Editorial

Plant Invaders

The distribution of almost the entire world's flora has been modified over hundreds of years. Plants have moved from one place to another, either by birds, animals or water, or by man. Many of these plants have grown briefly and died out, others have become part of the natural vegetation, and a few have become invasive or weedy.

The term "invasive" has several definitions. The first refers to non-indigenous species that adversely affect (either economically or environmentally) the habitats they invade, or "an invader is a species that does not naturally occur in a particular area and which causes harm". A second definition includes both indigenous (native) and non-native species that heavily colonise a particular habitat. And what is "a weed"? One definition says "a plant considered to be a nuisance" or "a plant in an undesired place". Weeds are not necessarily invasive – they often colonise disturbed areas and do not displace or out-compete any natural species.

What conditions lead to plant invasiveness? All species compete to survive. Invasive species seem to have specific characteristics that allow them to out-compete native species. Maybe they grow more quickly, or they have fewer predators, or their seed dispersal is very effective. Before a species becomes invasive, it must survive at low population densities, sometimes for years. It might also need to be re-introduced several times before it becomes invasive. Invasive species often coexist with indigenous species for long periods of time, and the two populations remain balanced. This balance may then change gradually over time, with the invasive species slowly taking over a habitat, or it may occur quickly and suddenly, for example after too many fires. It is also possible that invasive species succeed because they are using resources unavailable to local species, eg they have long tap roots which can reach deep water sources. Anyone who has pulled out a small Port Jackson *(Acacia saligna*) will know that the root can be several meters long. Another factor involved is a change in the environment, eg fires or road building or land clearing. These disturb a balance, and this can allow a fast growing species to dominate. Invasive plants can also alter an environment by changing the fire regime for example. This is very evident in the SW Cape where large areas of fynbos have been invaded by Port Jackson. These trees form dense colonies which burn fiercely, resulting in more frequent hotter fires which have an adverse effect on the native flora.

Which bulbous plants are listed as invasive? In South Africa, the only "bulbous plants" listed are *Canna indica* and *Lilium formosanum*, a beautiful white flowered species which grows in Mpumalanga in the areas of Pilgrim's Rest and Graskop. The only places that we have seen this species is on road verges and in disturbed places, and I have not seen it in undisturbed areas competing with native plants. I would therefore view it as a "weed" at present. However, perhaps it is biding it's time!
In New Zealand, several South African "bulbous plants" are listed as noxious weeds – these include *Zantedeschia aethiopica, Watsonia meriana bulbifera, Aristea ecklonii, Agapanthus praecox, Homeria collina* and *Crocosmia x crocosmiflora*. Not included is

Hesperantha coccinea, which is probably classified as a "weed" – we saw it lining the roads close to Christchurch on South Island making beautiful bright red patches in damp places.
In Australia, the list is similar, but in addition includes *Oxalis pes-caprae* and *Romulea* species.
California lists *Oxalis pes-caprae* as a pernicious weed, *Watsonia marginata* and various *Oxalis* species as growing in waste places (in other words, weeds), *Amaryllis belladonna* has apparently naturalized along the coast, and *Watsonia meriana bulbifera* is listed as sometimes invasive. *Chasmanthe floribunda, Freesia alba, Gladiolus tristis*, a couple of *Sparaxis* species and *Zantedeschia aethiopica* are mentioned as being found in the wild, but not common. So it appears as though *Watsonia meriana bulbifera, Oxalis pes-caprae* and *Crocosmia* are problems wherever they go to!

How are these plants introduced? The introduction of most invasive plants is associated with human activities. Plants have been introduced for shade, for dune stabilization, for food or for horticultural purposes. Many countries around the world now have regulations to control species being introduced into that country.
Australia and New Zealand probably have the most stringent controls, and both countries have lists of species that may and may not be imported. Each new species has to be assessed for its invasive potential, for diseases that it may carry, etc and if the plant passes the tests, it is allowed to be imported. The lists are constantly being modified to reflect the results of research, and they are published on the internet on the AQIS (Australian Quarantine and Inspection Service) and MAF (New Zealand Ministry for Agriculture and Forestry) websites. All seeds and plants entering these 2 countries are directed to the inspection facilities by the post office.
South Africa also has a list of genera that may be imported, and the latest version that I am aware of is the Government Gazette number 6409 of January 1999. Any genus not appearing on this list can only be imported with a permit issued by the Department of Agriculture. The Department of Agriculture has a website, but nowhere could I find the list of genera that can be imported.
The USA, through the USDA (US Department of Agriculture) and APHIS (Animal and Plant Health Inspection Service) also controls the movement of plants into the country by issuing import permits. The USDA only lists species that may **not** be imported, and they do not have one consolidated list that one can refer to, making it difficult to comply with the legislation. All seeds and plants entering the USA are supposed to be sent directly to the USDA inspection stations, and once the inspection is complete, the parcel is sent to the recipient.

All of these controls rely on two things – firstly, the efficiency of the country's postal services, and secondly, on the honesty of the population. The Australian and New Zealand postal services appear to be very efficient, and it seems as though most parcels containing seeds are inspected. Both the South African and USA postal systems are inefficient, and I would guess that the majority of plants and seeds bypass the inspection services in both countries. This means that the control of plant movement rests squarely on us. However, where plants are concerned, few people appear to be honest, and plant smuggling is rife! I am not about to moralize on this, but I will say – if you send bulbs and

seeds around the world, it is always best to do it legally. If you smuggle, think very carefully about what you are doing and which species you are introducing. And if you are growing plants from another area or country, and you notice that the plant is taking over your garden or is moving from one pot to another, when you discard this plant, don't just throw it into the rubbish bin, as it may escape from wherever it is thrown. The best is to burn the plant plus all its seeds and bulblets, so that your throw out does not become the next noxious weed or invader! ♣

Ornithogalum adseptentrionesvergentulum

Charles Craib

Ornithogalum adseptentrionesvergentulum was described by the Müller-Doblies in their partial revision of Ornithogalum (1996: 446 – 449). All collections of this very unusual and interesting dwarf plant cited in the type description were from the Moordernaars Karoo north and north-west of Laingsburg and further east in the vicinity of Prince Albert. *O. adseptentrionesvergentulum* is close to *Ornithogalum comptonii* in some respects. The main distinguishing features are the cryptic often densely pubescent cylindrical leaves that characterise *O. adseptentrionesvergentulum* and their invariable distinctive inclination to the north or north-west.

June and July 2008, the middle of the southern winter, proved ideal to search for further records of this unusual species and to conduct research during the growing period. There had been widespread rains and these were particularly heavy in places in early July. These moist conditions were very favourable for the growth of the plants which occur on arid ridges covered in grey shale fragments. The bulbs grow only a few centimetres below the surface of heavy clay soil which is a characteristic putty grey in colour. Plants are absent from much shale habitat and avoid growing on ridges with almost pure shale grit or grey shale chips with very thin soils below.
The Müller-Doblies recorded the species as rare (1996: 448). The bulbs are adapted to grow in very harsh conditions which are excessively hot and dry in summer and periodically moist after winter rainfall, which occurs mostly between May and August. Much of the precipitation in habitat falls as soft penetrating rain and as the bulbs are shallow growers, minimal amounts of rainfall can irrigate them. The patchy distribution of this species and its occurrence in small numbers where found, appears to be related to heavy stocking of the western Karoo with sheep and goats. The tuft of closely packed cylindrical leaves only reaches 1.5 – 2 cm in height and is not attractive to grazing animals. The bulbs and leaves may also well be poisonous. They are however readily damaged by the hooves of grazing animals and are particularly vulnerable to trampling at the seedling stage.

Many bulbs and geophytes that frequent the western Karoo avoid trampling by growing under or beside low shrubs or else amongst rocks. Those that grow on shaly ridges or hillocks are few with respect to individual species and numbers of plants per species.
O. adseptentrionesvergentulum is sometimes locally plentiful on shale bands situated in broad road reserves. At one such place north-west of Laingsburg many bulbs have established themselves in the absence of trampling by livestock. In the same habitat over the fence, no Ornithogalums were observed even under the ideal growing conditions of June and July 2008. The habitat in the farm is regularly grazed by flocks of sheep.
Research carried out on plants growing in the road reserve habitat indicated that there is a huge range in sizes of plants from seedlings to large mature bulbs. There were often numbers of seedlings, sometimes as many as 20, in the vicinity of the well established mature bulbs. Only one other bulbous plant was found to be plentiful on the shaly hillocks frequented by *O. adseptentrionesvergentulum*. This was *Lachenalia comptonii* which occurred in groups of mature bulbs as well as seedlings to sub-mature ones.

The growth cycle of *O. adseptentrionesvergentulum* is from May or June when the first winter rains fall to about the middle of August. The grey shale ridges on which the Ornithogalums grow absorb a lot of heat from the sun and the bulbs quickly enter dormancy as day temperatures rise. Short flower spikes of 3 – 4 cm in height appear in September immediately after the leaves have withered. The flowers are a greyish buff, small and campanulate. They are difficult to spot amongst the shales where the plants grow but are not as cryptic as the foliage.

The seed is very fine and black. It is usually produced in large amounts during late September and October. The Ornithogalums are unable to regenerate if this fine seed is buried too deep as it almost invariably is when the surface soil is disturbed by the hooves of sheep and goats. In the undisturbed soil conditions characteristic of road reserves these minute seeds stand the best chances of germination when the rains start the following winter.

Road reserves, whilst free from grazing livestock, are beset with other hazards. Large trucks may pull off the roads squashing hundreds of bulbs that grow just below the soil surface. Large broad road reserves are particularly favoured for this purpose. Shale may be dug off the reserves for use in maintaining culverts and embankments and amounts of glass and plastic pollution are increasing in some areas.

Reference:
Ute & Dietrich Müller-Doblies. Revisionala incompleta Ornithogalum Austra Africanorum (Hyacinthaceae) Feddes Repertorium 1996: 446 – 449. ♣

Brunsvigia radula, an enigmatic species from the Western Cape

Rod Saunders

Brunsvigia radula is the smallest species in the genus with a flower head no more than 70mm high and about 100mm across. When not in flower with only its papillate leaves visible, it is easily overlooked and mis-identified as a *Massonia*. When compared with *Brunsvigia josephinae* with a flower head over a meter tall and more than 600mm across, it is hard to believe that these plants are in the same genus.

Brunsvigia radula has long been known to science and was collected in the vicinity of the Olifants River by Boos & Scholl for the Royal Schoenbrunn gardens in Vienna shortly before 1797 when it was described by Jacquin as *Amaryllis radula*. In 1811 Aiton correctly placed the species in the genus *Brunsvigia*.

Rachel and I know of a site north of Vanrhynsdorp which we visit frequently in the hopes of seeing the plants in flower. Where it grows it shows a preference for limestone cracks, and at this site I have never seen it growing elsewhere. John Manning and Dee Snijman tell me that in other localities, away from the Knersvlakte, it grows equally well in quartz sheets and amongst quartz rocks.

In early March 2009 we again visited the site on our way north, although we didn't hold out much hope of flowers as it had been so hot and dry. We combed the area very closely for about 10 minutes and found nothing. Just as we were about to give up, I looked up from the ground, and as my eyes adjusted I couldn't believe what I saw. There before me were literally dozens of plants all in flower, in some cases 3 to 4 bulbs all pushing up flowers out of the same crack! What a beautiful sight – although the flower heads are small, the individual flowers are reasonably large, and are a lovely pink colour. We kept our eyes open for pollinators, but saw none at all.

At the end of March we visited the site again. Alas, it was as though the flowers had never been, not a trace of them anywhere. We can only suppose that because of the excessive heat after flowering, the plants shut down their flowering cycle and went back into dormancy. Cape Town had an extremely hot March with many days of over 30°C. The area around Vanrhynsdorp is usually much hotter than Cape Town, and frequently has temperatures of over 40°C. A week or more of these high temperatures would probably have frizzled the flowers within days.

