower tepals are green.
The globular ovaries resemble those of *C. nobilis*, those of *C. miniata* being elongated.

***Clivia* × *C. cyrtanthiflora* as a nothospecies**

As many *Clivia* fanciers have cut their teeth on the nomenclature of cultivated plants while studying orchids, it appears to be generally believed that this latter group of plants would serve as a good model for the naming of the former. Unfortunately the nomenclature of cultivated orchids represents an exception rather than the rule.

In orchids, the nothospecies concept is applied only to natural hybrids, whereas in most other groups of plants, a nothospecies is any hybrid, naturally occurring or an artificial hybrid, at the species level, that is named in terms of the International Code of Botanical Nomenclature (ICBN)[10]. Like all specific epithets, the name of a nothospecies is in lower case and is italicized; but this epithet is preceded by a multiplication sign to indicate its hybrid nature. A multiplication sign is available on the character maps of most widely used computer fonts such as Ariel, Verdana and Times New Roman. In cases where a special multiplication sign is not available, eg. on a typewriter, a lower case, un-italicised x may be substituted.

Clivia × *C. cyrtanthiflora* is a nothospecies, and there is a long history of the usage of this name. Its validity may be explored and the consequences of its status as a nothospecies should be considered. To do this, reference needs to be made to the ICBN. The current version in use is the Vienna Code published in 2006[10].

ICBN 40.1. *In order to be validly published, names of hybrids of specific or lower rank with Latin epithets must comply with the same rules as names of non-hybrid taxa of the same rank.*

This requires publication in printed matter available to botanists and the general public. It should be accompanied by a description or diagnosis of the taxon. From this, the date of effective publication and authorship should be determined. The earliest publication of the concept is considered to have priority and this yields the accepted name.
ICBN 33.2. *Before 1 January 1953 an indirect reference to a basionym or replaced synonym is sufficient for valid publication of a new combination....*

Regarding the hybrid under consideration, it was originally described in a genus (*Imantophyllum*/*Himantophyllum*) that is no longer accepted as valid, and thus a new combination was required to place the hybrid into the now-accepted genus *Clivia*.

In the case of *Clivia* × *C. cyrtanthiflora,* the following relevant nomenclatural list may be assembled:
Clivia cyrtanthiflora Lindl. *ms. ca*. 1858-1859, *ined*.[12, 18]
Himantophyllum × cyrtanthiflorum Lindl. ex K.Koch & Fintelm. *Wochenschr. Gärtnerei Pflanzenk.* 2: 122-123 (1859)[11].

Since *Imatophyllum* and *Imantophyllum* are simply orthographic variants of *Himantophyllum*, it is not necessary to characterise their first instances of publication in combination with cyrtanthiflorum.

Clivia × *C. cyrtanthiflora* (Lindl. ex K. Koch

& Fintelm.) T.Moore in Lindley, J & Moore, T. (eds.) *The Treasury of Botany: A Popular Dictionary of the Vegetable Kingdom*. **1:** 300 (1866)[14].

> Moore lists "*C. cyrtanthiflora*" in his list of valid *Clivia* names and mentions the basionym - *Imantophyllum cyrtanthiflorum*. This is chronologically the first instance of the publication of a legitimate combination of *Clivia* with *cyrtanthiflora* that I can find.

Regarding the name/s applicable to related hybrids and subsequent generations of hybrids, the ICBN10 has the following to say:
H.4.1. *When all the parent taxa can be postulated or are known, a nothotaxon is circumscribed so as to include all individuals (as far as they can be recognized) derived from the crossing of representatives of the stated parent taxa (i.e. not only the Fl but subsequent filial generations and also back-crosses and combinations of these). There can thus be only one correct name corresponding to a particular hybrid formula; this is the earliest legitimate name in the appropriate rank, and other names to which the same hybrid formula applies are synonyms of it.*

The implication of this is that any hybrid containing only the genetic material of *C. nobilis* and *C. miniata*, irrespective of the proportions of the two parents present in the progeny, is named *Clivia* × *C. cyrtanthiflora*. This is a relatively unsatisfactory state of affairs. *C. miniata* × [*C. miniata* × (*C. miniata* × *C. nobilis*)] and *C. nobilis* × [*C. nobilis* × (*C. nobilis* × *C. miniata*)] will both land up being called *Clivia* × *C. cyrtanthiflora*, but will barely resemble one another.

More information can be attached to a plant by tagging a clonal or cultivar name on behind the nothospecies name; this being used to differentiate exceptional plants. But this still leaves the bulk of the hybrid progeny having a name that is rather devoid of much useful information.

The addition of F1, F2, etc. for straight-up 1st, 2nd, etc. generation hybrids, and Bm and Bn for simple backcrosses to the parental species, covers some of the basic permutations; but where complete records are sought, any breeding that is more complicated requires that the cross be written out in full, perhaps taking up more space than a reasonable label could provide. Where clones or cultivars are registered, the full breeding of a plant would be recorded by the Registrar.

Whereas the use of grex names as suggested by Koopowitz (1998)[13] is inapplicable, "(Minicyrt Group)" (Koopowitz 2002)[1] and similar epithets for each of the different hybrid formulas may be created and combined with the name *Clivia* × *C. cyrtanthiflora* to create further clarity.

I hope that this note does not discourage anyone from pursuing the wonderful potential in terms of colour, form and the carriage of flowers inherent in the advanced breeding of *Clivia* × *C. cyrtanthiflora.* That would really be a disaster.

Acknowledgements

Grateful thanks to Pierre De Coster for forwarding a copy of the material from *Flore des Serres*, to Frikkie Marais and Keith Hammett for kindly reviewing the script and to Rafaël Govaerts at Kew for offering nomenclatural pointers.

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Photo: Anthony Miracolo

C. miniata 'LoB Sparrow' Grower Anthony Miracolo

Breeding the 'Universal Yellow'

Kerrie McElroy, Australia

In April of this year a number of posts to the Clivia Enthusiast e-group revealed that some members were hoping to breed a *Clivia* that was both a Group 1 and a Group 2 yellow. In the course of the e-group discussion, Mick Dower coined the term 'universal yellow' to describe such a plant. A number of issues arose from the discussion and they are mostly considered within Part 1 of this article along with the method for breeding a 'universal yellow'. One issue, in particular, raised questions that would be relevant to other breeding programs. This is discussed in Part 2 of this article.

Part 1 – Breeding for a 'Universal Yellow'

Breeding a 'Universal Yellow' from a known Group 1 yellow and a known Group 2 yellow would take two generations of breeding over about 10 years. The predominant characteristic of Group 1 and Group 2 yellow clivias is yellow flowers. A universal yellow would presumably also have yellow flowers; therefore I wonder what the objective of such a breeding program would be. Regardless of the objective, let us consider the feasibility of breeding for a 'universal yellow' and some other issues raised by the discussion about this.

To consider the feasibility of such an aim, we should start with what is already known about breeding for yellow flowers. It has been established by Koopowitz that there are a number of genes involved in the production of flower colour in *Clivia*. Each gene can exist in a number of versions, known as alleles. The alleles responsible for Group 1 and Group 2 yellows are mutated versions of two different genes. For the sake of clarity, let us call these Gene 1 and Gene 2. Gene 1 has at least three known alleles. These are: the allele responsible for Group 1 yellows; the allele responsible for Chubb's Peach; and the fully functioning allele that allows for orange flowering plants. Gene 2 has at least two alleles, one of which is responsible for Group 2 yellows and the other which allows for orange flowers. In breeding for a universal yellow, the allele for Chubb's Peach can be ignored.

Let us refer to the alleles as in the table below:

Gene 1 allele for Group 1 yellow	a
Gene 1 allele for orange	A
Gene 2 allele for Group 2 yellow	b
Gene 2 allele for orange	B

Clivias have two copies of each gene, one from each parent. For a *Clivia* to be a Group 1 yellow, it must have the genotype aa for Gene 1 (i.e. it is homozygous recessive). If the genotype for Gene 1 was AA the flowers would be orange. If the genotype was Aa it would be heterozygous, having the allele for both Group 1 yellow and the allele for orange, and would commonly be said to be 'split' for yellow. The genotype Aa would produce orange flowers. When considering both Gene 1 and Gene 2, a Group 1 yellow will have the genotype aaBB presuming that it is not 'split' for Group 2 yellow.

Group 2 yellows must have the genotype bb for Gene 2. If the genotype for Gene 2 is Bb or BB, the plant will not be a Group 2 yellow. Group 2 yellows will have the genotype AAbb if they are not also 'split' for Group 1 yellow.

A 'universal yellow' will have the genotype aabb, with Gene 1 being homozygous for the recessive allele a and Gene 2 being homozygous

for the recessive allele b. The first question, then, is how can we arrive at this genotype?

First of all we must start by crossing a Group 1 yellow with a Group 2 yellow. This has apparently been done by Ken Smith and Graham Duncan and most likely by other people as well.

The cross can be represented as follows:

Group 1 yellow		Group 2 yellow
aaBB	X	AAbb
	↓	
	AaBb	F1 (Orange)

where AaBb is the genotype of the resultant F1 offspring.

The phenotype (with regard to flower colour) will be orange, since none of the F1 generation will be homozygous for either allele a or allele b. To test whether the cross has in fact taken place (ruling out stray pollination), the F1 plants should be test crossed back to known Group 1 and Group 2 yellows. In each case the expected outcome will be approximately 50% green-based seedlings, which would flower yellow, and 50% seedlings with pigmented bases, which would flower orange. The yellow flowering offspring of the test crosses will be either Group 1 or Group 2 yellows but will not be 'universal yellows', although approximately half of them will be 'split' for the alternative group.

Of the F1 orange plants resulting from a cross between the two yellow groups, arguably the most important and best known is Kirstenbosch Supreme. Mick Dower told the e-group that "Kirstenbosch Supreme is a hybrid of Kirstenbosch Yellow (Group 1) x Kirstenbosch Natal Yellow (Group 2) = a very good big umbel; orange with deep yellow centre; recurved petals; and protruding stamens (see back cover of Yearbook 2)". With regard to test crosses, Mick went on to say, "Crossed with Group 1 yellows it has produced very good green stem yellows and red stem pastels. There is no record of its having been crossed with Group 2 yellows, so I did that last year – see #97 on our seedlist". Anyone growing this seed would do well to remember that there are four possible genotypes (with regard to the two genes we are discussing) that can be expected from this cross. These are: Aabb; AaBb; AAbb and AABb. The first of these, Aabb, will be a Group 2 yellow 'split' for Group 1 yellow. AaBb will be an orange plant with the same genotype as our F1's from the crossing of the Group 1 yellow with the Group 2 yellow, and will be 'split' for both Group 1 and Group 2 yellow. The third genotype, AAbb, will be a Group 2 yellow, and the fourth one, AAbB, will be an orange 'split' for Group 2 yellow. Thus the importance of breeding records can be clearly seen.

To return to breeding for a 'universal yellow', the second cross should be between siblings of the F1 cross, or by self-pollinating an F1 if it is possible. Thus we have the cross AaBb X AaBb.

The outcomes of this cross can be determined most easily by the use of a punnett square as below, where the left hand column and the top row contain the possible genotypes of the eggs from the ovary parent and the pollen sperm cells and the other squares show the possible genotypes of the F2 offspring.

	AB	Ab	aB	ab
AB	AABB	AABb	AaBB	AaBb
Ab	AABb	AAbb	AaBb	Aabb
aB	AaBB	AaBb	aaBB	AaBb
ab	AaBb	Aabb	aaBb	aabb

It can be seen that there are 16 possible outcomes with regard to genotype in the F2 generation. Only the genotype aabb is homozygous for both Group 1 and Group 2 yellow and could be said to be a 'universal yellow'. There are six other genotypes that will give the phenotype of a yellow flower. This outcome is dependent upon the independent assortment of Gene 1 and Gene 2 during the formation of the egg and sperm cells. If the genes are linked on the same chromosome, the chance of breeding a universal yellow would be considerably reduced.

Let us assume that the two genes under consideration are not linked. Then in the F2 generation we have a 1 in 16 chance of achieving a universal yellow. This raises some other issues. Firstly, how many F2 plants would we need to grow to have a fairly certain chance of producing at least one universal yellow? If you only grow one seed from the F2 generation, there is a 1 in 16 chance that it will be "it". Conversely, this means there is 15/16 or a 94% chance that it is **not** a universal yellow. If you grow two seeds, the chance of **not** getting the universal yellow is 15/16 x 15/16, or 88%. To reduce the chance of **not** getting a universal yellow in the F2 generation to 1%, it is necessary to grow 66 F2 seeds. So if you grow 66 F2 seed, there is a 99% percent chance of having at least one 'universal yellow'. This means that there is still a 1 in 100 chance of not getting a universal yellow.

The second issue is how to distinguish the universal yellow from the other yellows of the F2 generation. Unless the colour of the flower is significantly different, this could only be achieved by test crossing all the F2 yellow flowering plants back to known Group 1 and Group 2 yellows. Only the universal yellow should produce all green stemmed seedlings when this is done. Given the number of seedlings involved this would be a huge task. None of the green-based seedlings from the test crosses would be universal yellows. If the aim is to breed a universal yellow, this presents another issue because these seedlings should then be discarded.

Part 2 - Dominant Epistasis and The Trouble with Yellow

Another, and perhaps the most important issue, was raised by Mick Dower during the e-group discussion. An excerpt from one of Mick's e-mails is as follows: 'If you do succeed in breeding a yellow that has a pair of both Group 1 and Group 2 mutated genes are there then TWO "blocks" in the anthocyanin pathway and if so can one of them "kick in" before the other? And if so, which one?' In effect, Mick was asking, if a *Clivia* is bred which is homozygous for both Group 1 yellow at Gene 1 and homozygous for Group 2 yellow at Gene 2, could one of these genes be dominant over the other?

We are used to thinking in terms of one allele being recessive or dominant to another allele of the same gene. When a gene is dominant over another gene, this is called dominant epistasis. In fact, since flower colour in *Clivia* is determined by multiple genes, dominant epistasis is an important issue to consider. In the case of Group 1 yellows, Gene 1 is exhibiting epistatic dominance over the other genes involved in production of flower colour, while in Group 2 yellows, Gene 2 is exhibiting epistatic dominance over the other genes. I do not know the answer

to Mick Dower's question, but I suspect that in a 'universal yellow' Gene 1 would have epistatic dominance over Gene 2. Flower colour in *Clivia* is produced by a sequential pathway of chemical reactions and Gene 1 is believed to control a step in this pathway that occurs before the step controlled by Gene 2.

If this were the case, a 'universal yellow' would effectively be a Group 1 yellow. Other more interesting questions arise from this. What if we were to breed a Clivia which was homozygous for the Chubb's Peach allele at Gene 1 and homozygous for the Group 2 yellow allele at Gene 2? In this case Gene 2 may be dominant over Gene 1, resulting in a plant which is effectively a Group 2 yellow. On the other hand, Gene 1 may be dominant and the resulting plant would effectively be a Group 1 peach.

It is possible (and I think likely) that the Group 1 yellow mutation (in homozygous form) is dominant, in terms of phenotypic expression, to all the other recessive gene variants that result in Group 2 yellows, peaches, pinks etc. This has important implications for the breeding of other colours that result from recessive mutations.

Imagine the following scenario:

You obtain pollen from a rare mauve-coloured *Clivia*. Assume that this is caused by a mutation of a single gene which produces mauve flowers when the genotype of that plant is homozygous for the mutated version of the gene. Let us say that it is Gene 3 which can occur in this form and refer to the alleles as follows:

In an attempt to breed for more mauve-coloured plants, you use the pollen on some Group 1 yellows. The cross can be represented as follows:

Gene 3 allele for mauve	**c**
Gene 3 allele for orange	**C**

Where AaCc is the genotype of the resultant F1 offspring. The phenotype of all offspring will be orange, since none of them are homozygous for either allele a or allele c.

Group 1 yellow		**Mauve**
aaCC	**X**	**AAcc**
	↓	
	AaCc	**F1 (Orange)**

When the F1 generation flowers, you pollinate them all with pollen from the mauve flowering plant. This cross can be represented as follows, where the left hand column gives the possible genotypes of the egg cells from the F1 cross, and the top row gives the genotype Ac of the pollen from the rare mauve *Clivia*.

Two of the possible outcomes of the F2 generation will give us mauve flowers, namely the genotypes AAcc and Aacc. It would be easy at this stage to assume that these plants would be true breeding for mauve flowers since they must

	Ac
AC	**AACc**
Ac	**AAcc**
aC	**AaCc**
ac	**Aacc**

be homozygous for the allele c. But note that the genotype Aacc would give mauve flowers in our imaginary scenario but would also be 'split' for Group 1 yellow. If a plant with this genotype is pollinated with the original mauve or the sibling that is not 'split' for yellow, the recessive Group 1 yellow allele of Gene 1 will remain hidden and this could occur for any number of generations.

However, if it is sibling-crossed to another mauve which is 'split' for yellow or if it is selfed, the next generation cross would be represented as in the following punnett square.

The genotype AAcc would give a true breeding mauve-flowering *Clivia*. Aacc would

	Ac	ac
Ac	AAcc	Aacc
ac	Aacc	aacc

give a mauve-flowering *Clivia* carrying a hidden allele for Group 1 yellow just the same as its parents. The genotype aacc will be homozygous for both mauve and Group 1 yellow. Would it have mauve or yellow flowers?

At this stage, only practical breeding results will tell us which genes will exhibit dominant epistasis over which other genes. I asked Sean Chubb if he had any breeding results which support the theory that a gene which is homozygous for yellow would be dominant over another recessive gene that is also in homozygous form. His reply in part said "I have a plant which flowers pink and is bred from my pretty pink line, which also carries the genes for Group 3 yellow (yellow flowers but red berries). This plant when selfed will give you 50% Pretty Pink and 50% yellow with red berries." Rudo Lotter has also mentioned in e-mails that yellows will sometimes result from the offspring of some peach Clivias and he has advised, 'try to keep your groups separate, if possible! Keep dedicated breeding records. Always try to know the background of plants and seeds that you purchase. Never ever interbreed two different groups, if the breeding results are already known.'

In the imaginary scenario given above, the mauve-flowered Clivia could just as easily have been peach or pink or another unusual colour. So a peach or pink flowering *Clivia* may be homozygous for a particular recessive mutation that results in peach or pink flowers, but if it is also 'split' for yellow it is likely to produce some yellow offspring. Thus we have 'the trouble with yellow'! This is of particular importance when buying or selling seeds or seedlings of peach or pink flowering *Clivia*. A test cross back to known Group 1 and Group 2 yellows can be used to determine if a pink or peach (other than a Group 1 peach), is also 'split' for these yellow groups. If the test cross is not carried out, it should not be assumed that a true breeding line has been achieved before practical results verify that it is so.

Sincere thanks to Aart van Voorst for his advice and cofirmation of this article. Eds.

Photo: Mick Dower



A Group One Yellow 'Sky Chase' - Grower Mick Dower

Photo: Auriel Batten



A Group Two - Auriel Batten's 'Dwesa Transkei Yellow'

Selecting Striata Variegated Clivia for Breeding

John Craigie, Australia

There has been a lot written about variegation by more learned *Clivia* enthusiasts in past Clivia Year Books and I encourage readers to go back and review these articles, particularly "Variegation in Clivia" by Ben J.M. Zonneveld in CLIVIA 8. This article is about optimising variegated seedlings from striata (longitudinal) variegation in *Clivia*.

Variegated foliage plants usually attract more interest than plain green ones. One retailer, in expressing a preference for variegated foliage, said he can sell variegated *Clivia* all year round whereas sales of green foliage ones tend to occur best when in flower. But variegated foliage is not for everyone. Whilst very appealing to some, other people may be indifferent or actually dislike variegated foliage. My wife Gail observes that men tend to prefer variegation in C*livia* more than women. I will leave it up to you as the reader to consider whether this is so.

Chimeral variegation

A plant is said to be a chimera when it comprises normal and mutant cells growing adjacent to each other, for example, green and white variegation in a leaf has cells with normal chloroplasts and mutant cells with defective chloroplasts.

Looking more closely at a shoot apex there is an apical dome or meristem consisting of three layers - L.I is the outer layer or epidermis, L.II is the sporoderm and L.III is the core tissue. Striata variegation in leaves can occur when cells in one of more of these layers mutate. If the cell which mutates is located near the crest of the growing point (apical dome), then all other cells which are produced by division from it will also be the mutated type. If the location of the mutated cell is in a region where little further cell division will occur, then the likelihood of detecting this mutation by visual inspection of the whole plant may be low. Hence some plants may appear to be visibly non-variegated but do contain mutated cells and some offsets and siblings from these plants may be variegated.

Chimeras have been classified into three types – sectorial, periclinal and mericlinal but through cellular displacement these types can be modified.

- In Sectorial chimeras a mutation occurs in multiple layers at the top of the growing point, usually a wedge-shaped segment of tissue extending from the epidermis inwards towards the centre of the leaf. Sectorial chimeras are unstable and can give rise to shoots and leaves which are not chimeras.
- In Periclinal chimeras a mutation occurs in one layer at the top of the growing point and typically produces mutated cells that cover the entire tissue layer. Periclinal chimeras are stable to very stable.
- Mericlinal chimeras are produced when the derivatives of the mutated cell do not entirely cover the apical dome. They are generally restricted to one cell layer. Many mericlinal chimeras involve such a limited number of cells that only a small portion of a leaf may be affected (variegated). Mericlinal chimeras are not stable.

In summary, the pattern of cell division, frequency of cell division, and layered organisation of the cells in the shoot apex interact in determining the type of chimera which is produced and the stability of the pattern which results. Since mericlinal and sectorial chimeras are unstable, the likelihood of vegetatively propagating plants with the same morphological pattern from these types is low. In all cases propagation by seed is unstable because all the cells of the chimera plant are not of the same genotype but contain both normal and mutated cells.

Optimising variegated seedling production

Breeding striata variegated *Clivia* is a long term activity with individual plants taking up to several years of age before they flower. As a general observation only about 30% of seed from variegated plants may yield variegated seedlings but individual plants can yield more or less. So it is important to strive to work out how to breed increasing percentages of high quality variegated foliage and flowers. Sometimes assumptions come under serious question, with new growth on a good quality variegated *Clivia* turning either green or albino. Reversion is not unique to *Clivia* and occurs with other variegated monocots, for example, variegated grasses. During micro-propagation of some variegated grasses about 10% of tissue cultured grasses may be discarded as being either green or albino in the flask stage and a similar percentage may be further discarded at hardening off stage. But it does not end there! An even higher percentage of plants tend to be discarded during the growing up stage as the new foliage on some reverts to either green or albino.

Chimeral rearrangement is an inherent fact of life and whilst it can result in many disappointments it can also result in surprises like high quality variegated flowering size *Clivia* which were once, in the absence of a better description, "ugly ducklings" with barely visible variegation when seedlings.







Chimeral rearrangement is shown in the plants above. Note the "old" foliage has less variegation but the variegated pattern is now consuming larger areas of new foliage

Where all three layers in the epidermis are affected, rearrangement may lead to a more stable periclinal chimera where all cells in a single layer are genetically different from the rest of the plant. Ben Zonneveld pointed out in his article that we then have a green plant with a yellowish edge.

Another important consideration is uniformity of variegation of foliage on both sides of a plant. A *Clivia* with perfectly uniform variegation would be rare and may indicate that the variegation may be influenced more by nuclear than cytoplasmic inheritance. And if such variegation is nuclear-inherited then it would tend to come out in the seedlings irrespective of whether the maternal parent is variegated or not. But this has yet to be proved in *Clivia.*

The variegation in the majority of striata variegated *Clivia* is cytoplasmically inherited and is transmitted via the maternal parent. The range in instability can be great with some *Clivia* exhibiting good variegation down one side of the plant whilst the other side is either nearly green or albino. Whilst these *Clivia* may produce some good variegated seedlings, from a sustainable breeding program perspective, it may be better to exclude these and seek out *Clivia* that have more uniformity of variegation on either side of the plant.



Above: Too Variable



Below: More Uniform

The variegation can also be more or less stable on the underside of the leaves.



Leaf Underside



Leaf Topside



Leaf Underside



Leaf Topside

Another important consideration is the pattern of variegation in the foliage. It has been generally observed that there may be a correlation between this pattern and its extension carried up the peduncle, through the pedicels bearing the flowers, and eventually to the fruit. Apparently the strength of this correlation may influence the percentage of seedlings that may be variegated. I started to pay more attention to this relationship in 2008. And at the time of writing this article I inspected about 900 berries from 126 variegated plants.

The variegated pattern up the peduncle, through the pedicels may extend into the buds as shown below.



This variegation pattern in the pedicels and buds may or may not be reflected in the berries as shown in the same *Clivia* plant left and right below.





Thinly striped peduncles tend to produce more variegated pedicels and berries with a greater percentage of stripes than berries with higher percentages of yellow/white or green in them as shown below. These striped peduncles usually arise from striata types with relatively uniform variegation in the foliage.

(See six images below)















But there is one form of striata variegation where there is perfect correlation between the variegated patterns in the foliage, peduncle, pedicels, buds and berries and that is the Mandarin Duck form where the pattern is identical.

In 2007 I undertook an experiment on a Mandarin Duck form with a view to determining whether variegation in seedlings can be predicted from berry colouration. The outcome was as follows:

- The 100% white berries produced either albino or LOB variegates but over time the LOB types also died;
- The 50:50 white/green berries produced all albino;
- The 25:75 white/green berries produced one variegated *Clivia*, some albino and green types; and
- The 100% green berries produced all green seedlings.



The Mandarin Duck experiment added a further dimension to understanding the inheritance of striata variegation with 100% green berries always having 100% green pedicels extending out of a 100% green section of the peduncle. And it is the same with 100% albino berries which have 100% albino pedicels extending out of the white section on the peduncle. It is expected that this relationship and flower outcome may be expected with striata variegated plants. However, from my population of berries from striata variegated plants there are further possible combinations that confound the possible seedling outcomes.

These further combinations include some 100% green berries can be associated with variegated pedicels and some 100% green pedicels can be associated with variegated berries. In the latter case, on closer examination there is variegation running up the peduncle to the base of each pedicel. Also 100% albino pedicels can be associated with variegated berries. Again, on closer examination it can be seen that there is variegation running up the peduncle to the base of the pedicel. Just like the foliage in striata variegated plants, the pattern of variegation in the pedicels can be variable and may be correlated to some and not other patterns in berries. Hence some green berries and albino berries can produce variegated seedlings.









Clivia that have relatively uniform variegation in each pedicel may produce more uniform variegated berries.





One surprising outcome of the Mandarin Duck experiment relates to the 50:50 variegated:green berry. This berry produced all albino seedlings. On inspection there was less non-mutated material to mutated material in the pedicel. Furthermore all seeds in the berry were either fully positioned under or partially under albino peel.

John van der Linde in an article on *The Importance of the Flower Pedicels in Selective Breeding of Variegated Clivia* investigated the proposition by Harold Koopowitz that the degree of variegation in the pedicels of the flowers of variegated *Clivia* may be the best guide for pollinating them to produce desirable variegated progeny with few albinos. Some of the results of that experiment are detailed below:

- Non-variegated fruit on a variegated pedicel produced nine seedlings of which 4 had "good" variegation, 2 had slight striping, 2 had no stripes and one was albino;
- Lightly variegated fruit on variegated pedicels gave 17 seedlings, 11 of which had leaves with "good" variegation, 2 were slightly striped at 6 months, one had no stripes, and 3 were albinos.
- Heavily variegated fruit was borne on pedicels which were also heavily variegated. There were 22 seedlings, 5 of which had "good" variegation, one slight striping, and - significantly – 16 were albinos.

Whilst the sample size was small, the results are consistent with his proposition and in line with views of other notable *Clivia* personalities.

Shigetaka Sasaki in his article "Variegated *Clivia* in Japan", in CLIVIA 5, noted that when Mr Yoshi Nakamura harvests the seeds named "best variegated" he chooses only the seeds that are covered by peel with lots of thin stripes. Shige also suggests selecting flowering size plants that have well balanced striped foliage with about 30% of the leaf surface covered in stripes.

Based upon discussions above, *Clivia* that have relatively uniform striata variegation may have more uniform variegation in the peduncle, the pedicels and the berries than other variegated forms. These *Clivia* may yield

more lightly variegated berries, with or without lightly variegated pedicels, and therefore potentially yield more quality variegated seedlings and/or less albino seedlings than other plants. **However, leaf variegation on its own is not a sufficient predictor to optimise variegation in seedlings.**

An alternate view is that variegation in seedlings is unstable and random because all the cells of the chimera plant are not of the same genotype but contain both normal and mutated cells and the presence of both these cell types may not be detected visually. The fact that variegated berries on 100% green pedicels or 100% albino pedicels can occur when positioned directly above variegated peduncles may lend support to this view.

This year I will undertake a fairly large experiment on variegation involving the germination of many thousands of seed. The berries will be graded based upon the presence or absence of variegation in peduncles, pedicels and the berries. I will also commence an experiment on the contribution of pollen from various forms of variegated *Clivia* to improving variegation in seedlings.

Selection of *Clivia* seedlings

If the preferred striata variegated *Clivia* for breeding purposes is one that has relatively uniform variegation and with no more than 30% of foliage area yellow or white stripes, then these plants would be scarce and rarely available. Most enthusiasts would need to rely on selection from seedlings but which variegated seedlings should be selected as potential breeding stock?

Whilst some variegated seedlings may appear to have relatively stable variegation up to flowering size, the majority may not due to chimeral rearrangement. It is very difficult to make such a selection of seedlings until some "preferred" trend in variegation becomes obvious, which may take a couple of years. Even when the trend does become obvious the re-assortment process in new foliage is ongoing and can result in some seedlings being discarded and some previously discarded seedlings becoming preferred.

Preferred seedlings may exhibit little to no variegation in the older four to six leaves and slightly increasing variegation in newer leaves. But even when these preferred seedlings grow up, the proof in selection only becomes evident by assessing the uniformity of variegation in the peduncle, the pedicels and the berries. And this can change from year to year!



This seedling would be unsuitable due to the rapid increase in variegation



This seedling has potential but note the dramatic increase in variegated foliage at a young age. It the trend continues this plant may be unsuitable



This flowering size plant shows little variegation in the older leaves and moderate increases in variegated new foliage but is the level of variegation adequate to optimise variegated seedling production

Some new striata types?

New striata variegated types are emerging and each flowering season provides an opportunity to further progress the development of new types, including yellow leaf









Striata Variegation

Single Flowers



Single Flower Photo: Joubert van Wyk



Single Flower
Photo:
Helen Marriott

Breeding:
C. miniata (Orange)
x Tango



Photo: Rina van der Merwe



Photo: Sue Kay



Photo: Sue Kay



Photo: Helen Marriott



Photo: Rina van der Merwe



Photo: Felicity Weeden



Above: Photo: Claude Felbert



Left: Photo: Claude Felbert



Photo: Felicity Weeden

Clivia Rendezvous in Japan

Felicity Weeden, South Africa

I was privileged indeed to be invited on a tour of Clivia Breeders in Japan. The group included Marilyn Paskert (organiser) and Rashid Qureshi both from the US, Ian Coates from the UK, Joubert van Wyk and myself from South Africa with Shige Sasaki as our guide, interpreter and driver. I must say at this point, that Shige went far beyond the call of duty and had everything arranged to perfection for us. There is no way we could have found our way as quickly and efficiently without him - always pleasant, always on hand to sort out problems, queries or requests. He did a great job! After traveling by train from Narita Airport, we connected with the Bullet Train (Shinkansen) to Nagoya, where we collected our mini bus.

Our first stop was Mr. & Mrs. Hattori's nursery. A most striking feature was the wall of his office/reception, which was covered with enlarged photos of his special *Clivia*. Here were quite outstanding flowers. Palest Appleblossom-type colouring, others with cream white inners and blushed reverse, others just touched with pink or pastel on the extremities of the inner petals (Sakibeni), and



Mr and Mrs Hattori's Greenhouse - estimated to contain over one million plants



A delicate pink edged flower from Mr Hattori

many other delicate variations. There were also very compact bronze green throats. Among them was an amazing flower with pale green tufting that looked as if had been applied like oil paint with a pallet knife (Crystal). Quite extraordinary. Another exceptional flower was a would-be bronze, but was in fact a lovely wine pink. Again, quite extraordinary! There were also plenty of compact broad leaf oranges in his local dispatch department. Good enough, in fact, to tempt anyone. The plants here were all either really dwarf with broad leaves, or nice compact plants.

I enquired about the potting material used and was informed that it is made up of soil from the rice paddies, gravel and bark. Mr. Hattori also stressed that excellent drainage was essential. His plants were all on expanded wire tables (as were most that we saw) about 2-21/2 feet (77cm) high. Plants were watered by overhead irrigation about ever 10 days and they expect bloom in 3 -31/2 years. (See CLIVIA 10, pages 62-63.)

Next we arrived at Toshio Koike's greenhouse. Here I was privileged to view a veritable sea of 'Hirao Green' *Clivia*, and



A close-up of Toshio Koike's 'Hirao Green' Clivias

high quality green throat yellows, short broad leaf yellows, variegated yellows and at least one truly bright yellow (Shade 66 on the new colour chart). I have subsequently made enquiries about the feeding of 'Hirao Green', because it is claimed that these plants need special food in order to enhance the green. I am reliably informed that they do not require anything special, but DO need to be regularly fed, with perhaps a little extra towards flowering season. It may be of interest that there are at least two forms of 'Hirao Green'. The one form is very green with a dark green midrib, and the flowers are perhaps a little smaller with pointed tepals. The second form is a distinctly larger bloom with wider rounded petals, and a smooth,



An interesting multi-colour with near white splashed on the tips Breeder: Toshio Koike

all over light green colour - in fact very lovely. Besides the yellows and greens were very fine picotees and bronze green throats, TK original bronze and some lovely pink interspecifics, which were unfortunately not for sale.

Back to Tokyo by the two trains and then on again in Shige's mini bus. The next stop was the highlight among highlights of the trip for me. This was Nakamura's Clivia Plantation. For years I have of course heard of "Yoshi" and if there are special flowers mentioned, invariably, they have Nakamura breeding. I was not lucky enough to receive any of his early seed gifts to the Clivia Club, because I was not yet involved, so I had this huge need to get some plants from him personally and also to meet him! Nestled at the bottom of the bamboo and tree-clad mountains, his house commands a view over the farm lands and rice paddies. In front of and next to the house are the shade houses and low seedling growing tunnels.



Shigetaka Sasaki with Yoshikazu Nakamura

Yoshi Nakamura was sitting in the sun, waiting for us, wearing a woolen cap and nose mask. As time progressed and the day warmed up, the cap etc disappeared, to be replaced by a 'Toowoomba' peaked cap and a big smile. Because of the diversity of plants

and crosses, Mr. Nakamura started looking round for interesting things for us to consider. Shige, poor man, was inundated with queries, so help was definitely in order!

There were not too many plants in bloom here, but we did see a very lovely deep orange red multi-petal, a beautiful pastel, a lovely ghost as well as a very lovely pastel with Akebono variegation. Very fine variegated plants were also there, among them excellent broad leaf Akebono and tiger variegateds. And dear little green frogs basking in the warmth! Behind the house were delightful violets clinging to the sheer cliff sides, in the lawn daffodils danced in the breeze and here were the only known pale creamy dandelions in Japan. Mr. Nakamura was his usual generous self and kept bringing us gifts including fridge magnets, T Shirts, books, Clivia Plantation plant labels and Marilyn was specially favoured with a small bottle of sake with "Clivia" written on it (in Japanese of course!), which he duly signed for her.

From there to Shige's greenhouses. Once again a host of dainty daffodils to greet us! Here we were treated to viewing some of his fine collection. Very lovely pastels, bronzes, Hiraos, yellows, interspecifics. They were all there.



A Yoshikazu Nakamura 10 tepal multipetal



Shigetaka Sasaki's outstanding pastel

An Interspecific from Yoshikazu Nakamura



Shige with the two different flower shapes of Hirao



The next day was very busy. Leaving the hotel at 06:30 we traveled first to Mr. Miyazaki. Here were very fine short broad leaf variegateds, mostly Akebono, as well as normal green *Clivia* with very broad short leaves. Here were some of the finest bright yellows I have seen to date. Unfortunately not for sale!



An example of Mr. Miyazaki's intensely yellow flowers



Mr Mitsuhashi's extraordinarily large yellow flower

On to Mr. Tsuruoka - here was a wonderland of variegateds, mainly Akebono and a few superior Negishi. This was a very large, very full green house, with beautiful plants on at least two levels and hardly room to walk in the aisles. Mr. & Mrs. Tsuruoka hosted us to lunch at a delightful restaurant (watch out for those arthritic knees!) serving excellent food, after having served us tea and snacks and sweets in their lovely warm office - It was a COLD day.



A broad leafed Akebono from Mr Tsuruoka

Then on to Mr. Mitsuhashi's property, driving on the really narrow roads between rice paddies. Mr. Mitsuhashi is Chairman of the Japanese Clivia Society and Mr. Tsuruoka is Vice Chairman. We were treated to a close-up view of a yellow mutitepal and an enormous yellow on display in his show room. Here was a variety of quality plants. Beautiful dwarf pastel Akebono, intense golden yellows, beautiful interspecifics, the biggest multitepal I have ever seen, plants exhibiting both longitudinal variegation as well as Tiger. Of course there were groups of Hirao, peaches etc. Besides *Clivia* Mr. Mitsuhashi has an amazing range of unusual variegated plants including Haworthia and numerous dwarf aloes, as well as other rare and unusual zygocactus. Something that really drew my attention was the fact that I saw mature flowering plants growing in 4 inch pots!

Our last 'Clivia' call was Mr and Mrs Nakayama who specialise in multitepals. Here was dream material for the multitepal lovers! On a farm nestled between the tree-clad mountains the greenhouses were set above a series of dams which led to the rice paddies below (This is a working farm). Mr and Mrs. Nakayama are both over 70 and both are very active people. Mrs. Nakayama is fully involved with the care and maintenance of the plants. In fact, when it came to time to remove plants from pots, she was down on her knees, bashing away at the pots in order to release the roots. Great Lady! There was a very wide range of multitepal forms, very

beautiful. Mr Nakayama also allowed us to photograph him with his prize-winning plants (See also CLIVIA 10 pg 57).


An outstanding multipetal from Mr Nakayama

As has been mentioned before, Mr. Nakayama started breeding *Clivia* 50 years ago. The feeding programme he follows is quite simple: He feeds after the blooming season and then again in the autumn. No feeding during the summer as it is too hot and humid. A single feeding of an organic fertiliser is applied per year. He maintains that the pots we use are too big and we use too much potting mix. This certainly seems to hold true as his mature plants were grown in 15cm pots, and when the pot was removed, it was a solid mass of roots that emerged. He only applies a small amount of water at any one time, and stresses the fact that the water must run straight through the potting medium. AND all this work is done by Mr. & Mrs. Nakayama themselves!

Mr. and Mrs. Nakayama hosted us to lunch at a country restaurant where we had a private room to ourselves. Once again, arthritic knees were in trouble. However the food and the company were great. That afternoon we viewed the spectacular rice paddies that "flow" down a rather steep mountainside. At the top of the mountain was a small tea room where Mr. Nakayama ordered Dandelion Coffee for us. Very refreshing and not like coffee at all. That evening we were entertained by Shige's friend Binshu. It was such a delightful evening with singing, dancing, traditional ceremonies, drumming and lovely music. Shige also sang his 'Clivia' song for us. It was a really emotional ending to a very happy trip.

The last day was spent cleaning and preparing all our plants for the phytosanitary inspection. Shige kindly made his greenhouse and all facilities including a pressure hose available to us. This also provided a little more time to enjoy some of his lovely plants. And so the end came to a fairytale week in Japan. I could have spent a bit longer I think, but, starting at 6:00 or 6:30 most mornings and being on the go till up to 01:00 every day certainly took its toll, and some rest was in order!


Mr Nakayama's prize winning plants

The Welcome Predator

James Haxton, South Africa

A ball of fluff found in the house suddenly started moving about. When it was examined closely under the magnifying glass, the body and a pair of pincers were visible.



The ball of fluff

Several months later one was seen on a clivia leaf having a good go at some eggs of the Amaryllis Moth that had been laid on the leaf. The clivia was taken into the studio for a photo session. The insect was identified as the larva of a Green Lacewing, Order **Neuroptera**, family **Chrysopidae**. The larva is known to prey on small insects like gnats and aphids. The fluff on its back is part of its camouflage and is a collection of the remains of its prey, hence the name 'trash carriers'.



The larva feeding on eggs



Puncturing the egg

These particular eggs were fresh; laid the night before by the Amaryllis Moth. The insect tried older eggs as well but it is not known whether it can feed on the young larvae inside the eggs.



Sucking the egg dry



Very few viable eggs left after a feeding session

The larva emptied an egg in less than a minute and then moved on to the next egg.



Feeding on older eggs



Ventral view of a Green Lacewing on a sheet of glass



Brown Lacewing (**Hemerobiidae**) on a very ripe peach in spring

Would enough of these insects keep the Worm at bay?

Credits:
Thanks to Prof. Hannes Robbertse and Dr. At Schoeman for identifying the larva.
Reference used to identify the adults: http://BugGuide.net

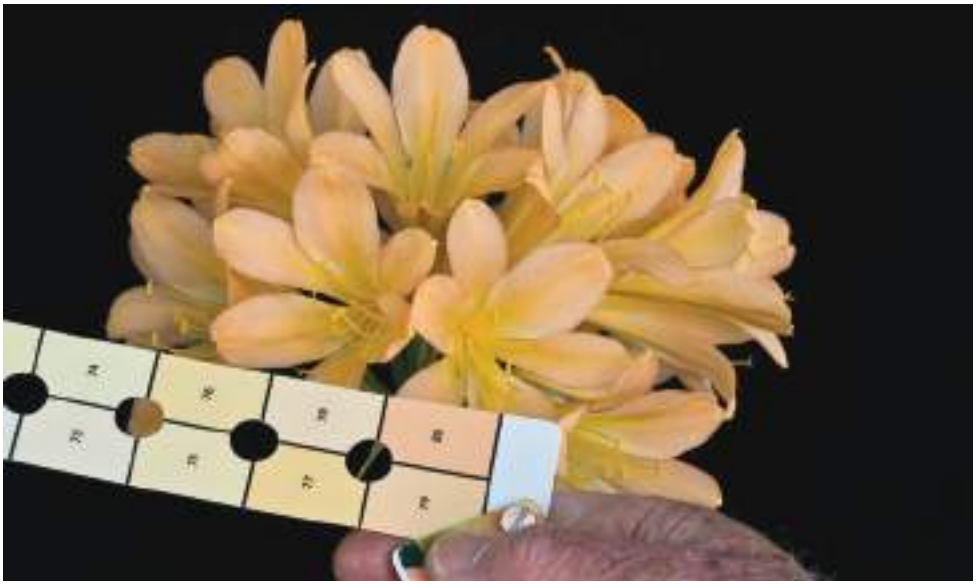


Photo: Claude Felbert

Use the Colour Chart II with this picture to see if the colour matches on your equivalent colour chart

Kiwi Clivia 2008

Kenneth Smith, Australia

Photogarphs in this article were taken by Ian Coates

During October 2008 I had the good fortune to be part of the KiwiClivia2008 Tour, organised by the New Zealand Clivia Club. What a fantastic trip it was - great company, great *Clivia*, great scenery and great gardens. Yes, it rained some of the time but that in no way dampened our spirits. The whole adventure was stimulating from start to finish.

We started at Alpers Lodge in Auckland, which was to be the base for the first part of the tour. A walk around the local streets and taking in the Eden Gardens showed some of the established garden *Clivia* in bloom. We even got to see the planting in the old Government House. The opening night dinner at Alpers Lodge was a chance to meet up with old friends and share lots of *Clivia* stories. A good international group had arrived to be part of this tour, but it is fair to say that the Toowoomba Mob stood out!

Saturday was Show Day and we set off for the Auckland Botanic Gardens. The display of *Clivia* was set up and the coach offloaded people eager to get in and view the plants. The whole scene was bustling with energy as plant sales activities coincided with lots of discussion about the merits of the many plants on display. A major attraction was the centre display of 'Vico Yellow' hybrids by David Brundell. Part of the program was a talk by Keith Hammett and people gathered to hear him speak about *Clivia* development.

Lunch was served and we were then treated to an introduction to the Gardens by the Curator, Jack Hobbs, who led a tour of the Gardens assisted by Terry Hatch. The weather was perfect and the plants and garden areas we viewed were beautiful. I found it very interesting as I am always keen to learn more about all plants so that I can pass on my knowledge as a horticulture teacher. The clump of *Watsonia* 'Pink Fairy' caught my attention and allowed me to focus on the visit to Joy Plants where I could view the *Watsonia* plant material developed by Terry. Jack and Terry have a wealth of knowledge and gave freely to the many questions put to them as the group wandered around the Gardens. The diversity of the plantings was interesting at every turn. We would use Terry's vast knowledge during the remainder of the tour many times over.



We travelled by Coach – showing David Brundell addressing the group from a stand



One of a selection of flowers seen in New Zealand

The following day was a visit to the large garden property of Keith Hammett. Our tour group stopped at the local school hall for a morning tea and a forum session to take advantage of the international participants on tour. The discussion was quite detailed and took in all perspectives so in that regard it was a valuable inclusion. The details of that session have been written up by Helen Marriott. Under cloudy skies the tour group made their way down the road to enter Keith's property. Well, to say that there is a wide range of material amassed in this garden is an understatement. Once people entered the drive there were group discussions starting up everywhere. Certainly not enough time to fully absorb all that was there but the darting back and forth by participants only went to show that choice blooms were to be found. Lots of photos were taken as well as lots of discussion about the plants set up outside Keith's study. The history of *Clivia* is well represented here. Plants and seeds were on sale and the ladies were kept busy during the afternoon.

Time caught up with us and we were soon on our way to the McLeman property - a smaller suburban block but no less an impressive



Alick McLeman facing the camera



One of a selection of flowers seen in New Zealand

array of plants. Every space was used to the maximum capacity and Alick was kept busy answering questions from the visitors. The table set up on the porch showcased the choice plants in flower grown by him. Refreshments were served and the delegates were asked to assemble for various group photos - lots of activities and lots of images. The shared enthusiasm for *Clivia* and the fellowship between the tour members was very evident during the lighthearted organising of the "group photo shoots".

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Another rainy morning saw us head off on Monday to visit the garden of Bev and Murray Gow. I should comment here on the skill of our coach driver, Dave. He was to show us that he was most capable on many occasions during the tour. I think we even made a *Clivia* enthusiast out of him. The display of the 'Sir John Thouron' progeny grown by Murray started the garden visit and people made their way around the garden, single file, to view not only the pockets of *Clivia* but the associated harbour scene. Raincoats, umbrellas and shoes everywhere in evidence, but there was still much discussion of plants, flowers and seedlings. It did not seem like people wanted to get out of the rain but we had to press on so that we arrived at Joy Plants, the nursery operated by Terry & Pam Hatch and their

son Lindsay. More rain but again this did not stop the crowd walking through the plantings of *Clivia* and other plants established on the 24 acre property. The history of the various accessions was fascinating, particularly the paler form from Govenor Grey's residence. Attention was also drawn to the fimbriated petals on one plant amongst the yellows. Whilst people continued to discuss the massed *Clivia* I ventured further along the path to see the clumps of dwarf *Watsonia* in flower in a back paddock. I am impressed with the development of these plants by Terry. The group then puddled their way back to the coach so we could continue to Ian and Shirley Baldick's house where a hot lunch was awaiting us. A well organised breakup of the groups saw some people meander through the wet garden under Ian's guidance, whilst the other group ate their fill. It is not sure that Ian got to eat anything as he was in constant demand to answer the many questions about the garden plants. I know that Irene Broadbent and I took up his time asking lots of questions about the magnolias, one of Ian's long time plant breeding passions.

Last stop of the day was at the property of David Brundell, where the plants developed by David using 'Vico Yellow' almost dwarfed us. These were huge plants, well grown, with an amazing flower display. After walking through the plantings in the garden we made our way to the shade-house area. As David would say, "a garden work in progress". Seed sales and plants sales in the shade-house were brisk, to say the least. With each new set of eyes viewing the plants it was always possible to discuss future breeding ideas. It is also very interesting to be involved with different people as they scan the lines of plants for sale, each searching for the character in the flower or the plant that speaks to them. The plant that Allan secured will be worth watching as it develops in years to come. Where else did we see fimbriated petals? I think people could have stayed in the sales area for a longer time but as daylight was fading we joined David in another walk back to the house, where a meal was being prepared. This was an extremely restful place to end the busy day, situated on the waters edge, accompanied by the familiar discussions about *Clivia*.

All that was left for the day was to return to Alpers Lodge for the last night in Auckland. The coach was loaded in the morning so that the tour could commence the second part of the itinerary, the trip down south to Paeroa. We left the volcanic area of Auckland to travel



Typical of *Clivia* growing outdoors in New Zealand



Ken Smith seems to have found a prize *Clivia*

through the farmland area of the Waikato Plains. The long drive was punctuated by a stop to collect delegates from Pukekohe then on to Paeroa. It was a most interesting trip as there was plenty of commentary on the way from "the locals".

Groups scattered in different directions once we reached the township of Paeroa as hungry travelers grabbed a bite to eat as well as finding time to do some shopping. I was not the last one back to the bus after looking through the antique shops along the main street. Off we went to our next *Clivia* stop. Dave carefully maneuvered the coach so that the group could make their way up the drive to Rex and Dee Williams' property. Here we saw the result of planting the sloped site with palms and bromeliads, and of course, *Clivia*. Pathways and stonework with establishing trees and under-storey plants. At the top of the drive we gathered to hear the story of the move and the "special *Clivia* house" construction. The best was to come when we each had the opportunity to move through the greenhouse and view up close the *Clivia* in bloom. There were even more special plants to be seen here. I will have to ask Rex about 'Fat Hen' and 'Fire Cracker' and the peach with the fine edging of red to the tepals.

Back on the bus so we could reach the lunch venue prior to our stop at Ian Duncalf's nursery at Te Puna where a mini show was benched for the delegates. I found this venue a very interesting one as there were batches of variegated plants as well as the *Clivia*. The variegated *Alstroemeria* was just stunning! In the large shed was a very welcome display of *Clivia* in bloom. In typical fashion, each plant was scrutinised by the delegates and lots of breeding scenarios were discussed. I am always on the lookout for unusual plants and this venue did not disappoint. Ian has been working with a most unusual *Clivia* mutation, one with yellow flowers but it has **white-striped yellow berries**! It will be interesting to learn about outcome of the berry colouration of the seedlings from this unique mutation. I also took advantage of walking around the well-established garden where the size of the trees was amazing. Some of the delegates also had



An attractive *Clivia* from the New Zealand selection



Careful inspection shows white stripes on these berries


More beautiful *Clivia* flowers

the opportunity to visit the nursery of a local, well known bulb grower, Bill Dijk. I went to see more watsonias, but also thoroughly enjoyed the chance to see how a specialist cultivates a wide range of bulbous plants. There were special treats at every turn.

It was to be a long day and it was getting dark when we arrived at the dinner venue Kiwi 360 at Taupo. Some shopping for the delegates and then a sit-down dinner, which was great, which was a good thing as it had to hold us out until we arrived at 9pm at the Quality Hotel Geyserland in Rotorua, which was to be base for the second part of the itinerary. Now there is something about Rotorua – the smell!

A new day dawned and the smell was still there, but we got used to that, after all, it was Rotorua. Garden visits were on the schedule and after a brief coach tour of the town we arrived at the garden of Jim and Juanita Elley, "Rhodohaven". This was the long time family home where four children were raised and only in the past ten years has it been developed into a show garden full of choice plants. Delegates had a very pleasant ramble around the garden to view the main plantings of Rhododendrons, with all spare spaces filled with a wide array of plants, including a few *Clivia*. I was interested to see a double flower form of the Mollis Azalea in bloom, and learned the cultivar name was 'Pavlova'. Morning tea was served and then the group was back on the coach to our next stop. If you are going to visit Rotorua you have to see the Wai-O-Tapu Thermal Wonderland. Now here was some incredible landscape - a strange world full of sights and sounds and smells. Following the walkways around this amazing place was an education. I certainly benefited by walking with Pam and Terry Hatch. We saw colourful land formations and changing vegetation and birdlife at every turn. Quite some time was spent here and there was a lot to learn. A special evening back at Geyserland had been organised and after an afternoon rest, the group was treated to a Maori concert and a feast to end the day. Bubbling mud, can you get enough of it?

Today would see us depart early so that we could visit the Volcanic Activity Centre at Taupo and travel the Lost World Highway en route to New Plymouth. It was quite an education to see all the exhibits and the movie whilst at the Volcanic Centre. The new-found insight was appropriate as we traveled the countryside through the very land affected by the earth's activity. We saw lakes, rivers, tussock pastureland and mountains. I told


Apricot or Peach?



The group enjoying some great New Zealand hospitality

you that Dave was a great coach driver, well, today would really show us his skill. The Lost World Highway, now that is an exciting way to see part of New Zealand.- rugged country, green pasture, huge trees and really narrow tunnels through mountains just wide enough for a coach to fit through. Well done Dave. And where did we end up by mid afternoon? Whangamomona Pub - quaint, quirky, old world. All of these but an absolute treat. After most of the day traveling the contents of the coach spewed out and headed straight for the refreshments on offer at this establishment. Nice drop of dark ale. To say we were entertained would be an understatement. Geoff Taylor is a publican extraordinaire and he had us all engaged in his banter when ordering beers, purchasing souvenirs and most of all, when having our Passports stamped. That's right; I am an official citizen of the Republic of Whangamomona. Now, the group picture outside the pub, well, that was a comedy of errors, but I am sure lots of images exist, no thanks to Geoff as a parting gesture. Did everyone get their cameras back? Nothing to do but back on the coach and admire the scenery as we made our way to the Autolodge Motor Inn at New Plymouth, the third base of our tour. It was a long day traveling but an extremely enjoyable day none the less, viewing the changes in scenery, punctuated by the stop at the pub.

After a meal at the restaurant I bet everyone slept well that first night at the Autolodge. I woke to a bright, brisk day with a view of Mt Taranaki from my hotel room window. Breakfast finished and we were on the coach again to explore the North Egmont Visitors Centre. Chilly little spot but we still walked the nature trail and viewed the monument. Stunning views from on the mountain, and of course, when the mist cleared, the mountain itself was amazing. Lots of images were taken from both on the mountain and from further away when other choice Mt Taranaki viewing sites were visited. Gardens were again on the schedule and a visit to "Tupare" was well worth it. This is a well laid out established garden from the 1930's that is now in the hands of the Taranaki Regional Council. To walk the


Mount Taranaki, tranquil and majestic

pathways and view the gardens and trees was a pleasure indeed, as was the house with the exposed heavy timber beams. I particularly liked the way that distant views seemed to be part of the garden and I was very taken by the walled garden and glasshouse - such a beautiful place. Another coach trip took us to another well established garden, the Jury Garden, "Tikorangi", where our hosts Mark and Abbie Jury took us on a tour of the grounds, an old garden full of character and hidden treasures. Hearing about the history of generations that had planted the site and about the continued plans for new things was a bonus for me. I knew of the Jury legacy and to be on site was fulfilling indeed. The *Veltheimia* seedlings grown from the gifted seeds are doing very well at my place and I await the colour of the resultant blooms, hoping to have the same bicolour effect as seen in the Jury Garden flowers. Last stop was to view the garden of Allan and Lorraine Inch, "Pai Rawa Atu". Attention to detail was evident in this beautiful garden and it was so serene to stroll around the well laid out garden beds and mown lawns. Everything looked like it was in place just for our visit but, having had a glimpse inside Allan's garage, I can tell that this excellence is par for the course. Wow, you should have seen the cars.

Some time was allocated that afternoon to relax at the Autolodge and that evening the group had the opportunity to have a meal at the local Chinese Restaurant, The Golden Sun. A good night was had by all and who said that one table got too rowdy? It was just a chance to unwind.

Now if you think you have seen old gardens, you shown have been with us when we went to Pukekura Park. We entered the park at the Kaimata Street entrance where the sign said Brookland Park and from there on the plant material was amazing. Huge trees that just had to be hugged, specimen trees of known plants that were just so big, so much to see and so little time, so it seemed. Luckily for us we had as a guide, Ken Davey, who proved invaluable as we toured each part of the garden. There were old houses and Chinese Gardens and bridges. The drizzle that had set in was not enough to worry us as we went from one spectacular part to the next. It did not matter whether you looked high or low, there was some special plant to see, like the double flower form of a pink bluebell! Ken was able to give us detailed history of this wonderful garden as he knew it well, having worked there for many years. At one point we made our way into a plain


Picotee with frilly tepals reminiscent of a Carnation


A peach with deep green throat



Clivia en mass

entrance in a hillside, only to come out into a packed enclosure full of bright foliage and flowers. What a unique glasshouse. We could have spent a lot more time exploring such a valuable piece of botanical history, but it was time to board the coach so that we could head for the seaside village of Oakura.

Groups went their different ways to partake of a meal in the various cafes and eateries, and while some made a good decision, others waited quite some time. A bonus for this stop was the closeness of a *Clivia* enthusiast's garden, that of Bruce Hookham. A short walk and a group of us were viewing the potted *Clivia* and seaside garden plants at Bruce's place. We had a discussion on *Clivia* over a cup of coffee, with the CD "Surrounded" by Laurence Elder playing in the background. A pleasant break in the day but we had to keep going as our next stop was the garden of Tony Barnes and John Sole, "Ngamamaku". We arrived mid-afternoon and walking up the drive to this garden showed that there would be many garden rooms to explore. Tony had a *Clivia* mini-show set up in a covered section and again the talk turned to *Clivia*. This was an interesting garden to explore, and not only were there potted *Clivia* set up, there were drifts of *Clivia* in garden and the word got around that the greenhouse should be viewed as well. Of course I was looking at all the plants in the garden and spied a variegated *Lavatera arborescens*. Climbing shoes were required to reach the greenhouse but worth the effort as there is always a different *Clivia* to catch the eye of the enthusiast, such are our differing likes. Lots of images and plenty of discussion followed about the breeding of this and that. Now this is a cold site on some days and as the afternoon progressed, it turned out that this was to be one of those days. So, gather near the house, try some of the red wine, and be part of the discussion about the upcoming meal. Oh, did I mention the Japanese Garden? I stated earlier that the fellowship between the delegates was evident during this tour, well the meal and visit to "Ngamamaku" was a great example of that fellowship coming out again. What a fantastic time we had. They even organised one of the local milkmaids to come and entertain us, outstanding. I forget how late it was when we had to leave but I am sure a weary but satisfied group took the coach trip back to the Autolodge for a good nights rest.



A brilliant display of *Clivia* with differing colours

Last day, homeward bound. After a breakfast we all piled into the coach to head back to Auckland. Still a couple of stops planned and we had to see a Kiwi while on tour so the destination was the Otorohanga Kiwi House and Bird Park. A walk around the enclosures allowed us to see the native birds up close and of particular interest was the Kiwi House. These are strange birds and a great experience to see them so close. Lunch was to be in the town and a filling meal was consumed at The Hungry Weka, which held us until we arrived at Hamilton Botanic Gardens. The weather on this day was clear and bright and was a perfect ending to the gardens and shows that we had visited during the past ten days. As it turned out there was a Bonsai Exhibition and we all joined the crowd of people making the Gardens their venue for a day out. The interesting thing about the Hamilton Botanic Gardens is the themed garden room setup. We were able to step out of a Persian Garden and into an English Garden. I am sure each group of tour members took in all that was to be seen, and the time flew. By mid-afternoon the coach was headed for Auckland with a scheduled stop in South Auckland to let some delegates off. It was a quiet trip back to the Alpers Lodge, where quite a few of us had booked an evening prior to going our separate ways back home.

The tour was so well planned and the variety of venues, with enough *Clivia* interspersed, was a credit to the team involved. Diana Holt was a prime mover and I know there were others, but to all, a big "Thank you" for making the KiwiClivia2008 such a memorable tour. There is so much more detail that could have been written about this tour but you will just have to visit New Zealand yourself to find out what a wonderful country it is!



Keith Hammett's Garden — a beautiful shady setting for the many *Clivia* he grows under the trees

Some New Zealand Clivia Growers
Tino Ferero, South Africa

Judy Shapland and Conrad Coenan have their *Clivia* collection in Apata, Katikati, New Zealand. The *Clivia* bug bit Judy in 2001, and since then she and Conrad, both landscape gardeners, have built up a excellent collection of beautiful clivias. They have two plant houses and the material has already been acquired for the erection of a third plant house.





Above and Below: Two flowers from the fine Coenan collection

Since Judy and Conrad are such enthusiastic *Clivia* growers, one can expect that much will still be heard of this collection in the future.

Tony Barnes is one of the Management Community members of the New Zealand Clivia Club and lives in Ngamamaku Gardens, New Plymouth, on a large property with a magnificently landscaped garden. Tony has built up a very good collection of top quality *Clivia* one of the best to be seen in New Zealand. The collection is housed in a plant house covered by plastic on a fairly steeply sloped part of the property.





Above and Below: Colourful *Clivia* from Tony Barnes

Tino Ferero has produced an interesting and comprehensive photo record of his New Zealand visit — unfortunatelly space allows us to print only a small number of his pictures. **Eds**

Alick and Frances McLeman are ex-South Africans who emigrated to New Zealand several years ago and now reside in Glen Innes, Auckland. Alick took part of his *Clivia* collection with him to New Zealand, and has subsequently been building up his collection from seed from amongst others, the KwaZulu-Natal Clivia Club. He presently has one of the finest collections of *Clivia* that I have seen.

Alick's collection is housed in much the same way as most South African collections in pots on tables in plant houses under shade netting. All plants are neatly marked and labeled.

Some of Alicks named plants include the following:
There was an attractive plant named 'Akebono Apricot' from the Cameron Peach strain.

'Olsen's Honey Puff' which was developed from the Vico Yellow line of David Brundell.

One of the most striking plants in the collection is the F2 Sir John Thouron that won best on show at the 2008 New Zealand Clivia Club show.



Alick's Pink Pastel, achieved by breeding to progressively reduce the anthocyanin levels (reg pigments) by crossing orange with yellow, is a very beautiful plant.



Alick also has a good Peach strain. Some bred from a crossing of a Christo Lotter yellow with Alick's Peach from the Chubb Peach Line.

David Brundell has a property that is situated in Waiuku to the south of Auckland. He has a beautiful home that is an architecturally designed dwelling with state of the art features to make maximum use of and blend in with the environment next to the lake that he created and where he runs his nursery, Gardenza. He is ably assisted by Shane who helps with the pollination, planting and maintenance of the large garden and nursery, and Fiona, who attends to most of the administration of this large undertaking.

