The Bushman Candles

Charles Craib & John Lavranos

Watercolour paintings by Ellaphie Ward-Hilhorst & Gerhard Marx
Pencil drawings by Bowen Boshier

This book is dedicated to
Ellaphie Ward-Hillhorst

1920 – 1994

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Left and right: *Monsonia patersonii* at dusk in the coastal Namib desert about 20 kilometres inland from the coastal town of Luderitz in south western Namibia.
Photograph: Connall Oosterbroek.

Sponsor's note

It is indeed a great pleasure for me to contribute a few words about this wonderful book *The Bushman Candles* – co-authored by Charles Craib and John Lavranos. Neither of these gentlemen need any introduction as their academic prowess in the world of botany and other fields precedes these words – nevertheless a few words about each of them are required to enable me to give a background to the creation of this book.

Craib tells me that, many years ago, he became interested in the Geraniaceae and was thus fascinated by the sarcocaulons, as they were then known. One day he resolved that, when he knew enough, he would write a book describing them.

More time passed, during which Craib had studied and seen all the different species in the field, except for two – *Monsonia mossamedensis* and *Monsonia marlothii*. He contacted Professor Rodney Moffett, who had by then revised the genus *Sarcocaulon*, to see whether he would be interested in co-authoring this book. However Moffett's commitments to lecturing and research prevented this venture. Craib knew John Lavranos and was aware of his work with *Sarcocaulon* and realized that he would thus be a perfect co-author. Lavranos agreed to the proposal and the book reached its embryonic stage.

Craib then visualized illustrations to accompany the text. He knew that the late Ellaphie Ward-Hilhorst had painted a set of water colours depicting *Sarcocaulon* and contacted Sue Goldswain – Ward-Hilhorst's daughter – who holds the copyright to the paintings. Goldswain agreed to the use of her mother's paintings in the book, and the South African National Biodiversity Institute – the owner of the paintings – also gave their blessing.

Lavranos had been very busy with his business in Johannesburg, and in his spare time publishing many new species of plants he had found in his travels to remote places. Thus *The Bushman Candles* project lay in abeyance. The catalyst for going forward with this publication was a letter from Goldswain in March 2007 asking what progress had been made. Lavranos was then contacted again and work on the book started in earnest.

A great deal of planning and co-ordination was required in arranging for additional artwork, photography and the creation of a publishing company. Bringing this all to completion has been very time consuming but extremely interesting for all involved. Craib's perseverance and dedication to "The Cause" is commendable!

John Lavranos came to South Africa in 1952. He had read law and studied economics. In 1967 he graduated from Unisa, obtaining a B.Sc. majoring in botany and geography. His research has covered large parts of southern, east and north east Africa, Arabia and Madagascar, with minor excursions to the southern and northern Americas, the Canaries and south-western Europe spanning the period from 1958 to the present. Lavranos has received many awards and distinctions and has contributed extensively to various scientific publications. His contribution to *The Bushman Candles* is invaluable, and he too should be commended for his foresight and vision in ensuring its success.

As an avid collector of botanical art books, I find that this publication stands out in both botany and botanical art. The scientific, yet readable text is enhanced by the amazing artworks by three renowned artists – Ellaphie Ward-Hilhorst, Bowen Boshier and Gerhard Marx. The profound talents of these artists will surely be preserved for posterity in the pages of this book.

I am reminded once again of the importance of publications such as this. Without a permanent record of our botanical wealth, future generations will surely be deprived.

We congratulate all those involved in the publication of this amazing book – may there be more to follow.

Steve Bales
Group Art Consultant
FirstRand Banking Group

Left: *Monsonia crassicaulis*. Drawing: Gerhard Marx.

Foreword

The history of the Bushman Candles goes back to the dawn of botanical exploration in southern Africa. The first published image of these plants dates from Johannes Burman in 1738, but that, confusingly, appears to show two different species in the single engraving! Somewhat later, William Paterson (1789) and Charles L'Héritier de Brutelle (1792) both published engravings representing distinct species still currently recognised today. These wonderful early works of botanical art are reproduced in this new publication, demonstrating a fundamental theme: that the study of plants and their visualisation are complementary, symbiotic activities, each being intimately dependent on the other.

Much later, the renowned South African botanist and explorer Rudolf Marloth wrote on *Sarcocaulon* in his magnificently extravagant work *The Flora of South Africa* (Vol. 2, 1925):

> "In its flowers this is nearly allied to *Geranium*, hence it was formerly included in that genus, e.g. by Burchell, but the plants have a very different habit. The stems are swollen and to some extent succulent, but covered with a thick cortex of special structure. This consists of numerous layers of compressed cork-cells, which are impregnated with resin and wax, thus forming an impermeable cylinder around the living tissues of stem and branches. Every year a new set of cork-cells is added to this mantle from within, which thus attains a considerable thickness in course of time. The quantity of resin and wax in it is so large that plants taken directly from the soil will burn like a torch, hence the name *candle bush* for *S. burmanni* [*Monsonia* species uncertain] (Karoo and Namaqualand) or *bushman's candle* for *S. rigidum* [*M. patersonii*] (Great Namaqualand).
>
> The existence of such an ample vegetation in an almost rainless country (in some years less than one inch of rain) ... is a puzzle to the visitor arriving there in summer. There seems to be no trace of moisture in the sandy soil, and the violent sand storms which often rage for weeks without interruption would appear to render vegetable life impossible. Yet, there they are – hundreds, nay thousands of shrublets within sight, and not one kind only, but ten or twenty or more species associated together on sand or rock. All dormant now but alive within their well protected exterior. In winter, however, conditions of life are different, for although there is barely any rain in some years, in others there may be several inches within a few weeks. But even the nearly rainless winters are not dry in the coastal belt, for every night fogs from the sea carry ample moisture many miles inland and often damp the ground to a depth of five inches, or more where sloping rocks act as an additional catchment area."

Marloth's book is a wonderful work but far, far more than a traditional flora: it includes beautiful colour plates and a considerable amount of ecological information, as the above extract exemplifies. He was familiar with the Bushman Candles and indeed a new species, commemorated in the name *Monsonia marlothii*, was first collected by him in the present day Namibia. Above he has described eloquently what makes these plants unique. Most distinctive of all is their structure: swollen, fleshy, spiny shrublets that are archetypal succulents, but distinct in being heavily impregnated with waxes, making them inflammable, from whence comes their common name. This drought-resistant structure is an adaptation for survival in the harshest, most arid and hence inhospitable environments of southern Africa. It is this ruggedness that both intrigues and appeals to all of us who are captivated by succulent plants. Marloth intimated that the taxonomy of these plants has not been uncontroversial. He knew them as *Sarcocaulon*, but prior to that some of them had been classed as geraniums and monsonias, and it is back in the genus *Monsonia* where they currently sit. This taxonomic shift is unfortunate because this distinctive small group of plants no longer has an exclusive home, since they have as bedfellows small, non-succulent herbs. However, the term Bushman Candles uniquely identifies the 15 species that feature in this book, so this is a useful handle.

These Bushman Candles have staunch devotees in Charles Craib and John Lavranos, who have been observing these plants in their habitats for over 30 years. It is the plants as they occur in the wild that is the focus of this book, so this is not a traditional taxonomic work. *The Bushman Candles* follows on from Charles's earlier books *Geophytic Pelargoniums* (Umdaus Press, 2001) and *Grass Aloes in the South African Veld* (Umdaus Press, 2005) where the main themes were ecological, unusual for works on succulent plants. Hence Charles and John follow in the footsteps of Marloth in bringing the Bushman Candles to our attention in this, the first book ever to be devoted to these remarkably resilient plants.

My own involvement with these plants has been a small contribution in the publication of the new combination *M. lavrani* and I am delighted that this commemorates one of the authors of this book, a well-deserved accolade indeed.

This book also follows a strong tradition in South African botanical art. Marloth's book was beautifully illustrated with colour plates and the current book is also visually appealing. The exquisite and botanically accurate water colour paintings of Ellaphie Ward-Hilhorst were first published by Rodney Moffett in his paper *The genus Sarcocaulon*, in the journal *Bothalia* in 1979. Most of these paintings, though, were reproduced in a reduced size, but are now published in full size where their artistic merit

Monsonia crassicaulis. This plant, typical of the species in the Little Karoo, has long petiolar spines. Drawing: Gerhard Marx.

can be fully appreciated. These provide the detail of each distinct species of Bushman Candle, based on plants in cultivation. To complement these, the plants in nature are portrayed in newly commissioned paintings by the renowned artist Gerhard Marx, along with pencil drawings of their habitats by Bowen Boshier, that together bring the harsh, arid environments in which these plants reside vividly alive. Reflections of all of this work are provided by these artists, the photographer Connall Oosterbroek and the taxonomist Rodney Moffett. This book, then, is truly a collaborative venture amongst a wide group of enthusiasts bringing together a diverse collection of skills to produce a book that not only provides a fascinating insight into an intriguing group of plants, but also presents them in a range of beautifully evocative images.

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Acknowledgements

It is impossible to produce any book such as this one without the contributions of many people with a range of talents and skills In this instance we are fortunate to have had significant contributions from many people and they are acknowledged and thanked below

The sponsors gave very generously and without their support the publication would not have been possible. Mr Steve Bales of FirstRand Bank is thanked in particular for his interest and support as well as for contributing the Sponsors Note about the publication at the beginning of the book. The subscribers to the standard edition of the book are also thanked and their support helped us with covering the printing costs.

Susan Goldswain, Ellaphie Ward-Hilhorst's daughter, gave the necessary copyright permission for the use of the magnificent illustrations of the Bushman Candle species painted by her mother. These grace the pages of the book and one of them, *Monsonia vanderietiae*, has been used as the cover illustration. Susan also lent us her mother's meticulously kept journals as a resource for writing the chapter on Ellaphie.

We are most grateful to the South African National Biodiversity Institute for permission to use the Ellaphie Ward-Hilhorst *Monsonia* paintings. In this respect we extend our sincere thanks to Professor Gideon Smith at the Institute, who went to a lot of trouble to co-ordinate the loan of these paintings for scanning purposes, in order that they could be featured in the book.

This book has been made possible by a very good and dedicated team of artists and photographers. Gerhard Marx illustrated various Bushman Candle species which feature in the section on the artwork and photography. The originals accompany the six sponsors' copies of the book, one with each book. Bowen Boshier travelled widely in the Northern Cape and Namibia in order to draw his spectacular drawings of Bushman Candle habitats.

Dr Timothy Harvey and Connall Oosterbroek took photographs of the different species and their habitats, often under trying conditions. Their photography brings the text to life and adds a special dimension to the book. Dawie Human, Rod and Rachel Saunders, Inge Pehlemann, Cameron McMaster and Ernst van Jaarsveld also supplied photographs for use in the book. Elsa Young took photographs of the ornamental container plantings featuring *Monsonia vanderietiae*.

Dawie Human made arrangements for us to visit the *M. salmoniflora* colony on Daniel Pauw's farm near Theunissen in the Free State, the easternmost known colony of this species. Dawie and Daniel are sincerely thanked for this opportunity and Daniel for providing the transport for travelling around the farm.

Dr Graham Williamson supplied valuable information on the *M. salmoniflora* colony on the calcrete plains east of Kuruman. Much of the information about the site, originally found by John Lavranos, had to be based on the recollections of John and Graham as the monsonias now appear to have been trampled out by livestock.

Professor Emeritus Rodney Moffett contributed reminiscences on his fieldwork when revising the genus *Sarcocaulon*, as the Bushman Candles were then known, and his collaboration with Ellaphie Ward-Hilhorst.

Robin and Bertha Halse from the farm Carnarvon Estates north of Queenstown helped us with information about *Monsonia camdeboensis* which occurs on their farm, the easternmost occurrence of this species. The Halses and their son-in-law Sean Bryan contributed photographs of these plants in habitat.

Arnaud Labuschagne, antiquarian book dealer in Johannesburg, gave valuable advice concerning the presentation of art and photographs in the book. Wynand van Eeden, my business partner in Penrock Publications, worked tirelessly on many aspects related to the printing and design of the book. He also established and maintained a data base about the book and liaised with many printers, scanners and editors during the production phase of the publication.

We would like to thank Piet Vorster for his scientific editing and Dr. Colin Walker for writing the foreword. Geraldine Dittrich typed and re-typed the manuscript at various stages when changes were made to the text.

Roger Dixon is thanked for editing and structuring the book. Tersia van Rensen designed the book.

Gordon Rowley is thanked for permission to reproduce the Paterson image from his extensive library of literature on succulent plants. Tina Wardhaugh is gratefully acknowledged for her expert digital manipulation of images from the books by L'Heritier and Paterson.

Faye Brawner contributed substantially to publicising the book amongst geraniaceae enthusiasts, mostly in the United States. Her efforts assisted in reaching a number of people who may not otherwise have known about it.

Preface

This book is neither a revision nor a taxonomic treatment. It is a compilation of information gathered from existing literature and, more importantly, from a study over many years by us both of the known species of the Bushman's Candles in their habitats in southern Africa, and their interactions with and responses to the ecological conditions under which they grow, the dangers to which their future may be exposed and of ways to cultivate and propagate them.

The book is divided into three sections. The first concerns the plants, focussing on their discovery, taxonomy and autecology. The second concerns the role of botanical illustration in the study of plants. It also elucidates the critical role played by photography in the discipline of autecology and explores the interesting and unusual function which the medium of pencil has for illustrating the vast landscapes in which Bushman Candles grow.

