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HERBERTIA

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HERBERTIA

the journal of the **International Bulb Society**, is devoted to the botany and horticulture of geophytic/bulbous plants. Special emphases of the journal are the Amaryllidaceae and other petaloid monocot families rich in bulbous or cormous plants, but articles treating any aspects of dicotyledonous geophytes are welcomed as well.

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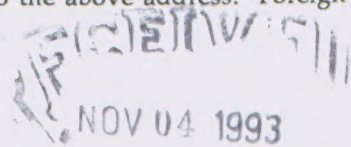
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The Board of Directors of the INTERNATIONAL BULB SOCIETY is making a special appeal to those of you who would like to promote the cause of ornamental, bulbous plants. The board asks that your last will and testament include a bequest to the INTERNATIONAL BULB SOCIETY. There's so much more your Society could do if only the funds were available:

- more extensive field collecting trips to help save the world's disappearing plant species;
- scholarships for deserving young botanists and horticulturists;
- more color in future editions of HERBERTIA;
- publication of a revised edition of "AMARYLLIDACEAE" and other monographs.

These are just a few of the plans being made for the society's future. The Board is asking that you become a part of these plans. Please write a bequest into your will to:

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Cover: *Sandersonia aurantiaca* is a South African plant commonly called "Christmas Bells". It is spring and summer growing from a stoloniferous corm. The showy flowers are produced for many weeks in early summer. A dry winter dormancy is absolutely required. Flowers last for many weeks, and it is an excellent cut flower. Corms for the cover photograph were obtained from sources in New Zealand!
Photo: M. Vassar.

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HERBERTIA
VOLUME 48, NUMBER 1&2, 1992

TABLE OF CONTENTS

Introduction	5
Brian Mathew on Brian Mathew Brian Mathew	6
Birthplace of the Bulbs A. T. de Villiers	10
An Introduction to <i>Clivia</i> Cliff Grove	13
The Genus <i>Ferraria</i> (Iridaceae) Maurice Boussard	17
Conservation of Cape Bulbs Richard L. Doutt	23
Notes on the Genus <i>Clivia</i> Lindley With Particular Reference to <i>C. Miniata</i> Regel var. <i>Citrina</i> Watson Graham Duncan	26
<i>Veltheimia</i> William T. Drysdale	30
Indigenous <i>Crinum</i> of Namibia (South West Africa) David J. Lehmilller	32
A Report on Freesia Breeding in Holland Marko Penning	39
Errata	42
Nerines 2001 - a Space Quandary Terry C. Hatch	43
<i>Bulbinella</i> Pauline Perry	46
Some Problems Regarding the <i>in situ</i> Conservation of Bulbous Plants in the Transvaal, South Africa David S. Hardy	50
Swap Column	51
Review of the Systematics of the Strumariinae (Amaryllidaceae) Deirdré Snijman	52

Salter's Revision of South African <i>Oxalis</i> (Oxalidaceae) and Some New Combinations M.B. Bayer	58
<i>Crinum hildebrandtii</i> Vatke David J. Lehmilller	70
The Genus <i>Homeria</i> Charles J. O'Neill	74
Additional Notes on Namibian (South West African) <i>Crinum</i> David J. Lehmilller	75
Restoration of <i>Crinum forbesii</i> (Lind.) Schultz Emend. Herbert David J. Lehmilller	86
The Genus <i>Watsonia</i> Charles J. O'Neill	91
Wat's New in <i>Watsonia</i> Terry Hatch	92
Journeyings in South Africa Clive Innes	93
Some Sources of South African Books, Bulbs, & Seeds	96

INTRODUCTION

This issue of *Herbertia* is dedicated to South African geophytes. The Republic of South Africa is one of the richest areas in the world for plants that produce underground energy storage units which we call corms, tubers, bulbs or rhizomes. Most gardeners do not realize how many of their favorite showy flowered garden and container grown genera originated there: *Gladiolus*, *Freesia*, *Oxalis*, *Watsonia*, *Zantedeschia*, *Rhodohypoxis*, *Veltheimia*, *Lachenalia*, *Agapanthus*, *Haemanthus* (and now some *Scadoxus*!), *Clivia*, *Nerine*, *Babiana*, *Sparaxis*, ...

Many of the less showy species often have the most interesting flowers or growth habits. All are wonderful.

The late winter and spring floral explosion in the western Cape Province, when annuals and geophytes burst into flower after good winter rains, is something that every plant enthusiast should witness. Botanically there is no place in the world like South Africa.



BRIAN MATHEW ON BRIAN MATHEW

BRIAN MATHEW
1992 HERBERT MEDAL WINNER
HERBARIUM, ROYAL BOTANIC GARDENS, KEW
RICHMOND, SURREY, TW9 3AB
ENGLAND

I have had a most enjoyable life with plants, and, in honouring me with the Herbert Medal, the International Bulb Society has added some delicious icing to the cake! It is particularly appreciated since in my taxonomic studies I have often admired and utilised The Rev. Dean's [Herbert's] work which, although 150 or so years old, is still as valuable today as it was innovative in his time. His monographic work on *Crocus*, for example, which has been particularly valuable to me in my own studies of the genus, was extremely astute, considering the limited material which was available to him. In fact his taxonomic judgement was such that the basic ideas of his classification of *Crocus* are as valid today as there were in the 1840s. So, needless to say, it is a great honour to have been awarded this coveted medal and to be associated more closely with the revered name of William Herbert.

I was born in 1936 in the little village of Limpsfield in Surrey, England, and this in itself almost ensured an interest in natural history since it was surrounded by open commonland, woods and farmland with a rich variety of flora and fauna. My sister Jean and I were encouraged by our parents to become gardeners by the simple method of competition. We were each allocated a small plot, and the prize of six pence was offered to the one who was deemed to have the best display. Although I cannot remember either of us ever actually being declared the winner, as far as I was concerned Jean won hands down for her show of polyanthus. My own efforts seemed to involve interesting but far less striking plants and much movement of earth concerned with the construction of "ponds", subterranean explosions and, in the later part of the second world war, a substantial underground shelter from which I downed many a Messerschmidt and V1 rocket with my air gun and, rather sportingly, the assistance of the Royal Air Force (RAF) Spitfires stationed nearby. Far from being terrified, I and my friends found that the war transformed our countryside into an adventure playground, and plants were forgotten in favour of collections of shrapnel, spent bullets and pieces of aircraft. Transatlantic visitors threw us goodies from camouflaged trucks, and on Sunday afternoons a German prisoner-of-war schoolmaster came to have tea with us. I never once considered him as part of the foe, and the pilots of low-flying enemy fighters used to wave at us on our way home from school, so it was all very confusing. I remember very little of the end of hostilities, apart from a lot of flags, but I do recall clearly The First Banana, an undisputed petaloid monocot!

Most post-war gardening activities revolved around food, and at this my

father was supreme, producing an endless supply of succulent vegetables throughout the year. There was no reason to compete with this excellence, and it is, therefore, not surprising that I went off in another direction growing unusual flowering plants. I would peruse our gardeners' dictionary making absurdly optimistic lists of those which I would like to grow. Studies at the local grammar school came first, however, and the only noteworthy personal horticultural event in those years was the discovery of a purple *Helleborus orientalis* on a garden rubbish dump near our home. This formed the nucleus of an interest which has lasted through to this day, and my book **Hellebores**, published by The Alpine Garden Society, is the end product of a most enjoyable study of these fascinating early-flowering perennials. After leaving school I almost enjoyed two years at Her Majesty's request in the Royal Air Force, supposedly making weather forecasts but in fact engaged in a now laughable but then secret project involving the A-bomb and the atmosphere. Above all it ensured that I and my colleagues had no parades or kit inspections, so it was all thoroughly worthwhile and satisfactory. One mystery which I never solved was why one of the RAF officers cultivated a plot of land immediately outside our "secret" unit office on which he grew nothing but Chinchinchees and never even picked the blooms. Was he an early *Ornithogalum* freak, or, perhaps, a KGB agent? We shall never know!

My father has always said that it was no use trying to make a career out of gardening, but, after leaving the RAF and finding myself at a loose end, I met Mr. Arthur G. Weeks, an old family friend, at limpsfield and one of those unforgettable characters who have such a marked effect on one's life. Mr. Weeks had a large, rambling garden with exciting features such as a woodland peat garden and a greenhouse full of treasures, the latter mainly devoted to the genus *Lewisia*. Here he crossed and selected the variants of *Lewisia cotyledon* and *L. columbiana*, plus several other species, and this sowed the seeds for a fascination in these hardy succulents which has stayed with me through the years, culminating in my recent **Kew Magazine** monograph, **The Genus *Lewisia***.

Although neither Hellebores nor Lewisias have anything to do with petaloid monocots, it is clear in retrospect that bulbs were in my blood from a very early age for it is on record from an unquestionable source that, when "very small", I would dig up the daffodil bulbs in my plot, scrub them under the kitchen tap and plant them again — they got so dirty in the soil! Mr. Weeks did have a fair number of bulbs, but, above all, he taught me that to communicate about plants it was necessary to have an undisputed Latin name. So it was here that I learned to say such splendid things as *Orphanidesia gaultherioides* and, more to the point, to understand what the epithets meant. Very importantly to me, he had faith in my abilities and he had soon mapped out a career [for me] via the horticultural school at Wisley, but to qualify for entrance one was required to have three years work experience, and this is where my second great piece of fortune came about. Mr Weeks was friendly with the Ingwersen family who ran the nearby Birch Farm Hardy Plant Nursery, and I was lucky enough to be taken on. Surrounded by a wealth of

plants and knowledge, a young enthusiast could absorb the atmosphere like a sponge. The years at Birch Farm were very happy ones, and it was a particular privilege to have worked there at a time when Walter, Will and Paul Ingwersen were all involved.

The course at the Royal Horticultural Society's garden at Wisley was also stimulating, with the company and competitive fun of fellow students, and here, again, I was lucky in that the rock garden was under the care of a great plantsman, Ken Aslet, and botany was taught by Chris Brickell. Chris's secretary at the time, Margaret Briggs, provided refreshing interest of quite a different nature. Fortune eventually came my way again in the form of a "yes" so that she is now Margaret Mathew; botanists are renowned for changing the names of all with which they come into contact!

Teaming up with some fellow students, I organised a plant hunting expedition to Iran in 1963, taking advantage of a Bowles Scholarship travel grant, named in honour of E.A. Bowles who, appropriately, was an authority on the genus *Crocus*. Fortune yet again smiled upon us, this time through Paul and Polly Furse who were already experienced bulb hunters and travellers in the region, and the information and advice provided by them was invaluable. Both were excellent artists and astute observers. Looking back at their notes from time to time, I still marvel at their diligence and depth of understanding of a wide range of genera, notably *Fritillaria*. Our five-month trip took us through some of the most interesting *Crocus*, *Fritillaria* and *Iris* country and involved another love, driving in adverse conditions which ranged from deserts to mountains and snowstorms with hardly a tarmac surface in sight. I suppose that if asked if I have any regrets about my life so far I should have to say that I am a frustrated rally driver!

A great many collections of bulbs were made on that expedition and on a subsequent trip to Turkey with Margaret and with John & Helen Tomlinson; in fact, far more bulbs were collected than would be decent today in view of the depletion of the flora. There seemed to be a super-abundance of bulbs, many of them little-studied in the wild and not many in cultivation; and the locals were not in any way interested unless they had some kind of use. In the mountain villages the preparation of herbarium specimens provided endless amusement for them, and rather than disapproving of our activities they would join in and collect even more samples. In those days there were hardly any collectors in the field, and the thought of conservation was not given a very high priority; but now, like everyone else, I am deeply concerned and as involved as much as time will allow in addressing the problem of over-exploitation of the world's bulbs. With so many people now able to travel and collect, things have changed, and we, including myself, should not take samples unless there is a very valid reason for doing so.

After these and other exciting trips to the Balkans looking primarily at bulbs and Hellebores, I found that my interest in plants was, perhaps, just slightly more botanical than horticultural, and I was successful in my application for employment in the herbarium at Kew Gardens, firstly in the

tropical African section, then in the newly formed petaloid monocot section when herbarium teams were rearranged from a geographical basis into research units dealing with groups of related families. The whole of my career at Kew has revolved around the petaloid monocots, especially the Iridaceae, Liliaceae [*sensu lato*] and Amaryllidaceae, but I have also worked on tropical African Labiatae, Celastraceae and Tiliaceae. With my combined interest in horticulture and taxonomy, I have tried to pitch my publications at a level which will to some extent appeal to a wide audience in both fields. This approach is to be found in my monographs of *Crocus*, *Iris*, *Helleborus*, *Lewisia* and *Daphne* [with Chris Brickell]. Other books I have written include two with a floristic approach, **The Bulbous Plants of Turkey** [with Turhan Baytop] and **Bulbs: The Bulbous Plants of Europe** [with Chris Grey-Wilson]; and those of a more horticultural nature: **Dwarf Bulbs**, **Larger Bulbs**, **The Year-Round Bulb Garden**, **Flowering Bulbs for the Garden**, and **The Smaller Bulbs**. I have also contributed floristic accounts of various families of genera to the *Flora of Turkey*, *Flora Iranica*, *Flora Europaea*, *Flora of Iraq*, *Flora of Tropical East Africa*, *Flore des Mascareignes*, the *Flora of Cyprus*, the *Mountain Flora of Greece*, and the *European Garden Flora*, and approximately two hundred individual papers in botanical and horticultural periodicals. Fortunately, I enjoy writing, and I am equally fortunate in that Margaret is an excellent typist, although the word processor has transformed our lives in that respect. She can now do a leisurely check on my finished articles rather than receiving a scruffy heap of handwritten papers the day before the final deadline. I also enjoy lecturing, providing that I can make liberal use of visual aids in the form of photographs or living material. I am a great believer in the impact of good colour images in getting across a message, and I prepare most of them myself. Photography has also been an almost life-long interest right from the time when I tried in vain to achieve the impossible involving birds and a Brownie Box!

My main leisure pursuit has to be gardening, mainly using bulbous plants, but our small plot must be described as a collection of plants rather than a beautifully landscaped garden. However, it does contain a lot of monocotyledonous interest. When not gardening or photographing I may be found under the car, playing squash or getting excited over rugby football, these days from a seat in front of the TV!. We still live in Surrey with our son, Paul, who, although not gripped by quite the same degree of plant madness as his father, does, I have to admit, possess a rather well-grown collection of carnivorous plants. Unfortunately for my greenhouse space these appear to be totally incompatible in their cultivation requirements with bulbs.

Thank you, the International Bulb Society, for awarding me this much-prized medal, and thank you for the good work which you do in promoting work on our beloved petaloid monocots.



BIRTHPLACE OF THE BULBS
(FROM INDIGENOUS BULBGROWERS OF SOUTH AFRICA BULLETIN #39, 1991)

A.T. de VILLIERS

INDIGENOUS BULBGROWERS OF SOUTH AFRICA (IBSA)

4 HAYFIELD CRESCENT, EDGEMEAD 7441, REPUBLIC OF SOUTH AFRICA

Bulbous and cormous plants are found in most parts of the world. Both are adaptations primarily to withstand adverse climatic conditions although many are to be found in areas which do not suggest that the climate would adversely affect them at any season. Was there a first bulb and a first corm from which they all descend and whose adaptation they have retained even where it is no longer necessary or are the adapted plants examples of parallel evolution? The concept of parallel evolution stretches the arm of coincidence to unbelievable lengths for the adaptations are not geographically groupable such as the marsupial adaptation in animals. Bulbous plants are essentially perennials which, in seasonal, subterranean dormancy wrap their active principle — the meristem — in swollen, nutriment-packed leaves. The leaves and stems put out at the end of the dormant period, the apparently new plant, are, in fact, direct growths from the previous season's plant and part of its continuous life. *Per contra*, cormous plants are essentially annuals which spawn a new daughter on top of, and from the substance of, the old plant much as a seed is a new plant formed from the substance of its parents. If there were a first protean bulb, a perennial which adapted to survive, and a first protean corm, where and when did they evolve?

Where a plant most thrives is not necessarily its place of origin. There are numerous examples of plants which grow reasonably and restrainedly in their natural habitats but which, when artificially translocated, become incursive pests. In order to establish an origin we must, rather, seek the epicentre of natural migratory routes having regard to all the many factors which facilitate or impede the spread of a particular plant across a particular region and to evaluate the nature and cause of adaptations forced upon it by those factors.

Yet another indication of more value when the epicentre has apparently been located is a disproportionately high incidence of genera showing the adaptation within a severely limited area. This suggests a point of origin from which the less adventurous forms have failed to migrate or, having shed migratory offspring, have remained in parental form in the ancestral home. Migratory routes for the bulbs and corms lead apparently to the area of south central Gondwanaland, to what is today the Cape Floristic Region. Here we find the confirmatory evidence of an extraordinary wealth of genera in a very small region. The plants of this region display yet another characteristic that is more indicative of an origin than of a migratory destination: in the gardens of the world, not least of highly industrialized countries where pollution and acid rain are part of the climate, these plants show ample proof of the vigor, the adaptability and the capacity to hybridize and mutate, yet in their own home they are each on the verge of extinction by reason of human agricultural and

industrial development. The romantic story of the so-called Guernsey Lily is typical of this: neither shipwreck nor immersion in salt water, not the storm of the Atlantic nor an alien shore in an alien hemisphere could prevent *Nerine sarniensis* from establishing a viable colony; yet in its own home it is a rare and protected plant.

If we accept the Cape Floristic Region as the place of origin, we can venture a time within reasonable geological age limits. The great concentration of reptilian fossils in the Karoo and in particular the Permian Age fossils along the line of Sutherland – Laingsburg – Prince Albert, which is roughly the line of the northern limit of the Cape Floristic Region, suggests a swamp habitat and, although there are aquatic bulbs and corms, the available evidence suggests that adaptations were land based and that a few bulbs and corms learned to adapt to water rather than from water to land.

By the time of the Cretaceous Age, when Gondwanaland was fractured and the bulbs and corms started on their long migration, they must already have been well established and we can perhaps place their origin during the erratic climates of the Triassic and Jurassic Ages. We are today used, in general, to annual cycles but this is by no means a condition of bulb and corm dormancy. The dormant period is for as long as is necessary to await a favorable stimulus. There are several bulbs and corms (and seeds) which remain dormant for years if need be awaiting a fire to galvanize them into life, a discovery which materially altered our attitude towards veld fires. There is yet another too easily overlooked indication of the scope of dormancy. The 18th and 19th centuries were the hey-day of indefatigable botanic explorers, men whose names are the currency of herbaria throughout the world. They described Cape plants which were not found again for as long as a century, some, indeed, have never been found again. Those plants have not been "lost" for want of searching and every now and then one is found where searches have been made in the intervening years. Every year a few plants are found described as *species nova*. Some are connected up to lost species. Some are classified as varieties of known species but some are accepted as new species. All this in a comparatively tiny floristic region. We cannot escape wondering at the extraordinary generation of botanic life in the not very fertile, rather sandy and slightly acid soil.

The possibility that there is, as it were, a sort of "soup of life" seething beneath the surface of this region could not be but enhanced by the phenomena of 1990. Ordinarily the drought of summer breaks in the autumnal rains in April. The hidden bulbs and corms begin to burgeon, coming to flower from May onwards but mostly in late August and September, in the spring. In 1990 the April rains were the heaviest and most prolonged since records were first kept in 1856. The seasonal pools filled up quickly and every hollow became a pool. The winter rains maintained the high water table and it was not until September that the hollows began to drain and the seasonal pools to retract to their usual high level marks. Reports began to come in of new species found, of colour varieties known in the literature but very seldom seen, of species appearing where they had not previously been found. Of the many genera we

might use to illustrate this, let us take *Spiloxene capensis*, the logo plant of the Indigenous Bulb Growers Association of South Africa (IBSA).

Spiloxene is a genus in urgent need of revision, the literature being some 60 years old. It has a number of unusual and interesting habits which seem to have escaped the notice of botanical writers. In the Cape Peninsula *S. capensis* is fairly common in its usual form of a star-shaped buttercup yellow flower, the perianth lobes bearing a large brown blotch at their bases. There is also a very much less common form with white lobes and a blue iridescence. The white form very rarely appears as a pink flower with plum coloured iridescence. In the spring of 1990 there was an explosion of *S. capensis* throughout the Peninsula. Not only was there a white form but also an ivory one that sported a brown blotch edged with golden yellow. The pink form appeared both as pink but also as white with faint pink margins but fully plum coloured iridescence. The blotches in all the colour forms were very variable: some communities showed a pea-sized regular spot instead of a blotch, others had spots the size of a pin-head and others no blotch or spot at all. One community displayed beige blotches. Where the blotch form was retained it was irregular in shape as in normal years but in other communities it had a definite and constant geometric shape. All this was intriguing but what was of the utmost significance was that the plants appeared in great numbers where they have not appeared in living memory notwithstanding that these places have been visited year after year by collectors. These plants were fully adult, well established and thick on the ground. From where did they come? How long have the corms been dormant? Why when other plants have been dug up from this ground have the distinctive *Spiloxene* corms not been found? What else lurks in this somewhat infertile, sandy, acid soil? What makes this place above all others the origin, the birthplace of the bulb?



AN INTRODUCTION TO *CLIVIA*
PRESENTED AT THE WORLD CONFERENCE HELD IN PERTH,
WESTERN AUSTRALIA, SEPTEMBER 1988

CLIFF GROVE

WEST AUSTRALIA GLADIOLUS, DAHLIA AND HIPPEASTRUM SOCIETY
39 PANDORA DRIVE, CITY BEACH, WESTERN AUSTRALIA 6015

Because the nature of the subject matter being discussed at this conference is diverse and the interests of the participants are varied, I feel sure that there are some who have never heard of *Clivia* or known the charm and beauty of this easy to grow plant.

First discovered in South Africa in the early 1850's, it was sent to England where it was reputed to have first flowered in the conservatory of the Duchess of Northumberland (Lady Clive), thus it was given the name "*Clivia*". In all, there are four named species: *Clivia miniata*, *C. nobilis*, *C. gardenii* and *C. caulescens*. The most beautiful and easily identified is *C. miniata*, which has trumpet-shaped flowers, whereas the other three have narrow, tubular, pendulous flowers. *Miniata*, being Latin for red, would indicate that the first discovered and natural form of the species was colored red. This seems strange to us here in Australia as a red colored *Clivia* is quite rare. Most vary from a light to mid-orange with a yellow center, this presumably being a cross between the original form and a naturally occurring sport called *C. aurea* or *C. citrina* to the purist. I believe it should be called *citrina* but the name most generally accepted in Australia is *C. aurea*. There are other names in various publications which further cloud the issue such as *C. kewensis*, *C. sulphurea* and *C. flava*.

A general description of *Clivia miniata* would be: a plant having long, narrow, smooth edged, strip-like leaves of 20-24 inches with pointed ends and bright orange, trumpet shaped flowers with a yellow center borne in umbels of 15 to 20 on a flat stem of 18-24 inches. The plant normally flowers here from September to November but may send up the odd flower at almost any time of the year. The fruits, when seeds first set, are dark green but turn to a bright red on maturity, a process which can take up to 12 months. *C. miniata* has been subject to an extensive and intensive breeding program which has resulted in many new hybrids, generally with much broader leaves, larger and more symmetrical flower heads and colors ranging from pale cream to almost a burgundy. There does not, however, appear to be any progress on a complete break away from this color range at present.

The second of the species, *Clivia nobilis*, has an umbel of 20-50 small, tubular, pendulous flowers of orange-yellow color with or without a green tip. The leaves are a deep green strip 1 to 2 feet long with rounded tips and edges that are rough to the touch. The flowering period and seed set are similar to *C. miniata*, although the fruit of *C. nobilis* is generally smaller and rounder.

The third species is *Clivia gardenii*, which was first discovered in 1855 and named after a Major Garden. The flowers are pendulous, slightly curved, and of a salmon color with a green tip which turns yellow with age. The umbels

usually consist of 10-14 florets atop a 20-24 inch stem. The leaves are long, green strips 1½ to 2 feet long, gradually tapering to the extremity with a blunt point.

The fourth species is *Clivia caulescens*, which was named in 1943. Like the previous two species, it is of pendulous form with the number of flowers per umbel intermediate between the two. The most distinguishing feature of this species is that with age the outer leaves fall off leaving a central stem that, on mature plants, can eventually grow to approximately 18 inches. I have yet to see this plant as it is generally unavailable in Australia.

The first recognized hybrid to be grown from these species occurred in 1904, a cross between *C. miniata* and *C. nobilis* called *C. cyrtanthiflora*. It is also of pendulous form but, as might be expected, the mouth of the flower is wider than *C. nobilis*, being approximately 1½ inches in diameter.

In preparing to write this paper, I read many articles but the statement that really caught my attention was, "the distinction between the three pendulous species was not great and that intermediates may exist". Here in Western Australia I find it extremely difficult to find and identify any species and think that most are intermediates rather than species. For example, *C. nobilis* according to most descriptions should have a green tipped flower, although I have recently read that they may exist in plain colors. I find that most plants I consider to be *C. nobilis* have flowers of a plain color. Another feature is long, strip-like leaves with rough edges and rounded ends. I have plants with long, narrow leaves with pointed ends and no serration. Others have short, thickish leaves with rough edges and rounded ends. In all, I have almost every form of leaf. The pendulous flowers vary in color from light orange to quite dark, the mouth varying from narrow up to the width of *C. cyrtanthiflora*.

If one follows the general description of *C. gardenii*, then I have such a plant. It flowers May through June, as it should, but it also has a few other attractive features. The stem of the scape when it first appears and right through the flowering period is a light brownish color and only turns green when the seeds are setting. The fruits when first set are the usual green but turn to a most attractive cherry pink rather than red when ripe. Is it *C. gardenii*, a sport or something new? Mrs. Les Larsson, during her recent visit to America, was unable to get an answer and this is the quandary in which I find myself with many of my plants. It would certainly be nice to have a color pictorial catalogue. Perhaps we could start one!

Cultivation of *Clivia* in Perth is not difficult. They will grow in the garden provided they are given adequate shade. They make most attractive pot specimens for the veranda or sheltered patio. Potting mixes are generally rich in humus as would be in their natural habitat of growing under trees. The suggestion that the mix be quite heavy with loam I find inappropriate in this climate.

During a normal Perth summer, we get an average of 60 days over 30°C with many days closer to 40° and several over. During this period we also get hot, dry, easterly winds which will burn the leaves and flowers if plants are not

adequately watered and shaded. However, during our short, wet winter we get the extreme with many nights dropping to below 10° with very heavy rain. Under these conditions I think that a very heavy mix would run the risk of root rot. I prefer a compost mixed with sand, of which we have plenty, an additive of bone meal to help tide the plants over during the long periods between repotting as they prefer to be left undisturbed and crowded for several years. During the hot weather, which is also the growing period, I like to give a liquid fertilizer once a month on mature plants and twice a month on seedlings. I rest the plants during autumn by reducing watering and I stop fertilizing. Once the scapes appear in spring or early summer, I again start fertilizing.