Most people I have spoken to who know the plant have never seen it flower. We feel privileged to have been there at exactly the right time to see such a beautiful display. ♣

A striking new colour form of *Dietes bicolor*

Graham Duncan

Dietes is a small evergreen genus of the Iridaceae comprising five African members (*D. bicolor, D. butcheriana, D. flavida, D. grandiflora* and *D. iridioides)* and one very disjunct member, *D. robinsoniana*, restricted to Lord Howe Island in the Pacific Ocean off the north-eastern coast of Australia. The species occurring in southern Africa are encountered mainly in the eastern summer rainfall parts of South Africa and in Swaziland; *D. bicolor, D. butcheriana* and *D. grandiflora* are endemic to South Africa, *D. flavida* grows in South Africa and Swaziland, while *D. iridioides* is widely distributed from the southern Cape to East Africa.

With their neat, spiky evergreen foliage complemented by sheets of yellow or white *Iris*-like flowers produced at well-timed intervals in spring and summer, coupled with their ease of culture and longevity, *D. bicolor* and *D. grandiflora* (both from the Eastern Cape and KwaZulu-Natal) are very important landscape plants in temperate parts of South Africa. Flourishing in full sun or light shade, in almost any soil, they survive harsh conditions and are widely used in roadside plantings, traffic islands, around office blocks and in mass displays in parks. They are able to withstand long periods of drought once fully established, yet are just as obliging in difficult, boggy conditions. The small white flowers of *D. iridioides* and *D. butcheriana* are not as showy, their greatest assets being their decorative foliage and ability to perform well even in a densely shaded environment. *D. iridioides*, a relatively low-growing plant of forest margins, multiplies so rapidly it can be used as a groundcover under deciduous trees. *D. butcheriana,* occurring naturally in mistbelt evergreen forest of the Eastern Cape and KwaZulu-Natal, is a much under-utilized garden plant, having beautiful fans of very broad, bright green leaves, and flourishes in even the shadiest of conditions. The light yellow-flowered *D. flavida* is a native of rocky ridges in Swaziland, KwaZulu-Natal and Mpumalanga, and an excellent choice for its broad, erect, grey-green leaves, placed in clumps towards the rear of sunny or semi-shaded borders. The robust *D. robinsoniana* is hardly ever seen in cultivation in South Africa and it too makes a handsome garden plant for full sun positions, producing thick clumps of broad, bright green leaves, and white flowers with light orange-yellow nectar guides. Individual flowers of *D. grandiflora* last for three days, those of *D. bicolor* last a full day, and the remaining African species are gone in less than eight hours! Certain forms of *D. iridioides* can withstand sub-zero temperatures for short periods but in general, the genus is tender. All the *Dietes* species are strongly self fertile with the exception of *D. bicolor,* producing copious numbers of seeds from hard, oblong capsules. The irregularly shaped, compressed seeds have a particularly hard seed coat, taking one to four or more years to weather away before germination takes place.

Dietes bicolor 'Mzamba River'

Dietes bicolor is endemic to coastal and slightly inland parts of the Eastern Cape and KwaZulu-Natal, occurring in clumps along the margins of perennial streams and in

marshy areas, in full sun or light shade. Although cultivated in Europe since the early 1830s and now grown worldwide, its numbers are declining in the wild due to habitat destruction. The specific name *bicolor* is descriptive of the contrasting lemon-yellow tepals and the prominent dark brown or almost black nectar guide near the base of each outer tepal.

In December 2004, a striking colour form of *Dietes bicolor* was found growing near the Mzamba River south of Port Edward in Pondoland, Eastern Cape, by Jan Burring, the Kirstenbosch Scholar for that year. Vegetatively the plant conforms to that of typical forms of this species in having a slender, horizontal, branched rhizome, each growing shoot having 6–12 light green, linear leaves 1.0–1.2 m long and 10–20 mm broad, with a prominent midrib, produced in an elegant, erect narrow fan with the upper portion of the leaves elegantly curved outwards. In keeping with the typical forms, the much-branched inflorescence grows to roughly the same length as the leaves and is borne atop an erect, rigid scape (peduncle). The saucer-shaped flowers are borne on erect, bright green pedicels 30–80 mm long and appear successively over a period of five to six weeks. The typical forms have light lemon yellow inner and outer tepals, the outer tepals each having a prominent, semi-circular dark brown or almost black nectar guide near the base, outlined with bright orange, with small, bright orange dots on the tepal claw that curves downwards toward the centre of the flower. *Dietes bicolor* 'Mzamba River' differs in having cream inner and outer tepals with a striking bright orange, semi-circular nectar guide on each outer tepal, and the tepal claw is devoid of orange dots. Whereas the outer tepals are broadly obovate (inversely egg-shaped) in both the typical and 'Mzamba River' forms, the inner tepals are obovate and slightly narrower, with obtuse (blunt) tips in the typical forms, but oblanceolate (inversely egg-shaped) with acute tips in the 'Mzamba River' form. Like those of the typical forms, individual flowers of 'Mzamba River' last just one day, but numerous buds develop successively within the floral sheaths so that there are usually several flowers open simultaneously per inflorescence during the summer flowering period that extends from late August to early February. The sub-erect, club-shaped ripe capsules conform to those of the typical forms in splitting partially at the apex when ripe.

Dietes bicolor 'Mzamba River' is cultivated in exactly the same manner as the typical forms, thriving in well composted, slightly acid soil, in full sun or light shade. It is a vigorous plant that multiplies rapidly by offset formation and although it prefers permanently wet surroundings in the wild, it performs well under ordinary garden conditions in temperate climates, if watered regularly. It can also be grown in deep containers with a diameter of at least 30 cm, but has to be divided regularly as it fast becomes potbound. *Dietes bicolor* 'Mzamba River' is not yet available commercially but has great horticultural potential as a novel garden and landscape plant.

References

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The genus *Clivia* and its Trans-Atlantic kissing cousins

Attempts at tracing a relationship

John van der Linde

The genera *Clivia* and *Hippeastrum* are both members of the same family, the Amaryllidaceae and as such they are distantly related – "kissing cousins", to use the USA expression. They have their habitats on widely separated continents – *Clivia,* with 6 described species, are native to southern Africa, while 80 or so species of *Hippeastrum* are native to tropical and subtropical regions of the Americas from Argentina north to Mexico and the Caribbean, with half of them being found in Brazil.

As a short reminder of what the Amaryllids have in common, I quote from Harold Koopowitz in his book "Clivia": "The main features of the family are the presence of 6 coloured tepals (similar petals and sepals), 6 stamens, and an inferior trilocular (meaning there are 3 cavities) ovary. Flowers tend to be borne in clusters with the flowers all coming from a single point on the peduncle or flower stalk forming a distinctive inflorescence called an umbel. Most of the Amaryllidaceae have strap-shaped leaves and form true bulbs".

"Both *Clivia* and its closely-related sister genus, *Cryptostephanus*, do not form bulbs…… The ovary locules [of *Clivia*] contain a reduced set of ovules, often only 5 or 6. Fruit is a coloured berry when ripe. Seeds are fleshy, without a coloured testa, containing phytomelanin, and spherical, usually at least a centimetre in diameter."

5 species of *Clivia* are native to the summer rainfall areas of South Africa, while *C. mirabilis*, the sixth species, is found in the winter rainfall region of the Northern Cape. *Clivia* are understorey plants growing mainly in coastal and relic Afromontane forests. The 3 *Cryptostephanus* species, either savannah or forest plants, occur further north, with the range of the genus extending from northern Namibia and the highlands of Angola in the west to the mountains of Zimbabwe in the east, up to Kenya in East Africa.

The form of fruit mentioned above, termed 'baccate', is common to the sub-family or tribe Haemantheae, which includes the genera *Scadoxus* (also bulbless), *Gethyllis,* and *Apodolirion*, and also *Haemanthus* which is more widely distributed in Africa, as well as two Australian genera, *Calostemma* and *Proiphys*, not considered further in this article. It has recently been proposed that the Haemantheae diverged from their antecedents around 33 million years ago, and that the clade comprising *Clivia* and *Cryptostephanus* split off from the other baccate-fruited genera around 28 million years ago, with *Clivia* in turn splitting off from *Cryptostephanus* some 2 million years later. For *Clivia,* the divergence of the winter rainfall *C.mirabilis* from the 5 summer rainfall species is estimated at between 15 million and 16 million years ago.

Hippeastrum, on the other hand, like the vast majority of the Amaryllidaceae, have true bulbs and all the species except one produce seed pods containing many winged seeds, usually enclosed in a papery sheath. The exception, *H. reticulatum*, apparently has seeds which are intermediate in form between those of *Clivia* and the other *Hippeastrum* species. I don't know about species in the wild, but flowers of cultivated kinds are held horizontally or drooping in an umbel. Flower colours of the species range from pure white to soft rose, pink, magenta, salmon, orange, red, mahogany, and red and white striped. Their habitats in the wild range from stream banks to rocky hillsides, from sea level to sub-alpine regions. The use of the name "Amaryllis" for the bulbs is common in horticultural circles.

The continents of Africa and South America once made up West Gondwana. Evidence, including DNA sequencing data suggests a southern African origin for the Amaryllidaceae and that plants radiated from there. There are in fact Amaryllids that are native to all former constituents of the super-continent of Gondwana, as well as to countries around the Mediterranean. One might therefore have expected that the *most recent* common ancestor (MRCA) of Clivia and Hippeastrum was a plant that existed over 100 million years ago somewhere in West Gondwana *before* it began to split up, but that may not have been the case!

Gene sequencing work (see 'Reading' at the end of this article) suggests that the MRCA of these two genera could have existed *as recently as 33 million years ago*. By this time Africa and South America had already been drifting apart for 90 million years, give or take a few million years. After all this time they were already separated by a vast ocean, perhaps already as much as 3500km wide (my thumbsuck). If the Amaryllidaceae originated in Southern Africa then how could that gene transfer have taken place?
It is the purpose of this article to set out some possible ways in which this could have happened. Each method is plausible, with some evidence in its favour – but not conclusive evidence. The article illustrates some of the almost unbelievable ways in which plant material and other organisms have moved around the globe in the past.

I first want to put into perspective the estimated divergence date of 33 million years ago, which is pivotal to much of what is said in this article. A group of scientists carried out a global analysis of angiosperm families using all available fossil data and then estimated divergence times by triangulation using the so-called molecular clock (see separate article in this Bulletin). They were not specifically investigating the relationship between the two genera. They just chose *Clivia* and *Hippeastrum* to be representative of the Amaryllidaceae of the 2 separate continents in the build-up of their data. The "33 million years" figure was just one of the results that emerged from their analysis. It is an artifact of the choice of data and method of analysis that was applied. It is not cast in stone, and is not accurate to the nth degree.

It is also important to note that if the two genera indeed diverged an estimated 33 million years ago, i.e. that was when their most recent common ancestor (MRCA) is estimated to have existed, it is in fact quite possible that the plant that migrated – if this is what happened - was *not the MRCA at all* but a more recent descendant from *one* branch of

the family while the other branch “stayed at home” and continued to speciate down the ages.

Now, how may such a migration have taken place all those eons ago?

There are a variety of ways that have been associated with similar dispersals across oceans, for example from the South American continent 1000 km westwards to the Galapagos archipelago:

(a) Wind dispersal is one method: Some plants produce seeds with wings or plumes that allow them to be caught up in a passing breeze. Upon reaching sufficient altitude, they may travel hundreds of kilometres before falling back to earth. As chance has it, that bit of earth may provide a suitable habitat. Other seeds can become airborne simply because of their light weight. For example, orchid seeds, the size of dust particles, are carried throughout the world by the winds.

