CLIVIA

TWENTY-TWO

The Clivia Society www.cliviasociety.org

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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 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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Editor
Glynn Middlewick

EDITORIAL

By Glynn Middlewick

This edition of the Society Yearbook is number 22. Will there be enough information to fill the pages? Our limit is 80 pages, including the four pages of the outer covers. The challenge for an Editor is to fill the pages with interesting information. Fortunately, we have some regular contributors of articles and I wish to thank them all. The correct balance for the Yearbook is some academic articles, for those that like a good read and photographs that appeal to everyone. This Yearbook has achieved a balance with some articles that are meant to be read!

A research article has been received from Ian Kiepiel and Steve Johnson, of the University of KwaZulu-Natal, covering their research into the evolution of *Clivia miniata*. This article clarifies any doubts we may have had about the main pollinators in the natural habitat. Further interesting information follows with regards to the evolution of flowers to adapt to their pollinators and their flowering times. Dirk Lootens from Belgium contributes an article on the possible classification of clivias according to their flowering physiology. This article follows on his interesting article in the previous Yearbook on his 'Search for a new series of hybrid *Clivia*'.

Anzette Snyders our winning photographer of last year, presents us with an article on the 'Phases of the Moon' and whether this has any relevance to the ideal time to plant seeds or plants. David Loysen, out representative in the USA, has a short comment on the correct pronunciation of 'Clivia', which, considering that *Clivia nobilis* was named in 1828, still has some relevance. Carrie and Luke Kruger have submitted and interesting article on some of their plants they consider to be 'Timeless *Clivia* Classics'. Interesting aspects of these selected plants and beautiful photos are included.

The Clivia Society Photographic Competition fills the rest of the pages of this edition. I was fortunate to have Claude Felbert, Ian Coates and James Haxton volunteer to participate in the judging of the photographs. A big thank you to all the members that have submitted entries into this competition. To decide on the best images in the various categories is a challenge to all. We should remember that the best photographic entry will win the competition. The most pleasing image to a viewer is not necessarily the best photograph.

My decision as what image to choose for the front and back covers is not that easy. What I choose is not always pleasing to everyone else. Any beautiful flower could grace the front and the back cover and be suitable. To honour Ian Coates, an English photographer, I have used his image of four clivia seeds on the back page. The top three winning photographs of the overall competition are included in a collage on the front cover.

Regards,

Glynn Middlewick

COVER: Top three positions in the Photography competition – Carrie Kruger, Roger Dinsdale and Carrie Kruger.

TITLE PAGE: Highly Commended 'Pendulous Category' – Andrew Kajewsky.

BACK COVER: Ian Coates Tanchoo Seeds.

CONTENTS

REPORT FROM THE EDITOR 2
    Glynn Middlewick 2

REPORT FROM THE CHAIR 4
    Glynn Middlewick 4

ARTICLES 4

The evolution of *Clivia miniata – Ian Kiepiel and Steve D. Johnson* 5

It's only a phase: Moon phase gardening – *Anzette Snyders* 18

What's Its Name? – *David Loysen* 21

Classifying Clivias according to their flowering physiology – *Dirk Lootens* 22

'Timeless *Clivia* Classics': A history – Part 1
'Some of our favourites' – *Luke and Carrie Krüger* 26

Photographic compettion

PHOTOGRAPHIC COMPETITION 53
    Introduction – *Glynn Middlewick* 53

PHOTOGRAPHIC ENTRIES 56
    Miniata Category 56
    Interspecific Category 60
    Single Flower Category 64
    Pendulous Category 68
    Clivia Related Category 72

REPORT FROM THE CHAIR

G Middlewick

The Year 2020 will be remembered as the year of the Covid pandemic. Unfortunately' the pandemic is not yet over. As I write this, the 'experts' are predicting another surge which will peak in the middle of May 2021. The vaccinations are not freely available and hopefully the Government will improve their competence in providing vaccines to all sooner than later. We all hope that the physical 'C.miniata' shows will take place in September. The Society has made plans for Virtual miniata and interspecific Shows. Details have been circulated to all clubs and will appear on the Clivia Society Website. 'www.cliviasociety.com'

The limitation of physical club meetings has taken its toll on the membership numbers of the various clubs. Zoom meetings were provided in 2020, which were poorly attended. Perhaps the age group of the Society is one of the limiting factors in joining a Zoom session? Most members have 'smart phones' or computers and the download of the Zoom programme is easy and free of charge. Added to this is the convenience of sitting at your own home, drinking coffee or tea and listening to an interesting talk. No travel is necessary! No risk of unnecessary contacts or the possibility of being infected or of spreading the Covid infection is present.

The number of members that regularly attend meetings is small. For these members, I have a lot of sympathy. The social get-together and the physical interaction provides an enjoyable experience for these loyal supporters. Learning from the experience of the Covid lockdown, we realise that the social media is a convenient way of communicating and sharing images. Social media allows for instant downloads and comments.

The activities of individual clubs are dependent on the contribution from the members. Constructive suggestions are welcome. The number of Facebook pages available that cover various clivia interests are numerous, perhaps too many? WhatsApp groups are successful provided that there are regular contributions from members. These groups do not restrict membership and most people are welcome to join them. WhatsApp does form a useful means of communication with members if no e-mail is available.

Owing to the unreliability of the South African postal service, many clubs now expect members to collect their copies of the Society publications from a suitable source. A digital distribution would obviously cut Society expenditure and allow for a far more efficient delivery of the publications.

The clivia hobby, involving the collection of exceptional plants, the breeding of your own special plants, remains a rewarding occupation. Are formal large shows necessary? Suitable venues are not easy to find. When they are suitable, the cost of hiring these venues is excessive. Should this cost be borne by the sellers? Plant nurseries prefer not to let 'visitors' sell plants on their premises. Some schools claim that their facility is not available for rental in accordance with the rules of the Education department. Going forward the difficulty in finding a 'suitable' venue will remain a challenge for most clubs.

The next Quadrennial Clivia Society Conference takes place in Cape Town in 2022. The organising of this event is a challenge. The uncertainty of the vaccination status of the country and the lockdown demands will hopefully not be a problem in September next year. The success of the Conference depends on the number of members attending the event. I appeal to all members to consider attending the Conference, probably towards the end of September next year. Combining the Conference with a holiday to the Cape would be an ideal opportunity for all to consider.

ARTICLES

The evolution of *Clivia miniata*

Ian Kiepiel and Steve D. Johnson

C*livia miniata* flowers have a subtle fragrance, the scent of which is best enjoyed during a forest walk on a warm sunny spring morning as the first buds of the season begin to open. It takes a keen nose to fully experience the subtle nuances of the fragrance. The scent becomes hardly noticeable on cold rainy days, fading quite quickly after pollination as the flowers begin to wither. The perfume has previously been described as "Azalea-like" (Swanevelder and Fisher 2009), a "sweet floral fragrance" (Manning 2005) that adds another dimension of beauty to the bush lily. Unlike *C. miniata*, the pendulous flowered *Clivia* species do not have fragrances that is discernable to a human nose. The lack of fragrance of *C. caulescens*, *C. gardenii, C. nobilis* and *C. mirabilis* flowers by no means lessen their beauty and scent is but one of their many floral trademarks. Flowers come in an awe-inspiring brilliant diversity of shapes and forms and are much lauded throughout human cultures. We are all drawn to gardens, parks, and nature reserves, using flowers in celebration and commemoration. We share our love of flowers with the animals that visit them; the colours, shapes, textures and fragrances that we enjoy are exactly the same traits that are used by animals depending on them for their survival.

Although some plants such as *Clivia* reproduce clonally, most plants reproduce through seed production. Seed production allows plants to spread and colonise new locations. More importantly, the seeds produced through cross-pollination maintain a population's genetic diversity, which prevents a population (or species) from going extinct. Being seed factories, flowers are an essential part of plant survival because they are the reproductive machinery of life. They produce pollen and ovules in the hopes that pollen grains will somehow reach a receptive stigma. With the right conditions, a well-placed pollen grain will germinate on a stigma and the emerging pollen tube will grow its way down into style and down further still into the ovary. The pollen tube then enters the ovule (through the micropyle) release two sperm cells, one fertilizing the egg to from an embryo, whist the other fuses with different ovular tissues to form the endosperm (the seeds nutritive tissue) – this is termed double fertilization. Pollination of the stigma depends on the design of the flowers and more specifically, how flowers have evolved to accomplish pollination. Although many plants are pollinated without the help of animals (i.e. by rain, water and wind), for those species like Clivia that rely on animals to carry their pollen to where it is needed, we can think of their flowers as sensory billboards (see Raguso 2004). Flowers are essentially multisensory advertisements to help pollinators locate them, and like any billboard, there is a great deal of information in a flower available to potential visitors. Much like we read billboards driving down the highway, information is given to pollinators through different flower advertisements. Plant advertisements are made up of various floral signals such as colour, scent and shape, all of which pollinators use as cues for finding, orientating (positioning to land) and landing on flowers. Without these signals, a pollinator would be like a pilot flying blind. Floral advertisements are therefore essential to plant survival and are one of the reasons that plants and animals have such intricate evolutionary relationships. A simple architectural analogy would be that of “form following function”, where the form of the flower functions as advertising to pollinators. *Clivia* flowers have evolved to make use of very specific pollinators and those pollinators can result in the creation of new species.

We are still learning a great deal about the way that flowering plants came into being and how flowers evolved different systems of pollination. Flowers have had a long and intricate relationship with their pollinators. By some estimates it is thought that flowers first evolved between 140 and 250 million years ago (Beaulieu, O’Meara *et al*. 2015). Many flowers fit the morphology of their pollinator’s, like a key fits into to a lock. Such design can arise though a process of coevolution, a process of natural selection where two (or more) species develop or evolve together. In most instances it is the plant that adapts unilaterally to its pollinator(s). In his ground-breaking work ‘The Origin of Species’, Charles Darwin described evolution as the process of natural selection through the survival of the fittest (Darwin 1859). Darwin himself was puzzled by the origins of so many different flowers and described the origin of the flowering plants as an ‘abominable mystery’ (Darwin 1859). It was during his work on orchid pollination, that Darwin gained a better understanding of the origins of flowering plants, leading him to the conclusion that flowers adapt and evolve through selection for those floral traits which enhance a plant’s mating ability (Darwin 1862, Darwin 1877). Darwin realised that traits which increase reproductive success were vital to survival and suggested that the origin of the flowering plants was due to selection for specific floral traits by different pollinators. A pivotal moment for Darwin occurred in 1862, after he received a specimen of the white-flowered Malagasy star orchid (*Angraecum sesquipedale*), he predicted that the long narrow nectar-filled spur of the orchid was likely shaped precisely for the tongue (proboscis) of an insect. Although Darwin had never seen the orchid’s pollinator, he suggested that when his hypothetical insect was drinking from the deep narrow nectar tube, the creature would bump into the pollinia (grouped pollen) and so transfer pollen to the next flower in a similar fashion. It was only four decades later in 1903 that the hawk moth *Xanthopan morganii praedicta* was discovered, whilst the pollination of Darwin’s star orchid by this hawk moth would only be described almost a century later (Wasserthal 1997). Darwin’s hypothesis would eventually become known as the concept of pollinator-driven diversification and understanding his ‘abominable mystery’ continues to be an essential part of biological science. As the name suggests, the concept advocates that when a plant’s pollinators change, preferences and morphology of the new group of pollinators result in selection of new floral traits. Another way of looking at this would be that plants adapt by modifying their flowers to suite the morphology and tastes of the new group pollinators.