Pests and diseases are few, the main trouble being caused by mealy bugs forming well down inside the axils and not always evident until some damage is done. To counter this pest, I use a systemic spray in a one litre trigger operated sprayer. I adjust the nozzle so that it squirts like a water pistol and I just shoot a stream of spray at the base of the leaves of each plant. This saves spraying the whole plant and negates the need of cover up with masks, etc., as there is no fine air-borne spray to drift and be inhaled. I realize this is not practical on a large scale, but it is surprising how quickly you can cover quite a number of plants and it is effective.

The easiest method of propagation is by division of well established clumps. My first *Clivia* was given to me by an elderly gentleman who just snapped off a piece at ground level with no roots at all and it grew. Not that I would recommend this method, but it does give an indication as to how hardy these plants are.

The second method is grow from seed and, whilst this is a very slow process, taking up to 5 years to get a flowering plant, it is certainly the most rewarding. Once you get past the first 5 years, provided you plant seed each year, you will have a continuity of new flowering plants. From flowering it takes nearly 12 months for seed to ripen. By this time the fruit is a bright red, except *C. aurea* (*C. citrina*), which is green-yellow in color, and my *C. gardenii*, a pink! At this stage, if the seed is ripe, a slight twist will break the fruit from the stem. The fleshy exterior is removed and a whitish, pea-sized seed is revealed in any quantity from a single seed up to six seeds per pod. To sow these I get a seed tray of my normal potting mix and push in the seed until it is 50% submerged in the mix. Roots appear very quickly but the foliage seems to be quite erratic with some appearing after a few weeks whilst others take months. No doubt bottom heat and glasshouse conditions would speed all these processes, but mine usually germinate quite well just in a shady location in the garden.

Cross pollination and hybridization of *Clivia* is an area hardly touched in comparison with other plants, although there are early recordings of named hybrids such as *C. astrosanguinea*, *C. aurantiacum cryebta*, *C. cooperi*, *C. grandiflora*, *C. lindenii*, *C. splendens* and *C. sulphurea*. Most of these names seem to have disappeared altogether, although I guess many are today among the plants I query.

There are recordings of crosses between such plants as *C. miniata* and

Eucharis grandiflora, such a cross supposedly being responsible for the perfume of some plants' flowers. Whilst some are perfumed, many people doubt the possibility of such a cross. There are other reported crossings, such as with *Agapanthus* and *Narcissus*, but when one tries to track them down it usually ends up with the same story: "I've heard about it, I've seen it somewhere, but nobody can obtain it."

When one compares what has been done with *Hippeastrum* from such humble beginnings, think of what can be achieved with *Clivia* when we have such a beautiful plant to start with. Let's get started but, please, let's get the names right first.



IN MEMORIAM

A contribution to the International Bulb Society has been made by the Southern California Hemerocallis and Amaryllis Society in the memory of KENNETH MANN and the many years of service he gave to both societies.

(Contributions for the "in memoriam" page may be in any amount and should be made by check or money order. If you wish to specify a certain project for your contribution such as the scholarship fund, improving *Herbertia*, or revision of *Amaryllidaceae*, please so indicate. Those "in memoriam" contributions which do not specify a project will be placed in the general fund of the International Bulb Society.)

THE GENUS *FERRARIA* (IRIDACEAE)

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Ferraria (Burm. ex Mill., 1759) is a small African genus including 10 species, 9 of which are restricted to the winter rainfall part of Southern Africa, the tenth species is widespread in tropical Africa south of the equator. This name was given by Burman in memory of the Italian botanist G.B. Ferrari who described the first species (probably *Ferraria crispa*) as early as 1633 as "*flos indicus e violacee fuscus radice tuberosa*". He believed it to come from Java (it must be said that both Indonesia and the Cape area were then Dutch colonies and ships coming back from Java usually put into Cape Town port). Botanists have investigated and reviewed this genus since: Linnaeus, Ker-Gawler, Endlicher, Klatt, etc., and the latest comprehensive treatments were by Baker (1896) and M. de Vos (1979) who reduced the some 50 binomials listed in the *Index Kewensis* to 10 species. I am indebted to her [de Vos'] monograph for some information given in this paper.

Some Iridoideae once included in *Ferraria* belong in fact to other genera and the younger Linnaeus even described as *Ferraria pavonia* an American bulbous irid which is now the type species of the genus *Tigridia* (*T. pavonia*), a very distantly related plant (bulbous and not cormaceous, plicate leaves, simple, tuftless styles except in the Peruvian species *T. cristata*): such a mistake has lasted for centuries since a Dutch trade catalogue still offered bulbs of *Tigridia pavonia* as *Ferraria* in the 1960's! Conversely, several species firstly described as *Moraea* eventually proved to be *Ferraria*.

The *Ferraria* are small to medium sized (7-100cm), deciduous geophytes which are (all but one species) winter growing, spring flowering and summer resting. They are usually found in sandy, rather dry soils. They have peculiar corms, smooth and apparently coatless, which simulate a tuber. A new one is produced each season, but they are persistent and that results in formation of a row of corms usually held vertically (contractile roots pull down the newest corm at due depth), sometimes obliquely to almost horizontal (*Ferraria ferrariola*). They are more or less symmetrical and vary from globose to ovoid in shape. An aerial axis (stem) is produced from an axillary bud of the latest corm but older ones may also sprout, chiefly if they are pulled away from the string. They may skip a growing season, albeit remaining sound under ground.

Stems are, as a rule, very leafy, the leaves being of the iso-equant iris-like type. 1 to 3 cataphylls occur at the base of the shoot, usually plain green but at times reddish purple (*F. densepunctulata*) or purplish red spotted (*F. ferrariola*). The leaves have a distal, unifacial, ensiform blade (lamina) and a proximal, cylindrical, bifacial sheath: the length of each part varies according to the species, *Ferraria brevisfolia* and *F. foliosa* having particularly developed sheathing parts. They are stiff, of a firm to half succulent texture (xerophytic adaptation) and held erect to horizontal. Young plants yet unflowered have

only 1-3 long, narrow, unifacial leaves without any visible stem. Conversely the stems of adult plants are densely covered by the fan of leaves with no visible internodes except for 3 species: *F. densepunctulata*, *F. ferrariola*, and *F. glutinosa*, which are laxly leaved, with long internodes. The upper part of the axis is repeatedly branched and bears the corymbose, rich inflorescence. The foliage withers and dies down at the end of the growing cycle (May-June except for *F. glutinosa*). [Flowering times are northern hemisphere except for references in Africa.]

The dense inflorescence carries some to many, erect/suberect, congested cymes of 2 flowers each (up to 6 in *Ferraria glutinosa*) enclosed in large, green spathes, opening in succession for weeks, and several flowers may be simultaneously open on a plant in the tallest species (*F. crispa*, *F. foliosa*). They are largely exerted from the spathes, tubeless and fugacious (1 day), though they remain open 2 days (*F. densepunctulata*, *F. divaricata*) and even 3 days in some species (*F. ferrariola*, *F. uncinata*). They are also often scented, the scent varying from unpleasant in *F. foliosa* to sweet in *F. brevifolia*, *F. ferrariola*, and *F. schaeferi*.

Ferraria flowers are all actinomorphic, star shaped and held upright. All segments are almost the same size, though the inner whorl may be a bit smaller. They also have the same shape with cup-forming claws and triangular blades whose margins are finely curled and crisped. They open flaring, then become reflexed and curl inwards and twist over the styles when they fade. All segments show exposed nectaries exuding abundant nectar.

They display a range of odd colours and combinations: creamy yellow (*F. kamiesbergensis*) with darker margins and nectar guides (*F. brevifolia*), lemon yellow mottled brown (*F. schaeferi*), clear yellow to dark purple (*F. crispa*), dark maroon (*F. foliosa*), grey green to pale bluish mauve (*F. ferrariola*), to bright lilac blue (*F. uncinata*). Flower size is 4 to 7cm across, according to the species.

The stamen filaments are fused into a tube surrounding the styles. They are free at the top for a few millimeters and carry the anthers (= pollen sacs) either divaricating (section *Macroscyphae*) or being parallel (sections *Ferraria* and *Glutinosae*). The styles are bi-lobed, opposite to the anthers and conspicuously fimbriated, forming the so-called tuft in the middle of the flower, most evident if seen from above. Such a feature is also found in *Moraea lugubris* (once called *M. plumaria* which was more appropriate) and *Tigridia cristata*.

Capsules (pods) are ellipsoid, sometimes beaked, and contain some 3-4mm, angled, clear brown seed with a wrinkled, shiny testa. They are freely produced and germinate readily. Seedlings take 3 seasons to flower.

Basic chromosome count is $n=10$ and *Ferraria* species are usually diploid ($2n=20$), though polyploidy may be found in *F. crispa* and *F. schaeferi* (40 to 60 chromosomes). This basic number of 10 is also found in other Irideae, namely *Diates* and some primitive *Moraea* (sections *Visciramosae* and *Moraea*, Goldblatt 1976). *Ferraria* is allied to other genera of the Iridoideae subfamily and has probably diverged from a rhizomatous ancestor — *Diates* or *Iris*-like (rather *Diates*, of African origin, than *Iris* whose cradle seems to be Southeast Asia).

As for cultivation, *Ferraria* prove to be rather easy. Some species (*Ferraria*

crispa, *F. divaricata* and overall *F. glutinosa*) have a wide distribution; other ones have a more restricted range (*F. schaeferi*, *F. uncinata*), while a few (*F. brevifolia*, *F. densepunctulata*, *F. foliosa*) are very local endemics. As already mentioned, they often occur in dryish habitats to which their plump corms are well adapted, so they will be best grown in a sandy, sharply drained compost in full sun. Don't overwater them; fertilize weakly. Overfertilizing with a high nitrogen (N) fertilizer induces a flush of foliage and rotting. They also benefit from an airy place which prevents any rotting. All the species except *F. glutinosa* are adapted to a winter growing cycle, so corms must be kept hot and dry during the summer dormancy. Rather tender, they stand only light frost.

The monograph of Miriam de Vos divides the genus into 3 sections according to the disposition of the pollen sacs (thecae) of the anthers.

- Section Glutinosae is monospecific and includes only the summer flowering tropical *Ferraria glutinosa*, which bears sticky areas (hence its specific name) below its inflorescence cymes as well as small (less than 10mm), globose pods.
- Section *Ferraria* contains 5 species (*Ferraria crispa*, *F. dense-punctulata*, *F. ferrariola*, *F. foliosa*, *F. schaeferi*), the anthers of which show parallel thecae.
- Section Macroscyphae contains the four remaining species which all have divergent (divaricate) thecae (*Ferraria brevifolia*, *F. divaricata*, *F. kamiesbergensis*, *F. uncinata*).

Ferraria glutinosa is very widespread south of the equator: Zaire (Shaba Prov.), Angola, Zambia, Zimbabwe, Namibia, Botswana — a station was even recorded in Northern Cape Province, so it may be said that all the known *Ferraria* species can be found within the Cape Province. That may account for the many synonymous names *F. glutinosa* has received: *Ferraria bechuanica*, *F. hirschbergii*, *F. viscaria*, *F. welwitschii*, *Moraea andongensis*, *M. candelabrum*, *M. malangensis*, *M. randii*, *M. spithamea*, ...

Whatever the size (25-80cm), the dark brown, pebble shaped corms of *Ferraria glutinosa* are surrounded by a lax scape with long internodes and leaves of a softer texture than its South African relatives. The upper nodes, each subtending a cyme, are underlined by a 2-3cm gummy (glutinous) area, a feature found in a few other irids (*Moraea bituminosa*, *M. viscaria*). The cymes are a compound of 2-6 flowers which open widely upon a bell-shaped perianth cup. They are 4-6cm across, odourless, the colour being a striking checkering of brown and yellow. Flowering season is May-September in the northern hemisphere. This species, unlike its relatives, is winter resting.

Two other species show well marked internodes:

Ferraria densepunctulata, to my opinion the showiest of all *Ferraria* species and the earliest flowering one (November-December). It is a very localized species, found only near Elandsbaai and Lambertsbaai (Western Cape Province). The aerial axis, 15-35cm high with clearly defined internodes and purplish cataphylls, emerges in early fall from a disc-shaped corm. The distichous

leaves have a more or less compressed blade, whereas the upper ones are sheathing and spreading. The flowers, 3.5-4.5cm, are very peculiar, heavily spotted with purplish violet dots on a pale greyish green ground on the outer segments, the dotting fusing into a large blotch on the inner ones, with the contrast of the bright yellow-green, fully exposed nectaries. Flowers appear 6-8 weeks after the plant sprouts before a new corm has formed and they last for 2 days each.

Ferraria ferrariola (synonyms: *F. antherosa*, *F. longa*) is more widely spread and has even narrower, almost terete lower leaves. The cataphylls are conspicuously spotted purplish-red (a feature found in some South African monocots) and arise from the uppermost, ellipsoid corm of an oblique, almost horizontal row. Its flowers are the largest in the genus, up to 7cm across, of a pale bluish or greenish grey hue striated with darker lines chiefly on the outer tepals. They give off a faint, almond scent. Flowering season is late January to March. This species occurs throughout Namaqualand from Clanwilliam to the Oranjemund in the Richtersveld, which are areas with very low rainfall (10-20cm/year). Thus, this species resents very much any excess of moisture.

Three species are tall, many-flowered, and closely related:

Ferraria crispa is the commonest, being found throughout the south west and southern Cape Province, from Clanwilliam to Willowmore and Mosselbaai. It is a polymorphic species known under many synonyms: *Ferraria major*, *F. obtusifolia*, *F. punctata*, *F. undulata*, and *F. vandermerwei*. Two subspecies are recognized by de Vos: *F. crispa* ssp. *crispa* and *F. crispa* ssp. *nortieri*. The latter is found north of the distribution range (Clanwilliam, Piketberg) and has smaller flowers.

Plants of *Ferraria crispa* are 25 to 80cm tall with globose, symmetrical corms 2-4cm across. The stout, heavily leaved stem shows laminae (blades) always longer than the sheathing part (it's the converse in *F. foliosa*). The upper ones harbor numerous, 2-flowered cymes. Flower colour varies from clear yellow-brown to very dark maroon, almost black, with small brown blotches in the paler cup. They are said to have an unpleasant, putrid odor, but I disagree with that. The scent, though pungent, is rather pleasant to my nose, recalling cinnamon. Flowers open in spring (March-April) and are followed by ellipsoid pods shedding away golden brown seed in late spring. Self-seedlings inevitably sprout next fall and this species is almost a weed with me!

Ferraria foliosa is even stouter than *F. crispa*, up to one meter high, but has a very limited range, inhabiting a coastal strip in the Western Cape, from Elands Bay to Hondeklip Bay. It is also distinguished by its larger (4-7cm), depressed, globose corm; spirally arranged leaves, spreading horizontally and with reduced blades and velvety dark maroon-purple flowers edged yellow or pale greenish brown. They have a mouldy scent (for pollination by flies). Flowers of both *F. crispa* and *F. foliosa* remain open for one day only but many open in succession for some three weeks.

Ferraria schaeferi, the third species, is the northernmost species of the group, occurring in the arid coast of North West Cape (Springbok, Port Nolloth)

and the adjacent part of southern Namibia in deep, loose sand. It has some xeromorphic features, particularly its succulent, stiff leaves. Rainfall is very slow and scant there and available moisture derives mainly from drifting, heavy sea mists and nightly dews; hence, do not overwater. Plant size is 25-50cm tall. Corms are large and flat. Leaves are intermediate between *F. crispa* and *F. foliosa* but decidedly succulent. Flowers are sweetly scented, yellow edged and mottled dark brown. It may be of hybrid origin with *F. foliosa* being one of the parents. Both *Ferraria crispa* and *F. schaeferi* are polyploids ($2n=40$ or 60) while *F. foliosa* is always diploid ($2n=20$). Moreover *F. crispa* (in the south) and *F. schaeferi* (in the north) overlap the distribution of *F. foliosa*.

Ferraria divaricata is a medium sized species 20-40cm tall which has the poise of a smaller *F. crispa*. Showy, 6-8cm flowers display a large range of colours: yellow, green, orange, and brown often with a central, purplish blue suffusion. Some forms are sweetly scented. It is a late bloomer (April-May) which sets pale brown seeds included in a beaked (rostrate) pod. Each flower lasts for 2-3 days. It is the most widely distributed spring flowering species and is found in Namaqualand, the south west Cape, the Karoo, southern Namibia and Kalahari (northern Cape). This variable species with its typical, divaricate anther-lobes (thecae) belongs to the section *Macroscyphae* and is either diploid or polyploid. It has been split by de Vos into 4 subspecies according to ploidy, geographical range and flowering time.

- *F. divaricata* ssp. *aurea* has concolor, bright yellow flowers and comes from Clanwilliam.
- *F. divaricata* ssp. *arenosa* has an erect habit and late, brown flowers. A native of the western coastal districts (Cape Town to Hondeklip Bay), its flowers are sweet scented.
- *F. divaricata* ssp. *australis* has spotted, unpleasantly scented flowers and is a tetraploid from the Little Karoo region.
- *F. divaricata* ssp. *divaricata* is of spreading habit, having greenish to brownish-yellow flowers with a blue-purple median zone. It is diploid and widely spread in Namaqualand, the Karoo, and Northern Cape Province.

Ferraria uncinata is 15-30cm tall with somewhat falcate leaves having finely crisped margins. Flowers are large (5-6cm), faintly but pleasantly scented and strikingly bicoloured. Flowering time is rather late (April) and flowers remain open for 2-3 days. Unlike the other *Ferraria* species, which are sand-dwellers, this species may also be found in clayey soils.

- *F. uncinata* ssp. *uncinata* (also known as *F. framesii*) is the so-called "blue *Ferraria*" with blue segments and green margins. It is found south of Vanrhynsdorp (Clanwilliam, Malmsbury).
- *F. uncinata* ssp. *macrochlamys* is pale yellow with darker margins and is found north of Vanrhynsdorp (Namaqualand).

The two remaining species (*F. brevifolia* and *F. kamiesbergensis*) are dwarf, less than 25cm tall.

Ferraria brevifolia is another very local plant, occurring along a strip stretching from Nuwerus to Garies in southern Namaqualand. A distinctive species whose peculiar, spreading leaves have thickened margins and short

ovate blades, its flowers open in March and are pale yellow with darker, almost orange margins and a faint scent. I remember seeking after it whilst in South Africa. We stopped on the road between Nuwerus and Bitterfontein. I was looking at a pale *Lapeirousia* species and kneeled down accordingly to catch a glimpse of it. Surprise! The neat, tiny foliage of dwarf *Ferraria brevifolia* (7-10cm high only) stuck out of the sand. The plants were already out of flower (it was mid-September). I forthwith scratched the loose sand and quickly dug out several pretty rows of corms.

F. kamiesbergensis was found in the same botanical trip, more northerly near Lilliefontein (Kamiesberg). It was dusk and the low angled rays of sunset stroked the creamy yellow flowers stippled with grey-green dots. Scent, if any, was very faint. According to de Vos the plants may reach 30-50cm, but the form I saw was by far smaller, being 10-20cm tall. Floral segments are long and narrow and not very crisped.

Photographs by Michael Vassar.



Figure 1. *Ferraria* sp. ↑ 3.8km south of Eksteenfontein turnoff N. of Lekkersing.



Figure 2. *Ferraria densipunctulata* ↑
Plant source: Rust-en-Vrede nursery.



Figure 3. *Ferraria crisper* ↑
Plant source: University of California,
Irvine Arboretum



Figure 4. *Ferraria crisper* var. *nortieri* ↑
Plant source: University of California,
Irvine Arboretum



CONSERVATION OF CAPE BULBS

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A substantial number of South African geophytes endemic to the Cape Province are at risk of extinction and conservation measures are being implemented to save these endangered species. As a concerned visitor to the Cape Province I have witnessed some of these efforts which I can enthusiastically applaud but there are others about which I have mixed feelings and decided reservations.

It often seems difficult for a single individual to alone accomplish any significant conservation of an endangered species but I did find one exceptional man who is doing wonders. He is Neil MacGregor of the tiny community of Nieuwoudtville in arid Namaqualand. Neil has a farm, Glen Lyon, on which he profitably raises very fine Merino sheep. This would seem incompatible with wild flower conservation, for sheep and goats can decimate the original vegetation of any area. Neil thought there was a better way to farm which he calls "Nature's Way". He imagined what the vegetation was once like when the roaming herds of antelope-type animals grazed the area before the arrival of Europeans. He envisioned the animals doing selective feeding on the vegetation and then moving on. His sheep are aliens to the South African landscape but Neil believed that by selective grazing, good range management, and timing the sheep's pasturage to coincide with the dormant season of wild flowers he could both raise sheep and conserve wild flowers. He decided to let the flowers grow in the spring, produce seed and store food in the bulbs.



↑ **Figure 1.** Neil MacGregor, quint-essential conservationist & sheep farmer, Nieuwoudtville, Cape Province, South Africa.



↑ **Figure 2.** Mass display of wildflowers, 70th annual wildflower show, Darling, Cape Province.

Photos by author.

Then he would let his sheep graze the area. With this procedure the seeds are saved, the hooves help to plant them, the droppings fertilize the area, and the bulbs, being underground, are not affected.

It took about 10 years to achieve what Neil now has at Glen Lyon. In the spring his land is ablaze with color and full of really rare bulbous plants. His farm is the type locality for scores of species that were first found there and described by the country's professional botanists for whom he is a generous host. He assists them in every way, even providing lodging in his guest cottage. He also welcomes lay visitors who ride in his farm truck while he gives them a tour of his wildflower preserve and explains the ecological miracle of rare bulbs on a working sheep farm. He lets people roam at will through the flowers, for Neil doesn't believe in what he terms "don't boards" - signs that would confine the people to paths or restrict their enjoyment of the flowers. His dedication to preserve one of the most beautiful concentrations of wild flowers in the world is unsurpassed and he has created a truly national treasure for South Africa. A partial list of bulb genera being conserved at Glen Lyon include *Brunsvigia*, *Bulbinella*, *Gladiolus*, *Sparaxis*, *Hesperantha*, *Romulea*, *Lachenailla*, *Lapeirousia*, and many more.

Among the delightful events of the spring season in the Cape are the wild flower shows which are annually held in several rural farming communities. The shows last three days and in a typical year they begin in the town of Vredendal about August 20, and are then successively scheduled over weekends at Picketberg, Clanwilliam, Riversdale, Caledon, Darling, Kirstenbosch, Hermanus, Tulbagh, Worcester, Villiersdorp, and Porterville to finally terminate at Ceres about October 10. Each is a community effort with eager volunteers and each has its own special charm and selection of wild flowers. The species composition varies tremendously from town to town thus reflecting the astonishing diversity and richness of the Cape flora.

All of the shows I have seen feature mass displays of wild flowers and some have a selection of carefully identified specimens. Some people believe that mass displays may seriously deplete the wild populations which need protection. Doreen Court, an authority on succulents, has forcefully expressed this view. She does not believe that the flower pickers know what is endangered or rare, or which bulbs are delicate and set back, even destroyed, by having the whole flowering stem removed. She writes, "We pot, bag and cut our treasures, many of which are swept out with the dust after the public have gone home." She concludes, "we should think again, and, wherever possible, leave the plants where they belong. To my way of thinking this would be true conservation."

To investigate this controversy I picked a representative example of wild flower show where they kindly permitted me to observe their show preparation, accompany the pickers in the veldt, and attend the opening to view the public's reaction. This was the annual show at Caledon, a small wheat and barley farming community about an hour's drive east of Cape Town. This show has a respectable reputation for it began in 1892.

I asked the Secretary of the Caledon Horticultural and Wildflower Society to respond to the negative view of these shows. She said the shows create a special awareness of these precious flowers. Farmers take pride in having rarities on their land and are fiercely protective of their habitat. She added that the Caledon Wildflower Society which sponsors the show must first get permits from the Cape Province officials and then must obtain the landowner's permission and a license to transport the flowers to the show. The Province's regulations require the name of the farmer-landowner, the names of the flower pickers, and the names of the drivers transporting the flowers. Also the rules require that no more than one third of the flowers be picked from a bush, and that a third of the stem be left on such things as bulbs. Furthermore, the flower stems are to be cut with scissors to prevent the bulb from being inadvertently plucked from the ground.

I accompanied the pickers to a mountain farm set aside by a local florist solely for the natural production of wild flowers. They were after the famous Caledon Bluebell, *Gladiolus bullatus*, which occurs as scattered single plants. I winced at the size of the picked bunch of lovely blue flowers which I thought was unnecessarily excessive and I was reassured that the plants would rejuvenate. The required scissors were not used and I saw at least one plant with its corm uprooted. Such mistakes are made, but my impression of the Caledon citizens is that they are serious conservationists for they have a special reserve set aside to protect the rare and striking *Moraea insolens* as well as a large community Caledon wildflower preserve.

The community wild flower shows sometimes make unexpected contributions to the knowledge of the Cape flora with the discovery of new species. Such is the story of *Moraea atropunctata*. It was brought to the Caledon show in 1978 and 1979 where it was recognized as new. Ion Williams, a botanist from Hermanus, preserved the specimens and established that the flowers came from the farm "Vleitjies" on the slopes of the Eseljacht Mountains. There it was later recollected and described by Peter Goldblatt in 1982. From seeds made available from the National Botanic Garden at Kirstenbosch, South Africa, I have been growing it in my garden since 1987.

By making seeds available to gardeners, the National Botanic Garden promotes conservation through cultivation. Gardeners can play an important role in the conservation of species that are at risk in their natural habitat. In my garden, for example, there are probably more plants of *Moraea loubseri* than exist in nature. So conservation has many faces ranging from individuals to institutions. All gardeners can participate in conservation through cultivation, and by their efforts they may save choice bulbs that otherwise might be lost forever.

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NOTES ON THE GENUS *CLIVIA* LINDLEY
WITH PARTICULAR REFERENCE TO
C. MINIATA REGEL VAR. *CITRINA* WATSON

GRAHAM DUNCAN

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Clivia is a small, evergreen genus consisting of four species belonging to the family Amaryllidaceae and is endemic to South Africa. The species are: *C. caulescens* Dyer, *C. gardenii* Hooker, *C. miniata* Regel and *C. nobilis* Lindley, of which *C. miniata* is the most attractive and well known, and their distribution extends from the eastern Cape through Natal and Swaziland to the eastern and northern Transvaal. *Clivia* have become one of the most popular South African indigenous bulbous plants in cultivation with *C. miniata* and *C. nobilis* having been grown in England for well over a century. Today they may be found flourishing as far afield as the United States, Europe, Australia and Japan.