The beautiful large garden has been landscaped very professionally with indigenous trees, tree ferns and many other indigenous plants, but there are also many cycads, aloes, *Scadoxus* (including a rare white form), *Amaryllis*, and of course, large plantings of *Clivia*, including really top quality yellows, oranges and many other colours.

The main *Clivia* collection and *Clivia* nursery are housed under a plastic and shade cloth covering.

A very important part of the *Clivia* collection is 'Vico Yellow', an offset from the original clone obtained directly from Sir Peter Smithers and hybrids from the 'Vico Yellow'.



Some of the hybrids bred from the 'Vico Yellow' have been named. The following named clones were in flower:



Above: 'Full Moon' Below: 'Lunar Impact'



From the 'Vico Yellow' line, David has also produced very good other colours. Some of the well known ones, such as 'Heaven Scent' and 'Honey Moon', were not in flower.

One of the most noticeable characteristics of the flowers is their very large size. David attributes this to genetic factors plus intensive feeding with a water soluble fertilizer high in potassium and low in nitrogen and phosphorous. A drip irrigation system has been installed and the plants are always watered with the fertiliser added, but at a much diluted rate. The pots are never allowed to dry. Once a month the pots are drenched with plain water to prevent the build-up of salts. It was a very rewarding experience to have visited David and to have shared his knowledge and experience and to have enjoyed his splendid hospitality.

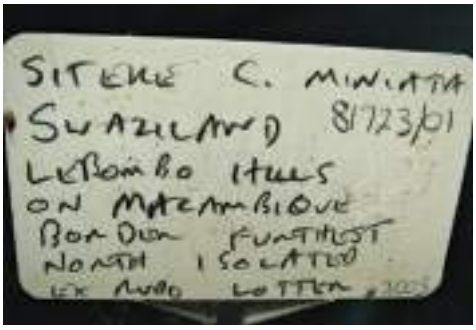
Keith Hammett lives on a 24 ha farm in Massey near to Auckland and has a beautifully landscaped garden with extensive plantings of *Clivia* under the most magnificent trees and tree ferns. Each group of *Clivia* in the garden is meticulously marked and coded. Keith is assisted by two ladies, Heather and Zi Hui Yu (Keith calls her Yuki), who help with the pollination, planting and maintenance of the garden and *Clivia* collection.



Keith Hammett with some of his garden *Clivia*

His plant houses contains his prize collection of very beautiful top quality plants of various colours, all meticulously coded and marked on the plant markers (and on computer).

Note: A full description of all information on the display markers would take up too much space. All descriptions have been abbreviated. There was a good broad leaf with a width of some 120mm with the following interesting inscription on the plant marker:



Dr Keith Hammett has some of the best *Clivia* material in New Zealand, and with his scientific background and disciplined approach to pollinating and growing *Clivia*, it is to be expected that some of the finest *Clivia* have and will still be produced from crossings made in this collection. A very attractive yellow green throat named 'Semper Augustus' ("without parallel"), is one of the striking plants in the collection. The green is retained throughout. (No photograph available)

He not only grows *Clivia*, but is regarded as one of the top plant experts in New Zealand, specialising in the hybridising of plants such as dahlias and sweet peas. During the visit by the tour group, seeds of sweet peas were available.



Keith Hammett's 'De Novo' a pale peach from a 'Chubb Peach' x Best Primach Yellow'

Rex and Dee Williams live on a farm at Paeroa, Waikato, and are very keen *Clivia* growers with a very beautiful landscaped garden full of cycads, agaves, succulents, dasylirions, bromeliads and large plantings of very attractive *Clivia*.

The *Clivia* collection is housed in two specially designed plant houses under plastic covering where one of the sides is equipped with an electronic device that causes the side panel to roll up automatically when the inside temperature rises above 15°C.

In the plant house there are many beautiful *Clivia* of various colours.



Rex and Dee's plant house

Rex and Dee also have a very good line of Chinese darumas and variegated darumas, some of which were on sale at the New Zealand Clivia Club show.



A *Clivia* from Rex and Dee Williams top collection

Ian and Shirley Baldick: Ian is Chairman of the New Zealand Clivia Club. They live in Drury, South Auckland. Most of Ian's *Clivia* are grown in his large garden planted full of the most magnificent magnolias, rhododendrons and other plants imaginable. Ian is a renowned authority on the breeding of magnolias and some named magnolia varieties originate from his crosses and are used for breeding purposes in various countries.



A green throat *Clivia miniata* from Ian and Shirley Balddick's collection

Terry and Pam Hatch, and their son Lindsay have a large nursery specializing in indigenous trees and other local plants. Their property is situated in Pukekohe East, South Auckland. Terry is a recognised authority on the indigenous flora and was one of the tour guides during the bus tour. The Hatches have a very beautiful large landscaped garden with very large trees and vast plantings of *Clivia* under the trees.



Terry and his son Lindsay in their garden



A multicolour *Clivia* from Terry and Pam Hatch's collection

Murray and Beverley Gow have a lovely home with a stunning view overlooking the harbour. Their home is situated in Orakei, Auckland. Most of the *Clivia* collection is grown in shade under trees in the garden, but there are quite a number in pots as well.



Some *Clivia* Murray and Beverley's Garden



An attractive flower with pastel inner tepals

David Olsen is the editor of the newsletter of the New Zealand Clivia Club, and grows most of his *Clivia* in the garden.

Many beautiful plants were in flower in the garden, of which the following two were of particular interest. (*See opposite column)*

A special word of thanks to all the above *Clivia* growers for the warm-hearted welcome to their gardens and for their royal hospitality. It was a wonderful experience to have met these lovely people and to have visited their collections.



Near white with liberal red / orange splashes



If only I had a larger luggage allowance!

CLIVIA 10 ERRATA

The contributor to CLIVIA 10 should read as Paul Michael diMeglio (and not de Meglio) throughout.

On page 56, last paragraph in the left-hand column the grower is Nakayama and not Nakamura.

Our apologies for these oversights. Eds.



CLIVIA

TWELVE



The Clivia Society

www.cliviasociety.org

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CLIVIA CLUBS

Cape, Eastern Province, Free State, Garden Route, Joburg, KwaZulu-Natal, Lowveld, New Zealand, Northern and Northern Free State

INTEREST GROUPS

Northern KwaZulu-Natal, Overberg and Waterberg

CLIVIA

TWELVE



EDITORS

Roger Fisher & Roger Dixon

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Editorial

It was decided by the Executive Committee that the Clivia Society's Yearbook for 2010, CLIVIA 12, would comprise of papers delivered at the 5th International Clivia Conference held in Cape Town, and that the production would be done in Pretoria. Claude Felbert informed the Executive that he would not be available to perform editorial duties for this issue. We wish to thank him for his past editorial services, and especially for the photographic content and layout of all eleven preceding Yearbooks. He has done sterling duty for the members of the Clivia Society as a member of the editorial team since the inception of the Yearbook series in 1998.

Starting at the beginning, Greig Russell revisits Dr Hooker and the early nomenclature of the genus *Clivia* and in a style all his own does some posthumous ticking off of the good Doctor for getting so much wrong! Greig also takes us on a visit to South Africa's earliest hybridiser of the genus, Miss Blackbeard, and uses the opportunity to reprint early articles on her breeding and collection, here for the first time illustrated with the watercolour depictions done by Miss Cythna Forssman [later Letty] which, for all these years, have mouldered in the collection of the South African National Biodiversity Institute. This is truly a privilege.

The potential offered by two of the pendulous species to those who breed and ennoble the genus are expanded upon, Wayne Haselau for *Clivia nobilis* and Francois van Rooyen for *Clivia gardenii* – although the question as to how long we will have all the plants at present included in this species definition is an open question.

Helen Marriott of Australia takes a broad view of the heritage and developments of the genus *Clivia* in its distinct cultivated forms in Asia and looks at the trends and directions the breeding has taken and is being followed in Japan and China respectively.

The Photographic Competition was chaired by Peter Lambert and adjudicated with the assistance of Roger Dixon. They observe the following:

More than 150 entries were received in the various categories and a sincere word of thanks to all of those who participated.

There were beautiful flowers to be seen, but the judges were of the opinion that a great numbers of these images were not up to standard as they were either out of focus or the colours had been over intensified (especially the reds and greens). There were also a number of white balance, compositional and background mishaps. These factors led to the affected images not being considered for the competition.

In the end it was those images where the photographers had taken extra effort to get the composition, balance, lighting, exposure and backgrounds correct that were the successful images.

Congratulations to Helen Marriott who secured the top three places in the competition.

Congratulations too, from the rest of the editorial team and Executive of the Clivia Society. The only reward entry to the competition brings is that of seeing your photographs in print. We value those who make time and take effort to record and submit photographs for the competition and ask that you feel inspired to add to the contributions for 2011.

With the limited space there are therefore many papers still to be published. It is envisaged that those of a more scientific nature be published under separate cover as occasional papers of the Clivia Society. This should be available with the AGM in 2011.

The Editors

Roger Fisher [Lead Editor] and Roger Dixon

Cape Clivia Club 2009 Show



PHOTO: CLAUDE FILBERT

Winner Best Own Breeding - Mick Dower.

Lowveld Clivia Club 2009 Show



Paul Kloeck, grower and shower of all show winners.



First Runner Up breeder, Col Pitman (Yellow).



Best in Show, *C. miniata* (Orange). Breeder, Felicity Weeden.



Second Runner Up 'Lime Green Throat Watermelon', Breeder, Les Brown.

PHOTOS: ANDRÉ SPIES/HEIN

Imatophyllum? ... Tut-tut, Dr Hooker

Greig Russell – South Africa

October 1, 1828 was a red-letter day for the genus *Clivia*. All of a sudden, like bats out of hell, two names appeared in print for one and the same plant. As far as I am aware, this is a unique event in the annals of botanical nomenclature. Both names, *Imatophyllum aitoni* and *Clivia nobilis*, deserve study and comment, and to set the ball rolling I am going to examine the name *Imatophyllum aitoni* here, the one coined by Dr William Hooker.

William Jackson Hooker (1785-1865) was indeed a great man; learned, a good scientist, a fine leader, a hard worker and a man with huge curiosity about the world around him. Within a few years of naming our plant he would be knighted for his contributions to Botany (although definitely not because of naming this plant!). My judgement, although not to be depended upon much, says that he was a good Latin scholar – his Latin descriptions of plants are readily and clearly understandable in most cases. I am only going to point a finger at his Greek here and I base this entirely upon his handling of the naming of this plant.

One tends to associate the name Hooker with the Royal Botanic Garden, Kew; and for good reason. In 1841, W.J. Hooker would become director of this institution and his son would follow in his footsteps. However, from 1820 until he went to Kew, Hooker was the Regius Professor of Botany at the University of Glasgow. Hooker took over the editorship of *Curtis's Botanical Magazine* in



William Jackson Hooker (1785–1865) in 1834 as depicted on Plate 12 from the *Makers of British botany* (1913).

1826, and for the next number of years, the intellectual properties of this publication were developed in Glasgow. Hooker was a skilled draughtsman, so aside from writing up the plant descriptions, he became the chief illustrator of the magazine for nearly a decade. Even the copper plate engraver, Joseph Swan, practised his art in Glasgow.

Thus Dr Hooker was probably in Glasgow when he addressed the material of the plant that he was to name *Imatophyllum aitoni*.

This material included a drawing of the plant that had flowered in the garden of



The plate of *Clivia nobilis* from the *Botanical Register* of 1828, accompanying John Lindley's description of the species, from a drawing by M. Hart, engraved by J. Watts.

Syon House in 1827, some dried flower and leaf material forwarded by James Bowie to Hooker in a letter in 1827, and a drawing and specimen of the fruit from William Townsend Aiton of Kew. Regarding the latter, Aiton was closely associated with Richard Forrest, the head gardener at Syon House, as the latter had trained at Kew under the former; and possibly the fruit and drawing thereof that Aiton forwarded had come via Forrest from the 1827 Syon House flowering.

For some reason Hooker decided that it was the leaves that were the most defining feature of this plant, and thus he chose to base his generic epithet on these leaves. Now it seems that generic names based on leaf characteristics are usually created in Greek, ie. *Something-phylum*, rather than in Latin, ie. *Something-folium*, whereas similarly related specific epithets may quite happily be rendered in either Greek or Latin. Perhaps to others, as it does to me, the Greek form sounds more impressive and



The plate of *Imatophyllum aitoni* from *Curtis's Botanical Magazine* of 1828, accompanying William Hooker's description of the species, from a drawing by Hooker, engraved by Joseph Swan.

one does, after all, want a good impressive name for a genus.

As a descriptor for this leaf, Hooker decided that 'strap' or 'thong' would be his word. At this point I feel the need to question this judgement, although that will not change it. A 'strap' to me is quite a narrow strip of material; and as for 'thong', well it is sufficient to say that I have grown *Clivia* seedlings with first leaves that are considerably broader than the thongs that I saw on Ipanema Beach in Rio de Janiero back on that day in September 1996 that I remember oh so well. So I do not think of clivias as having strap-like or thong-like leaves, but as Lindley in his original description of *Clivia nobilis* also described the leaves as "strap-shaped", I think that the definition of 'strap' may have changed over time; as is the case with many other concepts. Their 'strap' is my 'belt'. At this point, Dr Hooker reached for his Greek and in his own words named the plant "From **ιμας**, **ιματς**, a thong, or strap, and **φυλλον** a leaf, from the shape of the foliage"; **ιματος** transliterating as 'imatos'. And thus *Imatophyllum* was born which would prove to be a flawed and crippled child.

In 1830, in what would soon prove to be the autumn of his years, the German botanist Kurt Polycarp Joaquim Sprengel (don't you just love these names!) (1766-1833) published the then current edition of Linnaeus's *Genera plantarum*, which he had edited and rewritten as necessary. Sprengel was the author of a great number of works; but then what could you expect from someone whose one name was Polycarp (= many fruit Gr.). He was also a brilliant man and as a lad he had distinguished himself as a linguist, not only in Latin and Greek, but also in Arabic. Precocious too, at the age of fourteen (1780) he had published a small work called *Anleitung zur Botanik für Frauenzimmer* (tr. *Guide to Botany for Women*). There was possibly no living scholar in the world then better placed to review Hooker's botanical Greek. Sprengel must therefore have uttered 'yeeurtsch' or some other appropriate piece of German invective upon surveying Hooker's construction. If Hooker had done his homework properly, he would have found out that it was **ιμαντος** ('imantos') that would have been the correct form to use in combination; not **ιματος**. This is then the first strike against Dr Hooker.

Sprengel immediately corrected the name in his *Genera plantarum* to *Himantophyllum*. Undoubtedly this resulted in a rather less than happy Hooker. He probably nevertheless smirked a bit to find that even the flawless Sprengel was but human – aside from admitting *Himantophyllum* to his list in *Genera plantarum*, Sprengel had also included the *Clivia* of Lindley as a separate entry, not realising that these were two names for exactly the same plant.

You may ask how the initial 'H' in this form of the genus name arises? An initial Greek vowel has an aspirate nature about it, and thus an 'h' is often judged to precede such a vowel (or as the International Code of Botanical Nomenclature [ICBN] says it – "60A.2. The Greek *spiritus asper* (rough breathing) should be transcribed in Latin as the letter *h*.") Take the example of the name for 'Greece' in Greek – it is **Ελλας** (transliterating as 'Ellas') and it is always rendered in Latin script as 'Hellas' and hence the more commonly-used word 'Hellenic' to describe things Greek. Another plant genus which incorporates **ιμαντος** in its name is an orchid with a strap-like lip, the name of which is rendered as *Himantoglossum* and certainly not ~~*Imantoglossum*~~. Leaving out the 'H' is thus strike two against Hooker.

The French and the Germans particularly were quick to take up the name



The plate of *Imantophyllum? miniatum* from *Curtis's Botanical Magazine* of 1854, accompanying William Hooker's description of the species based upon Lindley's *Vallota? miniata*, drawn and lithographed by William Fitch.

Himantophyllum, but *Imatophyllum* satisfied those on the British side of the Channel who did not think that *Clivia* was in fact the valid name. Coming as I do to clivias from cymbidiums, I initially found it quite confusing that *Himantophyllum* could be a synonym of *Clivia* because I knew *Himantophyllum* as the section in the genus *Cymbidium* that contains the one species *Cymbidium dayanum* – a species noted for its narrow (c. 10 mm wide), flat, strap-like leaves (a perfect use of the name by my judgement). There is of course nothing wrong with such an application of an identical name at another rank.

Changing the spelling of a name because it is wrong for some reason is known as correcting the orthography (literally 'straight writing' Gr.), and the ICBN speaks to this in articles 60 and 61. Where orthographic variants exist, the authorship of such variants is attributed to the origi-

nator – so, as I see it, Sprengel is not the author of *Himantophyllum*, Hooker is.

There is, however, nothing at all wrong with the name *Himantophyllum*, and it has no less precedence than the name *Clivia* just because Hooker couldn't get his Greek right. So how does one sort out the conundrum of which name to use out of a perfectly parallel pair?

If one sees this as some sort of competition, then Hooker lost it quite rapidly. Whereas Lindley used the name *Clivia* at every available chance, as soon as four years after the initial publication of *Imatophyllum aitoni*, a short description of the fruit and seed of this plant authored by Hooker was published by Lindley in *Edward's Botanical Register* of 1832 under the heading "NOTE upon *Clivia nobilis*, fol. 1182." It seems to me that Hooker had capitulated at this point, losing the courage of his convictions. Third strike and out, Willie Boy.

Perhaps Hooker felt brow-beaten by such comments as that offered by the contemporary French botanist, Jean Baptiste Antoine Guillemin (1796-1842), who said the following in 1829 in reference to the *Clivia*/*Imatophyllum* affair: "*Les botanistes seront sans doute fort embarrassés pour l'adoption de l'un des deux noms proposés, puisque la publication en a été faite, non seulement la même année, mais encore le même mois et le même jour (1er oct. 1828). Il faudra que l'un des auteurs donne l'exemple, en abandonnant lui-même la dénomination qu'il a imposée à ce genre; espérons que cette question se résoudra promptement dans l'intérêt de la science*"; which, if you trust my dubious translating abilities, says: "The botanists will without doubt be very embarrassed by the adoption of one of the two proposed names, since they were published not only in the same year, but in the same month and on the same day (1st October 1828). One of the authors is required to set an example by abandoning the name he has imposed on this genus; hoping thereby that this matter will be resolved promptly in the interest of science". In my mind's eye I can see the smoke coming out of Guillemin's ears as he puffs up with righteous Gallic indignation at the doings of '*les deux idiots anglais*'.

It has often been mentioned that Anna Amelia Obermeyer (Mrs Mauve – 1907-2001), botanist at the National Herbarium, Pretoria, in writing the description of *Clivia gardenii* for the *Flowering Plants of Africa* (1972), said: "In 1830 Roemer and Schultes (Syst. Veg. 7: 892) chose the name *Clivia* and reduced *Imantophyllum* to synonymy." There are two minor problems in this quotation; *Systema vegetabilium* vol. 7, part 2, was authored by J.A. & J.H. Schultes (a father and son team), as J.J. Römer had departed this mortal coil in 1819, so it would have been highly irregular for the latter to have had anything to do with this choice; and as the name *Imantophyllum* would not appear until 1854 (see below) – the reference must be to *Imatophyllum*. My 'orthographic' rendition of this is thus: "In 1830, Schultes and Schultes f. (Syst. Veg. 7(2): LII-LII, 892-893) used the name *Clivia*, reducing *Imatophyllum* to synonymy." This is then precisely what Schultes and Schultes f. did. ICBN 11.5 says "When, for any taxon of the rank of family or below, a choice is possible between legitimate names of equal priority in the corresponding rank, or between available final epithets of names of equal priority in the corresponding rank, the first such choice to be effectively published establishes the priority of the chosen name, and of any legitimate combination with the same type and final epithet at that rank, over the other competing name(s)." Phew! So Anna Amelia Obermeyer's interpretation is completely correct.

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Other interpretations offered are thus incorrect. For example in his book *Clivias*, Koopowitz says: "It was not until 1864 that E. Regel clarified matters and designated *Clivia* as the proper name in a German journal *Gartenflora* giving the credit to Lindley because Lindley had actually written his description several months before Hooker." This much-referenced paper by Eduard Regel is, however, a dog. Regel didn't get it at all, saying: "*Clivia ist der von Lindley zuerst gegebene Name für die in Rede stehende Gattung und muss daher nach dem Rechte der Priorität festgehalten werden. Lindley stellte solchen nach der Clivia nobilis (Bot. reg. tab. 1182) auf. Erst einige Monate später legte Hooker der gleichen Pflanze den Namen Imatophyllum Aitoni bei*.", which I translate (with help this time) as: "*Clivia* Lindley is the first name given for the genus in question and therefore must be maintained in accordance with the rights of priority. Lindley created this genus in the description of *Clivia nobilis* (Bot. reg. t. 1182). Only a few months later, Hooker named the same plant as *Imatophyllum Aitoni*." Regel wrote this not knowing, as he should have, that the Lindley and Hooker names were published on exactly the same day and he is patently hardly one to follow in this regard. This is strike one against Regel. Koopowitz obviously did not understand what Regels had said. Furthermore, nowhere in the paper did Regel say that "Lindley had actually written his description several months before Hooker," as Koopowitz crafts his words to suggest. As the Lindley description of *Clivia nobilis* was based on the 1828 flowering of the plant and the Hooker description of *Imantophyllum aitoni* on a drawing of the 1827 flowering, I believe Koopowitz is completely wrong in suggesting a Lindley headstart in this matter. Is now then the time for strike one and two against Koopowitz?

But now this tale twists even further.

Hooker at some point obviously decided that his *Imatophyllum* was a dead name, so when he was confronted in 1854 by a plant that Lindley called "*Vallota? miniata*" and which Hooker knew was not a *Vallota*, he decided that this plant was similar to *Clivia* but had certain characteristics such as open, upright flowers that indicated that the plant belonged in new genus. So he resurrected his now 'dead' name, but as *Imantophyllum* this time – a spelling which had never been used prior to this time, and applied it as *Imantophyllum? miniatum* (yes, he did put that question mark after his generic epithet!). Through this action, he broke the then as yet uncodified rules which today dictate that this name is illegitimate. This, however, did not stop the hordes from applying this half-fish-half-fowl name to anything that looked like a *Clivia miniata* and *Imantophyllum* became a very popular name well into the twentieth century. William, William, William... get into the corner and put on your dunce's cap.

Imantophyllum 1854 of Sir William Hooker, even though it is an illegitimate name, needs to be considered from a nomenclatural point of view, which may appear rather perverse. It represents a new genus name and is not an orthographic variant of *Imatophyllum*; so species that have been transferred into it require separate listing as synonyms in works that cover the nomenclature of *Clivia*.

The species epithet applied to our plant by Hooker – '*aitoni*', commemorated William Townsend Aiton (1766 – 1849) who was then the superintendent of all the Royal gardens and after 1830 of Kew Garden only. Certain authors, as for example William Herbert, preferred the form '*aytoni*', probab-

ly to satisfy some orthographic argument, and today the name would be rendered *'aitonii'*. This epithet was chosen by Hooker because James Bowie requested in his 1827 letter to the former (this letter mentioned above) that the new species be named for Aiton, who was Bowie's patron at that time. It was then common practice for collectors to honour their patrons in this way. Bowie supplied a small amount of the material examined by Hooker and probably supplied plants of this species to Kew, although there is no indication that he had had anything to do with the plants at Syon House, nor that any Bowie plants had flowered at Kew in time to contribute towards Hooker's description.

Interestingly, volume 55 of *Curtis's Botanical Magazine*, the one in which the original description of *Imatophyllum aitonii* appeared, was dedicated to W.T. Aiton. It was only the second volume of this publication to be dedicated, a practice commenced by Hooker in 1827.

Readers who have arrived at this paragraph are to be congratulated on their tenacity. If you have not understood this piece sufficiently, but enjoy the challenge, re-read it after a good night's sleep. Remember that it took me a few weeks to get my mind around this all and I needed outside help in some areas. The next piece will deal with the name *Clivia* and its variants. This work aims towards the compilation of a complete and considered, fully-corrected, annotated nomenclatural list for the genus *Clivia*, which will clarify the properties of every relevant name that I have encountered. Although such a list will not make for scintillating reading, it will represent an indispensible basic reference source.

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Clivia nobilis – out of obscurity

Wayne Haselau – South Africa

Clivia nobilis is a profoundly interesting species as not only was it the first species described in the genus but it has proven to be an extremely good candidate for creating hybrids, especially when crossed with *C. miniata*.

Clivia nobilis is the most southerly occurring *Clivia* species and like it's recently described cousin, *C. mirabilis*, it is drought tolerant and can stand very high light intensities. Up until fairly recently colour forms i.e. yellows, blushes and other pastel forms of the species have been extremely rare. All this changed a few years ago when East London plantsman and 'tswele' (herbalist), Mike Onions, located a superb colony of *C. nobilis* near the coast south of East London. Mike heard rumours about unusually coloured *C. nobilis* from local sangomas. I was asked to accompany him on the inaugural trip in September 2005.

The bush in this area is extremely thick and thorny, more suited to buffalo and rhino, which used to frequent this habitat. Nowadays referred to as sub-tropical transitional thicket, this is a low growing xeric (dry) thicket. *Clivia nobilis* loves this habitat and typically grow along the stream banks ensuring that they get great drainage and higher humidity. On this first exploratory trip it was decidedly hot in the valley, once out of the wind on the hilltops. We struggled to find our first plants. However, once we found them, they



C. nobilis in sub-tropical transitional thicket habitat.

seemed to be everywhere – what a joy to see so many lovely plants in full flower. Initially we found no unusual colour forms and after many hours of sweat and blood (thorns) we managed to turn up two potential yellow plants.

The rest is history. However, as is so often the case the whereabouts of this colony became known to others and most of its unique clones have subsequently been plundered.

Since *C. nobilis* was first discovered and described in the 1800's it has been cultivated



Pink *C. nobilis* ex habitat.



C. nobilis ex habitat.



Yellow *C. nobilis* ex habitat.



Pearl *C. nobilis* ex habitat.

in Europe for almost two centuries. *Clivia nobilis* was the first pendulous *Clivia* to be crossed with its showier sister species, *C. miniata*. The results of these early crossings were not only successful but often spectacular and one has to admit that a really good *Cyrthanthiflora* is a superb plant. A number of authors have written most eloquently on the early history of *Clivia*, most notably Harold Koopowitz in his treatise *Clivia* and John van der Linde and Charl Malan in the Clivia Society yearbooks. *Clivia nobilis* occurs in large numbers in certain localities throughout its distribution range and certain localities contain thousands of individual mature plants. Places where the distribution of *C. miniata* and *C. nobilis* overlap are extremely rare and form what are known as mutating colonies (often with unusual plant and or flower forms), where plants have had the opportunity to interbreed over a long period of time.

Almost all known forms of *C. nobilis* are orange or red and mostly of inferior horticultural form. These plants have been utilized in breeding past hybrids. Despite the recent discovery of a fabulous yellow-blush colony, good quality *C. nobilis* forms are still rare. As a result serious hybrid breeding programmes using the best forms of this species have only recently begun or have yet to be undertaken. I have embraced this and made it my mission. In addition to this, *C. nobilis* is also underutilized in breeding programmes, largely as a result of ignorance, as there is a general persistent belief amongst the *Clivia* fraternity that *C. nobilis* just takes too long to flower from seed (see new growing techniques). All this despite a number of good articles by certain authors to the contrary in a valiant attempt to dispel this deeply entrenched myth, as such I believe *C. nobilis* gets a bad



Red form of *C. nobilis*.

rap. Charl Malan of Grahamstown is a prominent Eastern Cape breeder, who has led the charge in attempting to promote *Clivia nobilis* in popular articles and by using his *C. nobilis* in extensive breeding programmes, with spectacular results. Charl was one of the first South Africans to make the pilgrimage to Japan to investigate new trends in *Clivia* breeding and visited the now famous Clivia Breeding Plantation of Yoshi Nakamura. Mr Nakamura is the first modern *Clivia* breeder to use *C. nobilis* extensively in his hybrid breeding programmes. Charl was impressed by Nakamura's success and came back to South Africa intent on using *C. nobilis* more seriously in his own breeding programmes. The Lotter family in Gauteng have also been actively breeding interspecific clivias for many years and have produced some fabulous crosses to date.

In addition to the many magnificent new flower colour forms, a large number of new leaf forms have been discovered, such as short-broad, robust, semibroad, miniature and variegated, which are also bound to have a positive effect when utilized correctly in any breeding programme.

Distribution

The historical distribution of *C. nobilis* is fascinating and many questions are still a mystery. Why does the distribution stop abruptly just north of Port Elizabeth? Why does it fade into obscurity in the central Transkei near Coffee Bay? It is highly likely that *C. nobilis* was more populous during the last ice age when the coastal plain was far more expansive (extending to the currently submerged continental shelf) due to a significant drop in sea level along the eastern coast of South Africa.



Red form of *C. nobilis*.

Presently *C. nobilis* still has one of the most extensive distribution ranges, extending almost 500 km along the eastern coast of South Africa from the Alexandria district just north east of the port city of Port Elizabeth to Coffee Bay in the Central Transkei. This area of distribution falls within the mainly warm/temperate transition zone lying between the temperate Fynbos biome in the south, the xeric Karoo biome in the West and the Subtropical biome in the North East. There are three or more significant spikes inland where this species can be found up to 70 or more kilometres from the sea. These occur in the Grahamstown District in the south of its range and the King Williams Town and Butterworth Districts in the centre of the distribution area.

Throughout its range *C. nobilis* occurs in a wide variety of habitat types and can be found in dry coastal dune scrub, in warm inland valley thickets and in deep forest. This makes it the most habitat tolerant species and lends credence to the fact that it is perhaps one of the most ancient forms of *Clivia* i.e. one of the oldest and most successful. *Clivia* colonies are often found near water and are normally also associated with rocks and this holds true for this species as well. The ongoing genetic study at the University of the Free State will hopefully throw some light on phylogeny of this species and place it once and for all in its correct place on the *Clivia* family tree (I believe it is a ancient form).



C. x cyrtanthiflora hybridised out of *C. nobilis*



C. nobilis on the sparsely vegetated floor of the forest thicket.

Habitat

Clivia nobilis occurs in a wide range of habitats often close to water which ensures a fairly constant range in both temperature and humidity.

An interesting phenomenon occurs annually in *Clivia* habitat. Due to the deciduous nature of many tree species in the forests of southern Africa, trees lose some or all their leaves during the dry winter months. This increases light intensity to the understory plants and associated with this comes a reduction of photoperiod and colder temperatures. The fallen leaves accumulate on the forest floor forming a mulch which helps insulate the roots, keeping them warm and moist. At the onset of the first summer rains in spring these leaves begin to decay and provide a sudden release of nutrients



C. nobilis in full fruit.

which fertilizes the plants, initiating and assisting with the flowering.

Recently during a drought, I was surprised to note that many *C. nobilis* plants in habitat were not flowering as normal and many had, or where in the process, of dropping (aborting) their flowers. This is an obvious strategy for conserving vital stored reserves and moisture as due to the lack of rain the flowering process had been terminated half way. This proves the importance of the spring rains in the *Clivia* life-cycle.

In some years there is a definite winter (July) early flowering spike in this species that is, I believe, brought upon by radically fluctuating temperatures and moisture levels. This happens occasionally in the Eastern Cape when in some years a winter rainfall pattern predominates. Cold fronts pushing up from the Cape are preceded by hot dry berg winds blowing towards the coast from the interior of the country are then replaced shortly thereafter by the rapidly dropping temperatures and moisture (rain) associated with these fronts.

Growing requirements

As many of us who spend time in *Clivia* habitat have realized, the current methods of growing *Clivia* are somewhat archaic and based on the established horticultural techniques developed for other myriad species in horticulture. This is a gross simplification, as clivias are unique and should be grown accordingly. The fact that almost all *Clivia* species can be found growing as epiphytes under the right conditions proves my point. Many innovative growers are experimenting with new mediums and fertilization regimes.

Most pots currently in use for clivias are too deep and have insufficient drainage for the aerobic roots of *Clivia* plants. *Clivia* species with xerophytic tendencies such as *C. nobilis* and *C. mirabilis* benefit from the use of



Ripening *C. nobilis* fruit.



Germinating *C. nobilis* seed.

porous pots such as clay which breathe and dry out more quickly. Shallow clay pots, albeit expensive, are ideal for specimen plants of these species and it is possible to cut extra breathing slots up the side of the pots using an angle grinder.

All *Clivia* require a myccorhizal root fungus in order to absorb inorganic nutrients effectively. In a healthy plant this myccorhiza and associated aerobic bacteria assist the plant at a cellular level by providing a degree of protection against pathogens as well (somewhat like an immune system). *Clivia nobilis* and *C. mirabilis* (and indeed all *Clivia* species) are extremely dependent on healthy myccorhiza, if they are to achieve optimum growth as they both have very large individual root systems (storage mechanism in the absence of a bulb) under natural conditions. *Clivia nobilis* differs markedly from *C. mirabilis* in the type of root system in that that the roots of *C. nobilis* forms a large adventitious mat around the plant. In *C. mirabilis* there is distinct tendency for the roots to penetrate downwards, only moving sideways when blocked by rocks.

I believe this to be an extremely important and often overlooked aspect of part of their successful cultivation; this is especially true for their germination and growth of seedlings. As I grow large numbers of *C. nobilis* from seed, I make a point of inoculating each new seed tray and seedling container with soil from the pots of mature *C. nobilis* plants. I find that this makes a huge difference as is the importance of not spraying fungicides regularly on these plants. I only treat pathogens when absolutely necessary and then with minimum doses initially.

Clivia nobilis seedlings germinate rapidly, however they then endure a seemingly agonizing two year growth stage that seems to the grower to be ridiculously slow. What they are in fact attempting to do is build up root mass as this is their only protection during drought years. Both *C. mirabilis* and *C. nobilis* are guilty of this, although in my experience this takes longer in *C. mirabilis*. I grow large numbers of select *C. nobilis* seed annually and have strived to achieve faster growth rates in cultivation (myccorhiza). I find that higher light intensity and warmth in combination are critical to ensure faster growth. As *C. nobilis* is a shallow rooting species, growing seedlings in shallow trays is also a very good idea. Using finely chopped composted leaf litter as mulch also benefits growth enormously, as does fertilizing regularly with organic fertilizer such as well rotted cattle or horse manure.



Decaying mulch releases nutrients to forming *Clivia nobilis* seedling roots.



C. nobilis germinated seedlings. Note some variegated.

I am experimenting with a number of alternative types of containers for *C. nobilis* plants and have so far had the best results with plastic wash basins. By cutting slots up the sides and drilling holes in the bottom it is possible to make a really functional relatively cheap container for specimen plants. Fired clay bonsai pots also make superb, albeit expensive, containers for specimen plants. The large basins have the added advantage of helping to keep plants well spaced.

Mixes are important when growing xerophytic Clivias, as they need to be free draining, assuring that the roots get plenty of air and also that they provide a degree of nutrition. Jaco Truter and I recently discussed this very point at length. To facilitate lightness in his mixes and to prevent binding, he adds polystyrene granules (balls). I think this might just be the way forward for creating a superior *C. nobilis* potting mix. Polystyrene is inert (cannot break down) so maintains critical aerobic processes. Binding, i.e. the rapid decomposition of a mix, often exacerbated by earth worms, can be fatal to plants as this prevents oxygen from reaching the roots freely, causing anaerobic (rotting) bacteria to increase dramatically.

Using crusher dust, finely crushed dolomite (blue shale), seems to benefit the plants enormously (some growers use dolomitic lime), providing plenty of essential inorganic trace elements to the plants. I now incorporate this into all my mixes; however, it is advisable to use this material in small quantities as it can make the mix heavy. Coarse quartz sand is another good material to add for drainage but again I feel one should only use small quantities.

Natural history

In the wild *C. nobilis* may flower at any time, although 90% of flowering occurs in the Southern Hemisphere spring (Sept/Oct). I have noticed a distinct early flowering spike in mid-winter (June/July) both in habitat and in collections and I believe this coincides with the first cold winter weather and associated rain. In the warm/temperate zone the severity of the cold and whether it rains or not varies from year to year so that in some years little or no flowering occurs at this time.

All pendulous *Clivia* are primarily pollinated by sunbirds. I can tell you this with certainty as I have problem sunbirds in my garden that insist on pollinating my pendulous Clivias. I have to go to great lengths to prevent them from doing so. The culprits are easy to spot as they often

have pollen covered yellowy ceres. In my experience the number one *C. nobilis* pollinator is the Greater Double Collared Sunbird, closely followed by the larger and more secretive Olive Sunbird. In the southern part of the range of *C. nobilis*, Grey Sunbirds are common and they undoubtedly also play their part. In a recent article I wrote about small bees in the family Anthophoridae, which are also important pollinators of *Clivia* in the wild in my area. I believe they are invaluable in that they move pollen between species (interspecific) which results in mutating colonies, i.e. *C. miniata* to *C. nobilis* and vice versa.

Clivia seed dispersal is a fascinating subject and one that I often ruminate about. Ever notice how *Clivia* seeds bounce when they are dropped inadvertently, like when you are trying to clean them in the kitchen? I believe *Clivia* seeds have evolved to bounce. Take a few cleaned *Clivia* seeds and drop them on to rocks, you'll be amazed to see how far they travel, especially if they are on a slope and have gravity as assistance.

They bounce high (proportional to the height from which they are dropped) and in a great many different directions. In nature this assures that most of the seed falls down slope. So how do plants move upslope and long distance? They use seed dispersers of course and in the case of *Clivia* these are most often fruit eating birds, although monkeys and in some areas certain rodent species also avidly, albeit unwittingly play a part. The berries of *Clivia* are most often bright orange or red, occasionally yellow, and cover the seeds with a highly visible nutritious wrapper that shouts food to all frugivores (fruit eaters) even in the deep shade of the forest. I believe birds such as bulbuls, loeries (Turacous) have the ability to move *Clivia* seeds long distances in the wild, as they may pick a fruit and then fly a considerable distance before finding a suitable perch on which to clean it.

Monkeys undoubtedly also move seed around especially during the dry winter months when there is little food. They may pick a *Clivia* fruit out of curiosity, especially the young ones and carry it for some distance before dropping it. *Clivia nobilis*, like all *Clivia*, grow extremely well as epiphytes especially in Forest or Dune Forest and can only find their way into the trees buy using birds and monkeys to get there. Fruit eating bats, such as the common Walhberg Fruit Bat may also play a part in *Clivia* seed dispersal. Although this would be extremely hard to prove, it is likely as similar genera like *Haemanthus* and *Scadoxus* also have highly visible seed, which in the case of *Haemanthus membranaceous* gives off a strong odour when ripe.

Clivia nobilis releases its seed reluctantly as seed is often trapped in the leaf axils of the mother plant. These seeds often find their way onto the ground close to the mother plant, where they germinate readily, assisted by the mother plants mychorriza. Like all clivias, rain falling on the leaves is funnelled down to the base of the plant where it is absorbed by the roots. Any small seedlings growing here would then obviously benefit from this rainfall funnelling effect.

New forms / varieties

I believe *C. nobilis* is hugely underestimated currently as a parent in hybrid breeding programmes largely due to ignorance. Very few people are aware of how many wonderful new forms and varieties are now available. This should not be the case when one looks at its marvellous track record both internationally – Nakamura's breeding programme and locally with people such as Charl Malan who has bred some fabulous interspecifics

using *C. nobilis* as a reciprocal parent. Charl was undoubtedly heavily influenced by Yoshi Nakamura after he visited Japan some years ago. Recent research has shown the hidden potential for colour breeding as certain chemicals found in some pendulous species have the ability to block the standard anthocyanin pathways, potentially leading to the development of new colour varieties.

Clivia nobilis is now known to have a much broader colour range. I recently viewed a DVD compilation of photographs taken over two flowering seasons by the wife of a friend when visiting a local *C. nobilis* population. It was profound – the amount of flower variation displayed by individuals within this one population is remarkable. Only by viewing these pictures at home is the true degree of variation apparent.

Over the years I have made a concerted effort to seek out new and rare forms that are horticulturally significant and can honestly say that variegates, true pinks, yellows, blushes, party colours, deep reds, plum and bronze *C. nobilis* are now being utilized in my breeding programme. I recently acquired a plant that can only be described as an apple-blush. Some plants also have a very high flower count, I have one with 96 flowers recorded. I am aware of another that has 92.

Conservation

So much is said about clivias and their obvious decline. A lot has been said about the importance for conservation of all species and populations. Most is just lip service, as to date very little or nothing has been done to protect clivias in the wild. I propose that the Clivia Society gets more involved with the protection of clivias both in habitat and in heritage collections (which form an extremely important *ex situ* conservation role) and I propose that a *Clivia* conservation portfolio be established as soon as possible by the Clivia Society to promote these goals for future generations.

Clivia numbers are declining throughout their range as more and more suitable *Clivia* habitats are impacted upon by humankind in one way or another. There is in fact very little pristine *Clivia* habitat left, so if we do not act now there will be little or nothing left for future generations to enjoy. *Clivia nobilis* is a good benchmark species as it inhabits the narrow coastal plain of the Eastern Cape. This area is facing large scale development as it is in a zone easily accessible to people and much sought after for industrial and housing development, i.e. the huge Coega Industrial Development on the Albany Flats outside Port Elizabeth and surrounding areas and ongoing coastal holiday developments along East Cape estuaries, which is often in prime *C. nobilis* habitat.

I believe that one way forward is to actively promote the cultivation of *Clivia* from seed, especially naturally rare and or slow growing species, much like what John Winter achieved when growing *C. mirabilis* from seed for Kirstenbosch. *Clivia nobilis* is a naturally slower maturing species than say *C. gardenii*, and it is therefore understandable that growers are reluctant to wait a long time for plants to mature. It is far quicker and easier to either collect mature plants or buy them from other growers or nurseries. The sad part about this is that these mature plants have often been removed directly from the wild. Unfortunately, there are plenty of unscrupulous collectors and growers out there eager to make a quick buck and who will stop at nothing to get large quantities of desirable plants. The illegal cycad trade is a good example of this.

Growing large numbers of good quality *C. nobilis* plants from seed will, I believe, ultimately take a lot of pressure off the wild stocks if they are made available to growers in reasonable quantities and at fair prices, i.e. flooding the market lessens the demand and forces the price down (this is basic economics). This is all of our responsibility so when next you see good first class *C. nobilis* seed advertised you will hopefully purchase a few to try.

Pests

Clivias generally suffer the unwanted attentions of a vast array of pests. *Clivia nobilis is* largely immune to the ravages of the destructive lily borer caterpillar, although I did notice an affected plant in a local collection recently. I believe this is largely due to the inherently tough nature of the *C. nobilis* leaf. The greatest threat to *C. nobilis* plants is over-watering and binding of the potting mix soil leading to anaerobic conditions and associated rotting.

Many *C. nobilis* plants have what looks like a mosaic virus and this is especially obvious on young leaves. Most growers, myself included treat their plants for nutrient deficiency when plants start showing these signs however if symptoms persist I move the plant to secluded sickbay area. I believe this is wise as some forms of virus are definitely transferable from one plant to another. Occasionally, scale insects and mealy bug affect *C. nobilis* plants and to prevent their spread one should treat affected plants with a strong systemic insecticide. Ants are a nuisance, as they are the main vectors (movers) of these pests so I spray for them too.

Recently, I have noticed a marked increase in a form of pustular rust which forms unsightly wart-like lesions on the underside of *Clivia* leaves. This rust occurs naturally in the habitat and in many collections as well. To treat it, I break off the effected leaves and treat the damaged area with flowers of sulphur. Virikop and other copper based fungicides seem to work well in preventing this scourge.

There is a small white beetle larva that bores into the rhizome of *Clivia* plants that is becoming more common in collections and I strongly advise people to take it seriously. This is also a pest that occurs in the habitat and seldom affects adult plants fatally; however it is pernicious and can attack seedlings fatally. It can be treated by soaking affected plants in a strong systemic insecticide overnight. I then place a teaspoon of Karbaryl granules, which dissipate slowly, at the base of the plant and they seem to do the trick.

Recently, while walking in the dune forest near my home, I came upon a large striped African land snail devouring a mature *C. nobilis* plant. At first I was surprised that the snail would actively seek out and eat the tough foliage of *C. nobilis*, but once I started looking it became evident that this is a regular feature in this area.

Future

The future for *C. nobilis* horticulturally, looks bright, as more and more growers become interested in the pendulous species and their breeding potential. *Clivia nobilis* holds wonderful promise for *Clivia* breeding especially the breeding for colour as it is a vigorous parent and genetically it undoubtedly holds some of the greatest possibilities for colour breeding.

It is essential that we also grow more *Clivia* species, especially pendulous plants and promote the slower growing forms amongst younger growers, who will ulti-

mately really derive the most benefit from growing these plants. *Clivia* numbers are rapidly declining in the wild due mainly to habitat loss and the increased demand for wild *Clivia* plant matter in the muti (traditional medicine) trade. The wholesale destruction of *Clivia* colonies by unscrupulous collectors, out to make a quick buck, is also a very real threat and it's high time that such individuals be taken to task for such practices.

The heritage potential of this species is unsurpassed. Let's help this often maligned species to take its rightful place once and for all – meanwhile nurture what you have and pass some on.

Eastern Cape Clivia Club 2009 Interspecific Show

Carrie Krüger's pink mingard was voted the best on show with Gert Esterhuizen's double headed orange cyrtanthiflora as second choice. The pink interspecific is a cross between a Group 2 yellow *C. miniata* and a yellow *C. gardenii*. Gert's orange came from seeds which were obtained from Yoshikazu Nakamura.



Gert Esterhuizen's cyrtanthiflora.



Carrie Krüger's mingard.

Clivia gardenii – a new dawn

Francois van Rooyen – South Africa

Clivia gardenii was discovered and collected by Major Robert J. Garden in 1855, while stationed in the colony of Natal with the 45th Regiment. In the collection of Major Garden's paintings, there are quite a few representations of the KZN Table Mountain area. In his diary of his campaign in Pondoland he seems more interested in the indigenous people and their use of plants. Therefore it is fair to suggest that the live specimen collected came from the Table Mountain area near Pietermaritzburg. This live specimen, presumably collected there, was packed in a Wardian case with other living plants, and sent to the Royal Botanical Gardens, Kew in London, UK. In 1856 when flowering for the first time the new species was named by Sir W. Hooker in honour of the collector.

I was first made aware of *C. gardenii*, when we were phoned by a local doctor friend of ours about some flowers he had collected on our farm the year before. We knew about the *C. miniata* that grew there and the amazing flush of orange flowers that bloomed in September. According to the doctor the *Clivia* he collected looked different and sick. Needless to say these plants were *C. gardenii*, and yes, they did look sick. Plants with narrow untidy leaves and short peduncles with only a few hanging flowers. A lot has changed since then. Below I will discuss the diverse, wonderful beauty and potential of this pendulous complex of Kwa-Zulu Natal and Pondoland.

Kwa-Zulu Natal, northern Pondoland (Transkei), have three pendulous *Clivia* species. Although *C. gardenii* (Ngome) is still seen as a form of *gardenii*, hopefully it will in future be recognized as a new species. The traditional *C. gardenii* [*C. gardenii* (sensu stricto) or the Midlands form] consists of the most incredible variation in leaf, shape, size and colour. I think the distribution of this species is much larger than originally thought. Then lastly three other forms/species occur, swamp *C. gardenii*, *C. robusta* and *C. gardenii (maxima* form). These three forms/species are probably the most controversial and confusing, due to its DNA make-up, but definitely the most interesting.

This article is to introduce you to a plant that is amazing, beautiful and filled with talent. It is a 'must have' in any collection to be able to create new and exciting things as well as a beauty on its own.

Clivia gardenii (Ngome)

This is visually one of the most attractive *Clivia* species. The 'onion-like' base is quite unique, and grows bigger with age. The proud, strong peduncle stands high above the plant, making it ideal for interspecific breeding. The colours are very different from any other pendulous species I know – yellow, yellow-blush, pink, luminous orange to predominantly green with a faint blush. I have also seen two blood-red forms, very rare.



C. gardenii 'Gem's Hobbit'.

Clivia gardenii (Ngome) has also got one of the neatest arrangements of leaves, perfectly fan shaped and balanced. Leaf width varies but I have seen plants with a leaf width of 70 mm – ideal for breeding. The original description says 20 – 35 flowers but I've seen plants in collections with 45 to 60 flowers.

I think as a display plant and a garden plant, *C. gardenii* (Ngome) is a must. As a breeding plant to create world class interspecifics, it's an absolute necessity.

Clivia gardenii (Midlands)

These plants never cease to amaze me. Probably the *Clivia* species that has been criticized the most, but hopefully no more. This species has the most variation in size, leaf and colour. Plants were observed with the size of *C. robusta*, with leaves up to 80 mm wide. Then another with a leaf length of 20 cm, and a leaf width of 20 mm.

The colours are truly amazing: creamy white, yellow, blush to pink, peach, pastel, orange, red, bronze, and predominantly green. Then there are colours that even the colour chart does not capture. The flower count also far exceeds what was originally thought. Umbels with 40 flowers are not uncommon and I have seen some with up to 50 flowers.

Clivia gardenii flowers first of all the pendulous species, in April/May. Its vast colour range makes it a must for every collection. Its breeding potential for creating interspecifics makes it invaluable. A little more patience will be needed as the best results will be in the F2 generation.



C. gardenii 'Ngome Yellow'.



C. gardenii 'Ngome Blush'.



C. gardenii Ngorme.



C. gardenii Ngorme Bronze.



C. Gardenii pearl



C. gardenii pink



C. gardenii salmon.



C. gardenii watermelon.



C. gardenii



C. gardenii Orange-Red.



C. gardenii Orange Bronze.

Swamp *C. gardenii, C. robusta* & *C. gardenii* (maxima)

Of all the *Clivia* species, this complex of plants is the most mysterious and intriguing. I have seen plants 2 m high and a leaf width of 90 mm; also some with beautiful variegation. Medium size plants with olive green leaves, others with dark bluish leaves similar to *C. miniata* (Mzamba). Lately, I have been fortunate to have seen mature plants standing only 35 cm high. The variation and "unknown factor" in these plants, makes them exciting for future cross breeding.

The colours also vary substantially, from cream, blush, pink, orange, red and bronze.



PHOTO: SEAN CHUBB

C. robusta 'S0'.



PHOTO: SEAN CHUBB

C. robusta 'Munster Peaches & Cream' ex habitat.



C. gardenii Orange Bronze.

Swamp *C. gardenii, C. robusta* & *C. gardenii* (maxima)

Of all the *Clivia* species, this complex of plants is the most mysterious and intriguing. I have seen plants 2 m high and a leaf width of 90 mm; also some with beautiful variegation. Medium size plants with olive green leaves, others with dark bluish leaves similar to *C. miniata* (Mzamba). Lately, I have been fortunate to have seen mature plants standing only 35 cm high. The variation and "unknown factor" in these plants, makes them exciting for future cross breeding.

The colours also vary substantially, from cream, blush, pink, orange, red and bronze.



PHOTO: SEAN CHUBB

C. robusta 'S0'.



PHOTO: SEAN CHUBB

C. robusta 'Munster Peaches & Cream' ex habitat.



PHOTO: SILVIA CHUBB

C. robusta 'Notched leaf' - ex habitat.



PHOTO: SILVIA CHUBB

C. robusta 'Pink Blush' - ex habitat.

The flower count in some of these plants can also be extremely high, up to 75 per umbel.

Visually swamp *C. gardenii*, *C. robusta* and *C. gardenii* 'Maxima' are a definite for your collection and in your garden. For crossbreeding with other *Clivia* species, a big yes, you cannot do without.

In conclusion, the heritage of *C. gardenii* or to put it simply, what we are going to inherit, is what we do with *C. gardenii* from now, into the future. How we look at them, select them and partner them with other *Clivia* species will be the essential key to creating a masterpiece. A new dawn has arrived.



Clivia robusta? ('Maxima') ex habitat.
Fred van Niekerk's collection.



PHOTOS: ROGER FISHER

Clivia robusta? ('Maxima', yellow form) ex habitat.
Fred van Niekerk's collection.

Gladys Ivy Blackbeard – *Clivia* Pioneer

Charl Malan & Greig Russell – South Africa

One always marvels at those among us who are the pioneers, quietly going about their work with tenacity and determination, setting new standards for others to follow. As the interest in *Clivia* grows in leaps and bounds, interest increases in the early *Clivia* pioneers who actively hybridized and raised different species and varieties.

In South African *Clivia* folklore the name Gladys Blackbeard is foremost. She was the pioneer who worked on *Clivia* for many decades; from the 1920s until 1962 when she was forced to sell off her main collection. She created both intraspecific *Clivia miniata* and interspecific hybrids and built up an impressive number of varieties through exchange and hybridization.

Very little information on Gladys Blackbeard and her activities and interests is available and this article attempts to reveal what can be discovered about her, following extensive investigation, to share with all *Clivia* lovers.

Family History

Gladys Ivy Blackbeard is usually said to be the great granddaughter of Francis Blackbeard, 1820 Settler and silversmith, who arrived in Algoa Bay aboard the *Nautilus* with Rowles' Party. Careful genealogy has proven this to be incorrect. Gladys's grandfather, George Francis, born in 1815 in London, lived there through two marriages until he came out to South Africa in about 1854 with his second wife and four children, including Gladys's father, George Francis Jr., who was born in London in 1849. After their arrival in South Africa, the family continued to grow; so large indeed, that Gladys would be able to boast of having 54 first cousins on her father's side alone. In 1856, George Francis Sr. signed the Death Notice of Francis's son, Robert, as "Cousin of the Deceased". Since George Francis's father, John, was a silversmith like Francis, it can be assumed that these two were brothers. The parents of these brothers were possibly the silversmith Francis Blackbeard from Marchington, Staffordshire and Mary Titley of London who had married in 1775.

George Francis Sr. had worked in the shoe business in London since his youth, and when he arrived in Grahamstown, he opened the G.F. Blackbeard Boot & Shoe Warehouse at 27 Bathurst St, importing most of his stock from England. Upon his death, the business was taken over by Gladys's father and upon the latter's death at a relatively young age in 1902, Gladys's mother assumed the reigns. Later the business was passed to Luke, one of the twin brothers of Gladys's father. Dennis Blackbeard was the last of the family to own Blackbeards' Shoes and he sold the business in 1984. It is still trading today at the same address under the same name.

Gladys Ivy was the youngest child of George Francis Blackbeard and Elizabeth Harriet, née Marshall. She had three sisters,

Maud, May and Gertrude, and a brother Henry.

Apart from the third sister Gertrude, none of the others married, and as Gertrude had no children, this branch of the Blackbeard family ceased to exist upon Gladys's death on the 11th September, 1975.

Scott's Farm

This land, on which Gladys and her family lived for many happy years, would eventually bring them great heartache and sadness.

It was first acquired by Lt. Col. Hugh Maurice Scott, then Commander of the Eastern Frontier, as an Imperial Grant in 1822. Scott, born in 1779 of an Irish-English military family, had fought on the Iberian Peninsula in the Napoleonic Wars, was part of the force that occupied France at the end of these wars and was then sent to the Cape, arriving in 1821. In Grahamstown, Scott put his talents into designing buildings like the new Scott's Barracks, laid out the foundations of what would become the Cathedral of St Michael & St George and designed and built Scott's Cottage on Scotts Farm which would become the Blackbeard family home. Scott also founded Fort Beaufort. At the end of 1823, Scott became the Commander at Simonstown and was then posted to Bombay in India, where he died in 1828 of cholera.

Scott's Farm passed through many hands until it was purchased by Gladys's maternal grandfather, Mr. Edward Henry Marshall. Her mother Elizabeth inherited the entire property upon his death following payment of £400 into his estate, and when she relinquished hold on the Blackbeard Shoe business, the family went to live there permanently.

Upon their mother's death in 1932, Gladys and her siblings inherited the property, and continued to live there until 1966 when the property was purchased by the Grahamstown City Council.

Urbanization after the Second World War saw a significant immigration of particularly farmworkers to Grahamstown. Most of these families settled in the Valley in which Scott's Farm is situated, until by 1955 the entire property was surrounded by "an arid location of dirty streets, shops and jig-saw puzzle houses".

It was also at this time that the Government of the day started in earnest with the implementation of the cornerstone of Apartheid, the Group Areas Act of 1950.

Although the Grahamstown City Council vehemently opposed the introduction of the legislation, by 1955 a plan had been foisted upon them in terms of which Scott's Farm was included in the Coloured Group Area. As the Blackbeards were European/White, the harsh reality was that they had to vacate the property and move to the White Group Area.

The inevitability of the eventual move became clear to them as early as 1955, and Gladys offered the property to the City Council no less than four times up to 1963, when the offer was eventually accepted. They were bought out for the princely sum of R9 000, moving out in 1966.

On 28th October 1957 in one of her letters to the Town Clerk of Grahamstown, Gladys describes the property and improvements thereon as follows:

"The property is entirely fenced and netted and the poles are good sneezewood poles; it is subdivided into small and large camps. It is fully surveyed consisting of thirty (30) plots, has permanent and unfailing water, electric pumps, 23 delivery taps into tanks, municipal water laid on to nine (9) upright taps, numerous cottages, buildings and two sheds and housing for 22 cattle."

The main homestead erected by Scott



Gladys Blackbeard and Hardy, her famous pet Hadedah Ibis, photographed in the late 1950's

was considered of historical importance but in the end could not be retained, as it did not fit in with the Municipality's plans for the area.

Scott's Farm was transferred to the City Council on 28 April 1966. Later the Cottage was dismantled and re-erected behind Temlett House in the City.

Two sub-economic housing schemes were eventually developed on the property, and Blackbeard Street in this suburb, Scott's Farm, is named after the Blackbeard family. Gladys and her sister May moved in with their sister Gertrude at 1 Trollope Street, Grahamstown.

Gladys was eventually to inherit the house which was then bequeathed on her death in 1975 to her Alma mater, Kingswood College.

Gladys Blackbeard: Naturalist and Plantswoman

Gladys was born in Grahamstown on 19 May 1891. She attended the Wesleyan Girls High School, now part of Kingswood College, but unfortunately never received any higher education.

According to her article in the 1939 *Herbertia*, the original handwritten versions of which are kept in the Cory Library for Historical Research at Rhodes University, Gladys's early interest in *Clivia* was awakened by her mother. In this article she describes some of her early hybridisation attempts and the results thereof. She used *Clivia nobilis* and *Clivia miniata*.

Apart from *Clivia*, Gladys was a grower of various other plant genera such as *Aloe*,

Encephalartos, *Nerine* and a wide variety of succulents.

It is obvious from correspondence between her and the staff at the then Botanical Research Station, Grahamstown, that she supplied information and plants to succulent collectors and workers on Amaryllidaceae worldwide. She was a great help to Drs. Paulus Lotsy and Wouter Goddijn, visitors from Leiden University, Holland during 1926/7. They worked on the relationship between hybridisation and speciation in *Euphorbia* and *Cotyledon* in the Fish River Valley. While studying plant hybrids, they also saw the opportunity to study the "human hybrids" that constituted the neighbours of the Blackbeards. Their conclusions were published in the Dutch Journal, *Genetica*.

Gladys seems to have initially grown flowers such as carnations and was Grahamstown's first florist, well-known for her arrangements of plants and flowers. She was also a regular participant in the Grahamstown Natural History Society's Exhibitions.

Two plants were named for her: *Huernia blackbeardeae* – now considered a synonym of *H. zebrina* var. *magniflora*; and *Haworthia blackbeardiana* now generally seen as *H. bolusii* var. *blackbeardiana*.

Mr M.J. Wells, who was the head of the Albany Museum Herbarium in Grahamstown from 1961 to 1969, got to know Gladys well during his stay in Grahamstown and visited her often, both at Scott's Farm and after she moved, at 1 Trollope Street. He recalls that she was a tall person of spare build with intense penetrating eyes, reflecting a keen intellect.

He has vivid memories of the *Clivia* collection, particularly the amazing variety of form and colour. From the moment he first set eyes on it, he was in no doubt about its unique quality and the dedication necessary to create it. Gladys's goals with her breeding programme was to create as wide a variety of form and colour as was possible in the genus. He fondly remembers her indomitable spirit and her love for all animals and birds. She often tempted fate in the street at Scott's Farm by confronting donkey cart owners who were whipping their donkeys in an attempt to get them and their load up the steep and rutted road. She would disarm the owner and whip him instead, quite fearless in her pursuit of protecting the donkeys.

The *Clivia* work represented the quiet side of her nature and was a peaceful form of recreation for her. She discussed her decision to part with the clivias with him and he made representations to the relevant bodies at the time to acquire the collection. For various reasons this did not materialize.

Dr R.A. Dyer, the well-known botanist, who had come to know Gladys during a five year stay at the Albany Museum Herbarium in Grahamstown, commissioned Cythna Letty to paint Gladys's Clivias for posterity. She visited Scott's Farm in 1947, the visit being written up for publication in the *Herbertia* of 1948. Today these paintings, which concentrated on capturing colour, are in the custody of the South African National Biodiversity Institute in Pretoria and have been published for the first time in this issue, from pages 41-47. Unfortunately there is only one flower painted in this group that was the product of Gladys's own breeding.

By the time Gladys sold her *Clivia* collection to Gordon McNeil in 1962, it was without doubt the foremost collection of *Clivia* hybrids in South Africa. The collection was freighted off in a whole train truck.

She had taken the decision to sell very deliberately, under the cloud of having to



Gladys Blackbeard's *Clivia* collection in flowering season on the verandah, photographed by Gordon McNeil in the early 1960's, showing some of the quality and variation that was available in the Blackbeard collection.

leave Scott's Farm, and not being able to accommodate the plants elsewhere.

Gladys and her sisters Maud and May established an animal and bird sanctuary at Scott's Farm, and had a large collection of birds and animals, including a particularly fine collection of tortoises. People would bring injured and orphaned birds and animals to the farm from all over the district where they would be nursed back to health or cared for.

Gladys hosted many eminent personalities at Scott's Farm, particularly in connection with *Clivia*. These included Sir Arthur Hill, Curator of Kew Gardens as well as Dr Hutchinson also of Kew.

Conclusion

Gladys Blackbeard was a modest woman with a great love for the genus *Clivia*. She had an enquiring mind which led to her hybridization experiments. The beauty and variety of the McNeil collection is testimony to her work, and many collectors treasure those special plants which they know are Blackbeard plants. Not many hybrids have been registered which come from the McNeil collection, and thus secondarily from the Blackbeard collection. Two hybrids with very interesting colour from this source are *Clivia* 'Four Marys' and *Clivia* 'Gladys Blackbeard'.