Wild Clivia plants are inferred to have quite low rates of successful selfing. (see Kiepiel and Johnson 2014a). Fertilization through self-pollination is itself another floral trait that like colour or shape, can be selected for breeding. Any floral traits that that increase the efficiency and effectiveness of pollination will be selected and retained in future generations – natural selection and survival of the fittest. When a pollinator is more effective at transferring cross pollen, more seeds will be produced and those traits which helped the pollinator forage on the flowers will have a better opportunity to infiltrate and persist in the population. Pollinators exert a strong selection pressure on a flower’s characteristics and thus have a strong influence on floral evolution. The function of a flower is to distribute and receive pollen for seed production, so when a species is self-incompatible the form of a plant’s flowers are influenced by the need to attract pollinators. Advertising cues that are more attractive or better tailored to the likes of a pollinator (including various phenotypes, forms

Figure 1. *Clivia miniata* flowers displaying uncommonly large anthers in a Mistbelt Forest situated in the KwaZulu-Natal midlands. These anthers produce significantly more pollen than those of other plants (a trait beneficial to the plant and less so to its pollinators). Photo: I. Kiepiel.

or varieties) will produce better pollination results. As pollinators are responsible for plant reproduction, the floral traits which pollinators find irresistible will be selected for and those traits which increase seed production will be transferred to the next generation.

Mutations may also alter floral traits and any adaptations which enhance mating may undergo selection (see Figure 1). Plants that are more desirable to pollinators are pollinated more often and the genetics of those plants with more desirable features will be better preserved in future generations. Another way to think of this is through your own line breeding. Every year you painstakingly select and pollinate those plants with desirable traits that you wish to enhance, usually recessive traits, culling those plants with leaf or flower characteristics which you deem less desirable. Over time, your breeding program comes to fruition and your collection takes a certain shape or quality so to speak. The likes and dislikes of a person starts to be seen in their collection and we get a measure of a breeder's personality. In a similar manner this is akin to how Darwin saw undescribed pollinators in an orchid flower simply by looking at its floral traits. The selection process we use as breeders is not unlike that of natural selection, the only difference is that we have taken the pollinators out of the equation and we are now guiding evolution.

Biologists are constantly testing the theory of pollinator-driven diversification and are continually finding more examples and evidence supporting this reasoning. *Clivia* provides a wonderful model group for testing and exploring some of the mysteries of floral evolution and several years ago, research was published doing just that, where the evolutionary shift from bird to butterfly pollination in *Clivia* was described (Kiepiel and Johnson 2014b). Our research tested the hypothesis that there was an evolutionary transition from bird to butterfly pollination in *Clivia*. We investigated how floral traits such as shape, colour, orientation and scent were either modified or retained as *C. miniata* evolved into the species we all know. John Manning initially proposed this theory in his article "Pollination in *Clivia*" (Manning 2005), where he speculated that pendulous flowering *Clivia* were pollinated by sunbirds and *C. miniata* was likely pollinated by butterflies. Manning drew his inferences from the concept of floral or pollination syndromes, which suggest that unrelated groups of plants which share similarities or suites of floral traits such as shape, colour or scent are often pollinated by similar pollinators (Faegri and van der Pijl 1979). For example, many plants that are pollinated by sunbirds have tubular shaped corollas, the flowers of which allow birds access to the nectar, whilst preventing other animals such as bees from robbing the nectar without pollinating the flowers. Although this is not always the case and plant-pollinator interactions often do not involve a lock and key type of reciprocal morphology, applying this concept can provide quite accurate pollinator predictions, a very useful starting point when little is known about a plants ecology. Being a taxonomist, Manning understood that pendulous flowering *Clivia* species occupied more basal lineages, whilst

Figure 2. Male White-bellied sunbird (*Cinnyris talatala*) feeding on a *Clivia gardenii* flower. Photo: S. D. Johnson.

Figure 3. Male Mocker swallowtail (*Papilio dardanus cena*) just before a brush visit to a *Clivia miniata* flower in a Coastal-lowland Forest situated in the Pondoland Centre of Endemism. Photo: I. Kiepiel.

C. miniata occupied a relatively derived position in the genus. By this we mean that the *Clivia miniata* is a relatively newcomer to *Clivia*, having evolved from its pendulous flowering ancestors (Ran, Hammett *et al*. 2001, Conrad, Reeves et al. 2003, Conrad, Reeves *et al*. 2006). Harold Koopowitz had described an Olive sunbird (*Cyanomitra olivacea*) visiting *C. gardenii* in a coastal KwaZulu-Natal garden (Koopowitz 2002), and Manning was also aware of a Malachite sunbird (*Nectarinia famosa*) feeding on *C. mirabilis* at Oorlogskloof Nature Reserve in the Northern Cape, a Black sunbird (*Chalcomitra amethystina*) visiting *C. caulescens* at God's Window in Mpumalanga, and a citrus swallowtail (*Papilio demodocus demodocus*) visiting *C. miniata* flowers at Morgan's Bay in the Eastern Cape Province (Manning 2005). With these observations in mind and by drawing on floral syndrome inferences, Manning predicted that the two distinct *Clivia* flower morphologies went hand in hand with a shift from bird to a butterfly pollination syndrome (Manning 2005).

To test this hypothetical pollinator shift, we focused on wild populations of *C. miniata* and *C. gardenii*. We documented the floral traits and pollinators of these two species and evaluated which of these traits were modified and which served to facilitate the transition from bird to butterfly pollination in the context of the available phylogenetic studies (all of

Figure 4. Female Mocker swallowtail (*Papilio dardanus cena*) having fed and about to depart a *Clivia miniata* flower in a Coastal-lowland Forest situated in the Pondoland Centre of Endemism. Photo: I. Kiepiel.

which indicated that *C. miniata* was the most recently evolved of the genus (Ran, Hammett *et al*. 2001, Conrad, Reeves *et al.* 2003, Conrad, Reeves *et al*. 2006, Conrad 2008, Conrad and Snijman 2011)). We studied several *C. miniata* and several *C. gardenii* populations in their KwaZulu-Natal habitats. *Clivia miniata* and *C. gardenii* share similar habitats and are distributed in the same areas along parts of the eastern coast of South Africa and where possible we opted to study populations of the two species growing in close proximity to one other. When studying closely related species that can interbreed this is

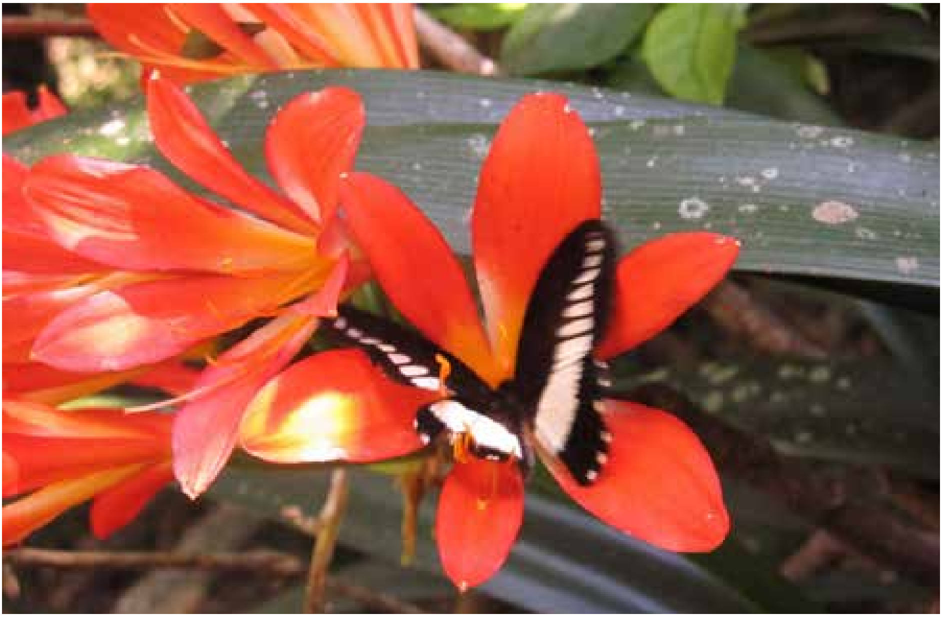

Figure 5. Male White banded swallowtail (*Papilio echerioides echerioides*) in a Mistbelt Forest situated in the KwaZulu-Natal midlands shortly after alighting on a *Clivia miniata* flower. Here the butterfly is folding its wings as it moves deeper into the corolla to feed. Photo: I. Kiepiel.

important because any differences in a species' pollinators should be reflected in the floral traits the pollinators select rather than being indicative of regional differences in the abundance of pollinators. We studied both *C. gardenii* and *C. robusta* – the robust from of *C. gardenii.* Although *C. robusta* has been described as a species based on its unusual karyology, anther exsertion, swamp habitat and large size (Murray, Ran et al. 2004), characterisation of *C. robusta* as a separate species is controversial because of inconsistent differences in DNA sequences between studies and because there has been no thorough research on the morphological differences between wild populations. Because of this we followed taxonomic authorities in treating *C. robusta* as a robust form of *C. gardenii* (Conrad 2008, Rourke 2012). Many populations of *C. gardenii* and what we refer to here as the robust form of *C. gardenii* are located very close to one another. Their flowering times overlap and it is highly likely that these two forms readily interbreed. It may be worth mentioning that we have found very robust *C. gardenii* plants, well over a meter in height on forest cliffs and scree slopes as well as gracile (non-robust) forms on the outskirts of swamps.

Tracking down the pollinators of *C. miniata* and *C. gardenii* involved many hours in the forest, documenting activity on the flowers. Some of this time involved observations during the night to ensure that no potential nocturnal pollinators such as moths were overlooked.

We discovered that like Darwin's orchid hypothesis, Manning's *Clivia* predictions were correct (Manning 2005) and sunbirds pollinate *C. gardenii* (Figure 2) whist butterflies pollinate *C. miniata* (see Figures 3-6 for examples). We found that *C. miniata* was visited by 20 different butterfly species (from three families) and that there were pronounced differences in the species visiting coastal populations compared to populations situated inland at higher altitudes. Although a variety of different butterfly species visit *C. miniata*, the swallowtails are its most common pollinators. Coastal populations of *C. miniata* were visited most often by Mocker swallowtails (*Papilio dardanus cenea*). The most frequent visitors to the KwaZulu-Natal midlands populations were White-banded swallowtails (Papilio echerioides echerioides) and Emperor swallowtails (*Papilio ophidicephalus*; Figure 9). We documented how the butterflies interacted with the flowers, recording how they approached or alighted and if they were likely to have pollinated a flower (measured by recording if they made anther and stigma contact). We also recorded the number of flowers per plant that each butterfly probed for nectar as well as the feeding duration and the overall time a butterfly spent on a flower. On warm days, butterflies began feeding on *C. miniata* flowers at around 08h00 in the morning and stopped feeding in the afternoon around 16h00 (Kiepiel and Johnson 2021). During rain, butterflies took cover in the forest canopy by hiding under leaves, and when temperatures dropped below 220C they waited for warmer conditions to return before continuing their breeding routines (Kiepiel and Johnson 2021). We found that whilst inspecting the flowers in mid-flight (Figure 3), butterflies frequently pollinated them by brushing the pollen which collects on the underside of their wings onto the stigma (see Figure 4 for behaviour prior to brush visit). These brush visits were often made by males which often engage in territorial disputes in their frantic search for females. Butterflies also pollinated flowers with the underside of their wings as they landed or just after alighting on a flower before folding their wings at rest (e.g. Figure 6). A fresh batch of pollen is deposited on the ventral surface of the butterfly wings as they brush the flowers during their inspections or when they are feeding on the nectar of the flowers.