Quite by chance, two British botanists, Lindley and Hooker, working independently of one another, each published a new genus on the same day in October, 1828, based on the same plant. Hooker named his genus *Imantophyllum*, a name later discarded by Roeme and Schultz in 1830. Lindley established the genus *Clivia*, named in honour of Lady Clive, Duchess of Northumberland, when he described *C. nobilis*, the Cape clivia, from material collected by James Bowie in the eastern Cape, which was sent to Kew Gardens as well as to Sion House, residence of the Clive family.

Clivia miniata, which is known locally as "Bush Lily" and occurs naturally in Natal, Swaziland and the eastern Transvaal, was discovered in the early 1850's, and was initially described as *Imantophyllum* (?) *miniatum* by Hooker in Curtis's *Botanical Magazine* in 1854. Ten years later the species received its present day name of *C. miniata* when it was published by Regel in *Gartenflora*. Its wide range of flowers in shades of orange or yellow and its ease of cultivation have endeared it to gardeners world-wide; it has been used extensively in hybridising.

C. gardenii from Natal and Transkei was described by Hooker in 1856 from material collected by Major Robert Garden which was sent to Kew Gardens. A fine planting of *C. gardenii* from Eshowe may be seen in the Dell at Kirstenbosch, where it has been growing since 1947. *Clivia caulescens* was described fairly recently by Dr. R.A. Dyer in *The Flowering Plants of Southern Africa* in 1943 and occurs only in the Transvaal where it has been recorded from the Barberton, Pilgrim's Rest and Pietersburg districts. It is closely related to the two other pendulous-flowered species, *C. nobilis* and *C. gardenii*, but differs mainly in that the mature plant produces a distinct "main stem" of up to 450mm in length. Besides the differences in distribution between these three species, they also differ in that the inflorescence of *C. gardenii* bears fewer, longer flowers than the other two and they have clearly protruding stigmas.

Further, the leaves of *C. nobilis* are often hard and leathery with blunt tips, while the leaves of *C. caulescens* are usually very broad.

CLIVIA COLLECTIONS

With clivias having been cultivated for such a long time, many hybrids and improved forms have been raised over the years, particularly in the United States and Britain, where they are grown as greenhouse subjects. In Australia and New Zealand they are popular as outdoor plants, a feature of Sir Frank and Lady Main's garden in Auckland having been a spectacular bed of clivias. Lord Aberconway maintained a famous collection of clivias on his estate at Bodnant in North Wales, and raised several hybrids and improved forms, such as his *Clivia* 'Bodnant Yellow', which received an award of merit from the Royal Horticultural Society in 1958.

Another well-known *Clivia* collection was that of Miss Gladys Blackbeard of Scott's Farm, Grahamstown, who cultivated species and numerous hybrids, and which was the subject of two articles in the *Herbertia* magazines of 1939 and 1948. Her fabulous collection was bought by Mr. P. Gordon McNeil in 1962 and established at his farm in Ofcolaco, Northern Transvaal. An interesting and humorous account of Gladys, written by Gordon, appears in the 1985 edition of *Herbertia*. Although I never had the honour of meeting Gordon McNeil personally, I corresponded with him for several years before his death and in September, 1988, had the good fortune of seeing his almost legendary terraces of *Clivia* at Ofcolaco, in full flower.

CLIVIA MINIATA VAR. CITRINA

The history of the naturally-occurring yellow forms of *C. miniata* is interesting. The first published record of one is that of Mr. W. Watson who described *C. miniata* var. *citrina* in volume 25 of *The Gardener's Chronicle* in 1899. The plant described here was donated to Kew Gardens by the Rev. W.H. Bowden of North Devon, having been found wild in Zululand. It is also mentioned that another specimen of the same yellow variety had been collected by a Captain Mansell in Zululand, and which flowered in the garden of Mrs. Powys Rogers in Cornwall, in 1897.

In the book *Flower Paintings of Katharine Saunders*, a quoted passage accompanying Plate 20 reads as follows: "yellow *Imantophyllum* from Eshowe, flower withering after being two days in post bag. Most lovely, delicate, peculiar shade of yellow, not orange, but like straw color mixed with pink, quite inimitable by me. October 8th, 1893. This drawing has been sent to Kew with the bulb by Maud." It is strange that Watson makes no mention of this collection from Eshowe in his description.

Plate 411 of *The Flowering Plants of Africa* volume II, 1931, describes *C. miniata* Regel var. *flava* Phillips, where it is mentioned that Mr. C.R. Saunders, of Melmoth, Zululand, had collected a couple of plants in the Eshowe Forest in about 1888. Plants were propagated from seed from these parents, and after many years flowered; all turned out yellow, indicating a pure strain. The variety name *flava* must however be discarded in favour of the earlier published

var. *citrina*; other variety names sometimes used, such as var. *sulphurea* and var. *aurea*, have no standing and should not be used.

Many different forms of *Clivia miniata* var. *citrina* are in cultivation today, and what makes the situation confusing is that in most cases the origin of the plants in question is unknown. That is, there is uncertainty as to whether the plants were originally collected in the wild, to whether they are the result of years of being under cultivation, where they might have been hybridised with other forms.

The Kirstenbosch bulb collection contains four different forms of *C. miniata* var. *citrina*, two of which are quite superior and have large horticultural potential. One of these was obtained in October 1951 from the former Reeds nursery, in Wynberg, Cape, South Africa but, unfortunately, no details of their origin are available. It is a fairly slow-growing form and has broad, fairly light-green leaves and blooms in September. The light yellow flowers have well-reflexed petals, and the base of the segments is a deep yellow; RHS Colour Chart 12D and 13A respectively.

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

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

There are a number of reports of forms of the var. *citrina* which do come true to type from seed, while there are as many to the contrary. In my 1985 article I reported that seedlings of 'Kirstenbosch Yellow' and 'Natal Yellow' were due to flower soon, as well as a cross between these two forms. The results are as follows: all the seedlings of 'Kirstenbosch Yellow' have turned out yellow, all those of 'Natal Yellow' are orange and the cross between the two, although quite superb, is orange! 'Kirstenbosch Yellow' is certainly a magnificent form, but it is unfortunately subject to a fungal disease causing leaves to die back from the tips which requires a rigorous spraying program. As far as I am aware, propagation by tissue culture for clivias has not yet been successful anywhere, so for the time being we will just have to plod on with breeding from seed, and hope that eventually a free-flowering disease resistant superior form which comes true from seed can be raised.

CULTIVATION

Shade is essential for the successful cultivation of *Clivia*, which makes them valuable plants for growing under trees, in large containers on a shady stoep, or in corners of the garden which receive poor light. Although clivias can take very light frosts, in regions of extreme winter temperatures they must be grown under cover. They prefer a rich soil containing plenty of compost or leaf-mould and require regular watering during their growing period which is in the summer months. During winter they can survive with very little water, but are not adversely affected by heavy winter rainfall, provided the soil is well drained. *Clivia* generally bloom in spring and summer, but sporadic blooms may appear throughout the year. *C. miniata* is undoubtedly most suited to garden culture as it is the most attractive, floriferous and long-lasting. Once established, clivias prefer to be left undisturbed and will eventually form large clumps producing many flowers each year.

This article originally appeared in *Veld & Flora*, the journal of the Botanical Society of South Africa, in volume 71(3) in 1985. Graham Duncan revised and updated the article for *Herbertia*.

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VELTHEIMIA

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One of the joys of the Mediterranean climate is that it not only makes winter gardening itself possible but also the growing of interesting plants which prefer such conditions. Among these is *Veltheimia*, whose dusty rose-pink flowers resemble a small sized *Kniphofia* flower because it has a cluster of pendulous, tubular bells. It presents no difficulty in culture, providing it does not receive too much water in summer.

The bulb forms a relatively large — several feet across — rosette of bright green foliage, shiny on the upper surface. Growth begins in late October, and by late December flower scapes are well developed, then flowers come in late February. Very likely one could have blossoms by Christmas if given additional warmth. It is native to the cooler sections of Cape Province often within sight of the ocean, indeed, sometimes just beyond the edge of the high surf.

The bulb itself is odd in that it is fairly large and truncated. In Europe it is sometimes called "Unicorn Roots". Most of the bulb is solid and appears to be an enormous basal plate. It does not rot easily, but small seedling bulbs are prone to do so if overwatered. In coastal areas they may be left in well-drained gardens during summer when dormant. However, in inland valleys summer heat and moisture are a bad combination. In such areas they may be left in the soil if one keeps it fairly dry, otherwise lift and store or grow in pots. If all things are equal the bulbs are best left in the earth. It will be some years before division is necessary. If grown in pots a mature bulb should have a generous sized pot to accommodate and encourage the increase of bulbs. A deep receptacle will obviate the necessity for frequent watering inland. Under coastal conditions heat and aridity are less acute and the bulb may remain evergreen. Inland it goes dormant in late spring.

Auriol Batten in *Flowers of Southern Africa* makes the following remarkable statement, "the flowers are subtended by leafy bracts and should the tip of an inflorescence happen to touch the ground, roots are sometimes formed and the bracts at the apex develop into the first leaves of the new plant, which later develop a bulb." Another novel means of increase is by pulling the leaf off at its juncture with the bulb. Place that end in the soil so that the leaf is upright. In six to eight weeks bulbils will form. Prevent the leaf's drying out by syringing [or misting]. Increase can readily be made by seed, producing flowers after three years. The head in which they are carried is composed of inflated capsules divided into three sections. Often none of these sections bears seed, but some will contain one seed, others two or three. Five seeds per capsule is unusual. The seed is larger than buckshot, slightly teardrop in shape and are easily germinated. Considering the cost of the bulb, around \$10.00, it is well worthwhile growing them from seed. The more one has blooming, the more effective the display. They make handsome gifts as potted specimens.

A potting mix to which sand, bark, or pumice has been added for improved drainage creates a good growing medium. The flowers will last longer and the scape will be somewhat longer if some shade is given. Early morning sun is ideal, but it doesn't need full sun if given good light. Full sun will bleach the flowers. If grown under the shelter of tall shrubs or trees they can take considerable cold including several degrees of frost without damage.

There are two species. *Veltheimia bracteata*, probably the most commonly cultivated, and *Veltheimia capensis*. They are quite similar, but culture is slightly different. The former can take considerably more water and does not require a dry dormant period as does *V. capensis*. *Veltheimia bracteata* can tolerate a dry period, but it is not necessary; in fact, it is better for them to have water throughout the year.

In South Africa several yellow forms have appeared. One is cream yellow, another, called 'Lemon Flame', is a soft yellow. Van Tubergens [of The Netherlands] developed in 1956 a pale colored form called 'Rosalba'. It is not as striking as the name might indicate but it is wonderful for color contrast.

The genus is named for August Ferdinand von Veltheim who lived in 18th century Brunswick and was a patron of botany.



Photographs by David Lehmill. See "Indigenous *Crinum* of Namibia (South West Africa)", which begins on page 32.



Figure 1. ↑ *Crinum graminicola*. Farm Otjihavera near Okahandja. Jan. 30, 1988.



Figure 2. ↑ *Crinum paludosum*. Sandhof Vlei near Maltahohe. Feb. 1, 1988.



Figure 3. ↑ *Crinum rautanenianum*. Ondangwa, Ovamboland. February 3, 1988.



Figure 4. ↑ *Crinum* sp. A. Flood plain of the Okavango River 16km east of Rundu. February 5, 1988.

INDIGENOUS *CRINUM* OF NAMIBIA (SOUTH WEST AFRICA)

(PRESENTED AT THE INTERNATIONAL SYMPOSIUM ON BULBOUS & CORMOUS PLANTS IN IRVINE, CALIFORNIA, FEBRUARY 1989)

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It was a fortuitous opportunity to return to Namibia (South West Africa) during the summer of 1988 for purposes of observing and photographing indigenous *Crinum*. Most regions had received abundant rainfall in contrast to the arid conditions experienced during the previous expedition. Several localities were impractical to explore because luxuriant expanses of tall grasses completely obscured the terrain. How ironic that places which were brown and barren a year ago had been transformed into grassy jungles. The field trip consumed two weeks.

Following my arrival at the capital city of Windhoek, I soon encountered a hillside covered with blooming *Crinum graminicola* (Figure 1). Only a pink dorsal stripe traversed the otherwise completely white flower segments, a striking variation in comparison to the diffuse, richly colored, purplish varieties native to the Transvaal. The umbels actually resembled *Crinum delagoense*, but they were readily differentiated on the basis of very short pedicels and long apical projections on the green and yellow fruiting bodies. Bulbs burrowed deeply into the loose, sandy soil and developed long underground necks. Others have documented the localized occurrence of *C. graminicola* to Farm Otjihavera, and I did not observe it beyond 20km from this epicenter.

The following day I traveled northeast of Windhoek in pursuit of *C. nerinoides*. The absence of summer rains in this area during my previous visit had negated the possibility of finding specimens. I knew precisely where to search: an ill defined limestone watercourse adjacent to the western boundary of Farm Combumbi. Plants were sighted within minutes of arrival, growing in loose clay soil discolored by nearby limestone deposits. The ground was dry, and leaves were drooping in the summer heat. Several scapes had recently sprouted but were not setting seeds. Armed with the knowledge of this successful encounter, I eagerly drove south to Witvlei, another reported collection site, and scanned the landscape for limestone deposits. Indeed, near the western city limits was a broad limestone wash accentuated by hundreds of blooming *Nerine laticoma*. After a brief hike I discovered a cluster of three hearty *Crinum nerinoides*. Leaves were distinctly canaliculated, minutely serrated, and arched in a fountain effect. There were 11-12 leaves per plant, and maximum leaf dimensions were 36cm in length by 1.3cm in flattened width. A thick, brown papery tunic encased the larger than anticipated bulbs, the largest of which was 5.0cm in diameter with a discrete 8.0cm long underground neck. One plant had produced an 11cm scape bearing five immature fruiting bodies. Pedicels were 1.8-3.0cm in length, and each oblong fruit had an apical projection 3.5-4.5cm long. Worms had penetrated into

several fruits and destroyed many seeds.

I observed *Crinum foetidum* on multiple occasions north and west of Gobabis. In every instance this plant was growing in loose sand, and all bulbs examined were globular in shape with long, underground necks. Its blue-green leaves were ciliated along the margins. The explanation for the plant's name became readily obvious. When an intact leaf was broken, a foul smelling, thick, white sap freely exuded from the proximal cut surface. Cattle avoided eating the leaves. One plant possessed a scape bearing fruiting bodies. I opened several fruits; seeds were pale green to tan in color, and each was encased in a coarse fibrous coat which readily absorbed water. Several fruits were stored in a paper bag which proved to be a mistake. Examined several days later, the fruit capsules had turned black and mushy. Wherever the decomposing capsule was in physical contact with seeds, it imparted a black stain; and what a stench! The odor was absolutely putrid and persisted for weeks.

The curator of the South West Africa Herbarium informed me that it had rained at Maltahohe, and *Crinum paludosum* was blooming in the giant Sandhof Vlei. I immediately set off for Farm Sandhof which lay 300km to the south. About a kilometer from the red farm house I could discern a sea of tiny white specks in the distance, so vast my mind refused to believe what my eyes were perceiving. The elderly widow owner graciously consented to an interview. She stated that the vlei's dimensions were 5.0 x 1.7km, and when filled with water it was only 50cm in maximum depth. She showed me many photographs of the vlei's sole inhabitant, *C. paludosum*. The plants only bloomed if there were sufficient rainfall to fill the vlei. Within six days following an adequate rain, a completely barren, shallow, gray depression was transformed into a vast meadow of flowers. Scapes grew 6cm per day. As the vlei began to dry up, sheep, goats and cattle foraged on the greenery, and within several months it reverted to a barren depression. She granted me permission to visit the vlei. Although many scapes were either declining or in seed, there were still sprinklings of beautiful, flowering umbels. It was mind boggling: *C. paludosum* as far as the eye could see (Figure 2). By conservatively estimating five plants per square meter, the vlei's plant population figured into the millions. Most flowers had white segments accentuated by a thin, pink dorsal stripe, but scattered throughout the vlei were diffusely pink colored flowering umbels; the latter were freshly opened flowers, not declining ones. Fruiting bodies were shaped like lumpy globes with a small umbilication at the original insertion site of the tepal tube.

The following day I revisited the complex of small vleis at Farm Wewelsburg north of Okahandja which harbored *Crinum carolo-schmidtii*. Most plants were in seed, and only a few sporadic late comers were still in flower. Further north toward Otjiwarongo I observed several enormous *C. delagoense* growing in red Kalahari sand. I could not resist recording measurements; one plant possessed leaves 27cm wide.

I conducted several sorties using Tsumeb as a lodging base. One was to Ovamboland. Here I was rewarded at the western city limits of Ondangwa by finding *Crinum rautanenianum*, which was blooming in several small ponds

(Figure 3). The initial three plants I examined had 5-7 flowers per umbel, although later experience revealed that most plants bore just 2-4 flowers per umbel. Then proceeding in a northwesterly direction, I encountered a flood plain beginning at Oskakati which wound back and forth across the highway; paralleling the highway was an aqueduct. Between Oskakati and 20km west of Ombalantu, a span of 160km, I counted 21 separate sites from the highway where masses of blooming *C. rautanenianum* flourished in standing waters of the flood plain. Donkeys grazed in shallow waters where grasses grew.

I then drove to Rundu. The flood plain of the Okavango River was frequently many kilometers wide, and it was again fascinating to travel the extensive network of dirt trails which transect the native grazing lands. I came upon two small vleis which nurtured a semidwarf variety of blooming *Codonocrinum* (Figure 4). Many scapes were less than 20cm tall, and flowering sized bulbs varied between 2.5-3.9cm in diameter. Of 100 consecutive umbels, 85 bore only one flower and the remaining 15 had two flowers. The slender U-shaped leaves suggested a close relationship to *C. rautanenianum*, but there were several variances. Mature anthers were yellowish-tan instead of black, the scent was pleasant, and the leaf arrangement didn't conform to a distichous or semidistichous pattern. (This plant is later referred to as *Crinum* species A.)

Then I undertook the laborious 550km trek to Katima Mulilo in the Caprivi, approximately 430km of which covered a rough dusty gravel road. After securing accommodations at a lodge on the Zambesi River, I set out to find *Crinum crassicaule* at a site listed as Mpola, 24km from Katima Mulilo along the road to Ngoma. The anticipated habitat was near or in river swamps. This published information sent me on a wild goose chase. After several hours of searching and numerous inquiries at native kraals, I finally located the three tiny villages of Mpola along a dirt path 13km from Katima Mulilo, not 24km. To my added surprise, *C. crassicaule* was growing in sandy soil, most definitely not a swampy terrain. Plants were widely disbursed, and none had bloomed. The leaf configuration and arrangement reminded me of *C. macowanii*: slender, pointed, arching, channeled leaves with serrated to ciliated margins, weak undulations, and lacking a midrib. Bulbs were nearly spherical, 11-13cm in diameter, and were covered with brown, papery tunics. Each possessed a thick, underground neck 16-21cm in length. The natives of Mpola related that several individuals had been digging up bulbs and selling them in Katima Mulilo, where they were ground up and made into a skin ointment used by local women as a bleaching agent.

The next day a Nature Conservation officer chauffeured me in his four-wheel-drive truck to several locations near Katima Mulilo. We soon entered a distinctive environmental habitat termed "mopamie veld." It was a flat, clay-based terrain where water would accumulate and stand for extended periods during the rainy season. The region was overgrown with grass because January had been an unusually dry month. Hidden among the grasses was *Crinum euchrophyllum*, recognized by its erect to arching, distichous to semidistichous leaves with a glaucous grey-green color. None showed evidence

of recent scape activity. We dug several bulbs which proved to be a major chore in the heavy clay soil. The bottle shaped bulbs were encased in thick, brown-black tunics and had long, tapering, underground necks. The largest bulb was 6cm in diameter and had a total underground length of 29cm.

Our final destination was the western edge of Katima Mulilo near a soccer field. The soil composition was loose clay in comparison to the dense clay of mopamie veld. The controversial *C. kirkii* Baker of Verdoorn was randomly scattered among the local grasses. None had bloomed. Its erect leaves exhibited a unique geometrical feature which I had not previously encountered; they were V-shaped in cross section with a sharp-edged, translucent, paper-thin ridge traversing the underside at the apex of the "V". This ridge measured approximately 0.1cm in breadth, often was marked with small closely spaced serrations, and was indistinguishable from the construction of the leaf margins. There was no defined or offset midrib structure.

DISCUSSION

I was disturbed following my exposure to *Crinum carolo-schmidtii* because its flowering umbels and the South West Africa Herbarium's photographic materials did not agree with Verdoorn's botanical illustration. I sought assistance and translated Roessler's article on S.W. African *Crinum* (in German), which was published post-Verdoorn. The text contained the following statement: "The illustration of *C. carolo-schmidtii* in **Flowering Plants of Africa** 41:T1629 (1972), reproduced in **Bothalia** 11 (1973), is incorrect and misleading...". A number of discrepancies were cited: flowers overhanging instead of inclined vertically, tepal segments forming a narrow tube instead of a wide funnel, and black anthers. To this list I included the broad pink stripe on the segment keels and the markedly recurved segment tips. After further investigation I was able to learn the source of the disparity. Verdoorn's observations were based upon bulbs cultivated in Pretoria and herbarium specimens, and apparently she never studied S.W. African *Crinum* in the field. She remarked that the specimen utilized in the drawing was originally collected by Tolken near Epukiro in the Gobabis District and cultivated in Pretoria. (Tolken actually collected the bulb and a pressed specimen at Farm Okatjukurie southeast of Steinhausen in the Gobabis District. The precise locality information is interjected because I have observed *C. lugardiae* in flower in the Nossob River flood plain just south of Steinhausen, and this river flows within a few kilometers of Farm Okatjukurie. Tolken originally submitted the specimen as probable *Crinum lugardiae*. Giess reviewed the mounted specimen at Pretoria and also thought it was *C. lugardiae*.) Verdoorn equated Tolken's specimen with another plant cultivated at Pretoria and previously identified by Dyer as *C. occidentale*. The photograph in Dyer's **Herbertia** article depicted flowers identical to Verdoorn's illustration. Dyer's bulb originally came from James in California, who in turn had obtained it from a collector in South West Africa, collection site not specified. However, James published an on-site photograph of the subject *Crinum* in bloom taken by his S.W. African friend.

Without question the plant appearing in James' article is *Crinum lugardiae*.

The S.W. Africa variety is generally smaller than its counterpart from the Transvaal. If one cultivates S.W.A. *C. lugardiae* bulbs under moist conditions for prolonged periods of time (personal experience), the leaves become long and flaccid, all but lose their canaliculated contour except for the young central ones, and assume an appearance similar to the leaves featured in Dyer's photograph of *C. occidentale*. Dyer's detailed description portrays *C. lugardiae*. It is my conclusion that the plant illustrated as *C. carolo-schmidtii* by Verdoorn is, in reality, the South West Africa variety of *C. lugardiae*.

The identity of *C. carolo-schmidtii* has now become equivocal in my opinion. Dinter's original description is remarkably similar to *Crinum* species A, in fact so analogous that I suspect they are cospecific. Dinter even remarks that umbels are usually unflowered, occasionally biflowered, and only one in a thousand bears three flowers. My collection site at 16km east of Rundu is where de Winter reports collecting *C. carolo-schmidtii* in 1955. Following an examination of Dinter's herbarium materials in 1959, Solch lists *C. carolo-schmidtii* Dinter as a dubious species with a dubious name, but he does not elaborate his reasoning for this decision. It should be noted that Solch's classification of S.W. African *Crinum* is derived entirely from herbarium materials, and to accurately differentiate species of *Crinum* by this method is fraught with error.

The issue is more complex. The most recent classification of S.W.A. *Crinum* is provided by Roessler; his analysis not only includes herbarium studies but also a selection of live plants supplied to him by Giess. The S.W.A. Herbarium contains numerous photographs of *C. carolo-schmidtii* taken by Giess at the vleis on Farm Wewelsburg and also pressed specimens from the same location. Roessler's description of *C. carolo-schmidtii* is based upon these plants because it corresponds exactly with the specimens I collected at the same site (and to which I have previously referred as representing *C. carolo-schmidtii*). However, *C. carolo-schmidtii* Dinter emend. Roessler is a considerably larger plant compared to Dinter's description, most of its umbels contain 2-4 flowers in contrast to Dinter's unflowered umbels, and it is my impression that significant structural differences in leaves probably exist. It is ironic that Roessler indicates examining a pressed specimen secured by de Winter from the site 16km east of Rundu (*C. species A*), and he equates it with the pressed specimens from Farm Wewelsburg; there are striking dissimilarities between the leaves of these two species when living plants are examined, which illustrates the potential for error when comparing *Crinum* herbarium materials. *C. species A* bears close resemblance to *C. rautanenianum*, but the plants at Farm Wewelsburg are more akin to *C. paludosum*. Until someone collects a living specimen from Farm Guntsas, the original site indicated by Dinter, the true identity of *C. carolo-schmidtii* will remain in doubt for me.

The leaves of *C. rautanenianum* and *C. euchrophyllum* are comparable in construction: slender, minutely serrated, deeply canaliculated U-shaped leaves which are distichous to semidistichous in arrangement. *C. rautanenianum* possesses larger leaves which tend to be stiffer. In the field one cannot help

but notice a striking color difference between their leaves; *C. rautanenianum* has a medium green color in contrast to the glaucous gray-green color of *C. euchrophyllum*. Much to my surprise when cultivated under semiaquatic conditions in Southeast Texas, the *C. rautanenianum* specimen from Ondangwa illustrated in Figure 3 has developed leaves which are indistinguishable in color from a Caprivi *C. euchrophyllum* grown under similar circumstances. If their pots are placed side-by-side, the two species are exact replicas except for a size disparity. I assume soil pH and nutrient factors account for the color difference in the field. Unfortunately, I have not had the opportunity to see *C. euchrophyllum* in bloom. However, the illustration, photographs and description of its flowers closely correspond to those I have observed of *C. rautanenianum*, including black anthers and the change in segment color to deep pink during the declining phase of flowers. It seems prudent to consider reclassifying *C. euchrophyllum* as a variety of *C. rautanenianum*.