Horticulture often has a dual function. It permits detailed study of the manner in which plants grow based on their behaviour in living collections. It also provides an opportunity for appreciating the aesthetics of various indigenous plants, in this case The Bushman Candles. One facet of this is ornamental horticulture, presenting these plants in specially crafted containers. These aspects are brought together in the third and final section of the book

The nexus between those who study plants and botanical illustrators is based on various shared constructs. Amongst these, accuracy is probably the most important, second only to the ability of the artist to use colour and composition as a vehicle for conveying scientific information. The second section examines various components of this process focusing on the different requirements of the plant taxonomist and the autecologist.

Photography has a critical role to play in conveying autecological information. In this respect it is possibly unique, reproducing details exactly as they are without any initial interpretation. The second section dwells upon this subject with specific reference to photographing the Bushman Candles

One of the most important and often neglected aspects when botanical illustrations are published is their size and format for presentation. In this respect we considered that Ellaphie Ward-Hilhorst's paintings of the different Bushman Candle species needed to be presented life size. They also require around them the provision of plenty of space provided by broad white margins. In this manner their accuracy, composition and the unique way in which they convey information is best appreciated.

Right: The plateau west of Bulletrap in northern Namaqualand. This locality is well known for its bulbous, geophytic and succulent flora and has rich concentrations of *Monsonia ciliata*. Photograph: Connall Oosterbroek.

SECTION I

BUSHMAN CANDLE SPECIES

'Portal'
This view balances the sweeping valley with its embracing mountain slopes. In the foreground is *Monsonia patersonii*. Living amongst the stony scree below the mountain summit on the right is *Monsonia peniculina*, one of the rarest plants on earth Pay your respects to these silent guards before you pass through to exciting new lands. Drawing. Bowen Boshier.

GERANIUM SPINOSUM.

Published March 30 1789. by J. Johnson in St Paul's Church-yard

Introduction

Considerable attention has, in recent times, been attracted to the shrubby species of *Monsonia* that have long been known as sarcocaulons. Belonging to the family Geraniaceae they are, in the most recent treatments by Albers (1996) and Touloumenidou *et al.* (2007), considered to form an integral part of *Monsonia*. Indeed, some of the species had, in the past, already been included within *Monsonia*. In recent times, evidence of a cytological and phytochemical nature as well as phylogenetic studies corroborate this relationship. We have decided, for the purposes of this book, to adopt the use of the term "Bushman Candles" where necessary, in lieu of the rather ponderous "succulent-stemmed species of *Monsonia*", although this too has been used, where appropriate. From the remaining species of *Monsonia*, the Bushman Candles differ by a number of characters. These include a shrubby, semi-succulent or even woody habit, and a thick, waxy bark which, in some species, endures in skeletal form long after the plant has died. It is inflammable and has earned these plants their common name of "Bushman's Candle" or "Boesmankers". By contrast, all the remaining species of *Monsonia* are soft or slightly woody herbs, which are often annual (Venter, 1979).

Sarcocaulon was first figured by Burman, in 1738, in his work *Rariorum Africanarum Plantarum* and described as "Geranium spinosum et nodosum ...". Paterson illustrated but did not describe two further species in his work *Narrative of four journeys into the country of the Hottentots and Caffraria : M. patersonii* (in the first edition of 1789 (see facing page), but named later in 1824 by De Candolle) and *M. multifida* (in the second edition of 1790, but named later in 1843 by Meyer). In 1792, L'Héritier then added and illustrated another species, *M. spinosa* (see illustration on page 5).

The name *Sarcocaulon*, however, appears for the first time in De Candolle's *Prodromus* as one of the two sections into which he divided *Monsonia* and he included under it three species: *M. burmanii*, *M. l'heritieri*, and *M. patersonii*. Of these, the two latter came to be known as species of *Sarcocaulon* while *Monsonia* (*Sarcocaulon*) *burmanii* has rightly been deemed by Moffett (1979) to be an "uncertain" species due to discrepancies in the drawing on which the name had been based, as was *S. spinosum* (Burm.f.) Kuntze *non* L'Héritier which, for the same reason, cannot be upheld.

Left: The type illustration of the species now known as *Monsonia patersonii*, from William Paterson's *Narrative of four journeys into the country of the Hottentots and Caffraria. In the years one thousand seven hundred and seventy-seven, eight, and nine Illustrated with a map, and seventeen copper-plates.* First ed. (1789), J. Johnson, London, shown here almost full size, and originally published opposite page 116. Many copies of this book have uncoloured plates

It was Sweet who, in 1826, raised *Sarcocaulon* to generic level and he was followed in this by succeeding generations of taxonomists. By 1912, when Knuth made his memorable contribution to the Geraniaceae in Engler's *Das Pflanzenreich*, six species were recognised and, when Rehm revised the genus in 1935, this number had increased to twelve, which included the "uncertain" *S. burmanii* and *S. spinosum* as also *S. rigidum*, which Moffett (1979) considered a synonym of the earlier *S. patersonii*.

Merxmüller and Schreiber reviewed the Geraniaceae of Namibia for the *Prodromus einer Flora von Südwest Africa* (1966). Later, in 1976, they reinstated *S. marlothii*, which had originally been described by Engler in 1889 but had been treated by Knuth as synonymous with *S. mossamedense*. This last had been collected, in 1859, in the Angolan Namib by the German explorer Friedrich Welwitsch and described by Oliver (1868), who attributed it to *Monsonia*. Hiern had transferred it to *Sarcocaulon* in 1896. In 1932, L. Bolus added two more species, namely *S. herrei* and *S. vanderietiae*.

Such was the situation when R.O. Moffett undertook his revision of the genus *Sarcocaulon*, which was published in *Bothalia* in 1979 and which the interested reader is referred to for a more complete history of *Sarcocaulon*.

Moffett based his work mainly on living material and observations in the field and selected 13 morphological characters which he considered relatively stable and of real taxonomic value. The principal of these were the nature of the leaf, leaf margin and petiole and the colour of the petals. He devised two identification keys based respectively on minimum (resting period) and maximum (growing season) gross morphology. These keys are very helpful in the context of field work.

Moffett recognised 14 species of *Sarcocaulon*, which he divided into four sections based on leaf characters. Of the species described earlier, he retained ten and added four new ones: *S. salmoniflorum*, *S. camdeboense*, *S. ciliatum* and *S. penicilinum*. He retained none of the infra-specific taxa that had been created from time to time, particularly so by Rehm. His work stands as an example to intelligent use of taxonomic characters, combined with astute observation of ecological and, more generally, geographical data

In a significant work, Albers (1996) reviewed the taxonomic position of *Sarcocaulon* and concluded that, in view of recent scanning electron microscope (SEM) studies of the androecium ontogeny and, as already mentioned, cytological and phytochemical evidence, there was no good reason to uphold the genus, and he consequently reduced it to a section under *Monsonia*. In further support of his decision he invoked, besides the incontestable close similarity of floral morphology, the fact that the various sections of *Pelargonium*, the other large genus in the Geraniaceae, differ among themselves far more than

Sarcocaulon does from *Monsonia* and yet they continued to be encompassed in a single genus. These conclusions were confirmed by him in a subsequent work (Albers, 2002).

In 1998 Halda described a new species from southern Namibia as *S. lavrani* based on material considered by Moffett to belong to *S. patersonii*. We have decided to accept this species with certain reservations which will be discussed below. This brings the total number of species accepted at present to fifteen.

In a major contribution Touloumenidou, Bakker and Albers (2006) present compelling evidence in support of the congeneric nature of *Monsonia* and *Sarcocaulon*, based on karyological and molecular as well as palynological studies. On the basis of their research Walker (2008) concludes that, as the succulent-stemmed members of *Monsonia* fall within at least two clades within the genus, it is impossible to maintain even sub-generic or sectional status for *Sarcocaulon* and the name has to be dropped.

The geographical range of the Bushman Candles extends over the more arid parts of the west and south of southern Africa, from south-west Angola through much of Namibia and a large area in South Africa. Individual species may occur exclusively in the winter rainfall area of the south-west of the subcontinent, in the summer rainfall region of the Eastern and Northern Cape, part of the Free State, and the Namib or in both. Thus, *M. camdeboensis, M. vanderietiae, M. mossamedensis* and *M. marlothii* grow under a summer rainfall regimen; *M. salmoniflora, M. crassicaulis* and *M. lavrani* seem indifferent to when the scanty rains fall, while the remaining species are confined to the winter rainfall region. More specifically, the genus extends from near Namibe (formerly Mossamedes) in Angola, through western, central and southern Namibia to virtually the whole of the old Cape Province, where its southern limit lies almost entirely inland of the folded coastal ranges, while it reaches eastward to the Fish River valley, near Grahamstown, Luckhoff and Theunissen in the Free State, and to 23 km east of Kuruman, its north-easterly limit. *M. salmoniflora* has been reported from Botswana (Setshogo, 2005).

As stated earlier, the focus of this work, representing many years of fieldwork by us both, lies largely in the field of autecology, which in the present case concerns the relationships and interactions of the Bushman Candles to their environment. The emphasis is mostly on processes that require meticulous observation for lengthy periods, often spanning several years. An understanding of these processes is indispensable to any notion aimed at *in situ* conservation of these plants. Research in the discipline of autecology is, however, rather rare as it is costly and time consuming and requires special skills in understanding cause and effect in the context of natural and human induced processes that are continually at work in the environment.

The average annual rainfall at places where Bushman Candles are found seldom exceeds 250 mm, while the majority of the species are denizens of the most arid areas of southern Africa. Thus, Luderitz Bay, on the southern Namib coast, receives 15 mm of rain on average annually, the minimum recorded in any one year being 1 mm. Yet, *M. patersonii* is abundant here and indeed along the entire diamond coast, to around Alexander Bay, south of the Orange River. Coastal fog contributes largely to the survival of this and several other western desert species.

The altitudinal range of the genus ranges from near sea level to about 1 800 m on the interior plateau. The temperatures experienced in its habitats correspondingly cover a wide range, from a scorching 50°C in the gorges of the lower Orange River, to many degrees of frost on clear winter nights on the plateau. Individual species display varying degrees of adaptability to climatic conditions; the more widespread, particularly, *M. salmoniflora*, being the most tolerant.

These plants invariably grow in full sun, often exposed to severe winds. Some species prefer sandy flats, while others grow best in rocky places; but good drainage is the most important environmental factor where they are found, since they are extreme xerophytes and intolerant of prolonged wet conditions within the substrates in which they grow. They are leafless for most of the year, but will spring into full leaf within a day or two of the first significant shower. They can be incredibly hardy The late Hans Herre used to tell of a specimen of *M. crassicaulis* which had been lying on top of a cupboard in his office at Stellenbosch for eleven years when it unexpectedly produced a flower. It was then planted and grew on happily for many years.

Bushman Candles are subject to grazing pressures and it may be argued that these plants are, in many cases, dependent on grazing animals, whether wild or domestic. In the drier parts of their range, domestic livestock contribute in thinning out the cover of other species, thus creating favourable conditions for the sun-loving Bushman Candles to survive and proliferate The habitats frequented by them lie almost entirely outside the South African grassland areas where veld fires occur frequently. In the absence of fires grazing animals play a significant, though often underrated, role in controlling both live and dead vegetation that might otherwise tend to smother existing *Monsonia* colonies and prevent their regeneration. Bushman Candles are among the few plants that will grow happily in the driest and least hospitable corners of the southern African deserts. They are supremely adapted to conditions of drought, scorching heat and the gale force winds that sweep up the well-known fierce sandstorms of the Namib coastline and the Namibian interior.

The greatest concentration of Bushman Candles species is to be found on both sides of the lowermost course of the Orange River, in northern Namaqualand and the adjacent regions of southern Namibia. Indeed, north of the river seven species are known within a radius of 50 km of the mining town of Rosh Pinah, and to the south eight species between the Orange River and the Steinkopf – Port Nolloth road. Species densities decrease rapidly away from this centre of diversity.

M. salmoniflora, the most widespread, is met with throughout the arid interior but is absent from the coastal lowlands south of Sandwich Harbour and, so far as is known at present, north of 21° S in Namibia. By contrast, *M. vanderietiae* and *M. camdeboensis* are confined to the south-eastern parts of the Great Karoo and the Eastern Cape Province, and *M. inermis* has a very limited distribution within a few kilometres around Rosh Pinah. The narrowest endemism, by far, is displayed by

The type illustration of *Monsonia spinosa*, originally published as plate 42 in Charles-Louis L'Héritier de Brutelle's *Geraniologia* (1792). The original is a large folio 45 × 32 cm, so it is reproduced here reduced in size.

M. peniculina, known only from two small valleys in the extreme south of Namibia.

The principal differences between the succulent-stemmed and the herbaceous species of *Monsonia* have already been outlined. From *Pelargonium*, *Geranium* and *Erodium*, all three of which also occur in southern Africa, *Monsonia* differs in possessing 15 stamens, instead of 10. From *Pelargonium* it is further distinguished by the actinomorphic (i.e. radial) symmetry of its flowers.

To speculate on the origin and evolution of these plants is risky, given the present state of our knowledge. It seems fairly certain that they arose as segregates of *Monsonia*, seeing the much wider geographical distribution and less 'advanced' characters of the remaining species of that genus. By virtue of its wide range and its "softer" and less sturdy habit, *M. salmoniflora* could be considered the most primitive of the species but much further work will be required before these questions can be answered with some degree of certainty.

The Key to the succulent-stemmed species of *Monsonia* used in this book is based on characters easily recognisable in the field or in cultivation, while the plants are vegetatively active. The individual species accounts are presented in the same sequence as those in the Key.