Nocturnal observations revealed that moths did not feed on the flowers although they were abundant in the forests. To verify our nocturnal observations that moths (or other nocturnal animals) were not in fact pollinating the flowers, we bagged inflorescences and exposed them either only at night or only during the day and recorded fruit and seed production. We found that plants exposed during the night to potential pollinators produced far less seed than those exposed during the day. We also collected stigmas from flowers and preserved and stained them (which allows pollen to be better seen) on a microscope slide, which was later checked under a microscope for pollen and butterfly scales (Figure 8).

Because *C. miniata* pollination takes place via butterfly wing pollination we correlated wing-scales with pollen grains

Figure 6. Male Emperor swallowtail (*Papilio ophidicephalus*) feeding on *Clivia miniata* in a Mistbelt Forest situated in the KwaZulu-Natal midlands. Note the heavy pollen load clustered around the ventral wing venation. Photo: S. D. Johnson.

Figure 7. Forest white (*Belenois zochalia zochalia*) about to unfurl its proboscis to feed shortly after alighting on a *Clivia miniata* flower in a Coastal-lowland Forest situated in the Pondoland Centre of Endemism. Photo: S. D. Johnson.

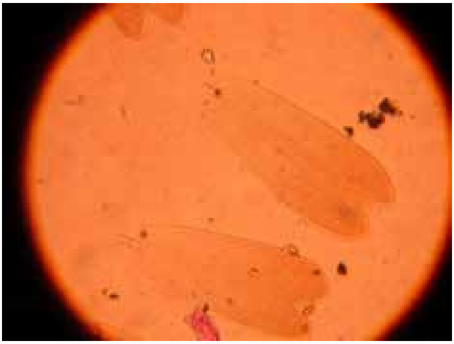

Figure 8. Butterfly scales and *Clivia miniata* pollen (stained pink) deposited on the stigma of *C. miniata* in a Coastal-lowland Forest situated in the Pondoland Centre of Endemism. Photo: I. Kiepiel.

and found a strong positive correlation between stigmatic pollen deposition and stigmatic wing-scale deposition. In fact, we found that the scales from butterfly wings were present on almost every single *C. miniata stigma* that we examined. Data from hundreds of butterfly visits showed that the wings of the primary pollinators of coastal and inland populations (the Mocker swallowtail and the White-banded swallowtail respectively) made contact with the stigma and the anthers more than two thirds of the times that they visited the flowers. Amazingly, most butterflies would only feed on a single flower of one plant before moving off to the next plant. This means that butterflies are not only very efficient pollinators, but they are also effective pollinators and ones which promote the outcrossing of *C. miniata*. We conducted further experiments to determine how much pollen a butterfly deposits on a stigma each time it visits a flower by bagging *C. miniata* flowers and exposing them to only a single visit from a Mocker swallowtail butterfly. We harvested these stigmas and looked at the deposited stigmatic pollen loads under a microscope and discovered that more pollen was deposited during brush visits than when

Figure 9. Common mother-of pearl (*Salamis parhassus*) resting on a *Clivia miniata* flower in a Coastal-lowland Forest situated in the Pondoland Centre of Endemism. An example of one of many butterflies that do not feed on (or are likely to pollinate) *Clivia miniata*. Photo: I. Kiepiel.

butterflies actually landed on the flowers. We also revealed that any physical interaction between butterfly and flower was more than enough to pollinate all the ovules of a flower (approximately 16, see also Kiepiel and Johnson 2014). Although we attempted this for the sunbirds, we had no luck as the sunbirds proved to be too timid.

As for the pendulous *Clivia* species, we found that the robust form of *C. gardenii* in the Pondoland Centre of Endemism was pollinated primarily by the Olive sunbird (*Cyanomitra olivace*), whilst White-bellied sunbirds (*Cinnyris talatala*) pollinated the gracile form of *C. gardenii* (Figure 2). Sunbirds began foraging on the flowers at daybreak and fed on the flowers throughout the day until dusk. The birds typically landed on the peduncle of the plants and fed on the nectar by probing the flowers in an upward direction. Claw marks were frequently seen along the peduncle of the plant where birds had perched to feed. It is worth mentioning that we double checked to see that birds and butterflies were carrying *Clivia* pollen by capturing the animals using mist and hand nets respectively. Before being released, samples of pollen were taken from their bodies which we later verified under a microscope. Pollen collected from butterflies was found to be only that of *C. miniata*, whilst the pollen collected from the single sunbird we were able to capture, was found to be exclusively from *C. gardenii.* This suggests that both groups of pollinators feed on and may rely almost exclusively on *Clivia* for their survival during their respective flowering times. We observed *C. gardenii* pollen inadvertently being collected as the birds thrust their bills into the flowers to feed. We watched as pollen was dusted onto the heads and bills of the birds – observations of which were later verified by our captured sunbird pollen samples. Butterflies were very rarely seen in the swamp forests and with one exception (see below) none were seen feeding on *C. gardenii* flowers. By the same token, aside from an isolated event of a Southern double-collared sunbird feeding on *C. miniata*, sunbirds were not seen feeding on the flowers of this species. This is because the flowers of *C. miniata* prevent birds which are perching on the flowers from reaching around to feed on the nectar. The birds have to rob the flower by breaking through the corolla to feed – a feat which is tricky and time consuming. *Clivia miniata* has a number of toxic alkaloids and broken tepals exude a very bitter clear liquid which likely contain some of these compounds. It is likely that these compounds act as a deterrent, which further discourage the birds from feeding on the flowers.

We also needed to test if small insects such as bees, flies, ants and wasps (as well as small butterflies and moths) were responsible for pollination and to do this we covered the flowers using plastic mesh cages. These cages prevented bigger animals such as birds and butterflies from entering, but still allowed small insects to reach the flowers. When birds and butterflies were excluded with these mesh cages, far less fruit was produced compared to the fruit produced on plants that were left untouched in the forest, meaning these selective exclusion experiments demonstrated that small insect's contribute very little to *Clivia* pollination. In a separate treatment, we hand pollinated flowers with supplemental 'cross-pollen' to test for pollen limitation of seed production. We did not find any differences in fruit or seed production between those flowers that were open pollinated (our controls) and those which were supplemented with 'cross-pollen'. This means that there is no shortage of pollen in these populations, and the pollinators of *Clivia* are doing a splendid job. It also alludes to the fact that seed production of wild *Clivia* is limited not by a lack of pollen, but by maternal resources. Suffice to say that no amount of quality pollen will increase seed set in these populations because the plants have limited energy resources with which to produce seeds. You can observe resource limitation in your collection. Prize winning plants getting all the love and light that they need, often throw out multiple inflorescences per season, whilst neglected plants growing in the deep shade of trees only flower sporadically.

We measured floral traits of both species including the dimensions of the flowers as well as recording the volume, concentration and the percentage of sucrose found in the nectar. Both species were found to be protogynous, where the stigma is receptive before anther dehiscence (release of pollen), and both species showed a marked separation between their anthers and stigma. Although the length of protrusion of the stigma and the anthers from the corolla is similar in *C. gardenii*, the stigma is usually presented either behind or in front of the anthers, which creates a little spatial separation (herkogamy). Both protogyny and herkogamy are characteristics which promote outcrossing and are floral traits that are typically associated with species such as *Clivia* that are predominantly self-incompatible (Kiepiel and Johnson 2014a). *Clivia gardenii* were found to produce more than four times the amount of nectar compared to *C. miniata*, but the concentration and type of sugars it produces are similar. These findings are of particular importance because it reveals that both sunbirds and butterflies consume the same type of nectar. Sunbird pollinated flowers are well known to produce more nectar than butterfly pollinated flowers and most importantly, the concentration and the types of sugars that these two groups of pollinators like are very similar (Johnson and Bond 1994). This sugary food plays a vital role in *Clivia*-pollinator interactions and this finding suggests that sunbird-pollinated flowers were actually pre-adapted to being pollinated by butterflies, a scenario that the famous evolutionary biologist and palaeontologist Steven Jay Gould referred to as an exaptation or a pre-existing adaptation (Gould and Vrba 1982). Because nectar need not be altered much in order to suit the preferences of butterflies, nectar likely greatly facilitated the evolutionary transition from bird to butterfly pollination in *Clivia*.

We measured the colour of flowers using a spectrophotometer (which measures the wavelengths reflected by various parts of the flowers) and found that both *C. gardenii* and *C. miniata* reflect UV light, a feature common in both bird and butterfly pollinated plants. The obvious colour difference between the two species being that C. gardenii has green perianth tips and lacks the yellow throat so typical of *C. miniata*. Aside from the abovementioned differences, these patterns of spectral reflectance revealed that the overall colour of these two flower species are similar, and like nectar, colour is a trait that was probably little modified during the shift from bird to butterfly pollination. Colour is an important floral trait used by feeding butterflies and it is likely that nectar feeding birds rely almost exclusively on colour cues whilst foraging (Johnson and Bond 1994). The similarity in colour would have acted as an important pre-adaptation assisting the evolutionary transition in pollinators. The yellow throat of *C. miniata* flowers is similar to other to other species pollinated by butterflies such as Lilium philadelphicum (Barrows 1979) and Hemerocallis fulva (Hirota, Miki *et al*. 2019) and likely functions as a target or nectar guide. We have found that some butterflies such as the Mocker swallowtail show a strong preference for these targets, visiting flowers which have these nectar guides far more frequently than those which lack them (Kiepiel and Johnson, in press). Other studies have shown that the foraging efficiency and ability of butterflies to distinguish between different plant species is significantly improved when they use these guides (Kandori and Ohsaki 1998).

We were able to analyse the scent of *Clivia* using gas chromatography coupled with mass spectrometry, which allows for accurate analysis of the chemical compounds which make up fragrances. We found that *C. miniata* scent is comprised of a simple blend of only a handful of volatile compounds. The fragrance is dominated mainly by benzaldehyde, benzyl alcohol, and benzyl benzoate. Benzyl benzoate is described as having a sweet somewhat balsamic fragrance whilst benzyl alcohol has a sweet floral odour. Benzaldehyde may be one of the more easily distinguishable of the bouquet to the human nose and has a characteristic almond-scented aroma. *Clivia gardenii* flowers are effectively unscented (*C. miniata* fragrance was found to be approximately 50 times greater than that of *C. gardenii*), a trait which is common in bird pollinated flowers and one which is thought to reflect the fact that birds generally have a poor sense of smell (Knudsen, Tollsten *et al*. 2004). Scent is important to many butterflies and butterflies often use floral fragrances to distinguish between different plant species (Andersson 2003). Butterflies also use a combination of both colour and scent to locate flowers and although no clear-cut universally appealing butterfly perfume has been identified (Andersson 2003), many butterflies are attracted to benzaldehyde and benzyl alcohol (Ômura, Honda *et al*. 1999). It is likely that the sweet almond scent of benzaldehyde is attractive to many different butterfly species and has an important role as an advertising signal (see Kiepiel and Johnson 2021). As the floral scent of *C. miniata* is simple, we can infer that the common ancestor of the species lacked a fragrance and that scent production in the genus is under phylogenetic constraint. Also called phylogenetic inertia, this means that there are restrictions in the ability of an organism to evolve down certain evolutionary paths due to the constraints imposed on those pathways by earlier adaptations. The evolution of scent production must have occurred through the modification of existing biosynthetic pathways and may have been one of the later adaptations to butterfly pollination that could have developed along with the yellow bullseye target pattern found *C. miniata* flowers.