The physical appearance of nonflowering *C. crassicaule* in the field was so near to the leaf configuration of *C. macowanii* that an element of doubt lingered in my mind. It was not until a specimen bloomed in my greenhouse six months later that I felt at ease. The 26 flowered umbel greatly exceeded all expectations, as did the soon to follow 21 flowered umbel. Not only did the bud count surpass the published range of 8-16 flowers per umbel, but there were other parameters whose dimensions were also greater: scape length 66-76cm versus 50cm, tepal tube length 14.5-16.0cm versus 9-15cm, and segment length 11.7-12.1cm versus 5.5-8.0cm. Maximum leaf measurements were 13.0cm wide and 138cm long, compared to the limited previous report of medium leaves 7.0cm broad. Prior to anthesis the buds passed through a drooping phase where they pointed directly at the ground. Herbert felt budding behavior was so important that he divided the *Stenaster* and *Platyaster* species into two major subclassifications, buds nodding and buds inclined. Unfortunately Herbert's records of bud movements were generally overlooked by subsequent botanists.

I personally find Herbert's bud motion scheme to be useful and recommend that it be widely applied in *Crinum* taxonomy. The term "cernuous" has been employed in recent years to describe bud nodding, but I believe this word is ambiguous when correlated with Herbert's nomenclature. For instance *C. mauritianum* (specimen courtesy of the Botanical Research Institute, Pretoria) produces an umbel that is quite similar to *C. crassicaule* except for pigmentation; however, it exhibits inclined buds (horizontal buds) by Herbert's criteria, which distinctly sets it apart from *C. crassicaule* and readily permits differentiation.

Verdoorn's description of *C. kirkii* Baker in *Bothalia* is based upon her experiences with specimens collected at Mpalela Island and Schuckmansburg in the Caprivi and at Nangweshi, Zambia. These collection sites border the Zambesi River, as does my collection at Katima Mulilo. In establishing the plant's identity, Verdoorn references its similarity to Baker's illustration of *C. kirkii*. Nordal defines *C. kirkii* Baker to have unique chromosome and alkaloid characteristics in addition to specific botanical features, which results in a geographical restriction of the plant's distribution to Kenya, Tanzania and

Zanzibar. Nordal lists *C. kirkii* Baker emend. Verdoorn as a synonym under *C. zeylanicum*. However, it cannot be conspecific with *C. zeylanicum* because of the V-shaped leaves with the midline serrated ridge as earlier described; in contrast the leaves of *C. zeylanicum* contain a distinctly offset midrib. The pigmentation in the tepal segments also differs; in *C. zeylanicum* the crimson stripe is prominent at the segment tip, while in the Zambesi *Crinum* the color completely fades several centimeters from the tip on the inner segment surface, similar to *C. fimbriatulum* of Angola. *C. politifolium* of Tanzania is excluded because its leaves are horizontally oriented and also possess a conspicuous midrib. The unique leaf structure of the Zambesi *Crinum* sets it apart from other striped *Crinum* of Southern Africa and deserves a separate species classification. *C. kirkii* cannot be accepted as its legitimate botanical name. It must be renamed, and I propose to honor the original investigator. I am currently working to establish a holotype specimen and will publish a proper accounting in the future.

Opportunities to observe and photograph indigenous South West Africa *Crinum* in the field are intimately tied to the brief summer rainy season, and success for an outside visitor is very much a coincidence. To date the blooms of several species have eluded me and, hopefully, I shall see them someday in my greenhouse or on a future field trip.

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A REPORT ON FREESIA BREEDING IN HOLLAND

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INTRODUCTION

Freesia has become an important cut-flower in Holland during the past decades. Intensive horticultural research, resulting in advanced growing techniques, and an increase in breeding activities, resulting in a range of improved new varieties, were two important reasons for the spectacular increase of the freesia growing area. In this article we will give a summary of our present freesia breeding activities, preceded by a short introduction of our company and freesia culture in Holland in general.

COMPANY INTRODUCTION

The company of Penning Freesia is situated in the centre of the world's major freesia growing area: the Westland, near the Dutch West coast. Originally founded in 1926 as a small vegetable and flower nursery, specialization in freesia culture started in the 1950's and was completed in the middle of the 1960's. The total surface area of our company has expanded over the years to approx. 70,000m², of which 55,000m² contains glass housing and some 5,000m² comprises cooling and preparation space.

Penning Freesia has developed into one of the leading suppliers of freesia corms and cormlets. Alongside supplying clients in Holland, export to more and more foreign countries is also on the increase. For 30 years we have been working on the improvement of the strains of freesia. This has resulted in a broad assortment of our own, which is extended annually with new introductions.

In the spring of 1990 a totally new specialized breeding-complex was put into use in order to meet the demands of the 1990's, including special compartments for resistance trials, and a controlled room for testing the keeping qualities and vase-life of the flowers.

FREESIA CULTURE IN HOLLAND

Freesia were commercially introduced in Holland in about 1930. In the first 20 years afterwards, the total growing area was only of minor importance. In the late fifties and during the sixties, there was a remarkable area increase due to improved growing methods and the introduction of new varieties. At the moment the freesia growing area in Holland has been stabilized on about 950 acres. The average price per stem is amounting to \$0.16. White is the most important colour in Holland (about 40% of the total turnover), followed by yellow (30%), blue (20%) and red/pink (10%).

Growing techniques are still in a process of development. For instance, the use of soil cooling to control soil temperatures and to prevent flowering delay

has become part of the standard procedure for year-round growers. Another interesting development is the use of additional artificial lighting in wintertime, which is reported to increase winter flower production by at least 50%.

After a couple of years in which there were only minor changes in the assortment, nowadays the assortment is moving rapidly. New, improved varieties have taken their place into the top 10. The number of recently introduced varieties has been enormously increased, however, only a limited part of these varieties are to achieve an important position on the market.

BREEDING FREESIA

The genus *Freesia* (Iridaceae) consists of about 18 species, distributed in different parts of South Africa. The development of the assortment has been based on crossings, involving mainly *Freesia refracta* var. *alba*, *Freesia leichtlinii* and *Freesia armstrongii*. These species were all diploid.

The first crossings were made at the end of the past century. Only after World War II have breeding activities continued on a larger scale. This has resulted in a number of different varieties and different colours and also in double flowering types, which were very rare in the beginning of freesia breeding. The present assortment is generally tetraploid.

Our breeding programme is based on a number of main objectives. These objectives are:

1. Suitability for year-round culture
2. High production (number of stems and sideshoots per plant)
3. Heavy stems
4. Early flowering (low number of days until flowering)
5. Increased resistance against *Fusarium*
6. Good keeping qualities and scent.

Besides these main objectives we have a number of sub-objectives that are of importance, such as bud presentation, number of flowers per crest, straightness of the stems, quality and number of the leaves, keeping qualities of the corms and cormlets and the multiplication factor (number of cormlets per corm). For all these objectives we work with minimum requirements for our selections. For instance, the minimum production of side shoots should be at least 3 per plant. Some objectives which cannot be quantified easily (such as bud presentation, scent etc.) are judged by means of (subjective) marks. All objectives have been brought together in standard judging forms.

YEAR-ROUND BREEDING SCHEDULE

Year 1

Every year in March and April an extensive crossing programme is carried out. Seed harvesting takes place during the month of June. After a period of drying of 4-6 weeks, the seeds are sown in the last week of July (approx. 84 per net square meter). The first seedlings usually start to flower about the first week of February (with a dark or severe winter, 2 or 3 weeks later), while the

greater part of the seedlings start to flower in March. Seedlings are selected during the flowering, focusing mainly on flower production, early flowering, heavy stems and flower presentation in this first year. About 2-4% of the seedlings are selected every first week of June, followed by a drying period of 2 weeks and a preparation of 12-14 weeks at 28-30°C.

Year 2

The selected clones (then consisting of one corm and 2-6 cormlets) are planted on approximately the 15th of October. They will flower from the beginning of March until the end of April. The second selection takes place during flowering and consists of judging keeping quality, leaf quality, scent and other qualities besides the qualities from year 1. The selected clones (about 5-10%) are lifted in June/July and then dried and prepared for 12 weeks.

Years 3-4-5

From the third till the fifth year the selected clones are planted in October and judged in March/April. After the third year some planting material is kept apart to start resistance trials against *Fusarium*. In addition, a few cormlets per clone are planted in different times of the year in order to test the possibilities for year-round culture. After 5 years, the number of selected clones from one single crossing year has been limited to only 3 to 5, every clone consisting of about 5,000 corms and 20,000 cormlets, depending on the multiplication factor.

Years 6-7(8)

In these years final selections are made based on the whole range of qualities and possible market expectations are determined. In some cases promising clones are planted in our assortment greenhouse. In this greenhouse our complete trading assortment including the new introductions is planted for flowering in March. During the flowering weeks growers, exporters, researchers and others involved with freesia business are invited to come to see the assortment. If a certain clone has gone through the final selections after 6-7 years, it will be given a variety name and will be applied for at the Dutch Council of Plant Breeders Rights.

RECENT BREEDING ACTIVITIES

Resistances

The growing concern for the environment, resulting in a number of limiting measures by the Dutch government, has been the cause of a rising demand for varieties with a higher level of resistance against different fungi and insects. In Dutch freesia culture most of the problems are caused by *Fusarium oxysporum*, freesia mosaic virus, necrosis and *Rhizoglyphus*. At present we have a breeding programme running to obtain resistance against *Fusarium oxysporum*. Testing takes place in special compartments to prevent infection of the rest of the greenhouses. We are also establishing programmes for working on resistance against mosaic virus and necrosis and against *Rhizoglyphus*.

Genetically short-stemmed varieties

In Holland the demand for freesia in pots is very limited, but important customers in the USA and England grow a big number of them every year. However, only a small part of the present freesia assortment is suited for pot culture. A few years ago the search for genetically short-stemmed varieties became part of our breeding programme. The first results are very promising and we are expecting to introduce the first genetically short-stemmed varieties within a few years.

Different colours and types

Years of research and breeding have resulted in the development of a strain of striped-flowering types. One of them (white with blue stripes) will be introduced on a limited scale in Holland next year. When the final testings are finished we expect to introduce other types in the near future.

ADMINISTRATION

The extensive breeding programme is delivering a constant flow of data. The entire breeding administration was automatized a few years ago and now all data are processed and analyzed by a computer programme. Thus, a quick disposal of the desired data is possible, which has resulted in an improvement of efficiency.



ERRATA

Breeding New Varieties of *Hippeastrum* With Brazilian Native Species. *Herbertia* 47 (1&2), pages 88-92.

The authors have requested that the following changes be noted:

- p. 88 The paper's authors were A. Fernando C. Tombolato, Virginio Bovi, Luiz A.F. Matthes, Cleide Azevedo, and Carlos E.F. Castro.
- p. 89 The *Hippeastrum* hybrid IAC 56-D should read "Dutch hybrid x Dutch hybrid", rather than "*H. blossfeldiae* x Dutch hybrid".



NERINES 2001 - A SPACE QUANDARY¹

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In compiling this talk of *Nerine* I have endeavoured to find out some of the early history of their introduction into New Zealand gardens. Over the years there has been keen interest in growing these bulbs. Our climate, though rather wet at times, is almost ideal for their easy culture, having long summers and little frost in many areas of the North Island. The bulbs, along with *Hippeastrum* and *Crinum*, were in all probability collected and brought out with the early settlers and miners via South Africa. Vast clumps of these bulbs still grow in long-abandoned homestead gardens, old mine sites and orchards. Many gardens display borders of *Nerine bowdenii* and *N. fothergillii* with *N. filifolia* used as edgings, smaller groups of *Nerine masonorum* and *N. undulata* can be found while *N. flexuosa* var. *alba* is grown, preferring the cooler conditions further south. *Nerine humilis*, *N. flexuosa* plus another unknown are rare. All of these have been in circulation for many years being handed down for generations.

Nerine flexuosa var. *alba* is at times hard to flower. It multiplies fast, thereby having wide distribution. Preferring cool shade it grows to perfection in the Waikato region being used for cut flowers. I was informed that a quantity of seed was sent to New Zealand by Major Pam. These were grown by Mr. Stevens of Wanganui, no date given, so there are different clones here.

A close friend found a giant form over one metre tall with large flowers. Unfortunately he killed it with kindness. We should keep a sharp eye out for that chance sport!

On the hybrids it has been difficult to find out much of value. Most of the data has been destroyed and the information I have, word-of-mouth, mostly second generation and, though scant, could perhaps be added to at a later date. The years of import appear to be the 1940's to the late 1950's. There seem to be three major collections all from the UK with odd bulbs from the USA and Australia. Strangely, there appears to be none from South Africa.

Mr. H. Chittick imported a collection from the firm of Barr and Sons, UK. He grew them for cut flowers growing them outside in rows. A number of these clones still exist plus some seedlings. They have wiry stems, mostly rose, magenta, red and pink flowers. I have one called 'Chittick Blue' which flowered with mauve blooms in 1990. These plants appear to be fairly hardy. Many were lost after Mr Chittick died. He also bred or selected a form of *N. bowdenii* called 'Bowden Frills' which is in circulation — to add to confusion it's also called 'Bowden Giant', of which there are others!

¹Originally presented at the 1989 International Symposium on Bulbous & Cormous Plants in Irvine, California.

A Mr. McDonald imported some named varieties from Col. Clarke, Borden Hill, UK. These were grown for cut flowers along with *N. flexuosa* var. *alba*. He wrote a paper on these but I have been unable to locate it.

What could be said to be the greatest step forward was the importation of a collection from Rothchilds, UK by R.E. Harrison. These bulbs arrived during 1954-55, they were given to someone, involving 600 bulbs for growing on. Incredibly, they were lost through neglect but not before Mr. Wally Hart had saved a hundred seeds or so.

These precious few were sown in boxes and grown on under an apple tree, fifty of the resulting bulbs were selected and from these the "Harrison nerines" evolved with further selection as the year went by. Mr. Hart said recently that he had never used *N. bowdenii* in any of his crosses. He stated that he was working for hardiness, colour, and suitability for garden culture.

It would seem then that all the Harrison hybrids have the Rothchilds background, but the parentage appears not to have been recorded. I have correspondence from R.E. Harrison stating that he had destroyed all his records and letters in 1980. He said that he had done a lot of research into the origin of *Nerine* hybrids. He was very keen for further work to be carried out on them and when I purchased my collection from him in the late 1970's, he gave me every encouragement to continue the breeding. He also said he could not supply the demand for overseas orders.

Within a short time I had a number of seedlings to look after. The seed ripens quickly; I sow it on the surface of a bark-pumice mix in pots and place it in a heated frame, say 20°C, until the plants are growing strongly. In the beginning I had no formed ideas on what I required as a goal to head for. I concentrated on building up stock. By the time the first seedlings started to flower I had learned how the bulbs behaved and much about their needs as to water, fertilizer, type of soil etc.

At this point mention must be made of early and continuing disasters. I had just planted out my entire stock in a newly built fibreglass house. They looked a work of art — all neatly in their beds. The day following completion there was a torrential storm and in the resulting flood 90% of the bulbs were washed down the hill. Many hundreds of seedlings and named varieties in one glorious mud bath. Needless to say, it took days of toil to replant them again and they have never been sorted out since.

Further trouble was just on the horizon: a plague of vine weevils, *Otiorhynchus sulcatus*, arrived from a neighbouring vineyard. By the time I noticed the damage to the foliage they were well established; the grubs completely destroyed the root system and adults were finishing off the foliage and buds. These insects are extremely difficult to control, small numbers can be hand picked at night or will hide under wood placed between rows and collected at leisure. I now leave the odd "dock weed" as they enjoy these and collect about the base during the daytime. With the early hoards I fumigated with methyl bromide before planting time. The newer pyrethroids now give protection with just two sprays per season for fresh arrivals. Is it possible these

insects spread virus?

The other source of trouble is *Fusarium sacchari*. Once again, this is virtually impossible to stamp out; various fungicides have been used with limited success — Octave and Difolitan 80 at 10g per 10 litres. I also use Scumisclax 25 for foliar fungi.

I now grow the bulbs in formed beds with a 7-10cm layer of pea grit and plant by just pushing them into the first few centimeters. Prior to watering I use a 15 - 9 - 5 - 2 (N-P-K-trace elements) dressing of slow release fertilizer 25g/square meter. They are watered once a week from mid-March to August, then only three times more September to October, and dried off November to March. When the foliage is dry, about mid-January, I set fire to them. This is quite spectacular. The flames race through the house really tidying up all and sundry at speed. It possibly promotes extra flowers but its main use is as a time-saver — 20 - 30 minutes against one month's hot work on knees. A running hose is needed!

Set-backs aside, I have continued to experiment, breed and grow even better *Nerine*. One of the main things has been the power of numbers: when a large quantity of seedlings is grown all sorts of results can be expected. It was clear that a good "blue" would be desirable, also an improvement in the number of stems per bulb. Flowers with blue tones or some purple shading were crossed onto the best whites, the resulting seedlings having lavender overlay on all shades of pink to red; other crosses using 'Unique' have yielded interesting colours in what I call Victorian velvets, rusty browns, muted purples, some quite strange variants also with colour zones not stripes.

In growing a quantity of anything by seed, variants are bound to occur. Early on I found a flower with extra petals, crossing it with one that had odd bits of petal instead of stamens. This produced a few double progeny, unfortunately the double factor isn't over-stable, though I'm sure it can be improved upon. With all these *Nerine sarniensis*-type hybrids there had been very little re-use of species, so I resolved to try to see what results would arise. Using *N. filifolia* as a seed parent I have found that the flowers have all been a rose colour with amounts of violet or purple shading. They have not been very much larger... could this be where the blue factor lies?

In using *Nerine undulata*, a group of dainty pale pink flowering forms resulted. With more work these could become a useful subject for pots or rock gardens. I feel that the cut flower side of things will be with crosses from taller forms of *N. bowdenii* and the best clones of the newer *N. sarniensis* hybrids. Other useful traits such as *Fusarium* resistance could be induced by using species that grow in wet areas.

With all these and many other projects, the future looks exciting, if, perhaps, a little crowded by the year 2001.



BULBINELLA

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The comparatively small genus *Bulbinella* Kunth, of family Asphodelaceae, is remarkable for its disjunct distribution, occurring only in New Zealand and South Africa. In South Africa it is confined to the winter rainfall area of the western and southern Cape and in New Zealand it occurs in the more southerly parts of North Island and in South and Stewart Islands as well as Auckland and Campbell Islands.

The most recent taxonomic revisions from the two centres of distribution indicate that in New Zealand there are six species, one with two varieties (Moore, 1964), whereas in South Africa there are sixteen species of which two species have two varieties (Perry, 1987). In New Zealand more detailed field and laboratory work is being carried out by Lesley Milicich at Wellington University (pers. comm.). Research is also continuing on the South African species.

Differences between the species in the two centres of distribution are comparatively slight. In both countries plants may be found forming large stands of many hundreds of plants in wet seepage areas; they also occur scattered in smaller numbers in drier areas, especially in South Africa. In all species the inflorescence is a many-flowered raceme and the flowers have a simple, regular-shaped structure in which the only clear difference may be in the colour of the tepals. All New Zealand species have yellow flower parts whereas South African species show more variation — in addition to various shades of yellow, one taxon has striking orange-red flowers and several have white, or off-white tepals with either a tinge of pink or yellow to orange in the buds. There are some differences in the capsule shape between species in the two centres, but the capsule always contains three or six seeds, depending on whether all six ovules have been fertilized or only half of them. The black seeds are angled on the inside and curved on the outside. Those of New Zealand species such as *B. hookeri* and South African species such as *B. latifolia* show more similarity than *B. latifolia* compared to another South African species, *B. divaginata*. A general difference between the species in the two centres of distribution is in the characteristic, tough, fibrous, basal sheaths found in South African species and which are barely formed in New Zealand species. The sheath has possibly developed as a protection of the delicate growing region against chewing by animals.

Although *Bulbinella* is classed as a petaloid monocotyledon and loosely referred to as a "bulbous plant", it does not have the solid storage and perennating organ of a bulb, corm or tuber, but survives the adverse season with food stored in numerous slightly fleshy, swollen roots. For this reason,

in cultivation it should be treated more as an herbaceous perennial than a bulb. Plants should not be allowed to dry out by leaving them out of the ground for any length of time. New Zealand species have their growing and flowering season in the summer months, flowering mainly from December to February in the southern hemisphere. The South African species are winter growers and require a summer dormant period. However, inflorescences are produced at different stages of growth and may appear in autumn (April in the southern hemisphere), mid-winter or early to late spring.

In spite of the striking appearance of the inflorescence of many of the species, the genus appears not to be well known in cultivation. New Zealand members of the genus require a comparatively cold climate, and one species, *B. hookeri* is known by the author to be in cultivation in several gardens in Scotland. A smaller and apparently more floriferous species, *B. modesta* deserves more attention. Although some South African species may survive a light frost, on the whole they require a warmer climate. Apart from the yellow forms of *B. nutans* and *B. latifolia*, little is known of the performance of other species outside South Africa. In fact few of the other species have been in cultivation in South Africa until recent years.

Although several of the South African species grow in the more arid parts of the country, they do require good supplies of water in the growing season to produce good flowers, especially if grown on lighter soils. In habitat the plants found in large stands in seasonally wet areas produce larger and more floriferous plants than those scattered over drier areas. In seasons where rainfall is exceptionally low large numbers may fail to flower.

Propagation by seed is probably the best way to start a planting of any *Bulbinella* species. For South African species seed should be sown in autumn in a temperature of 10-20°C, in a container deep enough to allow for the development of a good root system, or in the open ground. In good growing conditions flowering sized plants will be produced in two or three years. Seed of New Zealand species could probably be treated in a similar manner but require a lower temperature, possibly below 5°C, for germination.

The two best known South African *Bulbinellas* are the yellow forms of the early spring flowering *B. latifolia* and *B. nutans*. These are two of the largest species, growing to a height of 0.5-1m, with inflorescences containing a few hundred flowers. They are very similar, but *B. latifolia* has broader more spreading leaves and a comparatively longer and narrower inflorescence than *B. nutans* which has narrower, erect leaves. Both species have a form with a different flower colour which is equally striking and worthy of cultivation. In the case of *B. nutans* it is a creamy-white flower with yellow to orange buds and in *B. latifolia* the flower is a deep reddish-orange. Because this orange form is restricted to a small area where it occurs only on red, doleritic, heavy clay soils it has been given the variety name *doleritica*. For a similar reason populations of *B. nutans* found growing only in peaty seepage areas mainly at high altitudes in the mountainous areas of the south western Cape have been given the varietal name *turfosicola*. This variety has not yet succeeded well in cultivation. A third similar species, *B. elata* has an even broader leaf and longer

and narrower inflorescence than *B. latifolia* and creamy-white flowers. It flowers about a month earlier in mid-winter.

Another species that could be used as a cut flower as well as making a good show in the garden is *Bulbinella cauda-felis*. This has a long, narrow inflorescence of pure white flowers tinged with pink in the bud stage. It is quite widespread in nature occurring in a variety of soils and having different flowering times in different localities from early spring to early summer. It should, therefore, be possible to extend the flowering season over several months. Also forming medium sized plants are *B. eburniflora* with good sized inflorescences of ivory white flowers, *B. elegans* which has a lemon yellow form and a white form and *B. graminifolia* which has similar flowers to *B. cauda-felis* but with a more compact inflorescence and fruiting head and smaller seeds. *B. punctulata* occurs in sandy soils among rocks mainly in the Cedarberg range of mountains. It has long spikes of yellow flowers.

For smaller gardens, rockeries, or even pot culture, there are some smaller species. *B. divaginata* produces 40-80mm long inflorescences of yellow flowers in autumn, growing to a height of 250-400mm, followed by long, narrow, dark green leaves. *B. trinerveis* has similar sized inflorescences with white flowers produced in late winter to early autumn. *B. triquetra* is also similar in size, but has bright yellow flowers in spring. *B. gracilis* comes from more arid areas and has succulent terete leaves. It produces its dainty heads of yellow flowers in mid-winter. The smallest species, *B. nana*, grows to a height of 10-15mm and also has yellow flowers.

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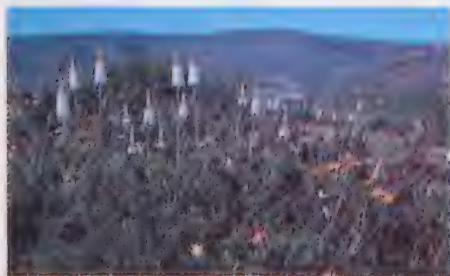
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↑ *Bulbinella nutans* var. *nutans* near Nieuwoudtville, South Africa. Photo by Colin Paterson-Jones.



↑ *Bulbinella nutans* var. *turfosicola*, Table Mountain, Cape Town. Photo by Colin Paterson-Jones.



↑ *Bulbinella cauda-felis*, Bidouw Valley, 1983. PLP 3020. Photo by Pauline Perry.



↑ *Bulbinella latifolia* var. *doleritica* at Nieuwoudtville. Photo by Colin Paterson-Jones.



← *Bulbinella eburniflora* with blue scarab beetles at Farm Biekos, Nieuwoudtville. Photo by Pauline Perry.



SOME PROBLEMS REGARDING THE *IN SITU* CONSERVATION OF BULBOUS PLANTS IN THE TRANSVAAL, SOUTH AFRICA

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Occupying a total area of 262,449 square kilometres, the Transvaal is the most northerly province of the Republic of South Africa. Rains fall during the summer months, September to March, precipitation varying from 380mm in the west and extreme north to 1500 mm in the eastern mountain ranges. A total of 13 nature reserves have been established in order to protect both fauna and flora while private individuals such as farmers have proclaimed many more. Attractive species such as *Gloriosa superba* are listed as protected while rare species such as *Clivia caulescens* are treated likewise. Unauthorised collecting or picking is forbidden. Although habitat destruction and afforestation with exotic species are the worst threats to the continued survival of many species, utilisation by herbalists has become a very real modern-day threat.

As more people vacate traditional homelands seeking employment in towns and cities and as inflation forces up the cost of conventional western medicines, more and more Africans are turning to the traditional medicines favoured by their ancestors.

Species such as *Bowiea volubilis* are used in the treatment of bladder and kidney ailments, while the familiar *Boöphane disticha* is not only used as medicine, but is regarded by some Africans as a medium in communication with the spirits of their dead ancestors.

From whence does the herbalist or *Sangoma* obtain most of his remedies? Unfortunately, to date most of the material is field collected and once common species such as *Scilla natalensis* are becoming increasingly rare. *Eucomis autumnalis*, sometimes referred to as the "pineapple flower", is one of the most popular species in the trade, and the bulbs are used both green and after drying.

Many remedies consist of mixtures which may contain bark, roots or bulbs as well as herbs. Some material has no medicinal properties, but only magical effects as far as the user is concerned. In some parts of South Africa a few enterprising conservationists have come up with the idea of growing medicinal plants and supplying the herbalist, thus taking pressures off natural populations.