(b) Many plants produce fruit or seeds that are eaten by birds. If such a bird happens to head off across the ocean it may reach land where it deposits the seeds where they have a chance of survival. Other plants have fruit or seeds with some form of adhesion such as barbs or mucilage. These too may eventually reach a new habitat while attached to the feathers of a bird. Still other seeds might arrive stuck to the muddy feet of a marsh bird.

(c) Coastal plants typically arrive on the ocean currents. *Cocos nucifera* (coconut palm) and *Scaevola plumieri* (inkberry) are prime examples of this type of dispersal mechanism. Most plants that take advantage of this method possess fruit that is not only buoyant but can survive long periods in salt water. This is believed to be the way that ancestral *Crinum* seeds were dispersed from Africa, not only to the New World but also elsewhere, including Australia and Asia.

(d) Occasionally an entire plant might survive a voyage as part of a larger mass of floating vegetation, swept out to sea on matted rafts of vegetation, including uprooted trees with large root masses, torn loose from river banks and driven across the seas by ocean currents, to eventually make landfall and take root elsewhere. This type of dispersal, known as rafting has also been used to explain how certain animals reached the Galapagos.

My purpose above has been to describe methods of long-distance dispersal *in general.* There are probabilities associated with each method and none can be entirely excluded. If I were to stick my neck out in favour of any particular method in the case of a *Clivia* and *Hippeastrum* MRCA or descendant that might have “relocated” across the ocean I would plump for dispersal by ocean currents as perhaps being most likely – or the least unlikely, taking into account the possible nature of the ancestral plant material and all the other factors involved.

A point worth making here about “likelihoods” is that we are talking not just about getting from one continent to another, but the successful transplanting of a plant or plants and/or seeds that then survived, thrived, met up with a pollinator (the old cliché “Do you come here often” comes to mind) and then multiplied. An alternative scenario would be that many seeds and/or plants became established over the eons, and that adult plants

eventually flowered, only to find that no suitable pollinator was present. Bear in mind that our intrepid early traveller would have had in its favour the fact that it would have been more 'primitive' and thus more adaptable to new and alien environments than the speciated and hence more specialised descendants with which we are familiar today. As such it could perhaps have been easily self-pollinated as well as being receptive to a wide range of pollinators, including the wind. When it arrived it could well have found itself amongst other long-established genera and would then have had to fight to become established in its own ecological niche. The chance of *any one* "migration event" succeeding may be mind-numbingly small, but who knows how many abortive dispersion events occurred over all those millions of years? Remember that a million-to-one chance could come off 10 times in 10 million years! The scientists use the very descriptive term "sweepstakes dispersals" for these events in their literature.

The available evidence suggests that, even those millions of years ago, ocean currents swept up the west coast of Africa and then, nearing the tropics, they veered westwards i.e., that the then South Equatorial current from the Gulf of Guinea towards Brazil could well have carried the MRCA (or descendant from one branch of the family) of *Clivia* and *Hippeastrum* from Africa to South America. I won't even begin to speculate on where on the west coast of the vast continent of Africa the jumping-off point might have been but it has been suggested to me that, if indeed such a transfer of plant material had taken place, then central Africa from around present-day Angola up to Cameroon could be a possibility. As an aside, it is worth noting here that modern small-scale experiments, such as studies of drift bottles, show that 1% make it from Africa to the US.

There are other current-driven cross-ocean migrations from Africa to South America that could be mentioned: The ancestors of New World monkeys between 40 and 25 million years ago provide one example, as described by Richard Dawkins in his book "The Ancestor's Tale". He postulates that a small founding population of African monkeys rafted across the Atlantic "perhaps on fragments of mangrove swamps that could support life as floating islands for a short while. Currents were in the right direction for inadvertent rafting. Another major group of animals, the hystricognath rodents, probably arrived in South America at the same time. Again they probably came from Africa….."

Considering the large number of *Hippeastrum* species, found right across the northern part of South America from Brazil in the east to Peru in the west and in the Caribbean, one might well wonder whether, if the hypothesis of transatlantic migration holds water (excuse the pun), there was *one* successful introduction, followed by widespread radiation, or several successive introductions from Africa, with plant material arriving at different destinations and then radiating.

Our migrant plant from Africa could have done just what the Spanish Conquistadors did when they arrived in South America in far more recent times – it interbred with the locals! These would have been a local plant, or plants, in the then-existing population of Amaryllids, and the immigrant would thus have introduced an African gene into the proto-*Hippeastrum* that was already there. It could then have been traces of this tell-tale gene of African origin that was picked up in the *Hippeastrum* sample that was used in the angiosperm work.

However, nothing is ever simple. There are *other* explanations of what may have happened, all those millions of years ago. Work on the South American Amaryllidacae by another group of scientists includes a reconstructed family tree showing *Hippeastrum* as nestling within a long-established family more closely related to **Eurasian** Amaryllids than to any other. One suggestion is that early Amaryllids, having radiated northwards up Africa, then followed more or less the route taken eons later by early man; they radiated **eastward** right across Asia, across the land link (Beringia) that existed between Asia and North America until comparatively (in geological terms) recent times, and then radiated downwards through western North America to the Caribbean, Central and South America. There is evidence, but not totally conclusive evidence, from a number of sources that supports this hypothesis.

Alternatively, there is evidence that at some stage, when it was warm enough, plant material moved from East to West, from Europe to North America. If this pathway was used by Amaryllids that moved north from Africa into Europe, **westwards** and then radiated southwards down the eastern side of the North American continent and eventually ended up in South America then this would help explain their closer relationship to the Eurasian clade than to the African one.

On the other hand, South America was isolated from both Africa and North America until some 3 million years ago, when the two Americas were connected by the formation of the Isthmus of Panama. If the Amaryllids arrived by crossing this land bridge they would have been far too late to have radiated as widely as they have. Does that throw either "overland hypothesis" out of the window? No, it does not. It is believed that around 50 million years ago a chain of islands emerged which, for a period, may have provided a corridor between North and South America. This chain included the present Greater Antilles (Cuba, Jamaica, Hispaniola and Puerto-Rico, which together comprise almost 90% of the land mass of the entire West Indies) as well as others which have long since submerged. A later pathway has also been suggested, comprising the Greater Antilles and the currently submerged Aves ridge. The name GAARlandia has been coined for this later migrational pathway, which may have existed for only 3 million years or so, between 35-33 million years ago. At that time the western portion of the Greater Antilles was separated from South America only by two narrow straits.

This brings me to the next hypothesis. The progenitor may have entered northern South America by a less roundabout route, but also by "walking across land" – from north or tropical Africa , across the land bridge which existed between the Brazilian Bulge and Nigeria until - **but not after** - the end of the Cretaceous, about 65 million years ago. The key point is that this **same** early ancestor **must** then have been shared with the Eurasian sister clade of the South American Amaryllids, for the **same** genetic traces to have shown up in the Amaryllids of those different continents. The next question is: **when** did the very first plants that could be classed as Amaryllids have evolved somewhere in Southern Africa? How long would it have taken them to radiate up to and across that land bridge, an option which ceased to exist some 65 million years ago? Does this hypothesis "make sense"?

If any of the “overland March of the Amaryllids” hypotheses are accepted, the timing of the window-periods for entry into South America indicated above suggests that the MRCA of *Clivia* and *Hippeastrum* must have existed a lot earlier than the previously quoted estimated 33 million years ago for all that travelling over such very long distances to have taken place. As I mentioned earlier in this article, this estimated date of 33 million years was the date that was thrown up by the computer model.

So what does all this say about the dates emerging from the computer-generated cladogram? There was nothing wrong with the model – it gave reasonable “big picture” results for the major branches of the angiosperm ‘family tree’. The sample of only two Amaryllids was just too small for more credible estimates to emerge for the ‘splitting of the branch-end twigs’, as it were.

What is now needed is another study using a much wider sample than just two Amaryllids. The inclusion of others from all parts of the world where Amaryllids are now found will enable the reconstruction of a much more accurate ‘family tree’, with more branch points. Maybe this work has already been done. As no fossil material of Amaryllids has yet been found, dating of the splits between the branches of the tree will once again have to be done using the ‘molecular clock’, possibly the one derived from the Angiosperm work cited earlier. It is more than likely such an exercise will give rise to a reconstructed ‘more bushy’ family tree, and that *Clivia* and *Hippeastrum* will each be found to sit on branches which, in turn, link to earlier branches which may then merge to give the much earlier dated branch point at which the MRCA sits.

If I have learned anything in the course of writing this article it is that explanations that at first sight seem to make sense for what might have happened all those eons ago should be carefully checked out against other possible alternatives. As my forensic scientist friend Roger Dixon, who saw earlier drafts of this article, put it to me: “John, the evidence you have produced so far won’t stand up in court. You have to take dates, window periods, the separation and coming together of continents and climatic events into account. You have to look at **all** the evidence, at what does make sense and at what does not make sense”

I am also awe-struck by the totally different time-scales on which plants have existed and the vast distances over which they radiated by one means or another to colonise our planet. To give a hypothetical yardstick: All that is needed by plants with a generation period of 5 years “seed to seed”, with seedlings sprouting 1metre from the mother plant, to radiate a distance of 2000kms is 10 million years in which to do it – all sorts of things being equal! Many mutations are likely to occur over the 2 million generations and the plants that “arrive” may look very different to those that set out on the journey. Another awesome thought for me is that each individual plant growing today carries a message from its ancestors in its DNA, the genetic material in every cell, handed down from generation to generation, reflecting all those inherited mutations gathered along whatever journey their ancestors may have taken on this planet.

I thank Dee Snijman for first raising my interest in this story and for useful conversations about it and also Roger Dixon, Hugh Bollinger and Jim Shields for their helpful comments on earlier drafts.

Reading

I am not a scientist and do not want to convey any air of scientific authority by setting out a long list of scientific publications as my references.

I found the recent PhD thesis of Ferozah Conrad of the South African Biodiversity Institute compelling reading, though I won't pretend to have understood its more technical aspects. Its title is "Molecular systematics, Biogeography and Dating of the tribe Haemantheae (Amaryllidaceae) and the Phylogeography of *Clivia*". Her list of references includes most of those that I consulted, and many others. I should imagine that it is obtainable from the Department of Botany, University of Cape Town.

A paper that she did not list is "Phylogeny of the American Amaryllidaceae based on nrDNA ITS sequences" by Meerow et al. It was sent to me by Jim Shields and I see that it was published in 'Systematic Botany' (2000), 25(4): pp 708-726.

Richard Dawkins is always a good read and his "The Ancestors Tale" is no exception. I have the paperback version published by Phoenix in 2005.

Anyone with any queries about specific sources that I used is welcome to contact me at vandal@iafrica.com. ♣

The use of DNA sequencing to reconstruct plant 'family trees' and the dating of ancestor plants by use of the 'molecular clock'

John van der Linde

The simplest way to explain how DNA is used to reconstruct family trees, is to give a practical example.

A group of evolutionary biologists (Wikstrom *et al*) set out to reconstruct a 'family tree' (cladogram) for the angiosperms. They had access to various fossils of ancestor plants at some key branch points. These fossils had been carbon dated and they planned to use these dates to help them estimate divergence dates for branches on the tree for which no fossil data existed, including the Amaryllidaceae.

They began by obtaining plant material from each of the plants in their sample, chosen to be a representative cross-section of the angiosperms. Each of these individual plants carried a message from its ancestors. That message is in the DNA, the genetic material in every cell, handed down from generation to generation. That DNA carried not only the histories of each plant in the sample, but also the whole history of their ancestry. The scientists extracted and magnified specifically targeted genes, the segments of DNA that

are the basic functional units of heredity. Each gene is rather like an identifying bar-code which can be read by special equipment, and which is directly comparable with the sequences similarly isolated from the DNA extracted from the other plants in the their sample. They worked on exactly the same gene in the case of each plant.