Much other material has been distributed from the McNeil stock, but there is little information available on where and how this has ennobled our present day clivias. Thus it is impossible to evaluate how Gladys Blackbeard has contributed to the *Clivia* of 2010. Whilst Gladys's plants may not form much of the basis of modern *Clivia* breeding, it is her spirit that will forever live on in the hearts of generations of South African *Clivia* breeders.

Gladys lies buried in Grave No. 552 in the Blackbeard Family Plot in the Wesleyan Section of the Old Cemetery, Grahams-



Photo: Peter Saayman

Pieter Saayman & Michael Holt's plant of *Clivia* 'Four Marys'.

town. This historically important cemetery has been much neglected by the current municipal authorities, and sadly Gladys's tomb stone has disappeared from what is now a very unsafe locality to visit.

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Acknowledgements

Mr. M J Wells of Froggy Farm, Simonstown, Erstwhile Officer in Charge of the Albany Museum Herbarium, Grahamstown for sharing his recollection of Ms. Blackbeard and her *Clivia*.

Mrs. Edith Blackbeard of 20 Riverside Drive, Port Alfred for sharing her knowledge of the Blackbeard family.



Photo: Mick Dower

Mick Dower's plant of *Clivia* 'Gladys Blackbeard', acquired by him from Margot McNeil in February 1994.

Sandy Rowoldt, Librarian of the Cory Library for Historical Research, Rhodes University, Grahamstown, for making available information on Ms. Blackbeard.

Craig Peter of Rhodes University for acquiring copies of the material from the Cory Library for Historical Research, Rhodes University.

Ms Estelle Brink of the Selmar Schönland Herbarium, Grahamstown for making available information on Ms. Blackbeard.

Mick Dower of the Cape Province Branch of the Clivia Club for initiating this article, for sharing information on Ms. Blackbeard and for his support in general.

Roger Fisher for all sorts of help and especially for his work on unearthing the Letty paintings.

Clivia Breeding

Gladys I. Blackbeard – South Africa

Scott's Farm, Grahamstown. Cape Province

[Reprinted from *Herbertia* 6: 190-193, 1939.]
The original draft of this article was published in *Clivia* 2: 43-45.

Of the many interesting flowering plants of South Africa, the Genus *Clivia* is worthy of special mention. It consists of handsome plants with dark green leaves and strong erect stems which carry massive flower heads in brilliant shades of nasturtium red to copper and gold. Even in winter they are most attractive pot plants with evergreen leaves and brilliant red fruits.

My early interest in the genus *Clivia* was awakened by my mother, who was deeply interested in South African flowers and gardening generally – an art almost neglected by women folk at that time. Gardening brought her into contact with many flower lovers and gardeners of the old type. She was fortunate in making the acquaintance of an old English gardener, who came to South Africa. He soon saw the possibilities of exporting bulbs, etc. to England. He collected the very handsome Red *Clivia*, *C. miniata*, (see p. 45 E) and presented my mother with one plant. As a child I well remember the joy of seeing it bloom each year. It increased and after many years has come to be considered almost as a family heirloom. I was fortunate in securing another

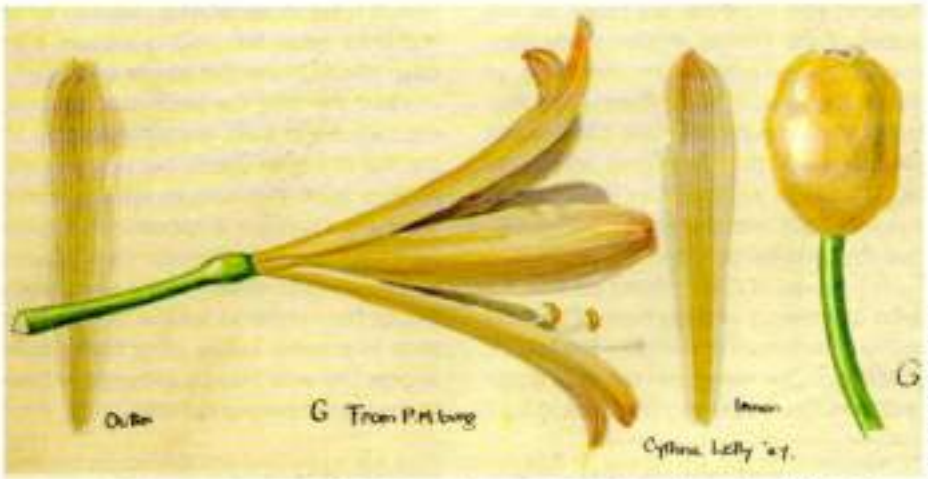


IMAGE: SANBI PRETORIA

A painting by Cythna Letty Forssman of Gladys's second breeding *Clivia miniata*, the one in which the flowers are of pale apricot tint.

plant from a friend, the origin of which she could not give. The flowers are of pale apricot tint, having broader and more widely spreading perianth lobes (see page 41).* This gave me an inspiration and soon I made a cross between these two. Some five and a half to six years later the progeny flowered. The cross had considerably enhanced colour and form, from the palest to deep shades, with larger flower heads and broad petals truly a brilliant show. Year after year I made crosses from the best plants and today those early crosses have multiplied to a family of some 2000 plants, from flowering plants to year-old seedlings.

Branching out from this family and making a fresh cross, I took again as my pollen parent the pale apricot one, and as the seed parent, a species that is indigenous to this part, *Clivia nobilis* (see page 43). The flowers of this species are tube like and hang down in a massive cluster, being supported by a strong peduncle. This is in nature a very hardy and robust species – growing under various conditions in shaded moist kloofs some thirty-six miles away from the sea, down to within a few hundred feet from the sea shore, on the slopes of the hillside, in part shade from the tall tree Euphorbia on the banks of Bushmans River in the eastern Cape Province. In this particular spot *Clivia nobilis* has survived the damaging effects of man. Whereas most of the undergrowth has faded out with the advance of civilization the *Clivia* has persisted.

The flowers of *Clivia miniata* var *flava* are erect or sub-erect whereas those of *C. nobilis* droop or hang their flower bells. The hybrids in this cross are somewhat varied in shade and form. The shades vary from dark to light apricot pink. They flower out of season, that is to say my general collection flowers in the spring, late August to September, whereas the *C. miniata* var *flava* – *C. nobilis* hybrids flower in May and a few in July, the flowering period having completely changed. If this will continue season after season is yet to be proved. This may be of immense value for making crosses with other related plants that bloom at this time.



Photo: Greg Russell

A selfed seedling of *Clivia miniata* 'Blackbeard's Yellow', recently donated to Sean Chubb's Heritage Collection.

From the time the seeds start to form, the capsules or fruits gradually develop to the size of a large cherry, but pear shaped. As they ripen they turn to brilliant scarlet and have a handsome appearance. It takes from ten to twelve months for them to ripen and they would remain on the plant much longer, but I prefer to remove the seeds as soon as possible before other flower buds appear. The seed may be gathered as soon as the fruits show any red colouration. After

* It is probable that this is *C. miniata* var *flava* Phillips, which was figured and described for the first time in 1931 *Flowering Plants of S. Afr.* t. 411. It was discovered in North Natal about 1888 and a number of plants were distributed from the originals.

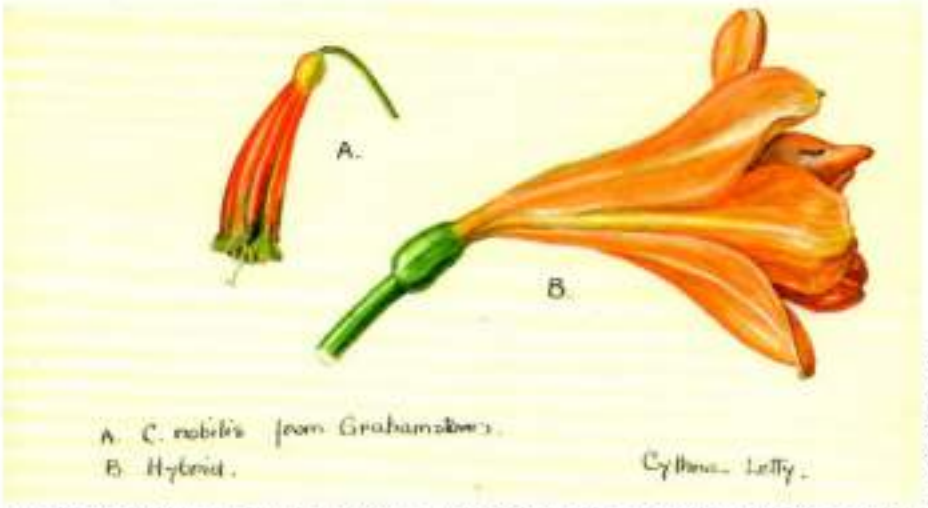


Image: SANBI Pretoria

A painting by Cythna Letty (Forssman) of Gladys's *Clivia nobilis* from the valley of the Bushmans River, together with what appears to be one of Gladys's complex interspecifics, based on this species.

removing the pods I leave them for about ten days to two weeks after which I peel them and remove the seeds. The fruit contains an average of 5 to 7 seeds. One should not leave the seeds in their fruit pods too long for they will probably start growing and the delicate shoots may be broken off when removing the seeds.

When planting the seeds I use flat pans or boxes with moss at the bottom as drainage and then fill up with a light mixture of one part each of sand and leaf mould to two of good light garden soil, well mixed. Place the seeds in rows one inch apart, cover them with soil and give the seed pans a tap down by lifting up a little and dropping on the bench. Tap down at least twice. This settles the seeds into position. The pans or boxes can be their home for some time up to eighteen months or two years. When transplanting never give the seedlings much pot room, and never transplant until the roots are pressing above and over the side of the pot. They will flower well in 9 inch pots. Never "over-pot" *Clivia* plants as they will not flower, but only increase in leaf and root system. The secret of flowering them is rather to starve the plants than to over feed them. The general cry from most people is "my *Clivia* will not flower in spite of the fact that I keep potting it on." I always reply "Starve it." To enhance the bloom, when buds show, sprinkle round each plant a little well decayed mixture of horse and cow manure. This is all I have ever done for mine. For cultivation I have a "bush house" with flat roof, but before flowering it is advisable to put the plants under more shelter such as a glass house or verandah to protect the blooms from damage. Plants can be broken up and subdivided.

It must be remembered that all details given in this brief summary are purely the result of my own personal experiments, unaided in any way. Therefore my experiments have not advanced as rapidly as I should have wished. However many things have small beginnings, and the joy and keen interest shown in my collection has more than repaid me.

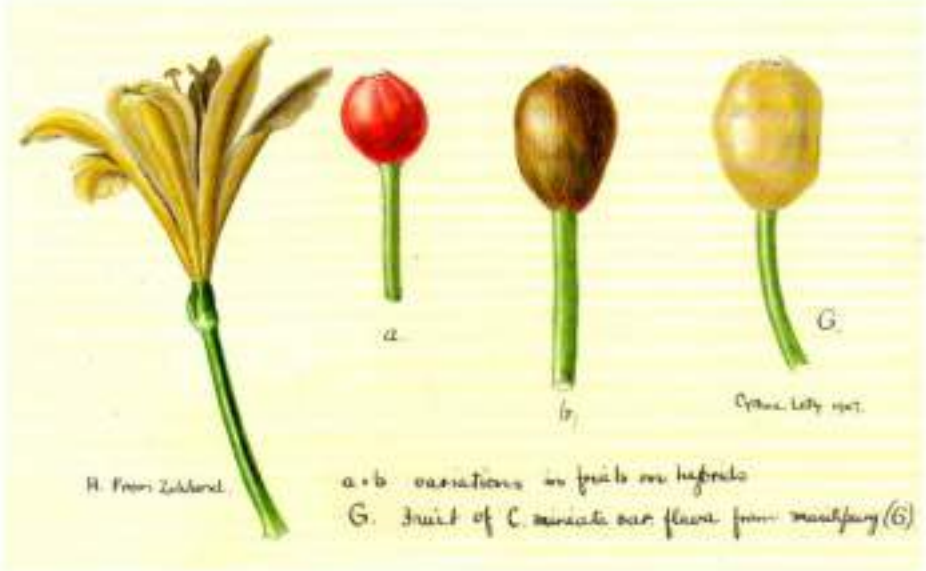
The Clivias at Scott's Farm, Grahamstown

Cythna Forssman – South Africa

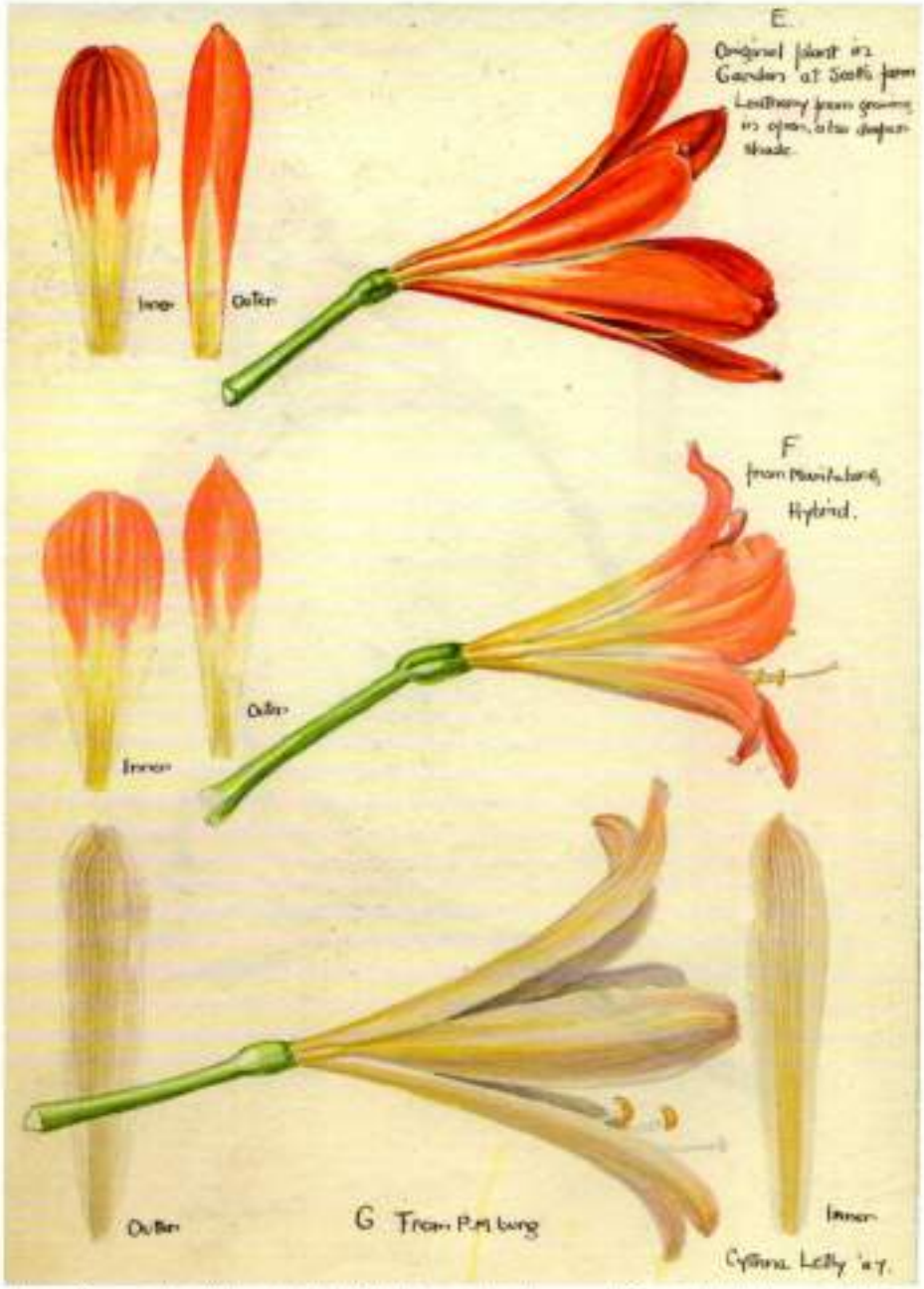
Division of Botany and Plant Pathology, Pretoria

[Reprinted from *Herbertia*, 15: 59-63, 1948, in response to the afore-going publication, here illustrated for the first time with the original watercolours, courtesy of SANBI, Pretoria, with our grateful thanks.]

In the 1939 volume of *HERBERTIA*, Miss Blackbeard of Scott's Farm, Grahamstown, gave a short introduction to her *Clivia* collection. It seemed desirable to have some of her results recorded in colour and it fell to my lot to do the work. It seemed fitting also that the second volume of *HERBERTIA* to be dedicated to South African *Amaryllidaceae* should continue the story of the Scott's Farm Clivias, and it is hoped that use may be made of my colour impressions. Miss Blackbeard's Clivias must be seen to be believed. It was on a grey day that Mr. R. Story (Botanical Survey Officer) drove me down to Scott's Farm and the rain clouds were hanging heavily over Grahamstown. On our arrival, a tall woman of about my own age detached herself from a group of coloured men who were arguing and gesticulating over the corpses of



The fruit on the right is that of the "pale apricot tint" flower. The flower is recorded as being from Zululand.



The top flower is that of the original dark Blackbeard plant. The second flower is labelled as a hybrid from Petermaritzburg. The bottom flower is the second plant of *Clivia miniata* that Gladys used - the "pale apricot tint" flower.



Two flowers from clones that Gladys had received from Zululand and Pietermaritzburg respectively.

three enormous Cycads (*Encephalartos*). She came towards us with outstretched hand and we were surrounded by and included in the warmth of welcome extended to any man, beast or plant, irrespective of degree of colour, who arrived at Scott's Farm. She had rescued the Cycads, she told us, from a garden which was being modernized. Nine men were needed to lift the branched veteran, seven had been enough for the others. Although they had been hacked off above their roots, she hoped they would again strike roots if she planted them in sand.

Then Hardy introduced himself by giving me a good bite on the ankle. He is a quiet, self-possessed bird with a nip for everyone except his beloved mistress. He had been brought to her by some urchins as an unprepossessing Hah-di-dah chick which had fallen out of its nest, and now he owned the place. The pair of owls, which had both turned out to be females, who were contentedly hatching some Bantam eggs, the wild duck on its nest among the reeds, the numerous dogs, fowls and geese did not dispute ownership with Hardy.

And then the Clivias, which in their off season live in a large rambling rush-house, were presented to us. They all started from *Clivia miniata*, a stout hardy specimen planted in the garden by Miss Blackbeard's mother. The flowers are a deep orange-red and the petals are thick and leathery. Then *Clivia miniata* var. *flava* was introduced from Pietermaritzburg, Natal, and then the crossing began. After that, various hybrids were procured from Natal and Zululand and the result is the wonderful show of exquisite blooms, ranging in colour from deep orange-red, through every shade of apricot and salmon-pink to pure cream. Some have white centers, some have striped centers and they have all been arranged on the stoep of the farmhouse. With their dark green and shining strap-shaped leaves they made a picture that will live with me forever.

The painting of the Clivias.

My first feeling was of utter bewilderment. The weather was unpropitious and the time allotted to me would not allow of my ambitions scheme, so I decided to do one flower from each of the six main parents and then two or three of the most striking hybrids.

The editors of the original publication noted: *Unfortunately, due to post war conditions, it was not possible to reproduce the very beautiful color plate submitted by Mrs. Forssman. It is hoped that it may be possible to interest the Editor of LIFE magazine so that this fine color plate may be given to the public.*

The whereabouts of the original painting submitted by Cythna Letty Forsmann for publication with her article is unknown, however the original description of the painting is used here, relettered to correspond with the SANBI collection of Letty paintings. It shows [E - p. 45] a flower of the original plant of *Clivia miniata* in the garden at Scott's Farm; [F - p. 45] a flower of a hybrid, from Pietermaritzburg, Natal; [G - p. 45] a flower of *Clivia miniata* var. *flava*, from Pietermaritzburg, Natal; [C, D - p. 46 & H - p. 44] flowers from Zululand and Pietrmaritzburg; [G - p. 44] fruit of *C. miniata* var. *flava*, and [a & b - p. 44] fruit of hybrids, showing variations in shape and color. *All of these are done most beautifully in color.*

The other Eden

André P. Brink – South Africa

(Translated into English by Greig Russell and published with permission of the author and LitNet.)

One of South Africa's foremost authors, André P. Brink, who had visited the "Misses Blackbeard" in the early 1960's, wrote a piece on them in Afrikaans published in Wegbreek of April 2008 (the Afrikaans language equivalent of Getaway magazine) as the last quarter of the article "Grahamstad - stad van wors en oorlog", which is available on the Internet in Afrikaans on the Afrikaans literary website, LitNet: http://www.litnet.co.za/cgi-bin/giga.cgi?cmd=cause_dir_newsitem&nws_id=34898&cause_id=1270 .

One Sunday, a particular friend, Laurie Graham, also one of Grahamstown's "unusual" Afrikaners, took my wife and me to meet the Misses Blackbeard; two ancient little women, both just this side of 80, who lived in a dilapidated, but charming old house in the township. Earlier there had been a third sister, sickly and bed-ridden, who lived with them, but of whom there was now no trace. Was she dead? Did she still live? Or do the two just keep the corpse in a bed in the passage, dressed and tended daily, even bringing her breakfast in the morning which is in fact eaten? Perhaps by a monkey from outside, or an ancient, stone-deaf servant, while they carry on undisturbed?

The little farm is encircled by smoking huts and hovels, clamorous children, an occasional outburst of sonorous song, a confusion continuing through day and night. A high fence surrounds the farm, patched with rusty galvanised sheeting and planks, woven through with branches and barbed wire. Within lies a few morgen of eden - one thick thicket which forms a foliage ceiling above; under it flame-red Clivias grow in earthenware pots, tubs, drums and galvanised baths, encircled by old spades, disintegrating chests and rolls of wire. Everything lies around in disarray, right up to the walls of the old house, even tumbling over onto the veranda. Everywhere are narrow paths where you dodge and dive between aloes, trees and shrubs. For the rest there is a planless labyrinth of cages like some organism which has developed in all directions by cell division: binding wire, barbed wire, chicken wire, fencing wire, full of holes plugged with planks and galvanised iron sheeting. In the cages is a collection of birds – dikkops, cranes, owls. Over the years they have arrived there with injured legs or wings, whereafter they have been made whole with love and care. And then they have just stayed, in a refuge amidst the clamorous, destructive township. Inside you feel closed off amongst the thick foliage, the flaming flowers, the warble and twitter of the birds, the twilight of the house.

For thirteen years they had a hadedah which was inseparable from them, and a duck which had become blind yet was nevertheless able to find his way faultlessly

along the paths to the water trough. The hadedah flew away, but returned a year later to show off his wife and two children. Two owls have lived for many years in a tree at the front door.

The youngest of the two Misses is the talker, as she tells of everything, the small grey head leans forward, her nose large and bony, the skin like rice paper with blue ink blotches. The skin of her throat hangs loose and around the mouth and eyes the skin is wrinkled with age; her hands are knobbly and veined and blotched. But the eyes still live clear and blue within their pink borders. Her sister is stouter; her petticoat seam does not stick out from under the pale blue dress. Her face is full of haste, downy, long hair and her eyes are small and suspicious.

They have come to a fork in the road; the Group Areas Act will not allow them to remain there. The City Council is going to expropriate the property for a song and they must go. These two, who for their entire lives have offered sanctuary to sick birds, now have no refuge. Just a year or three or five, then in any case they would no longer be there: but civic affairs can't wait. The bird reserve, that cool oasis in the township, must be cleared away. This news they tell us in their little house furnished like an overflowing museum with antique furniture, ornaments and bric-brac: delicate crochet work, paper flowers, painted dead flowers and grass seed, and the most delicate miniature bouquets.

Two people who have floated out of their own time on this island. And who now suddenly do not know where they are to go: life is not what it once was. In their own melancholic way they have become foreigners. Only in Grahamstown is there, in a sense, place for everything and everybody. And that is why it was, certainly in the years that I was there, a place like no other in the country.

Cape Clivia Club 2009 Show



1st Runner Up - John & Meg Winter - *C. miniata* 'Peach Apricot'



2nd Runner Up - Ian Brown - *C. miniata* 'Dark Pastel'

PHOTOS: CLAUDE FILLIET

Photographic Competition Winners

Best Photograph



Overall 1st - Helen Marriott - *Clivia miniata* (polytepal).



Overall 2nd - Helen Marriott - interspecific 'Mandala'.



Overall 3rd - Helen Marriott - *C miniata* (orange x yellow) x 'Vico Yellow' x' Vico Yellow.

Best Photograph *Clivia miniata*





Above: 3rd - Gordon Frasier - *C. miniata* - 'Peachmint'.

Left: 2nd - Joubert van Wyk - *C. miniata*.





Above: 1st - Gordon Fraser - 'Ngome Blush'.

Left: 2nd Helen Marriott - *C. gardenii* (Midlands).



Above: 3rd - Helen Marriott - *C. gardenii* 'Hobbit'.



Left: Short-listed - Joubert van Wyk.



Above: 2nd - Helen Marriott - interspecific *(C. miniata x C. nobilis).*



Left: 3rd - Helen Marriott - C interspecific *(C. miniata x C. caulescens)* x 'Vico Yellow'.

Novelty



1st · Joubert van Wyk.



Above: 2nd - Bridgit Randall - *C. miniata.*



Left: 3rd - Helen Marriott - *C. miniata* (Conway Particolor).

Habitat



Red form of *C. nobilis*.



2nd - Rod Randall - *C. nobilis* in habitat.



Above: Gerhard Faber - 'Greenboy's Child'.



Left: Gordon Fraser - *Clivia miniata* - 'Orient Joy'.



Joubert van Wyk - *Clivia miniata*.



Clivia miniata - Joubert van Wyk - 'Georgi'.



Above: Sakkie Nel - *Clivia miniata* - 'Coba'.



Right: Rina van der Merwe - *Clivia miniata* - 'Hirao'.





Above:
Jan Pohl -
Clivia miniata -
'Cinnamon'.

Left: Carrie Kruger -
Interspecific -
'Tricolour'.



Everett Hayward : *Clivia miniata* - 'Alida' ex Lionel Bester.



Everett Hayward - *Clivia miniata* - 'Cameron Caramel' ex Felicity Weeden.



Rina van der Merwe - *Clivia miniata* - 'Roly's Chiffon'.



Felicity Weeden - *Clivia miniata* - 'Green Throat'.



Rina van der Merwe - 'White lips'.



Rina van der Merwe.



Joubert van Wyk.



Joubert van Wyk.



Felicity Weeden - Orange.



Felicity Weeden - Multi petal yellow.



Jan Pohl - 'Banana Smoothie' - *Clivia miniata*.



Rina van der Merwe.



Bridgit Randall - *Clivia caulescens*.



Gordon Fraser - *Clivia miniata* - 'Irish Lass'.



Helen Marriott - *Clivia miniata* 'Gladys Blackbeard' pastel x 'Lotter Peach'.

The Heritage of *Clivia* in Asia

Helen Marriott – Australia

Introduction

The eminent Japanese plants man and breeder, the late Shuuichi Hirao[1], said of plant breeding in general:

> When we want to create flowers, we can either aim at "beauty" or "the unusual". It does not mean that we are just aiming at one of these objectives and sometimes we aim at both. Individual preferences vary so I think it is appropriate to follow what you think is beautiful or what seems new to you. (Hirao, 2007, p.90)

In this paper I will examine how *Clivia* have been transformed in different cultural settings in Asia in accordance with what others have considered to be beautiful and/or new. Already much has been reported on *Clivia* in Japan and China in the Yearbooks but I will attempt to summarize a few of the past, current and future trends, illustrated with photos. I will give a brief overview first, and then look at some of the specific developments and include examples of the work of a sample of *Clivia* breeders in these countries.

Clivia in Asian locations

Although "Asia" spans a very broad geographical area, from the perspective of *Clivia* attention invariably falls upon north-eastern China and Japan. A common characteristic linking China and Japan seems to be the relatively early initial introduction of *Clivia* from Europe to both countries. According to a Chinese reference, some *Clivia* plants were taken by a German to Qingdao after 1840, and referred to there as German-Lan. The same kind of flower was also taken by a Danish missionary to Liaonan around the same time (T'ao & Wang, 1997). Given the timing, we can surmise that *C. nobilis* was involved. Reports tell us that further introductions of *C. miniata* took place from Japan to China in the 1930s when, for example, a Japanese trader presented gifts of *Clivia* to the Chinese emperor. At that time, Changchun was established as the seat of government of the Japanese puppet state, and today, as the capital of Jilin Province, it remains the principal centre of *Clivia* cultivation in China (*Clivia 3*, p.20).

Apart from north-eastern China and Japan, *Clivia* appear to have some limited presence elsewhere in Asia. Although I had no access to information on North Korea, in South Korea a small investigation by S. K. Sung in late 2009 and early 2010 revealed the existence of some smallish nurseries propagating orange and red-flowering *C. miniata* in the metropolitan area of Seoul, though he is also aware of other larger nurseries in the south. He visited three of the metropolitan nurseries and reports that the growers tend to be old and their nurseries smallish. Two of them grow only *Clivia* and have been in the business for 22 to 30 years. At one of



Clivia in Asia, S K Sung

the nurseries he visited, he spotted some yellow-flowering *C. miniata* as well as several non-*C. miniata* species. Apparently these plants were obtained by a Korean missionary in South Africa. The retail price for a mature plant in Seoul is KRW25,000-30,000 (R162-195; US$22-26), though at a flower wholesale market, Sung recently purchased variegated *Clivia* for about one-fifth of this price. After growing an orange-flowering *Clivia* for some years, Sung purchased his first *Clivia* seed from two internet sites in China and New Zealand and now, after retirement, is beginning to breed *Clivia* and *Amaryllis* himself.

An Internet search on Google using Korean and Chinese languages failed to identify any Clivia club or society in Korea, Hong Kong or Taiwan, and nor were any specialist Clivia websites located. However, in both Hong Kong and Taiwan some general websites on gardening or online discussion forums did contain references to *Clivia*. In addition, a news article on the annual Hong Kong Flower Show (held since 1987) where *Clivia*, among other flowering plants were exhibited and sold, reported that 3000 pots of *Clivia* were sold by the eighth day, with the pot of *Clivia* which achieved the Best Exhibition Award being sold for HK$8000 (R7,600; US$1,000). The search also found that popular online shopping sites in Korea, namely Auction and C-market, sell *Clivia*.

Although I have gathered a little evidence of the movement of *Clivia* material between Japan and China during the past two to three decades, either on a one-way or

two-way basis, probably the breeding and growing of *Clivia* in these two countries has been undertaken relatively independently of each other, and in the beginning, from a narrow genetic base. Furthermore, while there may be some interest by certain individuals in one country in the other's developments in *Clivia*, for me, the linking of both China and Japan into the one grouping of "Asia" (or the "Orient" or the "Far East") is not particularly useful so I will deal with them separately.

At the outset, it is useful to try to put the cultivation of *Clivia* in China and Japan in perspective. Van der Linde (*Clivia* 3, pp. 20-23) has described the growth and spread of *Clivia* in China post-1945 as being slow at first but increasing in the 1960s through seed propagation. It is noteworthy that despite political turmoil in China, *Clivia* were reportedly found in around one-half of Changchun households by 1980. During the early years of that decade, "*Clivia* fever" occurred in three provinces in the north-eastern region with astronomical prices being asked for some plants, prior to the boom collapsing in 1985. Indeed, in 1984 *C. miniata* became the official emblem of Changchun. Since that time, some vestiges of "*Clivia* fever" seem to have continued, even if on a smaller scale.

China is a very large country with an equally large population of 1.3 billion inhabitants in 2008, so we probably need to be cautious about making generalizations concerning interest in *Clivia* for the country as a whole. Nevertheless, it appears that *Clivia* do hold a prominent position as an ornamental pot/house plant, at least in some areas of China. The National Parliament is said to order plants from Changchun (Clivia 9, p.109), and on a visit to China in the late 1990s, Graham Duncan saw many pots of dwarf-flowering *C. miniata* inside the Chairman Mao Memorial Hall on Tiananmen Square, Beijing (Duncan, 2008, p.17). Hein Grebe, when on a tour of western China in 2003, also observed pots of "ordinary" *C. miniata* in all the temple grounds he visited, though on one occasion he identified it as a type of cyrtanthiflora (*Clivia* 6, p.74). (For reports on Grebe's visit to China see *Clivia* 6, pp.74-80 and *Clivia* 9, pp.95-107.)

In giving more detail of his observations of *Clivia* in China, Grebe reports as follows:

> I have travelled to many places in China, from Hong Kong, Macau, Tibetan plateau, South-West, Mid-West, North-West, North-East, Mid-East and South-East of China including Hainan Island and have a pretty good idea where *Clivia* are popular and where to find the different types of *Clivia*. Most *Clivia* in China, especially in the Western parts of China you will find what is called the Australian *nobilis* or a cross of *nobilis* x *miniata*. You will find them in temples, churches, restaurants, shops etc and the colours vary from orange to the most beautiful one I have seen – a dark yellow gold in a modern cinema in Beijing. They also grow indoors in the entrance halls of modern apartment blocks in Beijing and are much hardier and disease resistant than the Chinese hybrids. There are also collectors who have old fashioned *miniata* which can be described as an early type of Belgian hybrid with semi broad leaves. I have also seen at many Beijing flower markets *Clivia* that can be described as caulescens and many yellow-flowering *miniata*. In the Western parts of China orchids are the most popular flower and most *Clivia* growers are based in the north-eastern section of China with Beijing the most

southern growing area for commercial growers. Six years ago only a few commercial growers could be found in Beijing whereas today there is at least 10 times more.

In attempting to explain the attractiveness of *Clivia* to the Chinese, Grebe suggests that in certain areas people of 40 years of age and above have *Clivia* in their homes and in the case of the Beijing area, which is not the centre of *Clivia* growing, he estimates that more than 50% possess *Clivia*. On the other hand, he believes that the younger people now prefer big ornamental plants for their homes/apartments, which need less attention and which are hardier than *Clivia*.

The popularity of *Clivia* in China is further confirmed by Eddie Pang (a Melbourne resident who regularly visits China), especially in northern cities like Changchun, Jilin, Shenyang, Liaoyang, Anshan, Dalian, Harbin, Qingdao, Yantai, Tai Yan, Tianjin and Beijing. In Changchun City itself, on average, he expects there to be at least one *Clivia* per family home.

The suitability of *Clivia* as long-lived pot/house plants with perennial green leaves also accords with several important cultural features in China. Pang reports that it is one of the most popular selling plants during the Chinese Lunar New Year Period (late January to mid-February), which is the most important traditional Chinese holiday. Furthermore, he states that in ancient Chinese culture red is associated with luck and happiness, hence reddish-orange flowering *Clivia* are favoured. In contrast, Pang notes that cream/white symbolises death. Thus, "even though the Changchun Imperial[2] cream/yellow hybrids have been in the Chinese *Clivia* world for a long time, they have never gained much popularity in the Chinese *Clivia* market" (Pang).

Grebe also confirms the popularity of the plant during the Chinese Spring Festival/New Year and further elaborates on how he sees the genus being positioned in China:

> Only enthusiasts and growers will pay high prices for special *Clivia*. The general public will go for the cheapest ones which are in flower as decoration and gifts for the Chinese Spring Festival and Chinese New Year when they are in flower. Millions are sold every year at flower markets and they are also displayed in parliament and conference rooms, restaurants etc. It looks like it is something that you must buy during that time of the year, like buying fireworks for instance. During the Spring Festival it is a very happy time of the year, where everyone celebrates and gives gifts to each other and it just happens to be that *Clivia* is one of the few plants that are in flower at that time of the year. As you move further away from the north-east of China, the popularity of *Clivia* becomes less. For instance, in the West and South of China orchids are more popular than *Clivia*.

As in most *Clivia*-growing communities, it is necessary to differentiate between the commercial-level *Clivia* and specialist hybrids, as noted above by Grebe. In the case of China, Pang reports that the general public purchase commercial-grade Anshan Daruma and Changchun *Clivia* hybrids (Guo Lan)[3] at flower markets. In northern China the retail prices range from RMB 20.00-100.00 (R22-109; US$3-15), depending on the quality, but these same *Clivia* can be sold for at least double the price in cities like Beijing and Shanghai. In those cities, apparently, *Clivia* enthusiasts will pay RMB1,000-2,000 (R1,086-2,171; US$146-293) for better-looking *Clivia*. Not surprisingly,

the top (exquisite) quality *Clivia* are not sold through this channel. (Pang also states that some inexperienced *Clivia* enthusiasts can be cheated by market resellers as they may pay high prices to acquire *Clivia* with features which have been artificially manipulated.)

According to Pang, the specialist Chinese *Clivia* hybrids which are highly priced are usually sold to three groups of buyers: (1) Breeders who wish to invest in order to acquire the genetics for their breeding program, from which they hope to earn future revenue; (2) Wealthy individuals; and, (3) People who wish to make special gifts to certain public figures or bosses for favours and benefits, with the recipients able to obtain a very high resale value.

The industry in China which supports this widespread distribution of *Clivia* is substantial. Some facts were reported by the leader of the delegation from Changchun to the *Clivia* 2006 conference, including the industry's economically profitable profile (*Clivia* 9, pp.108-109). Based upon data available in March, 2008 Pang relates that during 2006 and 2007, *Clivia* achieved the most annual sales in Changchun City's flower industry. Here, more than 20 *Clivia* cultivation bases exist, and at one of these – Hongda *Clivia* Base, at the end of 2008, there were 60 hectares of established greenhouses. In addition, more than 10,000 small-scale *Clivia* growers (each with more than 50 mature breeding *Clivia* plants) were scattered throughout the city. Another 700 greenhouses exist outside of the above-mentioned cultivation bases. An estimated 150 million pots of *Clivia* were said to be found in Changchun in 2008, with an estimated total value of RMB2,500–3,000 million (US$366-440 million). Six research institutes support the development of the *Clivia* cultivation industry, and a workforce of 100,000 people are involved in the industry.



Clivia arrangement by Shigetaka Sasaki.

In contrast with China, the situation in Japan today is very different in terms of the popularity and visibility of *Clivia*. *Clivia* are not listed in Masashi Yamaguchi's list of popular plants in Japan nowadays (http://homepage3.nifty.com/plantsandjapan/), though he does suggest that *Clivia* have been considered as a traditional pot plant in Japan, despite their origin from elsewhere. The early introduction of *Clivia* to Japan, possibly around the middle of the Meiji period (1868-1912) when contact with other countries increased, and the fact that these plants were given a Japanese-like name (Kunshiran) written in characters (as was the common practice at the time for increasing the lexicon) and which remains in use today, may have contributed to some peoples' impression of familiarity with the plant. Indeed, we are able to find small illustrated publications on *Clivia* in three separate series on ornamental plants which cover a

wide range of genera, but the existence of these books is perhaps indicative of the well-established horticultural industry growing ornamentals and other plants in addition to the strength of the Japanese publishing industry, rather than to any special societal interest in *Clivia*.

Not surprisingly, the earliest introduction to Japan from Europe was *C.* x *cyrtanthiflora* (incorrectly referred to as *C. nobilis*), to be later followed by *C. miniata*. Yamaguchi reports that *C. miniata* became popular in Japan during the historical Taisho period from 1912-1926. Later, in the 1960s, Yamaguchi explains that some breeders imported Belgian strain cultivars from Germany, selecting out small plants for breeding dwarf cultivars. From these, they have bred the Daruma cultivar group with short and broad leaves (http://homepage3.nifty.com/plantsandjapan/page074.html). Some current Japanese growers also refer to the breeding from long-leafed plants of Shimoda Hime Daruma, a cultivar which is said to have become the basis for the subsequent breeding of many Daruma plants, despite its uninteresting flower by current standards. The introduction of this cultivar on TV in the early 1980s apparently also led to considerable interest among the public at the time.

Shigetaka Sasaki observes that these days *Clivia* do not sell well in Japan: there is no variety in colour (with only orange available in the marketplace in the main); they are regarded as an "old" flower; and they are fairly widespread because of their longevity and are easily distributed from person to person via offsets. When strolling around the side streets of Tokyo, for instance, I have sometimes seen the long leaf, older orange-flowering *Clivia*, although Sasaki suggests that some people may be keeping a smaller Daruma plant inside their home. He reports that fashions change, with Daruma not appearing on the market much any more, a main reason being that the grower cannot charge much for *Clivia*. In early 2010, mature, compact orange-flowering *Clivia* retailed for only 1,300 yen (R105; US$14) at the beginning of the flowering season, but could be expected to fall to 800 yen or even to 300 yen in some cases as the season progressed.

Herbertia/Plant Life, the journal of the International Bulb Society (formerly *Amaryllis* Society), the early Clivia Club newsletters and some Japanese garden magazines or journals provide evidence of the sharing of *Clivia* seed and plants around the world in the 1970s and early1980s between plants people and nurserymen who often possessed a broad interest in bulbs and other flowering plants. Included in this literature is reference of the movement of new *Clivia* material from South Africa to Japan. For instance, in 1981 Hirao describes his receipt 10 or so years earlier of two small offsets of yellow-flowering *C. miniata* sent to him by Gordon McNeil who had collected the plant from the Natal habitat. In turn, Hirao made pollen and subsequent offsets (from this and other plants) available to others. In the later 1970s, Hirao also visited McNeil's property in Ofcolaco, Limpopo, accompanied by another Japanese person (Hirao, 1981b). Also in 1981 Hirao mentions having received a small offset of a yellow-flowering *Clivia* from a South African friend (May van Eeden) many years earlier (Hirao, 1981a, p.151). He thought that he also had *C. gardenii* in his collection, grown from seed sent by a South African friend, as well as *C. caulescens*, though he was somewhat unsure about the identification of both cases.

As a further example, a yellow cultivar named 'Oogonkaku' was sent from Cape

Town by an Englishman in 1975 (Mori, 1998, p.10), and we know that Isamu Miyake was growing several yellow-flowering *Clivia* around the mid-1970s, though the origin of these is unclear (Clivia Club newsletter 5, 5, p.19-20). Jim Holmes, South Africa, reports that at the end of the 1970s he shared a small number of the first 15 seedlings which he propagated from seed and which subsequently flowered yellow with someone in Japan who had contacted him (Holmes, 1992, p.8; (http://www.capeseedandbulb.com/). (He later learned that it was the Takii seed company.) Holmes was also contacted by Yoshikazu Nakamura, perhaps around the mid-1980s, and send *Clivia* material to him. Furthermore, we know that the late Cynthia Giddy sent (group 2) yellow-flowering plants to Japan around this time but are unsure of the date when this interaction commenced (Clivia Newsletter, 1994, p.2).

In more recent times, we can identify other individual networks which have been the channels for the introduction of important new *Clivia* material to Japan, including Hirao's receipt of 'Vico Yellow' from the late Sir Peter Smithers in the early 1980s (*Clivia 2*, pp.13-14; *Clivia 8* p.7). Yoshikazu Nakamura's ambassadorial-like role in the 1990s in introducing Japanese-bred material to South Africans and others, and his – and more recently Sasaki's – importation to Japan of important *Clivia* material from overseas sites is also of significance.

Toshio Koike purchased his first yellow-flowering *C. miniata* (which we now identify as a Group 2 yellow) around 1986 when it first became available from Takii seed company which, in turn, had obtained the material from Satoshi Komoriya. Koike is thus one Japanese hybridizer who has been propagating Group 2 yellows which have been circulating in Japan for 25 or so years (but of course not under this category).

Apart from rare examples, *Clivia* breeders and growers in China and Japan are not utilizing the English-based information and communication technology that has brought together many with interests in *Clivia* in overseas countries in recent years, or becoming individual members of the South African-based Clivia Society itself. On the other hand, domestic networks in the form of Clivia clubs or societies have emerged in these countries and have exhibited phenomenal growth in the case of China, no doubt due to the commercial value of the plant in that country, as described above (also see *Clivia* 9, pp.108-109). Pang, for instance, lists 18 known Clivia associations in China. Of these, the Clivia Association of Jilin Province was founded in 2000, and both the Changchun City **Clivia** Association and Beijing Clivia Society in 2006. Two small Clivia clubs previously existed in northern Japan (Yamagata and Kushiro) in the mid- to late-1990s (http://www8.plala.or.jp/Clivia/index1.htm), and a formal Japan Clivia Society (http://www.Clivia.jp/) was established in 2006, reaching a membership of over 70 members in early 2010.

Development of plant characteristics: shape and form

While it must be acknowledged that the Europeans (and perhaps others) have also worked on the further development of more compact and broader-leafed *Clivia* in recent decades, including an emphasis on plants that flower early, remarkable development of the plant's shape and form has taken place in China and Japan. One principal commonality between these two countries (and Europe) is the focus upon *Clivia* for pot/house plant culture, a necessity to suit the climatic conditions of these counties, especially north-eastern

China, as well as the limitations of domestic house or garden space. As briefly noted above, there has been some, even if limited, historical exchange involving *Clivia* from Japan to China, or *vice versa*. Nevertheless, overall, the breeding in these two countries seems to have been undertaken independently and has advanced in quite different ways, to the extent that in some cases certain developments in one country are not necessarily regarded positively in the other.

As mentioned above, breeding was undertaken in Japan of smaller plants with increased leaf width in an earlier period. Hammett (2003, pp.6-7) describes this development as follows:

> In Japan the squat broad-leafed Daruma forms have been developed. Much emphasis has been placed on a strict distichous habit, broad downward curving leaves and perfect precise interlacing of the leaf bases.

The ideal proportion of a Daruma plant is said to be a ratio of 1:3 (width to length) (*Clivia 7*, p.89), though the term often seems to be used loosely in reference to shorter, broad-leafed *Clivia* plants. There are many named cultivars in the Daruma cultivar group and various variegated forms also exist (*Clivia 3*, pp.21-25).

One contemporary grower of Daruma in Japan is Tetsuro Miyazaki, who grows broad-leafed plants with thick leaves. Sasaki reports that many members of the Japan Clivia Society are currently interested in yellow Daruma and yellow Akebono Daruma, though this may be a case of growers/collectors seeking the unusual, since such plants are still in the process of being developed. Sasaki suggests that the majority of plants on the Japanese retail market these days are small, orange-flowering *C. miniata* plants which are bred to mature early (eg grown by Hattori and others) and that these are quite different from the earlier-developed Daruma form(s).

Most of the Chinese, as well as the more limited English-based, literature on *Clivia* in China provide copious evidence and illustrations of the emphasis of Chinese breeders and growers on plant characteristics. Xueguan Song, for instance, claims that the city of Changchun has developed more than 10 good Clivia Cultivar Groups, including Da Sheng Li (Great Victory), You Jiang (Painter) and Ran Chang (Dye Factory). The characteristics he gives for high quality Changchun *Clivia* are as follows:

> ... fine glossy leaves, with good leaf vein contrast and well-balanced proportions between length and width of leaves, and flowers in good taste, held on sturdy stems. (*Clivia 9*, p.108).

In 2000, the China Association of *Clivia* (or China Clivia Association) published a set of judging standards. These are found in a bilingual booklet as well as in a 2002 translated version of another text by Wen-Chang Guo, also published in 2000 (China Association of *Clivia*, 2000; Northern Clivia Club, 2002, pp.69-71). These standards confirm the overwhelming priority upon plant, rather than flower, characteristics. The principal features (maximum of 98 points) – all relating to leaves or to a lesser extent plant shape – are brightness, smoothness, rigidity, thickness, veins, colour, ratio of length and width, form/head shape, seat shape and head tip shape. Flower and fruit, and other features (eg no damage) each attract a maximum of one point only (Northern Clivia Club, 2002, pp.69-71).

Pang has supplied a detailed description of these 10 Principal Criteria for the appreciation and appraisal of the quality of *Clivia*:



Venation texture - leaf of Malian.



Low Gold Ingot Shape - Pseudo Bulb.



Round Head hybrid.

1. *Brightness*: the degree of light reflection off the leaf surface. Judged as superior to inferior in decreasing order from oily/waxy bright – shiny bright – bright – lightly bright – non-bright.
2. *Texture*: the degree of smoothness of the leaf surface. Ranging from very smooth – relatively smooth – average smooth – relatively coarse – coarse.
3. *Rigidity*: the leaf's overall ability to resist bending; related to, but not identical with leaf hardness; long and short-leafed plants to be assessed about 10 cm from the leaf tip. Relatively higher rigidity means more superior, while relatively lower rigidity means more inferior.
4. *Thickness*: the degree of thickness measured at a cross-section of the leaf. The more superior plant has a smaller difference in the thickness of the margins of the leaf and the centre. Judged as superior to inferior in decreasing order: 1.6 mm – 1.4 mm – 1.2 mm – 1.00 mm - <1.0 mm.
5. *Venation (arrangement/pattern of veins)*: excellent venation means leaves with thick, wide, prominent and protruding longitudinal and transverse veins which form a continuous network of square wells across a large part of the leaf surface. If this pattern is uniform and extends from the leaf tip to ≥three-quarters of the leaf surface, it is ranked as an exquisite grade of venation. It will be more superior if the protruding transverse veins are concentrated at the leaf tip. If all leaves have excellent venation, it will result in a plant with a more superior venation characteristic.
6. *Colour contrast*: the colour contrast be-

tween the veins and leaf background. Leaves with a bigger colour contrast are more superior. Dark green veins on a yellow/lime green leaf background are considered as the most superior.

7. *Width and length ratio*: length is measured from the leaf tip to the leaf base adjacent to the pseudo bulb and width is the measurement at the widest part of the leaf. A ratio of 1.3 is the most appropriate, and above or below would be considered as inferior. The width and length ratio readings should be taken from six leaves and averaged.
8. *Overall shape*: actually refers to the leaf arrangement. A *Clivia* with an excellent overall shape should appear like a straight line when viewed from one side of the plant (controlled by genetics), and should also appear like an opened Chinese fan (so that a line could be drawn to join the leaf tips and form a smooth semi-circular arc) when viewed from the front of the plant (determined by cultivation technique by controlling the uniform growth of leaves – similar in length and evenly spaced).
9. *Pseudobulb shape*: the shape formed by the layers of the leaf base and leaf sheath. There are four main categories, in decreasing order, each with a low (preferred) and high form: (a) Chinese gold ingot shape (b) Tower shape (c) Wedge shape, and (d) Column shape. Superiority/inferiority is determined by (a) space between the layers of the leaf sheaths, and (b) the magnitude of the angle formed between the leaf sheath and the leaf base. A bigger angle and narrower space would result in a better looking pseudobulb shape.
10. *Head shape*: the shape of the leaf tip. If the leaf tip has the shape of a semi-circle it is more superior. More than half of the total leaves should be considered in the evaluation. In decreasing order, the criteria range from semi-circular shape – elliptic shape/flat shape – acute shape – gradually sharp shape – lancet shape.

Criteria adopted for the Fifth China Changchun *Clivia* Exhibition in 2008 only very slightly altered the previous allocation of marks for the judging criteria. The above-listed 10 criteria account for 100 marks, and the five categories into which *Clivia* are allocated on the basis of the total score remained the same as before: treasure ≥80, exquisite 70-79, excellent 60-69, good 50-50 and average ≤50 marks. Where there are two or more equal scores based upon the 10 principal criteria, two auxiliary criteria (20 marks in total) are used to determine the winner. The first of these auxiliary criteria (scoring 1-16 marks) covers large flowers and fruits, flower colour being bright and attractive, and appropriateness of length and width of peduncle; the second (1-4 marks) involves the lack of visual physical damage, and absence of disease or pest infestation.

When summarizing the most important features of the Chinese development of *Clivia*, Pang states that "It would be the development of the leaf features and quality from the poor leaf appearance of the originally introduced *Clivia* hybrids like Qingdao Dai Ye (Qingdao Big Leaf), which was very similar to the western world's commercial grade *Clivia miniata*". In explaining what attracts him to Chinese seed and plants, Pang states:

> The 60 plus years of selective and systematic breeding with specific concentration on leaf features and the quality development that various reputable Chinese *Clivia* breeders have made available to the Chinese and international *Clivia*



Nakayama's variegated polytepal.

enthusiasts with the impressive phenotypes which can be kept as a house plant. I believe that most of us are attracted to the following leaf characteristics of the Chinese-*Clivia* hybrids:

(a) obvious protruding transverse and longitudinal veins;
(b) rigidity of the leaf;
(c) texture of the leaf;
(d) colour contrast of the veins and the leaf background;
(e) brightness of the leaf surface; and,
(f) thickness of the leaf.

Grebe highlights what interests him and other South Africans in Chinese *Clivia*:

I like the short broad leaves, the different patterns on the leaves and the colours on the leaves. The Chinese refer to variegated *Clivia* as coloured *Clivia* with a wide variety of colours that vary from white, grey, silver, yellow, light green to dark green. Mr Zhu called a variegated *Clivia* that has five distinct colours on its leaves "five colour orchid". The Crinkle Face, Fukurin, Mandarin Duck, Love Bird, Painted Face, different types of LOB (Light of Buddha) make Chinese *Clivia* very colourful and interesting... I think South African *Clivia* enthusiasts like broad leaf variegated, different types of LOB, super broad leaf (16cm and wider) and miniatures the most... The ordinary South African who has *Clivia* in their garden has not seen these plants and will not recognise it as *Clivia*.



A Japanese Fukurin in bud.

Furthermore, when outlining the features which attract non-Chinese and the Chinese themselves to *Clivia*, Pang responded as follows:

> Internationally, there is growing interest in the leaf characteristics of the Chinese *Clivia* hybrids. However, genuine genetics are still not readily available to the western world; most of the enthusiasts in the western *Clivia* world are mainly attracted to the flower colour and shape. On the other hand, the majority of the Chinese enthusiasts are only interested in the leaf features in which they follow the guidelines (described above). Furthermore, venation, rigidity and texture of the leaves would be the most important features to the Chinese.

Pang has provided some details of Chinese breeders with whom he has contact as well as photos of their plants. For instance,



Nakamura's (orange x yellow) x yellow Akebono.

Feng Yi Guo of Changchun is well known for his miniatures, the Phoenix Crown series and short leaf hybrids. He became famous in the 1980s when offered in exchange for

his best and multi-prize winning Phoenix Crown hybrid (a Painted Face Short Leaf hybrid) a new imported Toyota Crown sedan. Xiao Yu Liu of Shenyang specialises in variegated hybrids of Guo Lan and Japanese Daruma. Some resellers pass on Liu's seed and plants to overseas customers.

A new phenotype arose in Changchun City about seven years ago, as represented by the Upright Sword series of Chun Ming Wang. It became very popular and was expensive, and some Changchun growers adopted it as the direction of their breeding. Pang reports, however, that market demand has dropped rapidly in the last couple of years.

Another significant form of progress with *Clivia* plant characteristics in both China and Japan is the development of variegated forms, including propagation for commercial purposes, either on a small or larger scale. While all forms most likely arose spontaneously due to mutations in the first place, it is the targeted development and production of *Clivia* with a variety of variegation patterns which makes China and Japan leaders in this area. While variegation in many plant species is not uncommon and is sought after by numerous plant lovers in many countries, the international *Clivia* community continues to draw upon the Chinese and Japanese advancements in variegated *Clivia*.

Nakamura reports that variegated *Clivia* have been in Japan for over 50 years and in 1994 he described four types of variegation existing in Japan in addition to a combined pattern (Clivia Club 1994, p.5). Since then, patterns of variegation have been described more fully by Sasaki (*Clivia 3*, p.24-25; *Clivia 5*, pp.52-56; *Clivia 10*, pp.59-62). It is noteworthy that certain Japanese terms for variegation (eg Akebono, Fukurin, Negishi) and translations of Chinese terms (Light of Buddha, Mandarin Duck) have been adopted in some cases by the international *Clivia* community where suitable English terms have not existed or have not been widely known or utilized.

Among the longitudinal types of variegated *Clivia* grown in Japan, Miyazaki and others, albeit on a small scale, cultivate broad-leaf Daruma with striata variegation, the most commonly-occurring variegation type. Negishi variegation with thin or broken lines (very occasionally dots) running lengthwise through lighter or yellowish green leaves is a sub-type of striata variegation which was recognised in Japan and some plants are available to specialist collectors.

A second type of longitudinal variegation available in Japan is Fukurin (margin/margined variegation or albomarginated/aureomarginated) variegates. This type needs to be propagated vegetatively and it is reported that three growers in the Chiba area produce these in small quantities and then market them to specialist growers or retailers through a middleman.

Several main kinds of horizontal variegates are being propagated in Japan. Nakamura's fine specimens of long-leafed Akebono are well-known and are the result of deliberate breeding (*Clivia 6*, pp.54-56). Nakamura reports that *Clivia* with Akebono variegation first appeared on the Japanese retail market 30 to 35 years ago, and that he has worked with them himself for around 25 years, improving and stabilizing the variegation pattern and also breeding yellow flowers (*Clivia 8*, pp.16-17). Another breeder, Hiroki Tsuruoka, grows fine, short- or shorter-leafed Akebono with orange flowers.

Nakamura, Hiroshi Mitsuhashi and Wakao Tsuruya have imported Light of Buddha variegates from China – plants and seeds –

and are now propagating them and further distributing this material in Japan. Nakamura, for instance, is working to improve the flower by hybridizing them with 'Vico Yellow' and other superior parents.

Finally, in recent times a new variegation-like pattern named Tiger has appeared on the specialist Japanese market which has horizontal, tiger-like bands (*Clivia* 10, pp.59-62). Mitsuhashi is said to have spotted this feature among his seedlings of a cross of a Daruma x Belgian hybrid in 1990 and he has been breeding with it during the past decade or so. The amazing feature of this particular pattern is that contrary to all the other kinds of variegation in *Clivia* which can be propagated by seed and which possess maternal inheritance, this Tiger pattern is primarily characterized by paternal inheritance. Mitsuhashi suggests that the Tiger pattern can be paternally inherited in 30% to 70% of cases, rising to 90% if Tiger is crossed with Tiger. He reports that the pattern is also recessive. Furthermore, it can be combined with certain variegation types, notably striata or Akebono types. In recent years Mitsuhashi has combined the Tiger pattern with various other flower characteristics, including polytepalled Tiger and Ghost Tiger, and in 2011 expects to have his first yellow-flowering Tiger.

Pang reports that Chinese *Clivia* hybrids with variegated leaves appeared as early as the 1960s but that they were mostly dis-carded as an abnormality at the time. By the late 1970s, however, the attractiveness of variegated leaves was recognised and selective breeding commenced. Representative of striata variegation, the collective name given to variegates in the late 1970s was Jinsi Lan, but subsequently the collective name of Dao Lan was attached to variegated hybrids developed during the 1980s and 1990s. The most well-known grower of Jinsi Lan during the early 1980s was De Ren Dai of Changchun City. Since that time, more growers have joined in the development of variegated Guo Lan (Changchun Clivia) series. In contrast, Ji Fu Zhu of Shenyang is notable for his development of variegated Daruma in China. Pang reports that in the early 1990s, Zhu successfully sold a number of short-broad leaf variegated hybrids at a very high price.

Because of the potential revenue, more Chinese breeders proceeded to breed variegated *Clivia*, with two types of developments emerging. One consisted of the development of variegated hybrids with pure Guo Lan genetics, and the other followed Zhu's development of variegated Japanese Daruma hybrids. Consequently, Jinsi Lan with a better variegation pattern, colours, leaf quality, leaf shape and overall shape and size were developed.

Pang also describes some hybrids as exhibiting a mixture of coloured lines of variegation like white, cream/yellow, green, lime green, dark green, blue and grey on the leaves. As a result of this colourful characteristic, some Chinese breeders started to name and market them as Cai Lan (Coloured Orchid), with variations according to whether there are five or seven contrasting colours. Nowadays, Cai Lan is the most commonly used collective name for all variegated hybrids, and Cai Dao is more commonly used than Jinsi Dao for describing variegation.

Overseas, it is the Chinese Light of Buddha (LOB) variegation which is probably the best-known variegate type from China (see http://Clivia.topcn.cn/New%20Cultivars1.htm). According to Pang, some other selected variegates with stable phenotype in China are Yuan Yang (Mandarin Duck), with 50/50 (left and right) of green and yellow/white stable variegation,

Fulun (marginal variegation, cf. Fukurin in Japanese), and Yi Xian Tian in reference to median variegated hybrids.

While it is easy to overgeneralise the spread and/or popularity of variegated *Clivia* in China, Grebe cautions that "LOB and variegated *Clivia* are not popular with the Chinese public. Most people who grow *Clivia* must make a living from the sales and thus grow plants which sell and are in demand from the general public". I feel that the same generalisation probably applies to Japan as well.

Clivia seeds from China, and in some cases, plants, have been available to overseas customers in recent years. Ken Smith, for instance, has coordinated a seed order for Australian members of the Clivia Society for some years now, starting around 2002. The seed is supplied to him by Jin Wu (commonly known as Wu Jin in the *Clivia* community) and Lily Wang. In 2005, for instance, 10 batches of seed were available, all covering either short and/or broad-leafed forms or variegates. Smith notes that Australian buyers have been attracted to the small size of the Chinese forms, with either green or variegated leaves, including Light of Buddha Daruma plants. At an earlier stage, 50 to 60 Australians took advantage of this service, though he expected the number to be around 20 in late 2009, reflecting the availability of seed from other sources as well as the fact that once members have some Chinese stock, they can propagate their own plants. Smith also reports that the list has changed over the past five or so years to now include "saleable" yellow, apricot, peach and picotee material, as a result, he believes, of Chinese breeders obtaining new genetic material from overseas to produce these new flower colours.

Development of flower characteristics

When we look at some of the advancements of the *Clivia* flower breeding which have been undertaken in Japan, I suggest that it adds substantially to improvements in *Clivia* even if great progress has been made in other countries as well – especially, but not only, in South Africa, where extraordinary habitat plants are also continuing to emerge. Sometimes I have the impression that generalisations made about *Clivia* in Japan are too dismissive of the importance of, and the development of flower characteristics in that country, especially during the past two to three decades. Although there are others who grow *Clivia* about whom I have no information, a number of leading breeders, such as those to be mentioned below – Kasumi Hattori and Atsushi Nakayama in addition to Koike, Mitsuhashi and Nakamura – have been hybridizing *Clivia* for 30 or more years. In the cases of these breeders, the breeding of flower characteristics sometimes has been undertaken in conjunction with the development of the plant form, but not necessarily. More recently, Sasaki is extending or building upon earlier developments in the improvement and diversification of flower characteristics (principally, but not exclusively), so new hybrids can be expected in the near future.

Although advancement of the *Clivia* flower has mainly focused upon *C. miniata* in various countries during the past two decades or more, including Japan, Nakamura's extensive breeding with *C. miniata* 'Vico Yellow' continues to deserve the highest praise. Utilizing as seed parents a large group of orange-flowering plants which were bred by Miyake from orange



Nakamura's Vico Yellow hybrid.