SWAP COLUMN

Exchanging plants and seeds is one of the most satisfying of all the benefits which come to gardeners. Many friendships have blossomed along with the plants and seeds exchanged. To promote such plant and seed exchanges, a page in each future edition of HERBERTIA will be devoted to a swap column. Subscribers are first referred to the International Bulb Society Seed Exchange, which has many exciting species and hybrids. A complete list is available upon request. Please include a self-addressed, stamped envelope when requesting a list of available seeds. (Subscribers outside the USA may include a check for \$1.00 [USA] to cover international airmail postage.) The Seed Exchange address is listed on the "addresses" page.

However, if, after checking the IBS seed exchange list, you are still unable to locate certain bulbs or plants, send in your request addressed to:

Swap Column, Editor, International Bulb Society
PO Box 4928, Culver City CA 90230-4928
United States of America.

This issue's plant swap requests are as follows:

Dorothy P. Slechta, 537 Linnell St, Coos Bay OR 97420-4385, United States of America; wishes to locate sources of hybrid *Watsonia* corms. Many of her established plants were killed in winter 1990/1991, but she may be able to swap unusual *Watsonia* varieties for one with orange flowers and cobalt blue pistils.

Atsushi Kashimoto, 3425-1, Nihongi, Hakusan, Mie, 515-26 Japan; wishes to locate tubers or seeds of *Tapeinochilos ananassae* and *Nicolaia elatior*, as well as taxonomic information on *Costaceae* and the genus *Curcuma* (Zingiberaceae).

Josephine deN. Henry, Henry Foundation for Botanical Research, PO Box 7, Gladwyne PA 19035-0007, United States of America; is trying to find a plant of *Agapanthus africanus* var. *henryae*. This variety was raised by Mary G. Henry and named by Hamilton P. Traub for her. Both Dr. Traub & Ira Nelson grew these plants prior to 1965 and may have distributed offsets. Please contact Ms. Henry if you have plants or further information on this cultivar.

James W. Waddick, 3233 McGee, Kansas City MO 64111, United States of America; is interested in exchanging seed or dormant rhizomes of species and variegated cultivars of *Canna*.

Sheila Carron, Lot 1 Bailup Road, Wooroloo, Western Australia 6558, Australia; would like to exchange her seeds of *Nerine*, *Clivia*, *Cyrtanthus*, and similar plants for your seeds of *Leucocoryne* species.



REVIEW OF THE SYSTEMATICS OF THE STRUMARIINAE (AMARYLLIDACEAE)

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INTRODUCTION

Confined to the south west of Africa is a generic complex in the Amaryllidaceae whose species are remarkably reduced in size. This complex constitutes the subtribe Strumariinae of the Amaryllideae. Genera originally placed in the Strumariinae *sensu* Traub (1957) were *Carpolyza* Salisb., *Hessea* Herb. and *Strumaria* Jacq. With the addition of the newly described *Bokkeveldia* D. & U. M-D., the monotypic genera *Namaquanula* D. & U. M-D. and *Tedingea* D. & U. M-D., and the resurrection of *Gemmaria* Salisb., seven genera are now circumscribed within the subtribe (Müller-Doblies 1985).

The primary characters which define the Strumariinae Traub ex D. & U. M-D. are two foliage leaves, an amplexicaul cataphyll, regular flowers, a more or less obsolete perigone tube, and an anther connective which forms a sheath around the filament tip (Müller-Doblies 1985). These character states are, however, not common to all genera, and the only shared characters are flower form and the arbitrarily defined state of small-sized plants. On this basis the monophyly may be regarded as doubtful.

Within the Strumariinae the relationships between the genera have also been much confused, as is reflected in the instability of previous classifications (Herbert 1837, Kunth 1850, Salisbury 1866, Baker 1888, 1896). Confusion about the delimitation of the genera was particularly evident in the period after 1923 when many new species of *Hessea* and *Strumaria* were described (Dinter 1923; Bolus 1923, 1930; Barker 1931, 1935, 1943, 1944; Obermeyer 1981). The only character used during this period to distinguish the genera was flower form. Species with stellate flowers were placed in *Hessea* and those with funnel-shaped flowers in *Strumaria*.

Goldblatt (1976) ultimately brought into question the distinction between *Hessea* and *Strumaria* with the publication of the cytology of the genera. The cytological evidence supported stylar characteristics and the presence of a perigone tube, rather than floral form, as important generic characters. He concluded that a re-evaluation of the generic relationships of the Strumariinae was necessary.

In the most recent contribution to the classification of the subtribe, the Müller-Doblies (1985) incorporated new data from bulb and anther morphology and re-established the importance of stylar characters. However, floral form remained heavily weighted. The significance of the Müller-Doblies' classification is that much of the confusion between *Hessea* and *Strumaria* was overcome, but it was based on limited material and no phylogenetic scheme was

presented. Furthermore, several new but as yet unpublished species have since been discovered, and these do not uphold the current classification.

The need to investigate the purported integrity of the Strumariinae as well as the relationships between the genera in the subtribe, and thereby establish taxonomic stability, is one aspect of the phylogenetic study on this southern African group, which is currently nearing completion.

THE STRUMARIINAE

The preliminary results of the cladistic analyses of all genera in the Amaryllideae suggest that the present circumscription of the subtribe Strumariinae may not be justified. The group forms only a weakly corroborated clade defined by the homoplasious character state of actinomorphic flowers. The analyses also support the close relationship of the group with *Nerine* Herb. and *Brunsvigia* Heist. All species of *Hessea*, with the exception of the rare *H. spiralis* Baker, form a clade united by the unique character state of centrifixed anthers. Furthermore, the genus resolves as a sister group to *Namaquanula*. The remaining genera *Strumaria*, *Bokkeveldia*, *Gemmaria* and *Tedingea* also resolve in a single clade with *Carpolyza* as the sister taxon. Although several ways of reclassifying the resultant subclades are possible, the strength of the novel synapomorphy, a swollen or winged style, in *Strumaria*, *Bokkeveldia*, *Gemmaria* and *Tedingea*, suggests that these taxa should be relegated to subgeneric or lower rank and that *Strumaria* should be amplified to encompass a greater diversity of vegetative and floral forms. Thus the genera which appear to be justifiably upheld are *Namaquanula*, *Hessea*, *Carpolyza* and *Strumaria*.

HESSEA AND NAMAQUANULA

Hessea is a genus of nine species. With the exception of *H. spiralis*, which shows a closer relationship with *Strumaria*, all the species share the apomorphy of centrifixed anthers. Species have a reduced number of leaves (2), and small, stellate, pink or rarely white flowers borne on long pedicels in hemispherical "umbels" (Figures 1-3). The filaments are fused into a tube of variable length, which acts as a nectar well.

As presently circumscribed *Namaquanula* is monotypic, although it shows a close relationship to the sister species *Gemmaria pulcherrima* D. & U. M-D. and *G. mathewsii* (W.F. Barker) D. & U. M-D. It has several autapomorphies, namely cartilaginous and brittle bulb tunics, absence of a non-sheathing prophyll and cataphyll, and sticky leaves and scape. The flowers most closely resemble those of *Hessea* but they retain the plesiomorphies, a perigone tube and dorsifixed anthers. *Namaquanula bruce-bayeri* D. & U. M-D. is adapted to extreme xeric conditions on alluvial plains flanking the Orange River in southern Namibia and the Richtersveld in the Cape Province.

STRUMARIA AND CARPOLYZA

Cladistic analyses support the sister group relationship between *Strumaria* and *Carpolyza*. Shared derived character states are the fusion of the filaments to the style and the karyotype of $x=10$. A karyotype of $x=11$ is considered basic

in the tribe (Goldblatt 1976), as well as the family (Inariyama 1937, Satô 1938, Wilsenach 1965, Meerow 1984). *Strumaria sensu lato* is polymorphic with respect to leaf number, leaf arrangement and floral form. Leaves range from six to two and are either spreading or appressed to the ground. Flowers are white to pink, erect or pendulous and range from funnel-shaped to stellate (Figures 4-5). As a result of floral specialization nectar collects in three discrete droplets or wells between the inner filaments and the style.

The relationship between *Carpolyza* and *Strumaria* parallels that between *Namaquanula* and *Hessea*. The only derived character state in *Carpolyza spiralis* (L' Hérít.) Salisb. is the fusion of the inner filaments to the style. As in *Namaquanula*, the flowers of *C. spiralis* have a distinct perigone tube.

BIOGEOGRAPHY AND ECOLOGY

Genera of the Strumariinae are distributed in south western Africa, a region which extends from southern Namibia through the western Cape Province and into the Karoo, in the east of the Cape Province. Only *Strumaria* extends eastwards beyond the Cape Province into the Orange Free State and Lesotho. This entire region of southern Africa is semi-arid, with a median annual rainfall of less than 500mm, and covers summer, autumn and winter rainfall zones from the east to the west (Zucchini and Adamson 1984). Most species show high fidelity to open, seasonally moist sites. Such habitats are rock ledges, depressions, rock aprons, scree and seepage zones (Figures 6 - 7). The associated vegetation is low, succulent or small-leaved xerophytic shrubland. The only other genus of Amaryllidaceae with a similar distribution is *Gethyllis* L.

Edaphic conditions appear to limit species distribution since species are confined to either heavy, loamy soils or the nutrient-poor soils of the Cape Fold Mountains. Most species fall within the Karoo-Namib Region (Werger 1978), whereas the only species which grow in association with the fynbos of the Cape Floristic Region (Goldblatt 1978) are those which occupy the Cape Fold Mountains (*S. salteri* W. F. Barker, *S. watermeyeri* L. Bolus, *H. pusilla* Snijman, *H. undosa* Snijman, *H. monticola* Snijman and *H. cinnamomea* (L'Hérít.) Dur. & Schinz). Within the Cape fynbos shrublands, *Strumaria* is restricted to the dry north western extension of the Cape Fold Mountains. In contrast, *Hessea* penetrates further south along this mountain belt to the Cape Peninsula. Here more mesic conditions prevail and open sites are only periodically available through the effects of wild fires. Thus, in *H. monticola* and *H. cinnamomea*, flowering is restricted to the first and second seasons following a fire.

Paleoclimatic conditions, which have been inferred from several kinds of paleontological data, indicate that the upwelling of the cold Benguela current led to aridification of the west from the early Miocene. It appears that a pronounced east-west climatic gradient had been established across southern Africa by the Pliocene (Coetzee 1978; Coetzee and Rogers 1982, Scholtz 1985, Maud 1986, Siesser and Miles 1979.) The biogeographic pattern, as well as the xeromorphic nature of the character states derived in the Strumariinae, suggests that speciation can be interpreted largely in terms of the climatic patterns which

have prevailed since the Miocene.

PHENOLOGY

Species of *Namaquanula*, *Hessea* and *Strumaria* are mostly autumn-flowering (March-May), a response following shortly after the first rains of the season. A few species do, however, flower on either side of this period. All species are deciduous and, with few exceptions, are leafless at the onset of flowering. Vegetative growth commences during or shortly after flowering. A rapid growth phase follows, but this is depressed during winter. Annual flowering has been confirmed in all species but inflorescences commonly abort following unfavorable conditions.

In general, each inflorescence is short-lived, a horticulturally disadvantageous factor. A distinct temporal sequence of floral maturation is evident in species of *Strumaria*, which are longer flowering than species of *Hessea*, in which a more synchronous pattern is evident. Flowering in a single inflorescence may last at most three weeks or as little as ten days.

In *Carpolyza* and some species of *Strumaria* the plesiomorphic state of dispersal obtains, in which seeds are released as individual units from the capsule, whereafter the infructescence collapses. The derived condition prevails in *Namaquanula*, *Hessea*, and to some extent in *Strumaria*. In this strategy the entire infructescence dries out rapidly, breaks away at ground level, and is released as a single unit. Abscission of the scape occurs one to three weeks after the last flower closes. This ephemeral quality is a remarkable feature of the group and may account for the recurrent discovery of new species in these genera.

CONCLUSION

The results of the preliminary cladistic analyses on the Strumariinae, in which additional data from several new species have been included, suggest that *Namaquanula*, *Hessea* and *Carpolyza* should be upheld. However, the cladistic pattern is at variance with the present delimitation of *Strumaria*, *Bokkeveldia*, *Gemmaria* and *Tedingea*. The analyses are yet to be published, as is the formal revision of these genera.

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Figure 1. *Hessea cinnamomea* (L'Hérit.) Dur. & Schinz

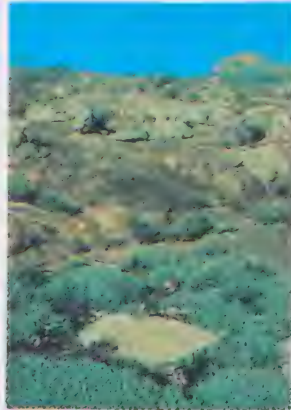


Figure 7. Habitat of *Strumaria salteri* W.F. Barker in loamy rock pockets at the interface of dry mountain fynbos and low, succulent shrublands.



Figure 3. *Hessea undosa* Snijman



Figure 4. *Strumaria truncata* Jacq.

Photographs by Colin Paterson-Jones.



Figure 5. *Strumaria salteri* W.F. Barker



Figure 6. Habitat of *Hessea undosa* Snijman along seasonal washes in mountain fynbos.



Figure 2. *Hessea monticola* Snijman



SALTER'S REVISION OF SOUTH AFRICAN *Oxalis* (OXALIDACEAE) AND SOME NEW COMBINATIONS

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ABSTRACT

The genus *Oxalis*, as it occurs in South Africa, is discussed generally in relation to the revision by T.M. Salter (1944). A brief account is given of Salter's collecting activities, the distribution and variability of the species, and the problems of classification. Some new combinations are made. Particular attention is paid to the section *Pardales* Salter, and all the 11 species recognised by Salter (many described by him) are combined in one species, namely *Oxalis pardalis* Jacq. Two species, *Oxalis dentata* Jacq. and *Oxalis lateriflora* Jacq., are reduced under *O. livida* Jacq. Similarly *Oxalis urbaniana* Schltr. and *Oxalis callimarginata* Weintr. are reduced under *Oxalis goniorrhiza* Eckl. & Zey.

Keywords: *Oxalis*, taxonomy, speciation.

Oxalis is particularly well represented in South America, and the species are also a very prominent component of the flora of the Mediterranean region of South Africa. This region extends from Luderitz in Namibia, southeastwards to near East London on the southeast coast (Bayer, 1974). Annual precipitation over this area varies enormously from as little as 100 to over 1400mm/annum. The area is divided by Rutherford and Westfall (1986) into four distinct biomes on the basis of summer aridity, seasonal distribution of rainfall and on plant growth forms. Both geology and topography vary enormously so that landscape heterogeneity and soil forms provide great habitat contrasts over short distances. These factors, together with historical events, probably account for the richness of the Cape flora. Despite the potential and realised weediness (for example: *O. pes-caprae* L. and *O. caprina* L.), many species are spectacularly colourful in autumn and winter and are useful and interesting as horticultural subjects. T.M. Salter (1944) revised the genus on the basis of his own intensive collecting. His interest in fact started in 1931, and, although he collected until 1957, serious attention to *Oxalis* continued only until 1942.

Salter's collecting activity is summarised in his four accession books where 1,740 specimens are listed. A weakness in this collecting is in the geographical coverage. He collected principally on the Cape Peninsula: the route to Caledon via Sir Lowry's Pass and back via Franschoek, the route to Springbok in the north, and the areas from Mamre to Piketberg and Porterville. One trip was made to the area between Caledon and George, another to west of Garies and two trips eastwards between Garies and Khamieskroon via Leliefontein.

Virtually no collecting was done in southern Bushmanland, in the Tanqua/Doornriver Karoo, the Little Karoo, the southern Great Karoo or even in the Worcester/Robertson Karoo. The areas north and west of Steinkopf and east and west of Springbok were not sites of collection. He finally recognised 208 species, stated that he was under no illusions about the completeness of his work, and admitted to the difficulties he experienced in deciding on what taxa to recognise. The revision is unquestionably the product of the most painstaking and meticulous labour. In using his revision to identify more than 1000 collections of my own, it became evident that Salter was remarkably successful in sorting out at least the material at his disposal. Nevertheless, the revision is a curious paradox of grossly variable "group-species" with many apparently rare and localised elements. This may, in fact, be the position in the field, but the inordinate difficulty I experienced in trying to identify the 13 species that occur in the small area of the Karoo Botanic Garden at Worcester led me to attempt a wider evaluation of Salter's revision.

Herbarium representation of the species may in some measure reflect the knowledge of the genus. Sixteen (16) of the described species are known only from the types. Salter, himself, described 13 species which remained known to him only from the type collections, and another 21 species are represented by only two collections. 20 species are represented by three cited herbarium specimens, while several species are represented by more specimens but all from the same locality. Altogether 29 specimens were known from only one gathering, while 70 species were represented by three specimens or less. By contrast 45 species were known from 20 specimens or more, and these include very variable "group-species" such as *Oxalis flava* L., *O. purpurea* L. and *O. obtusa* Jacq. The majority of the species, including six Namibian elements, occur in the winter rainfall region mentioned earlier. 12 species occur in the Eastern/Western Cape, while 16 species have a wider South African distribution.

Salter provides three identification keys in his revision. The keys are based on the number of leaves per petiole, the articulation of the peduncle, leaf-shape, corolla shape, and a variety of similar morphological characters. Salter stressed the value of bulb characters, but made very little use of this structure in circumscribing his species. The annual replacement of the bulb and the characteristic sequence of outer protective and inner nutritive scales was wholly ignored. Another character possibly useful as the basis for a sub-generic break, is that of the carpels being either fused or free.

Ornduff (1973) has made the only recent contribution to the taxonomy of the genus. He made use of a wide range of morphological characters, as well as of fertility and chromosome number in describing one species (*Oxalis dines*) which Salter had dismissed as a variety of *O. disticha* Jacq. Ornduff suggested (private communication, 1974) that Salter may have recognised too few species. However, my own experience with *Oxalis* suggests the converse, and also that the status of *O. dines* is not in the least convincing. Ornduff did not examine overall variability of *O. disticha* or pollen fertility within his concepts of either this species or his new *O. dines*. He suggested that sexual reproduction in *Oxalis* is a rare event. This may be true for some species, but my experience is

that many species produce abundant seed, and seedlings are common. Furthermore, there are many species which patently do not have the capacity to spread or even proliferate vegetatively. Vegetative reproduction is undoubtedly responsible for weediness of those *Oxalis* species such as *O. pes-caprae*, but this is not even necessarily a species character. In *O. pardalis* Sond. vegetative propagation results in the formation of a compound cluster of bulbs, but not in the physical relocation of plants. In *O. zeyheri* Sond. there are populations in which the individuals barely reproduce vegetatively while in others the plants are highly stoloniferous. Salter (1944) reports this in both *O. flava* L. and *O. glabra* Thunb., and this is also the case in *O. livida* Jacq.

The object of this paper is to present some conclusions drawn from a study of about 1000 specimens additional to Salter's work. In most cases living plants were brought into cultivation from where detailed notes and herbarium specimens were prepared. The proportion of confident identifications based on Salter's revision was a little above 60%. My experience with the identification keys was most frustrating, and positive identifications were frequently made only after painful comparison with the complete description and reference to the locality. Early in the work several new elements were identified outside of Salter's collecting areas, and descriptions of these were even prepared for publication. However, as I became more familiar with Salter's species, so did it also become increasingly evident that such an approach would produce an irrational proliferation of names and total confusion in the genus. The problem at this stage is not one of there being too few or too many species, but the wholly inadequate knowledge we have of their distribution and variability.

The following re-description and synonymy of three species is presented as an indication of the real state of affairs in the genus and as an indication of further problems which will be encountered in *Oxalis*.

RESULTS

- Oxalis pardalis* Sond. In *Flora Capensis* 1:345 (1860); Salter. In *J.S.Afr.Bot. Supp.* 1:234 (1944). Type: Sandy places at Hex River, Burke et Zey. 253 (holotype, S; isotypes, BOL, SAM).
- O. capillacea* E.Mey. ex Sond. In *Fl. Cap.* 1:435 (1860); Salter. L.c.:222 (1944). Type: Hex River, Burke et Zey. 251 (holotype, S).
- O. confertifolia* (O. Kunze) R. Knuth. In *Eng. Bot. Jahrb.* 41:27 (1937); Salter. L.c.:231 (1944). Type: *sine loc.* Drege 7426 (holotype, S).
- O. robinsonii* Salter & Exell. In *J. Bot.* 48:146 (1930); Salter. L.c.:236 (1944). Type: Reutersbosch, Salter 376/57 (holotype, BM).
- O. lineolata* Salter. In *J. S. Afr. Bot.* 2:1 (1936), l.c.:226 (1944). Type: near Doornbosch in dry shale flats, Salter 5382 (holotype, BOL).

- O. massoniana* Salter. L.c. 2:3 (1936), et :227 (1944). Type: in damp, muddy, shallow soil overlying flat rock at summit of Vanrhyns Pass, Salter 705 (holotype, BOL).
- O. melanograptia* Salter. L.c. 2:5 (1936), et :229 (1944). Type: in shale on low koppie 18 miles north-east of Vanrhynsdorp, Salter 714 (holotype, BOL).
- O. heidelbergensis* Salter. L.c. 2:5 (1936), et :232 (1944). Type: 3 miles west of Heidelberg, Salter 2385 (holotype, BOL).
- O. grammophylla* Salter. L.c. 2:8 (1936), et :234 (1944). Type: Karamoe, Salter 4469 (holotype, BOL).
- O. leptogramma* Salter. L.c. 2:147 (1936), et :224 (1944). Type: Worcester Division, near Orchard Siding, Salter 2178 (holotype, BOL).
- O. camelopardalis* Salter. L.c. 3:102 (1937), et :230 (1944). Type: Worcester, Rooihoogte Pass, Salter 2308 (holotype, BOL).

Plants: rarely acaulescent, 50-300mm high. **Bulbs:** to 200mm deep in soil, compound, old tunics loosely adhering, new bulb comprising 5-20 linear acuminate, scaly protective scales up to 60mm long and 5mm wide, with 2-4 harder, acute, undulate, coriaceous tunics enclosing 4-6 elongate, acute, fleshy, nutritive scales. Protective scales are clothed with retrorse brown hairs. **Rhizome and stem:** 50-150mm long, glabrous, glandular or pubescent. **Leaves:** epetiolate and cauline, to petiolate and terminally congested; leaflets glabrous, glandular, pubescent or ciliate, linear, linear-acute, obtriangular or elliptic, always with short, translucent, longitudinal idioblasts which turn black on drying. **Peduncles:** 1-flowered, with alternate or sub-opposite, linear, idioblastic-striate bracts above middle or near calyx. **Sepals:** 3-6mm long, ovate-obtuse, ovate-acuminate or lanceolate, idioblastic-striate. **Corolla:** white, pink, apricot, red-purple, lilac or yellow; petals 13-22mm long, 6-13mm wide, lamina ovate or elliptic. **Filaments:** the longer unequal, 5-5.7mm long, toothed or gibbous, glandular, anthers horizontal. **Ovary:** carpels fused, 2-7 loculed, uniseriate, lateral shiny idioblastic pustules; style pubescent below, with glandular or simple hairs above. **Seeds:** arillate, without endosperm.

Salter recognised 11 species which he grouped together in his section *Pardales*. Five of these species were based effectively on a single collection or population. Where specimen numbers increased, Salter recognised varieties and forms based primarily on flower colour and character of the petioles. The principal characters used by Salter in his identification key for the section were leaflet number, leaves sessile or petiolate, petal width, sepal length, plication of bulb tunics, proportion of lamina to tube length, indumentum, size, exertion of filaments, number of ovules and flower colour. My first experience with *Oxalis* was the collection of material from new localities, and even localities

visited and collected from by Salter, which invalidated his keys. Initially it was felt that some of these new finds were so strikingly different that they could be described as new. However, as my collection grew, so did the realisation that a more liberal attitude to the species was necessary.

The individual plant in this species comprises a deep-seated, compound bulb, each bulblet producing a single stem. Individual stems may reach as long as 300mm, although in rare cases the plants may even be stemless. The nature of the indumentum is surprisingly variable. The rhizome may be either glabrous, incipiently glandular, glandular or glandular/pubescent. The stem is similarly variable and may, in addition, be ciliate. The leaves are also glabrous, pubescent or ciliate. Occasionally there is a degree of viscosity, particularly of the stems. This indumentum of rhizome, stem and leaf is not correlated and different combinations are observed in different populations.

Bulb structure was observed to be the most consistent element in that the new bulb is subtended by many sharply pointed and loosely adhering outer scales, hardening progressively to the last few scales which enclose the softer, white, fleshy, nutritive scales. The outer tunics are always clothed with retrorse, brown hairs, although in one collection (Bayer 2301) these hairs appeared to be absent. *Oxalis massoniana* was characterised by transversely plicate protective scales, but this element is simply an unusual ecotype growing on the Nieuwoudtville escarpment in shallow sand overlying deeper stone. Thus, in this case the bulbs are affected by soil depth. There was never any indication of vegetative propagation by stolons as occurs in other species. Secondary bulbs arise in the axils of the scales on the rhizome above the primary, basal bulb-producing axil. Contractile roots appeared in many collections, apparently as a function of planting depth, and may be a factor assisting re-establishment after predation in the wild. Propagation and re-location is by sexual propagation from an exendospermous seed.

Salter described the stem in *O. confertifolia* as woody. There is no anatomical explanation for this and it may simply be the result of increased lignification to support a longer stem with more leaf mass. Stem length is related to leaf distribution and to available light, and I could find no evidence to suggest that there were any notable discontinuity between populations with respect to stem character.

Salter distinguished *O. capillacea* on the basis of the plants having 3-9 leaflets per petiole, and with leaves terminally congested and petiolate. Several populations were recorded with 5, 6 or 7 leaflets per petiole and also in which the leaves were either sessile or petiolate. Sessile leaves are, however, always cauline (along the length of the stem) as opposed to terminal. All gradations were found between populations with wholly sessile and those with wholly terminal, petiolate leaves, and at one locality west of Swellendam (Bayer 1300) both these types of plants were observed at the one site. Three new collections from the Ceres Karoo included one in which the plants had terminal leaves with broad elliptic or obovate leaflets, and in one of these the plants were acaulescent. In Bayer 1300, the leaves were partly cauline and had seven

leaflets each. In Bayer 1285, such leaves were all cauline. The linear to linear-cuneate leaf shape was fairly consistent for all populations, except those of the western Ceres Karoo.

Floral characters were all extremely variable, although consistent within populations. Many different colours were recorded also with great consistency within populations despite all style lengths (suggesting sexual propagation?). Flower size was variable between populations: from 22mm in the smallest to 100mm long in the longest. Petal width also varied from 4-14mm wide, without any apparent correlation between the two variables. The long filaments were invariably toothed, occasionally only gibbose, unequal and glandular, while the anthers on both long and short filaments were horizontally orientated. The carpels are fused and the ovule numbers varied from 2-7. Density of the idioblastic vesicles on the carpels was variable and occasionally inconspicuous.