An important point is that the DNA in question was extracted from genes from the chloroplast regions of the cells in each piece of plant material. The significance of this is that, unlike genes in the nucleus of the cell, which are inherited from both mother plant and pollen parent, chloroplast genes are inherited from the mother plant only. This means that the ancestors referred to above are the mother plants of the mother plants of the mother plants…….and so on, back generation by generation. The maternal lines were traced back from the present time, back into the long, distant past – in effect, to the Great Grandmother of them all.

Because there is no genetic material from the pollen parent in the chloroplast genes to 'cloud the picture,' the only source of change to genes inherited maternally can be mutations. These occur due to random errors in copying the genetic information.

The differences, from plant to plant, between the sequences show the effects of the mutations in that gene accumulated in different plants over the millennia as the angiosperm 'family tree' split into its various branches. The number of differences observed is a measure of how far back the most recent common ancestors (MRCAs) of the plants diverged from each other. For example, if there are few differences between the sequences of plants of two genera, then their MRCA must have existed fewer years ago than if there were significantly more differences between the two DNA sequences.

Their next step was to feed the sequence data into a computer, which then calculated all the possible 'family trees' which could have given rise to the differences in sequences that were observed. The computer, using an extremely sophisticated software program then picked out the most likely 'family tree' (cladogram) from the range of possible alternatives. Often there is no **one** most likely tree, but a range of equally likely trees.

If two species have more similar DNA sequences, then they have a common ancestor which lived more recently in the past, and so are joined by shorter branches on the cladogram. Species with more differences in their DNA sequences share a more remote common ancestor, and are therefore linked by longer branches.

Once a 'family tree' had been reconstructed, then a technique known as the *molecular clock* was used to estimate the dates of divergence of the branches. This technique relies on the fact that, for any particular gene, the amount of difference increases roughly proportionately to the amount of time separating the sequences being compared.

The number of differences per million years over the known number of million years from the branch points dated by the fossil records was then determined. It was then assumed that this same rate of mutation per million years applied to each of the other branches in the 'family tree'. Using this approach, estimates were then made for the dates of all the remaining branch points in the family tree. This is the way in which the estimated divergence date between *Clivia* and *Hippeastrums* of 33M years ago was determined.

For good measure the scientists repeated their work using other genes and also an alternative approach which gave rise to somewhat different - but consistent and in the same ball-park - divergence dates for all the branches in the angiosperm 'family tree'.

At each step in the process they would have done 'reality checks'. Did the results produced by the computer programs make sense? Were the overall cladograms and branches of cladograms reasonably in line with what might have been expected from work previously done? Did the dates thrown up for key branch points look reasonable? Did the estimated divergence date of 33M years for genera from two continents that had been separated for many millions of years before that look reasonable? That date was founded on a 'mini-sample' of only two genera in the Amaryllidaceae. Had a wider range of Amaryllids from all over the world been included to increase the number of data points then a different answer might have been derived. Until that is done, the 33M year figure remains the best current estimate.
This is just one example of the pitfalls that may be encountered, both in the process and in the interpretation of the results of exercises of this nature.

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Herbert and Baker – Fathers of the *Amaryllidaceae*

David Victor

Over the past two hundred and fifty years our understanding of plants and how they relate to one another has developed by leaps and bounds. Simple morphological determination led to the more complex "natural orders" approach and, following the general acceptance of Darwin's theory of evolution, new understandings today are leading to wide acceptance of phylogenetic approaches based on DNA analysis.

At home here in England, I grow a wide range of members of what is sometimes known as the daffodil family, the Amaryllidaceae. These include many from the Mediterranean area (such as Narcissus), others from South Africa (e.g. Cyrtanthus), from the Americas (e.g. Hippeastrum), from the Far East (e.g. Lycoris) and from diverse areas (Crinum). The more that I grow these plants, the more I want to know about how they relate to one another. This has led me into an ongoing research project on the family and its history.

One section of this story that I have found extremely interesting has been the part that various individuals have played in developing our understanding over the years. Central to the story were two botanists who, between them, dominated taxonomic developments during the entire span of the nineteenth century. Their names were William Herbert and Dr. John Gilbert Baker. The first of these I will deal with here and the other in a second part published immediately after this one.

Part 1

William Herbert (1778-1847)

William Herbert was a polymath, though one with a strong botanical bent. Having been educated at Eton and Oxford, he practiced law for a time and then spent two periods as a Member of Parliament. Then, in his early 30's, he suddenly changed direction completely and entered the Anglican Church, where he became the Rector of Spofforth in Yorkshire and later the first Dean of the Diocese of Manchester, when it was created shortly before his death. He wrote extensively on many kinds of subject. In religious matters, his major work was "Attila" which included the epic poem "Attila or the Triumph of Christianity" and an historical treatise "Attila and his predecessors". From his earliest years, he also had an interest in languages, the classics and poetry, publishing many of his own works as well as translating Norse sagas and poems from other European languages.

He was born at the family seat, Highclere in Berkshire, in 1778, the third son of the first Earl of Caernarvon, Lord Porchester. Incidentally, the combination of his being the son of an Earl and an Anglican Dean gives him the English honorific titles of "the Very Reverend and Honourable William Herbert, rather than the title "Dean Herbert" which will often be seen in American publications. In line with the fashions of the time, the extensive estate at Highclere had been totally re-modelled a few years previously, following designs laid down by Capability Brown. What is more, the Earl was a close friend of Bishop Stephen Pococke, a keen international traveller who collected seed which he shared with the Earl. Most importantly, the Earl introduced various Amaryllids into general cultivation in the 1810's, some of which were later first described by William. Indeed, the father was such a noted figure in this respect that A. P. de Candolle, the eminent French botanist, named the hybrid Amaryllis x carnarvonia after him (Pl. Rar. Hort. Genèv. Pl. 9). Having been brought up in such surroundings, it is not surprising that William had a wide interest in the natural sciences: He was an eminent ornithologist and an innovative plant experimentalist and breeder, carrying out extensive hybridisation of various hardy bulbs, including both Crocus and Iris, as well as various Amaryllids.

However, it is his work in the understanding and arrangement of the Amaryllidaceae family that concerns us here, the area for which he is best remembered. Much of his work on individual species was published in Curtis' Botanical Magazine, one of the two great 19th century part-works. There he not only wrote up new species, but also wrote occasional essays establishing general themes, sometimes including a new genus, such as Lycoris (1819) and Nerine (1820). However, after some years working at this detailed level, he drew together his main conclusions in three works which he produced over a period of two decades.

The first of these, "An Appendix", was published by the Botanical Register (the other great part-work of the time) in December 1821. Here his aim, whilst not clearly stated, was to create a framework at generic level for those exotic members of the family (the sub-family Amaryllideae) coming from outside the Mediterranean area (the remainder having already been handled by A-L de Jussieu in the sub-family Narcisses description published in 1789). Then, in 1825, he produced "Amaryllidearum synopsis", which was published by Curtis' Botanical Magazine. In this, he took his sub-family Amaryllideae and broke it into four groups (Tribes or sub-tribes in today's parlance). Finally, in 1837 he produced his monograph on the overall family, entitled "Amaryllidaceae". This was the first time that he adopted this term for the family overall.

By the time he had finished these works he had defined the family in the widest sense, encapsulating the vast knowledge and experience of the family that he had gained over his lifetime. At one level he set the family within the overall super-class of the monocotyledons, at another he described the family itself and divided it into a number of Divisions and Suborders, at another he described over 50 genera which still reside with the family, and well over 200 species. In the final monograph he made it clear that the whole was intended as much for "..the unlearned cultivator as well as for the edification of the scientific". To support this, he was meticulous in describing in detail everything from the family, through to the species, giving Latin diagnoses for all newly described taxa. What's more, he gave extensive cultivation information, based on his own experience of growing the plants. He was also thorough in analysing and criticising the work of his contemporaries, such as Lindley and Ker-Gawler (both one time Editors of the Botanical Register) and Robert Brown.

The latter was the cause of one particular problem which plagued Herbert (and went on to cause similar problems to others, such as Lindley, through to the early part of the twentieth century). Brown, in his "Prodromus" defined Amaryllids as "..Lilies with inferior ovaries", which means that the ovary is below the point at which the petals and sepals join the stem whereas, in the case of lilies, the ovary is above that point. This approach based the family's separation from other families on a single factor. Such an approach had already been found wanting and was in the process of being discarded in favour of "natural orders", in which the separation of families was based on multiple characteristics. Using this latter approach, Herbert identified some 24 criteria by which he could distinguish members of the family. However, having done that, he reverted to the Brownian doctrine and, in so doing he built a superstructure above genera that was almost totally erroneous. His overall analysis included the whole of the Monocotyledons and, in the case of the family Amaryllidaceae his errors led him to include two superfluous Divisions and many superfluous genera, including Hypoxis, Curculigo, Alstroemeria, Dioscorea, Ixiolirion, Agave and many others.

However, the work is redeemed by the description of the third Division, which contains Suborders 4 (Amaryllideae), 5 (Narcisseae) and 6 (Galantheae). Within these, Suborder 4 contains five groups, Cyrtanthiformes, Hippeastriformes, Oporanthiformes, Pancratiformes and Amaryllidiformes, which between them include some 46 genera. Suborder 5 contains 6 genera and Suborder 6 a further 3.
For all of their failings, these works are, perhaps, best summed up in the words of J. R. Sealy of Kew, who wrote "..Actually The Appendix forms the basis upon which all succeeding taxonomy and nomenclature (of the Amaryllidaceae) rests and this has already received recognition by the conservation of Zephyranthes Herb. (1821) against Atamasco Adanson (1763) and Nerine Herb. (1820) against Imhofia Heister (1753 &1755)."

Sealy wrote the above at the start of the longest argument that Herbert ever sparked, that of the "correct" name for Amaryllis belladonna and the genus Hippeastrum. In 1938, the magazine Herbertia published an article by Dr Uphof identifying a number of what he considered were incorrect names. Firstly, that Amaryllis belladonna L. was the correct

name for the South American species then (and now) known as Hippeastrum equestre (L.f.) Herb., that the name Amaryllis L. should be used instead of Hippeastrum Herb. and that the Cape Belladonna should be known as Callicore rosea Link. The arguments under-laying these proposals were considered in a 20 page long review by Sealy, in 1939, where he argued that the proposals were wrong. He proposed that the Cape Belladonna was properly called Amaryllis belladonna L. and that the issue raised by Dr Uphof had only arisen as a result of "a confusion in publication" by Linnaeus. Also, his view was that this plant should be the lectotype for Amaryllis L. and that, although in his view the correct name for Hippeastrum was Leopoldia Herb., the former should be conserved to maintain stability. At the core of this argument was the fact that Herbert's view of Amaryllis L. changed over the course of his work. Early on, he accepted the confused picture caused by Linnaeus, but by the time of The Appendix, he had come around to the view that Linnaeus had meant the Cape Belladonna to be covered by that name. This argument increasingly became a feud between the Editor of Herbertia, Dr Traub, and Kew, which was not helped by the outbreak of the Second World War before it could be settled. As a result, it raged on during the war years and through to the Botanical Congress in 1954 when Sealy's view was finally accepted.

Also included in Herbert's monograph there was a long and separate discussion of issues of hybridisation, based on his practical experience. Darwin was very interested in this work and his library contains a copy of Amaryllidaceae. In 1839, Darwin approached Herbert, via J S Henslow, asking for more details and thoughts on his experiments; Henslow was a past Regius Professor of Botany at Cambridge and Darwin's mentor. Over the course of a number of letters, Herbert obliged Darwin by providing a range of information and views on the subject based around the hybridisation of Hippeastrum.