C. minata x yellow *C. miniata* and which exhibited much variation, Nakamura crossed them with 'Vico Yellow'. The outcome has resulted in many plants with superb umbels of orange or pastel flowers, apart from the yellow hybrids themselves. Variations such as Ghost, striped petals, picotee-like types and others have also appeared. Nakamura's hybridization of Akebono and polytepals, and more recently Light of Buddha variegates with 'Vico Yellow', are further instances of his innovations, as noted above.

Nakamura has also improved the flower form of peaches by crossing 'Chubb Peach' with, for example, 'Vico Gold', and his interspecific hybridization has resulted in many magnificent outcomes. Furthermore, he has also propagated and distributed polytepals. Whereas other breeders and growers have tended to specialize, from the outset Nakamura undertook a diverse hybridization program and so he deserves to be singled out for his remarkable contribution (see *Clivia* 8, pp.6-18). Sasaki continues a similar multifaceted approach.

Japanese breeders have also contributed to the development and diversification of group 2 yellows. After his purchase of a yellow-flowering *C. miniata* around 1986, mentioned above, Koike, for instance, propagated this material and while increasing these yellows crossed them on to smaller Japanese Daruma plants and from the F2 hybrids he has produced plants which are referred to as TK Original, a cultivar group of shorter-leafed, more compact yellows (*Clivia* 7, p.86). As smallish to medium-sized plants, they possess either yellow flowers or yellow flowers with green throats. Koike started to sell these plants in Japan around 1996. Koike is also working on the de-



Nakamura's Vico Yellow hybrid orange.



Nakamura's Vico Yellow hybrid orange.

velopment of broad-leaf, compact yellows and in about three years time we can expect to see even smaller plants than what he has achieved to date.

In terms of colour development, a significant recent contribution from Japan has come from Koike's production of the green-flowering *C. miniata* cultivar group, Hirao (see photos *Clivia 10*, p.65; *Clivia 11*, p.91). As a horticulturalist, in his early years Koike had crossed orange-flowering *C. miniata* with green centres and obtained darker orange (or bronze) with strong green centres in the F2s and F3s (*Clivia 7*, p.87). When in the process of increasing his stock of yellows, he found four yellows with green centres and used this pollen on his darker orange plants. After crossing the F1 siblings, he was able to obtain Hirao. Importantly, this green colour is maternally inherited but when crossed to TK Original plants with green centres, a portion of green-flowering Hirao have appeared.

In his hybridization, Koike has found that if he uses Hirao as the pollen parent on a TK Original Yellow with no green centre, he can obtain some yellow flowers with green centres as well as yellow flowers with no green centres. Koike himself has multiplied his green-flowering plants through the cross of Hirao x Hirao, but Sasaki has also produced a green flower by using Hirao pollen on a yellow flower involving a cross of TK Origi-nal Yellow (without a green centre), thus pointing to the recessive nature of that characteristic.

Fully utilizing the Group 2 yellow at his disposal, alongside his development of the smaller yellow- and green-flowering *Clivia*, Koike also cultivates yellow-flowering variegates and occasionally a variegate will arise spontaneously from his Hirao plants. Like others such as Nakamura and Hattori, Koike has also been breeding a compact plant with picotee-like patterning, and has already produced his F3s. In addition, Koike has also bred some interspecifics crossing Group 2 yellow with (*C. miniata* x *C. gardenii*) or *C. gardenii*, from which peach has reportedly arisen (*Clivia 7*, p.87-88). From all of these examples, it is clear that the importance of hybridizing with Group 2 yellow has certainly been established in Japan.

Hattori has also developed smaller, compact or dwarf plants in conjunction with interesting colouration and patterns. Starting with the aim of producing an early flowering variety, Hattori first obtained Belgian *C. miniata* seed from a Japanese seed company in 1983 and selected out promising early maturing plants from which he developed small compact plants, with 70% flowering in three years (*Clivia 10*, p.62-64; *Clivia 11*, p.90). Recently, due to cost pressures, he no longer uses winter heating so these compact plants take around four years to flower. As mentioned above, these compact plants are now commonly found in retail stores throughout Japan.

While excellent bronzes have been bred in other countries, Hattori has also produced some deep bronzes on compact plants. By 1995 he had selected out two plants with bronze and deep red-coloured flowers respectively, both with green centres, and he crossed these to produce a dark, bronze-coloured strain with green centres which he has called UQ (*Clivia 10*, pp.62-63). 'Maroon', 'Red Queen' and 'Chocolate' are excellent samples of this breeding.

In addition, significant progress has also been achieved in relation to developing red-coloured *Clivia* in Japan. In this regard, Hattori has produced a strain called Kooyoo which are compact red plants (without green centres). Quite a few breeders around the world are currently working at improving reds and no doubt Hattori's



Koike's 'Hirao'.



Nakamura's Vico Yellow hybrid pastel.



Koike's 'Hirao'.



Koike's 'Hirao'.



Koike's 'Hirao'.



Koike's 'Hirao'.

breeding will be important to them.

From the Belgian hybrids Hattori has also developed other colours and coloration patterns. Although Nakamura and Koike have worked on the picotee-like flower form, mentioned above, Hattori's progress seems to be the most advanced with bicolours and picotee-like small plants. I was surprised to learn that Hattori has achieved this without the use of yellow-



Nakayama's polytepal

flowering plants in his breeding program. Hattori has given the name Tanchoo to the group of plants which have a cream or white throat assuming 90% of the inner flower, with 10% orange tips on the tepals. Another group, Sakibeni (or Saki beni) has a 70% cream or white throat and 30% orange on their tepal tips. (In Japan, the latter pattern is also often described as sokojiro.) A further group display yellow flowers but may develop a blush of pale orange irregularly spaced on the tepal tips as the flowers age. Needless to say, some other colouration patterns fall outside of the above-mentioned groups. On his website in early 2010 (http://www13.ocn.ne.jp/~baijyuen/home.html), Hattori displays many photos of these special plants which are available to Japanese customers through mail order. Not unsurprisingly, his plants have recently also gained the attention of the overseas *Clivia* community.

The development of flower form in Japan is not limited to *C. miniata*. Complimenting the interspecific breeding undertaken by others in South Africa, Nakamura has led in the development of many highly worthy interspecifics in Japan. This is not to say that he has been the only person working with interspecifics in that country. Some other Japanese nurserymen have utilized *C.* x *cyrtanthiflora* in their interspecific hybrids, such as Mitsuhashi, producing, for example, 'Chiba Shoden' and 'M M Joy', while others, such as Koike, used *C. gardenii* or (*C. miniata* x *C. gardenii*) as well as *C.* x *cyrtanthiflora* in further hybridization, as mentioned above (*Clivia 7*, pp.86-90). Nakamura, on the other



Hattori's 'Chocolate'



Hattori's 'Red Queen'



Hattori's 'Red Queen'.



Hattori's bicolor.



Nakamura's interspecific (*C. miniata* x *C. caulescens*) x yellow.

hand, initiated a varied interspecific breeding program, using *C. caulescens*, *C. gardenii*, *C. nobilis* as well as *C.* x *cyrtanthiflora* in his breeding in various innovative ways, including crossing the pendulous species between themselves (See *Clivia 8*, p.13-16).

For instance, Nakamura's use of *C. caulescens* in interspecific hybridization in the 1990s was particularly exemplary and has resulted in many superior outcomes, which have been reported previously (*Clivia 8*, pp.13-16). In particular, *C. miniata* x *C. caulescens* interspecifics are valuable because of their re-blooming capability, with many producing a second bloom during summer or occasionally autumn, in addition to their main late winter flowering. They also typically produce a long peduncle, even in summer.



Nakamura's interspecific 'Venus'.

Nakamura frequently selfed his F1 interspecifics to bring out excellent recessive characteristics in the F2s (as in 'Clementina' see *Clivia 7*, inside cover; *Clivia 8*, p.14). The interspecific hybrids where the inside of the flower remains pale throughout the period of flowering may be due to this kind of hybridization. In addition, Nakamura sometimes utilized an interspecific in a further complex cross, as in [(orange *C.*



Nakayama's 'Kiyou no Mai'.



Nakayama's 'Kiyou no Mai'.

miniata x yellow *C. miniata*) x 'Vico Yellow'] x 'Day Dream'. A cross such as this produces a lot of variation, including orange, orange with a prominent whitish/cream throat, yellow and even greenish flowers, while at the same time the flower shape shows the influence of 'Vico Yellow'. The shape of these and other flowers represents yet another worthwhile development of interspecific breeding.

In February this year, Nakamura flowered a beautiful interspecific which he has named 'Venus', where the flower exhibits a kind of 'Appleblossom'-like colouration. Labelled as coming from his "breeding mix", he believes that this flower may have arisen from a hybrid involving *C. gardenii*. On a limited scale, Nakamura has also produced variegated interspecifics, including variegated *C. miniata* x *C. nobilis*, *C. miniata* x *C. gardenii* and *C. miniata* x *C. caulescens*.

Sasaki is now extending the work of Nakamura in interspecific hybridization by drawing on a wide variety of Japanese as well as overseas plant material and is in the process of creating new hybrids, such as his cross of a Nakamura interspecific and a Vico Yellow hybrid which resulted in a larger, softly striped interspecific called 'Inspirational'. Recently, he has crossed a Nakamura (*C. miniata* x *C. caulescens*) x Chubb Splash, targeting an 'Andrew Gisbon'-like colouration in the F1. Another is a cross of a pastel

Vico Yellow hybrid x C. 'Fairy Felicity', one of his own interspecifics. Here he aims for a new pale inner interspecific flower with a darker outside. His hybrid of (*C. miniata* x *C. caulescens*) x Hirao targets a more greenish colour in the new interspecific hybrid. He believes that the future hybridization of interspecifics must involve new and innovative crosses so he himself is combining a variety of parents with specific goals in mind.

Another area in which Japanese breeders have advanced the development of the *Clivia* flower substantially during the last two decades is in relation to polytepalled flowers. Nakayama is a nurseryman who grew *Clivia*, first as cut flowers, among other plants, from around 1960 and took an interest in this form after a polytepal first appeared among his plants about 30 years ago. He subsequently increased his polytepalled *Clivia* from several other sources, and along with Nakamura, received a couple of plants from Mrs Hirano (who lived in the same prefecture and who grew *Clivia*), when she was finishing up around 1990. Nakayama has now amassed a large collection of excellent orange-flowering polytepals, many of which could probably be described as medium-sized plants. He has only named a small number of outstanding plants, such as 'Tadai', 'Hanyae' and 'Kiyou no mai' which he frequently uses in his breeding program. It is not uncommon for his polytepals to have nine to 10 tepals, sometimes even 12 to 14, and in many instances, all flowers in the umbel will have this number of tepals, though, of course, there is variation. Tepal shape and flower size also varies, with flowers ranging from smallish through to large. Nakayama is continuing to improve the size of the flower and also the tepal density (See *Clivia 10*, p.54-58; *Clivia 11*, p.93-94).

Nowadays, some individuals and specialist breeders in overseas *Clivia* communities are working on further developing polytepals and in some (perhaps many) instances it seems that their original breeding material came from Japan, especially from Nakamura seed (directly or indirectly) from the mid-1990s to the early 2000s. Splendid examples include Ian Brown's (South Africa) 'Woodlands Grande Multipetal' (see *Clivia 3* cover & inside page) and numerous plants grown by Laurens Rijke (Australia) (see *Clivia 7*, p.31; *Clivia 8*, p.6, 13). More recently, polytepal material from Nakayama and Mitsuhashi has also become available to collectors overseas.

In his breeding, Nakayama has invariably crossed polytepal x polytepal, hence has developed plants that have a strong inheritance of this characteristic. In his earlier years, Nakamura also typically undertook the same kind of cross. In more recent years, however, Nakamura has been working towards the production of an improved form of yellow-flowering polytepal so he has also been crossing a good yellow, such as 'Vico Yellow', onto superior orange-flowering polytepals and the outcomes are now starting to emerge. Both Nakamura and Nakayama have also been cultivating variegated polytepals, and excellent plants with these combined features are not uncommon.

Another Japanese breeder of yellow polytepals is Mitsuhashi, the current chairman of the Japan Clivia Society, who also is the breeder of the Tiger pattern. Mitsuhashi is currently building up his collection of petaloid-type yellow polytepals, which he reports are crosses of 'Vico Yellow' and a Solomone yellow polytepal.

While Nakayama continues to develop orange polytepals, and both Mitsuhashi and Nakamura – particularly the former – strive



Hattori's C. miniata 'K-Rex'.



Mitsuhashi's new yellow polytepal.

to further improve yellow forms, Sasaki is aiming at broadening the characteristics possessed by polytepals, either by crossing different types of polytepals together, such as a petaloid-type with a non-petaloid type, or else crossing a polytepalled parent with a non-polytepalled one. For instance, by crossing a Vico Yellow hybrid with large orange flowers x 'Haniyae', he targets a large flower with excellent polytepals on a compact plant in the F2 generation. He is also utilizing a 10-tepalled yellow flower of Mitsuhashi and by hybridizing it with peach, aims to develop a peach polytepal.

Sasaki is also breeding interspecifics with polytepalled flowers. For instance, he crossed a Nakamura *C. nobilis* interspecific, 'Helleborus', onto a red 11-petalled polytepal. As can be expected, the F1 has only six tepals, but it possesses an orange/bronze colour with a green centre. In this case, Sasaki argues that the green centre has been influenced by the pollen of the F2 interspecific hybrid (Sasaki, 2009). He will then cross the F1 siblings and expects a percentage of new hybrid polytepals in the F2s.

In another example Sasaki has combined a dark eight-petalled red *C. miniata* with 'Jazz Shuffle' (a Nakamura deep red/bronze *C. miniata* x *C. caulescens* hybrid), with the aim of producing a very dark ("black") red-coloured and polytepalled interspecific hybrid in the F2. In addition, he crossed another Nakayama 15-tepalled *C. miniata* with 'Ambitious', a polytepalled interspecific bred by Miyake, expecting to produce a new polytepalled interspecific.

While there still remains a real shortage of data relating to polytepal breeding and cultivation available to the international *Clivia* community, Sasaki has already shared with us some of the expertise developed by Japanese breeders. For example, polytepals can be bred from either the seed or pollen parent, that good fertilization is essential for the regular production of polytepalled flowers, and that petaloid-type flowers are recommended for the development of double flowers (*Clivia* 6, pp.57-60).

Building upon what has already been achieved in Japan, we can expect to see further progress in polytepal breeding around the world in the coming years – from Japan as well as from other countries – and this will no doubt include the production of plants with a consistently higher tepal density, the development of different coloured forms as well as progress with interspecific polytepals.

In the case of China, while it is reasonable to conclude that attention has been focused principally upon plant characteristics in the past, more recent developments reveal some interest in flower breeding there, as mentioned above. Grebe reports seeing a variety of *Clivia* flower colours and forms at markets in Beijing (*Clivia* 9, p.101) and he suggests that Chinese breeders/growers have become more interested in flower colours.

When asked about Chinese breeders who have an interest in non-orange Chinese hybrids, Pang provided a number of examples of growers who are breeding non-orange hybrids and who have large collections of these plants. He lists six growers in Changchun City, including Dian Chun Wang, who has established his series of yellow and cream flowering Changchun hybrids, as well as Dao Lu Zhang, who has developed the Imperial cream (near white) hybrid with a green tip from the Changchun Imperial cream hybrid (also called the Changchun white hybrid) and who possesses a collection of yellows grown from seed imported from Japan and the



Miyake's polytepalled interspecific 'Ambitious'

USA. Also in the area is Ying Hua Zhang, who has a large collection of yellow/cream hybrids grown from seed imported from Japan and South Africa.

Pang reports that Shenyang City includes three growers with large collections of non-orange hybrids who have also imported seed or plants from the USA, Japan, Australia or New Zealand. He identified the presence of *C. gardenii* (yellow blush; near white), *C. nobilis* and *C. caulescens* (yellow) in some of these collections. Shi Zhong He, for instance, started hybridizing Liu Laohen Monk hybrid with Changchun imperial cream and yellow blush broad leaf Daruma in 1992. From these he has developed some beautiful bicolour hybrids which have the leaf features of the Chinese hybrids. He also possesses Hirao and *C.* 'Caroline's Pride' (*C. robusta*), both grown from seed, in addition to other yellow/cream hyrbids.

Pang is also able to identify three to four growers with large collections of non-orange hybrids in Anshan City, including Xue Guang Ying, the major breeder for the yellow blush Anshan Daruma which have relatively darker and average quality leaves, and Er Zhao, the other breeder of yellow blush Daruma which have short broad leaves and good colour contrast on the leaf surface. Several other growers also have good collections of the Changchun Imperial cream/yellow hybrids and yellow/cream hybrids from imported seeds.

Despite these examples, Pang acknowledges that yellow-flowering *Clivia* are still not very common in China. Nevertheless, apart from the growers he has identified,



He's Guo Lan Yellow.



He's Picotee Guo Lan.

he suggests that it is sometimes possible to see a couple of yellow/cream hybrids when one walks into the glass houses of growers.

In relation to other developments, Pang describes the first recorded polytepal in China which was announced in 1980 as an eight-petalled hybrid of an offset mutation of Dong Yang Zhou's Changchun hybrid. Apparently little interest was shown in this at the time, due to the focus on leaf development. However, after the exposure of Yong Bao Wang's eight-petalled Anshan hybrids with beautiful short broad leaves, large dark red flowers and a beautiful over-all shape, growers' interest changed. Wang developed this polytepal from an offset mutation in one of his Anshan hybrids. Currently, polytepal Chinese hybrids with 10-18 tepals are available but only in relatively small quantities.

Combination of plant and flower characteristics

Assuming that the trend to increase the variation in colour and other flower characteristics in *Clivia* in China continues, we can expect to see more exemplary combinations of plant characteristics along side of different coloured flowers and different flower forms on small plants. The combination of certain plant and flower characteristics is already well advanced in Japan, especially in relation to combinations of variegated foliage with different flower characteristics. Variegates with yellow flowers were produced some time ago – both group 1 and group 2 yellows, and now peach and other coloured variegates are being bred. Nakamura's yellow, long-leafed Akebono certainly constitute one of the splendid Japanese achievements to date. In addition, the feature of variegation has been combined with polytepalled flowers and also with interspecifics in Japan, even if the latter is on a limited scale to date. Variegated Ghost with broadish leaves and numerous other combinations also exist.

Japanese smaller-sized compact plants, whether a Daruma-type or otherwise, which have special flower characteristics, such as Hattori's bicolours or deep bronzes or reds, and Koike's medium-sized, green-flowing Hirao plants or his yellow Daruma/compact plants, which are currently being further developed, represent other plants which are of current interest to overseas collectors. The development of these new colours and colouration patterns on smaller plants, or new colours in polytepals as well as polytepalled interspecifics are other significant results of breeding in Japan.

The past, present and future

Outside their natural habitats, *Clivia* have proven to be strong plants which are characterised by longevity when in cultivation and have been grown in a wide variety of climatic conditions, given appropriate management. They have proved to be eminently suitable as pot/house plants, and have yielded an amazing amount of variation through hybridization outside of South Africa up until the present.

Over the past 50 or so years, Chinese breeders have pursued new directions in breeding *Clivia* by developing a range of plant characteristics, in particular, small-sized, well-proportioned plants with various kinds of leaf characteristics. In Japan, some growers or hybridizers may have focused upon plant characteristics but others have made enormous progress with the development of the flower, with certain breeders achieving a combination of plant and flower features, a pattern that is now also emerging in China.

Some of the progress in *Clivia* breeding in China and Japan up until the present

does indeed parallel developments also being undertaken elsewhere. Nevertheless, China and Japan have made their own substantial contributions to the development of the genus, rather independently of outside communities and also of each other (though the degree of this latter claim is difficult to specify), in the advancement of both the plant and the flower, and especially in relation to pot/house plant cultivation.

It is true to say that some of the outcomes achieved in China and Japan represent enormous achievements in the development of the genus *Clivia*, which, as a result, have received much acclaim in the international *Clivia* community. It is thus not surprising that in this new millennium we are witnessing an intensification of acquisition of some of the "new" material from China and Japan by overseas collectors and breeders. Chinese small, compact broad-leafed plants, with or without variegation and/or special leaf features are sought after, and from Japan, polytepals – including yellow-flowering ones, interspecifics, green Hirao flowers, variegates, and more recently, Hattori's compact deep bronzes, reds and various bicolours are also highly desired.

In earlier periods *Clivia* reached China and Japan from Europe, and may have been transmitted in smallish numbers from Japan to China up until the present, with some movement of Chinese material to Japan in current times. On the basis of available evidence, we can state that during the last 30 to 40 years, at least in the case of Japan, *Clivia* did move directly there from South Africa and from other places, and this may also be the case with China. Now, however, individuals or groups from various countries visit China or Japan for buying and/or viewing purposes, and a limited number of individuals act as mediators between their own countries and overseas collectors or nurserymen, with plants and seeds from these countries appearing on e-Bay from time to time, and in some cases, direct buying and selling via websites or other channels also occurs. The situation has thus been reversed, with *Clivia* from China and Japan moving back to South Africa and to other overseas countries where there is demand for new and beautiful *Clivia*.

In relation to the preserving of cultivars, Hirao has noted:

> Anyone can produce a cultivar that they enjoy, and though it is good if such a flower can be spread throughout the world, it is impossible for all of these to be preserved permanently.
>
> Ultimately, it is the fate of the cultivars that those which are supported by the public survive while the others end up disappearing. We can say that the flowers of the old cultivars that still exist have survived under a lucky star.
>
> (Hirao 2007, p. 91)

I feel sure that the legacy of the Chinese and Japanese breeders will be appreciated by the international *Clivia* community for a long time to come and that there will be many special *Clivia* from these areas – individual cultivars as well as cultivar groups – which will survive in the foreseeable future in their own countries as well as in various overseas locations. Furthermore, more exciting developments await us as the blending of the best material that is available from South Africa, China, Japan and other countries accelerates.

Notes

I owe my very sincere thanks to all those who contributed towards this paper, especially Hein Grebe, Eddie Pang, Shigetaka Sasaki, Ken Smith, S.K. Sung, Lillian Yuk and John van der Linde.

1. Here, Japanese names are used following an anglicised order, where the surname comes last. For the sake of consistency in this English text, I have also converted the Chinese names so that the surname appears last.
2. Cultivar names are shown with single quotation marks, while cultivar groups are shown without quotation marks.
3. According to Pang, Guo Lan means Chinese *Clivia* and it is the common name for Changchun *Clivia* hybrids which do not have any genetic influence from the imported Japanese Daruma. Nowadays, Chinese simply refer to Changchun *Clivia* hybrids as Guo Lan.

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Cheung & Wang: http://www.Civiacollection.com/onews.asp?id=140
Jin Wu: http://Clivia.topcn.cn/
Kasumi Hattori: http://www13.ocn.ne.jp/~baijyuen/home.htm (2010 sales etc)
Toshi (Toshiyuki Hosoya): http://www8.plala.or.jp/Clivia/index1.htm
Toshio Koike: http://www.koikenouen.com/sgn/Clivia.html
(http://www.koikenouen.com/sgn/hatuhana2010.html first flowers in 2010)
Hiroshi Mitsuhashi: http://www.mitsuhashi-Clivia.com/cat2.htm
Shigetaka Sasaki: http://members.jcom.home.ne.jp/Clivia.3/
Masumi Uno: http://www7a.biglobe.ne.jp/~Clivia/
Masashi Yamaguchi: http://homepage3.nifty.com/plantsandjapan/
Some Clivia society websites:
Beijing Clivia Society: http://www.bjjzl.cn
Japan Clivia Society: http://www.Clivia.jp/

Joburg Clivia Club 2009 Show

The top three of the "Flowering Clivias" on show. The central plant is an orange broad tepal flower. The plant is owned and grown by Corra and Dawie van Heerden. The plant on the left is a yellow broad leaf flower. This plant receiverd the award of the runner up to the best on show. This plant is owned and grown by Henry Slabbert. The plant on the right is grown and owned by Chris Viljoen. This plant was awarded the third best on show. This plant of Chris Viljoen was the winner in the "Display Plant" category as well.



The Clivia Society www.cliviasociety.org

The Clivia Society caters for *Clivia* enthusiasts throughout the world. It is the umbrella body for a number of constituent Clivia Clubs and interest Groups which meet regularly in South Africa and elsewhere around the world. In addition, the Society has individual members in many countries, some of which also have their own Clivia Clubs. An annual Yearbook and quarterly Newsletters are published by the Society. For information on becoming a member and / or for details of Clivia Clubs and Interest Groups contact the Clivia Society secretary or where appropriate, the International Contacts, at the addresses listed in the inside back cover.

The objectives of the Clivia Society

1. To coordinate the interests, activities and objectives of constituent Clivia Clubs and associate members;
2. To participate in activities for the protection and conservation of the genus *Clivia* in its natural habitat, thereby advance the protection of the natural habitats and naturally occurring populations of the genus *Clivia* in accordance with the laws and practices of conservation;
3. To promote the cultivation, conservation and improvement of the genus *Clivia* by:
   - 3.1 The exchange and mutual dissemination of information amongst Constituent Clivia Clubs and associate members;
   - 3.2 Where possible, the mutual exchange of plants, seed and pollen amongst Constituent Clivia Clubs and associate members; and
   - 3.3 The mutual distribution of specialised knowledge and expertise amongst Constituent Clivia Clubs and associate members;
4. To promote the progress of and increase in knowledge of the genus *Clivia* and to advance it by enabling research to be done and by the accumulation of data and dissemination thereof amongst constituent Clivia Clubs and associate members;
5. To promote interest in and knowledge of the genus *Clivia* amongst the general public; and
6. To do all such things as may be necessary and appropriate for the promotion of the abovementioned objectives.

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PHOTOGRAPHIC COMPETITION - WINNERS IN THE *C. miniata* SECTION

Best Photograph

FRONT COVER: Overall 1st – Helen Marriott – *Clivia miniata* (polytepal).
(Also Best Photograph overall and Photographic Competition Winner)

BACK COVER: 2nd – Joubert van Wyk – *C. miniata*.

TITLE PAGE: 3rd – Gordon Fraser – *C. miniata* – 'Peachmint'.



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CLIVIA

Yearbook of the Clivia Society

13

2011



20th Anniversary Issue

CLIVIA **The Clivia Society** | www.cliviasociety.org

The Clivia Society caters for *Clivia* enthusiasts throughout the world. It is the umbrella body for a number of constituent Clivia Clubs and interest Groups which meet regularly in South Africa and elsewhere around the world. In addition, the Society has individual members in many countries, some of which also have their own Clivia Clubs. An annual Yearbook and quarterly Newsletters are published by the Society. For information on becoming a member and / or for details of Clivia Clubs and Interest Groups contact the Clivia Society secretary or where appropriate, the International contacts, at the addresses listed in the inside back cover.

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COVER PHOTOGRAPHS

FRONT COVER: *Clivia miniata* with a "Mandarin Duck" variegated umbel.
Grower: Peet van der Walt. Photo: Roger Dixon.

BACK COVER: *Clivia* 'Carmen Miranda'. Photo: Gordon Fraser.

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Hexa polyhedral Rossi Kru van der Merwe

A Tribute to Mick Dower

Mick Dower, surely one of the giants of the world-wide clivia fraternity, died in his sleep on 12 October 2011. He had been in increasingly poor health for some time. His contributions to the development of interest in the growing and breeding of clivias will be remembered long after his passing.

Mick attended the inaugural International Conference and Show in Pretoria in 1994 and, with John Winter and a few others in 1996, started the Cape Province Branch of the Clivia Club. He served on the committee of the Club and also of the Clivia Society for several years. With a small group he organized the second Clivia Conference in Cape Town in 1998. He was a founder of the Clivia Yearbook, and the lead editor



Figure 1. A photomontage of Mick Dower and plants he had bred or grown. Composed by Claude Felbert.

from number 1 up to number 5.

Mick was a lawyer with an incisive mind. He drafted the Constitutions of the Cape Province Branch of the Clivia Club and its successors, the Cape Clivia Club



Photo: Claude Felbert

Figure 2. Grown and bred by Mick Dower: #229 De Villiers Variegated Peach × #81 Nakamura pinstripe Yellow.



Photo: Claude Felton

Figure 3. *C. miniata* 'Floradale Apricot'. A favourite breeding plant of Mick Dower.

and the Eastern Province Clivia Club. He also assisted in the drafting of the initial Constitution of the Clivia Society. He was often called on, sometimes behind the scenes, for advice on legal matters and gave that advice most willingly. He also served on the Society's Research Committee and the Standards and Judging sub-committee.

John Winter, Curator of Kirstenbosch and close friend of Mick, played a pivotal role in the search for *Clivia* populations. From 1996, together with taxonomist John Rourke, they made many sorties into the hidden corners of *Clivia* habitat in southern Africa. They collected the well-known 'Apple Blossom' series, the 'Komgha Red', the Mbashe and Umtamvuma pastels and many other variants, all of which were added to the SANBI collection. On behalf of SANBI Mick helped, for many years, to distribute seeds from that collection to enthusiasts in South Africa and throughout the world.

After he retired from professional life Mick had more time to devote to his clivias and to clivia-related interests, particularly the genetics of *Clivia*. He contributed at conferences, in the Clivia Yearbook, the Society's Clivia News, and in the Cape Clivia News, which he established. He was also an active member of the Clivia Enthusiasts internet discussion group. Through that membership, his direct personal contacts, and his contacts with people to whom he distributed seeds and plants, Mick's name became known internationally.

Mick was active in Cape Clivia Club shows, exhibitions, workshops, plant sales and Kirstenbosch Garden Fairs. He utilised every opportunity to advance *Clivia*. His affection, enthusiasm and expertise were usually so contagious that many visitors became members of the Club. He impressed all at shows and exhibitions with the outstanding prize-winning plants he bred and grew. At Club meetings he



Photo: Mick Dower

Figure 4. *Clivia* 'JKD'. One of the six plants named by Mick Dower after his grandchildren.



Photo: Mick Dower

Figure 5. *C. miniata* 'Mopi Hirt' sent to Mick by a South African friend from America. He named it after her.



Photo: Mick Dower

Figure 6. *C. miniata* 'Julia D' bred out of *C. miniata* 'Floradale Apricot' x *C. miniata* 'Oribi Gorge Yellow'. One of the six plants named by Mick Dower after his grandchildren. A registered plant.

donated many of the raffle plants, usually exceptional and valuable specimens. As a result, his plant material has been spread across the membership of the Club. Mick was also generous in giving away top-class plants and suckers, particularly to younger people and to newcomers to the Club wanting to establish collections.

Mick contributed to a greater understanding of genetics through his experiences and knowledge of breeding which he freely shared with all. He was particularly keen to encourage Club members to exhibit plants that they had bred themselves, as opposed to those acquired from others. He persuaded the Club committee to introduce the "Own Breeding" class at Club shows, with various categories within the class. He donated a Trophy for the plant judged best out of all the entrants. His vision has paid off as the number of entries has grown over the years. The "Own breeding" class was in fact the largest class at the 2011 Cape Clivia Club Show.

In his retirement Mick became a very proficient photographer. Two of his plants featured on Yearbook front or back covers. One was "Emma Leslie". The other one was on the front cover of Yearbook 8 and was a winning entrant in the Clivia Society photographic competition that year. But that is not all by any means. He and Claude Felbert together developed and produced the two Cape Clivia Club colour charts which many of us regularly use.

A devoted family man, Mick leaves his wife Jill, children and their spouses, and grandchildren, all of whom supported him as he indulged in his passion for all things clivia.

The memorial to Sir Christopher Wren, architect of St Paul's Cathedral, London, includes the words in Latin, "Reader, if you seek his monument – look around you." In



Figure 7. *C. mirnata* 'Rosemary D'. One of the six plants named by Mick Dower after his grandchildren.



Figure 8. Mick Dower bred *C. mirnata* hybrid from (Warren Glover Yellow x Bill Morris Yellow) x (Fragrant Yellow x 'Floradale Apricot').



Figure 9. *C. mirnata* of Mick Dower's own breeding, a section winner at the 2018 Cape Cliva Club Show.

a clivia sense, the same thing can be said about Mick Dower. His monument is to be seen in the legacy of plants and plant material that he has left behind for so many of us throughout the world to enjoy and by which we can remember him.

This tribute to Mick was compiled by three of his friends who share his love of clivias and who remember him with affection.

October 2011



Photo: Claude Felten

Figure 10. A Mick Dower bred 'Ghost'-style *C. miniata*.



Photo: Mick Dower

Figure 11. *C. miniata* 'Emma Leslie'. One of the six plants named by Mick Dower after his grandchildren.



Photo: Claude Felten

Figure 12. A sibling of 'Emma Leslie' bred by Mick Dower.



Photo: Mick Dower

Figure 13. *C. miniata* 'Katie D'. One of the six plants named by Mick Dower after his grandchildren.



Photo: Mick Dower

Figure 14. *C. miniata* 'Margot D'. One of the six plants named by Mick Dower after his grandchildren.

Systematics and Phylogeography of *Clivia*

Ferozah Conrad & Dee Snijman

South African National Biodiversity Institute, Cape Town

The genus *Clivia* comprises six species: *C. miniata* (Lindl.) Bosse, *C. nobilis* Lindl., *C. gardenii* Hook, *C. caulescens* R.A.Dyer, *C. robusta* B.G.Murray, Ran. de Lange, Hammett, Truter et Swanev. and *C. mirabilis* Rourke. Five species (*C. miniata, C. nobilis, C. gardenii, C. caulescens* and *C. robusta*) are found in coastal and inland Afromontane forest along the east coast of southern Africa, from the Eastern Cape northwards to Limpopo Province and Swaziland (Rourke, 2002). One species, *C. mirabilis* which was discovered in 2002, occurs in the Oorlogskloof Nature Reserve, in a semi-arid valley in the Northern Cape.

The discovery of *C. mirabilis*, in a climate and locality so different from that previously known for *Clivia*, has prompted phylogeographic questions regarding this genus. *Clivia* has always been seen as belonging to densely forested, subtropical environments experiencing a summer rainfall, dry winter climatic regime. *Clivia mirabilis*, in direct contrast, occurs remotely in the arid Northern Cape with its strictly winter rainfall regime, isolated from the other *Clivia* species (Rourke, 2002). The distribution ranges of the tubular-flowered *Clivia* species (*C. nobilis, C. gardenii, C. caulescens* and *C. robusta*) are parapatric in relation to one another [they do not occupy the same geographical ranges but the ranges are contiguous (Wiley, 1981)], whereas the distribution range of the open-flowered *C. miniata* is partly sympatric [populations of two or more species are found together with all the tubular-flowered species, except for *C. mirabilis* in one part of their distribution range, but apart from them in another (Wiley, 1981)].



Photo: Neil Hewitt

Figure 1. *Clivia mirabilis*, Oorlogskloof Nature Reserve, Northern Cape.

In terms of morphology, *C. miniata* is distinct and easy to identify, but the morphological differences between the tubular-flowered species are subtle and geographical data have often been favoured in the identification of species.

Based on an earlier study by Conrad *et al.* (2003), the winter rainfall *C. mirabilis* is placed as sister to all of the summer rainfall

species. This prompts questions whether the disjunction to the Northern Cape is due to vicariance or dispersal and whether *C. mirabilis* shows reduced genetic diversity. In addition, partial sympatry between *C. miniata* and the tubular-flowered species also prompts questions about the discreteness of the populations in the areas of overlap.

C. robusta was described from Pondoland, Transkei, along the east coast of South Africa in 2004. Murray *et al.* (2004) used karyological, morphological and distribution pattern data to distinguish *C. robusta* from *C. gardenii*, the species to which it is most closely related. Considering the controversial nature of this taxonomic decision it poses an interesting population level case study.

Given the unusual distribution pattern of *Clivia*, its horticultural importance and its growing commercial market, the aim of this investigation was firstly to elucidate the species level relationships of *Clivia* and secondly to obtain a better understanding of the evolutionary relationships, by exploring the phylogeographic patterns within the *Clivia* species and among them.

Materials and Methods

Sampling

Of the 107 individuals sampled, 89, representing 33 populations across the distribution range, were successfully amplified for three plastid regions: the *rpoB-trnC* intergenic spacer, *trnL* intron and *trnL-F* intergenic spacer. Leaf material from all the localities cited by Murray *et al.* (2004) in their description of *Clivia robusta* was included in the analysis.

Selection of DNA regions for analysis was based on the broader study of the tribe,

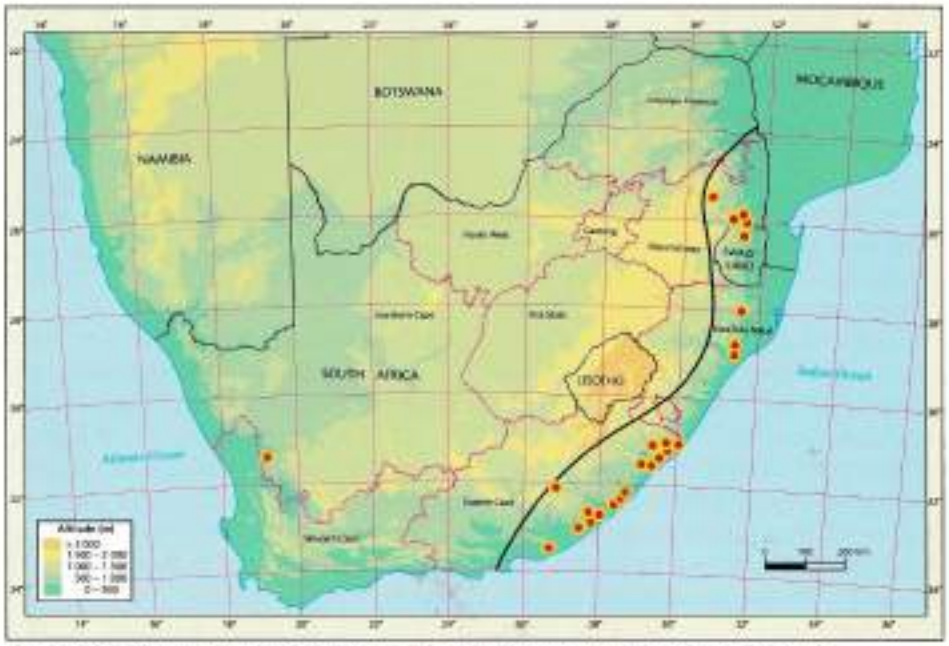


Figure 2. Distribution map of *Clivia*. Blue circles indicate populations included in the study.

where the *trnL-F* region and the *rpoB-trnC* intergenic spacer produced the most variation. Voucher and population locality information are listed in Table 1.

DNA extraction, PCR and DNA sequencing

Standard extraction, PCR and DNA sequencing protocols were followed.

Phylogenetic and phylogeographic analyses

To investigate genetic relationships among the haplotypes, networks were constructed separately for both the individual regions (*trnL-F* and *rpoB-trnC*) and the combined data matrices. Analysis software TCS (Clement *et al.*, 2000) and median joining networks using Network version 4.1.0.0 (Bandelt *et al.*, 1999) were used, and all the individuals (n=89) were included in the analyses.

To allow an assessment of the degree of differentiation among the sampling areas, a spatial analysis of molecular variance (SAMOVA; Dupanloup *et al.*, 2002) was conducted *post hoc* identification of clades in the network. The SAMOVA takes into consideration geographic locations of sampling and sequence data to identify groups of populations that are geographically homogenous and maximally separated from each other. It aims to maximize the proportion of genetic variation due to differences between groups based on simulated annealing procedures (Dupanloup *et al.*, 2002). As such, this analysis was useful for statistically differentiating between historically isolated groups in the network (Tolley *et al.*, 2006). It also incorporates traditional F-statistics (F_{CT}, F_{SC}, F_{ST}) in recognising population substructure. F_{CT} is the proportion of total genetic variance due to the

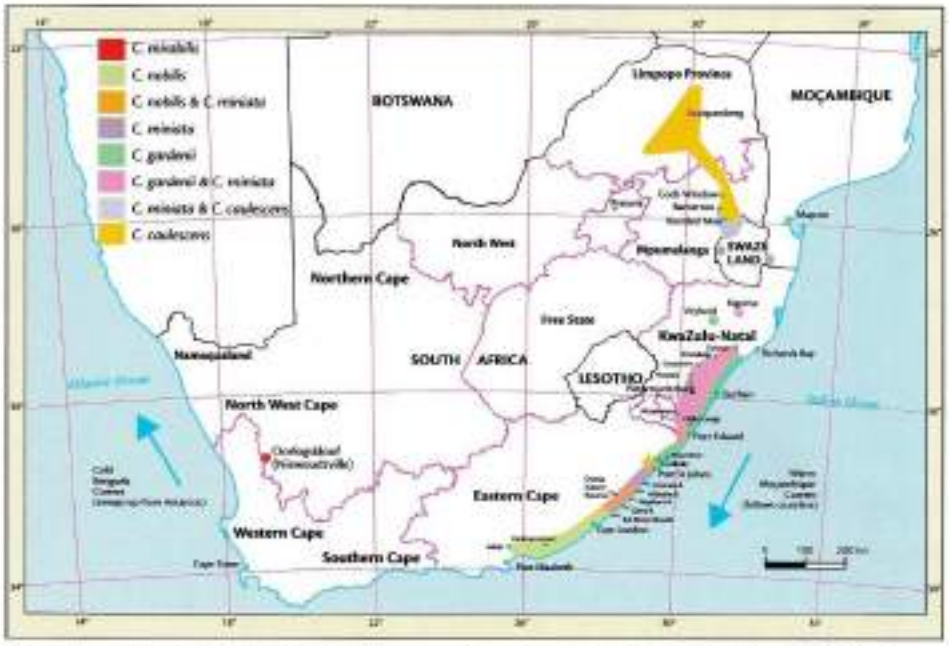


Figure 3. The known distribution of *Clivia* species (orange star = *C. robusta*). The map also shows where the species grow sympatrically. Source: Felbert (2003).

Table 1. Kirstenbosch Botanical Garden (NBG) accession information and population locality details for all *Clivia* individuals used in the analyses.

Population	Haplotype network reference	Individuals in population	Locality	Grid	Collector's details	Kirstenbosch accession number
Clivia caulescens	Caul01-03	3	locality 1 – Mpumalanga, Malandweni, Lobodtlyana Cliffs/ kloofs on Vooruitzicht	2531CC	JWI 569	NBG 441/99
Clivia caulescens	Caul04-05	2	locality 2 – Mpumalanga Elandshoogte Ngodwana Sappi forest station	2530DA	JWI 57	NBG 433/99
Clivia caulescens	Caul06-09	4	locality 3 – Swaziland, Bearded Man	2531CD	JWI 573	NBG 573/99
Clivia caulescens	Caul10	1	locality 4 – Swaziland, Malandzela	2631AB	ALL	NBG 321/00
Clivia caulescens	Caul11-14	4	locality 5 – Mpumalanga, Malandweni in Songimvelo Nature Reserve	2531CC	JWI 567	NBG 439/99
Clivia gardenii	Gard15-18	4	locality 1 – KZN, Ngome Forest	2731CD	JWI 565	NBG 437/99
Clivia gardenii	Gard19-21	3	locality 2 – KZN, Mpushini Falls on the outskirts of Eshowe	2831CD	JWI 559	NBG 430/99
Clivia gardenii	Gard22-25	4	locality 3 – EC, Mkambati Nature Reserve	3129BB	JW557	NBG 517/98
Clivia gardenii	Gard26-29	4	locality 4 – KZN, Entumeni Forest (Ngoye) at the waterfall on Ngoje River	2831CD	JWI 562	NBG 434/99
Clivia gardenii	Gard33-36	4	locality 5 – EC Umtentu Valley, Mkambati side of river	3129BB	Ex hort Fred van Niekerk	
Clivia gardenii	Gard37	1	locality 6 – EC Cultivated from seed from above plants	3129BB	Ex hort Fred van Niekerk	
Clivia gardenii	Gard38	1	locality 7 – EC, Lombazi riverbank, swamp	3129BD	Ex hort Len Chiazzara	
Clivia robusta	Robu30-32	3	locality 1– EC, Dimfi few km east of Ndindindi (locality 5 from Murray et al. paper)	3129BD	JWI 579	NBG 314/00
Clivia robusta	Robu39	1	locality 2 – EC, Mkambati Nature Reserve, cultivated at Kirstenbosch, Prof Kobus Eloff (Locality 1 from Murray et al. paper)	3129BD	JW557	NBG 517/98
Clivia robusta	Robu40	1	locality 3 – EC, Near Lusikisiki at the Fraser Falls S. Venter (Locality 2 from Murray et al. paper)	3129BC	Venter 3864	PRE 556875
Clivia robusta	Robu41	1	locality 4 – EC, Mount Sullivan, Port St John (Holotype from Murray et al. paper)	3129BB	J.T. Truter 4072	
Clivia robusta	Robu42	1	locality 5 – EC, locality 9 Lambasi Village on the Ndindindi Road, Mkambati (locality 4 from Murray et al. paper)	3129BD	JPR 2180	NBG 313/00
Clivia robusta	Robu43	1	locality 6 – KZN, Umtamvuna, Port Edward (locality 6 from Murray et al. paper)	3129BD	JWI 554	NBG 514/98
Clivia robusta	Robu44	1	locality 7 – EC, Mkambati Reserve, 3km west of Umtentu River mouth (locality 3 from Murray et al. paper)	3129BB	JPR 2145	

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Table 1. Kirstenbosch Botanical Garden (NBG) accession information and population locality details for all *Clivia* individuals used in the analyses.

Population	Haplotype network reference	Individuals in population	Locality	Grid	Collector's details	Kirstenbosch accession number
Clivia nobilis	Nobi45-47	3	locality 1 – EC, Bushmans River mouth – on dunes on west bank	3326DA	JWI 525	NBG 598/97
Clivia nobilis	Nobi48-51	4	locality 2 – EC, Nahoon Beach, Cambridge	3227DD	JWI 467	NBG 717/96
Clivia nobilis	Nobi52-54	3	locality 3 – EC, Ngabara River	3228BD	JWI 500	NBG 573/97
Clivia nobilis	Nobi55-57	3	locality 4 – EC, Wembley Farm	3228CC & CD	JW 534	NBG 606/97
Clivia nobilis	Nobi58-59	2	locality 5 – Transkei, Kei mouth collected on sand dunes, Butterworth	3228CB	JWI 485	NBG 715/96
Clivia nobilis	Nobi60	1	locality 6 – EC, Riet River	3326AA	JWI 466	NBG 716/90
Clivia miniata	Mini61-63	3	locality 1 – KZN, Entumeni River	2831CD	JWI	NBG 435/99
Clivia miniata	Mini64-67	4	locality 2 – EC, Umtamvuna Nature Reserve	3129CB	JWI555	NBG 513/98
Clivia miniata	Mini68-69	2	locality 3 – EC, Mbashe	3228BB	JWI 545	NBG 524/98
Clivia miniata	Mini70-73	4	locality 4 – Swaziland, Bearded Man (WEST) Mondi SATICO plantation	2531CD	JWI 570	NBG 442/99
Clivia miniata	Mini74-76	3	locality 5 – EC, Quora River, Mazeppa Bay	3228BC	JWI 470	NBG 720/96
Clivia miniata	Mini77-80	4	locality 6 – EC, Wembley Farm Gagura River and unnamed stream Kei V	3228CA	JPR 2195	NBG 569/00
Clivia miniata	Mini81-82	2	locality 7 – KZN Oribi Gorge, Port Shepstone, KZN- yellow, orange, white centred	3030CB	S Venter	
Clivia mirabilis	Mira83-87	5	Oorlogskloof Nature Reserve, Northern Cape	3119AC	JPR 2228	NBG 35/04

differences between groups of populations; F_{SC} reveals the degree of differentiation between populations within groups; F_{ST} shows the genetic variation between subpopulations relative to the total population. One hundred simulated annealing processes were performed for each possible number of populations, ranging from two through to eight populations for the *trnL-F* and combined datasets.

Haplotype diversity (*h*) and nucleotide diversity (π) among groups were calculated in Arlequin version 2.000 (Schneider *et al.*, 2000). The distribution of variation within and between assemblages was investigated by an analysis of molecular variance (AMOVA, Excoffier *et al.*, 1992) as implemented in Arlequin version 2.000.



Figure 4. *Clivia nobilis*, Bushmans River, Eastern Cape.



Figure 5. *Clivia mirabilis*, Oorlogskloof Nature Reserve, Northern Cape.

To assess the genetic divergence among these groups, F_{ST} and Φ_{ST} were estimated. F_{ST} takes into account only the differences in haplotype frequencies in the different populations, while Φ_{ST} takes into account both the haplotype frequency and nucleotide diversity (Hurwood & Hughes, 1998; Beheregaray & Sunnucks, 2001).

To estimate maximum likelihood (ML) migration rates among the populations of the six *Clivia* species we used MIGRATE version 2.1.3 (Beerli, 1997–2004). This approach, based on coalescence using Markov Chain Monte Carlo (MCMC) searches, takes both history and asymmetrical gene flow into account, unlike migration-drift equilibrium classical approaches, and allows simultaneous estimation of population growth or decline (Beerli & Felsenstein, 2001). The analyses were repeated several times with different combinations of short and long chains.

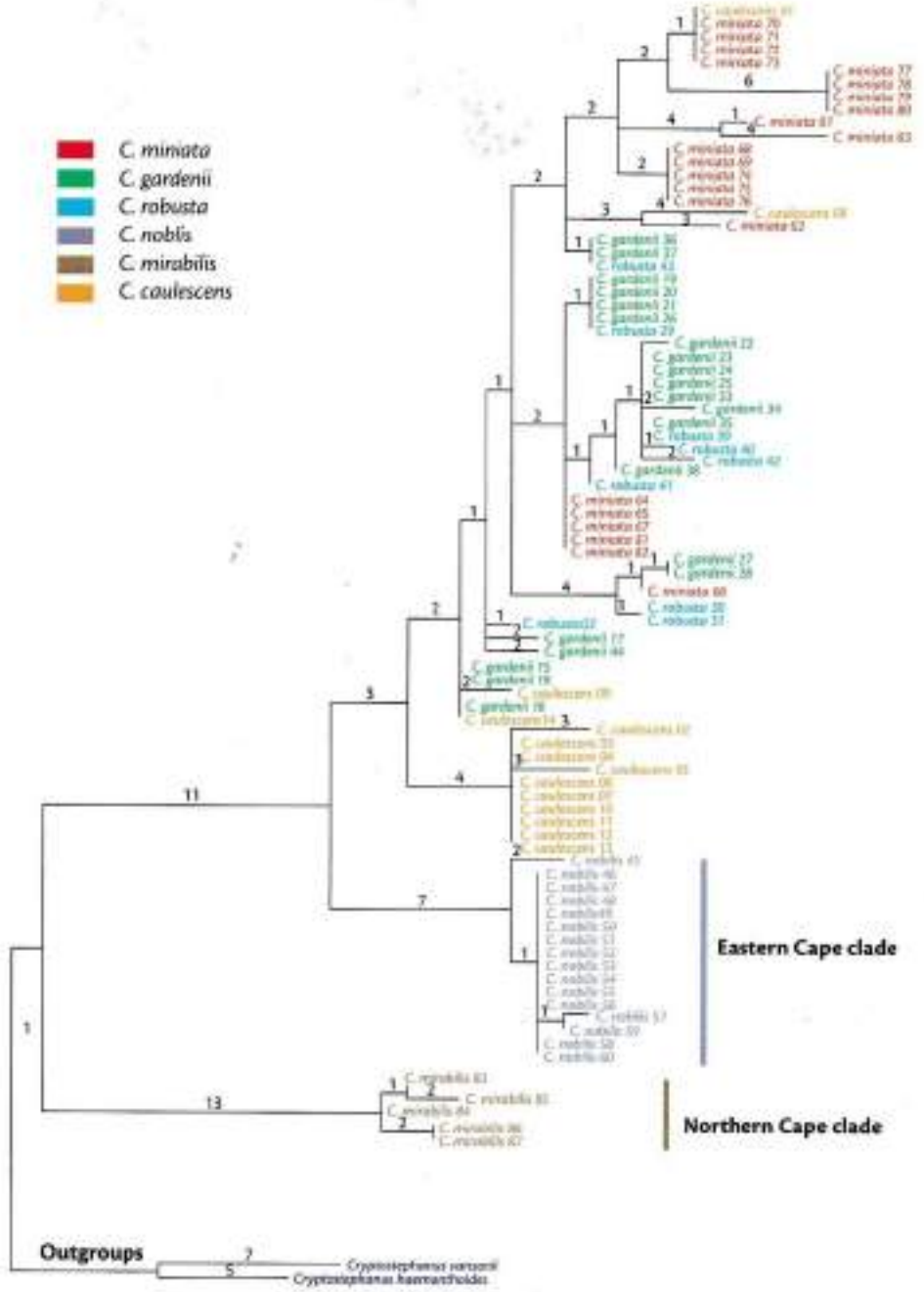


Figure 6. One of 208 equally parsimonious trees from combined analysis with branch lengths indicated above the branches. Numbers at end of species names indicate haplotype network reference numbers.

Results

Parsimony and Network analyses

Although individual datasets were analysed, only results from the combined analysis will be discussed as both the *trnL-F* and *rpoB-trnC* datasets represent chloroplast loci. Since the chloroplast is inherited as a unit, all loci by definition share the same history, and any differences must be due to positional sampling effects or compositional bias. It is therefore appropriate to combine chloroplast loci, as separate analyses are difficult to justify.

Haplotype reconstruction software Network (Bandelt *et al.*, 1999) was unable to execute data matrices consisting of more than 1000 characters. An alternative software TCS (Clement *et al.*, 2000) was utilised, as the combined datasets consisted of more than 1000 characters.

Of the 1732 characters included in the combined analysis 1667 were constant, 15 variable characters were parsimony-uninformative and 50 were parsimony informative. 3780 equally parsimonious trees were recovered with tree length 104, CI 0.644 and RI 0.920. Two clades were recovered in one of the equally parsimonious trees (Figure 6). One clade consisted of a monophyletic *C. mirabilis* and the other is further subdivided into two subclades comprising a monophyletic *C. nobilis*, sister to a clade consisting of the other four species. This split reflects the two lineages of *Clivia*: one lineage representing the winter rainfall/ Northern Cape lineage and the other the predominantly summer rainfall/east coast lineage.

Haplotype network reconstructed for the combined analysis is shown in Figure 7. Haplotypes of *C. mirabilis* occur in close proximity to each other. Sharing of haplotypes occur between *C. miniata and C. caulescens*; *C. gardenii* and *C. robusta*; and *C. miniata* and *C. robusta*.

Molecular Diversity Analyses

The SAMOVA analysis was run on the combined (*trnL-F* and *rpoB-trnC*) datasets to investigate the variation within and between the species. Although Table 2 only shows the structure for eight different groups, 24 groups were analysed in total. SAMOVA did not produce any significant results as the FCT results increased constantly without any noteworthy increase at any particular groupings. This may suggest that no isolation of the lineages has occurred with respect to the sequences used here and that variation in these data between the species is as great as the variation within species. None of the groups proposed by SAMOVA reflect the haplotype networks obtained.

Due to the small sample sizes from many localities and the lack of obvious criteria for the definition of groups of populations, individuals were assigned to groups on the basis of their taxonomic classification, i.e. groups were assigned according to species. For the six groups reflecting the six species, AMOVA revealed variation among populations at 33.92%, half of that of the within population variation (66.08%).

The groups revealed a low degree of genetic subdivision with only 23% genetic variation between the groups (species) for the combined analysis (F_{ST} 0.23424 $p < 0.0001$; Φ_{ST} 0.49653 $p < 0.0001$ respectively). Haplotype and nucleotide diversity are highest for *C. miniata* but this could be caused by sampling bias (Table 3). Nucleotide composition (Table 4) is similar between the different groups for both datasets.

Effective population size, FST values and migration rates obtained are summarized in Table 5 and 6. Several combinations of short and long chains were carried out with

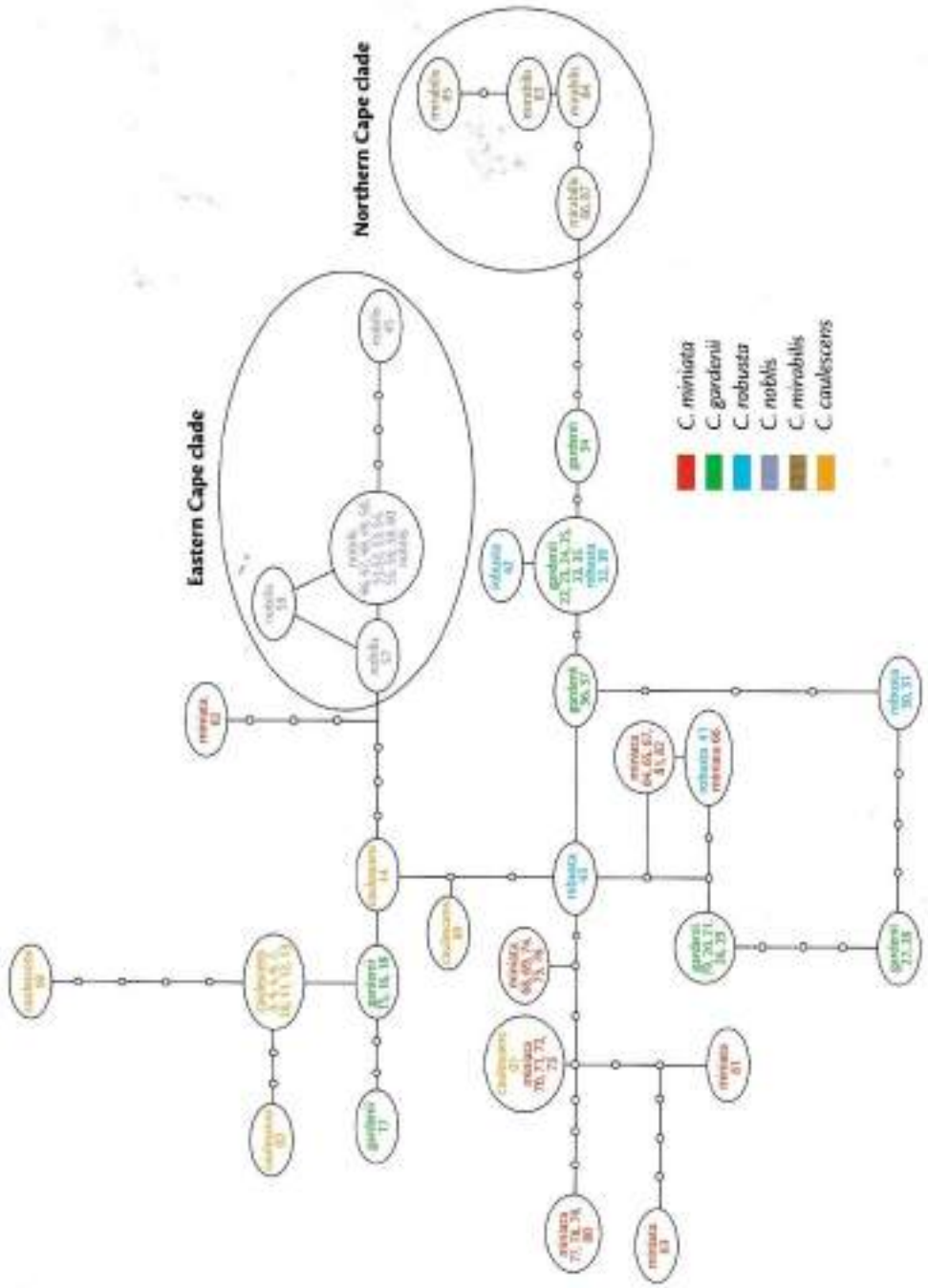


Figure 7. Haplotype network from TCS using combined plastid data sets. Circles surround species. Missing intermediates occur on the branches linking haplotypes. Numbers at end of species names indicate haplotype network reference numbers.

Table 2. Results from a spatial analysis of molecular variance (SAMOVA) showing F values given different numbers of groupings for the combined datasets. Sets of lineages that were combined within the groups are indicated.

2 Groups	
1. caulescens1, caulescens2, caulescens3, caulescens4, caulescens5, gardenii1	F_{SC} = 0.660
2. gardenii2, gardenii3, gardenii4, gardenii5, gardenii6, gardenii7, gardenii8, gardenii9, gardenii10, gardenii11, gardenii12, gardenii13, gardenii14, nobilis1, nobilis2, nobilis3, nobilis4, nobilis5, nobilis6, miniata1, miniata2, miniata3, miniata4, miniata5, miniata6, miniata7, mirabilis1	F_{ST} = 0.886 F_{CT} = 0.664
3 Groups	
1. gardenii2, gardenii3, gardenii4, gardenii5, gardenii6, gardenii7, gardenii8, gardenii9, gardenii10, gardenii11, gardenii12, gardenii13, gardenii14, , miniata1, miniata2, miniata3, miniata4, miniata5, miniata6, miniaca7, mirabilis1	F_{SC} = 0.506
2. nobilis1, nobilis2, nobilis3, nobilis4, nobilis5, nobilis6	F_{ST} = 0.858
3. caulescens1, caulescens2, caulescens3, caulescens4, caulescens5, gardenii1	F_{CT} = 0.714
4 Groups	
1. gardenii2, gardenii3, gardenii4, gardenii5, gardenii6, gardenii7, gardenii8, gardenii9, gardenii10, gardenii11, gardenii12, gardenii13, gardenii14, miniata1, miniata2, miniata3, miniata4, miniata5, miniata7, mirabilis1	F_{SC} = 0.424
2. caulescens1, caulescens2, caulescens3, caulescens4, caulescens5, gardenii1	F_{ST} = 0.853
3. miniata6	F_{CT} = 0.745
4. nobilis1, nobilis2, nobilis3, nobilis4, nobilis5, nobilis6	
5 Groups	
1. mirabilis1	
2. caulescens1, caulescens2, caulescens3, caulescens4, caulescens5, gardenii1	F_{SC} = 0.361
3. miniata6	F_{ST} = 0.845
4. nobilis1, nobilis2, nobilis3, nobilis4, nobilis5, nobilis6	F_{CT} = 0.757
5. gardenii2, gardenii3, gardenii4, gardenii5, gardenii6, gardenii7, gardenii8, gardenii9, gardenii10, gardenii11, gardenii12, gardenii13, gardenii14, miniata1, miniata2, miniata3, miniata4, miniata5, miniata7	
6 Groups	
1. mirabilis1	
2. caulescens1, caulescens2, caulescens3, caulescens4, caulescens5, gardenii1	
3. gardenii2, gardenii3, gardenii4, , gardenii5, gardenii6, gardenii7, gardenii8, gardenii9, gardenii10, gardenii11gardenii12, gardenii13, gardenii14, miniata1, miniata2, miniata3, miniata5, miniata7	F_{SC} = 0.297
4. nobilis1, nobilis2, nobilis3, nobilis4, nobilis5, nobilis6	F_{ST} = 0.839
5. miniata6	F_{CT} = 0.770
6. miniata4	
7 Groups	
1. caulescens1, caulescens2, caulescens3, caulescens4, caulescens5, gardenii1	
2. miniata4	
3. nobilis1, nobilis2, nobilis3, nobilis4, nobilis5, nobilis6	F_{SC} = 0.218
4. mirabilis1	F_{ST} = 0.828
5. gardenii2, gardenii3, gardenii6, gardenii7, gardenii8, gardenii9, gardenii10, gardenii11gardenii12, gardenii13, miniata1, miniata2, miniaca3, miniata5, miniata7	F_{CT} = 0.780
6. miniata6	
7. gardenii4, gardenii5, gardenii14	

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Table 2. Results from a spatial analysis of molecular variance (SAMOVA) showing F values given different numbers of groupings for the combined datasets. Sets of lineages that were combined within the groups are indicated.