By mapping the distribution of pollination systems onto available phylogenies (Ran, Hammett *et al*. 2001, Conrad, Reeves *et al*. 2003, Conrad, Reeves *et al*. 2006) we identified an evolutionary shift from bird to butterfly pollination in *Clivia*. Not only was this a special discovery for the *Clivia* fraternity but to the best of our knowledge this was the first ever documentation of a shift from bird to butterfly pollination. This shift in pollinators went hand in hand with the evolution of smaller nectar volumes, upright floral orientation, the production of scent and a widening of the corolla into a trumpet-shape. The colour and nectar of the flowers were largely unmodified and likely facilitated this transition. This shift also involved considerable modifications to the morphology of the flowers and is likely the reason why *C. miniata* appears as we know it today. The most obvious traits to be modified were also likely the most important in facilitating this shift. The upturning of the flowers from a pendulous to that of an upright orientation and a widening of the corolla were pivotal in accommodating butterflies (see Kiepiel and Johnson 2021). Upright floral orientation is critical for butterfly pollination because butterflies cannot readily alight on pendulous orientated *C. miniata* flowers to feed and they are unable to walk over the lip of the corolla to get to the entrance of the flower (Kiepiel and Johnson 2021). The trumpet-shape of *C. miniata* flowers not only provide an ideal landing platform for butterflies but also accommodates the folded wings of butterflies whilst they are feeding on nectar, allowing the anthers the perfect opportunity to deposit copious amounts of pollen on the ventral surfaces of the wings. By the same token, butterflies find it quite difficult to access pendulous flowering *Clivia*, but we did observe an Emperor swallowtail attempting to feed from a *C. gardenii* flower in the KwaZulu-Natal midlands. Similarly, in the same region, we observed Double-collared sunbirds (Cinnyris chalybeus) alighting in an ungainly manner on *C. miniata* inflorescences and robbing the flowers of nectar by breaking the corolla with their beaks. Although such cases are rare, they may happen from time to time. Like many other animals when food is scarce, pollinators can become opportunists out of desperation, and events such as these allude to the origins, similarities and potential evolutionary direction of these species' pollination systems.

In the context of our pollinator-driven diversification hypothesis we may speculate that the shift from bird to butterfly pollination occurred when the abundant butterflies in certain areas increased whilst sunbirds decreased, resulting in adaptive specialisation for floral traits favouring butterfly pollination. It would have taken the flowers untold millennia of gradual change to better accommodate their new butterfly pollinators in this manner, and during this time it is likely that both birds and butterflies fed on the flowers as the plants adapted to the new group of dominant pollinators. It is helpful to think of the flowers of a *C. miniata* interspecific hybrid here. Such plants lack the classic upright trumpet shape of *C. miniata* flowers, but their flowers are also not quite the hanging tubular flowers so typical of a pendulous flowered *Clivia*. This is what *C. miniata* may have looked like early in its evolutionary history, and as butterfly pollination increased, selection for the new pollination vectors was reinforced, with subsequent speciation ensuing through reproductive isolation (traits preventing interbreeding between the two forms). Over the past eight million years there have been significant changes in the climate of tropical Africa with glacial-interglacial cycles resulting in the contraction and expansion of forests, significantly altering their ecological dynamics and patterns of distribution (Hamilton and Taylor 1992). It is likely that these climatic fluctuations resulted in a change in the abundance of pollinators in certain areas and selection was directed by the most locally abundant pollinators. Johnson and Bond (1994) have suggested that butterfly pollination in the red-flowered Aeropetes-guild evolved from the robbing of nectar from ancestral bird pollinated flowers. This scenario was also very possible in *Clivia*, were the colour and nectar of the sunbird pollinated species would have certainly offered an enticing prospect to curious hungry butterflies. It may have been that a random mutation for floral width allowed butterflies such as swallowtails to more readily probe the semi-pendulous flowers of the new sport. Here, further selection would have widened and lengthened the corolla from a tubular to trumpet shape.

Another trait that was likely modified in *C. miniata* along with that of morphology was that of flowering phenology or flowering times. *Clivia gardenii* flower from autumn to winter, a time when many butterfly species are overwintering and not on the wing. It is likely that a shift in flowering times occurred in response to the synchronization with spring and butterfly peak-flight periods. Perhaps the propensity of *C. miniata* to sporadically flower throughout the year is a throwback-trait (atavism) representative of its evolutionary history. Spring flowering would have coincided with the emergence of a wide variety of butterfly species making for a better prospect for pollination than relying on only those few species on the wing during winter. It may have been that inland populations such as those situated at higher altitudes in Mistbelt Forests (which face much colder winter temperatures) had a greater influence on this shift in flowering times, since lower temperatures are not tolerated by many butterflies. Birds are also far hardier when it comes to facing cold and rainy conditions than butterflies and a shift from a cold to warmer climate may well have resulted in an increase in butterflies and the resulting shift in pollination systems. The emergent *C. miniata* may have presented an insufficient nectar supply to meet the high energetic requirements of sunbirds (given the awkward feeding positions and lengthy handling times), whilst the unpleasant exudations from damaged flowers would have discouraged the birds from habitually feeding on the flowers. With the energetic resources of the plant being just as much in demand, there would have been a trade-off between the production of larger amounts of costly nectar and the production of larger scented flowers.

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It's only a phase: Moon phase gardening

Anzette Snyders

Folklore or not? It is as old as agriculture itself. Dating from the Inca, Aztec, Mayan, Greek and Chinese, who had all kept meticulous records of their natural events. Finding repetitions and using these to make predictions on when to plant and harvest. Some believe in it and plant according to zodiac sign with correlation to the phases of the Moon. Those who believe in it, feel that if it is not planted in the correct phase of the Moon, the plants will be more prone to disease.

I will present my findings here, I was a sceptic myself, then you may make your decision.

The story goes as follows. Isaac Newton established gravity and in 1687 he explained how the gravitational pull of the Sun and Moon together creates ocean tides. The Moon's gravity in relation to that of Earth is 2.951.800 times lower, sitting at around 384.800 km from earth with a mass of 7.3x1019. The Sun on the other hand is 27 million times larger than the Moon. Its gravitational attraction is 177 times greater than that of the Moon, but it is 390 times further away. That makes the tide generating force half of that of the Moon. Some will argue that it cannot be strong enough to have any effect on the tides, let alone soil moisture. But the two together on New and Full Moon do have an effect.

The Moon phase gardeners believe that at New and Full Moon the gravitational pull of the Moon causes moisture levels to rise within the soil, which in turn, the seeds will absorb. These seeds will thus germinate faster. In mature plants, the movement of the sap from the roots up to the canopy, influence when the plant should be fertilized, the fruit harvested or pruned. Ute York, in her book Living by the Moon says: "The old-time gardeners say, with the waxing of the Moon, the earth exhales. When the sap in the plants rise, the force first goes into the growth above ground. Thus, you should do all activities with plants that bear fruit above ground during a waxing Moon. With the waning of the Moon, the earth exhales. Then the sap primarily goes down towards the roots. Thus, the waning Moon is a good time for pruning, multiplying, fertilizing, watering, harvesting and controlling parasites and weeds."

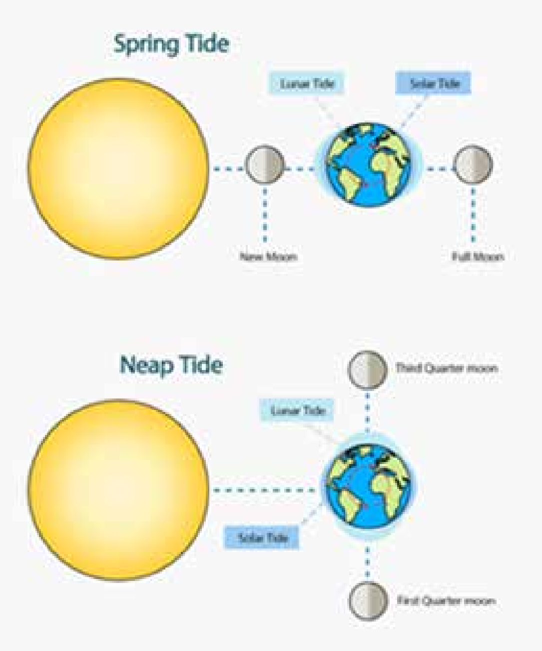
On a closer look, there should be sap movement daily, if you want to base it on the Moon, with a point on Earth passing the Moon with each rotation of the day. This effect is only lesser in the First and Last Quarter.

Plant growth is regulated by internal and external factors. Internally phytohormones are responsible for the coordination of metabolic and development processes at molecular and cellular level. Phytohormones can be divided into two groups: Firstly, growth promoting,

Moon Phase	Date planted	7 days	14 days	21 days	28 days	35 days
FQ	30/05/	Still healthy	1 germinated Day 15 - x4	Still the same	5th seed germinated	All germinated
FM	06/06/	Still healthy	No germinations	Some germination	X3 germinations	Still the same
LQ	13/06/	Still healthy	No germinations	No signs	X1 germination	X2 germinations
NM	21/06/	Still healthy	Day 15 – x3 germinated	1 more germination	All germinated	

and secondly promoting synthesis. Phytohormones together with external factors, can activate growth. External factors include temperature, direction and duration of the Sun's radiation and position with relation to the Earth's gravitational field. These factors can initiate and regulate the timing of development. Physical factors like soil composition, salinity, pH, temperature, pollution, wind and ultraviolet radiation all play a role. A scientific study of the functions and mechanisms in the plant species in question should be made to cultivate it to its full genetic potential and obtain maximal growth and reproductive potential.

According to Semmens, during certain periods, the moonlight is partially polarised. That polarised light can favour the diastase enzymes which catalyses the hydrolysis, first of starch into dextrin and afterwards into sugar or glucose, to favour germination. This was his observations in crushed mustard seeds in the presence of polarised light.



How does this affect *Clivia* plant growth?

Most of the information available relates to the use of vegetable seeds. *Clivia* seed in general will germinate after 1 month or longer. Is it possible to affect the germination rate in clivia seeds?

Keeping in mind that *Clivia* flowers show effects from external factors, such as flower colour and shape may changes may occur with altitude change. Furthermore, colour changes may result from the use of a metal-laden water source compared to rain-water usage. The question now is whether Moon phase planting will affect clivia germination?

My first experiment involved the usage of 3 *Clivia miniata* seeds and 3 interspecific Clivia seeds per phase of the Moon. They were all planted in the same seedling mix and placed

Moon Phase	Date planted	7 days	14 days	21 days	28 days	35 days
FQ	28/06/	Still healthy	15 days – small amount germinated	Still the same	Still the same	More germinations
FM	05/07/	Still healthy	No germinations	Little to no germinations	Some germinations	More germinations
LQ	12/07/	Still healthy	No germinations	No germinations	Some germinations	Still the same
NM	19/07/	Still healthy	Good germinations	High percentage	Slower rate	Good growth

in an incubator at a constant 24 degrees Celsius. The first phase was First Quarter on the 30/05/2020, next phase Full Moon on the 06/06/2020, Last Quarter on 13/06/2020 and New Moon on 21/06/2020. Surprisingly, those planted at New Moon did the best and started to germinate on day 14. Those planted on the last quarter did not do well at all and took more than a month to start germinating.

My curiosity was ignited. To obtain conclusive results I felt that the usage of 6 seeds might be too few and I would repeat the trial. This time all the seeds were from Coromandel stock for control purposes. With each phase a new seed-bearing stem was harvested, keeping the seeds as fresh as possible for each passing phase. The seeds were placed in Vermiculite this time, dampened, covered and placed in the incubator.

Now that I have seen the results, I have decided to run another trial in 2021. This time half of the seeds will be soaked in water for a half an hour before planting and again planted in each phase of the moon. Two types of media will be use, Vermiculite as well as a seedling mix, to reach a better conclusion regarding whether the “rising moisture content” on the New and Full Moon really does have an effect on the absorption and germination of the seeds. I intend keeping better records. I would also like to see the results of whether the seedlings are more disease prone if planted during the wrong phase of the Moon.