One of the most extraordinary aspects of Herbert's work is that he achieved his results by gifts from private collections and swapping material with a close group of colleagues, such as Lindley, Salisbury, Ker-Gawler and Sweet. The organisation that might have been expected to aid him most in his research, the botanic gardens at Kew, deliberately avoided offering any assistance. They were under the control of Sir Joseph Banks until his death in 1820 and he established a regime of hoarding new material from outsiders, which continued after his death. Herbert was most scathing about this behaviour in his monograph and a short excerpt will give the flavour: "It was the narrow-minded doctrine of Sir Joseph Banks that he could only render the King's collection superior to other by monopolizing its contents; and by so doing rendered it hateful and contemptible….It is nearly 20 years since I have visited that odious and useless establishment". Quite surprising sharpness coming from a clergyman!

Having completed these works, Herbert carried on working on the family, describing even more species in the Botanical Register, the last of which was published shortly before his death in 1847. His name is remembered today in the genus Herbertia, though it's perhaps ironic that it should be a member of the Iridaceae, as well as the Journal and Medal of the International Bulb Society.

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Herbert and Baker – Fathers of the *Amaryllidaceae*

Part 2

In my previous article I concentrated on the work of William Herbert, the person who to a great extent created the *Amaryllidaceae* family. By the time that William Herbert died in 1847, he and his contemporaries had developed a clear structure for the *Amaryllidaceae* family that carried through to the twenty-first century. What was needed now was a person to flesh out the family with the increasing amounts of material that was being received from throughout the British Empire and also from British traders, missionaries and collectors in other parts of the world. To a great extent, that role fell to J. G. Baker.

John Gilbert Baker (1834-1920)

Baker came from a family of yeoman farmers around Guisborough, the gateway to the North Yorkshire moors. Being a Quaker, he was sent to Quaker schools, first Ackworth School in Wakefield and, later, to the one at York. The latter had a strong formative effect on him as special attention was given to the natural sciences: It was the first school to institute a Nature Study Society, to which virtually all pupils belonged. Baker was very enthusiastic in these pursuits, won a prize for the best collection of local plants and became curator of the school's little herbarium.

When he left school at fourteen, he went into his father's business (a general merchant), where he stayed for eighteen years. However, not all of his energies went into commercial pursuits. As he admitted, "All my spare time was employed in studying botany and during this period of my career I wrote my book *North Yorkshire: studies of its Botany, Geology, climate and Physical Geography (1864).* This was followed by his *Review of British Roses (1864)* and *A monograph of British Mints (1865).* In 1863, the Journal of Botany was established by Seeman to which Baker contributed various articles and to which he eventually became an Assistant Editor.

In 1864, a fire destroyed his home, herbarium, his unfinished manuscripts and business premises. His previous works and the catastrophe led to a major change in his life as Sir Joseph Hooker, who had recently been appointed Director of Kew Gardens in succession to his father Sir William, wrote to him and offered him the post of First Assistant at the Herbarium under Professor Daniel Oliver. At that time, Sir Joseph was a complete stranger to him and the letter came as a compete surprise. However, it is thought that a book by Baker entitled "North Yorkshire: Studies in its Botany, Geology, Climate and

Physical Geography", which had recently been published by Longmans, had attracted Hooker's attention to him. In any event, Baker started work at Kew in January 1866, eventually replacing Professor Oliver as Keeper and retired in 1890.

Baker's 43 years spent at Kew formed a period of ceaseless botanical activity. He never forgot his childhood endeavours and throughout his time at Kew he maintained a deep interest in British botany. He was an expert in those Victorian favourites the ferns, completing Hooker's *Synopsis Filicum (1876),* producing a second edition a few years later and producing a monograph on Brazilian ferns for Martuis's *Flora Brasiliensis.*

However, as he said in the preface to the *Handbook of the Irideae (1892)*, "I found the groups of plants …that most wanted working at were the … Petaloid Monocotyledons" and it is for his work on this group that he is best now remembered. One of his Handbooks *(Iridaceae)* has already been mentioned, another was the *Handbook of the Bromeliaceae (1899).* The *Liliaceae* were treated in the *Journal of the Linnaean Society (1871-81)*, volumes 11-18. However, it is the final grouping, the *Amaryllidaceae*, that concerns us here.

The Victorian age was, as far as plants were concerned, the golden age. During the middle decades of the nineteenth century plants were pouring into London from across the British Empire which was in its prime. From these new introductions came many opportunities to describe new species and arrange them into genera and families. In the earlier decades of the century William Herbert led efforts to define and bring order to the Amaryllids. However, following his death in 1847 a vacuum emerged, as the other leader in these endeavours had been John Lindley who, by then, was heavily engaged in the world of orchids.

Whilst from the start of his appointment at Kew in 1866 Baker started to describe individual new species in various publications, his most important work was done in broader reviews of genera. The first of these was a review of *Narcissus* published in instalments in the Gardener's Chronicle during 1869. Then, in 1881 he published a ten part review of the genus *Crinum* in the same magazine. This was followed by a first monograph of the genus *Gethyllis*, which was published in the *Journal of Botany* in 1885, part of which was based on Masson's drawings of species of the genus.

Then in 1888 he produced his *Handbook of the Amaryllideae*, based on his previous 23 years at Kew. Like Herbert in his *Amaryllidaceae*, Baker aimed his work at cultivators and botanists, providing a handbook that described the attributes of genera and species. However, unlike him, he did not attempt to include information on cultivation.

Also like Herbert before him, he followed the dictum of Brown and erroneously treated the family on the basis of "..Lilies with inferior ovaries" and, as a result lumped in with other Amaryllids totally unrelated groups, including the whole of the *Alstromeriaceae*, *Agavaceae* and *Ixionliriona*ceae. However, even after removing these from the count, he included some 50 genera and 380 species, virtually all of which we recognise in the family today. Rather than writing separate monographs, he took the opportunity to review

some genera in great detail, adding a number of new species: a good example of this being *Zephyranthes*.

In addition, Baker wrote the whole of that part of *Flora Capensis,* which deals with monocotyledons. This did not include a wealth of new species, but an appendix which was also produced by him did so, especially for the genus *Haemanthus*, then including *Scadoxus*. In parallel, he worked on various parts of the *Flora of Tropical Africa*, both of these being parts of Hooker's great plan to produce flora covering the whole of the British Empire.

Interestingly, the production of these two African series took several decades, leading to a great deal of revision and re-working. This became something of a cause célèbre and the cause of much adverse comment, particularly by James Britten, the Editor of the *Journal of Botany*. What's more, the criticism was increasingly a personal attack on the then Director of Kew, Sir William Thisleton-Dyer and his defensive attitudes and reflected the rather poor relations between the British Museum and Kew at that time, the BM being closely allied to the *Journal of Botany*. It must be added that Baker was deliberately excluded from this criticism partly, no doubt, due to his earlier involvement with the journal.

After Baker retired, he continued his involvement with plants, though increasingly he returned to his British roots and one of his main loves, roses. His last major works were a revision of his work on the genus for the *Journal of the Linnaean Society vol. 37 (1905)* and the Introduction and technical descriptions for *The Genus Rosa (1910)* one of the twentieth century's finest books on roses, written by that great gardener and plantswoman Ellen Willmott.

Baker died on 16th August 1920 at his home at Kew and was buried at the Friends' burial ground at nearby Isleworth. James Britten, wrote a long obituary in the *Journal of Botany* in which he summed him up as follows "The kindness which Baker showed was, I think, his most striking characteristic – no kinder man can ever have lived". His name is still remembered in the genus *Bakeria* André in the *Bromeliaceae* and *Bakerella* Tiegh. in the *Loranthaceae*.

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Editorial	*"Book Reviews",* Journal of Botany, 39: p. 46-8 (1901) ♣

Name changes – the *Ornithogalum* saga continues

Do not be too hasty in changing the labels in your pots. Names which change this year may be changed again next year! This has happened with *Albuca, Dipcadi* and *Pseudogaltonia* which were all lumped into *Ornithogalum* a year or so ago. After further work by researchers at SANBI, the Missouri Botanical Garden and Kew, these 3 genera have been reinstated and the genus *Ornithogalum* has been redefined. So all those pots of *Albuca* with their new *Ornithogalum* labels will need re-labelling yet again!
There will more about this in the next IBSA Bulletin.

Four Clivia explorers in 19th Century South Africa

John van der Linde

Southern Africa has been blessed by nature in many ways. We enjoy magnificent scenery, wildlife and flora. From very early on, visitors from Europe collected plants and seeds to be taken back to the Northern Hemisphere, where they were described and named by the leading taxonomists of the day. For example, the 'King Protea', *Protea cynaroides,* which today is South Africa's national flower, was being grown in London over 3 centuries ago (1698).
Four of those visitors from Europe are amongst those relevant to *Clivia* history; two of them civilians with botanical training, and two of them army officers who were also off-duty plant collectors. We have a likeness of only one of them, and know the most about him: **William John Burchell**. You may know of Burchell's Zebra, and the bird, Burchell's Coucal, and you may recognize 2 of the plants named for him, *Androcymbium burchelli* and *Burchellia bubalina*, but few people know about him and his *Clivia*.
He was born in Fulham, London, in 1781, the son of a prosperous nurseryman. Having worked for a time at Kew, he was employed on the island of St Helena as a 'schoolmaster and acting botanist'. His fiancée sailed from England to marry him there but went off with the ship's captain instead. After that experience Burchell never married. He left for Cape Town in 1810. There he had a wagon specially built for him, and in June 1811 he trekked off into the interior, accompanied only by six 'Hottentot' [Khoekhoen] men and his span of oxen, on a journey that was to last four years. He recorded part of the journey in his two volume book "Travels in the interior of Southern Africa".
They set out from Cape Town accompanying a group of missionaries traveling inland, away from the beauties of the Cape Floral Kingdom. They crossed the Berg River and rumbled inland towards the Roggeveld, literally at the pace of an ox, most suitable for viewing plants along the way. After the mountains came the endless open vistas of the arid semi-desert of the Great Karoo. Before this trip Burchell had never in his life eaten food cooked over an open campfire, let alone spent a night out in the open. He was a small, gentle man who hated to kill even a bird, so one of his men would go out and shoot for the pot.
Burchell and his team got their wagon across the great Gariep or Orange River to Griquatown and Kuruman in the north, where he collected the type specimen of the White Rhinoceros. They climbed over the Sneeuberge (Snow Mountains) and got as far south-east as Graaff-Reinet, and then Grahamstown. Their long journey took them as far as the mouth of the Great Fish River, and finally CLIVIAS!

The earliest scientific record we have is that of a *Clivia nobilis* that Burchell collected on 28th September 1813, south-west of the mouth of the Great Fish River. It appears that Burchell may have intended to publish his specimen as *Cyrtanthus Sylvatica*, i.e. the forest cyrtanthus, but he never got around to doing so. This would have preceded Lindley's description of *Clivia nobilis,* which was written a full 15 years later. There is in fact a fair resemblance between the flowers of *Cyrtanthus obliquus*, which Burchell collected in the Mountains in the Somerset East district, and those of *Clivia nobilis*.

Around then Burchell decided to head back towards Cape Town, stopping along the way at Port Elizabeth and at coastal villages en route. They eventually reached Cape Town in mid-April 1815, 4 years - and 7200kms - after setting out on their journey. Burchell had collected over 40 000 specimens.
The next person to collect *Clivia nobilis* and send plants back to Britain was almost certainly an army officer serving in the Eastern Cape, asked to find plants by someone who had seen Burchell's specimens back in Fulham and who had found out from him where they had been collected. It was one of these plants which flowered at Syon House that the botanist Lindley saw and named for Lady Clive in 1828. It would appear that no record of this person's name exists today.
Meanwhile, back at Kew Gardens … **another** *Clivia nobilis* had flowered, this time one of several collected for Kew by James Bowie, probably in 1822, and described as growing "on shaded spots, near Quagga flats, and more common in the Albany tracts, near the great Fish River". In the records, it is Bowie's name that has ever since been associated with *Clivia nobilis*.