8 Groups	
1. gardenii4, gardenii5, gardenii14	
2. mirabilis1	
3. gardenii7, gardenii13	
4. gardenii2, gardenii3, gardenii6, gardenii8, gardenii9, gardenii10, gardenii11, gardenii12, miniata1, miniata2, miniata3, miniata5, miniata7	F_{SC} = 0.180 F_{ST} = 0.826 F_{CT} = 0.788
5. nobilis1, nobilis2, nobilis3, nobilis4, nobilis5, nobilis6	
6. miniata4	
7. miniata6	
8. caulescens1, caulescens2, caulescens3, caulescens4, caulescens5, gardenii1	

Table 3. Molecular diversity indices for the 6 groups (species) for the combined dataset. Significance values (p) are given in brackets.

Group	No. of individuals	No. of haplotypes	Molecular diversity indices	
			Haplotype diversity (h)	Nucleotide diversity (π)
Caulescens	14	6	0.6813	0.002078
			(0.1316)	(0.001247)
Gardenii	21	9	0.8571	0.002874
			(0.0466)	(0.001682)
Robusta	9	8	0.7222	0.000933
			(0.1592)	(0.000886)
Nobilis	16	4	0.3500	0.000388
			(0.1478)	(0.000388)
Miniata	22	9	0.8788	0.003343
			(0.0364)	(0.001843)
Mirabilis	5	4	0.9000	0.001449
			(0.1610)	(0.001082)

Table 4. Nucleotide composition for combined datasets from AMOVA.

Combined datasets		
Caulescens	**Gardenii**	**Robusta**
C:15.20%	C:15.27%	C:15.41%
T:31.88%	T:31.92%	T:31.67%
A:36.50%	A:36.58%	A:36.66%
G:16.42%	G:16.24%	G:16.26%
Nobilis	**Miniata**	**Mirabilis**
C:15.23%	C:15.22%	C:15.27%
T:31.86%	T:31.89%	T:31.88%
A:36.71%	A:36.67%	A:36.69%
G:16.20%	G:16.21%	G:16.16%

Table 5. Effective population size (expressed as $\theta = {}_{f}N\mu$) and FST values.

	θ	FST
caulescens (1)	0.023259	0.00688
gardenii (2)	0.016958	0.00081
robusta (3)	0.007471	0.00326
nobilis (4)	0.001986	0.00091
miniata (5)	0.005124	0.00187
mirabilis (6)	0.006533	0.00156

17 short and 3 long producing the optimal results with no error values reported. The estimates obtained for effective population size indicate *C. caulescens* to be the biggest and *C. nobilis* the smallest. Migration between the species was bidirectional with very high past gene flow rates observed between *C. robusta* and *C. gardenii*, within *C. mirabilis* and within *C. nobilis*.

Discussion

The phylogeny reconstructed from the combined dataset has short internal branches and weak bootstrap support, while most of the polytomies show sharing of haplotypes (Figure 6). One likely scenario is that the genus has recent origins, a phenomenon not uncommon in the region. Research focusing on dating of the tribe Haemantheae, using two different methods [Non Parametric Rate Smoothing (NPRS) and Bayesian Evolutionary Analysis Sampling Trees (BEAST)] suggests 17 Ma and 15.6 Ma for the genus, respectively. Richardson *et al.* (2001) dated the genus *Phylica* using island species and other genera from the same tribe and reported a radiation date of 7-8 Ma and Klak *et al.* (2004), in their study of the family Aizoaceae, reported a radiation date of 3-4 Ma.

Phylogeography relies on interpreting patterns of congruence, or lack of congruence between geographical distribution of the haplotypes and their genealogical relationships. When clades of closely related haplotypes are geographically restricted or occur in close proximity, congruence exists (Schaal *et al.*, 1998). Using parsimony, results from the phylogenetic analysis for the combined datasets (Figure 6), showed two clades. One clade consisted of *C. mirabilis*, one of only two monophyletic species in the genus, the other clade divided into two subclades. One of the subclades comprised a monophyletic *C. nobilis*, sister to a clade consisting of a combination of the other four species. A haplotype network reconstruction showed the same pattern. The incongruence between the phylogeographic patterns, the currently accepted taxonomy and geography suggest that there may be ancestral polymorphisms present or incomplete lineage sorting in the genus.

An alternative explanation for the sharing of haplotypes between species is hy-

Table 6. Migration rates estimated via ML with *MCMC* searches (using *MIGRATE*).

Direction of migration	Migration rate
M21	247.716904
M31	247.716904
M41	247.716904
M51	1057.06
M61	247.716904
M12	4445.21
M32	21508.1
M42	1822.47
M52	1822.47
M62	1822.47
M13	266.551971
M23	1298.19
M43	266.551971
M53	266.551971
M63	266.551971
M14	1234.05
M24	1234.05
M34	1234.05
M54	1234.05
M64	2289.35
M15	302.433968
M25	741.581994
M35	302.433968
M45	302.433968
M65	302.433968
M16	589.847565
M26	589.847565
M36	589.847565
M46	589.847565
M56	1091.98

bridization. References to artificial hybrids are made in the literature by Rourke (2003) and Koopowitz (2002). Natural interspecific hybridization in the genus has rarely been recorded. In 2006, Swanevelder *et al.* formally described a natural *Clivia* hybrid *Clivia* x *nimbicola*, an intermediate between *C. caulescens* and *C. miniata*, growing sympatrically with *C. caulescens* and *C. miniata* and confined to the Barberton area of endemism on the border of South Africa and Swaziland.

In the northern part of the Eastern Cape *C. miniata* and *C. robusta* grow sympatrically and share haplotypes in the haplotype network reconstructed from the combined datasets. However, they do not share the same flowering times; *C. miniata* flowers in June and *C. robusta* in September which makes hybridization unlikely although it cannot be ruled out completely since *C. miniata* has been known to flower sporadically throughout the year. In Mpumalanga *C. miniata* and *C. caulescens* grow sympatrically and they are also observed to share haplotypes but these two species have different pollinators; swallowtail butterflies for *C. miniata* and sunbirds for *C. caulescens*, again making hybridization unlikely, but not impossible. Although the presence of ancestral polymorphisms and incomplete lineage sorting are possible options to explain haplotype sharing for these sympatrically occurring individuals, it is difficult to discern which of the possibilities are likely for *C. miniata*. This aside, haplotype sharing is clearly evident in these sympatrically occurring species.

Haplotype sharing is also observed between *C. gardenii* and *C. robusta* in the Eastern Cape where they occur sympatrically. The interconnectedness between these two species brings into question the recognition of these two elements as discrete species since *C. robusta* was considered a 'robust' form of *C. gardenii* until it was formally described in 2004 by Murray *et al.*

Clivia mirabilis (Northern Cape) and *C. nobilis* (Eastern Cape) show the most discrete haplotypes, probably as a result of highly restricted gene flow. *Clivia mirabilis* occurs in the western most part of the distribution range and *C. nobilis* in the southern most part of the range.

Dupanloup *et al.* (2002) state that the SAMOVA model allows one to define the strongest structure of populations in genetic terms but that the identification of the correct number of groups depends critically on the degree of differentiation between groups. SAMOVA reveals no significant groupings of the populations, suggesting a lack of genetic structure. AMOVA was



Photo: Heidi Hendriks

Figure 8. *Clivia nobilis*, Bushmans River, Eastern Cape.

therefore structured to reflect the six species of *Clivia* as groups. The results showed low genetic variation among groups and high variation within groups and a low degree of genetic subdivision, implying once again a lack of genetic structure and the likelihood that no isolation of the lineages has occurred in these data. All analyses, including the statistical analyses, therefore support the likelihood of incomplete lineage sorting present in *Clivia*.

With the discovery of *Clivia mirabilis* in the Northern Cape in 2002, the question arose whether the genus once occupied a wider range spanning the Eastern and Western Cape. Evidence from the coalescent model, MIGRATE, supports the hypothesis that this is the case, with past flow gene rates recorded between *C. mirabilis* and *C. nobilis*, the most southerly species of *Clivia* and the closest geographically to *C. mirabilis*. Subsequent fragmentation of this distribution range may have been precipitated by the increase in aridity experienced in the Northern and Western Cape during the late Miocene (15-8 Ma), with subtropical elements giving way to fynbos elements. This may have caused the range of *Clivia* to retreat and may account for only one lineage, now represented by *C. mirabilis*, occupying a semi-arid habitat in the Northern Cape.

Although long distance dispersal should be considered, it is highly unlikely for two reasons. Firstly, *Clivia* have heavy fleshy berries that make them unsuitable for wind



Figure 9. *Clivia miniata*.

dispersal, and secondly, while dispersal of seeds by frugivorous birds between adjacent forest patches is likely, dispersal over 800 km of arid country does not appear very probable (Rourke 2002). Moreover, no frugivorous birds are known to migrate between the Eastern Cape and Northern Cape (Snijman, 2002).

An alternate scenario is that *Clivia mirabilis* is a relictual population that successfully colonised a previously unoccupied habitat in the Northern Cape. Tolley *et al.* (2006), in their study of the biogeography of dwarf chameleons, suggested that climatic fluctuations have created islands of differing vegetation types, some of which may have persisted as isolated patches for long periods of time. The considerable climatic fluctuation throughout the Pliocene and into the Quaternary caused vegetation changes in the region which are thought to be more complex than a simple reduction of forest and establishment of fynbos and other mesic and arid vegetation types (Midgley *et al.*, 2001; Barrable *et al.*, 2002).

In 2003, Snijman proposed that recurring intense fires in the fynbos have served to isolate clivias in the Northern Cape from those along the east coast of South Africa. In this scenario it seems that *C. mirabilis* has persisted at Oorlogskloof for hundreds of generations untouched by fires that probably destroyed its ancestors which once occupied the southern Cape during more favourable times (Snijman, 2003).

Conclusion

The debate on the definition of a species and how to determine species boundaries or species delimitations has been waging for decades and is one that will probably never be resolved. Preliminary DNA sequencing results for the phylogeography of *Clivia* suggests that only two species of the six in the genus *Clivia* are 'true species' in this case referring to monophyletic species, namely *C. mirabilis* and *C. nobilis*. The monophyly of *C. caulescens*, *C. gardenii*, *C. robusta* and *C. miniata* was not established using two plastid regions. However, the possibility that the haplotypes which *C. miniata* shares with other taxa (*C. gardenii* and *C. caulescens*) is due to hybridisation where their populations overlap, cannot be eliminated.

Two scenarios have been proposed to understand how *C. mirabilis*, in the Northern Cape, came to be isolated from the other five *Clivia* species which occur along the east coast of southern Africa, the nearest being *C. nobilis* some 800 km away. No records of wild *Clivia* exist in the southern Cape, despite more than a century of botanical exploration. The first scenario was long distance dispersal through seed but this was ruled out by Rourke (2002). Instead he speculated that *C. mirabilis* is relictual, a survivor of the past climatic history when subtropical vegetation covered much of the interior of South Africa. Dating of the tribe revealed the estimated divergence of *C. mirabilis* from the summer rainfall *Clivia* species to be about 16 Ma (17 Ma for NPRS and 15.6 Ma BEAST). This coincides with the Miocene and the increase in aridification that eliminated subtropical vegetation leaving survivors to adapt to the emergence of an increasingly dry climate. A second scenario, proposed by Snijman (2003), is that the impact of fire on the Cape forests since the development of the Mediterranean-type climate in the south-western Cape, and the inability of *Clivia* to cope with fire, have been major factors that led to its current disjunct distribution pattern.

Paper adapted from a chapter of the Ph.D. thesis by F. Conrad.



Photo: Carrie Knight

Figure 10. *Clivia robusta*.

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Glossary

Bootstrap – a statistical way to evaluate the strength of support for nodes on phylogenies. A number is presented by each node, which reflects the percentage of bootstrap trees which also resolve that clade

Clade – a group of organisms which includes the most recent common ancestor of all its members and all the descendants of that most recent common ancestor.

Effective population size – the number of breeding individuals in an ideal population.

Frugivorous – fruit eating.

Haplotype – combination of alleles at multiple loci that are transmitted together on the same chromosome.

Intergenic – a section of DNA sequences located between clusters of genes; portions of a genome that are not considered to lie within defined genes.

Mesic – adapted to moderately moist habitat or habitat which has a moderate amount of moisture.

Monophyly – clade, consisting of an ancestor and all its descendants.

Parapatry/ Parapatric – species whose ranges do not significantly overlap but are immediately adjacent to each other; they only occur together in the narrow contact zone.

Phylogenetics – the study of evolutionary relatedness among various groups of organisms (which is discovered through molecular sequencing data).

Phylogeography – the study of the historical processes that may be responsible for the contemporary geographic distributions of individuals.

Polytomies – a node which has more than two branches

Relictual – a remnant of a formerly widely distributed group in an environment different from that in which it originated.

Sympatry/ Sympatric – species occurring together; areas of distribution that coincide or overlap.

Vicariance – the separation of a large group of organisms from the population due to a geographic barrier.

Barcoding *Clivia* for species identification

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It is assumed that *Clivia* species can be easily and correctly identified morphologically. But what happens if we need to identify a seedling, or a plant that has not yet flowered, based only on morphological traits? What happens if a seedling of *C. mirabilis* is bought from a seller, but the buyer suspects that it is a *C. nobilis* seedling? Are there any alternative methods to identify and classify *Clivia* species correctly?

The answer is yes and no. DNA barcoding is a method where an area of the DNA is amplified (multiplied) with a technique called the polymerase chain reaction (PCR). When enough copies of an area have been obtained, the PCR-products are sequenced and a nucleotide pattern (Figure 1) is generated by an automated sequencer. The piece of DNA strand is represented as an electropherogram and each curve generated, indicates one of the four building blocks of DNA. Different sequences are then compared and the differences can be presented in a form that resembles barcodes (Figure 2 – each colour represents one of the nucleotide bases of DNA [A, T, C or G]). Like a barcode for products in a shop, each species should have a unique nucleotide barcoding pattern and should be identifiable from this unique pattern. But as we know, very few things in life are only black or white, and most things in life come with a challenge. But before we get to the challenges, let's start at the beginning.

The chloroplast is a cellular organelle containing its own set of DNA, which codes for proteins involved in electron transport in photosynthesis. Because a pollen grain mainly contains nuclear DNA, the chloroplast DNA is inherited from the maternal parent and passed on to all the offspring of that maternal plant. If we study the DNA of the chloroplast, we automatically study the maternal lineage of a plant. It is easier working with the chloroplast DNA, because you only have one copy of DNA.

Genes of an organism code for proteins that are important for the survival of the organism. A mutation in a gene can have a lethal effect on the organism, and for that reason, organisms have built-in mechanisms to minimize mutations in genes.

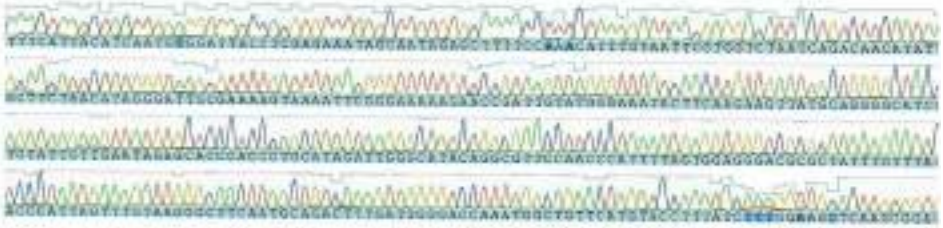


Figure 1. Example of results (called an electropherogram) from an automated sequencer.

When we want to generate a barcode for an organism, we need mutations. We need differences in the DNA so we can distinguish between species. Where do we get DNA that has enough mutations?

"Junk" DNA was considered as pieces of DNA that are removed from the genome during transcription and translation, when DNA is converted to protein. These days the "junk" DNA seems to play a bigger role in the organism than expected. Whether the organism uses this DNA or not, is of little concern to us, the geneticists, working with the DNA. These "junk" DNA apparently does not contribute to the survival of the organism and for that reason has a much higher mutation rate than the transcribed genes. This provides us with the perfect type of DNA we need for barcoding purposes.

Every time a cell divides and the DNA copies itself, there is a possibility that the wrong nucleotide will be incorporated in the new strand. The faster a plant grows, the faster cells divide and the higher the mutation rate will be. Because *C. mirabilis* and *C. nobilis* both have a very slow reproductive and growth cycle, the mutation rate of these two species will be much slower than the rest of the species. We suspect that there should be much less variation within these two species, than within the fast growing species with a higher mutation rate.

What are the different ways for a species to form? There are at least 2 different ways: 1) two species hybridise, the hybrid survives better than the two parents and develops into a new species; 2) a plant mutates. The mutation improves the adaptation of that plant in the environment. That plant and all its descendants survive better and develop into a new species. In whatever way a species develops, the "old" and

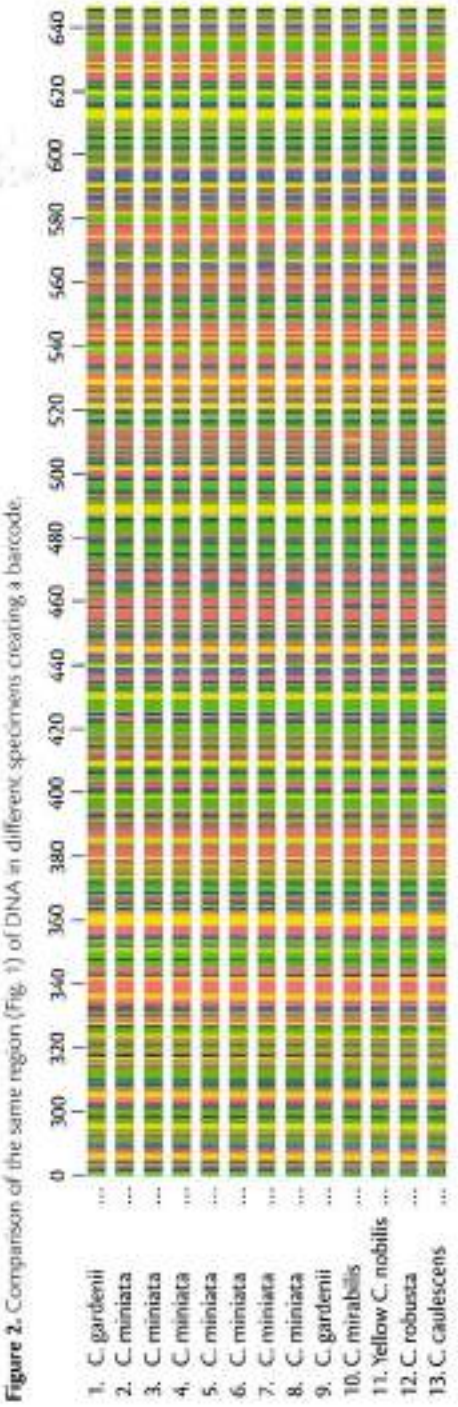


Figure 2. Comparison of the same region (Fig. 1) of DNA in different specimens creating a barcode.

"new" species will share some morphological and DNA characters. The "original" species will not necessarily die, but can co-exist with the "newly developing" species. It is usually only in a severe environmental event such as a drought or virus infection, that the adapted plants will survive and the other plants will die and this can lead to speciation. We have to consider this information when we investigate *Clivia*.

If a new species was formed from a single plant in any of the above mentioned ways, all of the offspring of those plants will contain an exact chloroplast copy of that plant. *Clivia* has a narrow seed dispersal ability since the seeds are too heavy for wind distribution. The seeds of clivias usually get distributed by rodents and by rolling down the slopes. Since the chloroplast, which we are investigating, is in the seeds and not the pollen, we would assume that the distribution area of the maternal DNA is relatively small compared to the distribution area of the nuclear DNA which is found



Figure 3. Approximate geographic distribution of samples used during the preliminary study.

in pollen. But of course, as mentioned, the new species will not have its own unique DNA, and will share most of its DNA with the original species. The earlier the speciation event started, the more time the DNA had to change and the more changes there will be between the two species.

In theory, we should be able to distinguish between populations if the populations are isolated from each other and if the populations adapted to new environments by means of mutation. Pollination from nearby populations, areas or other species should not influence the results, since the DNA in the pollen does not contribute to the DNA studied.

For the study on *Clivia*, the ideal was to find DNA that would distinguish perfectly between the different species. We analyzed five different DNA regions all of which have different mutation rates and which have different numbers of mutation sites. The aim was to find a region with enough mutation sites which could also distinguish between the different species.

The aim of this study was consequently to determine which areas (genes) are suitable for barcoding in *Clivia*. A barcode database will then be set up to which unknown samples can be compared and identified. The Barcode of Life initiative identified two barcoding regions (*matK* and *rcbL*), of which *matK* and four other regions were tested in this study.

Results and discussion

The total number of nucleotides from all five regions combined was 3 641, from which 52 mutation sites varied between the species. Barcoding patterns have been constructed for more or less 50 samples representing all of the species and various geographical distributions in the genus (Figure 3 – Note that the figure does not represent exact geographical positions, but only distribution estimates). *Cryptostephanus vansonii* and several representatives from the family Amaryllidaceae were included as out groups. To simplify the interpretation of the results, only the variable nucleotides were highlighted (Figure 5).

The *Cryptostephanus* barcodes clearly indicate that there is a relationship between *Cryptostephanus* and *Clivia*, but also clearly indicate that *Cryptostephanus* is a separate genus based on the number of unique nucleotides. *Cryptostephanus vansonii* shares 9.6% of the variable nucleotides with mainly *C. nobilis* and/or *C. mirabilis*, indicating that *Cryptostephanus* is closer related to these two species than to the rest of the *Clivia* species. *Cryptostephanus* has 12 unique nucleotide differences, distinguishing it from the rest of the genus *Clivia*.

C. nobilis and *C. mirabilis*

What does the DNA say about identifying *Clivia* species? Barcoding can, with 100% certainty, be used to distinguish between natural growing *C. mirabilis* and *C. nobilis* specimens. *Clivia mirabilis* has 4 nucleotides changes unique to this species whereas *C. nobilis* has 5 unique changes distinguishing it from the rest of the *Clivia* species. These changes can be used to identify both these species by comparing an unknown *Clivia* to the data base. False results can unfortunately be obtained from plants in cultivation. In an event where the pollen of *C. mirabilis* or *C. nobilis* is for instance used to fertilize any other species, a hybrid will be produced. If this hybrid is back-crossed to the pollen donor plant for a few generations, the DNA will indicate that it belong to the same species as the mother plant, even though it might morphologically represent the *C. mirabilis* or *C. nobilis* donor plant.

C. gardenii

The barcoding results show two putative barcoding regions that can identify *C. gardenii* from a 240 km stretch in central KwaZulu Natal (Figure 4). Both of these mutation sites were obtained from the trnL-F region in the chloroplast, which is a region between the coding gene for tRNA leucine and tRNA phenylalanine. More samples have to be included to narrow down this area, but at this stage we will be able to identify *C. gardenii* specimens in the area between Port Shepstone in the South, Entumeni in the North, and as far west as Greytown (Figure 4). An interesting observation is that the *C. gardenii* specimens in these regions share the same nucleotide with the genera *Scadoxus* (2n = 18) and *Brunsvigia* (2n = 22), both of the family Amaryllidaceae. This either indicates that *Scadoxus* and *Brunsvigia* share a unique common ancestor with *C. gardenii* or that there were independent evolutionary events resulting in the same nucleotide change. The probability of the latter occurring is however so small that it cannot even be considered. The ancient relationship that *C. gardenii* has with some of the other genera in the family, cannot be determined



Figure 4. All the samples investigated in this area share two unique nucleotide changes.

Figure 5. Representation of a part of the *matK* region. Grey areas represent similar DNA nucleotides. Coloured "dots" indicate a nucleotide different from the majority of samples.

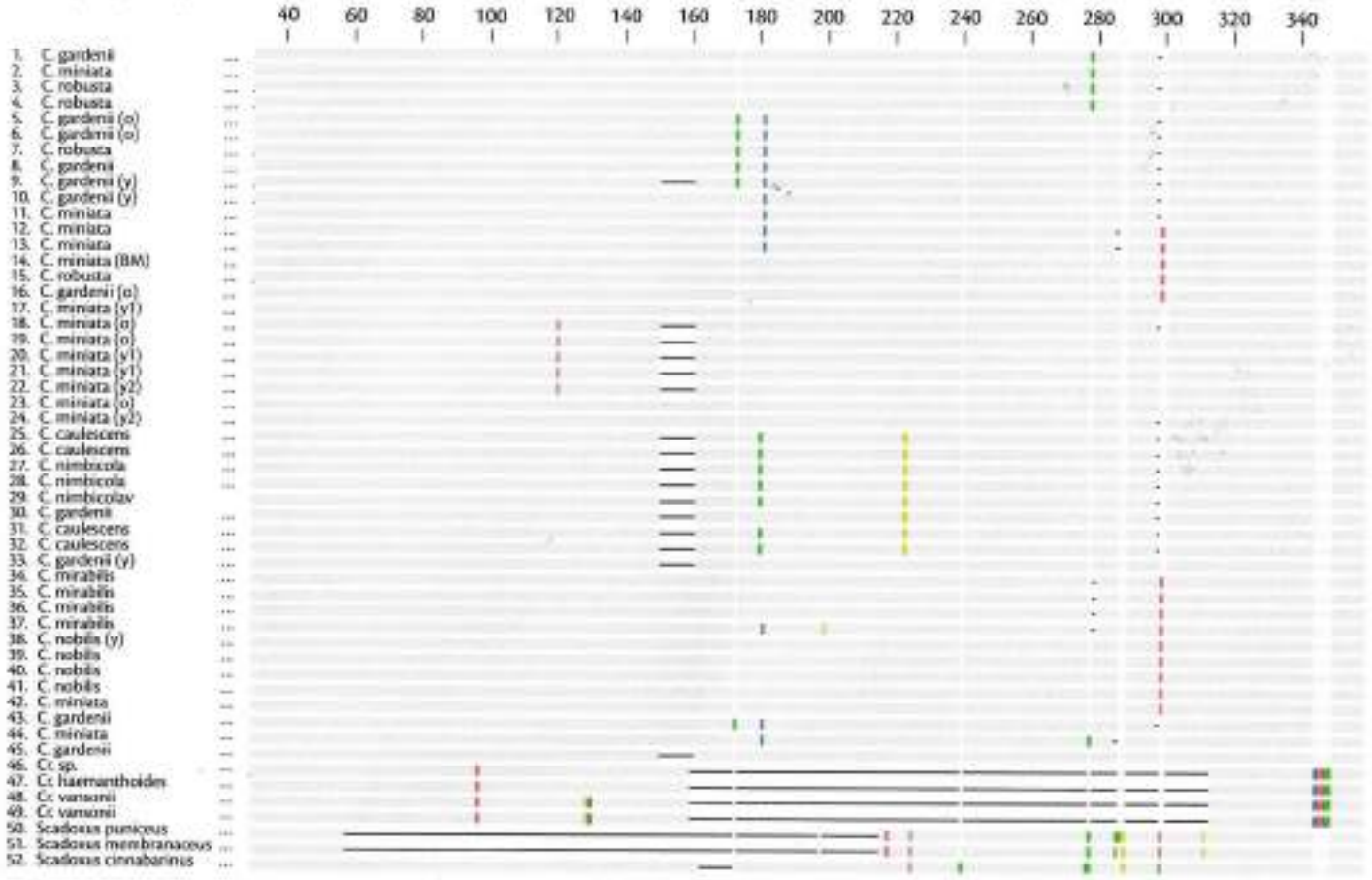
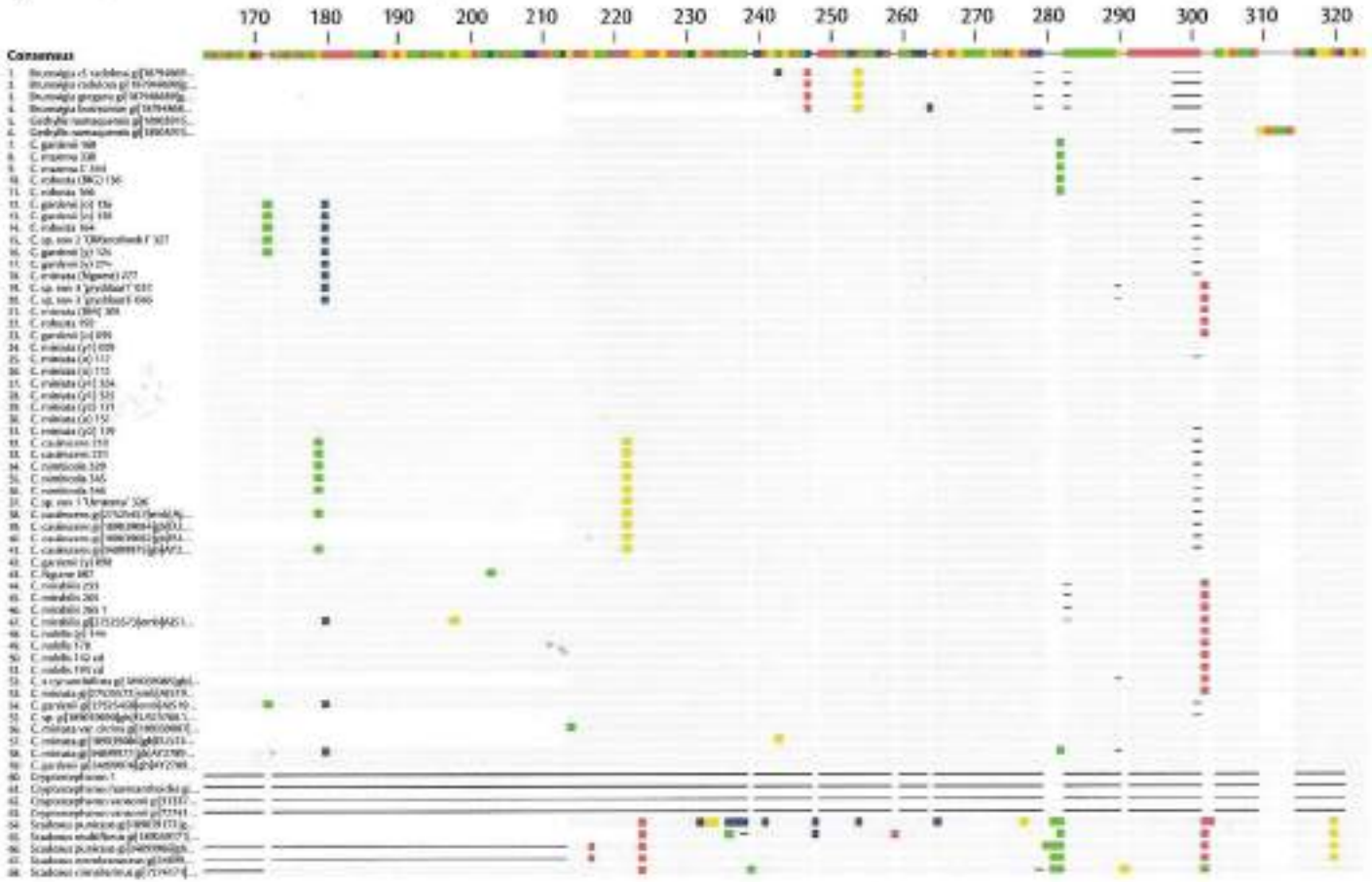


Figure 6. Representation of a part of the *trn*L-F region with barcodes for *C. caulescens* and *C.* × *nimbicola* in the Swaziland/ Mpumalanga area.



from this data. *Clivia*, *Cryptostephanus* and *Scadoxus* are the only genera in the family that have rhizomes and not bulbs, so it is interesting that *C. gardenii* shares a mutation with one of the bulbous genera.

C. caulescens

It was suggested that the natural hybrid, *C.* × *nimbicola*, originated from a *C. miniata* mother, since the flowers of this species is believed to be more susceptible to receiving pollen. In our samples for this pilot study, *C. caulescens* is the pollen receiver (mother plant) in all three cases. We studied a *C. caulescens* specimen which contained a *C. miniata* chloroplast genome. It means that a reciprocal cross with *C. miniata* as the pollen donor is possible and has happened. After a few back-crosses to *C. miniata* plants, the plant has developed a *C. miniata* morphology, but resulted from natural hybridisation. We are still in the process of investigating more chloroplast regions and more samples from the area between Mariepskop to Bearded Man (including samples from Swaziland).

There are two putative regions that could be used as barcodes to identify *C. caulescens* (Figure 6), but this part of the study is still in progress. The number of samples edited is insufficient to determine if these barcodes are linked to specific species/mother plant (i.e. *C. caulescens*), or whether they are linked to specific regions (Swaziland and Mpumalanga).

C. miniata, *C. robusta* and southern *C. gardenii*

We have searched intensively for markers to identify *C. miniata*, *C. robusta* and any *C. gardenii* specimens south of Port Shepstone.

Searching through 5 chloroplast regions, we found seven putative mutation sites that can be used as a barcode to identify *C. miniata* specimens, but found only one of these nucleotide changes (*rpoB* 56 – that is position 56 on the *rpoB* region) present in almost all (23 samples) of the *C. miniata* specimens. A group of *C. miniata* specimens from the Mzamba River and adjacent areas are excluded and do not have this barcode. Only one *C. miniata* from the Mzamba area shares this mutation with the rest of the *C. miniata* specimens. Plants from the Mzamba area are characterised as being morphologically different from the type *C. miniata*. Many of the specimens from the Mzamba river area have *C. miniata* flowers, but similar stem formation to *C. caulescens* and harder leaves than normal *C. miniata*. It seems that "marker" *rpoB* 56 can be used as a guide to identify "normal" *C. miniata* or any other plant that had a *C. miniata* ancestor (Table 1).

All of the other *C. miniata* specimens from the Mzamba and adjacent Umtamvuna area have a unique nucleotide difference (*rpoB* 303), that distinguishes them from the rest of the *C. miniata* specimens and all the other species (Table 2). Also sharing this mutation are three *C. robusta* and one *C. gardenii* specimens, indicating a shared ancestor. Answers we hope to find are whether plants from this area belong to a separate group/species/subspecies/variety. We are investigating more samples and more genes from this region to answer this question.

Evolution and hybridisation

Any species that has the morphology of one species but the chloroplast DNA of another can be considered a hybrid – either recent or ancient. Three plants in our preliminary study could be identified as having a *C. miniata* ancestor but with back-crosses to other species have "non-miniata" mor-

phology. These are a *C. caulescens*, *C. gardenii* and a *C. gardenii x C. miniata* hybrid, all being geographically in the same area as *C. miniata* species.

We found that some plants, for example a *C. gardenii*, share a nucleotide mutation with other *C. gardenii*, but ALSO with *C. miniata* (See Tables 1 & 3). You would think that the plant being investigated is a hybrid between the two species, therefore having DNA from both species. This is impossible through hybridisation, because the chloroplast DNA is only inherited from the mother to the offspring, the hybrids will have only one set of chloroplast DNA – that of the mother. The only explanation is that *C. miniata* and *C. gardenii* shared a common ancestor (i.e. with nucleotide sequence CAAAGC) (Fig. 7). The ancestor evolved through mutation into two predecessor species. The chloroplast DNA of these two predecessors would have differed slightly from each other, for example the last nucleotide mutated from a C to an A to form a *C. gardenii* predecessor (CAAAGA), and the second last nucleotide from a G to C in the *C. miniata* predecessor (CAAACC). However, the predecessors did not die and not all of them mutated further. Another mutation event resulted in plants belonging to the same species, but having slightly different DNA within a species: *C. gardenii* (TAAAGA and CAAAGA) and *C. miniata* (CATACC and CAAACC). If, by chance, we sequence a plant that is a descendant of the predecessor, it might look like one of the modern species, but still contain the "old" DNA. As seen with the arrows in Figure 7, a *C. gardenii* predecessor will share the first nucleotide with *C. miniata*, and the third nucleotide with the rest of the *C. gardenii*. In this manner it is possible for a plant to share nucleotide mutations between two modern species. If we assume that this

Table 1. *C. miniata* specimens sharing a unique nucleotide (rpoB 56), but not the nucleotide found in *C. miniata* species from the Mzamba area (rpoB 303). The two plants in green must have a *C. miniata* ancestor. The four plants in red are all morphologically *C. miniata* but share in other chloroplast regions a nucleotide with other species (indicated in brackets).

Species	No of samples	rpoB 56	rpoB 303
C. miniata group yellow 1	2	✓	✗
C. miniata orange	8	✓	✗
C. miniata group yellow 2	2	✓	✗
C. miniata Swaziland	1	✓	✗
C. miniata Bearded man	6	✓	✗
C. miniata (*C. gardenii*)	1	✓	✗
C. miniata Bearded man (*C. maxima*, *C. caulescens*)	1	✓	✗
C. miniata (*C. maxima*)	1	✓	✗
C. miniata Mzamba (*C. caulescens*)	1	✓	✗
C. gardenii x *C. miniata* natural hybrid	1	✓	✗
C. gardenii	1	✓	✗
C. caulescens	1	✓	✗

Table 2. Samples from the Mzamba area which have a unique nucleotide in position rpoB 303, but do not share the nucleotide with the rest of the *C. miniata* or any of the other species.

Species	No of samples	rpoB 56	rpoB 303
C. robusta	3	✗	✓
C. gardenii	1	✗	✓
C. maxima	6	✗	✓
C. miniata Mzamba	13	✗	✓

Table 3. Two *C. miniata* specimens with neither the *C. miniata* nor the "Mzamba" barcode, but sharing other nucleotides with species in brackets.

Species	No of samples	rpoB 56	rpoB 303
C. miniata (*C. gardenii*)	1	✗	✗
C. miniata Mzamba (*C. gardenii*, *C. caulescens*, *C. x rambicola*)	1	✗	✗

theory is true, then we can also assume that the species or plants with shared mutation between two species are more ancient or contain the more ancient chloroplast.

Without going into too much detail, we can conclude a few things about the evolution in the genus. The DNA indicates that there might have been a split from a common ancestor and two groups formed: Group 1: *C. nobilis*, *C. mirabilis* and *C. caulescens* and the second group being *C. miniata*, *C. gardenii* and *C. robusta* (Figure 8). The fact that *C. caulescens* was previously included with *C. nobilis* and only identified as a new species in April 1943, supports the fact that these species are morphologically similar. *Clivia caulescens* split from the rest, probably due to geographical changes, and

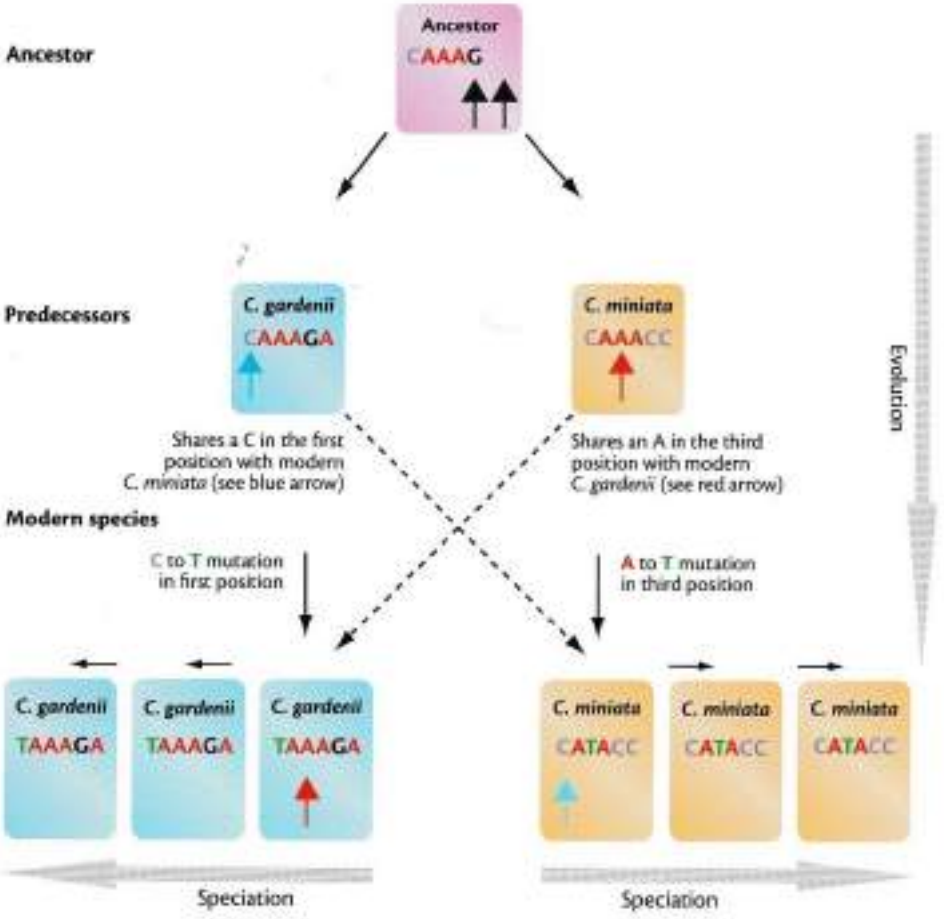


Figure 7. A schematic representation illustrating how two of the *Clivia* species might have evolved from a common ancestor and some specimens can share mutations with other species. *C. gardenii* can share the same nucleotide with some of *C. miniata* specimens, but not with all of them. This is explained by the possibility of predecessor *C. miniata* specimens which did not evolve with the rest of the *C. miniata* specimens.

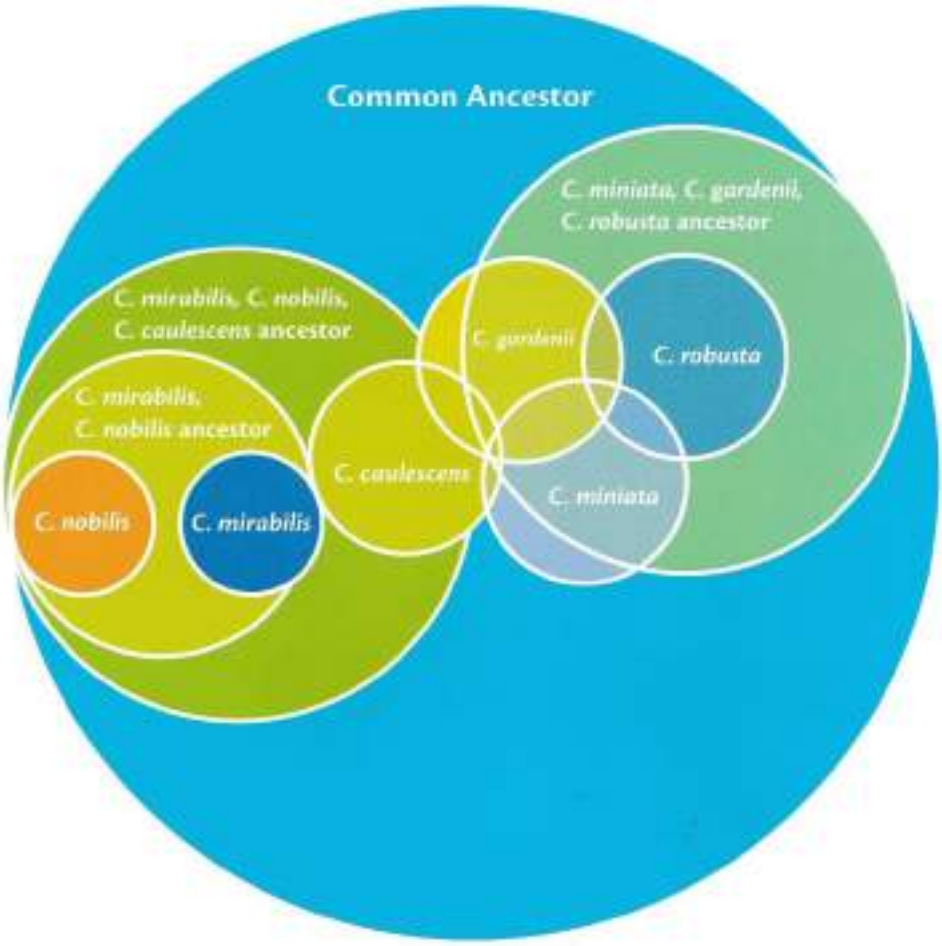


Figure 8. *Clivia* evolved from a common ancestor and split into two groups. Group 1 consisted of a *C. mirabilis*, *C. nobilis* and *C. caulescens* ancestor. Group 2 consisted of a *C. miniata*, *C. gardenii* and *C. robusta* ancestor. Group 1 subdivided into a *C. mirabilis* and *C. nobilis* ancestral group, from where these two species speciated into the modern species we know today. There seems to be ancestral and modern gene flow between the remaining species, explaining the overlapping morphological and DNA characteristics.

C. nobilis and *C. mirabilis* split from each other, also probably due to climatic changes. The second group is much more complicated, since there is very little geographical and reproductive isolation between the three species (*C. miniata*, *C. gardenii* and *C. robusta*) in the group. There is a degree of speciation, where we can clearly see morphological differences in the three species, but due to overlapping distribution areas, it is inevitable that there will be natural hybridisation. Since *C. caulescens* also overlaps geographically with other species, it contains DNA from other species as well.

To summarize, we have identified unique barcodes for *C. mirabilis* and *C. nobilis*.

Clivia caulescens and *C. gardenii* north of Port Shepstone can be identified with almost a 100% certainty. *Clivia miniata* also has one nucleotide mutation that can be used as a reference to identify a *C. miniata* or a plant which had a *C. miniata* mother as ancestor. Because of the gene flow through ancient hybridisation and evolutionary events in the rest of the species, 100% identification based on DNA barcoding is impossible. It is possible to identify plants from certain areas, for example if a plant originates from the Mzamba-Umtamvuna area or in the area between Port Shepstone and Entumeni. Ancient hybridisation can also be detected in some *Clivia* samples.

Some clivias can easily be identified based on morphology and DNA testing, but other plants test our patience and knowledge. The genus *Clivia* remains an interesting and challenging genus. This study has proved to us that while we try and fit all species in their own containers, nature is alive, has its own way and is constantly developing and changing. We humans have a huge need to identify, describe and name species. Maybe one day we will be able to do it to our own satisfaction, but in the meantime, we have this gift to humanity – called the *Clivia* – that is there for us to enjoy and study.



Photo: Rina van der Merwe

Figure 9. *Cliva miniata* with a strong green throat.

Identifying *Clivia nobilis* and *C. mirabilis* in the laboratory

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Clivia nobilis and *C. mirabilis* share a number of morphological traits that are unique to these two species. Both have a rough, tooth-like texture on the edge of the leaves and both may or may not have a median line on the leaves. Some of the leaves of both species have a notched (indented) tip that is mostly found in these two species. They are geographically separated in nature – *C. nobilis* is found in the Eastern Cape and *C. mirabilis* grows on the border between the Northern Cape and the Western Cape. Many enthusiasts, however, grow both species in almost every province of South Africa. Vegetative material (leaves) of these species is often difficult to identify, especially for such laymen as plant protection inspectors.



Photo: M. Coetzee

Figure 1. *C. mirabilis* in Oorlogskloof Nature Reserve, Northern Cape.

Clivia nobilis has a larger distribution range than *C. mirabilis* and many more *C. nobilis* plants are found in nature. Although both species are described as vulnerable in the Red Data List of southern Africa, the conservation strategy for *C. mirabilis* is currently enforced more strictly. To date there has been no effective way to distinguish between some specimens of the two species. Unscrupulous people sell (export) *C. mirabilis* plants as *C. nobilis*.

From a conservation perspective it is essential to find a way to safeguard against this practice. A study was consequently done to find a way to correctly identify these species from the DNA of a very small leaf sample. A technique called DNA barcoding was employed to correctly identify these species (Van der Westhuizen, 2011).

Over the last three years an in-depth study has focused on *C. nobilis* and *C. mirabilis*. In the process unique barcodes were developed for these two species.

A barcode is obtained when the DNA (nucleotide – AGCT) sequence is determined. If the sequence is the same for all the plants in a specific species and the sequence differs from the one obtained for the other species, it is considered a barcode.

During this study, seven different regions of DNA were tested. The DNA regions investigated include the *atpH-I*, *rpoB*, *rpoC1*, *matK*, *rpl16* and *tmL-F* regions in the chloroplast, and the *ITS1* region in the nucleus. The other five taxa of *Clivia* (*C. caulescens*, *C. miniata*, *C. gardenii*, *C. robusta* and *C.* × *nimbicola*) were used as so-called out groups to ensure that the barcodes obtained for *C. nobilis* and *C. mirabi-*

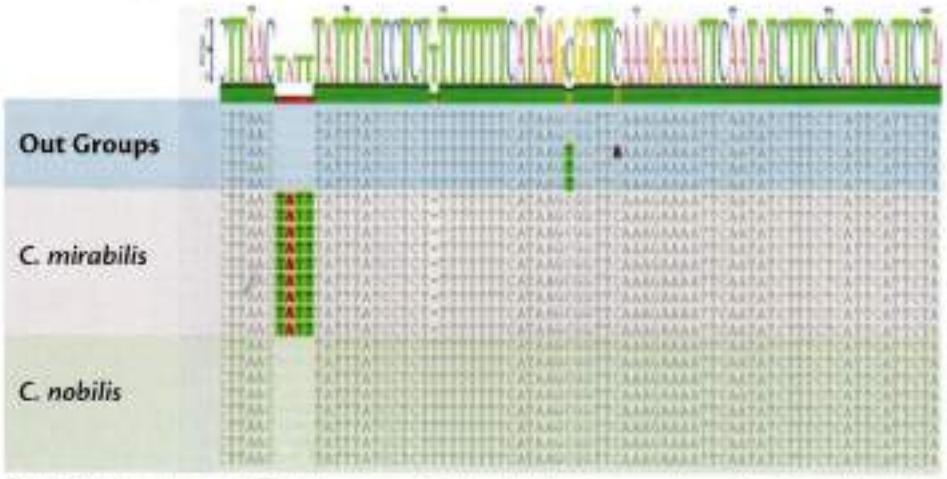


Figure 2. A four base pair (TATT) insertion within the *tmL-F* region was observed in *C. mirabilis* which was absent in all other species. In addition a single nucleotide (T) was missing from all *C. mirabilis*.

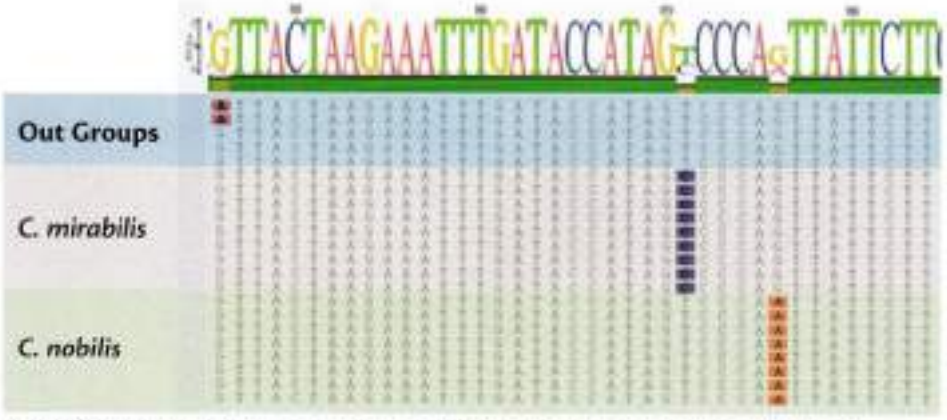


Figure 3. Two unique one base pair differences (SNP – single nucleotide polymorphism) were obtained respectively for *C. nobilis* (A instead of the G present in all other species) and *C. mirabilis* (C instead of T) within the *matK* region.

lis were unique for these species. We found a total of twenty-two variable sites between *C. nobilis* and *C. mirabilis*. Four of these differences are shown in Figures 2 to 5. The out groups consisted of one specimen of each of *C. caulescens, C. miniata, C. gardenii, C. robusta* and *C. × nimbicola*.

All seven gene regions showed a distinct difference between *C. nobilis* and *C. mirabilis* on the one hand and the other *Clivia* species on the other hand. The results showed that the *atpH-I, rpoB, rpoC1* and *ITS1* regions were not as informative as the *matK, rpl16* and *trnL-F* regions. These three regions showed a high number of polymorphic and parsimony informative sites, as can be seen in Table 1. A site is parsimony informative if it contains at least two types of nucleotides and each of those nucleotides occurs in at least two of the sequences.

All seven regions can be used together

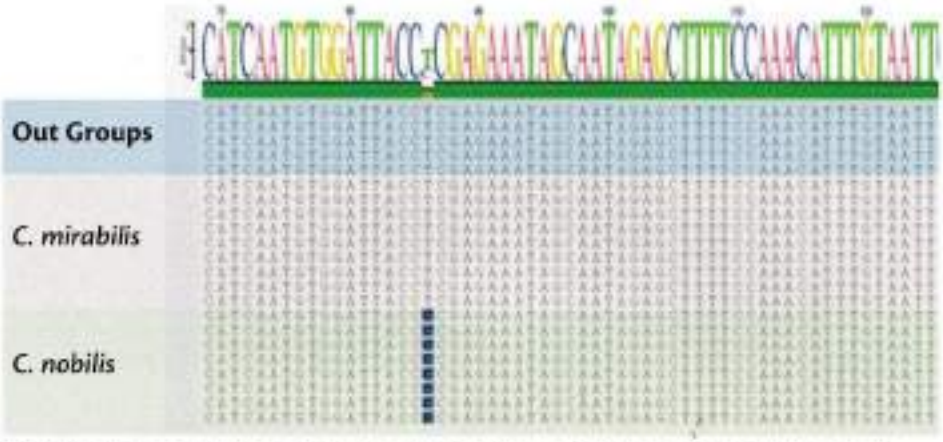


Figure 4. A unique one base pair difference (C replacing T in the other species) within the *rpoC1* region for all *C. nobilis* samples.

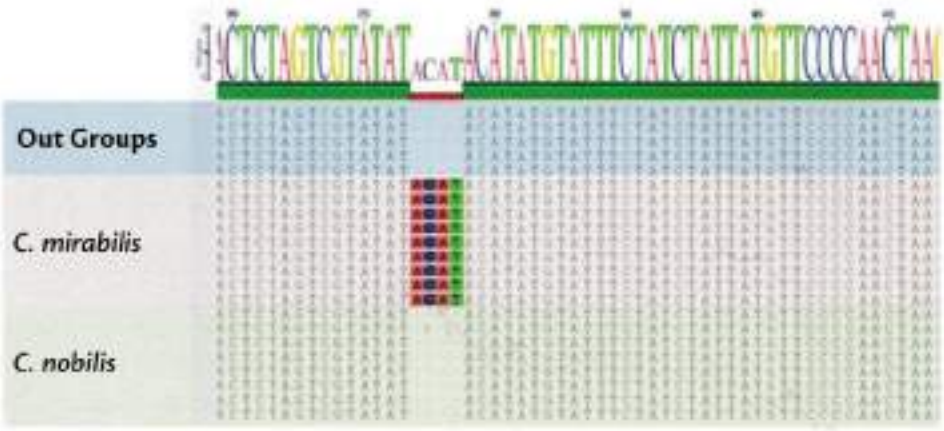


Figure 5. Another four base pair insertion in *C. mirabilis* (ACAT) in the *atpH-I* region.



Figure 6. *C. mirabilis*, Oorlogskloof Nature Reserve, Northern Cape.

for bar-coding purposes or different combinations can be used. Individually, none of the regions provided strong enough species discrimination and, therefore, more than one region should be used. We propose that *matK*, *rpl16* and *trnL-F* are used together as a barcode in the genus *Clivia*. Bar-coding is quite expensive and, therefore, it would be ideal to limit the different regions which must be analyzed without compromising the reliability of the results. The results from these three regions will be able to identify any *C. nobilis* and *C. mirabilis* plants that were removed from their natural environment with an accuracy level of 100%, provided that the plant investigated is not a hybrid of *C. nobilis* or *C. mirabilis* from a private collection or nursery.

This study has thus conclusively provided a tool to distinguish *C. nobilis* and *C. mirabilis* from one another and from all other *Clivia* species.

Table 1. Summary of the results of the seven *Clivia* taxa for the seven gene regions.

Region	Length in bp	Variable (polymorphic) sites	Parsimony informative sites
matK	651	15	8
rpoB	488	3	1
rpoC1	329	1	1
atpH-I	444	0	0
rpl16	916	11	11
trnL-F	725	14	8
ITS1	284	3	3
Total	**3837**	**47**	**32**

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The identification of genes involved in colour formation in *Clivia miniata* flowers

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Members of the genus *Clivia* (family Amaryllidaceae) are native to countries in southern Africa, including South Africa and Swaziland (Koopowitz, 2002). For many years, clivias have received considerable attention worldwide as cultivated ornamental crops (Duncan, 2008). Interest in these plants lies particularly in their flowers that display a diverse array of colours and variable forms (i.e. shapes). *Clivia* flower colour typically comprises orange, red, yellow and green. However, different combinations and intensities of various colours may also occur. For example, some flowers may display pastel colours such as peach and apricot. The demand for certain colours (e.g. almost white) is very high, such that the plants and seed stocks command exorbitant prices in the market. Thus, clivias are among the commercially important flower species in the floriculture industry.

Flower colour (also referred to as 'flower pigmentation') is a highly variable characteristic that is important to plants, where it attracts flower pollinators and seed dispersers (Weiss, 1991). In human terms, flowers are particularly important in the floriculture industry where they are sold as cut flowers, potted plants, or as ornamental bedding plants (i.e. garden plants). The floriculture industry is highly commercial such that, in 2007, it was projected to generate a global consumption value, at







Figures 1–3. *Clivia miniata* flowers.

consumer level, of between €100 – 150 billion (Chandler & Tanaka, 2007). The biggest challenge facing commercial flower growers and breeders is to produce cultivars with novel characteristics, such as flower colour and shape. So far, this has been achieved by applying classical plant breeding approaches that enable the assessment of characteristics (e.g. flower colour) to be performed only in mature plants. However, the approaches can be improved by incorporating information on the biology (read 'genetics') of characteristics of interest into the breeding strategy. In particular, knowledge of the genetics of flower pigmentation and shape will be relevant to approaches that aim to improve flower cultivars. Also, the availability and use of genetic information resources from currently commercialized and well-studied flower species will further aid efforts toward producing cultivars with novel characteristics.Studies in various plant species have enabled an understanding of the biochemistry and genetics of flower pigmentation (Grotewold, 2006; Chandler & Tanaka, 2007; Tanaka *et al.*, 2008). In general, there are three main pigments that occur in flowers. These include betalains, carotenoids and flavonoids. The latter two pigments are broadly distributed in the majority of flowering plants whereas betalains are restricted to plants in the order Caryophyllales, which includes carnations and catchfly (Steglich & Strack, 1990). Among the three types of pigments, flavonoids are the most abundant in flowering plants where they occur in almost all vascular plants. Flavonoids are responsible for a variety of floral colours including orange, yellow, red, purple, violet and blue. This array of colours is made possible by the coexistence of different classes of flavonoids including chalcones, aurones, anthocyanins, flavones,



Figure 4. *Clivia miniata* flowers used in the experiment.

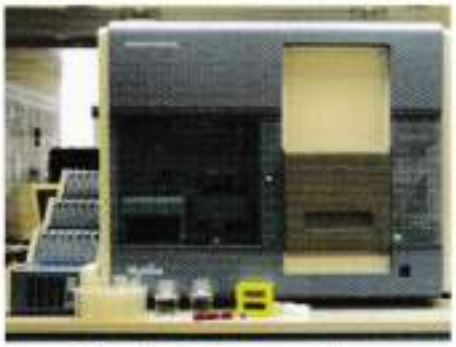


Figure 5. The Illumina Genome Analyzer on which DNA isolated from the flowers was used to perform DNA sequencing experiments.

and flavonols. Unlike flavonoids, the colour spectrum of carotenoids in flowers is typically yellow to orange, but coexistence with red or purple anthocyanins may result in brown and bronze colours (Forkmann, 1991). In addition to flower pigmentation, carotenoids also serve as precursor molecules for the formation (also termed 'biosynthesis') of vitamin A (Fraser & Bramley, 2004). Further, flavonoids and carotenoids are able to absorb UV-light, thus protecting plants and humans from UV damage (Winkel-Shirley, 2002). Considering the

functional importance of flavonoids and carotenoids. It is therefore not surprising that most of the genes (i.e. DNA sequences that carry information responsible for the formation and variation of characteristics) that produce biochemical agents (termed 'enzymes') involved in flower pigmentation have been identified in various plant species (Grotewold, 2006; Chandler & Tanaka, 2007; Tanaka *et al.*, 2008).