The findings so far have seen some positive results and I see myself in a long-term experiment to reach a decisive conclusion over Moon phase planting.

What’s Its Name?

David Loysen

Probably the most frequent question I get at flower shows is how to pronounce *Clivia*.

Is it clivia with a long i as in ice cream or ivory? Is it *Clivia* with a short i as in fit or gift?

Many of us know that the name originated in 1828 in tribute to Lady Charlotte Florentia Clive who had an extensive conservatory at Syon House, across the Thames from Kew Gardens in London. It may have been the first clivia to flower in England and was a *Clivia nobilis*. For more history go to www.CliviaSociety.com and click on ‘*Clivia*’.

A lot of plants have a variety of common or popular ‘names’ and such is the case with clivia. Some I’ve heard used are: Natal Lily, Bush Lily, and Fire Lily. And, of course, clivias are not really lilies.

But in the horticultural world, the Swedish botanist, Linnaeus, established a system of plant nomenclature which resulted in only one name for each plant in Latin. That scientific name for our genus is *Clivia*.

So, which is the correct pronunciation? Long i or short i? You may have noticed that I have also used both clivia and *Clivia* above.

The answer is that either one is acceptable but here’s the difference:

The most popular common name is clivia, named after the Clive family with a long “i” and is not case specific.

The scientific name is *Clivia* from Latin, pronounced only with a short “i” and always capitalised. In botanical nomenclature, the genus (*Clivia*) is always capitalised and italicised, and the species, (eg. *miniata*) is in lower case. Varieties (i.e. *citrina*) follow in lower case and registered cultivars (i.e. ‘Mary Lou’) are capitalised and in single quotes.

Classifying Clivias according to their flowering physiology

Dirk Lootens

INTRODUCTION

Mass production of plants multiplied by seed creates enormous opportunities for selecting new & improved variants. Growing Clivias in smaller numbers, on the other hand, also has its advantages: it is much easier to follow up individual plants and to keep records of all plants. Since almost all Clivias are multiplied by seed, each plant is genetically different. For some pronounced phenotypic characteristics, a lot is already known (e.g., flower colour, leaf width, leaf variegation, ...), but what do we know about characteristics such as flowering duration, flowering frequency, triggers for flower peduncle growth, flower fragrance, ... some of these characteristics are fundamental if we want *Clivia* to reach its full potential as a potted plant.

As quoted in chapter 3 of the article "An opportunity for the Clivia World. In search of a new series of hybrid Clivias" (yearbook 2021, p31) the aim is

- that each plant must be able to produce 3 flower peduncles per year with at least 2 different flowering times and
- Inflorescences must extend above the leaves, at a temperature of 21°C.

Classification of all Clivias, used for breeding, according to their flowering frequency and other flowering characteristics could help us identify the underlying heritable features and provide us with new breeding targets to develop the ideal Clivia pot plant.

CONSTANT MODULE-BLOOMERS

This category always blooms after closing a module of exactly the same number of leaves, once its specific flowering time has come. Characteristically:

- they almost always bloom at the same time of the season: if they are late bloomers, they will bloom late in the season every year. Rarely if ever do we see such plants flowering outside of the flowering season. In the Northern hemisphere these plants bloom from March on and the last ones around May/June.
- if for some reason no module could be formed, then the plant will not flower that year.
- If, on the other hand, 2 modules can be completed (e.g., a "half module" from the previous year and a completely new module in the latest growing season), then the plant flowers with 2 flower stems, being the flower stalk after the first completed module and one after the youngest module. It can be stated that the flower stalk after the oldest module often has a stiffer stem and needs a lower temperature to grow above the leaves. In such cases, we speak of an old and young flower stem with different levels of required stretching stimulators (I suppose cold, but...).

The importance of understanding this characteristic from the perspective of an end consumer, lies primarily in finding out why all Clivia do not bloom year after year. Consumers have high expectations and this is certainly part of it.

1.1. *Plants with growth modules of exactly 4 leaves*

- Q08 from ID'Flor is such an example.:
  - there are always 4 leaves between two consecutive inflorescences (according to own data, under Northern conditions!)
  - On average, this plant grows 4 leaves/year under my "standard" conditions (= frost-free for 6 months and a +-6-month growth period).
  - Consequently, this plant blooms with an

  average of 1 flower scape per year.
  - Possibly this is heritable. I have evidence that this characteristic is also manifested in certain offspring.

1.2. Growth modules of 5 leaves

- DL,016 (a dark red miniata):
  - is year after year the last bloomer of the season. It blooms always late May and always has 5 leaves between two consecutive flower stems.
  - The number of flowers on one inflorescence is variable depending on the total growth achieved that year.
  - This plant has never made any offsets, yet!
- 11,031 (a Cameron Peach)
  - this plant blooms in May, but always with three years between. Only then is a 5-leaf module completed.
- Other examples of this category have confirmed that if there is not enough growth in a certain year, you don't get a flower in that year.
- due to flower bud abortion, the number of leaves between 2 flower stems can be a multiple of 5.

1.3. Other types of module-growers.

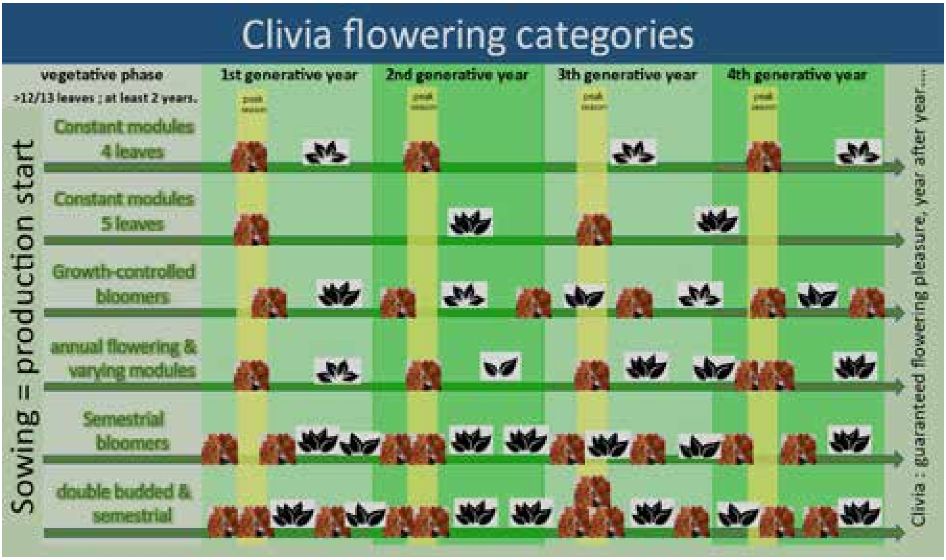
- At this stage I don't have any evidence of plants that have modules of e.g., exactly 6, 7 of more leaves.
- I have found that a number of Chinese plants make 6-leaf modules, but under the given Northern European conditions these plants don't flower enough to be able to state this as the absolute truth.
- it should be noted that plants that for some reason do not have a flower, can come to the top e.g. by flower abortion, so that here we are not going to aggregate the number of leaves of 2 modules into one module.

GROWTH-CONTROLLED BLOOMERS

- blooms at any time of the year provided a module is fully grown
- DL,020 is an example (a dark red miniata)
  - The modules of this plant consist of 3 or 4 leaves.
  - This plant can bloom in any month of the year.
  - The number of flowers per inflorescence can vary greatly: from 7 to 19. The feeling is that this varies along with the "seasonally driven" urge to still give a flower in the high season.
- Vinkske is another example (a yellow interspecific) (see yearbook 2021, p31-38)

ANNUAL FLOWERING PLANTS WITH VARYING MODULES

- These plants are guaranteed to bloom every year and at the same time
- The size of the module depends on the growth the plant could make that year
- 11,003,01 (a Twin flowering Robusta from South-Africa, breeder: Utopia Clivias)
  - Is guaranteed to flower year after year,
  - Has at the time when it blooms, already 4 new full-grown leaves after the flower stalk and 4 new not yet mature leaves in the heart of the plant.
  - The number of leaves between 2 consecutive flower stems, varies from 5, 6 or 7 leaves ...so the plant adapts = seasonal bloomer!
  - This plants always blooms in October in the Northern hemisphere
- 16,022 (a tetraploid miniata)
  - this plant has bloomed annually so far, except for a single time. That time there were 9 leaves between 2 consecutive flower stems, making it plausible that one inflorescence did not come up but dried up between the leaves.
  - always flowering in May
  - modules consist of 4 or 5 leaves. The last time the module was no more than 2 leaves! This is the first time that I have ever been able to observe this phenomenon.
- 17,010 5 (a Hot Lips type)
  - Flowers always in May
  - Modules are 4 or 5 leaves.
  - the inflorescence seems to have remained more vegetative in one year, while in other years more flowers matured orange and thus continued to develop genera-



tively.

- 2001.510.1 (a yellow miniata)
  - flowers at least once a year
  - this plant blooms regularly with 2 inflorescences in the same year
  - flowering period March/April and May/June for the second flower
  - modules of 3 or 4

SEMESTRIAL BLOOMERS

- These are plants that are guaranteed to flower twice a year,
- they usually flower the first time very early in the season (November/December in the northern hemisphere) and a second time later in high season.
- I have only two examples of this type
  - 'Il Quattro'
  - 'Triske' = sibling of Il quattro.
- If a module closes at an accelerated rate in order to bring the second bloom (modules will be 3 leaves), the flower stalk will have a lower number of flowers. Achieving sufficient growth is therefore essential. It goes even further: since these plants also close their modules with 2 buds, the chance of developing two full-developed inflorescences out of the same leaf axil is greater if sufficient growth has been realized.
- As these plants makes modules of 3 or 4 leaves, they have to grow at least 7 leaves each year.
- Important to note here is that because these plants start flowering for the first time in December, their natural cold period is much shorter than the other plants. After all, as soon as they show their flower buds between the leaves, the plants come under indoor conditions and growth can restart.

PLANTS WITH DOUBLE BUDDED MODULES

- These are plants that close their module with 2 buds instead of one single bud.
- these are the plants with the characteristic "Oks2" or are from the "rebloomers" type (see yearbook 2021, p35)
- it is assumed that plants with the 'oks 2' characteristic actually have the same underlying explanation as rebloomers: they are plants that simply form 2 buds at the termination of a module. Re-flowering branches are flower branches that for some reason are not triggered to stretch until later. If a plant is reflowering, the second inflorescence always appears within one year after the first. One can assume that in the

case when a second inflorescence doesn't appear, the second bud has dried up and the bud must have been aborted.

- There are indications that under certain circumstances dormant buds can be transformed into vegetative buds and that all the buds still present will develop into new shoots.
- If this is indeed the case, this genetic trait could help to increase the multiplication factor in in vitro production and make tissue culture of Clivia profitable.

DISCUSSION

- plants can also be classified according to the duration of their juvenile phase. Today's varieties often flower as early as 12 to 14 leaves, whereas in the past this was only after 17 leaves or more. Plants that flower for the first time after 10/11 leaves may also be in the pipeline.
- in addition to the flowering physiological characteristics listed above, the growth rate also determines the annual flower volume obtained. This might be subject for another article.
- It seems that the number of flowers on an inflorescence is also determined by the growth rate or that the number is reduced in case not enough growth is realized.
- research into the causes of flower bud abortion is certainly a very interesting subject
- It remains to be seen whether this proposed classification can be maintained or will be expanded in the future. Worldwide records of e.g., Clivias of a completely different origin, can provide a great input here. Here one is looking forward to, for example, the Chinese types of which it could be suspected that they may be different. I am greatly looking forward to new discoveries.