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

Bowie found it hard to settle down in London, and he returned independently to the Cape in 1827, the year before *C. nobilis* was described. He worked as a professional plant collector and gardener until he died in Wynberg in 1869, when he must have been close to 80. He never married. His name is commemorated in the genus *Bowiea*.
James Bowie might have ranked among the great botanical collectors of the Cape, but he often gave wrong localities in the labels attached to his plants. This has made his collections of little use to botanists. He was possibly simply trying to put his competitors off the scent. In fact, Bowie complained in writing about an army officer who sent 40 soldiers at a time out collecting for him. Competition among collectors is fierce, even to this day.

Throughout the period about which I am writing it was common for army personnel to make extra money by collecting and selling specimens from places where their army

activities took them. As well as plants, they collected items such as rocks, bird's eggs, seashells, snake skins, butterflies, seaweeds and small mammals and reptiles.

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

I say this because there is no trace of him or of his parents in the birth records of England, Scotland or Wales; nor a record of where and when he died. As for his *Clivia*, all that we know is that it was found somewhere in Natal. Annoyingly, he did not record where he found it. We know from army records that he served for a short time in Pondoland, which is swampy *Clivia robusta* country. Who knows, maybe the plant he found and took to London was a *C. robusta* and not a *C. gardenii*!
Garden's name is commemorated in *Clivia gardenii, Albuca gardenii, and Streptocarpus gardenii*.
Perhaps the romance of those early days has gone, but Clivia exploration continues in the 21st century, across rivers, up gorges and in difficult country. Plant collectors still go out looking for special plants in the wild, hoping to find *Clivias* as unique as "Appleblossom", collected somewhere in the Transkei and now in the collection of the South African Biodiversity Institute. They are not saying where it was found!

(This article has been adapted from an illustrated version published in 2007 in CLIVIA 9, the Yearbook of the Clivia Society). ♣

Try these cocktails!

Spray for Aphids:
1 chopped onion — 1 teaspoon cayenne pepper
3 garlic cloves — 4 cups water
Method: Grind in a blender then add the water. Let stand for 24 hours and strain through a stocking. Use without dilution.

Anti-Insect Cocktail:
To repel, if not kill, a number of chewing and sucking insects, mix:
5 litres water — 1 teaspoon Sanpic liquid
1 teaspoon paraffin — 1 teaspoon Sunlight Liquid
2 teaspoons Kelpak or other seaweed based product
1 teaspoon Jeyes Fluid — ½ teaspoon Scrubbs Ammonia
2 teaspoons spreader/sticker

Snail Spray:
Mix and spray over plants and the ground where snails occur:
5 litres water
1 tablespoon Epsom Salts (heaped)
1 teaspoon Scrubbs Ammonia

Waainek Wild Flower Reserve

Cameron McMaster

The reserve established by Philip Erasmus on the Bosberg is an excellent example of a private initiative for Biodiversity Conservation.

Philip Erasmus farms on Charlton, a farm on top of the Bosberg above Somerset East – a beautiful area of gently rolling grassland, blessed by a fairly good and dependable summer rainfall of around 600mm per annum. The area is well suited to sheep and cattle production. My association with Philip goes back as far as 1973 when I became involved in the establishment of his Dohne Merino Stud, an enterprise that has prospered over the years and has taken me back to the Bosberg on a regular basis ever since.

The road to Charlton is quite awe-inspiring, especially on the first occasion it is undertaken. After passing through the verdant and historic Glen Avon valley, the narrow road abruptly ascends a winding pass through thicket vegetation, to emerge 10km later into open grassland at an altitude of 1400 meters. There are spectacular views from the top of the pass, the steep forest-clad south facing mountain slopes plunging down to the left with the spectacular Glen Avon Falls at the head of the valley, and endless ridges of Karoo hills and mountains stretching away to the horizon in the north to Cradock and beyond.

I was first alerted to the botanical importance of the grassland on the Bosberg when my attention was drawn to some large and spectacular heads of *Brunsvigia grandiflora* flowering in April one year in the wide road reserves on the south facing slopes at the top of the pass. Even then, almost 30 years ago, my interest in wild flowers led me to explore further and I was to discover a wealth of floral diversity almost unequalled in the Eastern Cape. I was to embark on a learning curve that stimulated me to seek a deeper knowledge of the wild flowers of the region.

At the highest point at the top of the pass there is a narrow strip of grassland between the road and the steep forest-clad cliffs that plunge down to the valley below. On the regular occasions that I visited Philip to assist with the Dohne Stud, I took the opportunity to explore the area, each time finding more and more interesting plants. It was a challenge at that early stage in my wildflower career to identify and assess the importance of the species I was finding. Very soon I discovered that, in addition to being extremely rich in species, the area contained some very rare endemics (plants that occur only in a

particular region). On each occasion I would tell Philip about my discoveries and the fact that these rare plants occurred on his land and that he was virtually solely responsible for their welfare, and so we looked into the possibility of creating a reserve for them.
The concept of Wild Flower Reserve fitted in very well with other tourism enterprises he was developing on the property. A large and rambling farmhouse nearby was converted into comfortable self catering tourist accommodation, and hiking trails and trout angling facilities were developed. The Wild Flower Reserve would be an added attraction for a wide range of guests. An area of approximately 500m long and less than 100 meters wide between the road at the top of the pass and forest cliffs on the edge of the Glen Avon valley was set aside and named the Waainek Wild Flower Reserve, the name of the property in which it is situated. For the last 15 or more years Philip and I have discussed the management of the reserve and he has undertaken the regular burning that has been necessary and the clearing of alien pine seedlings that sometimes come up from seed blown in from nearby wind breaks.

The two most important endemics that occur here are *Haemanthus carneus*, known only from the Bosberg (see Farmer's Weekly 13 June 2008, p48) and the poker, *Kniphofia acraea* (see FW 27 June 2008, p56). The only other known population of this species is found in the mountains of the Mountain Zebra National Park about 40km to the north. There are strong populations of these two rare plants here, ample reason for the establishment of the reserve. Because the reserve includes the ecotone (the transition area) between the grassland and the Afromontane forest on the steep slope down to the valley, many other interesting plants in both biomes occur here. Over the years that we have made an intensive study of the flora in the reserve we have recorded many species including *Cyrtanthus macowanii, Cyrtanthus tuckii, Disa crassicornis, Lachenalia campanulata, Gladiolus mortonius* and *Eucomis autumnalis*, all plants that are target species for many visitors to the reserve.

One of the most significant plants in the reserve is a massive multi-headed female specimen of the rare cycad, *Encephalartos cycadifolius*. This cycad actually occurs in the Baviaans River area on the east side of the Fish River. This is the only specimen I know of on the Bosberg and because there are no male plants in the vicinity, the seed cones that it produces regularly, are all infertile.

A few hundred meters to the west of the reserve on property belonging to Dr Pieter Botha, there is a small population of another rare endemic, the hairbell *Dierama grandiflorum* (FW 15 Feb 2008, Page 50). This extremely rare plant has been recorded only here and on the Oudeberg near Graaff Reinet. An appeal in the local press for landowners to look out for other populations has so far not met with any success. Another remarkable discovery on Dr Botha's property, not more than 100meters from the reserve boundary, was a population of the very rare Green Bearded Disa, *Disa lugens*. I have had discussions with Dr Botha on the possibility of linking these populations to the reserve and am pleased to report that he has so far modified his grazing policy of the paddock concerned to permit flowering and seeding of these two rare plants. On a visit to the area in November this year I found 30 plants of the Dierama in full flower. The ideal solution would be the consolidation of all these populations in an extended reserve. If this could be achieved, the contribution that these two landowners would make to wild

flower conservation would be enormous and would earn the gratitude of generations of South Africans who in years to come would still be able to observe these threatened plants in their natural habitat.

The Waainek Wild flower Reserve is visited regularly by botanists and plant lovers from all over the world. It is an excellent example of how landowners can contribute to conservation and can benefit from the ecotourism spinoffs that will result. Anyone interested in visiting the reserve should contact Philip Erasmus at tel. 042 2433561 or email: charlton@eastcape.net . Great self catering accommodation is available right next to the reserve in the Glen Craig farmhouse situated in this safe, peaceful and beautiful environment on the Bosberg.

(This article was originally published in the Farmer's Weekly of the 30 January 2009, and is reprinted with the kind permission of the author. ♣

Rainwater

Many of us collect rainwater from the roofs of our houses, and use this to water our bulbs. What are the advantages and disadvantages of doing this?

Advantages include: Rain water contains small amounts of nitrites, negligible minerals, and a high dissolved oxygen concentration. In contrast to this, ground water has unwanted mineral content depending upon the hardness of the water (calcium, magnesium, sulphur, and other compounds) and a low dissolved oxygen concentration. Anyone in the Cape Town area who is using a borehole which taps water from the Cape aquifer will have contamination of their water by iron and high salts. To remove these contaminants is extremely expensive, making the use of rain water very attractive. City tap water contains high concentrations of chlorine.

Disadvantages – the biggest disadvantage is probably the high numbers of fungal spores in rain water and a low pH (acid rain). The acid rain is generally nutritious for plants (sulfates, nitrates, etc) as long as the soil pH remains controlled. If the pH is a problem, it can be corrected fairly easily by the addition of lime to the growing medium. Fungal spores are more of a problem and the only way to get rid of them is to filter the water, or sterilize it in some way.

To decrease the above problems of spores and impurities in the rainwater, it is important to resist collecting runoff from the roof until rain has fallen for an hour or so. Or perhaps avoid collecting water from the first rainfall of the season to allow all impurities on the roof to be washed off.

Containers used to store the water should be clean, closed and placed away from sunlight – the water should always look and smell clean.

Homemade pesticide/ feeding solution	General Insect Spray
To 5 litres water add: 1 teaspoon Jeyes fluid 2tsp Kelpak, Seagro or Marinure 1tsp Epsom salts 1-2 Tablespoons Scrubb's Ammonia 1 Tbsp Sunlight Liquid	3 large cloves garlic crushed 2 handsful marigold leaves/khakibos 2 large onions chopped Cover with water and boil or microwave. Cool. Make up to about 1 litre and use as a spray.

Memories from the Past

Marion Went

Taken from the back of a "cigarette card" book of SA flowers:

Prim little scholars are the flowers of her garden,
Trained to stand in rows and asking if they please.
I might love them well but for loving more the wild ones:
O my wild ones! they tell me more than these.

(Meredith: Love in the Valley)

Owing to family arrangements, I had the great good fortune to spend some time living at Keurboomstrand in the heart of the Garden Route when I was about 10 years old. For those who did not know the area in the late 1940's, there was an hotel, popular with fishing enthusiasts, a few rondavels, about ten holiday homes set under milkwoods and, while I lived there, a small caravan park was established.

By arrangement with the hotel manager, one could hire Willie the Gillie to collect bait and take one to the good fishing spots. It was quite safe, provided one watched the tide, for two little 10-year old girls – the manager's daughter and me – to wander some distance along the beach to the Matjies River for a picnic.

On Spring days when the weather was still too cold for the beach, my mother would suggest that my brother and I don our Wellington boots and go up the hill to pick a few flowers. This was a time when nobody gave a thought to the conservation of our flora – I'm sure there is no need to elaborate! The boots were a precaution against snakes – many puffadders found the area to their liking. I may mention that, although we had many encounters with snakes at other times, we did not see any on these outings.