In spite of the vast amount of biochemical and genetic resources available on the biosynthesis of flavonoid and carotenoid pigments, few studies have been conducted in monocotyledonous (i.e. monocot) plants. In particular, very limited information is available on the biosynthesis of flavonoid and carotenoid pigments in monocot flower species including clivias. Nonetheless, previous studies in orchids (Hieber *et al.*, 2006; Chiou *et al.*, 2008; Ma *et al.*, 2009; Albert *et al.*, 2010; Chiou *et al.*, 2010), lilies (Nakatsuka *et al.*, 2003; Nakatsuka *et al.*, 2009; Yamagishi *et al.*, 2010) and tulips (Momonoi *et al.*, 2009; Shoji *et al.*, 2010) have identified a few genes involved in flower pigmentation in these species. In addition, monocot food crops including maize (Paz-Ares *et al.*,

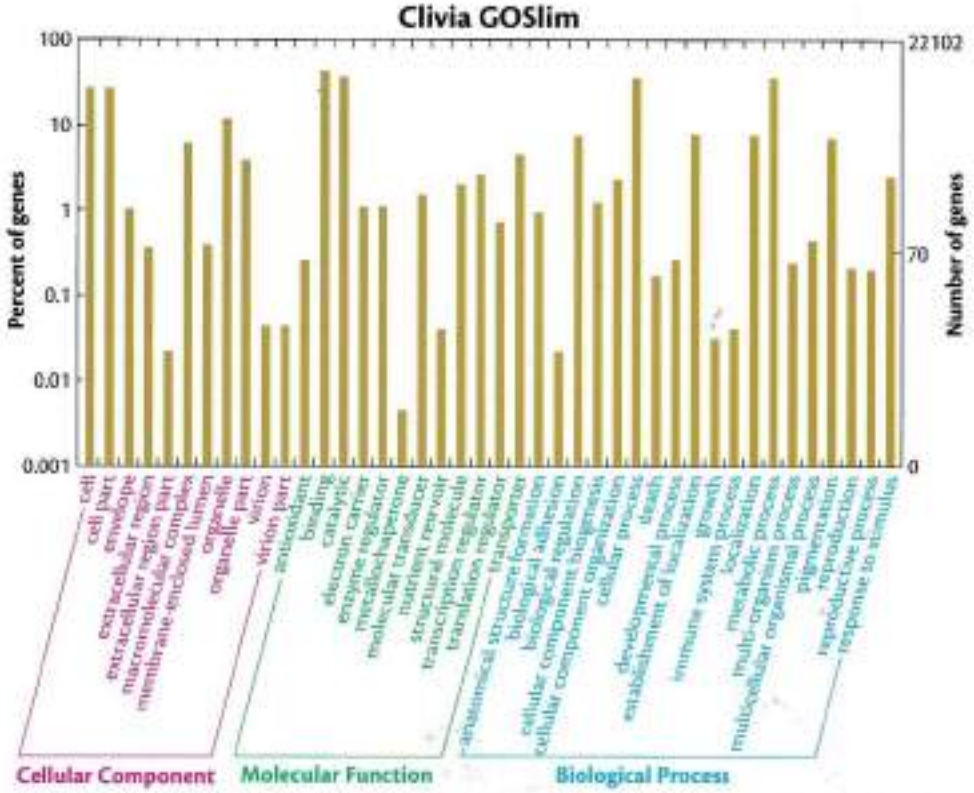


Figure 6. A summary of clivia genes that were assigned specific cellular functions (vertical bars) and grouped according to the functions they perform – Cellular Component, Molecular Function or Biological Process.

1986; Bernhardt *et al.*, 1998), onions (Kim *et al.*, 2004a, b, c, 2005) and rice (Reddy *et al.*, 1996; Bong *et al.*, 2007; Jeong *et al.*, 2008) have also been used to identify genes involved in the biosynthesis of flavonoid (particularly anthocyanin) and carotenoid pigments. This information, coupled with information reported for dicotyledonous (i.e. dicot) plant species, will be useful for further identification of flower pigmentation genes in other plants including clivias.

Rationale

The discovery of flower pigmentation genes in clivias will greatly aid efforts toward producing cultivars with novel characteristics in terms of colour. That is because the information on genes that produce enzymes involved in flower pigmentation can be used to genetically modify flower colour. Such studies have already been performed in other plants with varying level of success. In 1987, *Petunia* became the first plant to have its flower colour genetically modified (Meyer *et al.*, 1987). Subsequently, in the 1990s, the company Florigene (http://www.florigene.com/) released the 'Moon' series of genetically modified carnations. Recently, efforts were made to produce genetically modified blue roses (Katsumoto *et al.*, 2007) and tulips (Shoji *et al.*, 2010), but the results were not completely convincing.

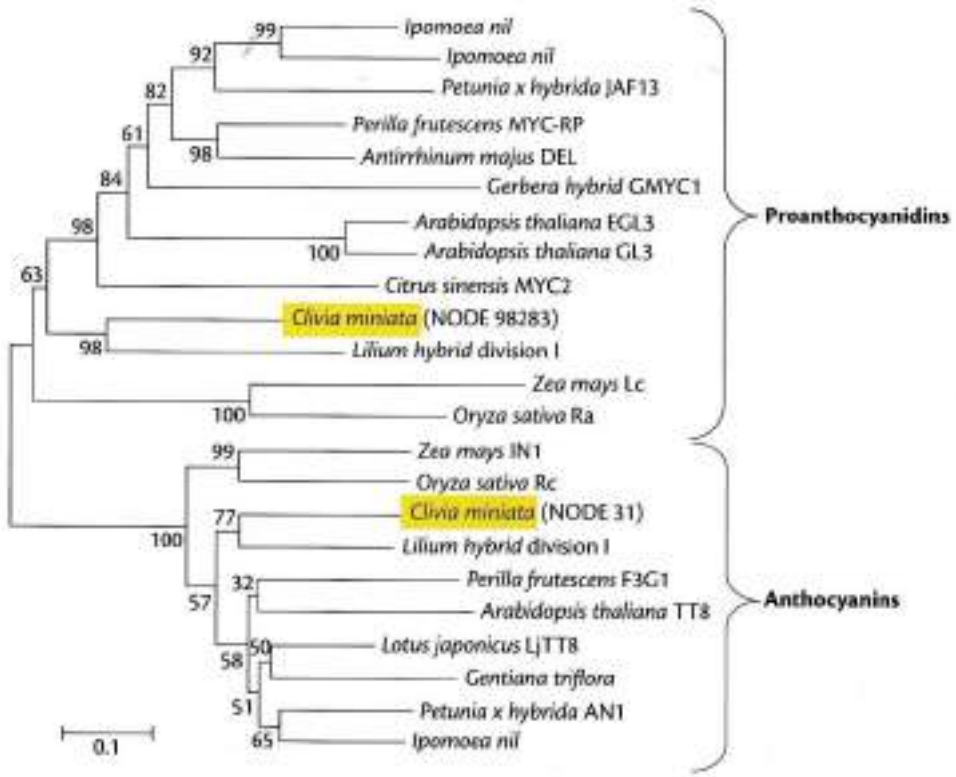


Figure 7. Phylogenetic analysis of plant bHLH genes. The genes are clustered into two main groups according to their function, namely, genes that activate the biosynthesis of proanthocyanidins and anthocyanins. Two *Clivia* genes were identified, one belonging to each of the groups.

In other cases, information on genes that produce enzymes involved in carotenoid pigmentation has been used to genetically modify the nutritional value (and colour) in food crops. In 2000, a genetically modified cultivar of rice (subsequently named 'Golden Rice') was produced that contained higher levels of provitamin A, which is the precursor molecule used in vitamin A biosynthesis (Ye & Beyer, 2000). Alternatively, studies on gene sequences have lead to the identification of mutations (i.e. changes in the DNA sequence information) that are responsible for variation in specific characteristics. For example, the variation in flower colour (Morita *et al.*, 2006; Choi *et al.*, 2007), flower colour patterning (Habu *et al.*, 1998; Itoh *et al.*, 2002; Koseki *et al.*, 2005; Saito *et al.*, 2006), and even fruit colour (Espley *et al.*, 2007; This *et al.*, 2007) have been determined through the analyses of various genes involved in the biosynthesis of pigments that occur in flowers and fruits. These reports, including those not reported herein, are important as they suggest that *Clivia* can possibly be improved as an ornamental crop in the floriculture industry.



Figure 8. *Clivia* 'Rouge Magic'.



Photo: Chris Wiegerinck

Figure 9. *Clivia* 'GT Pink'.

Results

We recently initiated studies aimed at the identification of genes involved in flower pigmentation in clivias. Our efforts were boosted by the availability of new technology that enables the analyses of many (ca. thousands) genes, simultaneously. In our studies, we harvested orange flower tepals of *Clivia miniata* (Fig. 4) and immediately froze the tissues using liquid nitrogen. The purpose of the latter step was to "freeze" all cellular activity including the biochemical processes that lead to flower coloration. Subsequently, DNA was isolated from the tissues and prepared for DNA sequencing experiments essentially aimed at determining the order of letters (namely A, C, G and T and these are collectively termed 'nucleotides') that make up genes. A high-throughput system (the Illumina Genome Analyzer, Fig. 5) was used to determine the DNA sequence of genes that were 'selectively' obtained from the *C. miniata* flowers. Overall, more than 23 million DNA sequences (each being 76 nucleotides in length) were generated. Various computer-based analyses were applied that joined the DNA sequences into 'recognized' genes comprising longer DNA sequences. Following this, a total of 37 014 gene sequences were generated. Of these genes, only 22 102 were successfully assigned specific cellular functions and ultimately grouped according to the functions they perform in the flower tissues (Fig. 6). Approximately 10% of the 22 102 genes, roughly 2 200 genes, were assigned functions related to one or more processes leading to flower colour. In addition, two other categories ('transcription

regulator' and 'transporter activity') were identified which, based on previous studies, should include genes that are involved in controlling various processes leading to flower pigmentation (Fig. 6).

Considering that each category of genes (i.e. the vertical bars in Fig. 6) included many sequences, further analyses were necessary to identify key genes that are particularly involved in flower colour in *C. miniata*. The analyses were based on the assumption that genes producing similar enzymes (hence, functions) in various species will tend to have similar DNA sequences. Therefore, the analyses compared *Clivia* genes with counterpart genes already known to be involved in flower pigmentation in other plant species. Herein, we report on the analyses of a specific group of genes (termed bHLH genes) that are known to control processes leading to flower pigmentation, thus, genes in the 'transcription regulator' category. Similar genes have previously been shown to activate the flower pigmentation processes in snapdragon (Goodrich *et al.*, 1992), petunia (Spelt *et al.*, 2000) and lily (Nakatsuka *et al.*, 2009). Overall, two *Clivia* genes were identified (Fig. 7). The analyses further revealed that not only were the *Clivia* gene sequences highly similar to counterpart genes obtained from other plant species, but they also tended to cluster/group with gene sequences obtained from other monocot plant species (Fig. 7). The same approach is currently being used to identify more genes that are involved in floral pigmentation in clivias. Once identified, *Clivia* genes will be studied further to better understand their specific roles during flower pigmentation. The results will guide future efforts aimed at *Clivia* cultivar improvement.



Photo Chris Wolgroved

Figure 10. *Clivia* 'Raspberry Sauce'.

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Photo: Chris Wellgreen

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The identification of genes for flower colour in *Clivia miniata*

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The basis of colour variation in *Clivia* is locked up in its genes. The first study to elucidate the formation of colour in *Clivia* was made by studying the different genes responsible for colour. This paper describes the process followed and summarises the results obtained.



Photo: Carine Knight

Figure 1. *Clivia* 'Estelle'

We know from the literature that anthocyanin occurs in *Clivia* and it is responsible for the formation of colour. Thus the first step of this study was to analyse all the available DNA sequences from the sequence database GENBANK, of different plants, for every gene involved in the anthocyanin pathway. The sequences of specific genes from all available plants was aligned (compared) using computer software and areas in common for these genes in all plants were identified. DNA was then extracted from open flowers to determine whether the specific gene was present and expressed. A laboratory technique known as the PCR reaction was then used to produce millions of copies of these genes using a piece of synthetic DNA (known as a primer). The millions of copies of DNA were then used to determine the specific sequence of the genes responsible for colour in *Clivia* as well as the level of expression of these genes.

By using this method primer sets were designed to amplify portions of the *CHS* (chalcone synthase), *CHI* (chalcone isomerase), *F3H* (flavanone 3-hydroxylase) and *DFR* (dihydroflavonol 4-reductase) genes. The amplified DNA was then sequenced to determine the order of the nucleotides. The DNA sequence of the *Clivia* DNA was then compared to the DNA from other plants. This resulted in a cladogram, indicating the position of *Clivia* among the monocots (Figure 2). It is interesting to note that the *F3H* gene of *Clivia miniata* corresponds most to *Allium cepa* (the onion). Similar trees were obtained for all the genes. Unfortunately the sequence data could not be combined

because different species were included in the different trees based on available sequences.

The sequence of a gene can be presented in a graph format that shows different coloured peaks for each nucleotide. This representation of the data is called an electropherogram. The electropherograms of a short section of the *CHS* gene is shown in Figure 3. Note the two instances where two peaks are shown in the same location in two different plants (an orange [A] and yellow [B]). This is an indication that two different alleles of a gene have been sequenced. The alleles of a gene are similar in almost all respects but occasionally a twin peak is observed. This observation strengthens the hypothesis that *Clivia* is an ancient polyploid and one copy differs slightly from the other in both plants.

So now we know that these genes (or to be precise, parts of these genes) are present. However, we have to do further tests to determine whether these genes are active.

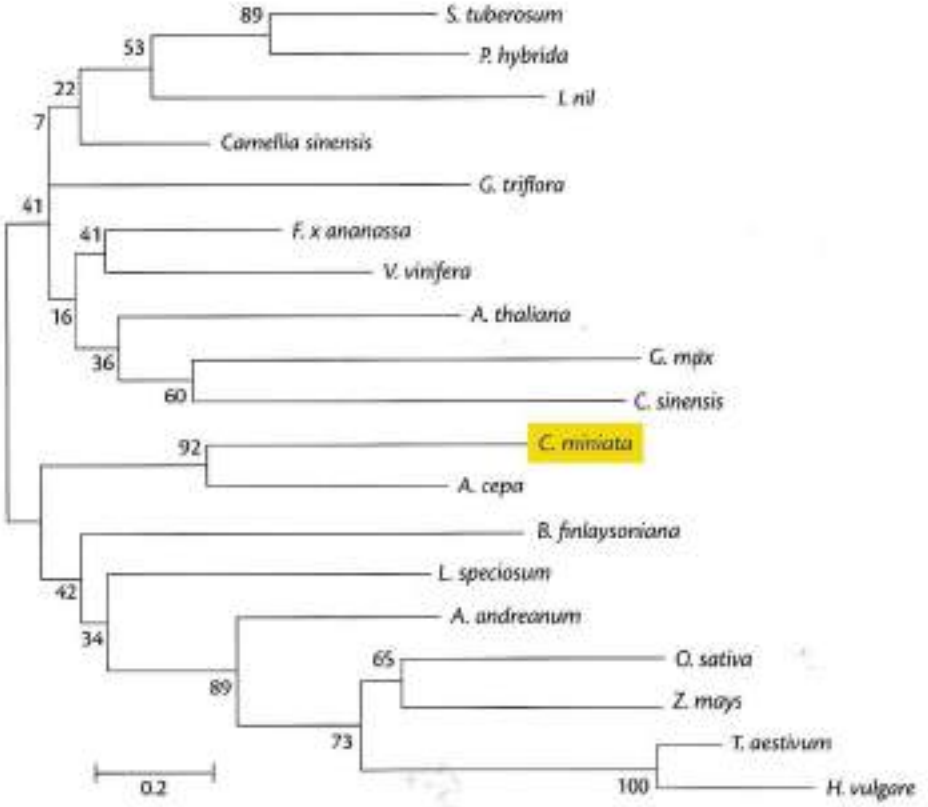


Figure 2. Cladogram determined by minimum evolution, based on the relationship between F3'H genes in different organisms. The numbers next to the branches represent the bootstrap value (based on 500 replicates).

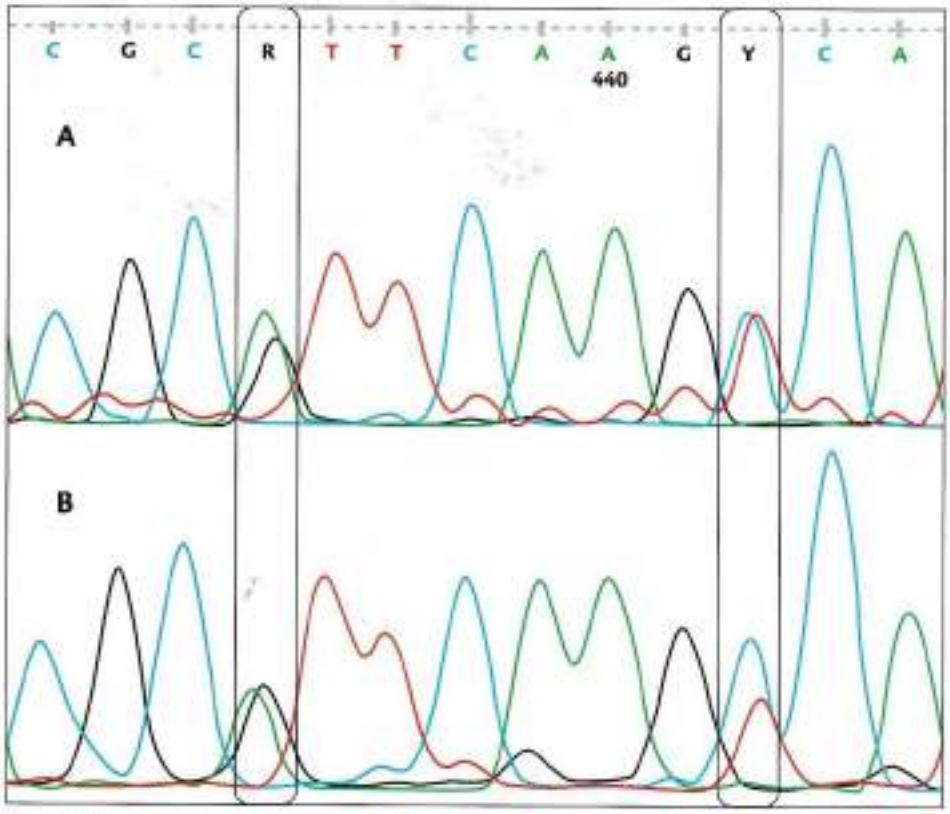


Figure 3. Sections of electropherograms obtained after sequencing part of the CHS gene in orange (A) and yellow (B) *Clivia miniata* specimens. Ambiguities are present at position 435 (R) with a G or A, as well as position 442 (Y) with a T or C.

Let us get back to our basic biology. The DNA is in the nucleus of the cell (with a few exceptions). If a gene is active it will form mRNA (messenger RNA). The mRNA will leave the nucleus to produce the product (a protein) according to the specifications of the DNA in the nucleus. So the next step was to determine whether the different genes were active (i.e. do they form mRNA?) and whether this activity differed through different developmental stages of the flower. Since we only wanted to determine whether the genes were active, we did not study all stages, only those up to the opening of the flower (Figures 4 & 5).

Three different types of tissue (tepal, stamen and carpel) were used for mRNA extraction. The RNA was converted to a more stable substance, cDNA (copy DNA). cDNA only represents the portion of the RNA that determines the composition of proteins since introns (sections of RNA that are excised from mRNA) are excluded. Another gene, the 18S rRNA, which is constantly expressed in all tissues, regardless of the conditions, was used to standardize the expression of the four most important genes in the anthocyanin pathway.

The expression of the genes was measured by a technique called RQ PCR (real-

time quantitative polymerase chain reaction). This technique accurately measures the quantity of mRNA formed from a specific gene. From the results of this study it has become apparent that the transcription of the *CmCHS* and *CmDFR* genes increased as tepals grew and peaked at stage 3 just before anthesis. However, the transcription of both genes decreased as the flower was opening (between stage 3 and 4), after which their transcription increased drastically towards the end of flower development. In the carpel both *CmCHS* and *CmDFR* genes had very similar levels of



Figure 4. The different stages (1–5) of flower development used for the orange *Clivia miniata*.



Figure 5. The different stages (1–5) of flower development used for the yellow *Clivia miniata*.

expression, especially from stage 1 to stage 4. Transcription of the genes peaked during the third developmental stage and then gradually decreased through stage 3 up to stage 4 where the genes were the least expressed. Further expression of CmCHS increased considerably from stage 4 up to the point where the carpel was fully developed, while transcription of *CmDFR* only increased slightly (Figure 6).

The target genes in the stamens showed similar trends regarding their temporal expression, although *CmCHS* was expressed at much higher levels than *CmDFR* (Figures 6C & 6D). Transcription of both genes decreased during stage 1 and was very low at stage 2, followed by a slight increase towards the middle of stage 3 with a decrease again during stage 4 to reach the equally low levels found during stage 2. Thereafter the same steep up-regulation as in the tepals and carpel could be observed until flower development was completed (full bloom).

There was a strong positive correlation in expression trends, for *CmCHS* and *CmDFR* during the different developmental stages in the tepal and stamen. When comparing stages 1 to 4 for *CmCHS* and *CmDFR* in the carpel, a high correlation was also observed (R = 0.996). The high correlation of gene expression may be an indication that these genes are regulated simultaneously.

From the transcriptional changes in *CmCHS* and *CmDFR* in the different flower tissues, two phases of temporal expression can be distinguished. 1) transcription

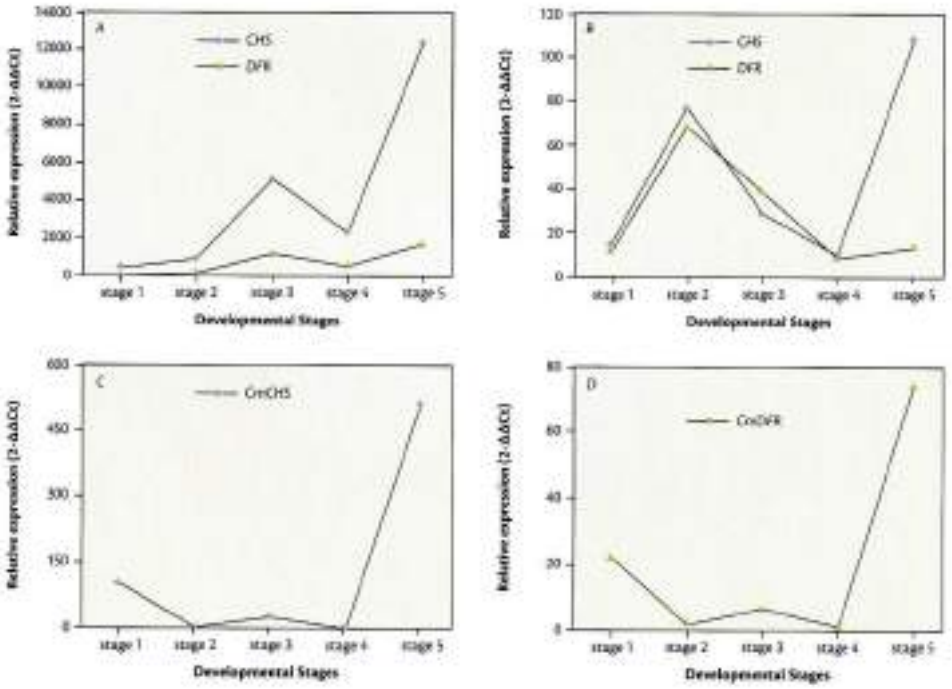


Figure 6. Relative expression of *CmCHS* and *CmDFR* in flower tepals (A), carpel (B) and stamens (C&D) from development stages 1 to 5 of an orange *Clivia miniata*.

of both genes increased as the flower bud grew, then decreased to very low levels before entering the second phase where 2) anthesis was activated and transcription of the genes increased drastically until the flower was in full bloom.

Transcription of *CmCHS* and *CmDFR* genes was constant from stage 1 to 2 in the tepals of yellow flowers. There was an increase in expression from between stage 2 and 3 just before the flower opened (Figure 7A). During stage 3 (anthesis) both genes were highly expressed, followed by down-regulation towards the end of tepal development. The trend in expression of the two target genes was very similar with a positive correlation ($R > 0.950$, $p \leq 0.05$).

In the carpel *CmCHS* and *CmDFR* showed a similar trend in their temporal expression with higher levels of *CmDFR* compared to *CmCHS* (Figure 7B). Transcription of both genes increased from stage 1 and peaked during stage 2, followed by a decrease in expression until stage 3 with an increase that peaked during stage 4. Thereafter the expression of both genes was down-regulated towards the end of carpel development. In the stamens of the yellow *Clivia miniata* no similarities were seen in the transcription of the two genes. *CmDFR* was mostly present at higher levels compared to *CmCHS* during stages 1 and 2, and especially during stages 4 and 5 (Figure 7C). Based on these observations it appears that transcription of *CmCHS* and *CmDFR* tends to decrease from the onset of anthesis (during stage 4) until completion of yellow flower development (stage 5). A decrease in transcription of these genes is expected to affect the production of anthocyanin derivatives, ultimately leading to lower anthocyanin concentration in yellow *Clivia miniata* flowers.

In the present study, *CmCHS* and *CmDFR* were transcriptionally active throughout flower development in pigmented tissue of both the orange and yellow flower varieties, suggesting co-ordinate regulation as a single module for anthocyanin biosynthesis in *Clivia miniata*. As mentioned before, each type of flower tissue exhibited similar

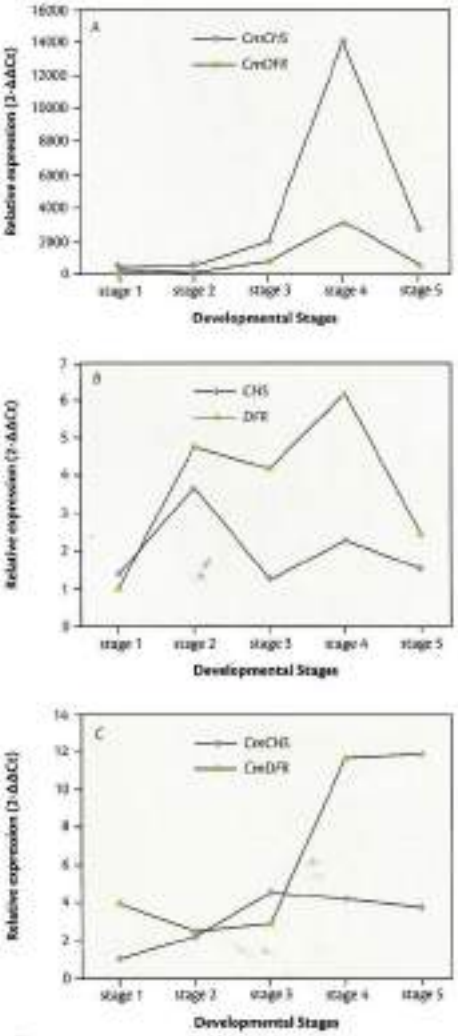


Figure 7. Relative expression of *CmCHS* and *CmDFR* in the tepal (A), carpel (B) and stamens (C) of a Group 2 yellow *Clivia miniata*.

temporal expression for *CmCHS* and *CmDFR* genes, except in the stamens of variety 'Giddy' where each gene was expressed differently. These observations support the possibility of co-ordinate regulation by either the same or alternative transcription factors, depending on the tissue type.

A further test was done to see whether the transcription of the genes correlates with amount of anthocyanin produced. This was done by determining the absorbance of ultra-violet (UV) light. An instrument called a spectrophotometer was used for this purpose.

The anthocyanin concentrations at each developmental stage in both colour forms of *Clivia* were plotted on a bar chart (Figure 8). At stage 5 the anthocyanin content in the orange tepals of the orange plant had increased by almost 16-fold compared with that in the yellow tepals. The results indicate that colour development in the orange tepals is strongly correlated with the accumulation of anthocyanins. The absence of orange colour in yellow tepals can only be caused by the very low anthocyanin concentration, overshadowed by the high concentration of carotenoids and, to a lesser

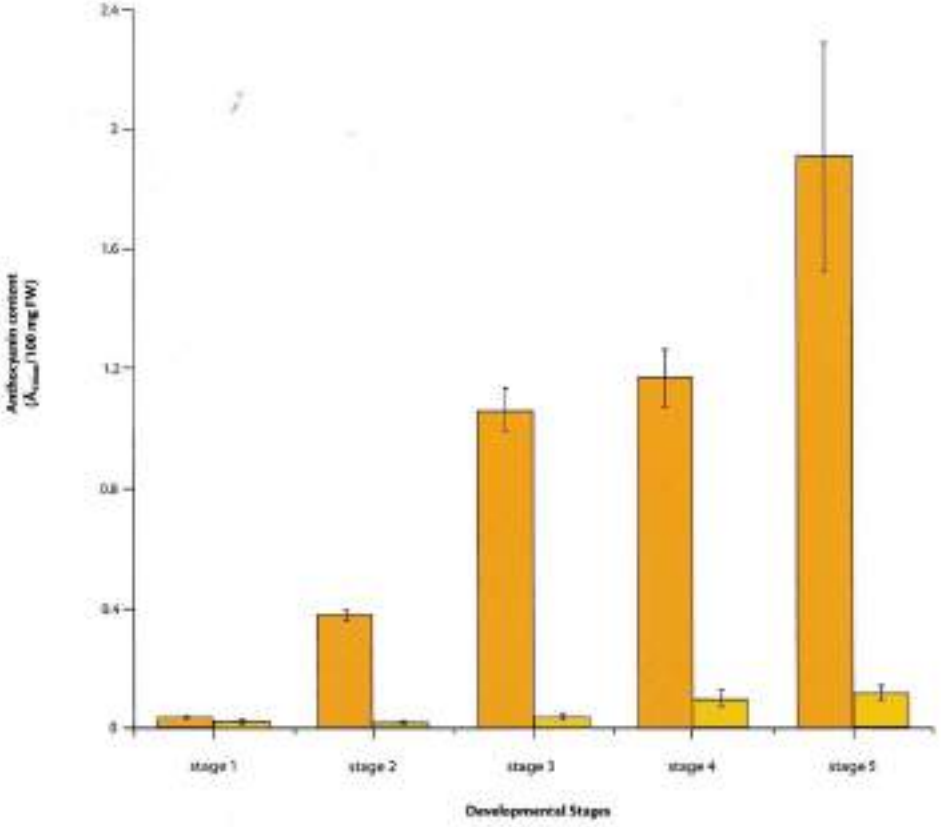


Figure 8. Anthocyanin accumulation at five developmental stages of tepals in *C. miniata* orange and yellow forms respectively. Vertical bars indicate the standard error of the mean of three absorbance readings.

extent, the presence of chlorophylls.

There was a semi-linear increase of anthocyanins in orange tepals, whereas the increase in yellow tepals displayed a sigmoid pattern (Figure 9). When the temporal expression of *CmCHS* and *CmDFR* in the tepals was compared with the anthocyanin accumulation at each stage, a clear trend was visible. In the orange tepals a decrease of gene expression occurred between stages 3 and 4, while a drastic increase of gene expression appeared between stages 3 and 4 in yellow tepals. Both cases coincided with the changes in anthocyanin content depicted in Figure 9. Furthermore, a slight decrease in anthocyanin content in the yellow tepals was observed after stage 4, which could be explained by the down-regulation of *CmCHS* and *CmDFR* expression that was observed between stages 4 and 5.

This study has determined that the genes required for anthocyanin formation are present in both orange and yellow forms of *Clivia miniata*. These genes are expressed in both colour forms. However, the expression is much lower in yellow plants compared to orange plants. Further studies are needed to determine how these genes are regulated in terms of anthocyanin production that ultimately results in orange versus yellow flower colour.

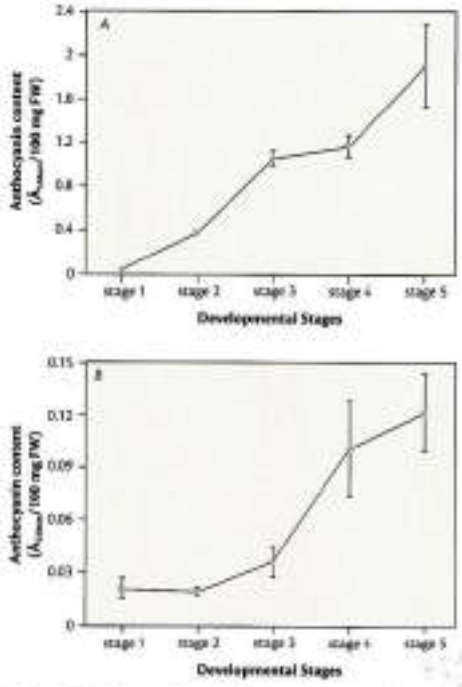


Figure 9. Changes in anthocyanin accumulation at five developmental stages of tepals in *C. miniata* orange (A) and yellow (B) flowers. Vertical bars indicate the standard error of the mean of three absorbance readings.

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Clivia with variegated flowers

Hein Grebe



"From our acquaintance with this abnormal metamorphosis, we are enabled to unveil the secrets that normal metamorphosis conceals from us, and to see distinctly what, from the regular course of development, we can only infer." *J.W. von Goethe – 1790*

The first time I learned about variegated flowers in clivia was in 2008 when I visited a well known property developer in Beijing, Mr. Zhang Jinxiang, who is a keen collector of clivia with unusual flowers. He has written a book called *Junzilan Shiyang Zhishi Wenda* – "Growing and Caring for Clivia" of which he has given me a copy. One of the photos in the book is of a clivia with variegated flowers. The photo was taken of a plant of a fellow Beijing clivia enthusiast. My search for this plant came to a dead end when the owner of the plant informed me that he sold it, because the flowers were not stable. More searches of similar plants were unsuccessful.

When I returned to South Africa beginning October 2009, I was surprised to find a Chinese plant with variegated flowers in my shade house. The wind damaged the few flowers that were still open, but I took a few photos to keep as a record, as I was very excited to find a plant that I spent so much time searching for in China in my collection. It flowered again in October



Figure 1. Almost all the flowers open.



Figure 2. Variegation and mature colours on petals.

2010 and this time I was lucky to take more photos and watch the flowers developing and opening up.

From the photos you will notice that the variegated flowers are from a short-leaf variegated plant. Most variegated plants will carry flowers on variegated flower stems. It is seldom that variegated flowers are produced. However when the flowers die, beautiful variegated berries are formed. The question is why do we not see more variegated flowers on variegated plants? An internet search did not give me any clues.

Variegated flowers take longer to open and can stay open for 3 weeks or longer if not pollinated. This specific plant of mine produces viable pollen, but does not self easily. If the flowers are exposed to direct sunlight, orange pigmentation will develop on sections of some petals. The variegation patterns on the tulip-shaped flowers



Figure 3. Colour comparison.



Figure 4. Colour comparison.

are usually the same as the variegation of the leaves and peduncle. The section of the flower stem with yellow lines will produce yellow or white flowers and those with green lines will produce flowers with similar green variegation on the petals. Sometimes a few normal petals will be formed in a flower. I have noticed that these petals will open first and are also slightly longer than the variegated petals. The colour and pattern on the flowers will vary from year to year on the same plant.

What is causing this abnormal behaviour? Most fellow clivia enthusiasts have identified the condition as phyllody. Phyllody is the development of floral parts into leafy structures, generally caused by virus or phytoplasma. Evidence suggests that the phytoplasma down-regulates a gene involved in petal formation, instead causing leaves or leaf-like structures to form. Phyllody causes the affected plant to become partially or entirely sterile, as it is unable to produce normal flowers. Many clivia enthusiasts have similar plants in their collections that produce green flowers on orange or yellow flowering clivia. Variegation is defined as having marks or patches of different colours [syn. varicoloured].

According to Shige of Japan, phyllody in *Clivia* is caused by inbreeding and carries recessive genes. Selfing the flowers might result in seedlings with the same behaviour. From the 2009 flowers, I harvested one seed and from the 2010 flowers I harvested 6 seeds. It will be a few years



Figure 5. First flower open.



Figure 6. Flower colours after two days in direct sunlight.



Figure 7. Note the orange at the bottom of some flowers.



Figure 8. Variegated flowers of raised vein "Mandarin Duck".



Figure 9. Compare the size difference of the orange-coloured petals.



Figure 10. Note the position of the white flowers on the white side of the flower stem.

before any results will be known. This year a semi-miniature "Mandarin Duck" has produced variegated flowers. Unlike the other plant it produced no pollen; flowers were deformed with almost no flower stem. Unlike the other plant, the flowers opened up unexpectedly quickly and when exposed to direct sunlight, many of the white and yellow coloured flowers changed to orange.

Research that has been done shows an alternative approach for generating new varieties of floriculture plants is to engineer plants with variegated flower colour patterns. Sometimes they carry unstable mutants. Variegated mutants might have defects in anthocyanin genes or genes that control intracellular pH of petals. These defective genes can change the colour of the flower and the leaves of plants. It will thus be interesting to see what happens when line breeding with variegated flowers is done.



Figure 11. Outside of first flowers to open.

Relationships in *Clivia*

Roger Dixon

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Introduction

The genus *Clivia* was erected by John Lindley in 1828, and the type species is *Clivia nobilis* Lindl. (Lindley, 1828). In 1854 *C. miniata* (Lindl.) Bosse was described (Lindley, 1854; Bosse, 1859). These two plants were introduced to horticulture in Europe and there was a great amount of cultivation and hybridisation between these two taxa in the period 1850 to 1900. In 1856 another taxon, *C. gardenii* Hook., was described (Hooker, 1856). There matters rested until *C. caulescens* R.A.Dyer was described in 1943 (Dyer, 1943) and half a century later *C. mirabilis* (Rourke, 2002) and *C. robusta* (Murray *et al.*, 2004) were added to the genus.

Due to the appeal of the plant, and especially its floral beauty, new varieties were constantly being sought to increase the range of shape and colour. A yellow-coloured form of *C. miniata* was described as a horticultural variety – *C. miniata citrina* or and also *C. miniata* var. *citrina* (Rogers, 1897). The same plant was later illustrated (Watson, 1899). A century later *C. gardenii* var. *citrina* (Swanevelder *et al.*, 2005) and *C. robusta* var. *citrina* (Swanevelder *et al.*, 2006) were described, elevating yellow-flowering forms to taxonomic status. *C.* × *nimbicola*, a natural hybrid between *C. caulescens* and *C. miniata* (Swanevelder *et al.*, 2006), has also been described.

With the increasing upsurge in interest in *Clivia* cultivation in the last 30 years, and the progress in breeding and hybridising, many questions have been raised about the variations and unexpected results obtained by various crossings, and many contradictory observations have been made about genetic traits and origins of different strains and forms.



Figure 1. *Clivia nobilis*. This illustration is from Hooker's 1828 description in Curtis Botanical Magazine of *Imatophyllum Aitoni* or Handsome-flowered Imacophyllum.

The dramatic upsurge in interest in *Clivia* since the formation of the Clivia Club in 1992, which has since become the

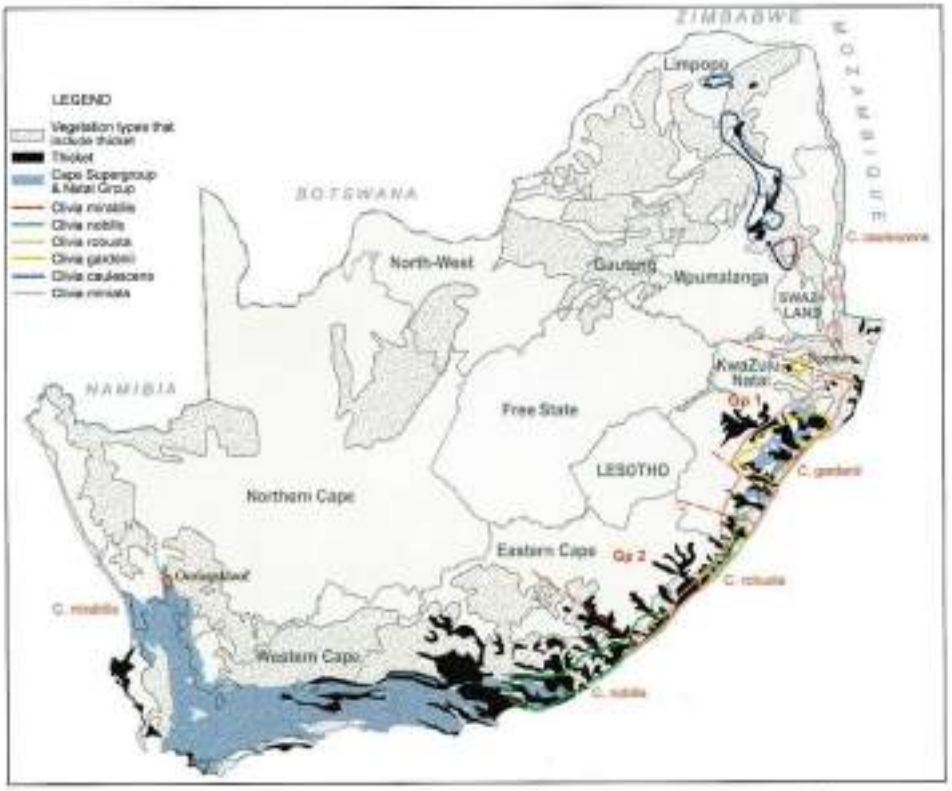


Figure 2. Distribution map of the genus *Clivia*, showing its relationships with southern African subtropical thicket vegetation and the sandstones of the Cape Supergroup and Natal Group. The range limits of Groups 1 and 2, two yellow-flowered forms of *C. miniata*, are also shown. Cartography: Elmi Dixon.

Clivia Society, and the further formation of Clubs and Societies devoted to the genus in a number of countries, has increased the amount of published information and observations on the various taxa in the genus and their hybrids. In addition, with the interest in the horticultural and medicinal promise of *Clivia*, and the quest to understand the origins of the genus, much research has been undertaken by a variety of interest groups, including those of medicinal, horticultural, taxonomic and botanical bent. The improvement of analytical methods in the fields of chemistry and genetics has also broadened our understanding of the genus, although much of this understanding is fuzzy and isolated.

Molecular phylogenetic approaches, combined with analyses of ecological and biogeographical information, both published and anecdotal, have provided sufficient information to propose a speciation model for *Clivia*, and give some insights into the observed behaviour of the genus in cultivation. In order to put all this information in perspective, it is necessary to relate the distribution of *Clivia* to geographic and ecological factors, and then look at the genetic information to understand why we have the variation in the genus.



Photo: Roger Elliott

Figure 3: *Clivia caulescens* in habitat in the Songimvelo Nature Reserve in the Barberton Mountainland.

What is a species in Clivia?

There is no general agreement as to what is the definition of a species, and this is highly variable as one looks at different types of organisms. A good generalisation is that each species is a breeding population that has taken an evolutionary course of its own, separate from related populations, and has consequently developed a set of distinguishing features which makes it identifiable from other species (Waters, 2011).

It may be that the differences between some species are obvious, but often distinguishing between several species is problematic, and a variety of criteria, not always obvious, have to be used to discriminate between them. As populations evolve, the features of the plants differ and change, but the exact point where the accumulated differences amount to the existence of a new species is quite arbitrary. This is because the knowledge of the distribution and appearance of the plants is never absolutely complete. In an ideal world naming a new species would mean that all the details of the plants' distribution, ecology, range of forms, genotype and evolution are known, as well as all the related species. In practice, a new species may be described on the basis of a single specimen with minimal information. At a later stage as more information is obtained the status of the plant may be confirmed or changed – this is what keeps taxonomists employed!

Some taxonomists – the "splitters" – divide plant populations into many species, based on small differences, whereas others – the "lumpers" – focus on similarities.



Photo: Roger Deal

Figure 4. *Clivia coulescens* in habitat at Songimvelo Nature Reserve in the Barberton Mountainland. The low canopy allows in plenty of light, and the festoons of moss and lichens on the tree trunks are indicative of the frequent mists experienced in the area. The substrate upon which the plants are growing is very rocky.



Photo: Roger Dixon

Figure 5. *Clivia miniata* in habitat at Songimvelo Nature Reserve in the Barberton Mountainland. These plants were growing very near to the *C. caulescens* shown in Figures 3 & 4, but the substrate here was less rocky and with deeper soil. The stellate white throat of these flowers is quite distinctive for plants from the area, as is the large flower size.

which can result in a number of different geographical populations being grouped under a single broadly-defined species. Looking at *Clivia*, we can see that during the heyday of botanical exploration, botanists tended towards the second group, with three morphologically distinct and/or geographically separate taxa being identified and described – *C. nobilis*, *C. miniata* and *C. gardenii*. There matters stood for almost a century until, amid a resurgence in botanical exploration, the taxonomic pendulum swung to the other side, and new taxa were identified within the pendulous flowering group – *C. caulescens*, *C. mirabilis* and *C. robusta* – delineating the geographical spread of the pendulous group in a fairly even range around South Africa, between the coastline and the escarpment.

In *Clivia* we find two ranks of classification, as exemplified in *C. miniata* and *C. miniata* var. *citrina*. What does this mean? In botanical classification there are three levels or ranks of a species – subspecies (abbreviated as ssp.), variety (Latin *varietas*, abbreviated as var.) and form (Latin *forma*, abbreviated f.).

Simply put, subspecies are populations of a species that have become reproductively isolated from each other and are evolving in different directions, usually as a result of a geographical barrier, such as a mountain range where the species cannot grow. If the barrier were to be removed, the subspecies (the separated populations) would interbreed again and merge back together. No subspecies have been named in *Clivia*.

Below that is the variety. A botanical variety is a population that has some dis-

tinguishing qualities, but is not as isolated as a subspecies. An example might be a population growing in a more exposed environment resulting in a more compact habit and darker colored flowers. A continuous variation may exist between the compact variety and larger plants growing in a moister, more wooded habitat. In *Clivia* there are three described taxa at this level – *C. miniata* var. *citrina*, *C. gardenii* var. *citrina* and *C. robusta* var. *citrina*. According to the botanical definition described above, all three of these taxa are not justified, as they are based on individuals from within populations which show a range of flower colour. The botanical definition should not



Photo: Rudi Lotter

Figure 6. An umbel of large flowers of *C. miniata* in the Bearded Man area.



Photo: Roger Dixon

Figure 7. *Clivia miniata* in thicket downslope from *C. caulescens* below Bearded Man Mountain in the Barberton Mountainland, where it occurs in soil and leaf-litter, and not on rocks as does *C. caulescens*.

be confused with the horticultural word "variety", which usually refers to a named cultivar.

Below variety is the form (Latin forma, abbreviated f.). A form is any plant or group of plants showing a difference in some character or other, for example, a yellow flowering plant in a population of more typical orange flowering plants. This does not imply that each form is a discrete breeding population, just that they are noticeably different in some way.

In the latter part of the 19th century, when hybridisation of *Clivia* was burgeoning (van der Linde, 2008), there was little distinction between the terms "variety" and "form", and they appear to have been used interchangeably. Also, botanical nomenclature had not yet been as rigidly defined as it is today, and botanical literature was not as clearly divided, as it is today, into the "scientific" and "horticultural" areas. The following admonition appeared in *The Gardeners' Chronicle* in 1891: "CLIVEIA: C.S. – Imantophyllum, Himantophyllum and Clivea are all synonymous. Cliveia has the preference as being the most correct name, but if you prefer to write Clivea there is no power on earth to prevent you."

Yellow flowering *Clivia* – a botanical or horticultural "variety"?

Yellow *C. miniata* had already been described as the variety 'Sulphurea' in *The Gardeners' Chronicle* in 1891 (Douglas, 1891) as "a distinct variety of a very pale yellow colour". Douglas further noted that: "There is a wide field for the hybridists in this genus of plants. Not more has been done than to breed in and in from the specific form, or a variety of it with broader foliage, named robusta."

The variety 'citrina', first described by Mrs Powys Rogers in *The Garden* in 1897.



Figure 8 *Clivia miniata* 'Mme Le Grelle d'Hanis', from the *Revue de l'horticulture belge et étrangère*, 1881.

The same plant was described in two horticultural magazines in 1899, in articles written by a certain W. Watson. The plant was illustrated in *The Garden* in Plate 1246, and Watson had this to say:

> "If the introduction of such a slight variation of the type as superb is resulted in the breeding of such varieties as Marie Reimers..., much more may be expected from crosses between variety citrina, and some of these."

He also discussed it in *The Gardeners' Chronicle*, as follows:

> "CLIVEIA MINIATA CITRINA. – This well-marked, beautiful variety is now in flower in the T range at Kew. It is said to have been collected wild in Zululand by Captain Mansell, and first flowered in the garden of Mrs. Powys Rogers, Perrenwell, Cornwall, in April, 1897, when flowers of it, and subsequently a little plant, were sent to Kew. An example of the same variety had, however, already been added to the Kew collection by the Rev. W. H. Bowden, Bow, North Devon, who sent it along with some other plants which had been collected in Zululand, and it is this plant which is now in flower. It resembles a good form of



Photo: Roger Dixon

Figure 9. *Clivia gardenii* from Ngome Forest in Northern KwaZulu-Natal.



Figure 10. Deep yellow *Clivia gardenii* from Ngome Forest in Northern KwaZulu-Natal.

the type in every particular except colour, in which it differs widely from all the forms hitherto raised in gardens, and popularly known as Imantophyllums. These are all more or less of a reddish orange colour, but the variety citrina is coloured a clear pale cream with a faint tinge of orange at the base of the segments. This variety ought to prove valuable to breeders of Clivelas, whose efforts so far have produced exceptionally little colour variation in the seedlings raised."

Other references to yellow *C. miniata*, in the *Journal of the Royal Horticultural Society*, include:

1908, vol. XXXIII, Page liv: "Award of Merit – Clivia miniata citrina from the Hon. Mrs Evelyn Cecil, 10 Eaton Place, S.W. A pure yellow-flowered form of the well-known C. miniata, and was found growing wild near Eshowe, Zululand, by Lady Saunders."

1910, vol. XXXVI, Page cxxxiii: "Award of Merit – Clivia 'King George V' Mr Miller, Wisbeck. A honey-yellow flowered variety."

1911, vol. XXXVII, Page xxxiii: "Yellow clivia – Mr R Hooper-Pearson showed a flower of Clivia citrina apparently a form of C miniata which Mr Worsley said occurred wild in South Africa."

From the above, it is abundantly clear that, botanically speaking, the yellow-flowered *C. miniata*, which occurs sporadically amongst orange-flowered plants in habitat populations, can be accorded no more than the taxonomic status of form – *C. miniata* f. *citrina*.

Plants occurring in cultivation, which are most probably the offspring of individuals from a variety of origins, selected for specific features, get the horticultural name more correctly referred to as a cultivar, for example *Clivia* 'King George V' cited above.



Photo Anne le Roux

Figure 11. A pink form of *Clivia* × *nimbicola* from Bearded Man Mountain from Area A.

The yellow-flowered forms of *C. gardenii* and *C. robusta*, which apart from their colour are otherwise indistinguishable from the populations from which they have been collected, similarly only warrant this status – *C. gardenii* f. *citrina* and *C. robusta* f. *citrina*.

This digression is warranted, in that it is necessary to be very clear when giving a name to a plant, as a name has meaning beyond that of the immediate label – it tells the history of the plant and its origins. In order to determine the origins of *Clivia*, we must ensure that our groundwork is soundly based, and not the construct of unfortunate interpretations of imprecise and often limited information.

Distribution

Clivia belongs to the Order Asparagales, which contains both the Amaryllidaceae family and the Orchidaceae family, which date from the early Cretaceous, around 100 Ma (million years ago). By 65 Ma all families within the Asparagales were present. The genus *Crinum* is the oldest and originated in south-western Africa.

The genus *Clivia* is found associated with a type of vegetation known as southern African subtropical thicket, which has been a major component of southern African vegetation for at least 60 million years (Cowling *et al.*, 2005), when it was globally widespread (Schrire *et al.*, 2005). The leaves of *Clivia* are net-veined, which indicates a forest origin, and the age of the genus. The roots of orchids as well as clivias are similar, and are adapted for a forest environment in trees, on rocks and in leaf litter, and not in soil.

Thicket is a dense formation of evergreen and weakly deciduous shrubs and low trees (2–5m), often spiny and festooned with vines, which derived from elements in the forests that prevailed on the subcontinent prior to that. The arid spiny forests of southern and western Madagascar are also thicket, and in some areas experience a very low rainfall. They are very old, and contain a number of plant genera which are also present in the thickets of southern Africa, showing that thicket was an established vegetation type before Gondwana broke up.

The distribution of thicket has contracted and expanded repeatedly in response to Neogene and Quaternary climatic oscillations. From the end of the Palaeogene at around 25 Ma till about 17 Ma, the southern African climate was quite tropical, with a high land mass (altitude c 2000 m) ringed by the sandstones of the Cape Supergroup and the Lesotho Highlands. At around 20 Ma there was an uplift that was greatest in the eastern part of southern Africa where it approached 300 m. This event correlates with the retreat of thicket to the coastal margins



Figure 12. A Google Earth image of the area just below Bearded Man Mountain, in the Barberton Mountainland, showing the abrupt transition between the thicket vegetation and the grasslands. The thicket catches moisture from mists and clouds, and protects the understorey from frosts.



Photo: Roger Deane

Figure 13. While *Clivia* stayed in the protection of the fire free thickets, other amaryllids adapted to the grassland and savanna biomes where they were subject to fire by becoming geophytes. *Scadoxus puniceus* in the Pilanesberg Game Reserve.

and escarpment of southern Africa. After that until around 8 Ma the climate was more variable, fluctuating from temperate to cold (in the Namib), with the tropics going northwards. From 8 Ma till present we have had the development of Berg winds, and the return southwards of the tropics. A major factor that has affected the climate in southern Africa for the last 4 million years has been the large amount of uplift on the south-eastern side of the subcontinent (up to 900 m) (Partridge & Maud, 1987). The steeper slopes of the escarpment resulted in the creation of incised valleys, and a great diversification of habitat types. The creation of these new habitats as a result of these uplift and erosion events provided a great stimulus for the diversification of southern African plant lineages, as witnessed by the number of centres of endemism.

The ancestral amaryllids came from West Africa, with net-veined leaves developed for forest conditions, thick roots and fleshy seeds. *Clivia* evolved towards the south-east and *Cryptostephanus*, its closest relative in the Amaryllidaceae, in the east, when the central part of southern Africa became hot and dry, and the grasslands developed, around 20 My ago. Amaryllids adapted to arid savannas with the retreat of thickets, with many becoming geophytes to adapt to the dry conditions and fires, while *Clivia* stayed in the retreating thickets.

It can be seen from the present-day distribution of thicket, shown greatly simplified in Figure 2, that there is a strong correlation between it and the sandstones of the Cape Supergroup and the Natal Group, and that in the south-eastern part of the subcontinent the distribution of thicket is

strongly correlated to the deeply incised valleys which are a result of the dramatic uplift experienced in the last 4 million years. The southern distribution of thicket corresponds with the long parallel valleys in the Cape Fold Belt, which have been stable for a long period, in stark contrast to the incised valleys of the south east.

Clivia has been a member of thicket for a long time, and its distribution is mirrored by a number of other very old plant lineages, such as *Encephalartos*, *Strelitzia* and *Cussonia*. In many of these genera, there is an increase in diversity of species in the major diversity centres, or centres of



Photo: Andy Forbes-Hastings

Figure 14. *Clivia robusta* in habitat, growing in quartz sand in a shallow braided stream flowing through thicket near the coast. Many of these plants, which are growing semi-aquatically, have buttress roots and can reach 2 m in height.



Photo: Roger Dixon

Figure 15. *Strelitzia* and *Encephalartos altensteinii* in thicket in the Kap River valley near Port Alfred in the Eastern Cape.



Photo: Roger Dixon

Figure 16. *Clivia nobilis* growing in thicket in the Kap River valley near Port Alfred in the Eastern Cape.

endemism, from the Eastern Cape up into Limpopo (Cowling *et al.*, 2005; van Wyk & Smith, 2001), which corresponds to the areas of major uplift of the land mass in the south-eatern part of the sub-continent over the past few million years.

Clivia and climate

The *Clivia* anatomy shows a number of features which have developed to survive arid environments and which are more pronounced in the taxa from the south and south-west – *C. nobilis* and *C. mirabilis*. These features include leaves which are stiff and leathery and semi-succulent, and roots which are absorbent and water storing, adapted for aerated leaf litter, not soil. The leaves contain cutan, which is a biopolymer found in plants adapted for surviving drought conditions (Boom *et al.*, 2005). These features indicate that the plants are adapted for distinct wet and dry periods.

A distinguishing feature of thicket climates is bimodal rainfall, with peaks in late spring and early autumn, although copious rain may fall at any time of the year. These peaks are mirrored in the flowering times of the various species – *C. mirabilis*, *C. nobilis* and *C. caulescens* usually flower in October to November, while *C. gardenii* and *C. robusta* flower in April to June. *C. miniata* usually flowers before the first rains, in August to October, depending on locality.

The areas of highest endemism among plant taxa, which are also those areas where *C. robusta*, *C. gardenii* and *C. caulescens* are found (see Figure 2), are also the areas of highest rainfall and are associated with sandstones and quartz-rich rocks and soils.

Speciation of *Clivia*

Speciation can be defined as the splitting of one ancestral species into two (or more) daughter species. This splitting is caused by a change in existing conditions which promotes the independent evolution of two parts of a formerly contiguous population.

The change could be an event creating geographical isolation, such as the origin of a barrier to migration (the incised valleys in the south-eastern part of southern Africa, separated by grasslands, exemplified by the development of *C. gardenii* and *C. robusta* in centres of endemism (van Wyk, 1990; van Wyk & Smith, 2001) or fragmentation of the original range due to local extinction – separation of *C. mirabilis* and *C. nobilis* due to climate change and subsequent loss of habitat (Snijman, 2003).

It can also be triggered by a change leading to the onset of divergent selection, for example a shift to a new range that straddles an ecological gradient (the open-flowered mutation of *C. miniata* in response to pollinator availability at the margins between grassland and thicket (Manning, 2005). Other modes of speciation exist, for example hybridisation between two parent species – *C.* × *nimbicola*, found at the interface between two species *C. caulescens* and *C. miniata*, with a very limited distribution (Swanevelder *et al.*, 2006; Spies *et al.*, 2011; Truter *et al.*, 2006), however isolation and ecological divergence are required for such a new taxon to survive and persist.

It can be seen from the discussion above that there are a number of factors which determine why, when and how species may develop. These can be divided into intrinsic (biotic) and extrinsic (environmental) factors. Extrinsic factors include the numbers of



(Photo: Roger Dixon)

Figure 17. A view of the thicket rolling over the hills along the Kap River valley near Port Alfred in the Eastern Cape.

potential geographical isolating barriers, i.e. mountain ranges, rivers, etc., or the strength and number of ecological gradients.

Intrinsic factors might be the typical dispersal distance of the lineage, which would affect gene flow and how severely they are affected by extrinsic barriers, or generation time, which could affect speeds of evolutionary divergence between populations (Barraclough, 2006). As a consequence the speciation rate of a particular genus, in this case *Clivia*, will depend on the interaction between a number of intrinsic and extrinsic factors.

What the DNA reveals

There is a large body of literature relating to the genetics and DNA of *Clivia*, which has resulted in a number of conclusions being drawn, at different times, as to the relationships between the different taxa described in the genus. Being restricted to the thicket, the study of the genetic evolution of *Clivia* can act as an independent measure of how the geological and climatic changes have affected the development of the flora of southern Africa over the past 20 million years or more. Such population genetic data for thicket taxa has previously been lacking (Cowling *et al.*, 2005).

Studies by Ran *et al.*, (2001), Swanevelder (2003), Gagiano (2006) and Conrad (2008), and the papers in this volume – Conrad & Snijman (2011), Spies *et al.*, (2011) and van der Westhuizen *et al.* (2011), have shown that *C. mirabilis* and *C. nobilis* are distinct species, clearly separated by both geography and genetics, but that the other taxa are more difficult to define precisely. What is even more puzzling is that *C. miniata* with its open flowers is, depending upon what particular part of the genome



Figure 18. *Clivia* × *nimbicola* growing on rocks on a steep south-facing slope at Bearded Man.



Photo: Roger Dixon

Figure 19. An atypical form of *Clivia miniata* with highly reduced tepals. This tepal reduction can reach the extreme of no tepals at all, a feature found in other members of the Haemanthae such as *Scadoxus*. This feature in *Clivia* is thought to be a possible result of the reduction of genetic diversity within small iisolated populations.

you use, indistinguishable from its pendulous flowering counterparts which occur nearby. Spies *et al.*, (2011) consider *C. caulescens* to be also a distinct taxon, and its geographical separation from the *C. gardenii* – *C. robusta* distribution is on a par with that of *C. nobilis*.

Within *C. miniata* there are distinct geographic groupings of genetic markers. Swanevelder (2003) showed that different haplotypes for orange-flowered plants were located in different geographic areas, and some were only found in one area. Gagtano (2006) looked only at the yellow-flowered forms and showed that what had been called Group 1 and Group 2 yellows, on the basis of their breeding characteristics, were due to different mutations, and were also geographically constrained (see Figure 2).

DNA also shows that *C. mirabilis* is the oldest of the *Clivia* taxa, and diverged at about 16 – 17 Ma (Conrad & Snijman, 2011), which correlates with the retreat of thicket to the coastal margins and escarpment of southern Africa, as described above, and the beginning of the aridification of central southern Africa. The relative ages of the various taxa can also be estimated from the amount of nuclear material in the cell, and a study by Zonneveld (2005) showed that this correlated directly with the distribution of the pendulous species from *C. mirabilis* having the least nuclear material, to *C. caulescens* having the most. The position of *C. miniata* was nearest to *C. caules-*

cens, however this is contradicted by other studies which showed it to be closest to *C. gardenii*. The position of *C. robusta* is discussed by Hammett (2005), who likens the speciation in *Clivia* to the formation and break up of clouds. The latest DNA studies clarify this and it becomes obvious that the genetic variation in *C. miniata* is as broad as that of the pendulous species whose distribution it mirrors.

Discussion

C. mirabilis and *C. nobilis* would appear to have been surviving relatively unchanged over the past 10 or more million years, sheltered by thicket, which has been reduced in distribution over time by a changing climate driven by, amongst others, uplift of the continental land mass and aridification of the central area of southern Africa.

The uplift of the escarpment and a changing, dissected landscape in the south-eastern part of the sub-continent in the last 4 million years resulted in a myriad of individual habitats and isolated populations, resulting in the need for the original *Clivia* populations to move and adapt to new or changing habitats, as the escarpment rose. This pressure was greatest in the Eastern Cape and KwaZulu-Natal, and resulted in the development of new taxa with thinner leaves and in some areas thinner roots, as the rainfall increased and the plants were forced to adapt to different soil types. *C. caulescens*, the northernmost taxon, is most probably the youngest as well.



Photo Roger Dixon

Figure 20. Another atypical form of *Clivia miniata* with highly modified tepals. This tepal modification (phyllody) can reach the extreme where flowers consist of solid green leaf-like tepals, with non-viable pollen. This feature in *Clivia* is another possible result of the reduction of genetic diversity within small isolated populations.



Photo: Roger Deane

Figure 21. Thicket at the top of a rock outcrop in the Kap River valley near Port Alfred in the Eastern Cape. Typical plant genera include *Strelitzia*, *Euphorbia* and *Encephalartos*.

having spread northwards from its traditional habitat on sandstones onto other rock types with similar properties.

The open-flowered mutation, which has been described as one taxon, *C. miniata*, developed independently at least two areas and most probably in more, corresponding to its range, as the climate changed and more different pollinators were available. It is now necessary to look more closely at the genetics of the open-flowered form of *Clivia* to see whether it merits the status of a single species, *C. miniata*, or whether it is in fact necessary to do the same to it as has been done to the pendulous forms.