The ultimate goal is to sell our customer a product that meets his expectations. He expects our product to look perfect as a green plant for many years, and he wants his *Clivia* to bloom at least annually under a wide variety of conditions.

‘TIMELESS CLIVIA CLASSICS’: A HISTORY - PART 1

‘Some of our favourites’

Luke and Carrie Krüger

A timeless classic, in this case a specific clivia, is a plant that despite the passage of time remains an exceptional contribution to the clivia world. The Clivias we have selected for this article, all fit into this description. The following plants have all been used extensively in breeding programmes by various growers over the years and they all led the way in a new breeding direction.

We have always enjoyed finding out further information about all the exceptional Clivia plants. Learning about their origins, their compatibilities when crossed with other plants, and features that they may have which may be evident in their offspring. When we decided to write this article, we realised that there are so many exceptional plants, that making a choice for this first article would not be easy. As everyone knows, we all have our own favourites and so we have decided to write more than one article, to include many more of our favourite and exceptional plants.

Figure 1 ‘Andrew Gibson’

We started off making a list of our favourite plants. When we realised that there were so many exceptional plants, we settled on featuring the first sixteen in this article. Finding out more details about these exceptional plants has been an interesting journey, involving many e-mails, phone calls and WhatsApp messages to breeders. Many hours were spent looking through previous Clivia Yearbooks and Clivia News publication for further information about these plants. Although some of these plants do not have known breeding origins, they have over time proved themselves as plants worthy of including in all breeding programmes and have produced spectacular results.

Figure 2 'Andrew Gibson' F1

1. 'Andrew Gibson'

'Andrew Gibson' a habitat plant was acquired by Andrew Gibson and gifted (as a yellow and named Andrew Gibson) to Etzel Nuss in 1998 by Andrew Gibson. Andrew Gibson was a real estate agent specializing in farms and was an

Figure 3 'Splash'

avid clivia breeder and collector. It has been suggested that the first clone originated from a farm or forest in Karkloof, Kwa-Zula Natal in the 1980's. The friendship of Etzel Nuss and Andrew Gibson was a fortunate event, otherwise we may never have seen this plant.

Figure 4 'Royal Gala'

Notable breeding from 'Andrew Gibson':

- 'Royal Gala' ('Andrew Gibson' x 'Naude's Peach').
- 'Fairytale' '(Msubo Wow' x 'Andrew Gibson').
- 'Splash' (Line bred from 'Andrew Gibson').

Photos supplied by Carrie Kruger and Val Thurston. Thank you to the contributors: Liz Boyd and Val Thurston. Clivia news Vol.17 No.3-4 2008 pg.23 'Andrew Gibson' by Etzel Nuss. Clivia news Vol.25 No.1-2 2016 pgs. 14-18 'Andrew Gibson' breeding by Rouzell van Coller.

2. 'Autumn Whisper'.

Not much is known about 'Autumn Whisper'. Most of the information about this plant has been lost with time. 'Autumn Whisper' is an interspecific plant bred by the late Bertie Guillaume of Brom 'n Nel Nursery, Louis Trichardt, Limpopo, South Africa. It was first identified at his nursery by his daughter Celia.

Figure 5 'Fairy Tale Green Kelp'

Figure 6 'Autumn Whisper'

Figure 7 'Efydd'

'Autumn Whisper' was first named 'Stolen Bronze' as it was liked by both Bertie Guillaume and his daughter Celia and it was constantly 'moved' between their individual shade houses.

It was later renamed 'Autumn Whisper' by Celia.

It is speculated that is could be from Bertie's Bronze breeding but like many other plants from the Guillaumes' collection, its breeding history is unknown.

'Autumn Whisper' has been used in the breeding some fantastic bronze interspecific plants.

Figure 8 'Autumn Angel'

Notable breeding successes from Autumn Whisper are:

- 'Autumn Angel'. ('Bell Boy' x 'Autumn Whisper').
- 'Eydd'. (Small Bronze Green throat x 'Tropical Bronze').
- 'Tropical Bronze'. ('Berties Bronze' x 'Autumn Whisper Seedling').
- 'Autumn Crusade'.

Photos supplied by Carrie Kruger and Nico Cloete. Thank you to the contributors, John Handman, Pieter Saayman and George Mann.

3. 'BELLA DONNA OPRAH'

'Bella Donna Oprah' was named for Oprah Winfrey in 2004. This particular plant was chosen from a list of entries in a competition organised by the Clivia Society and the Oprah Winfrey magazine.

Bella Donna translated from Italian means 'beautiful lady'. This plant may have been grown from seeds acquired from Mr Nakamura of Japan by the late Bertie Guillaume of Brom 'n Nel Nursery. Unfortunately, the breeding history is unknown.

This however did not deter growers from continuing the frantic pace of breeding with Bella

Figure 9 'Bella Donna Oprah'

Figure 10 'BDO' F1

Figure 11 'Bella Shae'

Figure 12 'Bella Baby'

Donna Oprah and its offspring.

It is a highly favoured plant for its unique breeding results.

'Bella Donna Oprah' is split for yellow and all the green stemmed seedlings produce stunning compact yellow plants with large full umbels with giant flowers.

Figure 13 'Hantie'

Notable breeding from 'Bella Donna Oprah'.

- 'Bella Mia'. (Seedling of 'Bella Donna Oprah').
- 'Bella Johan'. (Seedling of 'Bella Donna Oprah').
- 'Bella Baby' ('Bella Donna Oprah' x 'Cameo').
- 'Bella Shae'. ('Bella Donna yellow').

Photos supplied by Carrie Kruger and George Mann. Thank you for the contributions from Ricky Jardim and George Mann. Clivia Yearbook 7 pg.49 Clivia miniata 'Bella Donna Oprah' by Ajam, Kashiefa. Clivia Newsletter Vol.13 No.1 2004 pg.11-12 Correspondence of Jane Raphaely Editor: The Oprah Winfrey Magazine, John Winter and Clivia Society PRO Cobus Roos. https://www.iol.co.za/news/south-africa/a-flower-for-a-bella-donna-226260

4. 'HANTIE'

`Hantie` comes from the gardens of the Brenthurst Estate owned by the Oppenheimers. The estate is located in Parktown, Johannesburg. This plant was first spotted by Hantie Weitz while attending a function at the estate. The flowers are yellow with a touch of pink that mature to a darker pink with ageing. Claims have been made that the plants in the Brenthurst gardens were obtained from the McNeils in Tzaneen and would explain the compatibility with other 'Four Marys' strains.

Notable breeding from 'Hantie':

- 'Brenthurst' x 'Hattori Saki Beni'.
- 'Best Brenthurst'.
- 'Hantie' F2.

Figure 14 'Brenthurst' x 'Saki Beni'

Figure 15 'Hantie' F2

Figure 16 'Brenthurst' F2

Photos supplied by Norman Weitz, Francois van Rooyen and Carrie Kruger. Thank you for the contributions from Francois van Rooyen, George Mann and Norman Weitz.

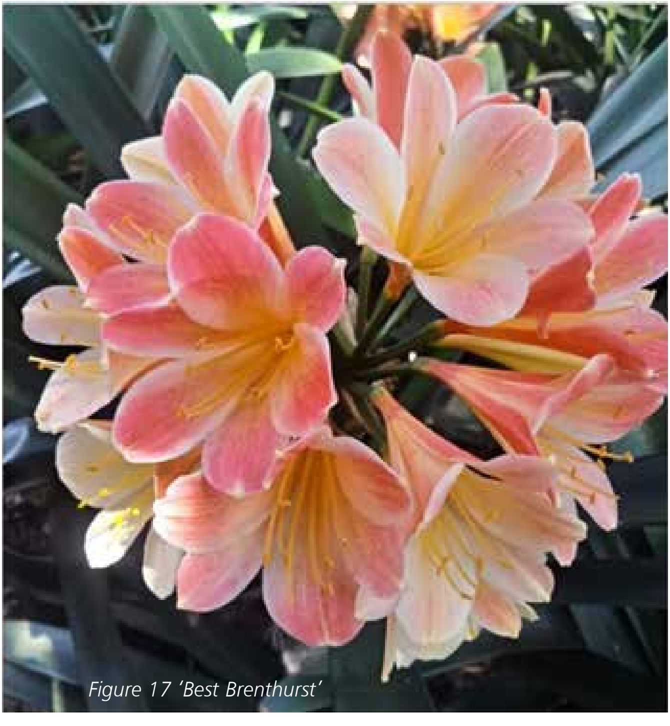


Figure 17 'Best Brenthurst'

5. 'BRONZE GREEN BOY'

'Bronze Green Boy' as it was so aptly named, was discovered in September of 1998 by Ian Vermaak and his wife Geraldine Vermaak while walking their dog. It was discovered in the garden of a Mr. & Mrs. Slabbert in George, Western Cape, South Africa. It was found among the orange clivias and stood out immediately. Hannes (Mr. Slabbert) told Ian Vermaak that it was bought at a nursery in Johannesburg before moving down to George. An offset was offered to Ian Vermaak, and it flowered two years later. Ian Vermaak was to name it 'Chardonnay' but after discussions with Hannes and Louis Swanepoel the name of 'Bronze Green Boy' chosen.

'Bronze Green Boy' was taken to the Cape Town Clivia Show in Sep-

Figure 18 'Bronze Green Boy'

tember of 2000 where it was a huge hit. Never before has a clivia with such remarkable colour been seen by both public and breeders alike. 'Bronze Green Boy' has gone on to win multiple 'Best on Show' awards over the years and is remains an exceptional bronze plant.

Breeding with 'Bronze Green Boy' has been a challenge for many. 'Bronze Green Boy' is self-sterile and has an extremely poor seed set even when pollinated with other pants. Moderate success has been achieved with the breeding of 'Bronze Green Boy'.

Dawie Strydom of South Africa has had success in the 2nd generation with 'Bronze Green Boy' pollen on multi-tepals plants. 'Clivia Yearbook 21, Pg.26-30'.

Notable breeding from 'Bronze Green Boy':

- 'DS Bronze' - ('BGB' X 'McNeil Bronze').
- 'Multitepal bronze'.

Photos supplied by Dawie Strydom and Carrie Kruger. Thank you for the contribution from Dawie Strydom. Clivia Newsletter Volume 12 No.4 pgs. 9-10 2003 The story behind 'Bronze Green Boy' by Ian Vermaak. Clivia Yearbook 21, Pg.26-30 by Dawie Strydom.

Figure 19 'DS Bronze'

Figure 20 Multi tepal from 'BGB'

6. 'CAMEO'

'Cameo' is a plant bred by the late Bertie Guillaume of Brom 'n Nel Nursery, Louis Trichardt, Limpopo, South Africa. Liz Boyd selected the first flowering seedling from a batch of plants at the Brom 'n Nel nurserey and named the plant 'Cameo'. The parents of 'Cameo' are unknown. but it is split for yellow.

'A cameo' is a form of glyptography or carving, cut into a variety of materials, but most often into glass, hardstones, and shells. These detailed reliefs were often used to adorn pieces of jewellery, such as brooches, necklaces, bracelets, and rings. In this instance the colour of a brooch after which Liz named her plant.

It has been proven to be a very worthy breeding plant in any collection.

Figure 21 'Cameo original'

Figure 22 'Cameo Supreme'

Figure 24 Cameo Brooch

Figure 23 'Bella Cameo'

Notable breeding from 'Cameo':

- 'Cameo Supreme' (The best 'Cameo Plus').
- 'Cameo Plus'.
- 'Bella Cameo'. ('BDO' x 'Cameo').
- 'Sunkist'. ('Cameo Yellow').