Key to the succulent-stemmed *Monsonia* species

(Formerly *Sarcocaulon*)

1. Leaf blades not divided into segments 2
   Leaf blades divided into segments 13

2. Leaf margins entire 3
   Leaf margins incised or indented 8

3. Petals lemon-yellow; leaves grey-green; branches ascending or erect, 5–10 mm thick ..... 1. *M. spinosa*
   Petals not lemon-yellow 4

4. Petals orange or salmon-pink, stems very thin, ascending or spreading ..... 2. *M. salmoniflora*
   Petals pink, magenta, creamy yellow or whitish; branches 6–16 mm thick, spreading 5

5. Branches rigid, more than 10 mm thick, with hard waxy bark, spines thick, rigid, 10–60 mm long 6
   Branches flexible, mostly less than 10 mm thick, spreading or semi-erect; spines thin, 5–20 mm long 7

6. Branches spreading; leaves vivid or sometimes dull green; spines 10–25 mm long; petals bright pink ..... 3. *M. patersonii*
   Branches ascending; leaves grey-green; spines 15–60 mm long; petals magenta to violet ..... 4. *M. lavrani*

7. Flowers creamy yellow; roots succulent ..... 5. *M. camdeboensis*
   Flowers whitish to rose-pink; roots wiry ..... 6. *M. vanderietiae*

8. Petals various shades of yellow or whitish 9
   Petals rose-coloured to magenta, or occasionally white 11

9. Branches very rigid, 10–20 mm thick; spines stout, 20–50 mm long, various shades of yellow or whitish ..... 7. *M. crassicaulis*
   Branches rather flexible, usually less than 10 mm thick; petals bright primrose-yellow 10

10. Petals apically ciliate; spines chestnut-brown; leaves bright green ..... 8. *M. ciliata*
    Petals not ciliate; spines grey-brown; leaves dull green ..... 9. *M. flavescens*

11. Branches with long spines 12
    Branches unarmed or with vestigial spines ..... 10. *M. inermis*

12. Leaf margin shallowly undulate, base cordate; petals uniformly rose-coloured to purple or occasionally white; peduncle usually shorter than 5 mm ..... 11. *M. marlothii*
    Leaf margin markedly undulate; petals rose-coloured with white base; peduncle mostly longer than 5 mm ..... 12. *M. mossamedensis*

13. Branches with well-developed spines, 12–30 mm long; petals pale yellow ..... 13. *M. herrei*
    Branches unarmed or with blunt vestigial spines; petals white, pink or salmon-red 14

14. Roots succulent; branches 10–20 mm thick; petals white, pink, or magenta, and almost always with crimson to maroon basal blotch ..... 14. *M. multifida*
    Roots wiry; branches 20–30 mm thick; petals usually salmon-red and always without basal blotch ..... 15. *M. peniculina*

Right: *Monsonia patersonii* in the Namib desert south of the Kowisberg in the coastal fog desert of south western Namibia. The monsonias grow in stabilised gravelly sand but after sandstorms small ridges of fine sand develop adjacent to the plants. Painting: Gerhard Marx.


GERHARD MARX

Monsonia spinosa

Monsonia spinosa L'Héritier, *Geran.* t. 42 (1972)

Synonyms

Monsonia l'heritieri DC., *Prodr.* 1: 638 (1824)
Sarcocaulon l'heritieri Sweet, *Hort. brit.* ed. 1: 73 (1826)

Description

Monsonia spinosa can grow to a height of almost 80 cm and reach a diameter of 50–60 cm, although most individuals remain much smaller. Its roots are wiry and not thickened. Over the greater part of its distribution its branches are erect or steeply ascending, but we have noticed that south of Garies, when growing in deep sand at lower altitudes, the plants become more intricately branched. The branches are thin and flexible, typically yellowish in colour, tending to become grey with age. They are usually 6–7 mm thick but can reach 10 mm later and bear rows of thin, sharp, often very long spines. These are almost black on fresh growth and each bears 2–4 short-stalked leaves in its axil. The leaves are both long- and short-petioled with entire (unindented) greyish- to bluish-green blades that are rounded and measure on average 7 × 6 mm, although the short-stalked ones tend to be somewhat larger. The leaves appear swiftly after the first rains, in May or June, and have normally been shed by the middle of October. The flowers are borne singly on smooth pedicels usually 20 mm or so long. They are 30–40 mm wide and of a very characteristic colour, varying from greenish-yellow to clear lemon-yellow

Diagnostic features

Roots wire-like ***Branches*** ascending to erect, flexible, seldom more than 10 mm thick (more usually 6–7 mm), pale olive-green to grey ***Leaf blades*** not divided into segments, obovate to orbicular, margins entire, grey green;

Monsonia spinosa in the hills near Komaggas in central Namaqualand, August 2009. Photograph Connall Oosterbroek.

Right *Monsonia spinosa* Painting: Ellaphie Ward-Hilhorst.


9/77.

Distribution of *M. spinosa*

spines well-developed, thin but rigid, 20–60 mm long, very dark coloured (almost black) when young ***Petals*** lemon-yellow

It resembles *M. salmoniflora*; but in that species the stems are ascending to spreading and seldom more than 4 mm thick, and the petals are orange to salmon-pink (rarely yellow)

Geographical distribution and habitat preference

M. spinosa inhabits the dry country ranging south through Namaqualand, and has a fairly extensive distribution. It is, however, confined to the belt that receives the bulk of its precipitation in the winter period, from May to September. Plants have been collected or observed from the southern Richtersveld in the north, near Eksteenfontein, to some distance south of the Olifants River, a total north-south range of almost 300 kilometres. In general terms, this species is most frequent to the west of a line running from Eksteenfontein through Steinkopf, Concordia, Kamieskroon, Kliprand and Nuwerus, to just south of the Olifants River, the only area where it is found close to the coast.

Over most of its range, *M. spinosa* grows on weathered gneissose or granitic rocks, by preference where these are covered by a substantial layer of sand or grit. Less frequently it is present on milky quartz outcrops. South of Bitterfontein it is commonly met with on deep, red or yellowish sand. It is interesting that it has not been recorded from the slightly saline Knersvlakte and its northern and western outliers. Rainfall varies from some 125 mm in the north to 250 or 300 mm around Steinkopf


Monsonia spinosa seedlings are regularly grazed by sheep and goats throughout Namaqualand. This causes the young plants to branch repeatedly as shown in this photograph taken near Komaggas. Photograph: Connall Oosterbroek.


Details of a *Monsonia spinosa* flower and newly emerged petiolar spines. The unidentified beetle may have been seeking pollen. Photograph: Connall Oosterbroek

and in the Kamiesberg and at the southern end of its distribution. Summer temperatures can be high but in most places altitude exercises a moderating influence while winter frosts, where they occur, are not severe.

M. spinosa is widespread but never common and seems to have edaphic (soil) preferences that remain to be elucidated. This would explain why small populations occur in certain places, while the species is entirely absent from adjacent, apparently indistinguishable tracts.

History

As noted in our introductory chapter, *M. spinosa* has a long history. It appears to have been first collected in 1778 by the explorer W. Paterson, who included an excellent engraving of it, under the name of *Geranium spinosum*, in the account of his travels "into the country of the Hottentots and Caffraria" (1789). An identical painting by Robert Jacob Gordon, unpublished until 1988, may well have been the original on which Paterson's illustration was based. Gordon accompanied Paterson in 1779, when they encountered *M. spinosa*. It was first assigned to *Sarcocaulon* in 1826 by Sweet, the specific epithet *l'heritieri* having been first applied by de Candolle under the generic label of *Monsonia*.

Life history

Flowering begins in mid-August, as a rule, and lasts till the end of September or early October, depending on the rains. *M. spinosa* is not particularly floriferous, compared with some other Bushman Candles. Nevertheless, when in full leaf and flower it is a very attractive plant, the yellow stems and delicate, translucent, greenish-yellow flowers appearing in harmonious contrast to the bluish-green leaves. It is one of the easier species to cultivate in places with mild and moderately rainy winters, provided a sandy and well-draining substrate is provided.

Autecology

M. spinosa near Steinkopf in northern Namaqualand, around the granite hills near Springbok, and east of Komaggas.

M. spinosa shares its habitat with livestock throughout its distribution range. The composition of herds and practice of pastoralism varies through Namaqualand. In the central and northern areas communal grazing is commonplace, with herds primarily of sheep and goats but also smaller numbers of cattle. Donkeys and some horses are ubiquitous near villages in the summer but range far and wide across the countryside in the winter months. At this time the local inhabitants re-occupy their winter grazing camps when the first rains begin, usually during May. In other parts of Namaqualand, particularly in the hilly granite country south of Springbok, extensive farms are stocked with sheep and goats. Grazing pressures are not as heavy here as in the communal areas, and there is usually a much denser cover of succulent and other perennial shrubs.

Grazing patterns have a marked and interesting effect on the *M. spinosa* distribution throughout Namaqualand. It is unfortunate that there are little data on the relationship between indigenous antelope species and the flora of Namaqualand. It may well be that nomadic pastoralism has many parallels to the past, at a time when wild herds moved seasonally over huge areas according to grazing conditions. The main difference nowadays lies in an increasing number of people living in the larger towns and settlements, keeping livestock which graze the countryside all year round. These factors are considered in the account which follows drawn from observations we have made over the years.

The granite hills south and south-west of Springbok

The granite domes of Namaqualand are a characteristic feature of the countryside between Springbok and Garies. The vast sheets of exposed rock and the sand-filled seepage areas which traverse them harbour a rich succulent and bulbous flora. These plants thrive in conditions that are often very wet for weeks on end in the rainy winter months and bone dry in summer. The vegetation on the rocky areas below the granite domes consists of dense shrubs and the succulent species here are either adapted to shady conditions or are tall and robust themselves

Details of the flowers and growth habit of *Monsonia spinosa* in the western foothills of the van Reenen se Water Mountains near Komaggas. Photograph Connall Oosterbroek.

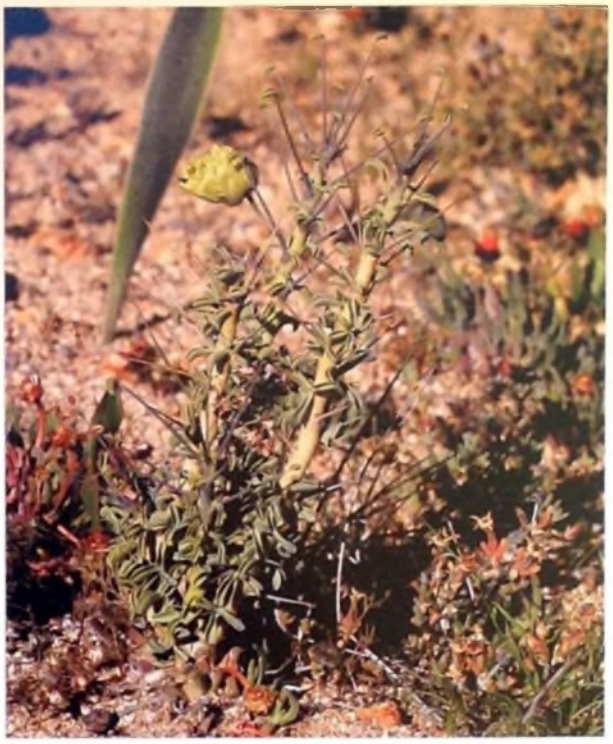
such as *Tylecodon paniculatus*. For these reasons *M. spinosa* is a minor and often rather scarce component of the flora around the rocky domes in northern and central Namaqualand. The plants however reach their largest sizes here and are conspicuous when bearing their lemon-yellow flowers from August to October

There are few niches suitable for *M. spinosa* as the vegetation is too dense to permit the establishment of seedlings. The plants grow in the rockiest areas that are usually exposed to direct sunlight. In these places they experience the least competition from other shrubby plants.

M. spinosa near Komaggas

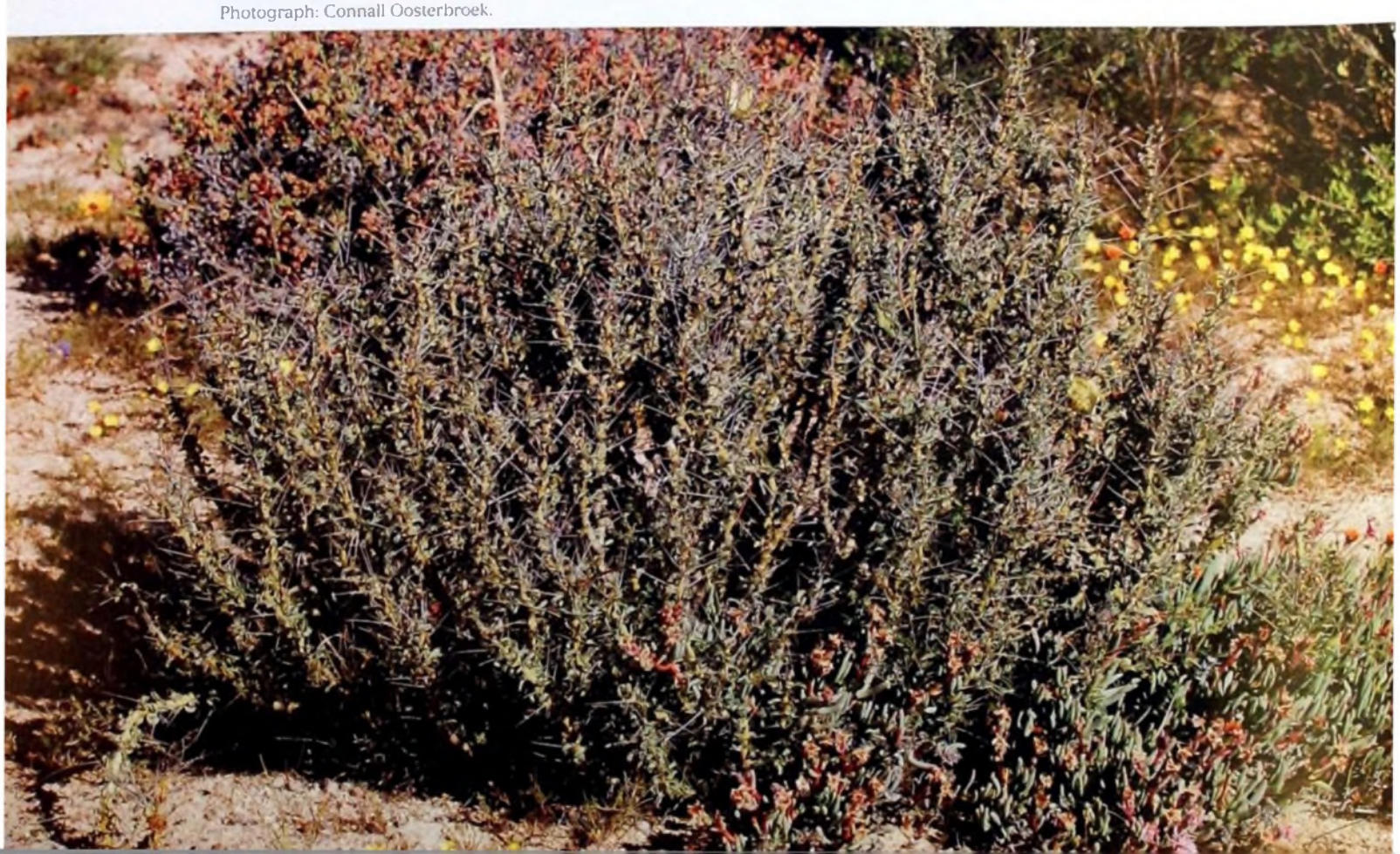
The Komaggas hills form a range that runs north-west and south-east of Komaggas, a small town in northern Namaqualand. The region is very rich in bulbous and succulent plants. Heavy grazing takes place throughout the winter months when the vegetation is in active growth. *M. spinosa* occurs together with *M. ciliata* in the Komaggas hills but is usually much less in evidence. It prefers open sandy places, which are often heavily grazed by goats, sheep and donkeys. The result of trampling is that few seedlings are able to survive. The peak flowering and seeding period also takes place at a time of the year when grazing is at its heaviest, lessening the chances for seeds to germinate successfully.