It can be seen that as the populations of the open-flowered form became more common, and more of the form spread, it hybridised back to its pendulous correlate. This introgression can clearly be observed in the habit of the pendulous species going northwards, and is demonstrated when hybridising pendulous forms across the range with a single open form – the resulting plants show a range of habits which vary from pendulous umbels in the south to round umbels in the north.

As *Clivia* moved northwards its variation and gradation increased, due to adaptive change & habitat islands. Each incised valley which was suitable for *Clivia* had a reduced and restricted gene pool – a reproductive island, and gene flow between these populations was limited due to the size of the seed and its dispersal by birds. In-breeding has resulted in the great variety of shapes and sizes we see today. The reduction in diversity in local populations has resulted in the distinct differences we observe when hybridising plants of different phenotype and geographic origin.

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PHOTOGRAPHIC

OVERALL WINNER

&

Best Photograph: **Trumpet Flower** Category



C. miniata 'Errol of Ankh-Morpork'
Photographer & grower: Ken Rosling
Breeder: Val Thurston, F1 plant bred from Val Thurston's
C. miniata 'Kaleidoscope'

COMPETITION

Best Photograph: **Tubular Flower** Category



Interspecific *Clivia* 'White Pico'
Photographer, grower & breeder: Shigetaka Sasaki

PHOTOGRAPHIC

Best Photograph: **Single Flower** Category



C. miniata 'Green & Gold'
Photographer: Gordon Fraser
Grower: Kobus Kearny
Breeder: Hirao

COMPETITION

Best Photograph: **Novelty** Category



Red-flushed foliar tepals
Photographer: Joubert van Wyk

PHOTOGRAPHIC

Best Photograph: **Art** Category



Photographer: Joubert van Wyk

COMPETITION

Special Mention



C. miniata 'Carmen Miranda'
Photographer & grower: Gordon Fraser
Breeder: John Handman

PHOTOGRAPHIC

Special Mention



Clivia 'Dreaming'
Photographer, grower & breeder: Carrie Kruger



Clivia 'Two-to-Tango'
Photographer, grower and breeder: Carrie Kruger

COMPETITION

Special Mention



C. miniata var. *citrina*
Photographer & grower: John Hunter

PHOTOGRAPHIC

Special Mention



Clivia 'Dainty Ballerina'
Photographer & grower: Ken Rosling
Breeder: Rudo Lotter

COMPETITION

Special Mention



C. miniata 'Joubert's Vesuvius'



Photographer: Joubert van Wyk

PHOTOGRAPHIC

Special Mention



C. miniata 'Harvest Moon'
Photographer & grower: Ken Rosling
Breeder: Gerhard Malan [*C. miniata* 'Vico' giant yellow
(Cape Show Champion 2001) × *C. miniata* Best 'Vico' yellow]

COMPETITION

Special Mention



C. miniata 'Tiffany Aching of Nkutu'
Photographer, grower & breeder: Ken Rosling
[Pastel *C. miniata* 'Helen's Dawn' × Pat Benett *C. miniata* yellow]

PHOTOGRAPHIC

Special Mention



C. miniata 'Voné's Cheer'
Photographer & grower: Ken Rosling



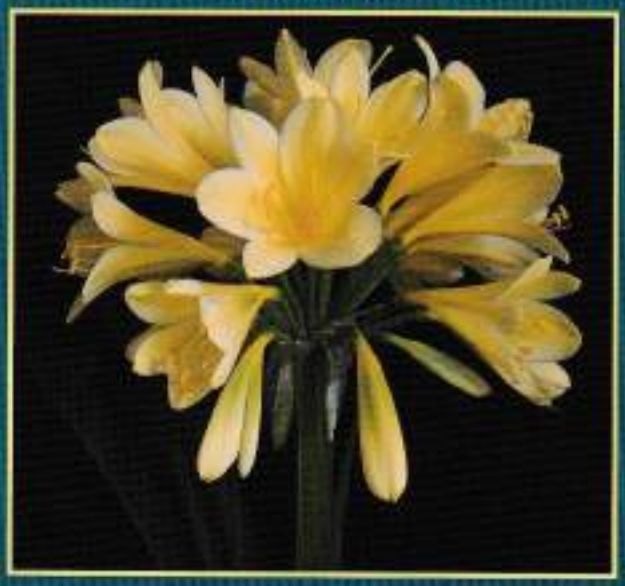
C. miniata 'Flamenco Flame'
Photographer & grower: Ken Rosling

COMPETITION

Special Mention



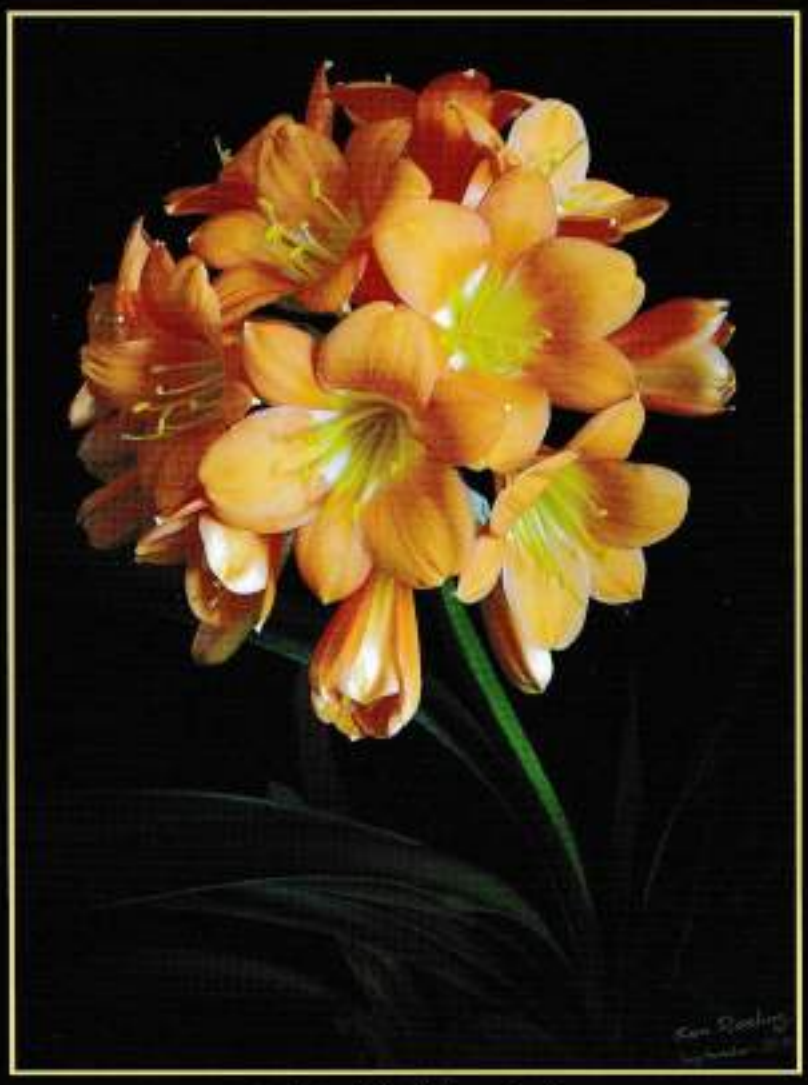
C. minutcia 'Orange Marmalade'
Photographer & grower: Ken Rosling
Breeder: Dr Bing Wiese



C. minnata 'Gail's Peach'
Photographer & grower: Ken Rosling

PHOTOGRAPHIC COMPETITION

Special Mention



C. miniata 'Nkutu's "Nanny Ogg"'
Photographer, grower & breeder: Ken Rosling

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CLIVIA

Yearbook of the Clivia Society

14

2014



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The Clivia Society caters for *Clivia* enthusiasts throughout the world. It is the umbrella body for a number of constituent Clivia Clubs and interest Groups that meet regularly in South Africa and elsewhere around the world. In addition, the Society has individual members in many countries, some of which also have their own Clivia Clubs. An annual Yearbook and quarterly Newsletters are published by the Society. For information on becoming a member and / or for details of Clivia Clubs and Interest Groups contact the Clivia Society secretary or where appropriate, the International contacts, at the addresses listed in the inside back cover.

THE OBJECTIVES OF THE CLIVIA SOCIETY

1. To coordinate the interests, activities and objectives of constituent Clivia Clubs and associate members;
2. To participate in activities for the protection and conservation of the genus *Clivia* in its natural habitat, thereby advance the protection of the natural habitats and naturally occurring populations of the genus *Clivia* in accordance with the laws and practices of conservation;
3. To promote the cultivation, conservation and improvement of the genus *Clivia* by:
   - 3.1 The exchange and mutual dissemination of information amongst Constituent Clivia Clubs and associate members;
   - 3.2 Where possible, the mutual exchange of plants, seed and pollen amongst Constituent Clivia Clubs and associate members; and
   - 3.3 The mutual distribution of specialised knowledge and expertise amongst Constituent Clivia Clubs and associate members;
4. To promote the progress of and increase in knowledge of the genus *Clivia* and to advance it by enabling research to be done and by the accumulation of data and dissemination thereof amongst constituent Clivia Clubs and associate members;
5. To promote interest in and knowledge of the genus *Clivia* amongst the general public; and
6. To do all such things as may be necessary and appropriate for the promotion of the above mentioned objectives.

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FRONT COVER: *Clivia miniata* by Barbara Jeppe, with kind permission of Leigh Voigt.

BACK COVER: *Clivia gardenii* by Barbara Jeppe, with kind permission of Leigh Voigt.

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1828

—

Clivia nobilis



Lindley, J. (1828). Clivia nobilis. Edwards's Botanical Register 14: t. 1182.

Clivia nobilis*

Scarlet Clivia

HEXANDRIA *MONOGYNIA*

Nat. ord. Amaryllideæ

CLIVIA. – ***Perianthium*** tubulosum, sexpartitum, deciduum, laciniis imbricantibus: exterioribus paulò brevioribus. ***Stamina*** sex, æqualia, perianthio basin versùs inserta; ***filamenta*** subulata, subinclusa; antheræ versatiles. ***Ovarium*** 3-loculare polyspermum. ***Fructus*** baccatus, indehiscens, monospermus. ***Semen*** carnosum; subrotundum. – Herba (*Capensis*) radicibus *fasciculatis*, foliis *distichis*, floribus *umbellatis pendulis*. Scapo *plano-convexo*!



C. nobilis, a good full head of flowers, from near the Kei River.

C. nobilis.

Radices *carnosi, fasciculati.* ***Folia*** *disticha, coriacea, atroviridia, ligulata, basi vaginantia, apice retusa oblique, margine scabra.* ***Scapus*** *erectus, plano-convexus, marginatus, versùs fastigium sulcatus.* ***Flores*** *circiter 48 v. 50, longè pedunculati, umbellate, penduli.* ***Perianthium*** *tubulosum, clavatum, deciduum, laciniis luteo-coccineis, apice virescentibus, obtusis, duplici ordine imbricates, versùs basin connatis, exterioribus paulò brevioribus, Lachenaliæ modo.* ***Stamina*** *6, fauce tubi inserta, æqualia; filamenta glabra; antheræ parvæ, ovales, viridi-luteæ, versatiles.* ***Ovarium*** *inferum, luteo-viride, 3- loculare, polyspermum, sphæricum, ventricosum;* ***ovula*** *plurima versùs basin axeos inserta;* ***stylus*** *filiformis;* ***stigma*** *subtrilobum.* ***Fructus*** *baccatus, indehiscens, ruber, sæpiùs, loculis 2, ovulisque plurimis abortientibus, monospermus; apice perianthio deciduo cicatrizatus.* ***Semen*** *unicum, ascendens, (maturum non vidi), glaberrimum, hyalinum, ovale;* ***hilo*** *parvo suprabasilari;* ***foramine*** *basilari;* ***raphe*** *brevi, elevatâ.* ***Testa*** *junior minutissimè areolata;* ***albumen*** *copiosum.* ***Embryo*****.....**

Left: *Clivia nobilis* by Barbara Jeppe

*We have named this genus in compliment to her Grace the Duchess of Northumberland, to whom we are greatly indebted for an opportunity of publishing it. Such a compliment has long been due to the noble family of Clive: and we are proud in having the honour of being the first to pay it.



Clivia nobilis type illustration from Edwards's Botanical Register, c.1182. Based on a plant that flowered at Syon House in 1827.

"The fruit of this plant is a round berry, about the size of a boy's marble, or ⅝ths of an inch diameter, slightly coloured with red. The three cells which contain the seeds consist of a red and very juicy pulp, which (like the internal segments of an orange) are separable from the rind and from each other; and they might easily be mistaken for seeds. Within each cell are from two to four, but generally three, pearl-coloured seeds, which are apt to germinate while still contained in the berry, and even long before it is perfectly ripe. In a cool and airy greenhouse the fruit is from twelve to fourteen months coming to maturity. The progress of the young plants, also, is slow." — *W. H.*

Hooker, W.J. (1832). Note upon *Clivia nobilis*, fol. 1182. Edwards's Botanical Register, 18: sub.t.1546



Clivia nobilis in habitat at Kei River.

This noble plant is supposed to have been one of the discoveries of Mr. Bowie at the Cape of Good Hope, from some of the inner districts of which colony it was probably procured. The plant from which our drawing was made flowered for the second time in July last, in the princely Garden of his Grace the Duke of Northumberland, at Syon House, and was communicated to us by Mr. Forrest, to whom we are indebted for several observations upon its habit and characters.

At first sight it has so much the appearance of a Cyrtanthus that it may easily be mistaken for one, especially if the detached flowers only are seen. But upon a more minute examination, it will be found that it is not only not referable to that genus, but that it is actually doubtful whether it does not belong to a distinct natural order. In the first place, it does not form a bulb, an almost indispensable character of Amaryllideae, from which there is but one other variation hitherto



Clivia nobilis in habitat at Qwaninga River showing flowers and last year's ripe berries.



One of many *C. nobilis* plants at Qwaninga River growing off the ground.



Clivia nobilis on the left bank of a dry river bed, with inset showing its inflorescence.

known, namely in Doryanthes. In the second place, the fruit is not a dehiscent dry capsule, but fleshy and indehiscent; and, thirdly, the seeds are not numerous, compressed, and membranous, but solitary, round, and fleshy. It is, therefore, obviously distinct from Cyrtanthus; and there is no other Amaryllideous genus to compare with it, except Eustephia, the fruit of which is still unknown, but which is peculiarly characterised by its 3-toothed filaments, and which is probably not far removed from Phycella.

Perhaps the real affinity of this plant cannot at present be determined: to us it appears most closely allied to Hæmanthus, the bulbs of which are very imperfect.

A greenhouse plant, not appearing to require particular care in its cultivation, and propagating either by seeds or suckers.

Roots fleshy, fascicled. ***Leaves*** distichous, coriaceous, dark green, strap-shaped, sheathing at the base, retuse and oblique at the apex, rough at the margin. ***Scape*** erect, plano-convex, bordered, furrowed towards the summit. ***Flowers*** from 48 to 50, on long stalks, pendulous, arranged in an umbel. ***Perianth*** tubular, clavate, deciduous; the segments yellowish scarlet, greenish at the apex, obtuse, imbricated in a double row, cohering towards the base, the outer rather shorter than the inner, like those of a Lachenalia. ***Stamens*** 6, inserted in the orifice of the tube, equal; ***filaments*** smooth; ***anthers*** small, oval, greenish yellow, versatile. ***Ovarium*** inferior, greenish yellow, 3-celled, many seeded, round, ventricose. ***Ovula*** numerous, inserted towards the base of the axis; ***style*** filiform; ***stigma*** somewhat 3-lobed. ***Fruit*** berried, indehiscent, red, generally, in consequence of the abortion of two cells and most of the ovula, one-seeded, marked at the top by the scar of the fallen perianth. ***Seed*** single, ascending, (only seen unripe), very smooth, transparent, oval; ***hilum*** small, above the base; ***foramen*** in the base; ***raphe*** short, raised. ***Testa***, when young, marked with very minute areolations; ***albumen*** abundant. ***Embryo***.....

J.L.



A variety of phenotypes at a single location, showing the diversity of colour and shape observed in *Clivia nobilis*. Note the high flower count (78!) on the overhead shot.

Hooker, W.J., (1828). Imatophyllum Aitoni. Handsome-flowered Imatophyllum. Curtis's Botanical Magazine series II 55: t2856.

Imatophyllum Aitoni.

Handsome-flowered Imatophyllum

Class and Order.

HEXANDRIA MONOGYNIA.

(Nat.Ord. – AMARYLLIDEÆ.)

Generic Character.

Flores umbellati, spathacei, nutantes. ***Perianthium*** superum, subcurvatum, sexpartitum, tubulosum, laciniis subæqualibus. ***Stamina*** basi submonadelpha, tubo inserta, perianthio longiora. ***Germen*** globosum, hexagonum: ***Stylus*** filiformis, exsertus: ***Stigma*** trifidum. ***Bacca*** globosa, trilocularis, loculis trispermis.

Habitus *Cyrtanthi; sed* radix *fibrosa:* folia *numerosa, loricata, disticha, marginata:* umbella *multiflora, floribus vix curvatis, limbo perianthii profunde sexpartito:* stamina *exserta.*

Specific Name.

IMATOPHYLLUM* *Aitoni.*

DESCR. ***Root*** perennial, consisting of numerous large and thick, fleshy, simply or branched fibres. ***Leaves*** radical, long, spreading out in a distichous manner, strap-shaped, flat, striated, green, with a diaphanous, jagged margin, the apex blunt, almost retuse, the bases sheathing each other, and purplish. On breaking a leaf, a greenish, gelatinous fluid extrudes in considerable quantity, which has the flavor and smell of a fully ripe apple. From the centre of these leaves arise one or more erect, rounded ***scapes***, with a large umbel at the extremity, of handsome, numerous, drooping flowers, accompanied by a many-leaved spatha, which soon withers. ***Peduncles*** filiform, glabrous. ***Perianth*** superior; of six somewhat incurved and slightly unequal, lanceolate, acute, orange-green segments, united at the base into a tube. ***Stamens*** six, inserted at the top of this tube, and, at the very base of the filaments, monadelphous: longer than the perianth. ***Anthers*** oblong, yellow, fixed near the centre of the back; the cells opening at the sides. ***Germen*** globose, with six angles and three cells, each with three ovules: ***Style*** longer than the stamens, filiform: ***Stigma*** trifid. ***Fruit***, a large, three-celled, red ***Berry***, containing about six, somewhat triangular, whitish seeds, clothed in a double integument; the outer loose and pulpy. Albumen between waxy and horny. ***Embryo*** cylindrical.

*From Ιμας, αντος a thong, or strap, and φυλλον a leaf, from the shape of the foliage.

Was the plant named *Clivia nobilis* in 1828 surreptitiously obtained from Kew?

John van der Linde

[First published in Clivia 5, pp. 92-95]

The late Amelia Obermeyer (Mrs. Mauve), who was a botanist at the National Botanical Institute in Pretoria, wrote the following in the August 1972 issue of *Flowering Plants of Africa*-. *"By a curious coincidence two English botanists, Lindley and Hooker, separately published on the same day in October, 1828, a new genus based on the same plant. Lindley named this new genus Clivia and Hooker called it Imantophyllum. In 1830 Roemer and Schultes (Syst. Meg. 7:892) chose the name Clivia and reduced Imantophyllum to synonymy. The plant in question was an introduction from the eastern Cape by Bowie and it grew in the hot houses at Kew and at Syon House, the residence of the Duchess of Northumberland. Lindley named the plant Clivia nobilis saying that such a compliment had long been overdue to the noble family of Clive.*



A high flower count at Kei River. The colour of this flower is very similar to the original one collected and still grown at Kew Gardens.

It is said that the plant described by Lindley 'had been surreptitiously obtained from Kew'."

The final sentence, with its strong hint of *Clivia* theft and the receiving of stolen property back in the early 1800s, intrigued me. I set out to examine the evidence. I began by reading what the two botanists closest to the action had said. Were there any clues there? I then spread the net wider to other writers, looking for evidence of any crime. Finally, I set out to track the allegation to its source.

Lindley, in naming the plant *Clivia nobilis*, said *"This noble plant is supposed to have been one of the discoveries of Mr Bowie at the Cape of Good Hope, from some of the inner districts of which colony it was probably procured. The plant from which our drawing was made, flowered for the second time in July last, in the princely Garden of his Grace the Duke of Northumberland, at Syon House, and was communicated to us by Mr. Forrest, to whom we are indebted for several observations upon its habit and characters."* Lindley also says *"We have named this genus in compliment to her Grace the Duchess of Northumberland, to whom we are greatly indebted for our opportunity of publishing it."*

The plant flowered for the second time in July, more or less the time one would expect a *C. nobilis* to flower in the Northern summer. This suggests that the plant was well-acclimatized to the Northern Hemisphere, and was probably imported before 1827.

The noble couple would almost certainly not have been directly involved in buying the plant; the Head Gardener would normally have dealt with suppliers. The said Mr. Forrest became Gardener to the Duke at Syon House in 1826. If the plant had been bought by his predecessor, Forrest may not have known its source. Lindley refers to Bowie as having discovered the plant, but the words he uses do not actually say that the plant at Syon came from those introduced by Bowie to Kew. Bowie is certainly credited in the records of Kew as having introduced *Clivia nobilis* to Kew. He must have done this when or before he was recalled to England in 1823, after 'his contract to collect plants in South Africa for Kew had been terminated. All *C. nobilis* plants he may have collected then would all have belonged to Kew. There was of course nothing to stop Bowie legitimately importing plants to England on his own account, but only after his recall in 1823, as speculated below.

In naming the plant *Imantophyllum aitonii* (after William Townsend Aiton) in the October 1828 issue of *Curtis's Botanical Magazine* Hooker gives considerably more detail than did Lindley: *"Mr. Bowie .... in the summer of last year, immediately previous to his return to the Cape, mentioned to me a Cyrtanthus-like? plant, which he had there found and imported, and which if it blossomed in this country, he desired might bear the specific name of his patron, Mr. Aiton. At the same time the letter enclosed one or two of the wild specimens of the flowers, and a small piece of the leaf ...".* Does the use of the word 'imported' imply that Bowie was already in England, i.e., between 1823 and 1827, the year he returned to South Africa?

Hooker, then goes on to say that a specimen of the plant had flowered in October 1827 *"in the noble gardens of Syon House"*, and that *"Mr. Forrest ... kindly requested His Grace the Duke of Northumberland's permission for a drawing to be made of the plant..."* Clearly a plant had also flowered at Kew, because W.T. Aiton, Director-General of all the Royal Gardens, including Kew,

"has likewise been so obliging to send me a drawing and specimens of the fruit...". Aiton also consulted Bowie's notes, stored at Kew, to tell Hooker that the plant(s) at Kew had been found *"on shaded spots, near Quagga flats, and more common in the Albany tracts, near the great Fish River"*.

Forrest would hardly be likely to have knowingly drawn attention to a plant that had been 'nicked' from Kew; similarly if Aiton had known that a plant 'surreptitiously acquired from Kew' had flowered anywhere else he is hardly likely to have co-operated in supplying further information on the plant, especially if it were to be named for him! This would have made him an accomplice to theft.

There had in fact been thefts from Kew; plants that were exclusively Kew's were appearing for sale in nurseries, probably smuggled out with the assistance of garden staff, bribed by middle-men who could make a profit, on-selling to eager customers. In 1824 it was found that the keys to the Royal Gardens at Kew had been counterfeited and all the locks had to be changed.

Robert Sweet, the manager of Colvill's nursery (which incidentally had a large collection of Cape bulbs) in Kings Road, Chelsea, was accused of receiving some choice Australian plants stolen from Kew. Aiton was determined to make an example of him and the case was heard at the Old Bailey in February 1824. *"Sweet's unblemished reputation, vouched for by other nurserymen, secured his acquittal on technical grounds"*.

So, going on what I had discovered to date there did not seem to be any evidence that the plant at Syon House had been 'surreptitiously obtained from Kew', even though other thefts from Kew had indeed taken place. So where did the plant come from? From Hookers' account which ties in with Lindley's in this regard, one could perhaps, at a stretch, conclude that it came from an importation by Bowie some time after 1823, when he was no longer under contract to Kew. Important to the story is the wording of Bowie's contract to collect for Kew. Exclusive supply to Kew was demanded: *"Should a plant sent by you to Kew appear in any other garden, an enquiry will immediately be set...."*

Then along comes the very well-connected Rev. William Herbert, the multi-talented bulb expert and younger son of the Earl of Carnarvon, with a more conclusive explanation. I repeat in full his account, given in his classic monograph *Amaryllidaceae* published in 1837:

"This beautiful plant was first discovered by Dr. Burchell, in whose herbarium, soon after his return from Africa, I saw a fine specimen, which not having been



A closer picture of typical habitat conditions shown on the next page.



C. nobilis growing in brackish sand adjacent to the Indian Ocean beach just showing at the foot of the picture. The large-leaved plants are strelitzias, which typically occur in *Clivia* habitats.



carefully examined, had been mistaken for an Agapanthus, *to which its root and leaves have a striking affinity. I soon after became possessed of a plant of this species, brought over by an officer who had been employed on the Caffre frontier, and I recognized it to be the plant I had seen in Dr. Burchell herbarium, but concluded it to be an* Agapanthus. *Not long after, I obtained for Mr. Tate, from the kindness of Dr. Burchell, a precise account of the spot where he had seen this plant; the result of which was a large importation of the roots—but after they had vegetated, Mr. Tate mistook them for the common* Agapanthus, *and was about to dispose of them as such, when I saw them accidentally, and immediately recognized them. One of the plants flowered for the first time in this country in the collection of the Duchess of Northumberland, after whom it was named. By a singular accident it appeared on the same day in the Bot. Reg. and Mag., being named in the latter work Imatophyllum aytonii, but the name* Clivia nobilis *has been generally preferred. Sir W. Hooker was mistaken in supposing Mr. Bowie to have been the first discoverer of this plant. Indeed, roots of it were in my hands before he had seen it in Africa. It is a plant of perfectly easy culture, requiring no particular care but to shelter it from frost, and it flowers freely in the greenhouse if placed near a front light, and ripens its seeds; but the seedlings are of very slow growth. The reason of its not having flowered in my collection earlier was that from the slowness of its growth I had been induced to put it in the stove, hoping that it might grow there more freely; but the heat increased its sulkiness."*

Left: Herbarium specimen of *Clivia nobilis*, housed at Kew, and collected by WJ Burchell between Riedfontein and the source of the Kasuga River, Bathurst Division, Oct 25, 1813.

'Stove' was the word used in those days for a hothouse with artificial heat. Herbert says he saw the plant (a dried specimen?) soon after Burchell returned to England, which was in 1815. He says that there was a *"large importation of roots"* which subsequently *"vegetated"*. This would have taken several years – Herbert refers to very slow growth – and then one or more plants were sold, prior to flowering.

Tate imported the plants directly, maybe even before Bowie returned to England in 1823. James Charles Tate had a nursery in Sloane Street, Chelsea, close to Burchell, who had collected in South Africa from 1810 to 1815, and who was then living in Fulham. Four other horticultural Tates are listed as having been born in Alnwick, Northumberland. What is significant about that is that Alnwick was the 'home territory' of the Duke of Northumberland, owner of Syon House. If James Tate had a family connection with Alnwick then this may have given him an entree to supply plants to the garden at Syon.

Herbert says that his own plant was acquired from an army officer before 1823, the year Bowie returned to England. Tate may have used a similar contact in South Africa – Bowie complains about having to compete with officers who sent their troops out on plant-hunting expeditions!

So neither Hooker nor Lindley appear to have known of Burchell's dried specimen, or of Tate's importation. Were they both in so much of a hurry to publish that they missed this information? Hooker does not even seem to have seen the plant at Syon. (This did not stop him from ingeniously putting together the picture which accompanies this article -his *Imantophyllum aitonii*, from *Curtis's Botanical Magazine*, Vol. 55 of 1828. It is a collage based on a drawing of the plant at Syon House, on a *'drawing and specimens of the fruit'* of a plant at Kew, supplied by Aiton, and possibly also on a *'small piece of the leaf'* given to Hooker by Bowie!)

With this additional evidence all three accounts seem to hang together, without significant contradictions, so where on earth did the *"surreptitiously obtained from Kew"* allegations originate? Robert Archer at the National Botanic Institute in Pretoria put me on a track which led back over the years from one source to another, each saying more or less the same thing, in more or less the same words; back to Saturday 29th October 1881.

This was the date on which the weekly newspaper for the serious gardener, *The Gardeners Chronicle of London*, published the latest in a series of articles on earlier plant collectors. This issue was about James Bowie. No author is named and no references were given. The relevant section of the article, dealing with events nearly 60 years before, reads: *"In the country of the Orange River State he discovered the beautiful Amaryllidaceous plant which was received at Kew in 1823 and having flowered, was in 1826 figured and named in the Botanical magazine by Dr. Hooker (afterwards Sir William) under the name* Imantophyllum aitonii; *at the same time a plant which had been surreptitiously obtained from Kew flowered in the Duke of Northumberland's garden at Syon House, was figured and described by Dr. Lindley under the name* Clivia nobilis, *both names appearing in their respective journals of the same date. Dr Lindley was requested to forego the name Clivia, but refused to do so, and ultimately it became the popular name"*.

And there the trail goes cold. Who wrote that article and who were his informants? Perhaps we will never know. But what I can say is that he did not read Hooker (writing

in 1828, not 1826), who set out exactly where Bowie found the plants growing – certainly nowhere near the Orange River State! Also, I find it hard to believe that any specialist writer at that time would not have known of Herbert's classic book and his version of events. Was that anonymous author simply doing what others did after him i.e. repeating without checking what had been written even earlier by someone else?

I did not let the matter rest there. To make sure this was indeed the end of the trail, I looked at other sources including the 465-page long very detailed *Kew – The History of the Royal Botanic Gardens* by Ray Desmond, former Chief Librarian and Archivist at Kew. Nowhere could I find any reference to the theft from Kew of a plant, subsequently to flower *"in the princely garden"* of the Duke of Northumberland, and to be published on the same day in October 1828 by two of the most prominent botanists in two leading botanical magazines in England. This must have been a high-profile event in horticultural circles. Surely there would have been some comment, if the plant had in fact been *"surreptitiously obtained from Kew"*?

My account contains speculations, but they – I submit – are logical, though they may not be conclusive. I would welcome any reader of this article to throw further light on this interesting episode in *Clivia* history. Until then, case dismissed or should it only be adjourned?

I would like to thank Victoria Herriott of Syon House, and Topher Martyn, currently the Head Gardener there, for examining Forrest's 'Alphabetical Catalogue of Plants of Syon garden", which he put together in 1831. I thought that might tell us where the plant came from. Yes, one *Clivia nobilis* appears on the list, but unfortunately there are no details of where it was obtained.

At an early stage in my research John Rourke drew my attention to Herbert's book and to his explanation for how the plant came to be at Syon House. When Harold Koopowitz's book Clivia was published I was interested to see his interpretation of this episode.

Michael Jeans and Drs. Robert Archer, Keith Hammett, Harold Koopowitz and John Rourke helped me, also Prof. Donal McCracken, who is researching the life of James Bowie. I thank them all.

Finally, you may have seen the Duke of Northumberland's two ancestral homes without knowing it; they have recently featured in three movies:
Syon House, Middlesex, in *Gosford Park*,
Alnwick Castle, Northumberland, in two *Harry Potter* films.

Bibliography

In addition to the sources specifically mentioned above, I also referred to:

Edwards' Botanical Register, Oct. 1828 (1182)

Gardeners Chronicle, 29 Oct. 1881 (568), which I traced back through

Kew Bulletin, 1891 (309)

Journal of Botany, 1889

Transactions of the Philosophical Society of South Africa, vol. 4, xlii, 1887, the 1886 Presidential Address of P. MacOwan, Director of the Cape Town Botanical Garden, entitled Personalia of Botanical Collectors at the Cape.

I also looked, without success, for some mention of this episode in a number of books on Hooker and Lindley.

The British National Dictionary of Biography, and two further books by Ray Desmond, his *British and Irish Botanists and Horticulturalists*, and *A celebration of flowers: 200 years of Curtis's Botanical Magazine* helped me get a feel for the times.

I also referred back to my earlier articles 'James Bowie' and *The noble family of Clive*, William Aiton , William Hooker and John Lindley', in Newsletters of the Clivia Society (Vol. 11, nos. 3 and 4 of 2002)

Some biographical notes on James Bowie

Extracted and edited from Smith, Gideon F &van Wyk, AE. 1989. Biographical Notes on James Bowie and the Discovery of Aloe bowiea Schult. & JH Schult. *(Alooideae: Asphodelaceae). In* Taxon, *Vol 38, No 4 (Nov), pp. 557-568*

Background

James Bowie spent a total of almost 49 years in South Africa and during his initial stay (1816-1823) undertook four journeys into the interior. Although very little is known about his activities after his emigration to the Cape Colony (1827) he no doubt travelled widely and was a member of many more botanical expeditions (Bowie, 1842). Apart from not having published much about his collecting trips and field experience in southern Africa, Bowie was notorious for providing insufficient and misleading details of the material which he collected, apparently for business reasons. An example is *Clivia nobilis* Lindl. (=*Imatophyllum aitoni* Hook.) which Bowie introduced into England at a time that Cape plants were in high fashion in Europe. He mentioned this species as having been collected from the Orange River, although its natural habitat is known to be in the vicinity of Grahamstown (Obermeyer, 1972; Duncan, 1985). This habit of Bowie has greatly detracted from the scientific value of his collections.



Clivia nobilis in habitat showing notched leaf tip.

James Bowie (*ca.* 1789–2 July 1869)

It was as the successor to Masson that James Bowie was sent to the Cape of Good Hope, almost 22 years after this great botanical collector had finally left the shores of southern Africa. Bowie was the son of a London seedsman who did business at the west end of what used to be Oxford Street in the early 1880's (MacOwan, 1887; Watson, 1897). In 1810, when nearly 21, Bowie also obtained employment at Kew and spent the next four years working there as a gardener. In 1814 Bowie and a colleague, Allan Cunningham, were sent on what was to be his first collecting trip abroad. They embarked for Rio de Janeiro and collected material in Brazil until 1816 (MacOwan, 1887; Hutchinson, 1946; Gunn and Codd, 1981). This visit lasted until 28 September 1816 (Hutchinson, 1946) [and not 1817 as stated by Smith (1881), MacOwan (1887), and Watson (1897)]. Bowie was then ordered

to the Cape of Good Hope as botanical collector and Cunningham, in a similar capacity, to New South Wales, Australia. .... On 28 September 1816 Bowie boarded the 'Mulgrave Castle' and arrived at Table Bay on 1 November 1816. During the first eighteen months of his initial stay at the Cape, Bowie concentrated his collecting activities to the vicinity of Cape Town. At this time he seems to have been engaged in the normal duties expected of a collector, cultivating and exporting to Kew plants of mainly horticultural interest (MacOwan, 1887; Rowley, 1960). Bowie apparently held his own collecting capabilities in high esteem since he stated in a letter dated November 1826 (quoted by MacOwan, 1887) that he collected and forwarded to Kew almost every plant from the Cape of Good Hope figured in Great Britain after 1817. In identifying the Bowie localities, the presentations of Hutchinson (1946) and Gunn and Codd (1981) have been followed. Hutchinson (1946) based his account of Bowie's travels on information obtained from GH Fourcade, a plant collector and Forest Officer at Knysna, stationed with the Superintendent of Woods and Forests for the Cape of Good Hope from 1882 to 1913. With regard to specific localities little can, however, be gleaned from the above sources. In many cases the only information available is a general locality or district. Bowie began his first collecting trip into the interior of southern Africa on 23 March 1818. On this trip he explored from Cape Town and Caledon in the west to Knysna and Plettenberg Bay in the east, returning to Cape Town almost ten months later along the coastal route. Bowie arrived at Cape Town on 14 January 1819 and probably spent the next three months dispatching to Kew the material that he collected on this journey. During this and subsequent journeys Bowie made Plettenberg Bay his headquarters (Fourcade, 1944). On 9 April 1819 Bowie departed from Cape Town on his second collecting trip. This trip again lasted almost ten months and took Bowie as far east as Knysna where Bowie stayed with George Rex (19 July or 29 August 1765-3 April 1839), a notary and pioneer of this town. The legend that Rex was the legitimate son of Prince George (later King George III) seems to be unfounded (Gunn and Codd, 1981). King George III did, however, act as patron of the overseas collecting trips of, amongst others, James Bowie. Rex was a hospitable man and he received many naturalists of that time at Knysna, Bowie in particular paying him frequent visits (Fourcade, 1944). He is commemorated in *Streptocarpus rexii* (Hook.) Lindl. which was collected by Bowie at Melkhoutkraal, one of Rex's farms at Knysna (Gunn and Codd, 1981). *Streptocarpus rexii* was the first species of this interesting genus to be discovered and was introduced into cultivation from the material sent to Kew by Bowie (Hilliard and Burtt, 1971). After having completed his second journey, Bowie arrived back at Cape Town on 22 January 1820 in the company of George Rex (Fourcade, 1944). Although the exact date on which Bowie departed on his third journey which took him as far east as Bushmans River, Kowie and Graham-

stown is not known, it must have been shortly after 22 January 1820. On 9 March 1820 he was already residing at Knysna, whilst it took him between three and seven months, respectively, to reach Rex on his first two journeys. One would thus have to assume that Bowie was now more familiar with the route from Cape Town to Knysna and that he did not stop to collect along the way. On this third journey George Rex accompanied Bowie from Cape Town to Knysna. This collecting trip, which lasted approximately one year, took Bowie further east than either of his first two journeys. After completing this journey he sailed from Algoa Bay on 15 January 1821, arriving on 29 January 1821 in Tabel Bay where he remained until 23 May 1821. On his fourth journey Bowie seems to have been eager to explore from Algoa Bay eastward since he again sailed from Cape Town (24 May 1821) and arrived at Algoa Bay two weeks later on 5 June 1821. During this last collecting trip that Bowie undertook into the interior of southern Africa during his initial stay at the Cape, he explored the lesser-known eastern and south-eastern parts of the Colony more thoroughly and also proceeded to the north-eastern Cape where he collected plants in the vicinity of Colesberg. He again resided with George Rex at Knysna from 1 June 1822 to 22 September 1822 and eventually returned to Cape Town overland. On his return journey Bowie met Dr George Thom (18 June 1789-11 May 1842), a missionary and minister of the Dutch Reformed Church at Caledon. Thom took a great interest in botany and sent specimens from South Africa to Prof WJ Hooker at the Glasgow University (Stirton, 1986). Sir Joseph Banks, who initially convinced King George III to make funds available for the employment of collectors of foreign botanical material, died on 19 June 1820. Two years later a vote reducing by one half the sum available for such collectors was passed in the House of Commons (Smith, 1881). This meant that either Cunningham, an earlier exploring companion of Bowie in Brazil, had to be recalled from New South Wales, or that Bowie had to be recalled from the Cape. Apparently because of his intemperate habits and lack of perseverance in his collecting duties, it was decided that Bowie should be recalled. On 23 May 1823, six months after completing his fourth journey into the southern African interior, he sailed from Cape Town for England in the 'Earl of Egremont'. After briefly collecting at St Helena, he arrived at London on 15 August 1823 (Hutchinson, 1946). Bowie was now no longer employed by Kew and spent his days working on herbarium specimens collected during his visits abroad. At night he passed his time in public houses and there boasted of his adventures and encounters with wild animals at the Cape and in Brazil (Verduyn den Boer, 1929). These drinking bouts eventually resulted in Bowie becoming an alcoholic. He decided to settle in South Africa and to become a collector of objects of natural history. After four aimless years in England, Bowie finally sailed for the Cape in the "Jessie" in April 1827 (Ffolliot, 1981). For the next 42 years Bowie,

who never married, lead an unproductive life at the Cape. His attempts to take over the business of Villet and Son, who dealt in the export of natural history specimens, failed and his hope of becoming the curator of a botanic garden at the Cape was never realized (MacOwan, 1887; Gunn and Codd, 1981). Later he made an unsuccessful attempt to make a living from selling Cape bulbs and also failed to obtain land for establishing an experimental English nursery (Anon., 1970; Ffolliot, 1981). By 1836, some nine years after having settled in Cape Town, he seems to have been employed as gardener and collector to Baron Carl von Ludwig of Ludwigs Garden in Kloof Street (Marloth, 1915; Stafleu and Cowan, 1983). This engagement lasted less than five years and, by 1841, he was again working independently and making a meagre living from horticultural tuition and inspection and from selling plants collected on field trips (Bowie, 1842). During the latter part of his life he was in poor health and, as an act of charity, was employed as a gardener by Ralph H Arderne at his magnificent garden in Claremont, Cape Town (Gunn and Codd, 1981). James Bowie died on 2 July 1869 (not in 1853 as stated by Smith, 1881) and was buried in Cape Town. Specimens that Bowie collected at the Cape of Good Hope are kept at the British Museum (Natural History) and at Kew. Drawings of plants sent to England by Bowie are in the Kew collection (Hutchinson, 1946; Reynolds, 1982).

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1854

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Clivia miniata



Hooker, W.J. 1854. Imantophyllum miniatum. Curtis's Botanical Magazine 80: t. 4783.

Imantophyllum miniatum

Brick-coloured Imantophyllum

Gen. Char. IMANTOPHYLLUM*. ***Perianthium*** superum corollaceum, 6-partitum, patenti-campanulatum, tubo brevissimo, laciniis late obovato-lanceolatis subæqualibus, 3 int. paulo majoribus. ***Stamina*** 6. ***Filamenta*** crassa, subulata, patentia, summo tubo inserta, ***perianthii laciniis*** subbreviora. ***Antheræ*** versatiles, brevi-oblongæ. ***Ovarium*** inferum trigonum, 3-loculare, ***loculis*** oligospermis, ***ovula*** subsex in quolibet loculo biseriatis, angulo interno affixa. ***Stylus*** crassus, decurvato-adscendens, perianthio longior. ***Stigma*** 3-fidum. ***Capsula*** carnosa, indehiscens. ***Semina*** (abortione) in singulo loculo solitaria, bulbiformia, rugosa, subpulposa, magnitudine seminis *Fabæ vulgaris* (horse-bean).—Herba *acaulis*. ***Radix*** *e fibris numerosis fasciculatis carnosis crassis*. ***Folia*** *radicalia ampla lorata disticha, basi latissima amplexante.*

Previous page: *Clivia miniata* near Mponde Falls, Pondoland, 25 October 1981. Painted by Auriol Batten and completed 21 July 1983.



Typical *C. miniata* in bloom at Umtamvuna.

Scapus *plano-convexus, latus, apice umbellato-multiflorus.* ***Spatha*** *polyphylla, marcescens, colorata.* ***Flores*** *ampli, miniati, unicolores, pedicellati, bracteolati;* ***bracteolis*** *linearibus, longitudine fere pedicellorum.*

IMANTOPHYLLUM? *miniatum.*
VALLOTA? miniata. *Lindl. in Gardeners' Chron.* 1854, *p.* 119; *and at p.* 149, *observations by Mr. Backhouse.*

*[Not *Imatophyllum* (more correctly *Imantophyllum*) of ourselves, at Tab. 2856. It was unfortunate that that plate of *I. Aitoni* appeared on the same day on which the same plant was figured by Dr. Lindley in the 'Botanical Register' as *Clivia nobilis*. The name may, we think, thus with propriety be transferred to the present genus, a near ally of, but certainly distinct from, *Clivia*, Lindl.]

[We have ourselves also received living plants of the same direct from Natal.]

Greig Russell notes on his website [http://pennypoint9.itgo.com/clivia/bosse/miniatum.html]: "Plate 4785, a plate of the orchid species Coelogyne testacea, was published on the 1st June 1854. It was followed by a description which had at its end a piece of open space, in which Hooker published the following short note: ... at Tab. 4783 there should be no note of interrogation after the word "Imantophyllum". It is obvious from this that the question mark should not be included in any reference to this work – and I will make a point of deleting it wherever I have made mention of it. The reference to this would be: Hooker, W.J. 1854a. At Tab. 4783 ... . Curtis's Botanical Magazine 80: sub. t. 4785.

A flowering specimen of this fine Amaryllidaceous plant was exhibited at a meeting of the Horticultural Society in February of the present year; and in the following month the Messrs. Backhouse, of the York Nursery, who imported the plant from Natal, obligingly forwarded from their greenhouse the specimen here represented. Dr. Lindley noticed the plant doubtfully as a *Vallota*: it wants the peculiar duplicature of the faux of the corolla of that genus, and it has not a bulbous root. Mr. Backhouse agrees with us that it is nearer *Clivia* than *Vallota*: so near, that I am not sorry to transfer one of the two generic names which that plant has borne to the present. Mr. Backhouse alone has imported ripe fruit; and the seeds which he describes are in appearance similar to the so-called bulbiform seed of other Amaryllidaceous plants, *Crinum* for example. We shall conclude this article with a description from the living plant, by Mr. Backhouse , which accompanied the specimen.

DESCR. "After removing the flower-stem, the plant was taken out of the pot, and the earth thoroughly washed from it, so as to allow a complete investigation of its root. This was done with a view of relieving the plant from the encumbrance of a ball of exhausted hard earth. The vertical ***root-stock*** is about four inches long, cylindrical, and truncated; the lower two inches are bare and like a section of a broomstick, about an inch in diameter. From the upper two inches protrude numerous whitish branched ***fibres***, about the thickness of a goose's quill, clothed with a short pubescence on their younger portions. The ***leaves*** on our



C. miniata growing along the steep banks of the Qwantinga River.

oldest plant were twenty-three in number, in opposite rows, the widened base of each leaf embracing that of the opposite one; and in this respect, as well as in the root, resembling *Clivia*. The leaves of our plant are not linear nor rigid, like *Clivia*, but are linear-lanceolate and stout, and exhibit not only the longitudinal nerves, but some of the stronger transverse partitions; like those of *Clivia*, they are perennial. In strong plants they come up from the centre in series of four to five at once, quickly succeeding each other; and about the time that the first of the new series is matured, the flower-stem is protruded between the outer one of these and the last of the next older series. The new leaves are of a rather brighter green than the old ones. The ***flower-stem*** is flattened, about a foot long, and supports an umbel of twelve to fifteen pedunculate flowers, at first enveloped in a sheath, composed of membranous and membranous-margined bracts.



A rare yellow *C. miniata* growing amongst typical oranges.

The ***stamens*** and ***style***, when the flowers begin to open, are decidedly declining; but the expansion of the flowers carries the upper stamens a little out of this position, and spreads the whole of them. So far as we have seen, but one ***ovule*** in each cell swells. Once, one in each of two cells was matured, and the third was abortive. In two other instances only one in one cell matured, and those of the other cells were abortive. I did not examine minutely the original number of rudimentary ovules. The seeds, being valuable to us, were not cut, so as to examine their internal structure; but their size was that of a smallish horse-bean, and, though less rugged than those of *Crinum*, decidedly 'bulbiform,' at least so both William Wood and myself considered them. They were sown immediately, under the idea that they would not keep, and they quickly pushed up each a leaf. The ***capsule*** turned of a brownish colour and became soft, and the integument of the seed was moist; and on a portion of the exterior being accidentally rubbed off, a silvery membranous coat, like that of the bulb-seeds of *Crinum*, was exhibited. Our old plant has for the last two years produced fresh leaves and a flower-stem about every four months. It has sent off several suckers from the portion of the root-stock which produces the fibres (if so the thick roots I have described may be called). If the flower-stem be kept in water, possibly some of the capsules may swell a little, so as to exhibit the number of the rudimentary ovules. The ***corollas*** are deciduous, as in *Clivia*, to which I certainly think the plant nearer than to *Vallota*. The flowers expand about two at a time daily, or in two days or longer periods, but remain so long as to form, along with the others also expanded, a fine head for from two weeks to a month, according to temperature."



A sympathetic domestic planting.



An attractive habitat scene at Umtamvuna.



Clivia miniata painted by Kathleen Lansdell in 1914.

Some biographical notes on James Backhouse

Extracted, edited and expanded from K[arstens], M[ia] C. 1968. Backhouse, James in De Kock, W. J. (Editor-in-chief). Dictionary of South African Biography Volume 1. Pretoria: HSRC. Pp. 31–32

Expanded from notes by Peter Davis of the Durham County Local History Society, Selected Biography No. 5 'The Backhouse Family – Bankers and Horticulturists'

James Backhouse, born in Darlington, England on 8.7.1794, the fourth child of James Backhouse, a banker at Darlington, and Mary Dearman, of Thorne, was to become renowned as a Quaker minister and missionary, nurseryman and botanist. In November 1822 he married Deborah Lowe (1827), daughter of the Rev. Richard Lowe, of Worcester. They had three children.

As a child he showed a great interest in religious matters, and in later life, after attending a Quaker (Society of Friends) boarding-school at Leeds, he became assistant to two Friends at Darlington in a grocery, drug and chemical business. For reasons of health he spent the summers farming, during which time he studied botany, helped by relations well versed in various branches of natural history – a great-uncle, Stephen Robson, who had published a British flora on Linnaean lines in 1777, and his uncle, Edward Robson, known as an enthusiastic botanist.

In these early years, he and his son, James, frequently visited Teesdale, west of Darlington, with its limestone and alpine flora, and made certain botanical discoveries. It was his love of botany that led him to gardening. He went to learn his business at Norwich, staying there for about two years, and making the acquaintance of Sir William Hooker, with whom he sometimes went botanizing. In partnership with his brother Thomas, he took over the well-established nursery business of J. and G. Telford at York, this being the start of the Backhouse Nurseries, renowned as suppliers of alpine plants, and in clivia circles, for the introduction of the Clivia miniata as a horticultural plant in England in 1854.

Though by profession a nurseryman and seedsman, he felt called to devote his life to the ministry, noting that:

In the study of Botany, as well as in other things, I found it necessary to keep ' to the limitations of the Spirit of Truth,' lest these things should gain an undue place in my mind, and become as idols, drawing my attention from that love and service to God, which was needful to my growth in grace, and due from me to the Author of all the mercies I enjoyed.

One of his engagements was a mission with his friend, George Washington Walker, to Australia, Mauritius and the Cape Colony, sailing for Australia with Walker on 3.9.1831 being primarily for preaching to colonists and convicts, and of visiting penal settlements, gaols, schools and other public institutions to suggest improvements and to promote temperance. Leaving his two children and his business in the hands of his brother, they stayed there for the next six years.

They spent the first three years (1832–34) in Van Diemen's Land (Tasmania) proceeding to New South Wales (1835–37) and Backhouse sent a valuable herbarium of inland species to Kew gardens. After a return visit to Hobart in 1837, they left at the end of the year and, after visits to Melbourne, Adelaide and Perth, left for Mauritius in February 1838.

After a three-months stay on this island they sailed in the schooner Olivia for Cape Town, entering Table bay on 27.6.1838. They set out on their journey into the interior by ox-wagon on 27.9.1838. During two and a half years in the country, they travelled 6,000 miles in the interior of the colony, visiting the various mission stations. B. also taking a keen interest in the indigenous vegetation. The route covered was as follows: Swellendam, Grootvadersbosch, the Little Karoo ('Kannaland'), Riversdale, Mossel Bay, George, Knysna, Plettenberg Bay, Essenbosch, Bethelsdorp, Port Elizabeth, Uitenhage, Grahamstown and Fort Beaufort. They left their ox-wagon on the banks of the Kat River and departed for Kaffraria on horseback. They travelled beyond Butterworth, by way of King William's Town and Bethel. Then they returned to the Cape Colony, picking up their ox-wagon at the Kat River. On their return journey, which took over a year, they visited Bechuanaland, Basutoland, Griqualand West and Little and Great Namaqualand.

They reached Cape Town on 11.5.1840, James sailing for England on 9 December, arriving in London on 15.2.1841.



C. miniata shown in a typical habitat of rocks and rotting vegetation.

In England he kept in touch with the colonies, sent books to Africa, and raised money for Robert Moffat's Tswana translation of the Bible. He published two large octavo volumes on his journeys, A narrative of a visit to the Australian colonies (London, 1843) and A narrative of a visit to the Mauritius and South Africa (London, 1844), which give full accounts of his activities, experiences and observations and include etchings and wood-cuts by his second cousin, Edward Backhouse. Although he writes in his introduction "The descriptions in this volume do not, however, pretend to much scientific nicety; they are rather designed to give, in few words, general ideas of the objects described," his second Narrative (1844) contains countless botanical records. The plants are given their scientific names, with, often, their common names. These notes on trees and shrubs, succulents and bulbous plants in great variety, orchids and many other plants, give a vivid picture of the vegetation of the various regions visited. The etchings illustrating the work include a plate showing the camel-thorn with the nests of weaver birds and community finches, and other depictions of South African plant life.

Backhouse was also interested in South African fauna, various mammals, birds, reptiles and insects being mentioned in his book. His contributions to the knowledge of the flora are based entirely on his own observations as a field botanist. He had an herbarium of Australian, but not, unfortunately, of South African plants. He, however, became the joint author, with W. H. Harvey, botanist and colonial treasurer, of a South African genus of the Iridaceae: Schizostylis. When the widely-distributed type species, *S. coccinea*, with its showy crimson flowers, was first identified and named, it formed part of a batch of plants received from the Backhouse Nurseries at York; the bulbs had originally been collected near rivers such as the Keiskamma, in the eastern Cape, although the name of the collector is unknown. Backhouse collected fungi in 1838 in the Albany Division; in the Cape peninsula he went on several excursions with Harvey. His Narrative is also important from an ethnographical point of view, as it gives detailed information on the way of life and the customs of various tribes, and an eye-witness account of the freeing of the slaves in Hankey.

Continuing his business in York, with his son, James, who was also a gifted naturalist, Backhouse travelled extensively in England on botanical expeditions, and paid three visits to Norway in connection with his religious work. He wrote tracts and short lives of prominent Quaker associates, and published a biography (with Charles Tylor) of his companion in Australia and South Africa: The life and labours of George Washington Walker (London, 1862).

His writings display his sense of humour, genial good nature and practical sense. Backhouse was an agreeable companion, plain of dress, with no pretensions, a strict Quaker in his daily conduct, but tolerant towards all, and one with the marked gift of moving with friendly ease among all conditions of men.

He died 20.1.1869 at his home, Holdgate House, in York.

J.F.W. Bosse and *Clivia miniata* – A question of question marks?

Greig Russell

The author of *Clivia miniata* was generally given as Regel alone, this having been the case from the latter part of the 19th century and onwards for the first three quarters of the 20th century. The reason for this appears to be that some of the earlier descriptions of this species had question marks associated with the given names – and most early taxonomists considered these names to be thus invalid. Prof. Piet Vorster formerly of the Botany Department of the University of Stellenbosch, and a man with a great interest in clivias, addressed this problem in a paper published in 1991 in the SA botanical periodical *Bothalia*. He pointed out that "Clearly *Vallota miniata* is validly published in terms of Art. 34.2 which states that 'a name is validly published when published with such a question mark or other indication of taxonomic doubt, yet published and accepted by the author'". He thus corrected the authorship, saying: "The correct author citation is therefore *Clivia miniata* (Lindley) Regel, based on *Vallota miniata* Lindley."

The International Code of Botanical Nomenclature (Vienna Code of 2006) says the following:

34.1. A name is not validly published

(a) when it is not accepted by the author in the original publication;

(b) when it is merely proposed in anticipation of the future acceptance of the taxon concerned, or of a particular circumscription, position, or rank of the taxon (so-called provisional name), except as provided for in Art. 59;

(c) when it is merely cited as a synonym;

(d) by the mere mention of the subordinate taxa included in the taxon concerned. Art. 34.1(a) does not apply to names published with a question mark or other indication of taxonomic doubt, yet accepted by their author.

52.2. Note 1. The inclusion, with an expression of doubt, of an element in a new taxon, e.g. the citation of a name with a question mark, does not make the name of the new taxon nomenclaturally superfluous.

Aside from Lindley's *Vallota* ? *miniata*, the original material of which can been examined on the website http://pennypoint9.itgo.com/clivia/, Hooker's "*Imantophyllum*? *miniatum*", usually said to contain a question mark, was an illegitimate name (see my 2010 article "*Imatophyllum*? ... Tut-tut, Dr Hooker." – *Clivia* **12**: 5–12.). I have recently discovered that it was not Hooker's intention for that question mark to be printed. See my page on the original material related to this name, as well as the note from Hooker. And then there is Bosse's ?*Clivia miniata* – too many question marks?

Various botanists have accepted this latter name as the first valid transfer of '*miniat-*' to the genus *Clivia*. There is no reason not to accept this name. The ICBN says the following:

33.2. Before 1 January 1953 an indirect reference to a basionym or replaced synonym is sufficient for valid publication of a new combination...

An examination of Bosse's entry regarding this species will readily show that he directly referred to Lindley's basionym *Vallota ? miniata* (this name rendered in full, including the question mark), as well as Hooker's illegitimate *Imantophyllum miniatum* (as "Imatophyll. miniat. *Hook.*"); so we cannot be in any doubt as to which plant he had in mind. Bosse's new combination saw the light five years before Regel published his notes on the species – and thus Bosse has priority.

Bosse may have had his concerns regarding the placement of the species in *Clivia*, but he did it, and did not offer any alternate option in his work; eg. he did not also place it under *Imatophyllum* – the other genus name he published in his work, from which entry he simply referred the reader to the genus *Clivia*, giving no other notes. Rafaël Govaerts of Kew, England, the Prince of Monocot botanical nomenclature, has accepted Bosse as the author of the combination, as "*Clivia miniata* (Lindl.) Bosse", on his World Checklist of Selected Plant Families (WCSP) (based upon my research). In my opinion Rafaël is the premier world authority in his field.









These four photographs show some of the variation which can be observed in *Clivia miniata* in habitat at a single location.

I am quite delighted that we are able to discard the work of Regel; it is just so shoddy and poorly researched that it was never worth much.

Julius Friedrich Wilhelm Bosse (1788–1864) was a German landscape gardener, horticulturist and botanist, who was the Curator of the Ducal Gardens at Oldenburg, Germany. He was of the fourth generation of the Bosse family who had all been deeply involved in German horticulture, his father being the more famous Carl Ferdinand Bosse (1755–1793). In 1807 J.F.W. finished his apprenticeship at the Royal Botanical Gardens in Berlin and then worked in the parks of Potsdam and from 1810 in the Karlsaue in Kassel. From 1812 to 1814 he worked, like his ancestors, in Lütetsburg; and then took care of Oldenburg Castle Gardens of Duke Peter Friedrich Ludwig for 42 years, eventually as curator (Grossherzoglich garten-inspector). J.F.W. Bosse added to the work of his predecessors in designing the palace gardens as 16 acres of garden art in the English style of the early 19th Century [his father having worked in England with the famous Lancelot (Capability) Brown]. This garden is said to look like a walk-in painting.

Bosse's major work was his *Vollständiges Handbuch der Blumengärtnerei, oder genaue Beschreibung fast aller in Deutschland bekannt gewordenen Zierpflanzen, mit Einschluß der Palmen und der vorzüglichsten Sträuche und Bäume, welche zu Lustanlagen benutzt werden, nebst gründlicher Anleitung zu deren Cultur, und einer Einleitung über alle Zweige der Blumengärtnerei.* (which translates as *Complete Guide to the flower garden, or a clear description of almost all known ornamental plants in Germany, with the inclusion of the palms and the principal shrubs and trees, including those plants which serve to delight, along with thorough instructions for their cultivation, and an introduction to all branches of flower gardening.*) ed. 1, 1829, 2 Volumes; ed. 2, 1840–1842, 3 Volumes; ed. 3, 1859–1861, 3 Volumes; Hannover : Hahn'sche Hofbuchhandlung.

I have prepared a translation of the applicable Clivia entry from the 3rd Edition, which was printed in Fraktur Gothic font (which offered me a great learning curve), and this may be downloaded in PDF at http://pennypoint9.itgo.com/clivia/bosse/.

The original pages concerning Clivia and *Imatophyllum* from the 3rd Edition of Bosse's Vollständiges Handbuch der Blumengärtnerei are also available here.

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1856

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Clivia gardenii



Hooker, W.J. (1856). *Clivia gardeni*. Curtis's Botanical Magazine, series III 12: t. 4895.

Clivia gardeni

Major Garden's Clivia

Nat. Ord. AMARYLLIDACEÆ – HEXANDRIA MONOGYNIA

Gen. Char. Perigonium superum, corollaceum, tubuloso-infundibulare, 6-partitum, irregular, deciduum; tubo brevi, tereti; laciniis imbricates; exterioribus lineari-lanceolatis; interioribus paulo longioribus, spathulatis ex his inferiore magis product, apice leviter recurvate, ex illis superiore breviore, convexo-curvata, cæteris rectiusculis. ***Stamina*** sex, summo tubo inserta, decurrentia, erecta; petalina paulo longiora, parum exserta. ***Filamenta*** filiformia. ***Anthera*** oblong, dorso supra basin bifidam affixae, erectæ (versatiles, *Lindl.*). ***Ovarium*** inferum, subovatum, obsolete trigonum, triloculare; ***ovula*** 6–7 in quolibet loculo, angulo interno affixa, biseriata, hemianatropa. ***Columna*** stylina filiformis, teretiuscula, erecta, stamina superans. ***Stigma*** trifidum; laciniis patulo-recurvatis. ***Bacca*** abortu monosperma (sub-6-sperma, Hook.) ***Semen*** adscendens, subgloboso-compressum; testa carnosa, areolata; hilo et chalaza lateralibus, raphe brevi elevata conjunctis. ***Embryo*** axilis, albumine carnoso dimidio brevior, extremitate radiculari hilo parallele contigua infera. – ***Herba*** *acaulis, Capensis.* ***Bulbus*** *imperfectus; fibris fasciculatis, carnosis, tuberoso-incrassatis.* ***Folia*** *crebra, disticha, lorata, rigida, persistentia.* ***Scapus*** *plano-convexus, solidus, apice umbellato-multiflorus.* ***Spatha*** *polyphylla, marcescens.* ***Flores*** *pedicellati,*



In the Ngome forest a distinct form of *C. gardenii* occurs, often bearing yellow and pastel orange flowers.

Previous page: *Clivia gardenii* painted by Barbara Jeppe.



Clivia gardenii type illustration from Curtis's Botanical Magazine, series III 72: t. 4895.



A variety of *C. gardenii* in habitat, showing the diversity of colour and shape of the flowers.

bracteolis linearibus distincti, nutantes, luteo-crocei, apice virescentes. **Semina** *sæpe in fructu germinantia. Kunth.*

CLIVIA *Gardeni*; foliis obtusiuscule acuminates, umbella sub-14-flora, floribus falcato-curvatis, sepalis apice patentibus.