The overall distribution of the species in question extends from at least Oudtshoorn and Klein Brak near Mossel Bay, throughout the south-western Cape, as far south and west as Bredasdorp and Infanta. Elements are found in the western Cape from Hercules Pillar (a favourite stopping point of Salter's who, however, did not find this species there) to Gouda, Piketberg and Porterville. Only three collections have been made in the Little Karoo: one from the Burger Pass west of Montagu, another from southeast of Touws River, and a third from Dysselsdorp near Oudtshoorn. A single bulbless specimen collected by R.D.A. Bayliss from near Joubertina is possibly this species. The species is common in the southern Tanqua/Doornriver (Ceres) Karoo and also in the southern Koue Bokkeveld. There appears to be a gap in the distribution of the species from here to the Botterkloof and Nieuwoudtville areas where it is again common and variable. Salter described four forms of his *Oxalis grammophylla* from this area, as well as *O. melanograptia* from the eastern Knersvlakte and *O. massoniana* from the edge of the Nieuwoudtville escarpment.

Salter's species, as well as many of the variants mentioned here, indicate the number of elements which could perhaps satisfy some requirement of discontinuous variability from the main body of the species. *O. confertifolia*, a large, red-purple flowered element from around Swellendam and Heidelberg, could particularly be regarded as discrete. At Mardouw, west of Swellendam, this sessile-leaved, trifoliate element grows immediately adjacent to a yellow, terminally-leaved, seven-foliate element. This yellow form is found from Mardouw southwards and westwards to McGregor, and it breeds true from seed after hand-pollination. However, around Mardouw there are populations with lilac, white, or salmon-pink coloured flowers, and in which the leaves are partly sessile and partly terminal. These could be interpreted to be of hybrid origin and suggest that two distinct species are involved. A similar situation arises at De Doorns where *O. pardalis* as a yellow, sessilifoliate form grows a short way away from a coppery-pink terminal-leaved form. Again at Rooihoogte Pass and Moddergat (near Villiersdorp), there is *Oxalis camelopardalis* as a glabrous, red-purple, sessilifoliate form, within kilometres of

a series of populations of a ciliate, lilac-coloured, partly sessile and partly terminal-leaved form. At Karooport (Ceres) there is a trifoliolate, terminal-leaved form near to a five-foliolate form.

It should be clear from the above that there is great difficulty in arriving at a taxonomic rationale which adequately expresses the situation. A derived philosophy of a species comprising a series of interbreeding or potentially interbreeding individuals which are continuously variable in space and time can only be fitted if all the necessary information is available. Obviously, a broad field study cannot accurately analyse or assess the many technical and genetic aspects of breeding or the detailed statistics of morphological variability. Even if it could, there would still be imponderables such as the Ceres Karoo forms, which, in addition to some morphological criteria, are also uniquely night-flowering. In fact a manuscript name was coined on the basis of their remarkable carnation-like scent. But fragrance has since been observed in many other species as well. The night-flowering character implies that this element has its own pollination syndrome and the capacity to eventually pursue a discrete species path. Present recognition would simply beg the question of what the situation is regarding its morphological and geographic complements. It certainly indicates the scale at which collecting needs to be done to sample adequately.

The conclusion reached here is that the most practical solution is to regard *Oxalis pardalis* also as a "group-species", recognisable immediately by a characteristic and unique bulb. The blackening idioblasts on the leaflets, sepals and on the ovaries are confirmatory. *O. purpurea*, in which the leaves and flowers are in fact very different but which also has similar idioblasts, the hairs on the outer bulb-tunics are vertically orientated. A further close relation between these species is most strongly nullified by the fact that in *O. purpurea* the carpels are free and the ovules many and biseriolate.

The extrapolation of the above treatment of *Oxalis pardalis* on the basis of Vavilov's principle of homologous variation (Davis and Heywood, 1967) may have severe implications for other taxa in the genus. However, Salter has already prepared the way for such a liberal species concept by his acceptance of "group-species", and the above comments indicate that many more of his species would fall into the same category were they better known.

Additional material examined (deposited at NBC):

3119 (Loeriesfontein): 32km north of Nieuwoudtville (-AB), Bayer 2756; north of Nieuwoudtville (-AC), Bayer 2752; west of Grasberg (-AC), Bayer 1880; 10km north-east of Grasberg (-AC), Bayer 1875; east of Nieuwoudtville (-AD), Bayer 2551; Oorlogskloof (-AD), Bayer 2747; Doornbosch (-CC), Bayer 1902; 6km north of Doornbosch (-CC), Bayer 1899; north of Doornbosch (-CC), Perry 707.

3219 (Wuppertal): Tertia (-BC), Bayer 3536; north of Gydo (-CC), Bayer 2199, 2200; Skitterykloof (-CC), Bayer 2522; north-east of Karooport (-DD), Bayer 644.

3318 (Cape Town): Hercules Pillar (-DD), Bayer 2855.

3319 (Worcester): east of Saron (-AA), Bayer 2853; Gydo (-AC), Bayer 1909; Theronsberg Pass (-AD), Bayer 1732; south-east of De Doorns (-BC), Bayer 880; Smalblaarrivier (-BD), Bayer 626; Worcester (-CB), Bayer 729; Fonteintjiesberg (-BC), Bayer 1277; Chavonnes (-CB), Perry 207; Penderris (-CB), Bayer 1795, 1798; west of Meulplaas (-CD), Bayer 1789; Hammanshof (-CD), Bayer 1790; Moordkuil (-CD), Forrester 50; Buitenstekloof (-DB), Bayer 1321; Roodekleigat (-DC), Bayer 1778; Elandsberg (-DD), Bayer 1291; Vrolikheid (-DD), Bayer 1285; Klaasvoogds (-DD), Bayer 1259.

3320 (Montagu): Harry Hill Road (-CC), Bayer 1300; 27km west of Swellendam (-CC), Bayer 1819; 2km north of Drew (-CC), Bayer 1821; 1km north of Drew (-CC), Bayer 1820; 3km north of Drew (-CC), Bayer 1715; east of Ashton (-CC), Bayer 1719; west of Mardouw (-CC), Bayer 1716; 4km east of Ashton (-CC), Bayer 1725; 8km east of Ashton (-CC), Bayer 1714; Mardouw (-CC), Bayer 1727; 13km north of Mardouw (-CC), Bayer 1717; 15km west of Mardouw (-CC), Bayer 1718.

3322 (Oudtshoorn): Dysselsdorp (-CB), Bayer 5772.

3419 (Caledon): 25km east of Caledon (-BA), Bayer 1810; 15km east of Caledon (-BA), Bayer 1808; 36km east of Caledon (-BA), Bayer 1809; north of Krige (-BA), Bayer 1805; Olifantsdoornpoort (-BB), Bayer 1292; Skietpad (-DB), Bayer 2247; Mierkraal (-DB), Bayer 2270.

3420 (Bredasdorp): Napky (-AB), Bayer 1814; Rooivlei (-AC), Bayer 2254; Kathoek (-AD), Bayer 2553; 10km west of Heidelberg (-BB), Bayer 1738; 14km west of Heidelberg (-BB), Bayer 1734.

3421 (Riversdale): 10km east of Heidelberg (-AA), Bayer 1741; Draaihoek (-BA), Bayer 2320; Cooper Siding (-BB), Bayer 1745.

3422 (Mossel Bay): 20km north-east of Mossel Bay (-AA), Bayer 1748; Klein Brak (-AA), Bayer 2301.

Oxalis livida Jacq. *Oxal. Monogr.* :39 t.8 (1794); Salter. In *J. S. Afr. Bot.* 6:11 (1940), et :84 (1944). Type: Iconotype *ut nominatus*, *Oxal. Monogr.*:38 t.8 (1794).

Oxalis dentata Jacq. *Oxal. Monogr.* :39 t.7 (1794); Salter. L.c. :83 (1944). Type: Iconotype *ut nominatus*, *Oxal. Monogr.*:39 t.8 (1794).

Oxalis lateriflora Jacq. *Hort. Schoenbr.* 2:41 t.204 (1797); Salter. L.c.:84 (1944). Type: Iconotype *ut nominatus* *Hort. Schoenbr.* 2:41 t.204 (1797).

Oxalis phellandroides E. Mey. ex Meisn. In *Hook. London Journ. Bot.* 2:54 (1843). Type: Postelyenberg, Drege (?).

Plants are shortly caulescent, often branched, usually sparsely glandular, 150-300mm high. **Bulb**: ovoid, shortly pointed, up to 30mm diam., new bulb comprising 8-11 outer, dark-brown, protective scales; scales to 10mm wide with 5-8 raised ribs, expanded above into membraneous wings with fringed margins, 7-8 nutritive scales of pale, creamy-white with some hairs at tips, arranged in 2-3 parastichies. **Rhizome**: 20-50mm diam., glabrous, with or without lateral stolons. **Stem**: up to 7mm diam., 10-150mm long, occasionally branched, smooth or sparsely glandular. **Leaves**: few to 20, usually glabrous, terminal or

occasionally cauline, petioles up to 60mm long, sparsely glandular; leaflets three, shortly petiolulate, occasionally with hairs on petiolules and on midrib, obtriangular, usually deeply bilobed and livid below, often with glandular and simple hairs admixed below, non-callused. **Peduncles:** 2-3, usually cauline and preceding leaves, 50-150mm long, glandular; lanceolate, callused bracts at upper articulation; pedicels 20-40mm long, glandular. **Sepals:** ovate-acuminate, with apical orange calluses, glandular and with adpressed short white hairs, often purple margined. **Corolla:** pale lilac to purple, petals 12-20mm long, glandular, funnel-shaped greenish tube; petals cuneate, obliquely sub-truncate, often with purple margin below. **Filaments:** the longer is sub-equal, toothed, sparsely glandular; anthers abaxially sub-vertical. **Ovary:** carpels adnate and with suture to base, 1-2 loculed, sparsely glandular or with setose hairs above. **Style:** setose below, glandular above or smooth. **Capsule:** not exerted. **Seeds:** endospermous.

The species in the section *Cernuae* Knuth are characterised by an umbellate, many-flowered inflorescence. Salter recognised 23 species in 5 sub-sections. Of these, five are Namibian, six are broadly South African, and the rest occur in the winter rainfall region. I have experienced difficulty in identifying the rather limited number of collections in this section, and much more collecting, particularly in northern Namaqualand, will be needed to resolve problems here. The section *Lividae* Salter, clearly comprises only one species. Salter distinguishes his three component species only on the behavioral characteristics of the bulbs. In *Oxalis livida* the contractile root was said to operate vertically, in *O. dentata* horizontally, whereas in *O. lateriflora* there was said to be no contractile root and only lateral runners. In my series of collections, there appeared to be only one species in which any such distinctions were obscure. In some collections the bulbs in one clone were oriented either vertically or horizontally under the influence of contractile roots, while some bulbs were without such roots. As mentioned before, the formation of a contractile root is often the response of the bulb to shallow placement in the soil. Any other differences which could be inferred from the respective descriptions, such as the depth of the division of the bilobed leaflets, or on colour, are supercilious when viewed against the variation within Salter's own "group-species". Salter could have merged these three species merely for consistency. My experience with other species, as noted in the introduction, is that vegetative behaviour is variable within, and barely a basis for recognition of, species.

Thus, *Oxalis livida* is a species characterised by its bulb with up to 11 outer, protective scales which are ribbed below and which broaden above into expanded, membraneous wings with fringed margins; and 8-9 nutritive scales arranged spirally in the parastichies 2 and 3. The bulb is not "beaked". The plants are usually clothed with glandular, or both glandular and simple hairs, and flowering usually occurs before vegetative growth. The fleshiness of the leaves and purplish coloration of the short thick stems may also be distinctive.

There is a close resemblance vegetatively to *O. bifida* Thunb. but this latter species has an usually branching stem and an one-flowered peduncle.

Additional material examined (deposited at NBG):

3318 (Cape Town): Tygerberg (-DC), Bayer 2731.

3319 (Worcester): west of Tulbagh (-AC), Bayer 4277; Montpelier (-AC), Bayer 3461; Boontjieskraal (-AC), Bayer 2728; Sandberg Hills (-BC), Bayer 836; Fonteintjiesberg (-CB), Bayer 1285b; Moddergat (-CD), Bayer 1252.

3420 (Bredasdorp): Stormsvlei (-AA), Fascio 15.

Oxalis goniorrhiza Eckl. & Zey. *Enum.* 1:89 n.699 (1836); Salter. In *J. S. Afr. Bot. Supp.* 1:276 (1944). Type: Stellenbosch in Zwartland, Eckl. and Zey. 699 (holotype?).

O. semiglauca Eckl. & Zey. *Enum.* 1:? (1836).

O. semiglauca (Eckl. & Zey.) Sond. In *Fl. Cap.* 1:319 (1860) (holotype?).

O. urbaniana Schltr. *Eng. Bot. Jahrb.* 27:157 (1900); Salter. *Ut supra* :255 (1944). Type: Saron, Schlechter 7859 (holotype, B).

O. callimarginata Weintr. *Journ. Bot.* 44:209 (1931); Salter. *L.c.* :256 (1944). Type: Saron, Leopoldt in BOL 18619 (holotype, BOL).

Plants caulescent, up to 200mm high, occasionally branched, glabrous to sparsely pubescent, or with glandular and simple hairs admixed. **Bulb** clustering, ovoid, up to 15mm long and 8mm diam., new bulb comprising sub-entire, membranous, outer tunic; cochlear, 3-5 ribbed, hard, protective scale enclosing a second scale also with a raised mid-rib, occasionally a third more membranous unribbed protective scale, two sub-equal, white, nutritive scales, all with sharp apical points. **Rhizome**: 20-30mm long, occasionally with stolons. **Stem**: up to 150mm long, glabrous to sparsely pubescent, occasionally also glandular, sometimes branching, with several epetiolate or sub-petiolate cauline leaves. **Leaves**: lower leaves cauline, terminal leaves shortly petiolate, petioles 5-15mm long; leaflets three, linear-cuneate, conduplicate, incised at apex, 5-8mm long, 2-3mm wide, glabrous to sparsely pubescent below with simple or admixed hairs, usually callused with apical and sub-marginal calluses. **Peduncle**: one-flowered, axillary, glabrous or sparsely pubescent with two alternate, lanceolate, callused or inconspicuously callused bracts near calyx. **Sepals**: lanceolate, acute, purple margined, usually callused, rarely glabrous. **Corolla**: 15-20mm long, glabrous, funnel-shaped, yellow tube; petals obovate, obliquely sub-truncate, white, pale pink or lilac. **Filaments**: the long unequal, toothed, sparsely glandular, anthers horizontal; the shorter with anthers sub-horizontal. **Ovary**: carpels fused, 3-5 locules, uniseriate, glandular and ciliate above. **Style**: ciliate below, glandular above. **Seed**: arillate, without endosperm.

The three elements as recognised by Salter were accommodated in three different sub-sections of the section *Angustatae*. *Oxalis urbaniana* and *callimarginata* were placed in the sub-section *Sessilifoliatae* despite hav-

relatively petiolate leaves, and *O. goniorrhiza* in the sub-section Lineares despite a comparatively leafy stem. Comparison of *O. goniorrhiza* with *O. recticaulis* Sond., which was also placed by Salter in the sub-section Sessilifoliaetae, highlights this anomaly because *O. recticaulis* has no more a leafy stem than does *O. goniorrhiza*. In fact in one specimen of the latter cited by Salter, the leaves are entirely terminal. This kind of anomaly indicates just how difficult it is to use the revision for identifications. Variation in *O. pardalis* already indicates that petiolate versus non-petiolate, or sessile-cauline versus petiolate-terminal leaves, may be encountered within the same species, and this also occurs in *O. goniorrhiza*.

Oxalis urbaniana and *O. callimarginata* were both collected at Saron. The latter was regarded as a stouter species with more distinct bulb ridging, distinctly callused leaflets, shorter petal claws and shorter teeth on the filaments. My own collections from there do not support two such closely related species and differ in detail from both of Salter's circumscriptions.

Oxalis goniorrhiza is, therefore, regarded as a species characterised by a bulb with 4-6 acutely angled, vertical ridges, contained in a sub-entire membraneous outer tunic. It occurs in damp, marshy situations and is usually white-flowered. It is not yet certain if characters other than the bulb can be used to easily separate this species from *O. multicaulis* Eckl. & Zey. and *O. recticaulis*, which are very similar, if also in fact distinct from another. The synonymy of the elements merged here and in the preceding two species, emphasises a weakness trenchant in at least the history of South African systematic botany. This is the general failure to first determine what a species is, and then to develop a species concept which can properly accommodate the variability in and of the local flora.

Additional material examined (deposited at NBG):

3318 (Cape Town): Hercules Pillar (-DD), Bayer 2887.

3319 (Worcester): north of Saron (-AA), Bayer 2848; Kluitjieskraal (-AC), Bayer 1349; Wollesley (-AC). Bayer 2902; Romans River (-AC), Bayer 2903; Darling Bridge (-CA), Bayer 2904; Worcester (-CB), Bayer 2907; Brandwacht (-CB), Bayer 689; east of DuToits Kloof (-CB), Bayer 871; north-west of Worcester (-CB), Bayer 843; Rooihogte (-CD), Bayer 678; Brandvlei (-CD), Bayer 860; Kwaggaskloof (-CD), Bayer 2887.

SUMMARY:

Oxalis pardalis Sond.

- (= *O. camelopardalis* Salter).
- (= *O. capillacea* E.Mey. ex Sond.).
- (= *O. confertifolia* (O. Kunze) R. Knuth).
- (= *O. grammophylla* Salter).
- (= *O. heidelbergensis* Salter).
- (= *O. leptogramma* Salter).
- (= *O. lineolata* Salter).
- (= *O. massoniana* Salter).
- (= *O. melanograptia* Salter).
- (= *O. robinsonii* Salter & Exell).

Oxalis livida Jacq.

- (= *O. dentata* Jacq.).
- (= *O. lateriflora* Jacq.).
- (= *O. phellandroides* E. Mey. ex Meisn.).

Oxalis goniorrhiza Eckl. & Zey.

- (= *O. semiglauca* Eckl. & Zey.).
- (= *O. urbaniana* Schltr.).
- (= *O. callimarginata* Weintr.).

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CRINUM HILDEBRANDTII VATKE

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When Vatke described *Crinum hildebrandtii* in 1875, he cited a bulb cultivated in Berlin which Hildebrandt had collected in the mountains of Anjouan Island (formerly known as Johanna Island) in the Comoros Islands. Three years later Kirk gathered a second bulb in the Comoros Islands which Baker subsequently described and illustrated in *Botanical Magazine*. Thereafter this species seemingly was lost to cultivation, although several pressed specimens were forwarded to Kew from Madagascar late in the nineteenth century. *Crinum hildebrandtii* resurfaced in *Flore de Madagascar* in 1950 but only as an unsubstantiated commentary.

A South African horticulturist sent me a bulb of an unknown *Crinum* species from the Comoros Islands in 1989 (van Zyl 31235, PRE); the bulb originated from the volcanic slopes of Mount Karatala on Grand Comore Island. The transplanted bulb grew quickly in the moist climate of Southeast Texas and bloomed in 1990 (illustration on page 85). This bulb correlated exactly with Vatke's description of *C. hildebrandtii*; it also matched with Baker's illustrated account and with pressed specimens at Kew.

DESCRIPTION

Crinum hildebrandtii Vatke. (subgenus *Stenaster*).

Bulb ovoid columnar, white, 60*mm in diameter by 100*mm long, with basal offsets, continuous with a stout cylindrical leaf column extending 100-160mm above the ground. Leaves 10-22, suberect, slightly arching and forming a rosette, green, 520-740mm long by 65-80mm broad, lorate with midrib, firm textured, narrowed and thickened near the leaf column; leaf tips bluntly acute; margins bearing sparse, minute teeth. Scape compressed, rust red, 270-410mm long. Spathe valves to 175mm long by 40mm broad. Bracts prominent, 100-150mm long. Umbel 4-17 flowered; flowers subsessile, scented. Buds inclining prior to becoming erect at anthesis. Spathe valves, pedicels, ovaries and tepal tubes rust red, fading with age and changing to green. Pedicels 3-15mm long. Ovaries 15mm long by 7mm in diameter. Tepal tubes 160-190mm long. Segments spreading, linear, white, sometimes with a pink keel, 86-95mm long by 8-10mm wide, unequal; apiculates small. Filaments spreading, white becoming dark red distally, 59-65mm long. Anthers versatile, black, 25mm long at anthesis; pollen amber yellow. Style red becoming dark red distally, 75-100mm long; stigma trilobed. Fruits oblong, nodular, with >80% of the tepal tube persisting as an apical projection. Seeds irregular, usually large and solitary, to 35mm in diameter. [Note: Baker categorizes C .

hildebrandtii in the subgenus *Platyaster*. However, the length:width ratio of the segments exceeds 8.5:1, well beyond the 6:1 limit for a classification of lanceolate. The segments are linear, which places *C. hildebrandtii* in the subgenus *Stenaster*.]

DISCUSSION

Perrier briefly commented upon *C. hildebrandtii* in his monograph on the Malagasy *Crinum*. Perrier thought that Vatke's description could not be accurately distinguished from *C. firmifolium* Baker. Therefore he equated the two species and postulated that the Malagasy undoubtedly carried *Crinum* to the neighboring islands in the past, including the Comoros Islands.

Perrier's decision to make *C. firmifolium* Baker conspecific with *C. hildebrandtii* seemed dubious, since he did not examine any specimens of the latter. However, this classification conformed to Perrier's scheme in which he relegated various *Crinum* from the *Platyaster* and *Stenaster* subgenera to varieties of *C. firmifolium* Baker emend. Perrier. Three varieties of *C. firmifolium* existed according to Perrier: var. *hygrophilum*, var. *xerophilum*, and var. *geophilum*. Even Perrier admitted that his varieties of *C. firmifolium* exhibited considerable divergence in plant morphology and habitat.

What was Perrier's justification for consolidating multiple species under *C. firmifolium*? He felt the subject plants were closely related to *C. asiaticum* L. In fact, he hypothesized that all of his *C. firmifolium* varieties evolved from *C. asiaticum* after the latter was introduced into Madagascar; over a period of time, local ecologic factors induced the transformations into the three varieties.

Perrier demonstrated an undue bias toward herbarium specimens in his analysis. He discounted the importance of habitat, bulb shape, leaf morphology, and plant structure; he neglected the singular features of living plants. Furthermore, his classification scheme conflicted with prevailing concepts of *Crinum* speciation. For example, *C. firmifolium* Baker emend. Perrier var. *hygrophilum* was actually *C. asiaticum*; Perrier described the bulb as an elongated column growing "above the ground" which produced long leaves with an overall plant stature reaching 2m. No one else ever proposed uniting *C. asiaticum* into a single species along with other *Crinum* that possessed swollen underground bulbs, such as *C. firmifolium* Baker and *C. hildebrandtii*. Verdoorn criticized Perrier for including *C. asiaticum* as a variety of *C. firmifolium*. Moreover, Perrier's scheme was illegitimate because the earliest date of publication should have established name priority; Perrier should have classified the plants as varieties of *C. asiaticum*. [Note: *Crinum asiaticum* is characterized by an unusual bulb, consisting only of a basal plate and stump growing at or above the ground level and upon which rests a cylindrical leaf column. *Crinum hildebrandtii* has a bulb resembling a giant leek, whereas the bulb of *Crinum firmifolium* Baker is ovoid with a tapering neck. The bulb shapes of these three Malagasy species are quite diverse.]

Perrier was not familiar with all the known Malagasy species, and this deficiency caused him to misinterpret plants. For example, he classified *C. voryonii* Jumelle under his desert variety, *Crinum firmifolium* Baker emend.

Perrier var. *xerophilum*. Jumelle's treatise included a large revealing photograph of his plant in flower, showing its arching and deeply channeled leaves that were quite unlike any other Malagasy species; it was especially unlike the desert species which had flaccid ciliated leaves that sprawled on the ground. Actually, *C. voryonii* was a synonym for *Crinum mauritianum* Loddige, a bog or swamp plant. Perrier omitted another reported Malagasy species, *C. braunii* Harms, although it, too, was a synonym for *C. mauritianum*. [Notes: 1) Harms remarked on the similarity between his plant and *Crinum mauritianum*, but when he published his account, no known living plants or pressed specimens of *C. mauritianum* were available for comparison. 2) The illustration of *Crinum firmifolium* in *Flowering Plants of Africa* t.1874 is erroneous; the Malagasy plant depicted is *C. mauritianum*.]

Perrier overlooked evidence available to him concerning the morphology and the distribution of *Crinum hildebrandtii*. He never made reference to Baker's description and illustration. Perrier examined specimens at Kew including *C. firmifolium* Baker (Baron 1638, K, holo. !), *Crinum ligulatum* Baker (Baron 1982, K, holo. !), and *Crinum modestum* Baker (Baron 48 and 4223, K, holo. !), and he even left a determinative slip on another specimen of *C. ligulatum* (Baron 4389, K !). Yet why did he not examine or acknowledge the three specimens identified as *C. hildebrandtii* Vatke in the same Madagascar folder (Baron 6465, Baron 5728, H. Smith s.n., K !)? [Note: The latter specimens were collected and identified between 1887 and 1893, a time frame when memories of Kirk's cultivated specimen at Kew were still fresh. Smith sketched his plant in the field, and his drawing resembled Baker's illustration.]

Regarding Perrier's revision of the Malagasy *Crinum*, I conclude: 1) His conception of *C. firmifolium* is illegitimate, inaccurate, and inconsistent with prevailing *Crinum* nomenclature; and 2) His comments about *C. hildebrandtii* should be disregarded because he never examined a specimen of this species.

Perrier's assumption that natives carried bulbs between Madagascar and the neighboring islands is probably correct, because bulbous plants have held a prominent position in herbal folk medicine. Botanical explorers and merchants also transported bulbs between the islands. Baker showed the effects of the latter practice in his review of the detailed botanical records from Mauritius and the Seychelles, where he estimated that by 1877 almost 20 percent of the flora on these islands was alien. Although *Crinum hildebrandtii* was discovered in the Comoros Islands, the collections by Baron and Smith from diverse localities on Madagascar within 20 years of Hildebrandt's finding implied that the species was ubiquitous to the region, whatever its mode of spread might have been.