The shrubby vegetation found on the Komaggas hills is similar to that around the granite domes near Springbok.



Monsonia spinosa often grows together with a rich and varied bulbous flora in Namaqualand. This plant was photographed growing together with *Haemanthus unifoliatus* on sandy hills near Komaggas. Photograph: Connall Oosterbroek

Monsonia spinosa often reaches a very large size. This plant in the hills near Komaggas measured about 140 cm across at the base. Photograph: Connall Oosterbroek.



Monsonia spinosa typically grows amongst large boulders in many parts of west central Namaqualand. This plant in the Spektakel Pass, west of Springbok, was growing in deep gritty sand surrounded by large rocks. Photograph: John Lavranos.

The main difference though lies in the density of the vegetation. Heavy grazing pressures around Komaggas keep the habitat much more open and this has the effect of increasing the number of places suitable for *M. spinosa* to colonise. The paradox however is that the most open places are also those that are most heavily grazed. Grazing pressures are not the same every year and it appears to be this variation that permits some of the *M. spinosa* seedlings to establish themselves.

M. spinosa near Steinkopf

The sandy plains that lie at the foot of the mountain near Soebees, west of Steinkopf, contain well established and locally plentiful colonies of *M. spinosa*. Large numbers of livestock, a naturally open and sunny habitat and deep sandy soils have all connived to create ideal conditions for the monsonias. Grazing livestock is spread out evenly over the terrain and is not confined to open areas between tracts of dense shrubs. This lessens the chances for heavy trampling in specific places.

These Bushman Candles, whilst they are not trampled to any significant extent, are grazed early in their growing season and during dry winters when grazing is scarcer. In addition to keeping the habitat open, livestock also loosen the soil creating conditions for large numbers of *Monsonia* seeds to lodge soon after they have been shed. Well-grazed open countryside has also benefited the numbers of other plants, particularly those readily able to resist trampling or are poisonous to livestock. The otherwise rare *Pelargonium radicatum* is locally plentiful in open places with gravelly sand. *Haemanthus namaquensis*, which is not grazed by livestock, has made good use of the open conditions and occurs in quite large clumps which are sparsely but widely scattered across the countryside.

Conservation status

This species is under no great threat at present. Grazing of new growth by sheep or goats has been noticed throughout its range, but plants seem to recover well. The main threat to the survival of *M. spinosa*, as to that of so many other Namaqualand plants, stems from the severe and progressive degradation of its habitat. Regeneration is often sporadic, although this may well be normal for the species.

Monsonia salmoniflora

Monsonia salmoniflora (Moffett) F.Albers,
S. Afr. J. Bot. 62(6): 346 (1996)

Synonyms

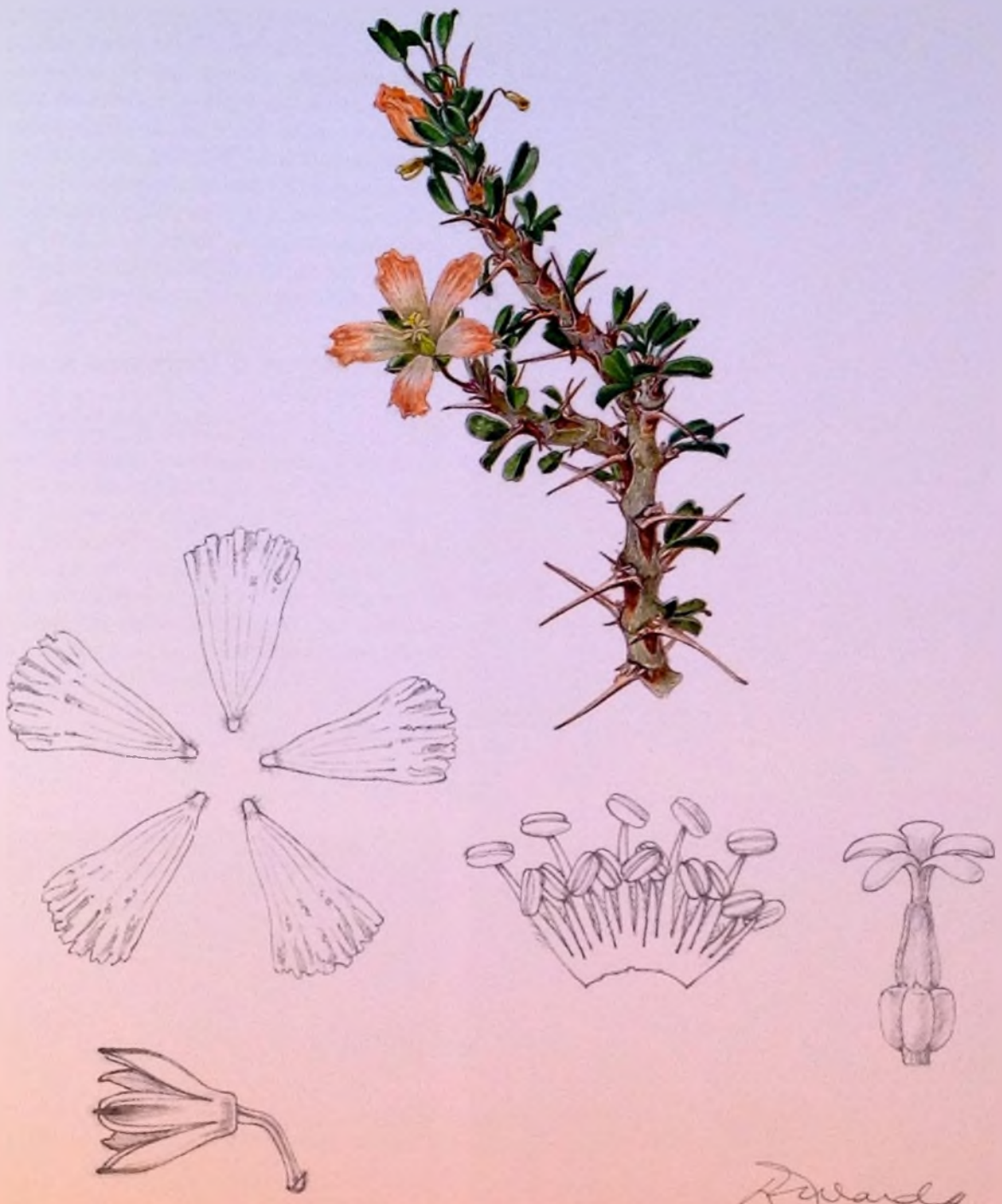
Sarcocaulon salmoniflorum Moffett, *Bothalia* 12: 590 (1979).
Sarcocaulon l'heritieri DC. var. *brevimucronatum* Schinz, *Verh. Bot. Ver. Prov. Brandenb.* 29:58 (1888).
Sarcocaulon patersonii (DC.) G.Don ssp. *typicum* Rehm, *Bot. Jb.* 67: 268 (1935).

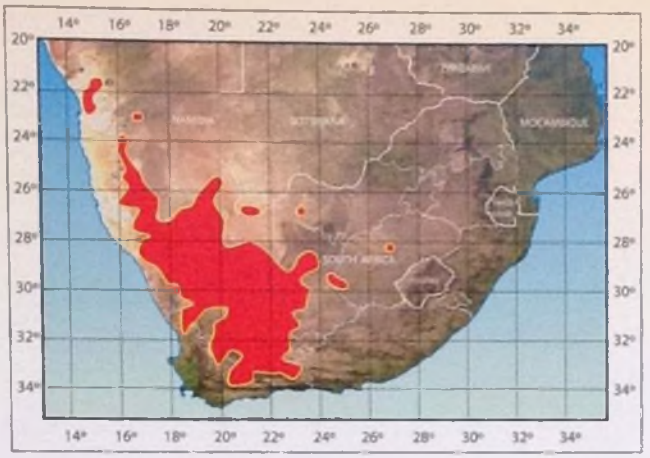
Description

The roots are fibrous and tough. The branches are flexible and seldom more than 4 mm thick with thin, 4–30 mm long, straight or recurved spines. Like most of the other species, it bears leaves with long petioles (stalks) and others with short ones. The leaf blade is smooth, without hairs and variously elliptical in outline, with entire margins and an indentation at the apex, and measuring 4–10 × 3–5 mm Short-stalked leaves tend to be somewhat longer in total than those with long petioles. Open flowers are around 30 mm across and are carried on pedicels about 7 mm long. The sepals are smooth or slightly hairy, some 7 mm long and terminate in a long, thin point. The petals are translucent, rounded and most frequently salmon-pink or orange-yellow in colour, while bright yellow forms do occur occasionally.

Monsonia salmoniflora is common throughout Bushmanland. The sandy foreground with *Aloe dichotoma* is the typical habitat in the Klein Pella area Photograph: Connall Oosterbroek

Right: *Monsonia salmoniflora*. Painting: Ellaphie Ward-Hilhorst.





Distribution of *M. salmoniflora*

Diagnostic features

Roots wire-like ***Branches*** ascending to spreading, flexible, seldom more than 4 mm thick, pale olive-green to grey. ***Leaf blades*** not divided into segments, narrowly to broadly elliptic, margins entire, greyish; ***spines*** well developed, thin, 12–30 mm long, grey. ***Petals*** orange-yellow or salmon pink or occasionally bright yellow.

It resembles *M. spinosa*, but in that species the branches are thicker, and the petals are lemon-yellow.

Variation

As might been expected from its wide range and the inevitable variation in its growing conditions, *M. salmoniflora* shows a considerable degree of variation which, however, is largely confined to its habit of growth, while the leaf and flower characters remain remarkably uniform, wherever it is found. In the central Namib it is a low growing, little-branched shrublet. Further south in Namibia the branching becomes more intricate but the size generally remains small and these characters persist almost throughout its South African distribution. A notable exception to this can be found some distance east of Springbok, in Namaqualand, where plants exceeding 50 cm in height and as wide have been seen in some abundance. Moffett (1979) recognised two growth forms of *S salmoniflora* a northern, dwarf form with recurved spines that is characteristic of the Namib desert and also the southern and south western fringes of its distribution; and a taller form, with fairly long and ascending branches and straight to slightly curved spines that inhabits the remainder of its range. The tall plants from western Bushmanland belong to the second of these forms.

Geographical distribution and habitat preference

This, undoubtedly, is the most widespread among the species of Bushman Candles. It has been observed or collected from the central Namib, along the road from Henties Bay to Uis, and southwards in a widening west-east belt through much of Namibia. In South Africa it is present throughout the central and upper Karoo, east of the main winter rainfall belt. The southern limit of its distribution runs from near Touws River, along the northern foot of the Swartberg range to Aberdeen. It has been recorded as far east as Luckhoff and Fauresmith. In the north-east it has been found about 23 kilometres to the east of Kuruman, and also between Theunissen and Welkom in the Free State.

Monsonia salmoniflora, like many of the Bushman Candle species, flowers with or without leaves on its branches This plant was growing in red sand south of Aus in south-western Namibia. Photograph: Dawie Human.

Monsonia salmoniflora on the farm Leeufontein in the Theunissen district of the Free State. The plants are quite often uprooted and grazed here by re-introduced antelope species, particularly in the second half of winter as grazing becomes scarce Photograph: Connall Oosterbroek.

With such a very wide distribution it is impossible to generalise on the climatic, edaphic, and other conditions under which this species grows. One thing is certain, namely that it is virtually absent from those parts of southern Africa where winter rainfall conditions predominate. It inhabits arid country, where the average annual rainfall ranges between 25 and 200 mm. Only in the extreme north-east of its range is the rainfall higher; but here it grows on particularly shallow, permeable soils. Over the entire range summer temperatures are very high and often exceed 45°C. By contrast, winters are very cold, particularly on clear nights, when minima of well under -10°C have been recorded in places. Most of its habitat is, moreover, exposed to persistent, desiccating winds.