The area over which we would wander was a grassy hill slope situated between The Crags and Keurboomstrand. It was only later that we learnt the names of our flowers – *Watsonia ssp*, *Chasmanthe sp, Gladiolus maculatus subsp maculatus, Disa cornuta, Ornithogalum dubium* – in short, a collection of pretty plants we found in flower. At least we had sense enough to leave some for "another day". I clearly recall a huge clump of *Moraea spathulata* growing near a deserted farmhouse near the top of the hill.

Years later, when I wished to establish my first garden, I approached various nurseries in order to grow “wild flowers”. I was at a definite disadvantage as I did not know the names, and the response from the nurserymen was “there is no demand for them, so we don’t grow or supply them”. I had to settle for “normal” garden plants like Agapanthus, Red Hot Pokers, Watsonias and the like, little realising their origins!!

The call of the country resulted in the purchase of a small-holding in Klapmuts, with a very old vineyard set on the front and back of a patch of natural sandstone rocks, surrounded by a small area of veld which had been burnt about three years previously. An old school friend living nearby suggested I join her on a weekly stint assisting at a nursery near Stellenbosch. This turned out to be Bloemerf Nursery run by Mrs Lenie Richfield! The latter introduced me to IBSA, with Mrs Margaret Thomas in the chair, Mr JW Loubser as secretary and member Mrs Margaret Lawder, who was a fairly frequent contributor to Veld and Flora. Profs Delpierre and du Plessis were active members at the time, and until very recently I treasured some *Eucomis zambesiaca* I purchased from their “Blombos Nursery”.

We used to meet about four times a year in members’ homes. There was always a speaker, followed by tea and an opportunity to see what the different members were growing. As now, members then were generous with knowledge and bulbs and/or seeds.
The joy of discovering all the flora on our small-holding knew no bounds. Among the shrubs we had several bushes of *Protea burchellii*, one *P. scornzonerifolia*, and I gladdened Dr Rourke’s heart with a request for a name to the *Serruria* I had found – it turned out to be *S. gracilis* which had not been seen for many years – believed to be extinct. Subsequently it was re-discovered on Rhodes Fruit Farm properties, so there were sufficient plants to propagate from and plants were available to purchase at a recent Kirstenbosh Plant Fair!

The bulbs were special and flowered in season. I list just a few species: *Lachenalia aloides var quadricolor* on the rockery, *Moraea neglecta* & others, *Synnotia variegata (*now Sparaxis*), Galaxia* (now Moraea*), Freesia, Gladiolus brevifolius, alatus & liliaceus, Gethyllis, Haemanthus coccineus & sanguineus,* a minute *Ornithogalum* and, probably my favourite*, Nerine sarniensis!!*

It was at this time that I started my collection of books on indigenous flora, and I now have quite a good library. The books were not as readily available as they are now, and I had to stretch the housekeeping budget to get together, for example, the R27.00 needed for Rourke’s “The Proteas of Southern Africa”!

While still on the small-holding I had to resign from IBSA for family reasons, but continued as a member of the Cape Garden Club which Margaret Lawder and Betty Louw had founded, and which drew members from various Boland towns. The interest was not

limited to indigenous flora, though there was encouragement in that direction. There was also strong interest in the medicinal use of indigenous plants.

I moved back to Cape Town and several years later I took my friend, Chris Schultz, to an IBSA show at Kirstenbosch, where we met Paul von Stein and other members. Chris was delighted to find names for the "wilde blommetjies" that he had seen growing on his small-holding on the Cape Flats.

We decided that, for anyone interested in our indigenous bulbous flora, membership of IBSA is a must! ♣

New Species

Two articles in Bothalia, by Peter Goldblatt and John Manning are partial revisions of the genus Ixia.

Bothalia (2008) Volume 38 part 1

The first article tackles *Ixia rapunculoides,* a widespread species in the SW Cape, found from the Richtersveld in the north all the way to the Little Karoo. It is very variable with large morphological differences between specimens, and there are 6 varieties. All the members of the complex have about 3 leaves, an erect flowering stem with relatively few flowers and the flowers are funnel-shaped with short stamens and style branches. Often 2 populations of different varieties are found side by side and flowering together, but they fail to hybridise, suggesting that they may be different species. The authors have attempted to resolve these taxonomic problems by re-examining herbarium specimens, and by taking into account flower scent, bracts and the presence or absence of basal cormlets. They conclude that the complex should be divided into 10 separate species:

Ixia rapunculoides is now the form found in the Western Karoo, it has broad leathery leaves, a short perianth tube and half nodding blue-mauve flowers.

Ixia rapunculoides var flaccida is divided into 2 species:

I. flaccida in the Olifants River Valley with white or pale blue flushed flowers, soft leaves and corms with basal cormlets, and

I. sobolifera from the Western and Little Karoo, with linear leaves, nodding spikes and flowers, and corms with stolons.

It has 3 subspecies – ssp *carnea* with pink flowers on the Bokkeveld Plateau
- ssp *sobolifera* with slate blue flowers in the Klein Roggeveld
- ssp *albiflora* with strongly scented white flowers from the Little Karoo

I. namaquana (from *I. rapunculoides var namaquana*) has a longer perianth tube, and white, pale lilac or pink flowers which are horizontally oriented.

I. oxalidiflora from the Hex River Pass area, has ascending purple-pink flowers with a white cup and a longer perianth tube.

I. rapunculoides var subpendula and var *rigida* with upright flowers and branched stems are now:

I. divaricata with white to pink/ light purple flowers from the Citrusdal/Clanwilliam area, &

I. contorta with purple flowers with a yellow cup, unscented, from the Koue Bokkeveld
Forms of *I. rapunculoides var rapunculoides* from the Klein Roggeveld south of the typical *I. rapunculoides* are now
I. lacerata with longer perianth tubes and lacerate 5-veined dry rust-tipped bracts
I. rivulicola, a new species found in stream beds on the Roggeveld has large white flowers
I. robusta (from *I. rapunculoides var robusta*) has pink flowers, 4 or 5 leaves and corms with a collar of coarse fibres.

Bothalia (2008) Volume 38 part 2

In this Bothalia, the *Ixia capillaris* complex is dealt with. The species concerned all have filiform leaves of less than 2mm wide with no raised central vein or margins, and they were all included in *I. capillaris* and *I. pauciflora. I. capillaris* has been divided into 4 species, and *I. pauciflora* into 2 species.
I. capillaris – pale blue to pale mauve or white radially symmetric flowers on a branched flowering stem, no scent, tepals longer than the perianth tube, filaments exserted, from Piketberg to RIversdale area.
I. exiliflora – tepals and perianth tube about the same length, flowers grey-blue to dingy white, a faint rose scent, filaments included, from the Worcester Montagu areas.
I. dieramoides – tepals and perianth tube the same length, included filaments, mauve blue to lilac flowers sweetly scented, found near Touws River.
I. reclinata – large flowers with a long tube and even longer tepals, declinate stamens with filaments exserted, horizontally held white flowers suffused with mauve and faintly scented, from Theewaterskloof Dam.
I. pauciflora – stamens and filaments exserted, pale blue to mauve flowers face to the side, not scented, from the Cederberg to the Koue Bokkeveld.

Also in **Bothalia vol 38 part 1** are two new species of Babiana described by John Manning and Peter Goldblatt:

Babiana symmetranthea – 20cm high in clumps, sparsely hairy leaves, 2-3 actinomorphic flowers, salver-shaped, violet with darker violet marks near base of tepals, sweetly scented (violets), flowers mid August to September, found on the summit of the Langberg near Loeriesfontein.
Babiana virescens – 20cm, slightly twisted hairy leaves, 3 – 7 flowers per spike, zygomorphic pale grey-green flowers with yellowish green blotches and purple streaks on the lower tepals, spicy acrid chemical scent, flowers late May to June between Nuwerus and Bitterfontein on granite hills.
Babiana tubaeformis is the new name for *B. longiflora*, and
Babiana hirsuta is the new name for *B. thunbergii.*

A new Drimiopsis species described by A. Hankey & P. Lebatha

Drimiopsis linioseta (from the Roossenekal area in Sekukhuneland) is about 10cm in height, has a bulb below the ground surface with white fleshy outer scales, 1 or 2 long leaves mostly unspotted above but spotted below, a dense erect raceme of hyacinth-scented green to purple brown flowers in late spring or early summer.

Oxalis odorata, described by J. Manning and P. Goldblatt from the Sutherland area. It has greyish green leaves and sweetly scented lilac flowers with green tubes in May or June.

Two new Romulea species described by J. Manning and P. Goldblatt:

Romulea lutea from the coast in seasonally wet areas near Koekenaap. 5-10cm, asymmetric corm with crescent shaped basal ridge, 3 4-grooved leaves, deeply cup-shaped golden yellow flowers with pale green reverse August and September. It is similar to *R. tabularis*.

Romulea tubulosa from the Kamiesberg. 30cm in height, sub-globose asymmetric corm with crescent shaped basal ridge, 3-5 long leaves, salver-shaped pale canary yellow flowers with median brown streaks in throat, very long perianth tube.

From the Archives

From the IBSA Bulletin number 42 of 1994 comes the following article:

"*Lapeirousia*, a novel genus of bulbous plants for the garden" by Peter Goldblatt

Plants with bulbs, corms and the like are a source of endless fascination for gardeners. Among the African genera of the Iris family nearly all of which have corms, *Gladiolus, Sparaxis, Freesia* and *Watsonia* are well known. They are well suited to southern African gardens, both in the summer and the winter rainfall parts of the country. There are more than 20 more genera that also offer something special to those of us that are particularly interested in bulbous plants. One of these is *Lapeirousia*, a genus of some 40 species, that ranges from the south western Cape to Ethiopia and Sudan. The species favour semi-arid habitats and thus are most common in fairly dry parts of southern and tropical Africa. Their drought tolerance should make them good garden plants for areas with prolonged dry periods or water restrictions. Yet, for all their charm and beauty, few people know about the genus.

Perhaps best known is *Lapeirousia silenoides*, the species which is sometimes called "Springbok painted petals". This is normally a compact plant with brilliant cerise to magenta flowers and it is abundant in central and northern Namaqualand. In years of even moderate winter rains, *L. silenoides* always makes stunning displays along roadsides and slopes although it is seen to its best advantage in cracks in granite

outcroppings. I have hardly seen this plant grown successfully, yet with compact habit and numerous flowers clustered together and each lasting 3 – 4 days, it would look superb in a pot or corner of a rock garden. Related to this species is *L. pyramidalis*, native to the drier areas of the south western and southern Cape. It has less striking flowers, more often white or pale blue, but occasionally dark blue or red, but their attraction lies in their strong fragrance. Plants most often grow in heavy clay and do well in the wild on rainfall as low as 50mm per year, of course falling in the winter months. This species, like *L. silenoides*, is ideal for the rock garden. It is amenable to cultivation and can be seen to advantage at the Karoo Garden in Worcester. A less common Namaqualand species, *L. dolomitica*, closely resembles *L. silenoides* and is just as worthwhile though, given its rarity, it is not a contender for horticultural attention. The flowers are larger than those of *L. silenoides* and range from dark magenta to pale blue or cream.
There are even lovelier species of *Lapeirousia* that could be tried in the garden. *L. fabricii* which occurs in sandy soils in the western Cape and Namaqualand is one of these. Also adapted to low rainfall, plants prefer well-drained sandy soil. They flower later than *L. silenoides*, in September and October, when the white to cream flowers with red markings and pink flush on the reverse of the tepals do not show up well among the dry grass and the last of the spring annuals that make early spring in this part of the world famous for its wild flower displays. In garden conditions, *L. fabricii* would probably make a better display, for the flowers are quite large, and the flowering period of 2 – 3 weeks can probably be extended by judicious watering.