Is *Crinum hildebrandtii* a distinct species from *Crinum firmifolium* Baker? The answer is "yes!" I have not observed *C. firmifolium* in bloom, but in addition to the previously discussed variance in bulb shape, the two species also differ in plant structure and leaf morphology. *Crinum hildebrandtii* fashions a leaf column that maintains its shorter, firmer-textured, slightly arching leaves well off the ground; its leaves are arranged in a slowly rotating rosette which

resembles a spiral staircase near the leaf column. In contrast, the longer leaves of *C. firmifolium* are not as sturdy, and mature leaves are reflexed near the mid section while old leaves sprawl on the ground. *Crinum firmifolium* does not produce a leaf column; its leaves arise randomly from the neck in corn-stalk fashion. Comparing individual leaves: the proximal segment of *C. hildebrandtii* is distinctly narrowed, the widest portion occurs beyond the mid point, and the distal leaf tapers to a blunt tip. The leaf of *C. firmifolium* is widest near insertion into the neck, whereupon it exhibits a gradual tapering to the distal tip. The pressed specimens at Kew reinforce these observations of individual leaves. The appearances of these two species are so dissimilar that differentiation on the basis of living plants is straight forward; separation via herbarium mounts is more subtle but easily accomplished when well preserved specimens are available.

[Illustration on page 85.]

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THE GENUS HOMERIA

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The genus *Homeria* is at the beginning of its introduction and culture in the gardens of Southern California. Introduced into Australia several years ago, the genus has become a serious weed, especially in over-grazed land. The worst offender, *Homeria pallida*, is extremely toxic and causes considerable livestock losses. Other toxic species include *H. miniata*, *H. ochroleuca*, *H. bulbifera* and *H. flaccida*. Because they are toxic, homerias are gopher and rabbit resistant, making them very durable in gardens with rodent problems. In fact, of all the bulbs I've tried to naturalize in my home garden, homerias are the only ones that survive year after year. *Homeria* make an excellent addition to the garden.

Homeria are Mediterranean climate (winter rainfall) corms that undergo a deciduous rest in the dry summer months. They make a wonderful addition to the bulb garden and are virtually care free. Care should be taken, however, should you have pets or children that graze your flower beds on occasion.

Perhaps the most floriferous and easiest species for the garden is *Homeria flaccida*. Occurring naturally in salmon pink or yellow, it is extremely showy when in bloom. Flower spikes reach 2 feet in height and are covered in large flowers about 1 inch across. Another showy species is *H. ochroleuca*, with large, cupped flowers on 2 foot stems somewhat resembling miniature tulips, hence the common name "Cape Tulip". As with most homerias, the color is variable, being either yellow or orange. Another attractive favorite is *H. elegans* with large yellow or orange flowers blotched with large spots of green or orange on the three petals, a fascinating coloration. The flower spikes are 12 inches tall.

All homerias are relatively easy to grow in cultivation. They are adaptable to most soil types, which explains their "weediness" in both their native South Africa and in other parts of the world with similar climate. Given a slight rest during their dormant period in summer, homerias require very little else. Some species such as *H. flaccida* can even tolerate some summer irrigation. Fertilizer requirements are low, as with other Mediterranean climate bulbs and corms, with a once a month low nitrogen feeding being more than sufficient.

Being poisonous if ingested they are also pest resistant from major predators such as rodents. Aphids and red spider mites are the only problems that seem to affect homerias, but not to the extent that they affect other crops.

Homerias produce an abundance of seed in the spring which should be sown in the fall months at the start of the rainy season. Four inch containers are best initially until the corms are large enough to plant out in the landscape. The corms also produce offsets and clump with age. These can be divided during the summer dormant months and replanted in the fall.



ADDITIONAL NOTES ON NAMIBIAN (SOUTH WEST AFRICAN) *CRINUM*

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After deciding on a third field trip to collect *Crinum* in Namibia, I contacted South African friends with whom I planned to visit briefly in the Johannesburg-Pretoria metroplex. I was surprised when I received a telecom from Frans van Zyl, a horticulturist employed at the Botanical Research Institute in Pretoria. He wished to accompany me on the upcoming field trip — a pleasant note! I would have a traveling companion well-versed in the native botany and fluent in Afrikaans.

We began our journey on January 24, 1989. A welcome sight greeted us when our plane approached the airport at Windhoek: the semidesert landscape was exceptionally green, and the reservoirs glistened from standing water. Our fears of a summer drought vanished as we set about our mission. Frans brought an arsenal of supplies. Instead of traveling as tourists we slept in bungalows at national parks and barbecued sausage and lamb chops over hot coals in open fireplaces. (The Afrikaans expression for the latter was "lekker braai" if the grilled meat were delicious.)

Our field trip consumed thirteen days. The first morning we investigated a colony of *Crinum lugardiae* which adorned a stream bank north of Windhoek. Perhaps 100 plants were blooming (Figure 1). Near the center of the colony was an unusual plant whose only scape was withered. Its leaves differed from the neighboring *C. lugardiae* by being wider and bearing cilia on the margins. We were curious so we dug up the mystery bulb and an adjacent *C. lugardiae* bulb. The unknown bulb was spherical with a cylindrical neck, whereas the bulb of *C. lugardiae* was ovoid with a tapering neck. Clearly the unknown bulb was not *C. lugardiae*, yet its leaves were inconsistent with other native species. A natural hybrid of *C. lugardiae* seemed the obvious explanation. I found a natural hybrid (*Crinum carolo-schmidtii* sensu Roessler x *Crinum macowanii*) in Namibia once before, so the hypothesis warranted consideration. Assuming it was a hybrid, the logical pollen candidate was *Crinum graminicola*, the only species with ciliated leaves populating the northern Windhoek district.

We then visited Farm Otjihavera south of Okahandja to collect bulbs of *C. graminicola*. Many plants manifested fruiting bodies. The pale-yellow fruits held 8-12 ovoid seeds measuring 15-30mm in diameter. Each seed was encased in a coarse, fibrous coat which underwent a series of color changes from pale green to light tan to a final brownish black at maturity. These seeds resembled the seeds of *Crinum foetidum* and *Crinum acaule*. An unpleasant odor accompanied seeds of *C. graminicola*. This odor was not as offensive as noted in *C.*

foetidum, but it was potent enough to make us store our seed bag in the trunk of the car.

As we turned westward, we entered a dry zone. We planned to collect near Karibib and then to continue into the Namib Desert, but it became apparent that the prevailing aridity would make this a fruitless endeavor. That evening we stayed at Tsoabis Leopard Park, a wildlife refuge situated amid rocky desert terrain; this locality averaged 139mm of annual rainfall. During the night a thunderstorm dropped 16mm of rain. The amount of rainfall seemed insignificant, yet it brought down the local river in flood. Nearby Karibib experienced a tremendous downpour, 48mm of rain. We made tentative plans to return to Karibib in 7 or 8 days, the anticipated prime time in which to collect bulbous plants in bloom following a substantial rainfall. We examined a group of *Crinum forbesii* (syn.: *C. delagoense* Verdoorn) in seed 9km south of Otjiwarongo. One plant bore a 31-flowered umbel. The jumbo red fruits contained variable numbers of smooth-surfaced, pale-green seeds, measuring 15-40mm in diameter. Verdoorn cited differences in pedicel length and both color and shape of the fruiting bodies as the distinguishing features between *C. forbesii* and *C. graminicola*. We decided that dissimilar seed morphology also warranted inclusion in this list (Figure 2).

Since this was Frans's first visit to Namibia, we spent one day sight-seeing in Etosha National Park, an enormous game reserve larger than the state of New Jersey. The focal point of the park was Etosha Pan, a huge salt water lake. Vast expanses of treeless "sweet veldt" surrounded the pan, and it was here that many wild herbivores eked out their existence in the delicate arid ecology. Indeed, we saw numerous wild beasts and birds. We sought out a botanist assigned to the Nature Conservation contingent. My notes referenced a collection site for *Crinum nerinoides* in the park, and we asked the botanist if he would take us to the location, since park rules forbade visitors from leaving their cars. He agreed. When we arrived at the site, he insisted that we walk behind him, as he was carrying a loaded pistol to protect us in case we happened upon one of the many lion prides that resided in the park. We collected a dwarf *Nerine*, but we never found *Crinum nerinoides*, and fortunately the lions did not find us.

Our mission to Farm Guntsas, where Dinter collected the holotype specimen of *C. carolo-schmidtii*, was ill-timed. The summer rains had commenced within the week. Although the owner escorted us to the only vlei on the premises and remembered seeing "water lilies" in the vlei the previous summer, the bulbs were apparently still dormant and hidden beneath the vlei bottom. However, the owner informed us that he had seen similar "water lilies" in vleis near Tsumkwe, a remote location about 250km to the east in Bushmanland. We immediately set off for Tsumkwe. The only road was unpaved. We traveled about 80km before we were forced to turn back; the road was in abominable condition and inundated from recent rains.

More rainy weather lay in store for us. A raging thunderstorm had virtually washed away Rundu, a small community overlooking the Okavango

River. Gaping ruts of over a meter "cut into" the dirt roads in the center of town. It was impossible to explore the local flood plain of the Okavango. The tarred highway ended 60km east of Rundu, where the road turned into mud. Then at 35km west of Mayara Clinic, we came across two shallow pans that harbored many small *Codonocrinum* in bloom. This species was identical to the one that I had encountered near Rundu on an earlier trip and which I had labelled *Crinum* species A. Geoff Nichols, a conservation officer employed by the city of Durban, informed me that he had found *C. baumii*, *C. rautanenianum*, and *C. crassicaule* sensu Verdoorn in the Mahango Game Reserve adjacent to Botswana. Moreover, he kindly provided me with a map. We planned to spend the night at Poppa Falls, just a few kilometers from the game reserve. As we approached Poppa Falls, we noted *C. rautanenianum* blooming along the flooded banks of the Okavango River. After we registered at the campground, we attempted to visit the Mahango Game Reserve, but a river of mud claimed the road.

We were determined to find the rare dwarf *Stenaster* species, *Crinum baumii*, so against better judgement, we embarked again in the morning for the Mahango Game Reserve. Rangers at the gate assured us that we would not travel far since our vehicle lacked four-wheel drive. We drew a map showing our intended route and asked the rangers to rescue us if we failed to return. Soon thereafter, we sighted a small pan about 100m from the road. *Crinum rautanenianum* was blooming in the pond, and we decided this was a promising spot. As we neared the pond, there it was: *C. baumii* in bloom! The flowers were so tiny that they were not visible from the road. Only a few plants were blooming (Figure 3), but the banks of the pond were carpeted with thousands from this species. I felt guilty walking about, because it was impossible to avoid trampling on them. Floral segments were white, but they turned deep pink as the flowers aged. Scapes were 39-42mm long, tepal tubes 90-120mm long, and segments 60-61mm long by 5mm wide. Each plant displayed 6-7 leaves measuring 160-175mm long by 3mm wide. Success! We felt that we had exhausted our luck, and we departed the reserve lest we fell prey to the mud monster.

Soldiers at Bagani Checkpoint were reluctant to authorize our entry into the Caprivi; they doubted we could reach the tarred highway at Kongola without a four-wheel-drive vehicle. We persisted and they let us pass. For 190km we navigated through muddy soup at speeds of 40-50km/hour; it was impossible to keep the car from sliding off the road if we drove faster. Fortunately traffic was scant and consisted mainly of occasional eighteen-wheel trucks. Whenever we encountered these trucks, we had to pull over and absorb a dousing of flying mud.

Once on the tarred highway, we resumed normal speed. Our minds were so preoccupied with the hectic driving that we failed to notice our entry into jungle territory. A wild elephant grazing next to the highway brought home the reality of the new environment. So did the sign posted at our lodge in Katima Mulilo: "Beware of crocodiles. Absolutely no swimming." The lodge overlooked the Zambesi River. After unloading our baggage, we hastened to

the western edge of town to observe *Crinum verdoorniae* (proposed name; syn.: *C. kirkii* Baker sensu Verdoorn). Many plants were blooming (Figure 4). One plant brandished flowers whose segments and styles were pure white. I could not resist adding this albino to our bulb cache.

The next day, Manie Grobler, conservation officer and specialist in aquatic research, escorted us into the bush. We rented a four-wheel-drive truck for the event. Although I was initially the driver, we soon reached a remote area in the flood plain of the Zambesi River where 2m tall wild grasses obscured the dirt trail we were following. Manie took the wheel, and as if by instinct, he safely guided the vehicle through about 10km of the grassy jungle. Several times we drove through sandy flats flooded with 400-500mm of water from recent rains. We occasionally observed *C. verdoorniae* in clearings; it always grew in sandy soil near the river.

Later we explored south of the Katima Mulilo-Ngoma road. It was easy to find the villages of Mpola on this occasion, since a crude sign had been erected to point out the trail leading from the main road. We observed numerous *C. crassicaule* sensu Verdoorn en route to the villages (Figure 5). All scapes were either in bud or in fruit. We examined one plant which had produced a 19-flowered umbel but only a single fruit. Unstimulated ovaries were green, whereas the ovoid fruit was shiny red. The fruit measured 35 x 22 x 22mm, bore an apical projection 160mm long, and sheltered numerous green pea-sized seeds.

We then entered a zone of mopamie veldt. In contrast to my previous visit, the shallow swamps were filled with water. *Crinum euchrophyllum* was abundant. The plants looked robust. Typical plants possessed 8-10 arching, channeled glaucous leaves with maximum length 1.0-1.1m and maximum width 38-43mm. After a brief search, we found a blooming plant; a 3-flowered umbel on a 420mm scape. Flowers had white segments, white filaments, black anthers, gray pollen, a style colored purple distally, and a lobed stigma.

Manie remarked that he had noticed a small *Codonocrinum* several times during routine sorties into the bush. After we departed mopamie veldt territory, we entered a dry sandy terrain that was flat and really had no distinctive features. Just imagine our excitement when we discovered the fourth *Crinum* species for the day. It was the semi-dwarf *Codonocrinum* that Manie had described (Figure 6). Its long, slender leaves closely resembled grass, and we would never have found the plants had not an occasional one been in bloom. We scoured the immediate area and were able to locate three small clusters of this species, which later proved to be a variety of *C. carolo-schmidtii* in cultivation. Two plants were in bud, and that night Manie and I returned with our cameras and flash attachments to photograph the fresh flowers (Figure 7). I was nervous about this adventure, as I had visions of meeting up with a giant black mamba or other poisonous snake. (A black mamba had killed three residents of Katima Mulilo near the hospital only a few months previously.) Manie was barefooted and not the least concerned!

It was time for us to begin the return trip to Windhoek. The car was

encased in mud when we slithered into Poppa Falls at the day's end. There would be no return engagement at Mahango Game Reserve as another 36mm of rain fell during the night. En route to Rundu we picked up an American hitchhiker who had traveled from Cape Town to Victoria Falls by train, squandered his money, and was now making his way back to Cape Town.

The last day arrived; our plane was scheduled to depart at dusk. *Crinum minimum* remained to be found. Our last opportunity lay at Karibib, a reported collection site for *C. minimum*. This place was also where Dinter collected *C. parvibulbosum*. (Several investigators equated these two species.) While keeping in mind the heavy rainfall of eight days past, I scanned the pasture land along the roadside. Frans was driving. We were 14km north of the Karibib Airport when I screamed: "Stop the car!" There was a solitary, dwarf striped Codonocrinum in bloom (Figure 8). Much to my surprise, it was not *C. minimum*. The plant bore two subterranean scapes with umbels containing 1-2 flowers. Floral segments were stiff and showed no evidence of wilting in the afternoon sun. Other features included: light-tan anthers, eleven arching channeled leaves measuring to 280mm long by 10mm wide, and small widely-spaced teeth on the leaf margins. This was *C. acaule*; I was familiar with it from prior excursions into Zululand and Tongaland. However, the flowers were smaller than their Natal counterparts and not as brightly pigmented. Between Karibib and Okahandja, we saw many *Crinum macowanii* blooming in roadside ditches. The rains surely continued after our earlier visit to this area because these plants bore the tallest, sturdiest scapes I had ever seen in *C. macowanii*. We could not resist stopping at Farm Otjihavera again to observe *C. graminicola*; many plants now were blooming. The Namibian *C. graminicola* emitted the most pleasant, perfume-like scent of any *Crinum* known to me.

Our return flight to Johannesburg was uneventful. I spent several days browsing in the herbarium and library at the Botanical Research Institute. The English tradition of "tea time" was practiced at the institute; it was an excellent opportunity to gather with colleagues and to discuss common interests.

DISCUSSION

The typification of *Crinum crassicaule* Baker was based upon an incomplete specimen. In October, 1861, Baines painted a flowering scape in Ngamiland, Botswana; the plant bloomed in the absence of leaves. Baines wrote in the corner of his painting that the umbel was "half faded," and that the flower petals were more recurved than shown in his sketch with the curved portion positioned above the tips of the stamens. Adjacent to his comments, he penciled a small trumpet-shaped flower. Moreover, Baines returned to the site three weeks later in November and painted a second plant. On this occasion, the painting clearly depicted a blooming Codonocrinum with light pink stripes on the segment keels, a short scape, and bluish-green leaves with truncated withered tips. He also pressed a budding scape nearing anthesis (Baines s.n., K, holo. !), and this specimen formed the basis for Baker's description; the specimen did not include leaves. Apparently Baker never examined Baines's second painting at Kew, because Baker classified the depauperate scape as

belonging to the subgenus *Platyaster*. (Baker also cited Baines's specimen as being collected in October instead of November, 1861.) Later Mrs. Lugard illustrated a *Codonocrinum* in Ngamiland which she identified as *C. crassicaule* (Lugard 45, K !), and her drawing correlated with Baines's second painting. Brown condensed Baines's and Lugard's findings into a detailed description which included ciliated leaf margins.

Brown's description of *Crinum crassicaule* Baker is indistinguishable from *C. foetidum* Verdoorn, while Baines's second painting and Lugard's illustration also portray *C. foetidum*. Furthermore, the habitats correlate: *C. foetidum* flourishes in Bushmanland and the Gobabis District of Namibia, areas lying on the fringe of the Kalahari Desert similar to Ngamiland. My conclusion is self evident: *C. crassicaule* Baker is conspecific with *C. foetidum* Verdoorn, and the latter must be relegated to synonymy by date of publication. *Crinum papillosum* Nordal is probably another synonym.

What is the correct identity for *C. crassicaule* Baker sensu Verdoorn? Since it belongs to the subgenus *Stenaster*, it clearly cannot be *C. crassicaule* Baker. The distribution of *C. crassicaule* Baker sensu Verdoorn includes the flood plains of the Okavango and upper Zambesi Rivers. Verdoorn and Nordal suggest that it may be *C. subcernuum* Baker which is reported from the lower Zambesi River. The type specimen of *C. subcernuum* (Kirk s.n., K, holo. !) and an earlier collected specimen (Kirk s.n., K !) with an accompanying sketch do not include leaves, but their umbel morphology agrees with *C. crassicaule* Baker sensu Verdoorn. The best clues lie in Kirk's sketch where he shows: 1) completely reflexed segments; and 2) a vertical drooping bud. These features are characteristic for *C. crassicaule* Baker sensu Verdoorn. A vertical drooping bud is a highly unusual phenomenon in the subgenus *Stenaster*; bud motion in this subgenus is normally confined to horizontal inclining. Therefore, the evidence suffices to make *C. crassicaule* Baker sensu Verdoorn a synonym for *C. subcernuum* Baker. [Note: *Crinum menyharthii* Baker (Menyharth 690, K, holo. !), also from the lower Zambesi River, appears to be the same plant as *C. subcernuum*, but *C. subcernuum* has name priority by date of publication.]

I examined a full-scale photocopy of the holotype specimen for *Crinum carolo-schmidtii* Dinter (Dinter 2307, B, holo., photo. !) while visiting the Botanical Research Institute. I compared this photocopy with: 1) Tolken's specimen from Farm Okatjikorie (Tolken 1300, PRE !) which Verdoorn used to illustrate and describe *C. carolo-schmidtii*, and which was synonymous with *C. occidentale* Dyer; and 2) a specimen submitted by Giess from Farm Wewelsburg (Giess 11223, PRE !). Plants collected at Farm Wewelsburg constituted the reference base for Roessler's description of *C. carolo-schmidtii*. This exercise reinforced my belief that both *C. carolo-schmidtii* sensu Verdoorn and *C. carolo-schmidtii* sensu Roessler were non Dinter. Verdoorn's plant was the Namibian variety of *C. lugardiae*, while the size of Roessler's *Crinum* from Farm Wewelsburg utterly dwarfed Dinter's specimen.

Dinter provided an unusually detailed description of *C. carolo-schmidtii*; I earlier discussed how the morphology and the dimensions correlated with *C.*

species *A* as did his statements on bud count. The photocopy of his mount added a perspective that I could not appreciate from his description. The mount revealed intact configurations of two plants with erect, channeled leaves. These silhouettes mimicked the appearance of *C. species A*. The verdict was sealed: *C. species A* was cospecific with *C. carolo-schmidtii* Dinter.

Crinum minimum Milne-Redhead (Milne-Redhead 2761, K, holo. !) is a small statured plant with linear glabrous leaves about 3mm wide. Botanists publishing monographs on Namibian *Crinum*, Solch, Roessler, and Verdoorn, list *C. minimum* as the indigenous dwarf Codonocrinum. These investigators who are relying completely upon herbarium specimens cite narrow leaves as a diagnostic parameter. However, slender leaves in a field-collected desert specimen could reflect stunting from insufficient moisture. The identification of a narrow-leaf specimen should be deferred pending cultivation of the bulb.

Wide-leaf specimens were discovered in Namibia which fell outside the taxonomic limits of *C. minimum*. For example, Maedler photographed and collected a dwarf Codonocrinum in the Namib Desert, and then Giess prepared a mounted specimen (Giess 10186, WIND !); the leaves measured 11mm in width and had teeth on their margins. Giess, who was Curator of the Namibian Herbarium for 40 years, identified the plant as *C. acaule*. However, Roessler could not conceive that *C. acaule* occurred outside of Zululand, so he emended the description of *C. minimum* to encompass Giess's specimen.

The plant which I have identified as *C. acaule* (Figure 8) is identical to the plant in Maedler's photographs. At least one other wide-leaf specimen resides in the Namibian Herbarium (Wiss 3244, WIND !) which qualifies for *C. acaule*. Moreover, *C. parvibulbosum* Dinter ex Overkott (Dinter 6793, M, holo.; K, iso. !) also represents this species and is declared a synonym. *Crinum acaule* is indigenous to Namibia, but is *C. minimum* a native plant?

Aridity stunting also must be considered in semidwarf Codonocrinum. I still find it difficult to believe that the small Codonocrinum prefaced by Manie Grobler in the Caprivi (Figure 7) transformed under cultivation into a variety of *C. carolo-schmidtii*; its long, slender, grass-like leaves (240 - 460mm long by 3 - 4mm wide) became wider, deeply channeled, erect to arching leaves in the moist climate of Southeast Texas. [Figure 7 shows a variety of *Crinum carolo-schmidtii* Dinter, depicting the unusually patent floral segments in this variety. Photo taken south of Katima Mulilo, Caprivi, Namibia, February 2, 1989.] The Caprivi is not as arid as Namibia proper, which may explain how this plant escaped from its normal vlei habitat — yet aridity stunting obviously occurred in spite of abundant summer rainfall in the Caprivi during 1989. This finding is important because no morphologic difference exists between our pressed specimen from the Caprivi (van Zyl 113B, PRE !) and the Angolan *C. stenophyllum* Baker, *nom. illeg.*, non Baker 1881 (Baum 406, K, holo. !) collected during the Kunene-Sambesi-Expedition of 1903. [Note: The latter Angolan Codonocrinum bears a "*nomen illegitimum*" because Baker forgot that he had already selected the same specific epithet for a *Stenaster* species from Burma. This is a fortunate coincidence, because it means that no botanical name conflict exists with the later published *C. carolo-schmidtii*.]

In a previous report I detailed the remarkable similarity between *Crinum rautanenianum* and *C. euchrophyllum*. Further discussion follows: (1) Leaf color: The leaves of *C. rautanenianum* in the wild are medium green whereas those of *C. euchrophyllum* are glaucous. This color difference is caused by local ecologic factors. In cultivation the leaves of *C. rautanenianum* can acquire a glaucous appearance indistinguishable from *C. euchrophyllum*. Conversely, the Botanical Research Institute maintains a bulb of *C. euchrophyllum* (Vahrmeijer 2206, PRE !) in a pot of coarse sand rather than wet clay soil. This bulb bears shiny green leaves instead of glaucous leaves. (2) Leaf size: *Crinum euchrophyllum* is not the small plant which Verdoorn portrays. When I observed plants during an earlier trip to the Caprivi, they were small in stature but rainfall had been scant and the mopamie veld swamps were dry. However, rainfall was plentiful during the summer of 1989, and the swamps overflowed — *C. euchrophyllum* achieved dimensions comparable to *C. rautanenianum*. (3) Umbel size: The 1 and 2-flowered umbels listed as characteristic for *C. euchrophyllum* are misleading and represent a cultivation artifact. Although I only observed *C. euchrophyllum* blooming once in the Caprivi (a 3-flowered umbel), I bloomed seedlings from the holotype specimen in my greenhouse, and each umbel sported 4 - 5 flowers. Bulbs collected near Katima Mulilo brought forth 3 and 4-flowered umbels. (4) Flowers: I cannot discern the slightest difference between the flowers of *C. rautanenianum* and *C. euchrophyllum* under cultivation or in the wild. [Note: The illustration of *C. rautanenianum* in **Flowering Plants of Africa**, which is reproduced in *Bothalia*, is incorrect. The anthers are black, not yellowish, and they are covered with gray pollen.] In summation, the evidence is irrefutable that the distribution of *C. rautanenianum* extends from Ovamboland across the entire northern sector of Namibia including the Caprivi Strip. *Crinum euchrophyllum* must be relegated to synonym status by virtue of publication date priority.

Since returning from this expedition, the suspected natural hybrid discovered near Windhoek bloomed in my greenhouse. Flower morphology was consistent with a hybrid between *C. lugardiae* and *C. graminicola* (Figure 9). Umbels displayed 15-18 flowers. The scent approximated the pleasant odor of *C. graminicola*, although not as exhilarating. Scapes were seed sterile.

I encountered another instance of natural hybridization among *Crinum*. In 1987, I collected seeds of *C. forbesii* in the Kruger National Park, Transvaal, South Africa; the red fruiting bodies were huge. A seedling from this collection exhibited aberrant leaf morphology; although the same color, its leaves grew longer and narrower than siblings, and they were suberect and arching rather than sprawling on the ground. This plant recently flowered. The floral features included black anthers. I concluded that it was a hybrid between *C. forbesii* and *C. macowanii*.

How prevalent are *Crinum* hybrids in the wild? Fortuitous *Crinum* hybridization happens in the garden via hummingbirds, moths and other pollinators; why should it be unusual for this same phenomenon to occur outside the garden? Several Namibian species, such as *C. lugardiae* and *C.*

macowanii, are highly receptive to foreign pollens.