Photos supplied by Liz Boyd and Carrie Kruger. Thank you for the contribution from Liz Boyd. https://mymodernmet.com/history-of-cameo-jewelry/

Figure 25 'Cameo' Yellow - 'Sunkist'

7. 'CHARL'S GREEN'

'Charl's Green' was one of the first green Clivias available in South Africa. Charl's Green was sold for R32 000 at the 2006 Clivia conference held in Pretoria. At that time, it was the highest price paid for a Clivia in South Africa. Prior to the auction, 'Charl's Green' was originally named 'Green Lad', but then renamed 'Charl's Green' by Charl Coetzee after he acquired it from Charl Malan from Grahamstown.

'Charl's Green' followed the same route in history as 'Star Green'. In 1997 Charl Malan received seed from Mr. Nakamura of 31 different crosses. Charl Malan and Philip Crous (Charl's neighbour) simply numbered the batches 1-31. Batch no.13 was described by Mr. Nakamura as 'Special Seed'. Charl Malan grew 15 seeds from this batch and Philip Crous grew the other 9 seeds. From this batch (No.13) 'Charl`s Green' would emerge.

Notable breeding from 'Charl's Green'.

- 'Ice Ice Baby'. ('Vico Yellow' x 'Charl's Green') x 'Charl's Green'.
- 'Charlston' ('P8/Shimmer' x 'Gunston') x 'Charl's 'Green'.
- 'Iced Beauty' ('Coromandel yellow' x 'Charl`s Green' x sibling).

Photos supplied by Chris Smit and Carrie Kruger. Thank you for the contribution from Charl Malan. Clivia Yearbook 9 pg.112 Charl's Green: The coolest clivia by John van der Linde. https://www.iol.co.za/news/south-africa/prize-clivia-auctioned-for-record-amount-2931

Figure 26 'Charl`s Green'

Figure 28 'Ice Baby'

8.

Figure 27 'Iced Beauty'

Figure 29 'Crown Prince'

'CROWN PRINCE'

'Crown Prince' is a dark bronze bred by the late Bertie Guillaume of Brom n Nel Nursery, Louis Trichardt, Limpopo, South Africa. This was a seedling selected by Celia out of the breeding house. It was named Crown Prince because it stood out like royalty among the other plants. Breeding history is unknown. This plant started Celia`s "Africa Range" of bronzes.

Notable breeding from Crown Prince:

- 'Crown 7' ('Crown Prince' x'777').

Figure 30 'Crown 7'

Figure 31 'Gothic'

- 'Gothic' ('Crown Prince' F1 x Hirao).

Photos supplied by Carrie Kruger. Thank you for the contribution from John Handman. http://www.cliviaforum.za.net/forum/index.php?topic=4608.0 http://www.cliviaforum.za.net/forum/index.php?topic=4828.0

9. 'DEKLAN'

'Deklan' is a plant with a beautiful head of recurved pastel pink flowers bred by the Late Johannes Boshoff de Kock (Bossie De Kock). Deklan was named after Bossie De Kock`s son. The

Figure 32 'Deklan'

Figure 33 .Deklan`s Diginity'

Figure 34 'Deklan`s Virtue'

breeding is unknown, but has been proven to be split for Group 1 yellow. 'Deklan' crosses, breed beautiful recurved pink and pastel coloured flowers. This plant was featured on the cover of the Clivia Yearbook 6.

Notable breeding from 'Deklan':

- 'Deklan`s Virtue'.
- 'Deklan`s Dignity'.

Photos supplied by Carrie Kruger. Thank you to all contributors: Clivia newsletter vol.18 no.1 pgs.3-4 2009. http://www.cliviaforum.za.net/forum/index.php?topic=26632.0

Figure 35 'Four Marys'

10. 'FOUR MARYS'

'Four Marys' is a strain of plants originally obtained from Margot and Gordon McNeil. The flowers have narrow tepals, the buds starting off green, changing to near white, then to yellow and finally colour up to pink with age. Margot McNeil mentioned that Gordon named the plant 'Four Marys' after the ladies in waiting of the Mary, Queen of Scots. They are known in history as 'The Four Marys' - Mary Seton, Mary Fleming, Mary Beaton and Mary Livingston. The number four was used for the four colours seen with the flowering of 'Four

Figure 37 'Four Marys' F2

Figure 36 'Paljas Magic'

Figure 38 'Gordonia'

Marys'.

Notable breeding from 'Four Marys':

- 'Paljas Magic'. ('Jumbo Yellow' x 'Four Marys' x siblings).
- 'Monet'. ('Four Marys' seedling).
- 'Lady Jane'. (A selected 'Four Marys').
- 'Gordonia'. ('Four Marys' Seedling).

Photos supplied George Mann, Dawie Strydom and Hilton Atherstone. Thank you to all contributors. Clivia newsletter vol.27 no.3 pgs.6-14 2018 'Paljas Magic – A new colour strain' by Dawie Strydom.

Below: Figure 39 'Monet'

Figure 40 'Gunston'

Figure 41 'Janneman'

http://www.cliviaforum.za.net/forum/index.php?topic=9028.15

11. 'GUNSTON'

In 1997 Pikkie and Elize Strumpher travelled to Fronehave Nursery near Badplaas also known as eManzana and eBhadini is a small town on the R38 road in eastern Mpumalanga, South Africa. At the nursery they spotted a bronze flowering clivia. This clivia was named G06. The plant had been pollinated at the nursery and developed berries. Pikkie germinated the seeds and the offspring were named 'Gunston Brothers'.

At the Metro Show in 2001 'Gunston' was awarded 'Second Best on Show'. The late Koos Geldenhuys, one of the judges present and suggested the name 'Gunston', as the colour


Figure 42 'African Princess'


Figure 44 'Verdi'


Figure 43 'Mrs Brown'

Figure 45 'Klein Erda'

of the flower was the colour of a packet of Gunston cigarettes.

Notable breeding from 'Gunston':

- 'Mrs. Brown'.
- 'Gunrao'.
- 'African Princess'.
- 'Janneman'
- 'Classics series'.

Figure 47 'Best on Show 2018'

Figure 46 'Play Erda'

Photos supplied by Pikkie and Elize Strumpher. Thank you for the contributions from Pikkie and Elize Strumpher. Clivia newsletter vol.21 no.3 pgs.18-20 2012 'Breeding green throats' by Pikkie Strumpher.

12. 'KLEIN ERDA'

'Klein Erda' is a plant grown from Nakamura seeds by the late Bertie Guillaume of Brom `n Nel Nursery, Louis Trichardt, Limpopo, South Africa. This plant was exceptional and Bertie Guillaume and his late wife Erda Guillaume,named it after their granddaughter Erda (now Erda Ferreira Coxen). It is an orange-coloured flower with a white throat, now classified as a bicolour. This plant has proven itself as noteworthy breeding plant in many collections.

Notable breeding from 'Klein Erda':

- 'Play Erda'- Best on show NCCK show 2018.
- 'David'.
- 'F1 USA orange x Klein Erda'

Photos supplied George Mann and Carrie Kruger. Thank you to the contributors George Mann and Erda Ferreira Coxen. https://www.facebook.com/clivias2go/photos/ a.223890504781372/329084917595263/https://cliviasociety.com/clivia-register/clivia-register-detail/?pdb=1889

Figure 48 F1 'USA orange x Klein Erda'

Figure 49 'Naude`s Peach'

13. 'NAUDE'S PEACH'

'Naude's Peach' was first noticed by Mrs. Olive Naude in a neighbour's garden in Kloof, KwaZulu-Natal in 1977. Their neighbour had yellow flowering clivias, as well as this plant in their garden. Olivie Naude potted up this plant and this plant rewarded her 2 peduncles annually.

'Naude's Peach' was first entered into the Natal Clivia show in 1997 by Olive Naude. The flower starts off as a yellow flower. With age the outside of the tepals change colour to a light pink/peach. At the show in 1997 the plant created a large amount of interest with the interesting colouring of the flowers. This colouring is now classified as a versicolour. Although the original 'Naude`s Peach' flowers are not spectacular, it has

Figure 50 'Zol'

Figure 51 'Naude`s Peach' F2

Figure 52 'Best on show 2007'

Figure 53 Size comparison of 'Sleeping Beauty'

proven to be one of the best plants to use in a breeding programme.

Notable breeding from 'Naude's Peach':

- 'Pastel Blush'. (Group 2 yellow x 'Naude's Peach').
- 'Narcotics Series' e.g., 'Zol', 'Daggakoekie'.
- 'Royal Gala'. ('Andrew Gibson' x 'Naude's Peach').
- 'Blushed Yellows'.

Photos supplied Liz Boyd, Sean Chubb and Carrie Kruger. Thank you to the contributors, Sean Chubb and Liz Boyd. http://cliviasa.co.za/index.php/naude-peach

14. 'SLEEPING BEAUTY'/'F14'

'Sleeping Beauty/F14' was purchased from the collection of the late Nico Frik from Swellendam in the Western Cape. Nico Frik's plants were bought by Johan Conradie. The late Johan Conradie numbered them with an F preceding the number of the plant. 'Sleeping Beauty' was number 'F14'. 'F14' was a big plant with thick leathery leaves and roots much thicker than the usual clivia plants.

'Sleeping Beauty' was named after the mountain in Riversdale, which resembles a reclining woman. Johan Conradie grew up next to the mountains of Garcia Pass, Riversdale, in a small place called Novo. The plant would often not flower every year and was another reason for naming it 'Sleeping Beauty'. This plant flowered in 2007 and won the award for the 'Best on Show' at the Garden Route Clivia Club Show. With this win, many clivia growers showed an interest in this plant. Aart van Voorst of the Netherlands tested the pollen and confirmed that it was a 'tetraploid', different from the rest of our clivia, which are 'diploid' chromosome number.

Seed set on 'Sleeping Beauty' is very poor. The pollen is infertile on plants that are not tetraploids. The seed pods look as though they

Figure 54 'Sleeping Beauty'

Figure 55 'Star Green Original'

have formed seed, but are soft and struggle to germinate. 'Sleeping Beauty`s' offspring are slow growing and take many years to mature and flower.

Photos supplied by Carrie Kruger and Wouter Conradie. Thank you to all contributions of Wouter Conradie and Aart van Voorst.

15. 'STAR GREEN'

'Star Green' is an unusual green versicolour with red/brick on the outer petals. The name 'Star Green' was randomly chosen by Phillip Crous because of the green undertones. 'Star Green' is a slow grower and it does not self-pollinate very successfully. When pollen is used on other plants, seed set is also poor.

In 1997 Charl Malan received seed from Mr. Nakamura of 31 different crosses. Charl Malan and Philip Crous (Charl's neighbour) simply numbered the batches 1-31. Batch no.13 was described by Mr. Nakamura as "Special Seed".

Figure 56 'Star Green Destiny'

Figure 57 'Star Power'

Figure 58 'Warmheart'

Charl Malan grew 15 from this batch and Philip Crous grew the other 9 seeds. From this batch (No.13) 'Star Green', 'Charl`s Green' and 'Cromwell Bronze' would emerge. This confirms that these plants are siblings.

These plants are now in the hands of a lucky few breeders to take breeding one step further.

Notable breeding from 'Star Green':

- 'Star Green Destiny'.
- 'Charl's Green' x 'Star Green' (Bronzes)
- 'Star Power'.

Photos supplied by Carrie Kruger. Thank you to all contributors Carrie Kruger and Charl Malan Clivia news Vol.24 No.1 2015 pg.15-18 'A Star is Born' by Carrie Krüger, Utopia Clivias https://cliviasociety.com/clivia-register/clivia-register-detail/?pdb=2521

16. 'WARMHEART'

'Warmheart' is one of those timeless Clivia

Figure 59 'Arishook' F1 'Warmheart'

Figure 60 'Shen'- 'Warmheart' F1

classics. Bred by the late Wessel and Rudo Lotter, this interspecific has proven to be an asset to any breeder's collection.