M. salmoniflora does not exhibit any particular edaphic preferences and grows equally well on soils derived from basement rocks, Karoo sediments, or surface limestone. It is also found on deep sand.

History

The taxonomic history of this species is rather complex and we feel it is unnecessary to bore the reader of this book with all the relevant details. Those interested ought to consult Moffett's excellent monograph that has already been referred to repeatedly in these pages. Suffice to say here that *M. salmoniflora* has in the past been assigned to at least three taxa of *Monsonia*, namely to a variety of *S. l'heritieri* and also two varieties of *S. patersonii*. It was Moffett who established that it represented a distinct entity and gave it its present specific name.

Life history

For the greater part of the year *M. salmoniflora* remains in the leafless state and only bursts into active growth after good autumn or spring rains

Protodesma orpenii grows all around the arid calcrete hill slopes where *Monsonia salmoniflora* used to grow, 20 kilometres east of Kuruman in the northern Cape. Photograph: Connall Oosterbroek

The pebbly calcrete ground on which *Monsonia salmoniflora* used to occur east of Kuruman was largely devoid of dry flammable grass cover that could cause dry season winter grass fires. Photograph: Connall Oosterbroek

Autecology

M. salmoniflora in south-western Namibia and South Africa

As already stated, *M. salmoniflora* with its very wide distribution is relatively uniform across most areas. We are therefore concentrating, in the discussion that follows, on populations that grow under conditions that differ from one another with respect to rainfall, soil types and geology. *M. salmoniflora* is the only succulent-stemmed *Monsonia* that extends well into a grassland biome. Two others, *M. camdeboensis* and *M. vanderietiae*, occur to a minor extent on the periphery of true grasslands.

The occurrence of *M. salmoniflora* within grasslands poses some significant and interesting questions about the relationships of the succulent stemmed *Monsonia* species to the herbaceous ones. The latter have a wide distribution in the grasslands of southern Africa, dying back in the winter as the grasslands dry out. All of them are regularly burnt in winter grass fires and perpetuate their populations by means of seeds that escape the fires and germinate when the first rains fall or else survive by perennial underground structures. Succulent-stemmed monsonias cannot survive in true grassland biomes owing to their waxy stems which blaze furiously when set alight.

The inclusion of *Sarcocaulon* in *Monsonia* is based on morphological and molecular grounds. An extension of this approach, adding additional dimension to the rationality, is provided by including processes that occur in the habitats, such as grass fires. The genus *Pelargonium* in southern Africa has many parallels. The majority of species that grow in summer rainfall grasslands are tuberous with the stems and leaves dying back in the dry winter, when they are burnt with everything else in the fires. The few

Monsonia salmoniflora on the summit of the Tiras Mountains in south-western Namibia. Here the plants grow in stony ground littered with white quartz fragments. Photograph: Tim Harvey.

true shrubby species survive either by re-sprouting from a thickened underground root system or in occurring as annuals. One shrubby species, namely *Pelargonium graveolens* escapes the worst effects of grass fires by growing amongst rocky scree at the bases of cliffs. This is typical of the *Pelargonium* in places where it occurs below cliffs along the central and western Soutpansberg in Limpopo Province, South Africa. The rocks below the cliffs along the Soutpansberg are as much of a fire exclusion zone as are the dolerite and calcrete areas, with little flammable material, inhabited by *M. salmoniflora* in the grasslands near Theunissen and Kuruman. Succulent-stemmed pelargoniums do not occur in grassland ecosystems driven by fire for the same reasons as those which exclude succulent-stemmed monsonias. The greatest diversity of *Pelargonium* with respect to shrubby, tuberous, and succulent forms occurs outside grasslands. The same applies, in a general sense, to the Bushman Candles.

The newly described *Avonia lavbleckiana* grows amongst calcrete pebbles on arid west-facing hill slopes where *Monsonia salmoniflora* used to grow. The monsonias at this locality, east of Kuruman, have now been trampled out by livestock.
Photograph: Connall Oosterbroek.

M. salmoniflora near Theunissen in the Free State grasslands

The farm Leeufontein lies in the Theunissen district and is characterised by short grassland with prominent dolerite hills that rise above the surrounding plains. These hills contain extensive sheets of exposed rock on their summits as well as areas with loose and fixed dolerite boulders. The grass cover is very sparse on top of the hills but becomes more dense on their slopes. At the base of the hills there is the typical short grassland of the north-central Free State, interspersed with fire-resistant shrubs and trees such as *Searsia lancea*.

Leeufontein was visited in the middle of August 2008, only two weeks away from the beginning of the southern spring. It is also near the end of the dry winter and a good time to assess the relationship of *M. salmoniflora* to the distribution of dry grasses on the hilltops.

The farm belongs to Mr Samuel Pauw and is a private nature reserve stocked with 15 species of indigenous herbivores of which gemsbok (oryx), springbok and black wildebeest were the most abundant at the time of the visit. There were also about 25 ostriches. There had been no winter grass fires on the hills before the field trip and also none in the surrounding grasslands, including the neighbouring property of the Joel Mine.

The preceding summer had been one of good rainfall and there had also been some rain during the winter. The timing of the visit fortuitously turned out to be ideal for collecting significant data about the autecology of *M. salmoniflora*.

The plants were observed growing scattered across the rocky flat hilltops and occupied several niches. They grew with their roots wedged into soil-filled cavities on sheets of exposed dolerite, beside rocks where shallow soil had accumulated, and also in thin gritty soils over rocks. They avoided depressions amongst the rock sheets which become seepage areas after rainfall. These places are rich in annual herbs and grasses where there is enough soil, and there are colonies of the amaryllid *Nerine laticoma* where the soil is deep enough for their bulbs.

The monsonias grew mostly as solitary plants and occasionally in small groups. Regeneration was evident

Nerine laticoma grows in seasonally moist seepage areas close to where *Monsonia salmoniflora* occurs on dolerite outcrops near Theunissen in the Free State. This photograph, taken at the end of winter, shows the dry *Nerine* leaves.
Photograph: Connall Oosterbroek.

Connall Oosterbroek, Samuel Pauw, Dawie Human, Jan Molise and Charles Craib on the farm Leeuwfontein 256 in the Theunissen district. Photograph: Les Bush.

everywhere, with seedlings and young plants observed in all the different niches occupied by the species. All the places frequented by *M. salmoniflora* are in direct sunlight for most of the day and temperatures on the rock sheets during the day in summer are very high. A few monsonias were encountered in rocky places largely devoid of grass on the upper third of the hill slopes near their summits. They disappeared lower down, close to the point where perennial grasses become a regular feature at the locality. They were also absent from suitable habitat, mainly low rocky outcrops, which occasionally occur at the bottom of the hill slopes. It is probable that a combination of winter grass fires as well as low winter temperatures at night, with severe frost, prevent the monsonias from growing in these lower areas

An interesting observation was that, all over the tops of hills, mature *M. salmoniflora* had been uprooted. Plants freshly dug up were in evidence everywhere as well as others in various stages of decomposition. The same circumstances were encountered along the Orange River in south-western Namibia. Here it is likely that antelope species, probably oryx, had destroyed *M. crassicaulis* in an identical manner. Oryx were the second numerous introduced indigenous species on Leeufontein at the time the data was collected and may have been the animals that uprooted the monsonias. Further research will be required to confirm which animals uproot the plants, whether or not this is prevalent at certain times of the year, and the overall effects this has on the populations. The reasons the monsonias were excavated is not clear since the root areas were not eaten at all. Had porcupines been responsible for the damage, chewed roots would probably have been in evidence as well as their droppings and quills. There was a preliminary indication that only the largest *M. salmoniflora* were targeted which would eventually impact on the numbers of plants on these hills.

A large *Monsonia salmoniflora* in the eastern Tiras Mountains of south-western Namibia. The monsonias grow in rocky places typically amongst other succulent shrubs such as *Euphorbia* species. Photograph: Tim Harvey.

M. salmoniflora in the grasslands east of Kuruman

The region between Kuruman and Vryburg in the North-West Province, a distance of about 150 kilometres, is flat and featureless. It contains grasslands of various types, often dotted with *Searsia lancea*, *Ehretia* cf. *rigida* and large numbers of camphor bushes, *Tarchonanthus obovatus*, a dominant large shrub in the area. In some places exposed level rocky areas and gentle slopes of calcrete are found interspersed with grassland. Much of the habitat in the west has been degraded by overgrazing as well as a proliferation of annual and perennial weeds associated with these conditions

Some 25 years ago, while looking at what appeared an interesting biotope consisting of a broad, gently sloping expanse of hardpan (calcrete), along the eastern bank of the Manyeding seasonal stream-bed that crosses the national road some 23 km east of Kuruman, the authors were surprised to chance upon a few plants of *M. salmoniflora* The place is shown on certain maps as Wesselsvlei, in what is now the North-West Province. The area was almost bare of grasses but harboured an array of interesting other species, notably the fine, yellow-flowered *Prepodesma orpenii*, the dwarf *Ruschia calcarea*, a diminutive species of *Pteronia*, a species of *Bulbine*, a tiny *Euphorbia* apparently related to the Namibian *E. juttae* and, most surprisingly, a species of *Avonia*, undescribed at the time. Dr Graham Williamson, who visited this locality on three occasions in recent years, was good enough to supply us with the names of the above but has reported that he found not a trace of *M. salmoniflora*.

It is worthy of note that most of the species mentioned above do also occur in the sparse, overgrazed grasslands adjoining the site where the *M. salmoniflora* once grew The only exceptions seemed to be the little *Euphorbia* and the *Avonia*, which appeared to shun the presence of grass cover, as must have been the case of the monsonias. The locality is surrounded by extensive and rather featureless short grasslands that are subjected to frequent burning. No succulent *Monsonia* could survive the resulting regimen! The recent disappearance of *M. salmoniflora* from this area is undoubtedly due to worsening pressure from ever-increasing numbers of humans and their accompanying stock. This, so far as we know, is the first adequately documented instance of disappearance of Bushman Candle species from its former habitat.

Monsonia salmoniflora grows sparingly across the summit of the Huib Hochplateau in south-western Namibia. The plants often grow above seasonal water courses on dry dolomite ridges. This photograph was taken on the farm Aar at the northern end of the plateau. Photograph: Dawie Human.

M. salmoniflora near Patatsrivier

Patatsrivier is a tributary of the Grootrivier north-west of Matjiesfontein in the winter rainfall western Karoo. *M. salmoniflora* is at the south-western boundary of its distribution range in this area and occurs close to *M. crassicaulis* but rarely shares the same habitat. *M. crassicaulis* prefers arid stony ridges whereas *M. salmoniflora* grows in greyish clayey soil with large amounts of shale fragments. *M. salmoniflora* is found mainly on the sides of gently undulating hills and more rarely in flat open areas. It avoids the washes and seepage areas which are common in the western Karoo and remain moist for long periods after rain in the winter.

The region around Patatsrivier and further westwards is used extensively for sheep farming but *M. salmoniflora* is rarely grazed. The main factor that limits its occurrence is the habitat, since most of the areas with deep soils are well colonised by various karoid shrubs. *M. salmoniflora* may be locally common in places where there is thin shaly soil but, as at all other localities where we have observed these plants, they grow singly or in small groups.

The growing and flowering season of the monsonias here is mainly the autumn and winter months from May to August, and the rain which falls is generally light and penetrating. In common with most other Bushman Candles, this species responds rapidly to rainfall at any time by flowering shortly afterwards, often in the leafless state.

Monsonia salmoniflora is capable of taking root in cracks on rocks. This photograph was taken on a dolerite outcrop on the farm Leeufontein near Theunissen in the Free State. Photograph: Connall Oosterbroek

M. salmoniflora on the Tiras Mountains in south-western Namibia

The Tiras Mountains in south-western Namibia lie within the boundaries of the Tiras Berge Conservancy. This is a privately owned reserve consisting of five farms and covering an area of about 125,000 hectares. Stock farming is practised alongside ecotourism and there is a strong emphasis on the preservation of fauna and flora. A number of rare plants are preserved in the conservancy, such as the recently described *Namaquanula bruynsii* and large numbers of *Aloe argenticauda*. *M. salmoniflora* is plentiful on the Tiras Mountains and is associated with detrital granite or gneiss on the summit plateau. The plants growing on the farm Tiras are typical of the occurrence of this species in the general area.

The south eastern section of the mountain range is situated adjacent to the C13, the road that runs from Aus to Helmeringhausen. The summit is very rugged and convoluted and *M. salmoniflora* occurs on dry ridges in the valleys below the high peaks. The monsonias grow amongst large boulders as well as rock fragments in places where they receive little competition from xerophytic shrubs. These shrubs grow mostly in deep soil close to rivulets and seepage areas, which remain moist longest after rainfall.

Some of the *M. salmoniflora* are very large for this species, up to about 40 cm high and 50 cm across. They are usually widely dispersed across the habitat, occurring singly or in small scattered groups. Young plants and seedlings are scarce, limited by the very rocky nature of the habitat on the ridges frequented by the plants.

These Bushman Candles may retain their leaves for several months after rainfall and they also continue to flower sporadically. This is an unusual feature amongst Bushman Candles, the majority of which quickly shed their foliage when conditions dry out.

Cattle ranching on the Tiras Mountains has had little if any effect on *M. salmoniflora*. The herds graze mostly in areas with the highest concentrations of scattered grass tufts, which are avoided by the monsonias.