How many of the *Crinum* illustrations published during the eighteenth and nineteenth centuries were actually garden or natural hybrids instead of species? This controversy arose with the beginning of modern botany in *Species Plantarum*. Consider Ehret's painting which Linnaeus listed as a possible ("?") example of *LilioNarcissus africanus* (cited as the lectotype for *C. zeylanicum* L. sensu Nordal); was it really a species or was it a *C. x submersum* hybrid? Illustrations presented as holotypes or typical specimens often portrayed bulbs possessing a cultivated or dubious origin; bulbs lacking a clear reference to a collector or collection site remain suspect for garden hybrids. For example, the origin of *C. scabrum* was confusing since the initial specimens were collected in South America rather than in Africa; how could anyone be certain that these early accounts and drawings depicted a species rather than an interspecific hybrid?

Hybrids frequently simulate species as living plants. Drawings only compound the ambiguity, and it is impossible to distinguish hybrids from species in herbarium mounts. Unfortunately the important differentiating criteria between species and hybrids, such as fruiting bodies, seeds, and faithfulness of progeny, are rarely mentioned in pre-twentieth century literature. Be aware that *Crinum* easily hybridize in nature. Otherwise, it is quite possible to overlook this occurrence in the garden as in the wild.

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Figure 1. *Crinum lugardiae*. North of Windhoek, Namibia. January 26, 1989. All photographs are by the author.

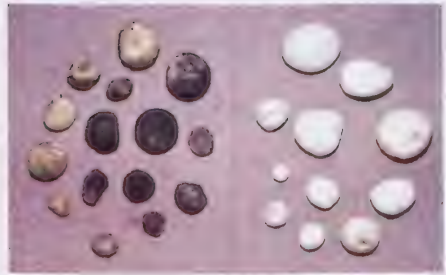


Figure 2. Comparison of the coarse dark seeds of *C. graminicola* with the smooth light-green seeds of *C. forbesii*. January 27, 1989.



Figure 3. *Crinum baumii*. Mahango Game Reserve, Namibia. February 1, 1989.



Figure 4. *Crinum verdoorniae* (proposed name) near a termite mound. Katima Mulilo, Caprivi, Namibia. Feb. 2, 1989.



Figure 5. *C. subcernuum* (syn.: *C. crassicaule* Baker sensu Verdoorn). Plant collected at Mpola, Caprivi, Namibia, & cultivated in S.E. Texas.



Figure 6. Variety of *C. carolo-schmidtii* Dinter. South of Katima Mulilo, Caprivi, Namibia. February 2, 1989.



Figure 7. Variety of *Crinum carol-schmidtii* Dinter, south of Katima Mulilo, Caprivi, Namibia, 02/02/89.



Figure 8. *C. acaule* north of the Karibib Airport, Namibia. Feb. 5, 1989.



Figure 9. Natural hybrid *C. lugardiae* x *C. graminicola* collected near Windhoek, Namibia, and cultivated in S.E. Texas.



Figure 10. → Natural hybrid *C. forbesii* x *C. macowanii* collected as seed in the Paul Kruger Park, Transvaal, South Africa, and cultivated in southeast Texas. Foreground: seedling of *C. forbesii* from the same collection.



← *Crinum hildebrandtii* Vatke. Bulb originally collected in the Comoros Islands and cultivated in Southeast Texas. May 1990. See article on pp. 70-73.



RESTORATION OF
CRINUM FORBESII (LIND.) SCHULTZ EMEND. HERBERT

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After reading Verdoorn's account which discusses the naming of *Crinum delagoense* Verdoorn, I find the reasoning behind the name change disconcerting. *Crinum forbesianum* Herbert has long been accepted as the botanical name for this taxon, having been published as such by Herbert in **Amaryllidaceae** and later promulgated by Baker in several publications including **Handbook of the Amaryllideae** and **Flora Capensis**. Verdoorn contends that Herbert erred by adopting an illegitimate name, and, therefore, she devised a new name.

A brief historical synopsis is recounted: Forbes collected bulbs near Delagoa Bay in 1822 and dispatched them to England. Unfortunately Forbes became ill and died before he was able to return from the expedition. Lindley described one of Forbes' plants in 1826 which he named *Amaryllis forbesii* Lindley; he characterized it to have a large bulb; narrow, canaliculate, glaucous leaves with cilia; a many flowered umbel of delicately pink colored flowers; and tepal tubes as long as the bell-shaped limbs. Schultz reclassified the genus to *Crinum forbesii* (Lind.) Schultz in 1830. Herbert published under the name *C. forbesianum* Herbert in 1837 with direct reference to Lindley's article and a particular (now lost) painting. Herbert categorized the plant under the general classification: leaves not undulating, umbel growing on a peduncle; and subclass: flowers less patent, cells with many seeds, southern Africa. The specific description which was referenced to Lindley and the painting consisted of the following: bulb very large and spherical, lorate, canaliculate, glaucous leaves with cilia, 30-40 flowered umbel, and flowers richly purple. A variety *punicea* was also delineated: flowers richly purplish-crimson with segments more curled back at the edges. Herbert commented: "The bulbs were... of difficult culture, and I fear that they may have been all lost to rottenness." (No preserved specimens or drawings of either *A. forbesii* or *C. forbesianum* are known to exist.)

Verdoorn charges Herbert's naming of *C. forbesianum* as invalid and illegitimate. Quoting Verdoorn: "...known as *Crinum forbesianum*, the name used by Herbert in his **Amaryllidaceae**, 1837, when referring to *Amaryllis forbesii* Lindley. According to the rules of nomenclature, a change in the form of a specific name when transferred to another genus is illegitimate." Verdoorn questions whether Lindley's plant and Herbert's plant are indeed the same, and she postulates that two species may have been involved because Lindley's description of pink flowers and narrow, glaucous leaves does not agree with the actual morphology. She concludes that *C. forbesii* (Lind.) Schultz cannot be accepted as an accurate identification and proposes a new botanical epithet, *C.*

delagoense Verdoorn. (She acknowledges *C. forbesianum* Herbert as a synonym for *C. delagoense* Verdoorn.)

I take issue with Verdoorn because I believe she makes assumptions which unfairly discredit both Herbert and Lindley. More important, she incorrectly cites the International Code of Botanical Nomenclature. My counter argument follows: Herbert and Lindley were contemporaries and friends. Each was actively engaged in realigning and reclassifying the orders of plants. Herbert was critical of Lindley's **Natural System of Botany** and felt that the botanical descriptions were inconsistent and contradictory. Lindley subsequently made revisions in his second edition to accommodate Herbert. There were publicized instances where Lindley and Herbert did not agree upon the classification of plants such as *C. zeylanicum* and *C. longifolium*, which Lindley insisted were *A. zeylanica* and *A. longifolia*. It was not surprising that Lindley classified the plant under discussion as *A. forbesii* rather than *C. forbesii*. If Herbert had incorrectly referenced *A. forbesii* when he described *C. forbesianum*, surely Lindley would have publicly rebuked him.

Considering the friendship and exchange of communications between the two men, it is difficult to accept Verdoorn's premise that two different species of *Crinum* are involved. Quoting Herbert on Lindley: "I cannot, however, proceed with any observations that have the least bearing on the botanical labours of that gentleman, without previously expressing not only the high opinion I entertain of his talents and acquirements, but the obligations under which I feel myself to him, not only for the liberality with which he has entrusted to me portions of his library and valuable herbarium, but for the invariable urbanity and kindness with which he favoured me with his opinion and instruction on some points, concerning which I found my general information deficient, and, indeed, upon every occasion in which I was desirous of his advice." Their association not only involved the exchange of ideas, criticisms and notes, but also botanical materials. Herbert endured an antagonistic relationship with the Royal Botanical Gardens at Kew, and he remarked in **Amaryllidaceae** that he had not communicated with Kew for nearly twenty years. Herbert's isolation from Kew made him extremely dependent upon friends and other botanists for new materials to study. On the other hand, Lindley was an influential botanist at the University of London and editor of the **Botanical Register**, and he was once even appointed to head a government commission which investigated deteriorating conditions at Kew. There is little reason to doubt that the plants in possession of both Herbert and Lindley could be traced to the Forbes expedition, but it seems highly probable that Herbert actually obtained his specimens directly from Lindley. Herbert even applied the comment "fortuitous" to his variety *C. punicea*.

Verdoorn freely concedes that she has never been able to locate a *Crinum* species from the Delagoa Bay region which completely satisfies Lindley's description. With respect to the pink colored flowers, Verdoorn does not relate all of Lindley's observations. There are two separate articles published in 1826 by Lindley in **Trans. Hort. Soc. Lond.** In the first he describes *A. forbesii*, but in the later one he reports a new variety, *A. forbesii beta purpurea*. Quoting from

the later article: "the whole of the colour, which in the original variety is a delicate pink, was in this changed to a rich purplish crimson, resembling the colour of *Crinum amabile*. A smaller number of flowers was produced in this new variety, and the divisions of the flower appeared more revolute than in the kind first seen; otherwise they were not observed to differ." Why Verdoorn chooses not to mention this later accounting about "rich purplish crimson" flowers is not clear, because she cites *A. forbesii* var. *purpurea* Lindley in her *Bothalia* article. (The translation for the Latin word "purpurea" is purple, not pink.) Regarding the leaf discrepancy issue, Verdoorn remarks that leaves belonging to *C. delagoense* Verdoorn in the Delagoa Bay region are broad and grass green in contrast to Lindley's narrow, glaucous description. Bulb cultivation in the cool damp English environment is very tenuous according to Herbert, and it is reasonable to assume that less than optimal leaf development occurs. Leaf color can also be substantially altered by soil pH, available nutrients and sunlight exposure. The major significance of leaf color should be reserved for indigenous plants in their natural setting; extrapolations from artificial culture can sometimes be misleading (personal experience).

Herbert writes in the preliminary treatise of *Amaryllidaceae* that a great deal of confusion prevails in the naming of plants; in particular, hybrids and species are not being segregated. To help alleviate this problem, he devises a new scheme to name plants. Included are the following provisions for the naming of a plant in honor of a person: a) If the plant is a hybrid, then it should be named directly after the individual by using the Latin noun case; and b) In the event it is a species, then the name should be written in the Latin adjective case. "With this view I venture to alter all the proper names adopted in this order to an adjective form . . ." According to this methodology when Herbert states *C. forbesianum* (adjective form), he is writing the equivalent of *C. forbesii* (noun form) in reference to the species under question; had Herbert utilized the name *C. forbesii*, it would have implied a hybrid instead of a species. The actual botanical taxon which Herbert establishes in *Amaryllidaceae* is *C. forbesianum* (Lind.) Schultz emend. Herbert, but in all subsequent literature it is erroneously transcribed as *C. forbesianum* Herbert. All *Crinum* species and hybrids listed in *Amaryllidaceae* are modified by Herbert to conform to this scheme. There are other examples where he refashions the name of a previously published *Crinum* species, such as *C. commelinianum* for *C. commelyni* and *C. broussonetianum* for *C. broussonetii*. However, Herbert does not change basic stem words in his scheme, only the Latin terminations.

Article 32.5 of the International Code of Botanical Nomenclature reads as follows: "names published with an incorrect Latin termination but otherwise in accordance with this Code are regarded as validly published; they are to be changed to accord with Articles 17-19, 21, 23 and 24, without change of the author's name or date of publication." The Code clearly specifies that *C. forbesianum* Herbert is a validly published name, not an illegitimate name as Verdoorn states, except that the Latin ending must be amended in conformance with the rules to *Crinum forbesii*. Although Herbert modifies Lindley's

description, he attributes Lindley to have originally published on the plant, and such being the case, *C. forbesianum* Herbert is appropriately corrected to *C. forbesii* (Lind.) Schultz emend. Herb. This effectuation is in total agreement with Art. 51.1: "An alteration of the diagnostic characters or of the circumscription of a taxon does not warrant a change in its name . . ." According to the recommended terminology of the Code, both *C. forbesianum* and *C. forbesii* are permissible botanical expressions with correct Latin formats (Recommendation 73C. 1). However, the original epithet spelling has precedence, which is also stipulated in Article 73.1: "The original spelling of a name or epithet is to be retained, except for the correction of typographic or orthographic errors and the standardization imposed by Arts. 73.8 (compounding forms), 73.9 (hyphens), and 73.10 (terminations; see also Art. 32.5)."

Verdoorn does not dispute the authenticity of Herbert's *C. forbesianum* description. According to Art. 45.2, the date of a taxon's valid publication does not change when a correction is made in the spelling of its name. Since Herbert's accounting represents a completely accurate and validly published description, I conclude that *C. forbesii* (Lind.) Schultz emend. Herbert is a legitimate botanical name. It is my conviction that *C. delagoense* Verdoorn is an illegitimate name according to Article 63.1 of the Code and must be relegated to synonym status. It is unclear which portion of the Code Verdoorn references in declaring *C. forbesianum* Herbert to be an illegitimate name. She states that Herbert erred in changing the specific epithet from "forbesii" to "forbesianum" when he transferred the plant from the genus *Amaryllis* to the genus *Crinum*. Article 55.1, which deals with transference to another genus, details the following: "When a species is transferred to another genus or placed under another generic name for the same genus without change of rank, the epithet of its formerly correct name must be retained..." Applying Art. 55.1 to the situation also derives the same result; the name *C. forbesianum* Herbert must be corrected to *C. forbesii* (Lind.) Schultz emend. Herbert, and legitimacy is not in question.

It is not my intention to further muddy the waters concerning the confusion between *C. forbesii*, *C. forbesianum* and *C. delagoense*, but the legitimate name issue is important to discuss at this time. Nordal indicates that *C. stuhlmannii* Baker of Tanzania may be cospecific with *C. delagoense* Verdoorn. If Nordal's presumption is verified, then according to the valid publication date rules of the Code, the name *C. stuhlmannii* Baker would have preference over *C. delagoense* Verdoorn, but not over *C. forbesii* (Lind.) Schultz emend. Herbert. I am currently cultivating a young bulb of *C. stuhlmannii* originally collected from the T6 region of Tanzania (courtesy of the Department of Botany, University of Dar es Salaam); its leaf arrangement and morphology are identical to similar-sized bulbs of *C. forbesii*. Nordal's published description and photographs strongly support cospecificity. Hopefully a definitive answer will be forthcoming.

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THE GENUS WATSONIA

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Watsonia has long been a recognizable garden plant, especially in California gardens of the 30's and 40's. With their hardiness and ease of cultivation, it is no wonder that gardeners of that era used them so extensively. It seems that we are always "rediscovering" what we think are new bulbs or plant material when they can be found in the records of gardens 50 or 100 years ago. *Watsonias* were grown and collected in Europe as far back as the 1780s.

Watsonia is a genus of 52 species restricted to southern Africa. It has a wide distribution from the mountains and coastal belt of the western Cape Province to the Drakensberg escarpment of Swaziland and the eastern Transvaal. In the Cape winter rainfall region, there are 34 species, while in the summer rainfall areas of South Africa there are 21 species. Bearing corms, as with other members of the Iridaceae, *watsonias* are unusually robust and tall for the family with some species up to 6 feet (2m) tall. Many species are also evergreen, although the majority of the species are seasonal (deciduous). Site variation both in the wild and in cultivation can affect this condition; plants grown in wetter areas tend to be evergreen.

Watsonia flower spikes remains distichous (in a single, fan-like plane) during and after flowering, a feature that distinguishes the genus. The number of flowers varies from 40-60 in some of the taller species to only 3-5 in some dwarf species like *W. occulta*. Flowers of species with a funnel-shaped tube are usually shades of pink to purple-pink and are thought to be pollinated by bees, while those with a cylindrical upper tube are bright red to orange and are probably pollinated by sunbirds (South Africa's equivalent of hummingbirds).

When attempting to cultivate *watsonias*, it is essential to bear in mind the general climatic requirements of the plants, particularly whether the species is from a winter or a summer rainfall area. For southern California gardens the winter growing species are the best choice, while the summer growing ones may be better suited for eastern and southeastern United States gardens. In areas of extreme cold the corms should be lifted seasonally. As with most other bulbs and corms, *watsonias* do not require much fertilizer or care. Although they prefer the open ground, especially for the more robust species, *watsonias* can grow perfectly well in containers. In any case, after several years of growing they should be lifted and divided because over-crowding reduces flowering. The only real pests of *watsonias* are flower thrips in the late spring.

Among some desirable garden species are *Watsonia marginata* which has small pink, actinomorphic flowers on tall spikes. It was one of the earliest species to be collected in South Africa in 1773 and named in 1782. Another favorite and easy to grow species is *W. aletroides*, which is being grown extensively in New Zealand for the cut flower trade. It would be a valuable addition to the rock garden, its flowers resembling those of *Aloe* in shades of scarlet to pink. With the stature and ease of cultivation of these durable irids,

it is a wonder they haven't made a come-back into the trade. Hopefully articles on these plants will stimulate more gardeners to become interested and inspire the trade to offer these durable, delicate-looking African beauties.



WAT'S NEW IN WATSONIA

TERRY HATCH, JOY NURSERIES, R.D.2. PUKEKOHE, NEW ZEALAND

The islands of New Zealand are renowned for the variety of plants that flourish here. The native vegetation, excepting alpine areas, was rain forests, but the larger part of this has been removed and replaced by pasture lands. Colonists, both Polynesian and European, carried plant material to the islands; this still continues with many plant imports every year. The strange fact is that as the percentage of imported plants grows, rare species often become weeds. The climate is so equitable that tropical, temperate, alpine and desert plants can be grown in the same garden with little or no environmental manipulation. The weed situation will always be a problem and growers should self-impose trials on new acquisitions (apart from the "prohibited") before releasing them.

For plant breeders being able to grow such a wide range of plant material in one area has its rewards. A long growing season (8 - 9 months) together with a high light factor produces fast growth. Production of some of the slower crops can be shortened by at least 2 or 3 seasons. *Nerine* will flower from seed in 3 years, many other bulbs in 2 years, some like *Schizostylus* in only a few months. With this climatic advantage it is hard to stop oneself from adding new species to the plants being grown and cross pollinated.

In the early years of settlement, ships passed South Africa *en route* to New Zealand. We now have a large range of plants from that amazing botanical treasure house, *Watsonia* being a high on the list. Many plants have been consigned to the rubbish tip or side of the road, now flourishing in some areas by the thousands. *W. meriana* var. *bulbifera* has spread for many miles, perhaps numbering in the millions! They are eaten by sheep, so are not a pasture weed.

We've made collections of many of the better species and forms available, though it's nearly impossible to name but a few, the majority being hybrids of the more robust, taller types. Over the past 7 years I've collected a number of smaller ones, and I'm now breeding hybrids suitable for pots, rock gardens, and the front of the flower garden. The early results are very encouraging. Many new colours are starting to appear: apricots, pinks, white, wine-lilac, purple, rusty purples, and now bicolors. I'm also trying to select flowers with unusual features like frilly petals, upward-facing flowers and extra petals. Some of the species used have been *W. laccata* (pink and lilac), *W. aletroides* (red) (from which bicolors possibly evolved), *W. humilis* (white & pink); I'm now incorporating some of the larger types. The potential for a wide range of new colours and sizes is endless.



JOURNEYINGS IN SOUTH AFRICA

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ASHINGTON, WEST SUSSEX, RH20 3BA
ENGLAND

My far too few visits to this remarkable country [South Africa] have provided an insight into what must be the indisputable fact that scarcely any other country can compare to the splendour and magnificence of the floral landscape of South Africa. I must admit my first venture was in pursuit of the succulent flora which abounds in almost every region of the country. However, I was so captivated by the beauty of numerous bulbous, cormous, and tuberous rooted plants which abound in the mountains, plains and desert that I just had to go back for quite a long period the following year.

I recall travelling from Paarl, through Bainskloof and Michells Pass *en route* to Ceres — all in Cape Province. Bainskloof is a winding road which passes through some of the most spectacular scenery one could ever wish to see: mountains with deep valleys, generally forest covered, and along the roadside numerous fascinating plants of great appeal to the enthusiast. I came across what appeared to be a close associate of the iris family, at least as far as the foliage was concerned. The inflorescence, on the other hand, seemed to convey but little of its affinity to that group, and I was baffled. I discussed this "find" when visiting Kirstenbosch Botanic Gardens a day or so later. There I learned that there was indeed a kinship, the plant being a *Klattia*, a genus in the plant family Iridaceae.

The genus was erected by J. G. Baker and recorded in the *Journal of the Linnean Society* in 1878, the title honouring a very prominent 19th century botanist, Friedrich Wilhelm Klatt (1825-1897). Klatt's explorations are well recorded in the earlier works on South African botany. It remained a monotypic genus for a time until a second species was discovered. Both are mountain plants and more or less confined to high altitude habitats in south and south western parts of Cape Province. They are somewhat shrub-like (the specimen I discovered seemed to have the tendency to climb!) The species are evergreen with a fairly thick, underground rootstock which could almost be termed a caudex. Stems are woody and branched, generally of erect growth. Leaves are distichous, firm, equitant, that is to say the leaves are set opposite, overlapping one another at the base, being "enfolded" one within the other, this being a typical feature of most of the Iridaceae. The inflorescence is a dense, terminal head enclosed in colourful bracts. Flowers come in pairs and are enclosed in opposite spathes, radially symmetrical with a short perianth tube and very slender. The almost threadlike segments broaden at the tips. Stamens are erect, filaments long and slender, the style is 3-lobed. The cylindrical capsule contains just a few compressed seeds.

The genus and species are as follows:

Klattia partita Bak.

A plant to about 90cm high with more or less erect stem and branches, these being pubescent when young, later becoming glabrous. Stems leafy along their lengths, the leaves distichously arranged and sword-like in appearance. The inflorescence up to 10-flowered, the flowers in pairs, each subtended by a narrow, linear, leafy spathe. Flower segments purplish-blue, the outer three about 5cm long, 2mm wide with a broader, obtuse apex. Inner segments much narrower, the anthers about 1cm long, the style reaching to the tips of the floral segments. Flowering in habitat during December and January. Native to mountainous country from towards Tulbagh and south to Swellendam.

Klattia partita var. *flava* Lewis

Generally shorter in growth, otherwise very similar. The inflorescence is 10-flowered and terminally borne on stems and branches; the perianth tube is about 6mm long (as also applies to the species). The segments are pure primrose-yellow, about 5cm long, 2mm wide; the inner three segments are spoon-shaped at the tips, the outer segments are slightly wider. This is seen flowering in mountainous country near Caledon.

Klattia stoloei Guthrie

This is the plant found in Bainskloof. In many respects similar to the foregoing, the differences are mainly apparent in its having shorter, broader leaves and also a different structure of the inflorescence. The inflorescence is terminal on stems and branches, consisting of several flowers with narrow perianth tubes about 15mm long, 2mm wide, the inner and outer segments slender and about equal, 5-6.5cm long, bright red and red bracts. It flowers January to March and seemingly is confined to the eastern mountainous areas of southwest Cape Province.

These *Klattia* species might well prove a welcome addition to enthusiast in both America and Europe. How to grow them successfully will, to a large extent, be experimental, although suffice it to add that where I was growing them was very much Ericaceous country!

Of the several other attractive species seen, particularly on the more easterly areas of the country, were those of the family Hypoxidaceae. Especially of interest was *Empodium namaquensis* (Bak.) M. Thompson, a cormous plant which seemed to be most variable in growth, from a matter of 8-10cm to almost triple that size in height. This I observed in flower during early April in rather grassy, flat terrain near Nieuwoudtville in Namaqualand. The sharp, slender leaves and the remarkably bright yellow flowers provided a beautiful combination. This species, I find, readily adapts to cultivation in Britain, using an enriched, permeable soil, enjoying a temperature of around 15°C at flowering time.

Another somewhat low-growing bulbous plant encountered was *Gethyllis ciliaris* (Thunb.) Thunb., a member of the Amaryllidaceae. This was discovered in late January and, with the foliage being almost absent, it proved difficult to ascertain either the genus, or even more so, the specific epithet. Subsequent enquiries disclosed the genus but only after returning to Britain was I able to be assured of the species. One particular feature seems to pertain to the majority of the species included within *Gethyllis* — namely the spirally twisted leaves. This particular plant has grown happily in cultivation, and has thrived in a very porous but fairly rich soil, the pure white flowers reaching their prime in late January. It is recorded as being widespread in southeast Cape Province. I found it on very arid countryside just off the road near Malmesbury.

Two somewhat uncommon species of the Iridaceae were encountered: one from the lower slopes bordering the Palmiet River inland from Betty's Bay, the other from the Malmesbury region. The first of these, *Nivenia stokoei* B.E.Br. is one of about eight species included in the genus. They have a woody often caudex-like rootstock and woody, branching stems. *N. stokoei* ranges from 30-60cm in height with leaves about 9cm long, the tube being up to 4cm in length. It seemed to be rather widespread in habitat, but in early February, when I saw it, only few flowering plants were in evidence. There is a distinct similarity between the different species, to the extent that implicit identification proves rather difficult.

The other species was one of the many species of *Romulea*, certain of which are to be seen in northern parts of the continent, and even in Europe. I was escorted to the habitat of *Romulea eximia* de Vos, as I was informed the habitat near Malmesbury was very limited, and the likelihood of seeing flowers was remote — however, I was fortunate! The rootstock is cormous, the leaves deciduous. The crocus-like rose-pink flowers with a deep red blotch at the base of each segment is enhanced by the yellowish throat, each flower 3-4cm long, and to 1.5cm wide. It has been found that seeds germinate freely with flowers appearing after about two years.

Altogether it was a most exciting and informative safari. The more western parts of South Africa proved to be another worth-while enterprise two years later.

[ed. note: For further information of *Klattia*, *Nivenia*, and *Gethyllis*, see Veld & Flora, vol. 78(4), December 1992.]



SOME SOURCES FOR SOUTH AFRICAN BOOKS, BULBS & SEEDS

BioQuest International (bulbs)
P.O. Box 5752
Santa Barbara CA 93150
United States of America

Botanical Society of South Africa
Kirstenbosch National Botanic Garden
Private Bag X7
Claremont 7735
Republic of South Africa (book & seed list for members)

Euclea Books
P.O. Box 11017
Brooklyn, 0011 Pretoria
Republic of South Africa

Honingklip Book Sales
13 Lady Anne Avenue
Newlands 7700
Republic of South Africa

Indigenous Bulbgrowers Association of South Africa (I.B.S.A.)
3 The Bend
Edgemead 7441
Republic of South Africa. (newsletter, books, seeds)

Real Exotica (Books & seeds)
P.O. Box 1105
PeaceHaven, East Sussex
England BN10 8QY

Rust-en-Vrede Nursery
P.O. Box 231
Constantia 7848
Republic of South Africa
(seeds & bulbs)

Silverhill Seeds
18 Silverhill Crescent
Kenilworth 7700
Republic of South Africa