There are several more winter rainfall species not often seen, and difficult to obtain, but the western Cape *L. corymbosa* and its close relatives *L. azurea* and *L. fastigiata* deserve attention. All are small plants ideal for rock gardens or pot culture, and all produce masses of flowers in a dense cluster above the leaves. *L. corymbosa* has fairly small flowers of a clear sky blue with a white central star, and though charming, is perhaps more of a curiosity than a candidate for cultivation because the plants and flowers are rather small. *L. azurea* however, has quite large flowers of a wonderful intense dark blue and the lower tepals are marked with almost black chevrons, against which the rich brown colour of the anthers show conspicuously. *L. fastigiata* has pale yellow flowers with dark markings. Given good conditions in a pot or rockery, *L. azurea* would make a notable addition to the range of native southern African bulbs.

Lapeirousia species are not often thought of as subjects for the summer garden, but several species from the Transvaal and Namibia deserve attention. *L. sandersonii*, a rather poorly known species from the central Transvaal and eastern Botswana, is actually quite common and can be a striking sight growing on rocky outcrops in crevices with hardly any soil. The flowers are a rich dark blue with white nectar guides on the lower tepals. Well grown plants may be 40cm tall and form rounded tufts that bear numerous flowers. In years of ample rainfall, the flowering season lasts about 4 weeks. Not many bulbous plants can equal that! Why the species is not in general cultivation can only be due to ignorance of its attributes. I can attest to its being easy to grow, for I have had it flower each summer for years in a small pot in a greenhouse, and given no special

attention. Another summer rainfall species that merits attention is *L. bainesii*. This is quite a common species in the northern half of Namibia and western Botswana, but it extends into the northern Transvaal and southern Zimbabwe. In years of low rainfall one would hardly notice the plant which may be only 12 – 15cm tall and have a dozen or so flowers. But again, when the rains have been good (and good in Namibia is not necessarily much rain!) the plants can stand 50cm high and be literally covered with pale pink flowers, each lasting several days, and having a pleasant sweet scent. Water restrictions in a Transvaal garden are hardly likely to affect *L. bainesii*.

Another summer rainfall species that is worth growing is *L. odoratissima*. The plant grows in a dense tuft with the flowers borne at ground level, a bit like a European crocus. But the flowers are huge, some 12 – 15cm long, and almost 5cm across. And the plants produce numerous flowers over a period of 3 weeks. Each flower opens in the evening and is then pure white and wonderfully scented as its name suggests. (This species is almost certainly adapted for pollination by hawk moths, but there are no recorded observations of this). The following day the flowers turn cream and then ivory and lose much of their scent, although they remain open. There is seldom a day through the flowering period when each plant doesn't have at least 1 or 2 flowers open. There are also species of *Lapeirousia* native to Zimbabwe, Zambia, Malawi and Mozambique that would grow equally well in any southern African garden. *L. erythrantha* is the most common. Rather like *L. sandersonii* in general form, the flowers are smaller and have a shorter tube. The common colour is light blue with white markings, but in eastern Zimbabwe, southern Malawi and Mozambique there are populations which have brilliant dark red flowers. The species probably would do well in a rock garden but in the dormant stage in winter they may not stand frost which does not occur in their native haunts. I can vouch for *L. erythrantha* as a good pot plant. Year after year, with no care beyond twice weekly watering, the species flowers for me.

Why aren't there *Lapeirousia* species for sale at nurseries and advertised in bulb catalogues? It must be sheer ignorance of the plants in the horticultural world, where daffodils, freesias, gladiolus and sparaxis reign supreme. Give them their due, but try growing daffodils for a summer display in a Transvaal garden. The emphasis on growing native plants can be overdone, but where there are native drought resistant species that are also easy to grow and beautiful to boot, there is little excuse. The ultimate question is, where can one get *Lapeirousia* corms or seeds? Apart from occasional offerings to members of the Botanical Society, there is today no other way than to hunt out their native habitat and collect seed. Don't try to dig out the corms. Not only is it illegal, but it is horribly wasteful for almost invariably the corms of most species lie buried deep in hard ground, or wedged in rock, and get destroyed in the effort of removing them. Incidentally, the corms of many *Lapeirousia* species are good to eat and some formed an important food source for humans in past times, and still do for baboons, porcupines and mole rats. That is why the corms are so difficult to get at. The more accessible ones have been taken by hungry four-legged mammals! Seeds germinate readily after they have ripened for at least 4 months, and must not be overwatered. Two year old seedlings will flower, and after 3 years, plants are mature. The hardest part in growing any species of

Lapeirousia is getting the seedlings established. When they start to wither at the end of their natural growing season, let them dry out. Don't keep watering them, thinking they are wilting for want of moisture. Save the corms, either in their pots or in a dry place for the dormant season, summer for the Cape and Namaqualand, winter and early spring for the summer rainfall region species. And don't forget them. They will sprout by themselves at the appropriate time, and if they are not planted and given water then, they will simply grow into a new corm, and wait for at least 6 months, behaving as they do in the wild when the rains fail, and thus ensuring their survival for another year. ♣

Obituary

In Memoriam Johan Loubser (snr)

Johan Loubser passed away on 21 September 2008 only 12 days after his 86th birthday. He was one of the founder members of IBSA on 15 April 1961 in Bellville, and was Secretary/Treasurer of IBSA for many years, and attended meetings regularly until his health deteriorated in early 2008.

He grew up on a farm near Eendekuil in the Western Cape. His father was a keen amateur botanist and collected many Protea species, and also tried to grow the beautiful red Disa of that area. Johan also took a keen interest in the flora of that region, especially the bulbous plants such as *Moraea* and *Gladiolus*. He subsequently lived in Welgemoed for many years where he ran a small nursery aptly named "Indigenous Gladiolus Nursery".

In 1973 Johan discovered a violet-blue *Moraea* on Olifantskop near Langebaan, a site that was destined to become a quarry. He notified Peter Goldblatt, who honoured Johan by naming the plant *Moraea loubseri*. During 1976 Johan brought another new blue *Moraea*, this time from near Saldanha Bay, to Peter Goldblatt's attention, who named this one *Moraea calcicola*.

Johan was a very keen amateur botanist, making his own herbarium sheets and notes – just a few years before his death, he donated these to the University of the Free State in Bloemfontein. Johan was particularly fond of the species of *Moraea, Freesia* and *Gladiolus*.

Johan will also be remembered for a noteworthy Gladiolus cross that he made: *Gladiolus cardinalis* crossed with *Gladiolus carmineus* resulted in a striking easy flowering hybrid called *Gladiolus* Rougex. At the funeral service for Johan, a vase of these lovely flowers was displayed in the church.

Johan is survived by his wife, two sons and a daughter, and grandchildren.

The members of IBSA salute an exceptionally keen amateur botanist and gentleman. ♣

In Memoriam Chris Schultz

Hans Christian ("Chris") Schultz (17/09/1921 - 27/02/2009) was a man of many interests
- business management;
- dentistry – not a dentist but as secretary of the local branch of the Dental Association for more than 55 years;
- sports cars – founded the Triumph Club of SA and completely re-built his Triumph TR4A twice;
- the history of World War 2 of which he was a veteran and about which he had an extensive library; (and was instrumental in restoring the correct name of the Red Cross War Memorial Childrens' Hospital);
- politics – early & active member of the Torch Commando and, later, a municipal councillor for Pinelands ;
- the plight of the elderly persons in our country – chairman of the Brown & Annie Lawrence Home for 16 years and co-founder of the Halt Elder Abuse Line telephone help line;
- poetry, music and photography;
- archaeology and anthropology;
- geology and natural history in general.

By the time I met him in 1993, Chris had long since given up trying to find names for the wild flowers that he had seen growing on the Cape Flats during part of his childhood on a small-holding there. Nobody he asked had been able to name the flowers and people were surprised that he should take much notice of them as they "just grew there". When we attended a show staged by IBSA at Kirstenbosch several years ago, he was surprised and delighted to see so many familiar wild flowers displayed and named!

That show, and the IBSA members he chatted to, decided Chris that we should join the group. I renewed my lapsed membership and we became active members, trying to cultivate many different species of our indigenous bulbous flora. In fact, as Chris had space at his home, this activity developed into rather an obsession.

There is almost no better manner in which to get to know the members of a society than to serve on the committee for a spell and there came a time when IBSA required a replacement honorary secretary. Chris, who never claimed to know much about our flora, certainly knew about being a secretary and he volunteered to fill the position for a time. He was instrumental in computerising the newsletter mailing system thereby reducing the time and costs previously involved. He also enjoyed chatting to the visitors to the shows staged by IBSA, particularly the annual show held by the Cape Clivia Club at which IBSA was invited to have a display.

The secretarial position gave him the opportunity to meet many of the local members and to have – mostly electronic – contact with many overseas enthusiasts. The contact was appreciated by these members, judging by the favourable comments received. Being

involved in organising two successful symposia afforded Chris the pleasure of meeting many up-country and overseas members in person as they enrolled as delegates and visited the Western Cape for one or both of the events.

After relinquishing his committee work, Chris remained an active member and always enjoyed attending the IBSA meetings. He was disappointed when his declining health prevented him from participating, and was always touched by greetings from his IBSA friends.
Chris passed away peacefully on 27 February 2009, a gentleman of "old world courtesy and charm', a "free-lance Christian", concerned citizen, champion of the elderly and a true and loyal friend. He will be long remembered and sadly missed. ♣

Book Review

"Field Guide to the Orchids of Northern South Africa & Swaziland"

By D. McMurtry, L Grobler, J Grobler, S Burns

Given the size of the orchid family in South Africa (466 species) and the passion this group of plants arouses amongst collectors, it is remarkable that so few popular works on South African orchids have been published. Graham Williamson and Joyce Stewart have both published popular works, but none of these represent all the species in a particular area, but rather present an overview of the family.
In 1999 Linder and Kurzweil published their monumental work "Orchids of Southern Africa", and this is the most complete work on our indigenous orchids. However, no more than 900 copies were sold before the publisher's warehouse burned down and all unsold copies were burned as well as all the plates! Therefore this new Field Guide fills a vital niche in our botanical literature. It is of particular interest to IBSA members as over 75% of all SA orchids have some form of underground storage organ and can be cultivated as easily as our bulbous plants.

This new book is a true field guide and the dimensions are such that it could be dropped into a rucksack. It is well bound together in sections with a semi-hard cover.

The introductory section is designed to dispel myths about orchids and classify them for the layperson. There is a section on flower structure and pollination headed "When is a plant an orchid?" The next section in the introduction covers the main vegetation types where orchids are found, illustrated with good photos and graphs throughout.
Before the commencement of the main text and the descriptions of the species, two pages are devoted to how one should use the book. These are followed by 9 pages of generic descriptions, with each genus illustrated by 2 or more photographs.

Then start the species descriptions. A helpful feature is a life-size image of an individual flower next to the main heading on each page – so much nicer than reading dry measurements and fumbling for a ruler (if you even have one on you!). A total of two pages are devoted to each species. One page has information under the following headings: Flowering time, Recognition of the species, a table of similar species, Ecology and Notes, Conservation status, Distribution and finally Taxonomy and nomenclature.

Given the complexity and diversity of orchids, the table included on each page on similar species and the way to tell them apart is particularly useful. The second page has between 7 and 9 colour photographs illustrating the plants in habitat, close up pictures of flowers, of flower spikes and of leaves.

Whilst the authors have made every attempt to keep the text simple, in the interests of brevity, some botanical terms are necessary, and a glossary at the back of the book explains their use. As well as a glossary, there is also an explanation of all the abbreviations used in the book.
The book has 482 pages and is lavishly illustrated with colour photographs throughout. At only R295 this represents excellent value and should be on every plant enthusiast's shelf.

Rod Saunders ♣