These plants are invariably found growing in places fully exposed to the sun and their rocky habitat becomes very hot in the summer. The southern aspects of the Tiras Mountains carry a different and equally rich variety of succulents, of which the shrubby *Pelargonium xerophytum* is usually the most abundant.

Horticultural potential

In terms of horticultural interest, *M. salmoniflora* is not a particularly exciting plant. Its thin branches and often untidy growth lack the aesthetic appeal of most of its relatives. Its flowers are dainty but small and rather dull in most forms, though some populations produce vivid salmon-coloured flowers (hence the specific name) and others carry blooms coloured bright lemon yellow.

Conservation status

M. salmoniflora is rarely met with in dense stands. Isolated small groups of 3 to 4 individuals are its normal mode of occurrence On account of its extensive range, the arid nature of its habitat and its probable unpalatability to stock, it certainly is the least threatened species within the group. It should, however, be noted that certain populations along the north-western periphery of its distribution and which the authors have been keeping an eye on for some 35 years, seem to have suffered considerably in recent times as a result of human interference.

A specimen of *Monsonia salmoniflora* ripped out of the ground by re-introduced antelope species on the farm Leeufontein near Theunissen. This is a common occurrence on the farm and may have taken place regularly before game herds were replaced by livestock. Photograph: Connall Oosterbroek.

Monsonia patersonii

Monsonia patersonii DC., *Prodr.* 1: 638 (1824)

Synonym

Sarcocaulon patersonii (DC.) G.Don, *Gen. Syst.* 1: 715 (1831).

Description

Characteristically *M. patersonii* forms low shrubs, usually no more than 15 cm tall that are only moderately branched, although very old specimens may exhibit somewhat more complex branching. The branches almost invariably are very slightly ascending or horizontal, this character being diagnostic of the species as accepted here. They are 10–15 mm thick with a hard, greyish to wax-yellow bark that persists as long skeletal tubes after a plant has died. It is, so to speak, the archetypical "Bushman Candle". The petiolar spines are robust and rather short, rarely exceeding 2 cm in length and tend to be somewhat blunt, compared with those of many other species. The leaves are a light, bright green tending to yellowish-green and turning reddish-brown at the onset of drought. Under these circumstances they are soon deciduous. The leaf blade is generally obovate in shape, markedly folded along the mid-rib, the margins being entire and the apex indented. The pedicels are rather short and, generally speaking, do not exceed 20 mm. Flower colour is usually bright pink, varying from almost white to a clear or even fairly dark pink, but without the magenta or purple component characteristic of *M. lavrani*, which follows immediately in this account. The flowers are between 20 and 30 mm in diameter and wide open, the petals standing out horizontally, and slightly recurved towards their outer margins, which are somewhat uneven or crenulate.

Diagnostic features

Roots wire-like ***Branches*** spreading, rigid, more than 10 mm thick, pale grey to almost golden-yellow with a hard waxy bark. ***Leaf blade*** not divided into segments, narrowly to broadly obovate, margins entire, vivid green; ***spines*** well-developed, thick and rigid, yellowish-brown, 10–25 mm long ***Petals*** usually bright pink

It resembles *M. lavrani*, but in that species the branches are ascending, the leaf blades are grey-green, the spines are 15–60 mm long, and the petals are magenta to violet.

For the purposes of this work, the name *M. patersonii* is confined to the rose-flowered, more or less horizontally branched plants that occur within the fog zone a short distance from the South Atlantic coast, from just south of the Orange River in South Africa, to a point a little north of Luderitz, in Namibia.

Moffet (1979) includes under this species the larger plants with pale magenta to purple flowers, blue-green leaves, ascending to erect branches and very long spines that populate the sandy and stony flats away from the coast, where fogs are much less frequent or absent and the air generally drier These plants have recently been assigned to *M. lavrani*.

Monsonia patersonii growing in stabilised gritty sand in the Namib desert about 20 kilometres east of Luderitz in south-western Namibia. Photograph Tim Harvey.

Right: *Monsonia patersonii*. Painting Ellaphie Ward-Hilhorst


12/77.

Distribution of *M. patersonii*

Monsonia patersonii about 20 kilometres south of Alexander Bay in the Northern Cape. The plants are often so heavily blotched with lichens that their trunks become obscured
Photograph: Connall Oosterbrock.

Geographical distribution and habitat preference

As stated above, *M. patersonii* occurs within a short distance from the South Atlantic coast, from just south of the Orange River in South Africa, to a point a little north of Lüderitz in Namibia. In the south of its range the species occupies a belt not exceeding some 20 km from the coast In the southern Namib this belt gradually widens to over 40 km along the road from Lüderitz to Aus. It reappears, after a gap in its distribution, in the high country around the latter town.

M. patersonii is usually found in flat gravelly areas where it often occurs in huge populations. It is also present on gently sloping rocky surfaces, where the ground is normally covered by a few centimetres of windblown sand. In these conditions the roots are most often embedded in crevices or between the slabs of schistose rock. As already stated, it is invariably associated with the dense, wet fogs which are such a well known characteristic of the coastal belt between Saldanha Bay and Angola The rainfall decreases northwards along this coast, averaging some

A large specimen of *Monsonia patersonii* flattened out against the sand by frequent strong winds. This plant is covered in leaves and flowers after dense winter fogs that condense along the coast as light penetrating rain. Photograph: Tim Harvey.

40 mm in the south and 15 mm around Luderitz. As a rule, rain falls in winter, while the summer months are generally dry. Temperatures are fairly uniform and frost is absent. Distinct cold spells follow the passage of South Atlantic frontal systems while temperatures can rise into the upper thirties Centigrade when high pressure over the interior to the east causes descending hot easterlies, locally known as "berg winds". As high pressure over the southern African interior is mainly a winter feature, it is not surprising that the highest temperatures recorded along the southern and central coasts of the Namib desert are mostly observed in the winter months.

History

As mentioned earlier in this work, *M. patersonii* was first gathered by Paterson (1789) who published a very good colour plate of the species under the name *Geranium spinosum*. For technical reasons that does not count as a valid publication of the name. The specific epithet *patersonii* was coined by de Candolle (1824) who placed it in *Monsonia* and applied it, validly, to another species of Bushman Candle.

Life history

Plants mostly flower when in leaf and a large population in full flower after good rains is an unforgettable sight in this starkest of environments. Flowers have been recorded almost throughout the year but are apparently absent in October and November (Moffet, 1979).

This specimen of *Monsonia patersonii* on the Lüderitz peninsula in south western Namibia appears to have succumbed after being smothered by dense accumulations of lichens.
Photograph: Connall Oosterbroek.

Autecology

M. patersonii in south-western Namibia and the adjacent part of the Northern Cape in South Africa

The habitat niches colonised by *M. patersonii* are distinctive as they are characteristically frequently bathed in coastal fog which falls as fine rain and often wets the sand in which these plants grow. These mists are frequent at certain times of the year, particularly in the autumn, winter and spring. It is at these times that the Bushman Candles grow, flower

Monsonia patersonii often grows in the protection of sheltering rocks on parts of the Lüderitz peninsula that are frequently scoured by strong winds. Photograph: Connall Oosterbroek.

and set seed. Flowering and seed setting may be prolific in years when there are heavy and prolonged fog periods

All the habitats occupied by this species along the coast are subject to severe, often gale force winds. In fact, wind plays a most significant and, at first glance, paradoxical role in the autecology of this species. Wind is responsible for dispersing seeds far and wide throughout the habitat. It also limits opportunities for seeds to germinate by burying them too deeply in the sand or sweeping them to areas of shifting sand dunes. These Bushman Candles are only able to grow and take root in areas of stabilised gravelly sand that are a prominent feature of the coastal deserts east of Luderitz

The littoral desert to the east and south-east of that small town is characterised by vast populations of the *M. patersonii*. In these places they have no competition from other vegetation. The opposite is the case on the Luderitz peninsula where habitat niches are quite often competed for by shrubby species of *Othonna* and *Pelargonium* as well as other non-succulent species. The situation is much the same south of Alexander Bay in South Africa and near the mouth of the Orange River

In general, few of the *Monsonia* habitats are protected in any way from the full force of strong winds The exceptions are some sheltered depressions, or the leeward sides of rocky outcrops along the Luderitz peninsula

This *Monsonia patersonii's* roots have been almost completely exposed by the scouring effects of strong winds. The photograph was taken on one of the sections of the Luderitz peninsula most exposed to onslaughts of fierce wind
Photograph: Connall Oosterbroek

and the plains between the rolling sand dunes south of Alexander Bay. In these localities various lichens take hold, often festooning the *M. patersonii* branches like forest moss. These lichen growths often kill off the oldest monsonias and together with gale force winds are the major factor that stabilises the numbers of these prolific plants

Monsonia patersonii often grows with clusters of branches facing away from the prevailing winds on the Luderitz peninsula
Photograph: Connall Oosterbroek

It may be that the autecology of these Bushman Candles, so inexorably intertwined with winds and coastal fog, should be taken into account for separating this species from *M. lavrani*. This extra dimension, external to the physical characteristics of the plants, is necessary for a holistic understanding of the various species in the genus.

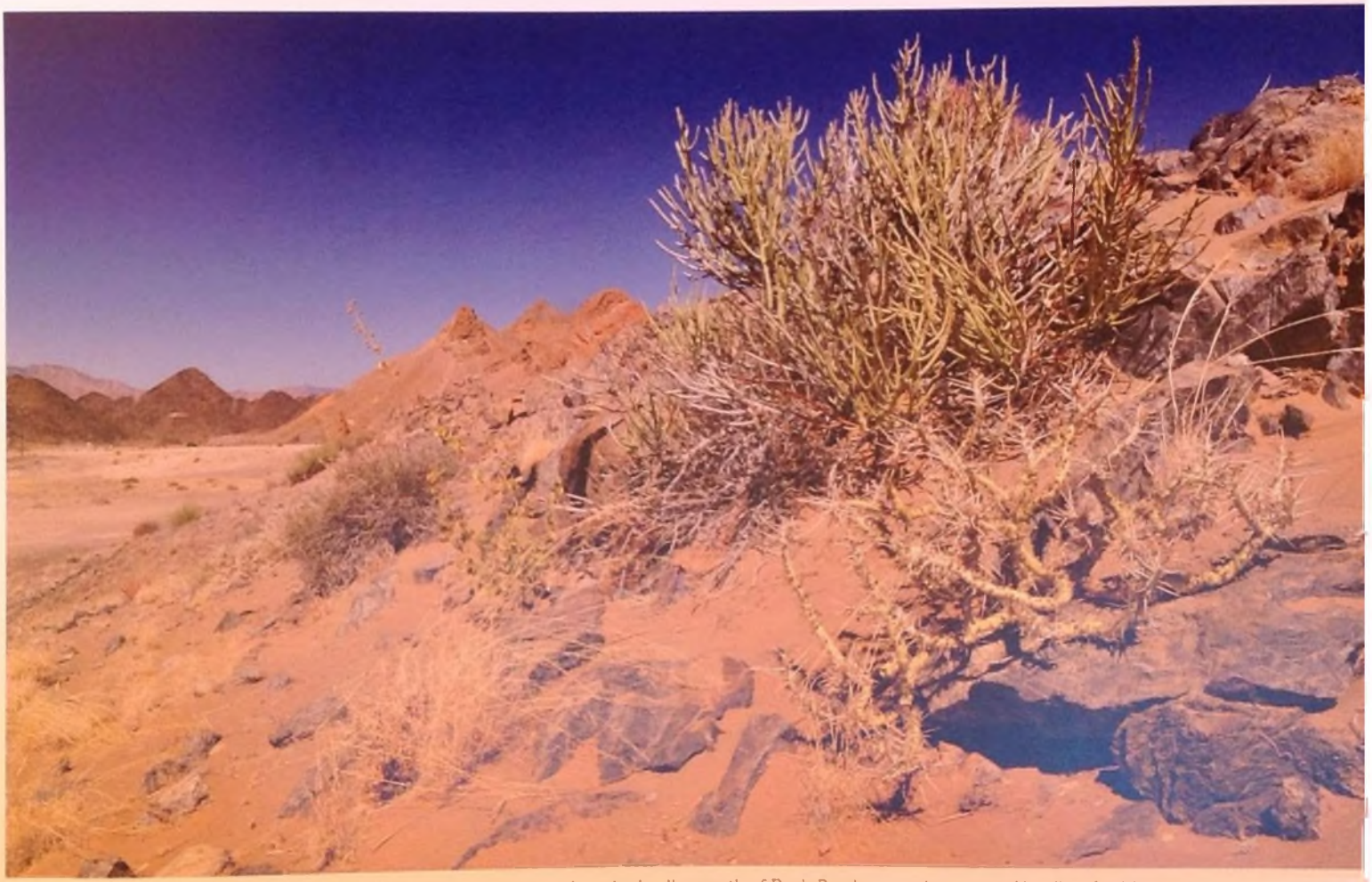
The following discussion focuses on particular *M. patersonii* colonies in times of drought and of plentiful rains. This information provides a glimpse of how these plants live in their harsh wind-scoured desert environments.

Monsonia patersonii, here growing on the Lüderitz peninsula, often has clusters of branches facing away from the prevailing winds. Photograph: Connall Oosterbroek.

Colonies on the sandy plains south of the Kowisberg near Lüderitz

Some of the most spectacular coastal desert scenery in the Namib is to be found on the coastal plain south of Kowisberg, some 20 to 30 kilometres inland from Lüderitz. These plains are blasted with gale force winds at various times during the year. The grit which these winds carry close to the ground abrades the stems of the monsonias with the efficacy of coarse sandpaper. The effect of this is to rip off the petiolar spines from the stems. These trunks appear a rich burnished golden yellow when the plants are in their leafless state during the summer months. After growing seasons when there has been a good amount of moisture, the ends of the branches grow out carrying fresh petiolar spines only to be abraded once more as the summer gales resume.