Clearly a species of *Clivia*, Lindl. (Imantophyllum, *Hook.*), and perfectly distinct from the only hitherto known species of this African genus, figured at our Tab. 2856. The leaves are longer, and they taper gradually into an acuminated but not sharp point; the umbel has fewer flowers, but these flowers are twice the size of *C. nobilis*, and more brightly coloured, very much curved or falcate, and the apices of the sepals, instead of being incurved so as to form a very contracted mouth, are spreading, thus forming an infundibuliform corolla. *Clivia nobilis* is an inhabitant of the Albany Tracts, near the Great Fish River, South Africa; *C. Gardeni* was discovered in the Natal Colony by our excellent friend Major Garden, and by him introduced to the Royal Garden of Kew. Treated as a greenhouse plant, it flowers finely in the winter months, and continues for several weeks in blossom.

DESCR. ***Root*** exactly as in *C. nobilis*, of several stout, fleshy ***fibres***. Leaves distichously inserted, numerous, all radical, the bases sheathing; the blade one and a half or two feet long, gradually tapering towards the extremity into a rather blunt point. ***Scape*** erect, very much and ensiformly compressed, flat on one side, slightly rounded (subsemiterete) on the other. ***Bracts*** few, small, membranaceous, among the pedicels. ***Umbel*** of about fourteen flowers. ***Peduncles*** two inches or more long, erect or erecto-patent, curved upwards. ***Flowers*** full two inches long, independent of the ovary, very much falcate or curved downwards, of a dull orange or brick-red colour, gradually passing upwards into yellow, and that again into the green of the upper extremity: their shape is infundibuliform, curved: the ***sepals*** (united only at the base) overlap each other for their whole length, except at the apices, which are patent, and thus give their flower a very different appearance from that of *C. nobilis*. The ***stamens*** are inserted above the base of the perianth, longer than it: the ***filaments*** white, curved: ***anthers*** oblong, yellow. ***Ovary*** subglobose, but three-lobed or angled. ***Style*** longer than the stamen, much inserted beyond the sepals. ***Stigma*** trifid.



C. gardenii on a favoured rocky slope with unripe seeds.



Clivia gardenii Hook. Collect: L.E. Codd. Locality: Ngome Forest. Nat. Herb No: 29814. Artis's No: C. L. No. 718 PNGB. Flowered Bhekintaba. Sept 1965.

Some biographical notes on Robert Jones Garden

Edited and expanded from: Leverton, BJ. 1977. Garden, Robert Jones. In HSRC. Dictionary of South Africa Biography, Volume III. Pretoria: Tafelberg for HSRC.

Garden, Robert Jones (•United Kingdom, c. 1820 – United Kingdom, after 1853), British soldier and artist of whose parentage nothing is known, joined the British Army as an ensign in the 45th Foot Regiment in June 1839. He was promoted to the rank of lieutenant in April 1842 and captain in August 1848 and retired from the army in 1854. G. arrived at Simonstown with his regiment in 1843 and took part in the Seventh Frontier War (1846-47). He marched against Shiloh and for some while served under Major W. Sutton against other chiefs, and was commended for his work.

In 1848 G. came to Natal and for most of his time there was stationed at Pietermaritzburg. With H. F. Fynn he unsuccessfully tried in 1851 to raise a force of Bantu levies in response to an appeal from the Governor of the Cape Colony for assistance on the eastern frontier. In the winter of 1853 he endeavoured with T.W Fannin to find a new way through the Drakensberg for a shorter road to Bloemfontein, but could not find a suitable pass. In that year he was sent on a mission to Pondoland to bring to heel a recalcitrant chief. A heavily built man, Garden possessed little sense of humour. He quarrelled with most of the Natalians, including his own commanding officer, and on this account he was very much disliked in the colony, particularly as he was most critical of the Natal people (both English and Boer emigrants) and of the missionaries, wagon drivers and Bantu. During his sojourn in Natal G. made numerous journeys, both official and private, and with an easy pen recorded most of what he saw and heard, historical, botanical and ethnologic al. On Bantu matters his main informant was H. F. Fynn and the story of the Boer emigrants in Natal he obtained from J. J. Uys.* From the latter he received an account of the battle of Blood River (16.12.1838) and it was G. who drew the first map of the action.

G.'s account of the colony of Natal is preserved with the Garden Collection in the Natal Archives, Pietermaritzburg. His account narrates several excursions inland and along the coast in 1851 and 1852. Among the collection are also sketches and anecdotes of chiefs, and accounts of Bantu tribes (with Whites residing among them) and of Zulu battles. A description of the country and its wild animals as well as reports on Boer immigration are included. Several of G.'s drawings in black and white and his water colour paintings, which show that he was an artist of some merit, are preserved in the Killie Campbell Africana Library, Durban.

In 1853 G. went to Durban to command a detachment of troops there and in November of that year he left for England to retire and publish his writings on Natal, but this was never done.

Editors' note:

John van der Linde, in his piece Four 19th Century Clivia explorers (Clivia 9, pp.20–24) remarked:

As for his Clivia, all that we know is that it was found somewhere in Natal. Annoyingly, he did not record where he found it. We know from army records that he served for a short time in Pondoland, which is swampy Clivia robusta country. Who knows, maybe the plant he found and took to London was a *C. robusta* and not a *C. gardenii*! This piece of information has always piqued me, and I wondered if by perusing the Garden papers and watercolour depictions held at the Killie Campbell Africana Library in Durban I might find something revealing. I have also read in his biographical information in Gunn and Codd that he sent a Wardian case (in effect a miniature glasshouse named for its creator) of living plant material, a novelty for the time, to Kew Gardens. I have, as yet, no clarity on the matter, but amongst the papers (which are typed transcriptions) are letters regarding donations of plant material by collectors. Also, his notes on Pondoland seem more focused on ethnology and ethno-botany, with no mention of plant collecting. This all needs to be further and more thoroughly researched. [RCF]



Yellow *C. gardenii* growing happily on rotting vegetation over a stream in Ngome forest.

1943

Clivia caulescens



Dyer, R.A. (1943) *Clivia caulescens*. *The Flowering Plants of South Africa*, 23: t.891.

Clivia caulescens

Transvaal

AMARYLLIDACEAE

Clivia caulescens *R. A. Dyer*, sp. nov. affinis *C. nobili* Lindl. et *C. Gardeni* Hook. f. ab ilia floribus paucioribus ab hac floribus minoribus ab ambabus caulibus usque ad 45 cm. longis productis differt.

Caules non-nunquam basi ramosi usque ad 30 vel 45 cm. longi, 3-5-4 cm. crassi. ***Folia*** plus minusve 15, disticha, lorata, 30-40 vel usque ad 90 cm. longa, 2-5-5 cm. lata, rigida, demum decidua. ***Scapus*** circiter 30 cm. altus, usque 1-5 latus, compressus, plano-convexus, solidus, apice circiter 15-20-florus. ***Pedicelli*** 1-5-3-5 cm. longi. ***Perigonium*** 3-5 cm. longum, tubo 4-5 mm. longo, segmentis apicem versus leviter recurvatis, segmentis exterioribus usque ad 7 mm. latis elliptico vel spathulato oblongis, segmentis interioribus 1-1-2 cm. latis. ***Stamina*** summo tubo inserta decurrentia, plus minusve periauthio aequilonga. ***Ovarium*** circiter 5 mm. longum; stylus filamentis aequilongus. ***Fructus*** subglobosus, circiter 1-5 cm. diametro.

Description:—***Stems*** sometimes branched from the base up to about 45 cm. tall, 15-5-4 cm. diameter, becoming leafless below with age and transversely ringed by leaf-scars at intervals of 0-5-1-2 cm. distance, with a tuft of about 15 leaves at the apex. ***Leaves*** dark green, lorate, distichous, but the blades spreading somewhat spirally, usually about 30-40 cm. long and 3 cm. broad, but may be up to 90 cm. long and 5 cm. broad, widening very gradually from the base for about 5 its length and thence narrowed gradually to the apex, ultimately withering and falling. ***Peduncle*** compressed, sharply 2-edged, unequally convex on the surfaces, about 30 cm. long, 1-5 cm. broad at the base, narrowed to 1 cm. under the umbel. ***Spathe-valves*** 4, membranous, unequal, more or less lanceolate, 4 cm. long. ***Umbel*** about 15-20-flowered. ***Pedicels*** 1-5-3-5 cm.



A red *C. caulescens* on Mariepskop.

Previous page: *Clivia caulescens* painted by Barbara Jeppe.

long. ***Perianth*** deep salmon, with the lobes green tipped with yellow oil the overlapped margins, 3-5 cm. long, with a tube 4-5 mm. long and lobes slightly spreading at the tips: the outer lobes elliptic to spathulate-oblong, 7 mm. broad; the inner lobes 1-1-2 cm. broad. ***Stamens*** about equalling the perianth-lobes in length, inserted at the throat of the perianth-tube and the base of the filaments projecting over the mouth of the tube and fitting closely round the style. ***Ovary*** about 5 mm. long; style extending about the same distance as the anthers. ***Fruit*** a berry, subglobose about 1-5 cm. in diameter.—R. A. Dyer.

Transvaal: Barberton district; in woods, summit of Saddleback Mtn., 4000-4650 ft., Oct., *Galpin* 1102 ft; Pilgrims Rest district; MacMac, 4500 ft., *Van der Merwe in Nat. Herb.* Pretoria, 26,511 (type); near Graskop, 5000 ft., Nov., Reynolds 3037; Pietersburg district; Politzi, Oct., *Repton*, 311.



C. caulescens at God's Window in the early sun.



Red *C. caulescens* en masse near the summit of Mariepskop (1947 metres).



The Pinnacle at God's Window with *C. caulescens* growing exposed on the top.



A mature *C. caulescens* at God's Window. A misty area as evidenced by the moss.

Clivia caulescens has been under observation for several years without being definitely identified. It has been collected several times in the eastern Transvaal, and plants have flowered in October and November at the Division of Botany and Plant Pathology during the past few years. The specimen figured was collected by Dr. F. Z. van der Merwe at MacMac near the margin of forest, usually with its roots in leaf-mould. When the species was first studied there was some doubt as to the justification of separating it specifically from *C. nobilis* Lindl. and *C. Gardeni* Hook. f. Both these are stemless plants; the type specimen of the former, from the eastern Cape Province, is characterised by a dense umbel of comparatively small flowers; while the latter, from Natal, has fewer and larger flowers. Baker, in Flora Capensis 6, 228 (1896–1897), included in *C. nobilis* plants from Natal and Transvaal. Whether the Natal plants are correctly placed is open to doubt, and the specimen, *Galpin* 1102 from Barberton cited by Baker, is here referred to *C. caulescens*. Galpin collected the flowering material in October 1890 and stated on the label "Stem 12–18 inches".

C. nobilis and *C. Gardeni* were illustrated under figures t.2856 and t.4895 of Curtis's Botanical Magazine, in 1828 and 1856 respectively. Our plant is intermediate in the number and size of flowers between these, and differs from both in the produc-



Red *C. caulescens* on Mariepskop.

tion of a stem up to 45 cm. long, which is considered sufficient justification for specific separation.

Besides the above-mentioned species there is only one other described, namely *C. miniata* Regel, illustrations of which are to be found on t.4783 of Curtis's Bot. Mag. and Plate 13 of this work and variety *flava* on Plate 411. The flowers are large and attractive.

Clivia miniata and *C. nobilis* were used in artificial hybridisation work soon after the discovery of the former about 1854, and the number of hybrids and segregates in cultivation to-day is very high. Prominence to *Clivia* hybrids has been given in several horticultural works, notably in Herbertia, the Journal of the American Amaryllis Society.



C. caulescens at God's Window with a stem nearly two metres long. Many plants at this locality grow on top of large rocks which are covered in moss.



Clivia caulescens drawn and painted by ME Connell.

Biographical notes

Compiled from: Glen, H. F. & Germishuizen, G. (Compilers). 2010. Botanical explorations of southern Africa. Edition 2. *Strelitzia* 26. Pretoria: SANBI.

Frederick Ziervogel van der Merwe

Frederick Ziervogel van der Merwe (1894-1968) born in Stellenbosch, died in Claremont, Cape Town. Various medical qualifications from Trinity College, Dublin, Liverpool University and the University of the Witwatersrand. He travelled South Africa widely as Medical Inspector of Schools, which lent opportunity for him to pursue his botanical interests, particularly in Aloe and Merwilla (then Scilla), of which he described a number of new species.

(Glen & Germishuizen, 2010: 431).

Ernest Edward Galpin

Ernest Edward Galpin (1858 12 06 – 1941 10 16) born in Grahamstown, died in Mosdene near Naboomspruit, Limpopo Province (then Transvaal). He was a banker by profession and botanised as a pastime. In 1888, after meeting with and encouraged by GF Scott Elliot, on visit to South Africa, and William Tyson in the eastern Cape, he started a private herbarium. When in 1889, after a brief period in Johannesburg, he was appointed bank manager in Barberton he was fascinated with the little-known flora of this region and made carefully preserved and meticulously labeled specimens with several duplicates, these distributed to Kew, Bolus, Medley Wood, MacOwan and Zurich, these novelties soon making an international impact. Here he met DF Gilfillan, to become his brother-in-law, through their marriage to the two sisters, he to Marie Elizabeth de Jong, who was fond of the outdoors and shared his botanical interests, accompanying him on most of his expeditions and painting some of the flowers he had discovered. In 1892 he was transferred to Queenstown where he spent the next twenty-five years. In 1916 he donated his herbarium, comprising some 16 000 sheets, to the National Herbarium in Pretoria, and when, in 1921, they were housed in a new building opened by General Jan Smuts, he described Galpin as 'the Prince of Collectors'. In 1917 he retired to Naboomspruit and resumed botanizing in earnest, assisted by his wife until her heart attack on one of their trips to the eastern Transvaal, and subsequent death in Durban in 1933, and then his son, EA Galpin.

(Glen & Germishuizen, 2010: 181–184).

Dr Robert Allen Dyer

Dr Robert Allen Dyer, who described *Clivia caulescens* as set out above, collected by Dr FZ van der Merwe from the MacMac forest margin, was born on 21 September 1900 in Pietermaritzburg. Here he did both his schooling and completed his university education, obtaining his DSc in 1937 for a botanical survey of the Grahamstown and Bathurst district, of interest to us as the habitat of the *Clivia nobilis*.

He started employ in the sugar-fields of Zululand where he contracted malaria. In 1925 he was appointed to the Albany Museum Herbarium in Grahamstown, where he spent six productive years, including his field-work on the succulent *Euphorbiae*.

From 1931 to 1934 he was South African Liaison Officer at the Royal Botanic Gardens, Kew. On his return to South Africa he was posted to the National Herbarium, Pretoria, where, in 1944, he became Chief of the Division of Botany. He agitated for better facilities, resulting in the new headquarters building in the Botanic Gardens built in the 1970s. He was responsible for founding the National Botanical Gardens in Pretoria.

He retired in 1963, but remained active in the world of Botany, being awarded the South African Association of Botanists first gold medal in 1971, as the "doyen of South African botanists".

Some interesting aspects of his personality emerge in the Obituary prepared for *Veld & Flora* (March 1988, pages 31–2, on which this article is based) by P. Vorster of the department of Botany, University of Stellenbosch. Besides his many publications, he was instrumental in obtaining subscription for those by others, including W. Reynold's *The aloes of South Africa*, and Cynthna Letty's *Wild flowers of the Transvaal*, in which the *Cliva caulescens* is illustrated, as well as Auriol Batten's *Flowers of southern Africa*, which has the *Clivia miniata* illustrated. He was tenacious when the occasion demanded it. He insisted being included as second author to Alain White in exchange for his own research towards the monograph *The succulent Euphorbiae*.

As a person he was a patriotic South African, which created difficulties during the Second World War, as his staff held widely divergent political views. His wit showed when he named *Encephalartos cupidus* as record of the removal to his own premises by the collector of the almost entire known population, hence recording for posterity "a passionate desire to the extent of greed or lust".

He was a photographer, gardener – priding himself on his production of artichokes and African Marigolds, of which he hybridised the biggest and most spectacular in Pretoria – collected the mown grass from the Botanic Gardens as bedding for his fowls, and tested many untried fruits as jellies.

While not a collector of earthly goods, he had a fondness and respect for books. He died in Pretoria on 25 October 1987.

(Glen & Germishuizen, 2010: 160–161).

2002

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Clivia mirabilis



Rourke, J.P. (2002). Clivia mirabilis (Amaryllidaceae: Haemantheae) a new species from Northern Cape, South Africa Bothalia 32: 1–7

Clivia mirabilis (Amaryllidaceae: Haemantheae)

a new species from Northern Cape, South Africa

J.P. ROURKE*

Keywords: Amaryllidaceae, arid Mediterranean climate, *Clivia* Lindl., new species, Northern Cape

Abstract

Clivia mirabilis Rourke is a new pendulous tubular-flowered species from Oorlogskloof Nature Reserve in Northern Cape. Its distribution area is some 800 km outside the Previously accepted range of the genus *Clivia*. This sun-tolerant species is adapted to an arid Mediterranean climate, producing vegetative growth in winter and maturing its seeds rapidly in late summer/early autumn to synchronize with the arrival of winter rains.

Introduction

The genus *Clivia* Lindl., consisting of four currently recognized species, *C. nobilis* Lindl. (1828), C. miniata (Lindl.) Regel, *C. gardenii* Hook. (1856) and *C. caulescens* R.A.Dyer (1943), is presently considered to be endemic to southern Africa (Vorster & Smith 1994; Snijman 2000). These species occur in coastal and inland Afromontane forest from Eastern Cape through KwaZulu-Natal, Swaziland and Mpumalanga to the Soutpansberg in Northern Province. Rumours of the occurrence of *Clivia* in Mozambique have not yet been confirmed by accurately localized herbarium collections.

Left: *Clivia mirabilis* painted by Leigh Voigt.

Clivia is an evergreen, rhizomatous genus in the Amaryllidaceae, characterized by distichous strap-shaped leaves, umbellate solid scapes and red subglobose berries containing one to few cartilaginous, pearly-white seeds embedded in soft yellow pulp.

In February 2001 material of a further species was submitted to the Compton Herbarium for identification in a batch of herbarium specimens from the Oorlogskloof Nature Reserve near Nieuwoudtville, in Northern Cape, collected by the nature conservation officer in charge, Mr Wessel Pretorius. The author confirmed this astonishing discovery during a site visit to Oorlogskloof on 22 February 2001 when two fruiting populations were examined. The new species is here described as *Clivia mirabilis*. Rarely can such an extravagant epithet as mirabilis be confidently applied, yet in the case of this extraordinary *Clivia*, so unusual in its distribution and characters, its usage seems entirely appropriate.

Clivia mirabilis *Rourke*, sp. nov., a speciebus affinibus, corollis actinomorphis rectis tubularibtis bicol-oribus (miniatis/luteis); pedicellis cernuis, 22–40 mm longis, miniatis per anthesin (demum viridibus post anthesin); foliis lineamentis medianis albis et apicibus acutis, distinguitur.



A lone *C. mirabilis* greets you immediately below the escarpment as you enter Oorlogskloof, growing between Peninsula Formation Sandstone boulders. These plants grow where the scree is kept moist by underground seeps or springs.

Rhizoma perenne solitarium, erectum; caespite foliorum 0.6–1.2 m alto. ***Folia*** disticha, rigida, erecta, 0.6–1.2 m longa, 30–50 mm lata, glabra, coriacea, lineamentis medianis albis; margines cartilagineae, plerumque laeves, interdum leviter scabra; apices acuti. ***Scapus*** 300–800 mm longus, carmineus, late ancipitius. ***Inflorescentia*** umbellata, 20–48 floribus; spathae 5–7, cymbiformi-acutae, papyraceae, 35–50 mm longae, 10–15 mm latae. ***Pedicelli*** cernui, graciles, 25^40 mm longi, miniati per anthesin, abrupte viridescentes post anthesin. ***Perianthium*** rectum, tubulosum, 35–50 mm longum, dilatatum versus orem; miniatum sed viride ad apicem per anthesin, tandem flavescens distale. ***Antherae*** 6, basifixae, leviter exsertae; filamenta 30 mm longa, basaliter adpressa circa stylum. ***Stylus*** 40–45 mm longus, trilobatus; apices subtiliter penicillati. ***Ovarium*** ovoideum, nitidum, miniatum per anthesin; viride post anthesin; loculi 3–4 ovulati. ***Baccae*** pendentes, irregulariter ovoideae, glebulosae; (l)2–5(–7) semina continentes, pericarpium maturum scarlatinum. ***Semina*** irregulariter ovoidea, ±10 mm in diam., alba.

TYPE.—Northern Cape, 3119 (Calvinia): Nieuwoudtville, Oorlogskloof Nature Reserve, eastern margin of Oorlogskloof Canyon at Agterstevlei Farm, (–AC), ± 900 m, 18–10–2001, *J.P. Rourke 2220* (NBG, hole; BOL, K, MO, NSW, PRE, iso.).

Stout, rhizomatous, solitary, evergreen perennial, 0.6–1.2 m tall; stem reduced to a vertical rhizome, up to 250 mm long terminating in a tuft of leaves. ***Root system*** massive, up to 0.7 m diam., horizontally spreading; roots perennial, very stout, fleshy, up to 20 mm diam., outer surface covered in a corky, velamen-like layer. ***Leaf sheath*** prominent, flushed deep carmine (RHS 183A greyed-purple). ***Leaves*** long-lived, stiffly erect, distichous, strap-shaped, 0.6–1.2 m long, 30–50 mm wide, flattened to slightly V-shaped with a distinct pale whitish grey striation in the midrib area on upper surface, striation becoming less distinct in older leaves, coriaceous, glabrous, deep dull green, flushed carmine-maroon at base, apex obtuse-acute; margins entire, cartilaginous, usually smooth, occasionally irregularly scabrous, becoming slightly revolute in old, mature leaves. ***Scape*** 300–800 mm long, broadly ancipitous, longitudinally ridged, 10–14 mm wide, glabrous, carmine-flushed. ***Inflorescence*** umbel-like, 20–48-flowered, subtended by 5–7 brownish/carmine, papyraceous spathe valves, narrowly cymbiform-acute, 35–50 × 10–15 mm; pedicels drooping, slender, 25–40 × 1.2 mm, orange-red, abruptly turning green in post-pollination phase. ***Perianth*** straight to imperceptibly curved, tubular, becoming progressively flared towards apex, 35–50 × 5 mm below ovary, 10–12 mm diam. at mouth, orange-red (RHS 32B) proximally, green-tipped (RHS 145A) distally on opening, the green changing to yellow (RHS 22B) distally, entire perianth becoming deep orange-red (RHS 33A) after anthesis; tepals fused distally to form a tube 10–15 mm long, outer tepals narrowly oblong, apices acute, inner tepals slight-ly wider, apices obtuse, outwardly flared. ***Stamens*** 6, dorsifixed, 2 mm long, very slightly exserted at anthesis; filaments 30 mm long, attached to tepals 10 mm above ovary; inwardly bowed proximally, adpressed around style at point of attachment forming a 10 mm long nectar well above ovary. ***Ovary*** ovoid, shiny, greenish yellow in bud, becoming orange-red at anthesis, changing to bright green in post-pollination phase; ovules 3 or 4 in each locule; style 40–45 mm long, terete, glabrous, tapering distally, included



A variety of colours and forms found over three *C. mirabilis* sites. In general, the more sun they get, the redder they are.

at anthesis, later elongating and becoming exserted 5–8 mm in post-pollination phase; stigma trilobed, lobes 0.4–1.0 mm long, penicillate at apex. ***Fruiting heads*** with 25–35 pendent berries. ***Berries*** irregularly oblong to ovoid, 10–30 × 10–15 mm, glebulose to submoniliform, often narrowed to a distinct neck above pedicel, apex often tapering to an eccentrically angled beak, containing (1)2–4(–7) gongyloid seeds projecting prominently and irregularly through thin pericarp; pericarp glossy, pale apple green, maturing through yellow, orange to pinkish red; mature berries red (RHS 40B eventually becoming RHS 45B). ***Seeds*** somewhat ovoid, slightly faceted, ± 10 mm diam., pearly white; embryo green. (Colour references according to Royal Horticultural Society colour chart.) Figure 1; Plates 1&2.

Diagnostic characters

Clivia mirabilis is distinguished by its straight, actinomorphic, bicolored (orange/yellow) tubular corolla, long drooping pedicels, 25–40 mm long, that are orange-red at anthesis and green when fruiting; the distinctive single median white striation on the upper surface of the leaves with smooth cartilaginous margins; and irregularly shaped glebulose-gongyloid berries. The basal part of the leaves forming the leaf sheath is flushed a deep carmine maroon, unlike any other *Clivia* except *C. nobilis*, which occasionally produces similarly coloured leaf bases. The orange-red coloration of the pedicels in this species during anthesis is a unique character in the genus *Clivia*.

Distribution and habitat

Apparently confined to the Oorlogskloof Nature Reserve in Northern Cape (Figure 2), *Clivia mirabilis* is restricted to a small area on the eastern margin of the Oorlogskloof Canyon. Populations are known to occur just north of Eland se Kliphuis adjacent to Agterstevlei Farm and a little further south around the Driefontein Waterfall. The distance between these sites is ± 5 km. The species also occurs at a few sites between these two localities.

The margins of the Oorlogskloof Canyon are capped with 30 m cliffs of Peninsula Formation Sandstone. This has eroded to form coarse sandstone talus screes below the cliffs that are partly covered in a light woodland of relictual Afromontane evergreen forest elements, principally *Olea europaea* subsp. africana, *Maytenus acuminata*, *M. oleoides*, *Cassine schinoides*, *Halleria lucida* and *Podocarpus elongatus* with additional shade provided by outsize, (4 m tall) specimens of *Phylica oleaefolia*. Small groups of *C. mirabilis* grow rooted in humus between cracks in the sandstone talus of the rock scree, either as solitary individuals or in small groups. Occasionally some clumps occur in full sun but these tend to have shorter leaves and often show signs of water stress (dried leaf tips). However, the remaining leaves show no signs of sunburn, despite the intense insolation experienced for several months each year. The main population extends over several hectares and probably consists of well over 1 000 individuals. Due to the position of these two sites under the eastern cliffs of Oorlogskloof Canyon, most plants experience shade until about mid-morning after which they are in direct sun.

The area is characterized by a semi-arid Mediterranean climate with a strictly

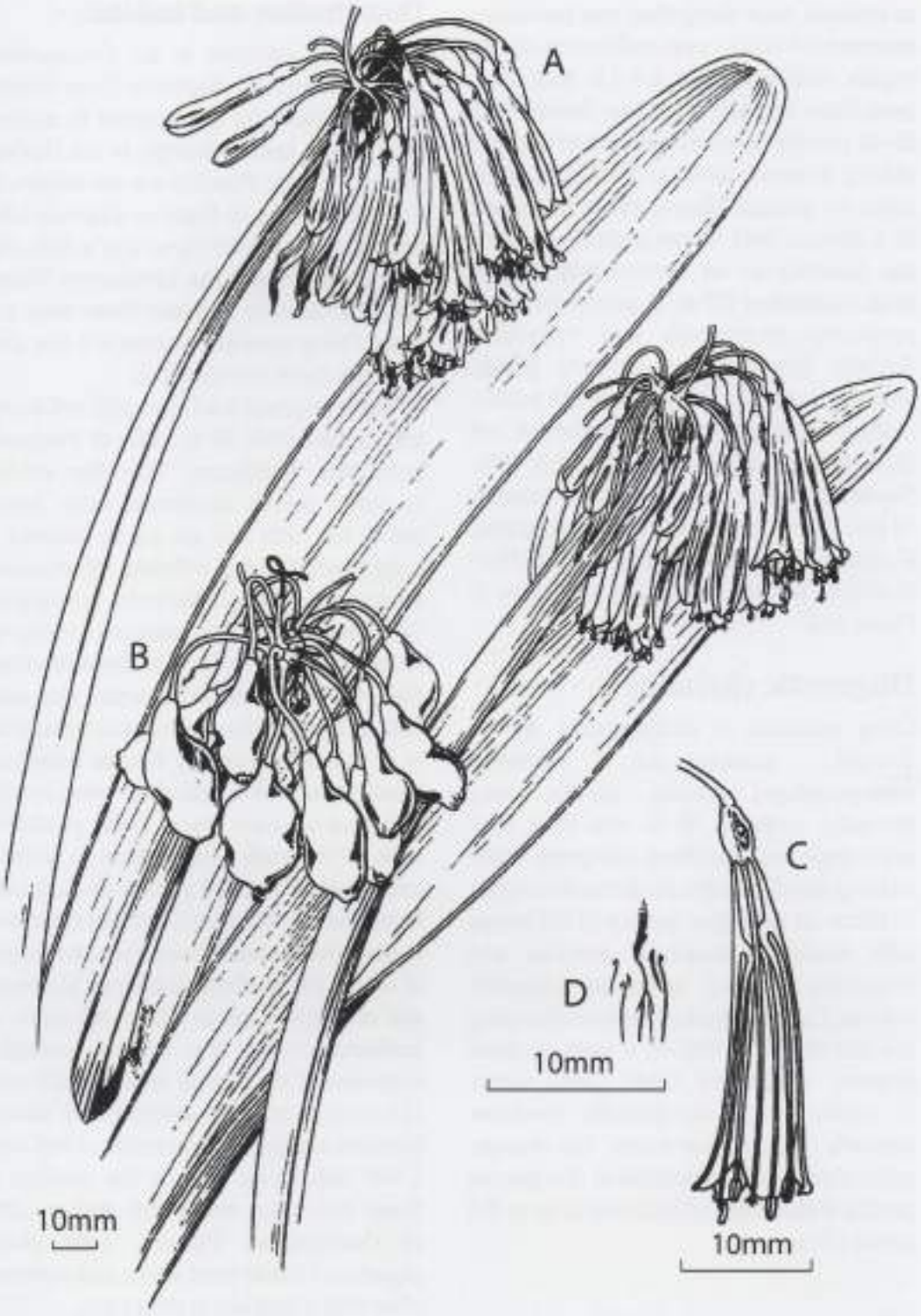


FIGURE 1. *Clivia mirabilis*: A, mature inflorescence; B, fruiting head with irregularly shaped berries; C, longitudinal section through flower; note filament bases adpressed to style forming nectar reservoir; D, detail of filament bases. Scale bars: 10 mm. Artist: John Manning.

winter rainfall regime— exactly the opposite climatic conditions experienced by the other four species in this genus. The mean annual rainfall for Oorlogskloof is 414 mm, falling mainly between May and September. Vegetative growth is thus restricted to a brief winter growing period. Situated at 850–900 m, some 100 km inland from the coast, these populations are subject to brief but light frost in winter.

Morphology and biology

Root system

On excavating several plants in the habitat for cultivation at Kirstenbosch, the enormous root system characteristic of this species was revealed. Large adult plants have a mass of fleshy, succulent roots radiating between ½–¾ m from the base of the rhizome, each root ± 20 mm in diameter. This disproportionally large volume of subterranean biomass gives mature plants an extensive water storage capacity, allowing them to survive the prolonged rainless summers of the Oorlogskloof environment.

Flower colour, development and pollination

The general impression of a fully open scape is of bicoloured, perianths, orange-red at the base, yellow towards the mouth and with orange-red pedicels. During the development of the flower, both perianth and ovary progress through a series of well-marked colour changes. The unopened bud is yellowish, but prominently green-tipped, and the ovary is also pale green. At anthe-







More examples of the variety of colours and forms found over three *C. mirabilis* sites.

sis the green coloration slowly disappears from the tips of the tepals which take on the same yellow tones as the basal half of the perianth. The pedicels and upper half of the perianth are deep orange-red at this stage. After pollination the yellow coloration disappears and the whole perianth and ovary take on a uniform orange/red colour. As the perianth begins to wither, the ovary swells and undergoes an abrupt colour change from orange to bright green, as do the pedicels. No other Clivia has pedicels the same colour as the perianth when the flower is fully open. The pedicels abruptly change to green as the perianth abscisses and the ovary swells in the post-pollination phase.

The purpose of these colour changes is not yet understood, but is probably related to pollinator cues. Pollination appears to be by sunbirds. A single sighting of a malachite sunbird probing the perianths was made at Oorlogskloof in October 2001 suggesting that sunbirds could be involved in pollen transfer. However, like the other three tubular-flowered species, C mirabilis may also be a selfer as between 80 and 90% of the flowers in each umbel are pollinated and produce viable berries. Flowering time: ± six weeks, from October to mid-November.

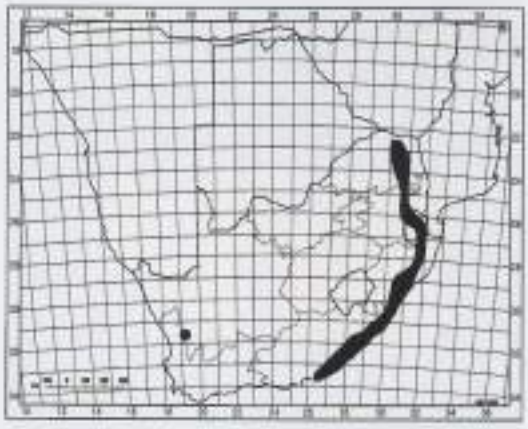


FIGURE 2. Distribution of *C. mirabilis*, •, in relation to the distribution of the remainder of the genus *Clivia* (black shaded area).

Fruiting

The berries mature more rapidly than in the other *Clivia* species. By the end of February, four months after flowering, the fully developed berries turn from yellow and orange to pinkish and later red by the end of March and are shed shortly thereafter prior to the onset of the first winter rains in April/May. This rapid autumn maturation of berries is in sharp contrast to the summer rainfall area clivias which mature slowly, usually 12 months for *C. miniata* and *C. gardenii*, about nine months for *C. caulescens* and *C. nobilis* (Duncan 1999) to coincide with the commencement of October/November summer rains.

Seed dispersal and germination

Berries commence falling from late February to early April. Germination appears to be rapid in response to the onset of autumn/early winter rains. At Kirstenbosch seeds sowed on 18 March 2001 had already developed a 10 mm radicle by 10 April 2001.

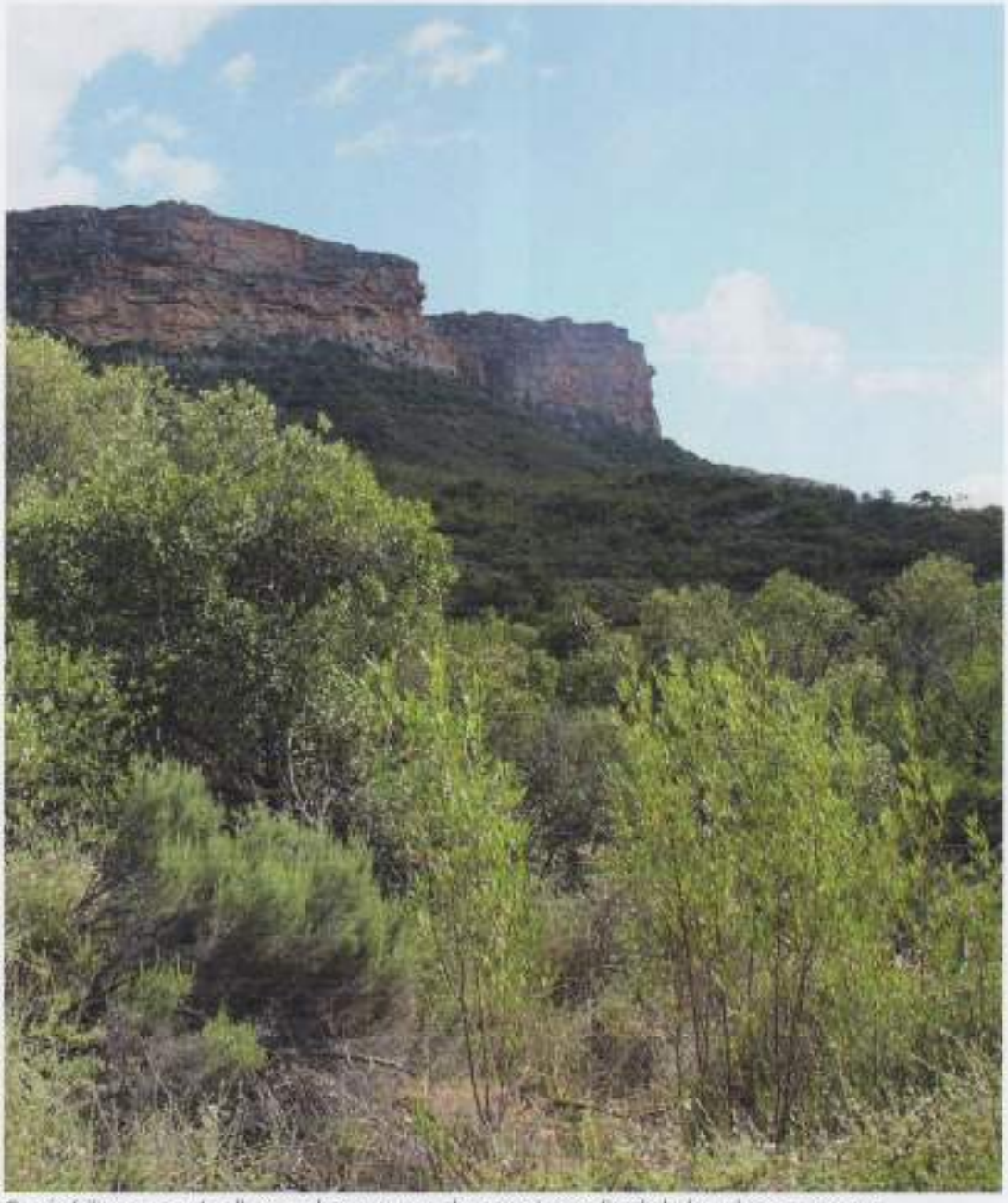
On germinating, the primary root develops into a swollen, white, succulent cylinder up to 50 × 5–6 mm. During the moist winter months (May–September), it swells, accumulating water in its succulent tissue. By October, two short (5–10 mm long) leaves have been produced, whereafter further vegetative growth of the seedling slows or largely ceases with the onset of summer dormancy (November–April). During the rainless phase of ± six months the seedling survives on water reserves stored in the greatly enlarged primary root. Vegetative growth commences again in autumn. Thus the biology of a *C. mirabilis* seedling in its first year is much akin to a winter rainfall area geophyte with the swollen primary root being functionally equivalent to a corm or bulb.



Plate 1. *Clivia mirabilis*, A, inflorescence in habitat showing orange/red pedicels; B, plants in habitat between Peninsula Formation Sandstone boulders; C, leaves showing prominent median white stripe on upper surface and variation in dimensions. D, E, fruiting head; D, immature berries; E, mature berries; F, seedlings five months after germination, note large radicle and prominent carmine pigmentation on cotyledon and at base of first pair of leaves. Photo: C. Paterson-Jones.

The phenology of the germinating seed described above is clearly an adaptation to a semi-arid Mediterranean climatic regime—exactly the reverse of the summer rainfall region *Clivia* species.

Within a few months of germinating, the plumular bud (cotyledon plus first true leaf) (Boyd 1932), becomes densely pigmented with anthocyanins (Plate IF). This prominent development of anthocyanins at the base of the leaves is later evident in the leaf sheaths of adult plants which are heavily suffused with purple-carmine pigments. Why the seedlings of *C.*



C. mirabilis country. In all cases they grow on the areas immediately below the escarpment.

mirabilis are so densely pigmented with anthocyanins is not clear, but it may be a response to the intense levels of sunlight experienced in the natural habitat, thereby providing effective screening during the seedlings' critical establishment phase.

Relationships

The distribution ranges of all four previously known *Clivia* species are contiguous or overlap, while at many localities different pairs of species occur sympatrically, *C. nobilis* with *C. miniata*, *C. gardenii* with *C. miniata*, and *C. caulescens* with *C. miniata*. Geographically, populations of *C. nobilis* in Eastern Cape, though more than 800 km distant, are the closest spatially to *C. mirabilis*. *C nobilis* also appears to be the closest relative to *C. mirabilis* on morphological grounds: tough stiffly erect coriaceous leaves with a median pale striation on the upper surface (some populations of *C. nobilis* occasionally have a faint median striation), and the small seeds.

Phytogeographic implications

Palynological evidence indicates that in Western Cape and southern Namaqualand, subtropical forests were present during Miocene and Pliocene times (± 5.3 million years BP) (Scott *et al.* 1997). Since then, apart from more recent cyclical changes in the Quaternary, there has been a progressive eastward retreat of these forest elements. Assuming that the genus *Clivia* has not changed its dependence on a forest environment significantly since pre-Quaternary times, it can be argued that the Nieuwoudtville species is relictual and that its survival in the Oorlogskloof Canyon is partly fortuitous and partly due to its adaptation to a different climate. The berry maturation period, seedling and germination biology are so perfectly in harmony with an arid Mediterranean climatic regime that *Clivia mirabilis* is able to survive environmental conditions inimical to all other *Clivia* species.

It is currently believed that the late Miocene also saw the development of a Mediterranean climate in the western part of the Cape (Axelrod & Raven 1978). This would have interrupted the further spread of an essentially summer rainfall genus like Clivia into the forests of the southern and western part of the Cape. It would also have left the precursors of *Clivia mirabilis* to adapt to increasing aridification and the onset of a pronounced Mediterranean type climate. Thus if *C. mirabilis* evolved from forms with an essentially summer rainfall phenology, the adaptation to an arid Mediterranean type climate is a derived condition dating from late Miocene times.

Long distance dispersal should also be considered as a possible explanation for this bizarre distribution pattern, but this



Typical habitat showing some offsets but mostly seedlings where they have been caught by the existing clump as they roll downhill.



Plate 2. *Clivia mirabilis*, × 0.75, showing flowering and fruiting scapes against a background depicting Oorlogskloof Canyon. A fully open inflorescence on left shows the red/yellow colour pattern. A younger inflorescence with green tipped perianths is on its right. From the type collection, *Rourke* 2220. Artist: Auriol Batten.

seems highly unlikely as no living vectors for the long-distance dispersal of *Clivia* seed have yet been identified nor has biotic dispersal been recorded for any other species of Amaryllidaceae (Meerow & Snijman 1998). Birds are probably the main seed dispersal vectors. *Clivia miniata*, *C. gardenii* and *C. caulescens* have all been observed by the author growing epiphytically in forest trees, five or more metres above ground level. It is probable that frugivorous birds deposited seeds in these positions, leading one to postulate that forest dwelling birds are responsible for the dispersal of large scarlet *Clivia* berries. While the dispersal of *Clivia* seed by birds between closely adjacent forest patches is a strong possibility, dispersal over distances of 800 km of arid country seems highly unlikely.

Conservation status

No populations are known outside the Oorlogskloof Nature Reserve where the species currently enjoys maximum protection. Yet there is no reason why *C. mirabilis* should not occur further down the Oorlogskloof Canyon, outside the reserve, as numerous suitable habitats occur there. If this proves to be the case, special efforts will have to be made to protect these populations as the species' horticultural potential will render it vulnerable to exploitation.

Other material examined

NORTHERN CAPE.—3119 (Calvinia): Oorlogskloof Nature Reserve, (–AC), 10–11–2000, *W. Pretorius 651* (NBG).

Acknowledgements

I am most grateful to the Northern Cape Department of Nature and Environmental Conservation for granting permission to collect the type material of this species; also to Wessel Pretorius, officer in charge of the Oorlogskloof Nature Reserve for his generous assistance in the field. Colin Paterson Jones patiently photographed various stages in the life history of C. mirabilis and John Manning skilfully prepared the line drawings reproduced here. Dee Snijman and John Manning provided critical comments on early drafts of the manuscript. I thank all of them for their invaluable assistance.

Auriol Batten's fine painting of *C. mirabilis* was prepared from the type material. I am especially grateful to her for loaning this plate to the National Botanical Institute for reproduction in this paper.

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2004

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Clivia robusta



Murray B.G. et. al. (2004). A new species of Clivia (Amaryllidaceae) endemic to the Pondoland Centre of Endemism, South Africa Botanical Journal of the Linnean Society, , 146, 369-374.

A new species of *Clivia* (Amaryllidaceae)

endemic to the Pondoland Centre of Endemism, South Africa

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Clivia robusta B.G. Murray, Ran, de Lange, Hammett, Truter et Swanevelder **sp. nov.** (Amaryllidaceae) is a tabular, pendulous-flowered *Clivia* species, restricted to the Pondoland Centre of Endemism, South Africa. The unique morphology, distribution, karyotype and molecular fingerprint distinguish it from all other pendulous-flowered species in the genus. © 2004 The Linnean Society of London, *Botanical Journal of the linnean Society*, 2004, 146, 369–374.

ADDITIONAL KEYWORDS: *Clivia gardenii* – Haemantheae – taxonomy.

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Left: *Clivia robusta* painted by Claire Smith. This painting originally appeared as *Clivia nobilis* in Flowering Plants of Africa, Vol 53. Page 74. Plate 2094.

Introduction

Clivia Lindl. (Amaryllidaceae), with five described species, falls within the African tribe Haemantheae (Meerow *et al.*, 1999; Rourke, 2002a). It is indigenous to South Africa and Swaziland and forms part of the southern Africa centre of diversity for the family Amaryllidaceae (Meerow & Snijman, 1998; Snijman, 2000).

This perennial genus is well known for growing in diverse habitats ranging from coastal forest and secondary coastal dunes, to swamps, riverbanks and rock screes; specimens are even reported to grow as epiphytes in some localities. The genus generally favours cool, shaded, well-drained habitats with the exception of *C. mirabilis* Rourke, which is found in a semi-arid area with a Mediterranean climate. The genus is linked directly to the inland and coastal Afromontane forests of southern Africa, with *C mirabilis* found in relictual evergreen Afromontane forest elements in the south-western corner of the Northern Cape province, South Africa (Duncan,

1999; Winter, 2000; Rourke, 2002a, b).

In July 1960, W. L. Chiazzari deposited specimens of an unidentified *Clivia* species at the National Botanical Institute (Pretoria) (FSB 37066 and PRE 37058). These specimens were later identified as *C. gardenii* Hook., with the differences in morphology attributed to natural variation. Subsequently, chromosome and DNA sequence analysis by Ran and coworkers (Ran, Murray & Hammett, 1999, 2001; Ran, Hammett & Murray, 2001a, b), carried out to establish relationships between and within species, further showed that plants identical to Chiazzari's specimens and known in horticulture as the 'robust form' of *C gardenii*, 'Swamp Forest *Clivia*' or 'Robust *gardenii*' (Hammett, 2002) had a distinct karyotype and unique DNA marker pattern. The chromosome studies used Giemsa C-banding, fluorochrome banding with DAPI (4'–6-diamidino-2-phenylindole) and CMA (chromomycin A3), which preferentially bind to AT- or GC-rich regions of the genome, respectively, and the location by fluorescent *in situ* hybridization (FISH) of the 45S and 5S rRNA genes to identify the chromosomes of the complements.

Little intraspecific karyotype variation was observed and all the described species plus 'Robust *gardenii*' could be identified on the basis of their karyotypes (Ran *et al.*, 1999, 2001b). Two different approaches were used to investigate the phylogeny of the group. DNA sequences from the nontranscribed spacer between the nuclear 5S rRNA genes and the internal transcribed spacer of the 45S rRNA genes and the RAPD (random amplified polymorphic DNA) profiles were used to construct phylogenetic trees. In all cases 'Robust *gardenii*' was sister to *C. gardenii* and *C. miniata* Regel (Ran *et al.*, 2001; Ran *et al.* 2001b). Further investigation indicated that these plants have a distinct morphology, but appear to be closely related to *C. gardenii*. In tandem with the unique karyotype and DNA profiles, the morphological characters amply distinguish these plants from *C. gardenii* and all other known *Clivia* species. We therefore recognize these plants herein as a distinct taxon at the rank of species.

Material and methods

Plants of 'Robust *gardenii*' were grown outdoors in Auckland, New Zealand from seed collected from seven localities in the Pondoland Centre of Endemism, Transkei, South Africa. The localities were: (1) Nkambati Nature Reserve, subsequently cultivated at Kirstenbosch Botanic Garden, Professor Kobus Eloff (133/86); (2) near Lusikisiki at the Fraser Falls, S. Venter (885); (3) swamp at Mkambati, M. Dower (8988); (4) Lambasi Village, KRW Hammett, J. Winter & J.P. Rourke (81141); (5) Dimfi, between Ndindindi and Mkambati River mouth, KRW Hammett, J. Winter & J.P. Rourke (8144); (6) Umtamvuna Nature Reserve, KRW Hammett, J. Winter & J.P. Rourke (81147); (7) cultivated material ex. A. McLeman.

Right: Figures 1–6. Fig. 1. *Clivia robusta* sp. nov. growing at Kirstenbosch Botanic Garden, South Africa to show plant size. Fig. 2. Inflorescence of *C. robusta*. Fig. 3. Leaf apices of (left to right) *C. nobilis*, *C. miniata* (narrow leaved variant), *C. miniata* (broad leaved variant), *C. gardenii*, *C. robusta* and *C. caulescens*. Fig. 4. Single flower of *C. robusta* (centre) with flowers from four different accessions of *C. gardenii*, two on each side, showing the clear difference in stamen exsertion between the two species. Fig. 5. *C. robusta* growing at Umtamvuna showing stilt roots. Fig. 6. *C. robusta* growing in water at Lambasi.

[Anne-Lise Fourie of SANBI is thanked for her assistance in obtaining these illustrations – Eds.]


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Material from natural populations was collected in accordance with the rules and regulations of the particular provinces and with permits from Ezemvelo KwaZulu-Natal Wildlife, South Africa (permits, 27110/2001, 30443/2002 and 966/2003) and Department of Economic Affairs, Environment and Tourism, Province of the Eastern Cape, South Africa (General Permit 01/07/2001). Seeds and plants in South Africa were grown outdoors and under shade netting.

In addition to field observations, we supplemented our knowledge about the environment, habitat and natural populations of 'Robust *gardenii*' through correspondence with *Clivia* enthusiasts familiar with the species. Data supplied by these individuals were verified by comparison with available herbarium records.

Measurements of morphological features were made from random samples selected in the different populations and compared with observations made by the enthusiasts. These are given as ranges with outlier values given in brackets. Observations and measurements from live plants were made from cultivated material grown from seed collected from throughout the distribution range of the species.

Description of new species

CLIVIA ROBUSTA B. G. MURRAY, RAN, DE LANGE, HAMMETT, TRUTER & SWANEVELDER **SP. NOV.**

Diagnosis: *Clivia gardenii* Hook, affinis sed qua habitu robustiore majoribus, apicibus foliorum apiculatis, staminibus et pistillis inclusis, habitatione silva palustri anteferenti, et ab omnibus aliis speciebus generis Clivia karyotypo chromosomatum et ordinationibus DNA indicibus differt.

Holotype: [South Africa]: Eastern Cape, Transkei, Port St. Johns, Mt. Sullivan (Topo. Ref. 3128 UMTATA 1:250 000): southern flanks of mountain, growing in wet seepage on ledge against cliff face, roots in humus and leaf mould, 100–200 m, I.i.2001, J.T. Truter 4072 (PRU).

Description: Perennial plant, stout, rhizomatous, solitary or clumping, evergreen, 0.5–1.6 m tall; stem reduced to a vertical rhizome < 400 mm long, terminating in a tuft of leaves. ***Root system*** massive, horizontally spreading. ***Roots*** perennial covered in a corky, velamen-like layer. 'Stilt/buttress' roots produced along the stem in swampy conditions. Root diameter 5–15 mm. ***Leaf sheath*** green to light red. ***Leaves*** long-lived, arching-erect, distichous, strap-shaped, 0.3–0.8(–1.5) m × 40–70(–90) mm, glabrous, alternate, 6–10 leaves per rhizome, broadly linear to linear-oblanceolate, coriaceous, weakly canaliculate, base markedly plano-convex, broadening and becoming planar from midsection to obtuse apiculate apex. Lamina of adaxial surface dark green, pale whitish grey striatum in the mid-rib area may be present, becoming less distinct in older leaves; abaxial surface markedly paler green, lamina margin entire with extreme distal portion slightly scabrid, teeth antrorse. ***Scape*** hermaphrodite, up to 0.8–1 m long, subterete, somewhat laterally compressed, ellipsoid, grooved with weakly developed median ridge, green, flushed pinkish red, flecked pale yellow or cream. ***Inflorescence*** an umbel, form variable, usually loose and tending to globose, with 15–40(–45) flowers subtended by two chartaceous, deciduous, lanceolate bracts 30 × 40 mm. ***Pedicels*** stiff, erect/suberect, slender 15–60 × 1.2 mm, green but variable. ***Perianth*** tubular, somewhat



Over six foot of Wayne Haselau dwarfed by *C. robusta*.



A clump of orange *C. robusta*. Buttress roots can be seen close to the ground where they support large plants in the soft water-logged soil.



A typical *C. robusta* umbel.



One of a number of large yellow-flowering *C. robusta* plants.



Typical *C. robusta* habitat, wet and swampy with many plants with their feet in the water.

falcate with an increasingly flaring apex, 30–55 × 5 mm, widening to 6–13(–20) mm diameter at mouth. ***Colour*** variable from dark orange-red, with red tips, through pale orange to pink orange; rarely yellow in some plants with light to dark green apices. ***Perianth*** segments (tepals) 6, united only at the base, otherwise overlapping, decurved, slightly asymmetrical, oblanceolate, infundibuliform, slender, involute, dilated at apex to form a somewhat thickened lip; apiculate at apex, the apiculum finely covered in white hairs. ***Stamens*** 6, adnate to perianth, one per segment, usually included within perianth tube, very occasionally extending to, and exceeding the perianth mouth. ***Filaments*** 30–35 mm long, white, terete, glabrous. ***Anthers*** 6, versatile, 3–4x1–1.5 mm oblong dorsifixed, 2-locular; pollen yellow. ***Style***: 28–35(–50) mm, terete, glabrous, included within perianth tube. ***Stigma*** tri-lobed, 5 mm terete, approx. glabrous, usually with sparse, fine, white cobwebbed hairs scattered along inner surfaces, distial portion pale green to pinkish-green, finely papillate near apex. Stigma occasionally protrudes from tip of perianth tube prominently. ***Ovary*** subglobose, dark-greenish in bud, remaining that colour at anthesis, changing to green-orange colour after pollination; 3-locular. Fruiting heads with (1–)10–2(K–35) pendant berries. ***Berries*** irregularly ovoid, 15–40 × 10–20 mm, globulose, containing 1 or 2(–4) large seed (largest in genus), prominently projecting through thin pericarp. ***Pericarp*** glossy, pale green, maturing through orange to bright red. Yellow-flowered clones produce yellow or mustard-coloured berries. SEED large, somewhat globose, 10–18(–20) mm diameter, white in colour. ***Emerging seedlings*** the most robust in the genus exhibiting rapid growth. ***Flowering time*** extended over 5–6-month period from late March to early August, i.e. early autumn to late winter (Southern Hemisphere); 9–12 months for seed to ripen and berries to fall off. ***Chromosome number*** 2n = 22.

Habitat: Afromontane Forest in the Pondoland Centre of Endemism, 0–500 m.

Material examined: SOUTH AFRICA: *Lusikisiki District, Lombazi River, North of Port St. Johns*: Chiazzari 3129BD (PRE); *Transkei, Ntsubane, Mkoziriver valley*, Venter 76/885 (PRE). CULTIVATED ex South Africa: *Transkei, Nkombati Nature Reserve*: Hammett 133/86 (AK) (specimen over four sheets).

Table 1. Summary of the key differences between Clivia gardenii and C. robusta sp. nov.

Morphology	C. gardenii	C. robusta
Habit	Gracile plant, strongly clump-forming, <1 m in height	Massive plant with stout rhizome, often with prop roots, ^ 2 m in height
Leaves	Linear-accuminate, strongly sulcate in cross-section	Broad, strap-shaped with with obtuse-apiculate apex, planar in cross section
Flowers	Stigma and stamens strongly exserted	Stigma barely protrudes and stamens usually retained within corolla tube
Karyology	45S rDNA site + C-band on chromosome 2 No 45S rDNA site or associated C-band chromosome 8	45S rDNA site but no C-band on chromosome 2 45S rDNA site + C-band on chromosome 8
Distribution	Widespread in KwaZulu-Natal	Confined to Pondoland Centre of Endemism

Etymology: The species epithet 'robusta' refers to the massive nature of the plant compared to other species in the genus.

Distribution: *C. robusta* is endemic to the east coast of South Africa, with its distribution as isolated populations from Port St. Johns in the south (Eastern Cape Province) to Mzimkulu River in the north (KwaZulu-Natal) (Swanevelder, 2003), with a few northern outliers at Oribi Gorge, Paddock, Umtentweni, Southport and one southern outlier just south of Port St. Johns. This region is known as the Pondoland Centre of Endemism (Van Wyk, 1994; Van Wyk & Smith, 2001).

Karyotype studies: The unique karyotype initially observed in material collected from Nkambati Nature Reserve, subsequently cultivated at Kirstenbosch Botanic Garden and illustrated in Ran *et al.* (2001b) was also observed in the additional material from the locations listed above in Material and Methods. There are two key features of the *C. robusta* karyotype that differentiate it from that of *C. gardenii*. In *C. robusta* there are two 45S rDNA sites compared to one in *C. gardenii*. One of these sites shares a common location in the two species (on chromosome 2) but in *C. gardenii* it is associated with a Giemsa C-band that is absent in *C. robusta*. The second site in *C. robusta* is on chromosome 8 and is also associated with a C-band.

Recognition and relationships: The key characters that distinguish *C. robusta* from *C. gardenii* are summarized in Table 1 and elaborated upon here. Morphologically, *C. robusta* is distinguished by being extremely robust; specimens approach 1.5–2 m in height (Fig. 1). The very long, broad leaves, abruptly rounded leaf apex with fine serrations (Fig. 3), pale whitish-grey striation occasionally present in the upper leaf midrib, stigma and anthers largely included within the perianth (Figs 2, 4), as well as prominent 'buttress/stilt' roots (Fig. 5) in swamp populations, amply distinguish this from all other known Olivia species. This is the only species in the genus that seems to prefer perennially wet, swampy habitats (Fig. 6) or damp seepages on rock ledges. However, the allied *C. gardenii* does occasionally grow along stream edges or in wetter than usual habitats. Botanically, *C. robusta* was regarded as part of *C. gardenii* although it has commonly been confused with other species also. For example, Vorster (1994) used *C. robusta* to illustrate C. nobilis Lindl.

Using a variety of chromosome techniques, DNA fingerprinting and sequencing, Ran and coworkers (Ran *et al.*, 1999, 2001; Ran *et al.*, 2001b) showed that 'Robust *gardenii*' was sufficiently distinct from the other species to justify naming it as a new species. 'Robust *gardenii*' was sister to *C. gardenii* and *C. miniata* (Lindl.) Regel in their phylogenetic trees based on the two regions that were sequenced and on the RAPD profiles.

Clivia robusta is also distinct from *C. gardenii* with regard to its distribution. Swanevelder (2003) showed that the plant named here as *C. robusta* formed one of three geographically distinct groupings apparent from an examination of herbarium specimens collectively treated as *C. gardenii*. *Clivia robusta* is one of these groups and its distribution is distinct from that of *C. gardenii s.s.*, which is only recorded from the Durban area northwards; no records connect the different distribution regions.

Ecology: The vegetation of the Pondoland Centre of Endemism consists mainly of grassland plateau, with a few isolated for-

est patches in the protected riverine gorges that occasionally spill over onto south- and south-west-facing slopes. Forest is more extensive and exposed in the south of the region. Of all the forest types in this region, Swamp Forests are the most rare, usually comprising small patches associated with marshy areas in grassland. *Clivia robusta* is found in these Swamp Forest patches, either sparsely (c. 5–6 plants 10 m^{-2}) or in extremely dense stands (c. 20 plants 10 m^{-2}) in wetter areas.

Buttress roots, along intervals on the vertical rhizome, act as support for the larger individuals growing in this marshy environment. The swamps are never stagnant: water



A clump of yellow flowering *C. robusta* with orange flowering plants in the background.

moves through these specialized systems, albeit very slowly. The wet soil has a high content of rotting humus and leaf debris. The new species is also found along stream banks where the soil is often moist or wet, but not swampy. Field-work has confirmed that the species also grows in seepage on cliff faces and also relatively dry rocky areas adjacent to the wet swamps. In these situations, plants are noticeably 'stockier'. In all localities, the plants are found under a high understorey of closed canopy trees in light to semi-shade.

The Pondoland Centre is highly diverse, with approximately 1800 specific/intraspecific taxa residing within its boundaries, of which 120 are endemics or near-endemics (Van Wyk & Smith, 2001). This 1880 km² large outcrop of Msikaba Formation sandstone is characterized topographically by rugged plateaus (100–500 m a.s.l.) that are deeply dissected by narrow river gorges in which isolated forest patches, with mixed tropical and Afromontane elements, are confined. Annual rainfall varies from 1000 to 1200 mm and occurs mainly in the summer months, with a mean annual temperature of 20 °C along the coast. Soils in this centre are usually sandy, acidic, highly leached and often shallow (Van Wyk, 1994; Van Wyk & Smith, 2001).

The conservation status of *Clivia robusta*: Human exploitation in the form of habitat destruction and illegal removal of specimens is the main threat to *Clivia* in the wild. Habitat destruction occurs as forests are removed for fuel, agricultural purposes and/or urbanization (Chubb, 1996; Duncan, 1999). Plant collection for medicinal purposes is probably the most serious threat (Chubb, 1996; Duncan, 1999; Lötter & Krynauw, 2002). The high demand by traditional healers for *Clivia* plants was clearly evident when Mander (1998) identified *C. miniata* as the tenth most sought after medicinal plant traded in Durban, KwaZulu-Natal. Williams, Balkwill & Witkowski (2001) found Clivia species in 70% of the Witwatersrand *muti* shops they surveyed. A. Hardinge (pers. comm.) confirmed that the same factors are also threatening the survival of *C. robusta* populations, with only remnants of some remaining.

At present, most *Clivia* species are classified as Lower Risk-Least Concerned, Lower Risk-Near Threatened and Vulnerable (Golding, 2002; Lötter & Krynauw, 2002). This seems insufficient when one considers the restricted ecological niche, geographical distribution and current exploitation. Swanevelder (2003) proposed that plants treated here as *C. robusta* should be categorized as Endangered (EN) Bla +2a (according to 2001IUCN Red List Categories, Version 3.1, as in (Golding, 2002)).

The survival of *C. robusta* is constrained by its limited geographical distribution and human exploitation. Limited to the Pondoland Centre of Endemism, this species is further restricted to microhabitats usually associated with patchy Afromontane forest elements (Swanevelder, 2003). Afromontane Forests occupy *c.*6000 km² of South Africa and Swaziland of which only 17.64% are conserved (Lubke & Mckenzie, 1996). Even though *C. robusta* distribution may be termed 'locally abundant', communities are restricted to specific ecological niches (Swanevelder, 2003).

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