The name is a very accurate description of the colour of this flower. It is a versicolour, but as it matures the inside of the tepals develop a warm red glow. It is speculated to be a f2 caulesescens interspecfic hybrid.

Notable breeding from 'Warmheart':

- 'Arishook'.
- 'Shen'.
- 'Sheriba'.

Photos supplied Pieter Saayman and Carrie Kruger.

Thank you to all contributors Pieter Saayman and Carrie Kruger.

Figure 61 'Sheriba'- 'Warmheart'F1

PHOTOGRAPHIC COMPETITION

Introduction

Glynn Middlewick

I wish to place on record my thanks to Claude Felbert, James Haxton and Ian Coates for their willingness to judge the photographic entries.

Some of the comments from the judges are repetitions of previous competitions. These include aspects such as: leaves appearing blue, image not sharp, file too small, distraction from main image, overexposed, depth of field shallow, untidy background, flower cut off in image, background colour not suitable, bad lighting and oversaturation of colour.

All entries are welcome for this competition. Most of the photographs submitted have been taken in 2020. Going forward, I would like to suggest that the Yearbook be published at the end of the year. This would allow for the photographs to be taken of the current year's blooms. A big thank you to all entrants.

The six categories for this competition are:

1 Habitat.
2 C. miniata umbels.
3 Interspecific flowering umbels.
4 Pendulous species.
5 Single Flowers.
6 Other *Clivia* related images.

There are winners of each category and then the overall winners of the competition.

The choice of the Judges for the best photograph overall is this one of Carrie Kruger. This image also won the award for the best '*C. miniata*' photgraph.

The ‘Second Best’ Photograph of the Overall Competition was this image submitted by Roger Dinsdale. This photograph also won the award for the ‘Second Best’ *C. minata* photograph entered.

The position for the 'overall' 'Third Best' photograph entered was submitted by Carrie Kruger. This photograph was also awarded the 'Best' in the 'Single Bloom' Category.

PHOTOGRAPHIC ENTRIES

CATEGORY: C. MINIATA

FIRST POSITION C. MINIATA CATEGORY – Carrie Kruger

SECOND POSITION C. MINIATA CATEGORY – Roger Dinsdale

THIRD POSITION C. MINIATA CATEGORY – Carrie Kruger

HIGHLY COMMENDED C. MINIATA CATEGORY – Anzette Snyders

HIGHLY COMMENDED C. MINIATA CATEGORY – Pieter le Roux

HIGHLY COMMENDED C. MINIATA CATEGORY – Rudi Koekemoer

CATEGORY: 'INTERSPECIFIC FLOWER'

FIRST POSITION – 'INTERSPECIFIC FLOWER' – Andrew Kajewski

SECOND POSITION 'INTERSPECIFIC FLOWER' – Roger Dinsdale

THIRD POSITION 'INTERSPECIFIC FLOWER' – Carrie Kruger

HIGHLY COMMENDED INTERSPECIFIC CATEGORY – Dawie van Heerden

HIGHLY COMMENDED INTERSPECIFIC CATEGORY – Anzette Snyders

HIGHLY COMMENDED INTERSPECIFIC CATEGORY – Mike Riska

CATEGORY: ‘SINGLE FLOWER’

FIRST POSITION ‘SINGLE FLOWER’ – Carrie Kruger

SECOND POSITION ‘ SINGLE FLOWER’ – Anzette Snyders

THIRD POSITION ‘SINGLE FLOWER’ – Mike Riska

HIGHLY COMMENDED SINGLE FLOWER CATEGORY – Carrie Kruger

HIGHLY COMMENDED SINGLE FLOWER CATEGORY – Carrie Kruger

HIGHLY COMMENDED SINGLE FLOWER CATEGORY – Andrew Kajewsky

PENDULOUS CATEGORY

FIRST POSITION 'PENDULOUS CATEGORY' – Carrie Kruger

SECOND POSITION 'PENDULOUS CATEGORY' – Dawie Strydom

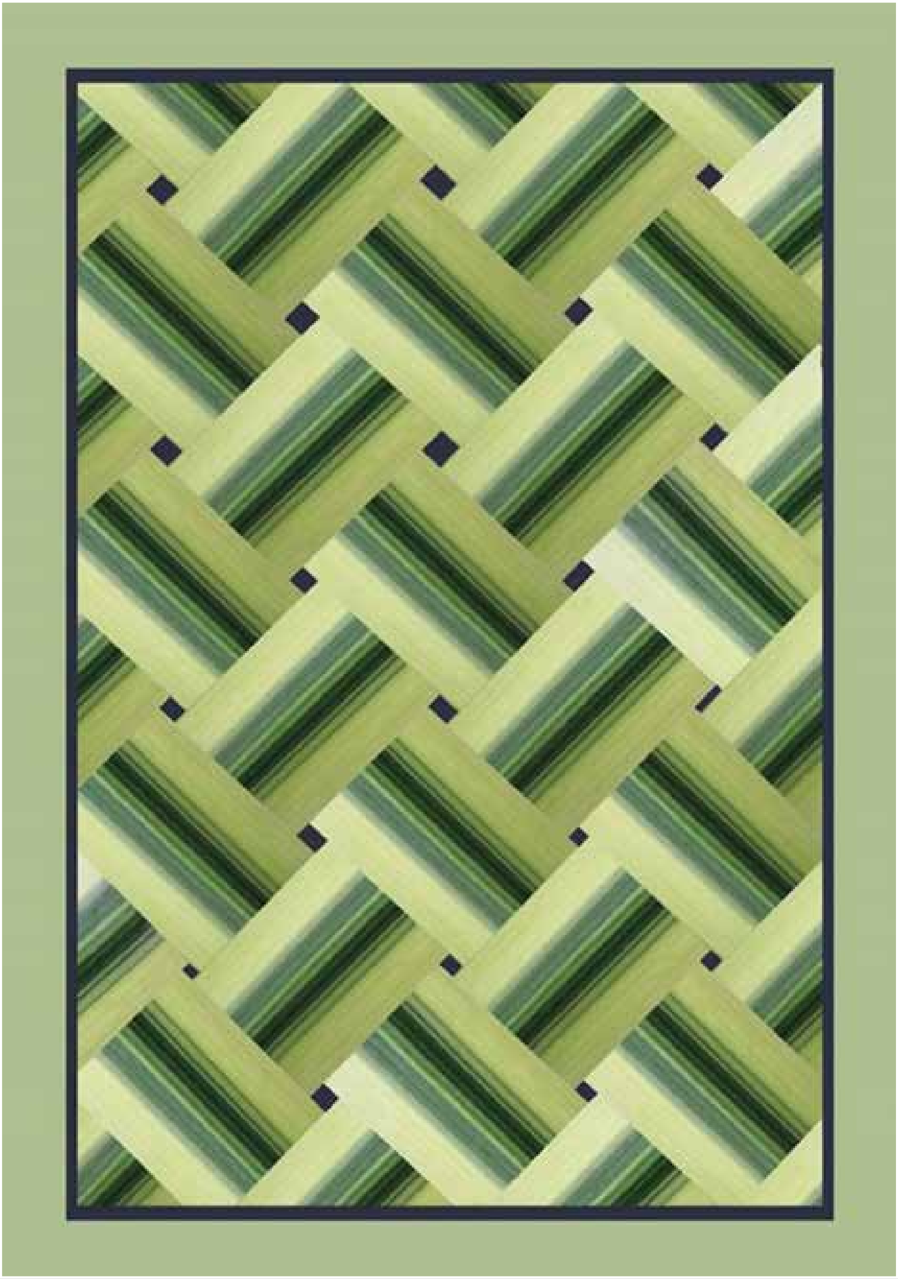
THIRD POSITION 'PENDULOUS CATEGORY' – Carrie Kruger

HIGHLY COMMENDED ‘PENDULOUS CATEGORY’ – Andrew Kajewsky

HIGHLY COMMENDED ‘PENDULOUS CATEGORY’ – Carrie Kruger

HIGHLY COMMENDED ‘PENDULOUS CATEGORY’ – Andrew Kajewsky

CLIVIA RELATED CATEGORY



FIRST POSITON 'CLIVIA RELATED CATEGORY' – Werner Sanders

SECOND POSITION ‘CLIVIA RELATED CATEGORY’ – Roger Dinsdale

THIRD POSITION ‘CLIVIA RELATED CATEGORY’ – Andrew Kajewski

HIGHLY COMMENDED CLIVIA RELATED CATEGORY – Wessel Barnard

HIGHLY COMMENDED CLIVIA RELATED CATEGORY – Alex Mikhalevitch

HIGHLY COMMENDED CLIVIA RELATED CATEGORY – Alex Mikhalevitch

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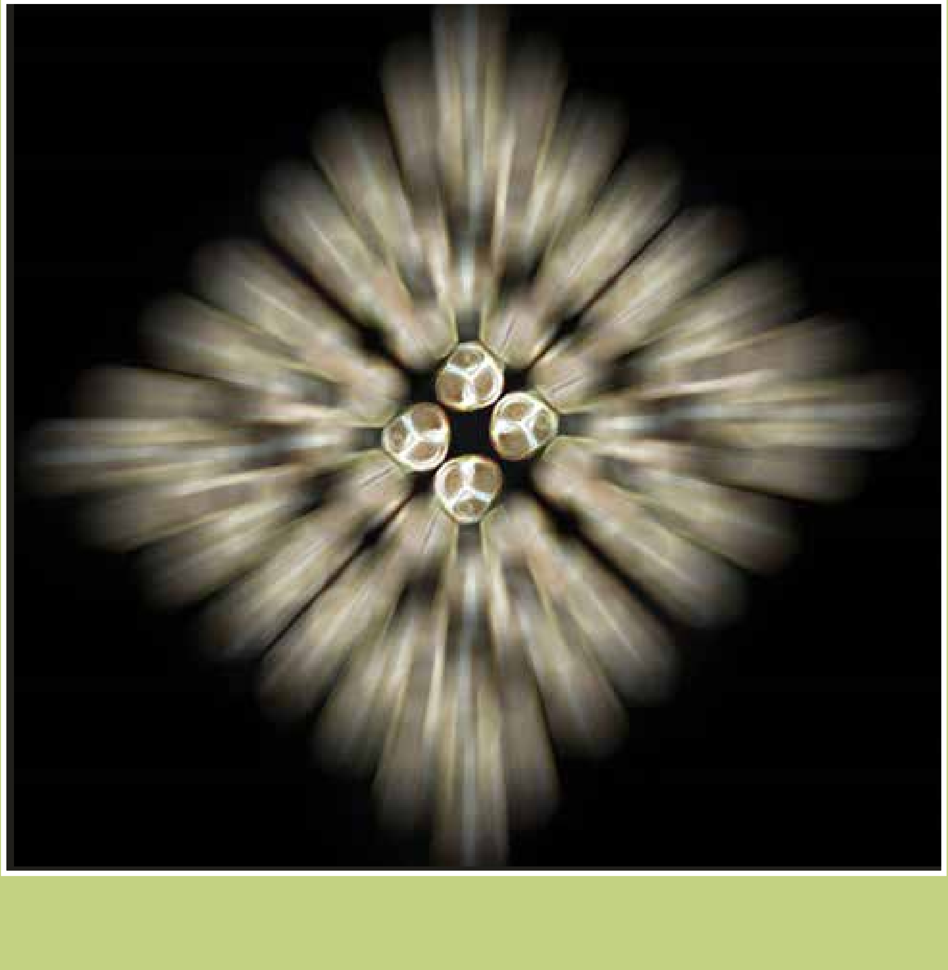

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