At times during the winter and early spring, many thousands of the Bushman Candles are visible from afar. Their bright green leaves and conspicuous pink flowers form swathes across the low lying areas of the coastal desert.



Monsonia patersonii occurs scattered across the extremely arid sun-drenched valley south of Rosh Pinah in south-western Namibia. In this hostile environment the plants spend much of their life in the dormant leafless state. Photograph: Connall Oosterbroek.

We had the good fortune to be taken by Kurt Laufer, a well known personality in Luderitz, to the Kowisberg on a few occasions. En route, north of the main road from Luderitz to Aus, there are spectacular dunes sheltering flat gravelly basins with colossal colonies of *M. patersonii* Many of these plants had recolonised areas stripped of sand and gravel during the diamond rush. Some huge plants were covered in petiolar spines since here they are protected in these sheltered areas from the worst effects of the wind.

After rains or dense fog, many seeds germinate but very few young plants mature. Seedlings that have the best chances of survival are those that take root amongst coarse gravel, or beside a stone in places where they have the most protection from the wind.

M. patersonii on the Luderitz peninsula

The Luderitz peninsula lies south-west of the homonymous town. The desert flora growing here is well preserved and some species, such as *M. patersonii*, are abundant.

The sands on the peninsula are often moistened by frequent fogs and there are many kinds of niches frequented by plants in a varied array of different genera. The Bushman Candles mostly avoid the rocky hills directly adjacent to the Atlantic, such as those around Grosse Bucht and Eberlanzhohle. Instead they occur gregariously on the sandy gravelly plains and rocky outcrops to the east. These places are generally drier and more exposed to the wind than parts of the peninsula that abut the ocean

Some parts of the peninsula are much more open to wind than others. In the windiest places only the flattest lichens can utilise the *Monsonia* stems and their occurrence

After death *Monsonia patersonii* persists in the littoral desert of south-western Namibia as skeletal remains of wax impregnated branches and trunks Photograph: Connall Oosterbroek.

Monsonia patersonii often becomes partly buried in windblown sand after sand storms in the desert inland from Luderitz. The sand usually shifts again during the course of subsequent winds leaving the branches exposed once more.
Photograph: Connall Oosterbroek

Monsonia patersonii often flowers in the leafless state in response to coastal fogs, after dry periods. Photograph: Dawie Human.

Monsonia patersonii in full growth and flower immediately south of the Orange River near Alexander Bay. Photograph: Tim Harvey.

on the plants' branches is rather limited. The opposite is true in more sheltered areas such as the frequent depressions between stabilised sand dunes. In these places the branches of the Bushman Candles are draped in pendant lichens. These plants eventually succumb when they are overwhelmed by simultaneous growths of flat and pendant lichens.

The Bushman Candles share their habitat with three succulent and one geophytic *Pelargonium* species. The sandy area of the peninsula east of Halifax Island is home to large numbers of *M. patersonii* as well as *Pelargonium crassicaule*. The association of these two species across the peninsula is ubiquitous. A less frequent co-occurrence is that between the *Monsonia* and *Pelargonium cortusifolium*. This *Pelargonium* prefers rocky outcrops close to the Atlantic where wet fogs are ubiquitous. On odd occasions, however, the two may grow in close proximity.

Pelargonium sibthorpiifolium is a very abundant geophyte in areas of the peninsula with deep, level sandy areas, usually along seasonal watercourses. It appears in large numbers soon after the habitat has been thoroughly moistened. It grows around the monsonias in many places and, like them, has a preference for areas with that enjoy full sun all day long.

Pelargonium ceratophyllum is commonly found in sandy or rocky areas, even on outcrops facing the Atlantic. It grows together with the monsonias on many parts of the peninsula, but particularly in the southern parts. Close to the sea this species tends to outnumber the Bushman Candles, particularly on the rocky outcrops.

M. patersonii colonies in the vicinity of the Orange River near Alexander Bay

M. patersonii is plentiful on the South African bank of the Orange River, from the vicinity of the Alexander Bay airstrip eastwards to Beauvallon and Beesbank. This area consists of wind blown dunes, wind-blasted rocky hills and large areas of level stabilised gravelly sand. The Bushman Candles are at their most abundant in areas of stabilised sand but also occur on sandy patches on ridges and hills or less frequently with their roots wedged into rocky crevices.

M. patersonii frequently grows together with a stoloniferous form of *Pelargonium ceratophyllum* in areas of level sand. It may also occur together with *M. multifida* in similar habitat but on the whole the latter species is an inhabitant of the crests of west-facing rocky hills. These wind swept plains receive heavy fog which at times condenses as light penetrating rain.

The monsonias are not nearly as common along the

Orange River as they are inland from Luderitz. The main reason appears to be related to the more fragmented and more limited area of habitat available to the plants

The peak of the growing and flowering season consists of the winter and spring months from June to September, though buds and flowers may be seen on the plants at any time of the year after good foggy spells.

The monsonias further south of the Orange River

There are some extensive gravelly or sandy stretches south of Alexander Bay. These places are in effect huge low-lying depressions between sand dunes and low rocky hills. Not only do they provide ideal uninterrupted habitat for *M. patersonii*, but they are also but a few kilometres from the Atlantic which ensures a regular supply of coastal fog. The habitat and the regular fog together contribute to create what are probably the most ideal conditions for this species in South Africa. Thousands of plants, ranging from seedlings to very large specimens, are scattered across the low lying depressions.

The habitat is protected from the worst effects of the winds and is also home to a rich diversity of other succulents and geophytes which make their appearance after rainfall. Large monsonias are nearly always covered in pendant lichens which may eventually lead to the demise of plants when there is insufficient exposed stem area left for leaf production and flowering. The effects of lichens on this species and those in other genera that grow in the same habitat would repay further study. In all probability lichen is one of the factors that control the population sizes of these *Monsonia* plants.

In some years heavy rains fall, usually during the period June to September. The low-lying depressions retain moisture for a few weeks after rainfall, and at these times the monsonias are covered in leaves and flowers. Excellent seed sets occur during these periods and seedlings may be seen scattered across the countryside, should the moisture persist. The general area also houses some of the most extensive colonies of *Pelargonium sibthorpiifolium* in South Africa. The rounded leaves and diminutive white flowers of this lovely plant provide an attractive foil to thousands of pink *Monsonia* flowers when both bloom together.

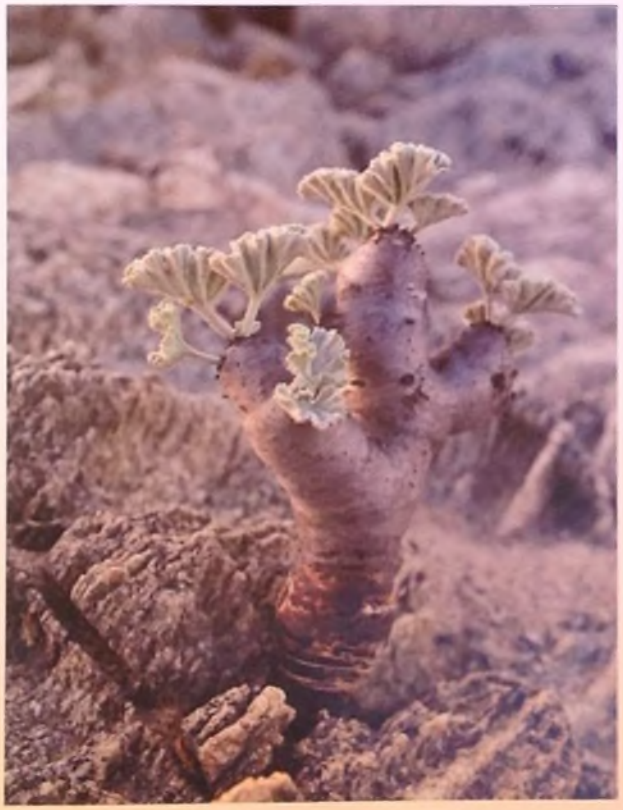
Monsonia patersonii is very common about 20 kilometres inland from Luderitz growing in stabilised gravelly sand. The plant in the foreground has precipitated the formation of a sandspit, rising above the grit and gravel, after a desert sandstorm. Photograph: Tim Harvey.

Conservation status

In view of its wide distribution, its huge populations, and the fact that most of its habitat lies within the inaccessible Diamond Area of southern Namibia, with its northernmost outliers inside the Namib-Naukluft National Park, *M. patersonii* is in no way threatened by other than purely natural factors. Increasing aridity may, in time, result in the death of entire populations, a phenomenon which has already been observed.

Pelargonium cortusifolium and *Monsonia patersonii* commonly grow together on the extreme western parts of the Luderitz peninsula facing the sea. This photograph was taken at Eberlanzhohle where the hills face the Atlantic and trap a lot of fog. Photograph: Connall Oosterbroek.

A peculiar *Ornithogalum*, which may be undescribed, grows together with *Monsonia patersonii* on several parts of the Luderitz peninsula. Photograph: Tim Harvey.



Pelargonium crassicaule frequently occurs together with *Monsonia patersonii* in the central rocky exposed parts of the Luderitz peninsula. Both plants have their roots wedged tightly in rocky fissures. Photograph: Connall Oosterbroek.

Pelargonium ceratophyllum grows in sandy depressions on the Luderitz peninsula, in places which are less frequently colonised by *Monsonia patersonii*, and is more common in the stony ridges. Photograph: Connall Oosterbroek.

Monsonia lavrani

Monsonia lavrani (Halda) C.C.Walker,
Cact. World 26(4): 249 (2008)

Synonyms

Sarcocaulon lavrani Halda, *Cactaceae etc.* 7: 123 (1997).

Description

The leaves usually have a very long petiole that persists as a long, sharp spine. They are usually bluish-green and appear very soon after a good shower, only to wither and drop within a few weeks if there is no further rain. The flowers of *M. lavrani* are very showy, ranging from magenta to violet-pink in colour.

Diagnostic features

Roots wire-like. ***Branches*** ascending, thick and rigid, more than 10 mm thick, brownish-yellow with a hard waxy bark. ***Leaf blade*** not divided into segments, obovate, margins entire, grey-green; ***spines*** well-developed, thick and rigid, 15–60 mm long, grey green. ***Petals*** magenta or violet-pink.

It is similar to *M. patersonii* with which it was confused until 15 years ago; but in that species the branches are spreading, the spines are 10–25 mm long, and the petals are bright pink.

Monsonia lavrani south of Witpütz in south-western Namibia. The plants here inhabit deep red sand and may become very large. This plant was photographed at the end of a dry spell when the long petiolar spines are prominent. Photograph: Dawie Human.

Right. *Monsonia lavrani*. Painting: Gerhard Marx.

Distribution of *M. lavrani*

Geographical distribution and habitat preference

M. lavrani grows away from the coastal stretches of the southern Namib, at the confine between the areas characterised by the predominance, respectively, of winter or summer rainfall and also further east. These plants are found from east of Sendelingsdrift, just south of the Orange River and thence east of a line extending from the Lorelei flats and the level, sandy valleys around Rosh Pinah via the Witpütz farms to Pockenbank and the escarpment about 20 km east of Aus. They have been observed as far east as beyond Kuibis, in an area where what little rain there is falls mainly in the summer half-year.

It grows under particularly harsh conditions in the transition zone between the winter and summer rainfall areas, where the reliability of precipitation is usually at its lowest and averages remain well below 100 mm per annum. Light to fairly heavy frosts occur over its entire range while summer highs can be scorching and well in excess of 40°C. The air is usually very dry, a circumstance aggravated by almost continuous high winds. It is interesting to note that fog is of rare occurrence where this species grows, in sharp contrast to conditions reigning throughout the range of *M. patersonii*. *M. lavrani* grows at altitudes of between 250 and 1 000 metres. In the higher reaches of its range precipitation is more abundant and has been known to occur in the form of snow.

This species seems to prefer sandy flats or outcrops of acid rocks, particularly fields of milky quartz. At various places around Rosh Pinah we have observed it in numbers on flats of deep sand, on quartz patches and on slopes covered by sand. In this area, as soon as these edaphic conditions change to shale or calcic rocks, *M. lavrani* is immediately replaced by *M. flavescens*. The latter species, however, has a considerably wider range within the drier parts of the winter rainfall region.

Monsonia lavrani growing in a cavity amongst black limestone. The plants are common in this extremely harsh habitat near Witpütz in south-western Namibia. Photograph: Connall Oosterbroek.

History

In his revision of *Sarcocaulon*, Moffet (1979) included under *S. patersonii* certain plants with pale or dark magenta, or even purple flowers. In addition to the distinct purple component of their flowers, which is absent from those of *M. patersonii* as accepted here, these plants also differ from that species by their distinctly bluish leaves, their shrubby, intricately branched growth, ascending branches, and very long spines.

We had suspected that these plants might well merit recognition as different from *M. patersonii*, but felt that further, detailed field work was desirable before a decision could be reached. While much work was put by us into trying to trace the distribution of these plants we were not satisfied that the time had come to describe them as something new. It consequently came as a surprise when we learnt that Josef Halda, a botanist from the Czech Republic, with whom we had discussed these questions during a chance encounter at Rosh Pinah, had proceeded to use our provisional findings to describe a new species which he named *Sarcocaulon lavrani*. It had actually been our intention to call these plants "*S. magenteum*", should it have been decided that they were indeed distinct and we still hold that this name would have been more appropriate. Albers (1999) considered this taxon to be in need of further field research to determine its status and did not effect its transfer to *Monsonia*. This was eventually done by Walker (2008).

Monsonia lavrani frequently succumbs to prolonged droughts in south western Namibia. Decomposition after death is a slow process. The petiolar spines disintegrate first followed by the wax-impregnated trunks. Photograph: Connall Oosterbroek.

Life history

The flowers are mostly produced in spring. We have, however, observed plants in bloom at most other seasons, with the exception of the hottest summer period, from December to the end of February.

The petiolar spines of *Monsonia lavrani* frequently form a dense nest of thorns. Photograph: Connall Oosterbroek.

Autecology

Monsonia lavrani in the Witpütz area and on the southern section of the Huib Hochplateau

Autecologically *M. lavrani* differs in several significant ways from *M. patersonii* throughout the latter's distribution range, from south of Alexander Bay in South Africa to beyond Lüderitz in south-western Namibia, a plant dependent on moisture supplied by fog. In contrast, *M. lavrani* occurs well outside the Atlantic fog belt and is adapted to survive harsh conditions which may be rainless or almost so for several years in succession.

M. lavrani occurs most commonly in situations which retain moisture for longest periods after rainfall. These are limestone outcrops and plains with heavy clayey soils, which are moisture retentive for long periods after good rainfall, particularly the depressions so often found on the summit of the Huib Hochplateau. Lower down, as on the calcrete flats around Witputz, the monsonias are concentrated around places which become temporary seepage areas after rainwater is funnelled off huge sheets and domes of barren exposed black limestone.

Monsonia lavrani often grows between rocks. These are the places where most seeds lodge and germinate after dispersal by winds. Photograph: Connall Oosterbroek.

Additionally *M. lavrani* is found on deep red sands which also retain moisture for several weeks particularly

Monsonia lavrani is common on the calcrete plains at Witputz. The plants respond to the lightest rainfall producing leaves and flowers within a few days. Photograph: Tim Harvey.

Strumaria hardyana often grows close to *Monsonia lavrani* on the black limestone outcrops near Witputz in south western Namibia. The strumarias grow in water retentive rocky fissures whereas the monsonias occur close by in arid rocky places.
Photograph Connall Oosterbroek

Monsonia lavrani often flowers in profusion after rains In this instance buds and leaves developed a few days after rainfall
Photograph: Tim Harvey.

when rains fall in the autumn and winter months. This is the time of year when most of the erratic precipitation can be expected Overall however the species seems to be commonest on calcrete clay soil and there are some extensive populations on the farm Witputz Nord, to the north of Rosh Pinah Further to the north-east on the farm Kanies the monsonias throng calcrete soils cobbled with small stones on flat elevated sections of the southern end of the Huib Hochplateau. A similar situation occurs on the distinctive flat-topped black limestone hills on the farm Kliphoek, immediately south-west of Kanies.

These localities, which are good representations of the terrain occupied by this species, are compared to one another and also contrasted in the following discussion.

M. lavrani at Witputz Nord

The landscape at Witputz Nord is characterised by black limestone hills which rise up from calcrete plains. The plains are gently undulating and cobbled everywhere with

Monsonia lavrani has a varied growth habit. The plants near Witputz are often squat with the branches low whereas in the red sands to the south they are often tall spiny shrubs Photograph: Dawie Human

Monsonia lavrani, like *Monsonia patersonii*, is able to take root and grow in rocky fissures. This plant near Witputz, was forming seed after rain a few weeks earlier. Photograph: Connall Oosterbroek.

chips of chert and fragments of black limestone. In many places thin soil lies over rock but in some areas the rocky clayey soil is deeper.

The monsonias are widely scattered across the plains and some specimens have become very large with crowns of branches about 50 centimetres wide. These robust plants grow in places where the soil is deepest and often at the edges of shallow depressions which retain moisture for longest after rainfall. The habitat is very arid and desolate for long periods and the plants spend much of their lives dormant in a leafless state. A profusion of flowers, which covers the *Monsonia* stems, is produced shortly after rainfall and this persists for several weeks. At these times large amounts of seed are liberated. The seeds either germinate shortly after they have been set if they land in a suitable moist niche between stones, or remain in the environment for many months or years until the next rainfall.

The overall number of young plants encountered on the calcrete plains is usually small. The main reason is to be found in the stony thin soils which characterise the habitat. Many niches do not remain moist for long enough to permit seedlings to reach a stage where they can resist desiccation when drought sets in once more. During the 20 years or so that observations were made at this locality no livestock was seen, probably as the farm is too arid. Grazing livestock, or herds of indigenous antelope, would assist loosening the hard stony soil for the *Monsonia* seeds to lodge and germinate successfully after rainfall. The importance of loose soil with some depth for widespread germination of this *Monsonia* has repeatedly been observed in the road reserve of the C13 which runs from Rosh Pinah to Aus. The reserve lies adjacent to the *M. lavrani* habitat and was well graded at the time the road was built. Many of the large stones were also removed or loosened during construction or subsequently during maintenance activities. Large numbers of young plants were encountered in the reserve, having established themselves in the loose soil. These monsonias were periodically destroyed when the reserves were graded. The C13 has now been tarred and cambered, narrowing the reserve. The remaining parts of the road reserve have also been graded once more. It will be interesting to see in future if more *M. lavrani* are able to establish themselves in the rather restricted remaining section of the reserve.

The flora encountered on the arid limestone hills immediately south-west of Witputz occurs in specific habitat niches. Plants frequenting the calcrete plains, which are exposed to day-long sunlight are either geophytic (appearing after rainfall) or succulent. *M. lavrani* avoids desiccation by means of its hard, thick, waxy bark which also becomes covered in fine insulating dust particles during prolonged droughts. The south and east-facing slopes on the black limestone hills are characterised by various runnels and streams which flow briefly after rainfall. These places and the associated seepage areas retain moisture for several weeks should rains fall in the autumn or winter months. *M. lavrani* are usually absent from these areas which are shaded for much of the day, particularly in the winter months.

M. lavrani at Kanies and Klipheuwel

The conditions for farming along the Huib Hochplateau are arid and harsh in the extreme. Some farmers are not resident and numbers of livestock vary according to the carrying capacity of the land and rainfall or absence of it in a given year.

Studies on *M. lavrani* were conducted at two separate but adjacent places, one on the farm Kanies and the other on the farm Klipheuwel. The first observations were made in mid-May 2004 on parts of the plateau immediately south-west and south of the deserted Nooitgedacht farmhouse. Heavy local thunderstorms had fallen during April, so much so that the D727, the road to Goageb, had been badly washed away in places. The conditions of abundant rainfall were ideal for locating the monsonias in leaf and flower. None were found on the flat summits of the tallest quartzite hills south-west of the farmhouse, but they were common in equivalent habitat on black dolomite to the south.

They were found in flat stony areas, growing amongst black rocks and calcrete pebbles. Some were even growing in fissures on sheets of exposed black dolomite, a very harsh sun-baked environment. Most monsonias were large, mature specimens with only a scattering of them exposed to intense day-long sunlight.

The shady south-facing slopes of the flat hill summits hold some of the densest colonies of *Pelargonium xerophytum* that have been observed in south-western Namibia. As elsewhere, the monsonias are not encountered on southern aspects of the hills.

The limestone plains on the farm Kanies carry some large scattered colonies of *M. lavrani*. The countryside here is less convoluted than it is near the Nooitgedacht farmhouse which has much more habitat suitable to the monsonias. Some fieldwork was conducted in late July 2006, after exceptionally good rains had fallen during the previous months. The plants were in leaf and flower and easily spotted amongst the rocks. Most were growing in thin soils, some also with their roots wedged into cracks in sheets of exposed black limestone. Huge numbers of seeds are liberated during such times of plenty, over a period lasting several months.

Most succulent flora on the Huib Hochplateau avoids areas of uninterrupted heat absorbent black dolomite rocks. *M. lavrani* is apparently the only non-geophytic plant that is able to extensively utilise this extremely harsh habitat.

Conservation status

M. lavrani is under no apparent threat at present. Much of its range is remote and very sparsely inhabited. Stock carrying capacity is extremely low so that trampling by high concentrations of grazing domestic animals is not as yet a serious threat to it. However, in the more densely grazed parts one often finds plants severely chewed by donkeys. Regeneration is variable but generally satisfactory with numerous young plants present in places.

Monsonia lavrani typically grows scattered across the sandy plains south of Witputz surrounded by xerophytic grasses and succulent shrubs. Photograph: Dawie Human

Monsonia camdeboensis

Monsonia camdeboensis (Moffett) F.Albers,
S. Afr. J. Bot. 62(6): 346 (1996)

Synonym

Sarcocaulon camdeboense Moffett, *Bothalia*, 12(4): 593 (1979).

Vernacular name

M. camdeboensis is known locally by the common name "Kersbos" or candle bush. Branches of dead plants were used as fuel but their cortex is not by far as thick as that of other species.

Description

In common with the apparently unrelated *M. multifida*, *M. camdeboensis* shares a character, unique among the Bushman Candles, of having thickened, apparently water-storing roots. It forms low shrubs, branching profusely from very near the base. The olive-green to grey branches are, at 5–10 mm, rather thin and flexible. The leaves are smooth, with entire margins. They are either long- or short-petioled and their green blades are elliptic in outline. The petioles persist as thin spines, 15 mm or more long in the long-petioled leaves, but only 2–3 mm long in the others. Leaves are shed when conditions become dry. The large, wide open flowers, about 30 mm across, are produced in profusion after good rains and are usually a pale or bright yellow.

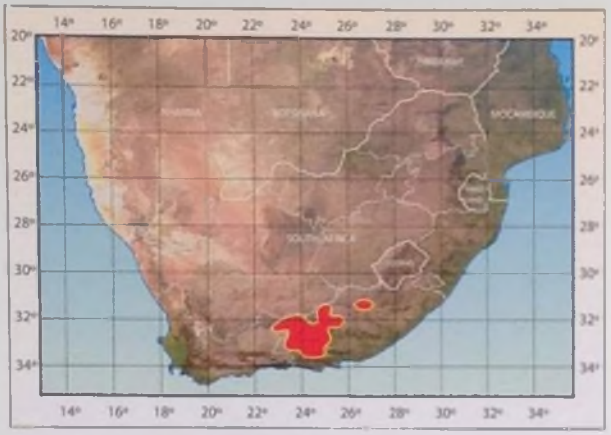
Diagnostic features

Roots succulent ***Branches*** semi-erect or spreading, flexible, 5–10 mm thick, olive-coloured to dark grey. ***Leaf blade*** not divided into segments, obovate to elliptic, green, margins entire; ***spines*** well-developed, thin, 5–20 mm long but sometimes longer, olive-green to brown ***Petals*** creamy yellow.

It resembles *M. vanderietiae*, but in that species the roots are wire-like, and the petals are whitish to rose-pink.

Sheets of exposed dolerite east of Steynsburg in the eastern Great Karoo are home to large numbers of *Monsonia camdeboensis*. The plants grow in shallow soil mixed with grit or else in rocky fissures filled with soil. Photograph: Connall Oosterbroek.

Right: *Monsonia camdeboensis*. Painting: Ellaphie Ward-Hilhorst.



Distribution of *M. camdeboensis*.

Geographical distribution and habitat preference

Monsonia camdeboensis is largely confined to the summer rainfall eastern Great Karoo. It occurs on shale and, particularly, on dolerite ridges and mountains in the eastern parts of its distribution range. It is usually associated with dry stony places but when the plants grow on dolerite they sometimes colonise extensive areas of gritty soil over sheets of rock. The plants are most numerous in the section of the eastern Great Karoo bounded roughly by the towns of Aberdeen, Murraysburg and Middelburg in the west and Steynsburg, Cradock and Pearston in the east. They are also encountered east of Beaufort West in the central Karoo and very surprisingly on the well watered dolerite outcrops immediately north of the Andriesberg, a prominent dolerite mountain north of Queenstown.

A low-growing compact variant occurs on the Spring bokvlakte east of Steytlerville where it is associated with a particularly rich succulent and geophytic flora.

M. camdeboensis is abundant in places and quite showy when in flower in its arid habitat, which is generally poor in trees and characterised by low Karoo vegetation with many succulent plant species. Its flowering season corresponds to a predominantly summer rainfall regimen of 250–300 mm per annum. Summer temperatures are generally high, while during the usually dry winter months very low temperatures may be recorded.

History

Though only described in 1979, *M. camdeboensis* was known to Harvey who, however, assigned it, in *Flora Capensis* (1860), to *Sarcocaulon patersonii*. He was followed in this by Dyer (1932). It was Moffet who, in his revision, established that these yellow-flowered plants represent a distinct species.

Monsonia camdeboensis is usually a spreading plant near Steynsburg with its crown of branches often flattened out above dolerite boulders. The plants flower throughout the summer, usually after thunderstorms have drenched the Karoo.
Photograph: Connall Oosterbroek

Autecology

M. camdeboensis in the eastern Great Karoo and adjacent areas

M. camdeboensis is abundant in suitable habitat consisting of rocky ridges, hills and mountain foothills but absent from grassy plains on typical eastern Great Karoo scrubland. The species is also unrecorded from much suitable terrain that appears ideally suited to its requirements.

The plants throughout their range occur in areas stocked with sheep and goats but with mostly cattle in the extreme eastern part of the distribution range. A recent development has been the emergence of game ranching and in such cases the farms are grazed by antelope species such as Springbok, either in the absence of conventional livestock or else alongside these animals

Rain falls from October to April, usually as thunderstorms of variable intensity. Droughts are commonplace and often prolonged except in the extreme eastern areas which are in effect on the border of a true grassland biome.

The extensive root systems which characterise these plants spread out laterally into rocky niches and shallow gravelly soil. This habit permits the plants to soak up moisture even after small amounts of rain which are so typical at the fringes of Karoo thunderstorms. Some plants manage to take root in fissures that traverse sheets of exposed dolerite Their trunks become very thick and hard when growing under these harsh conditions. The plants also grow amongst boulders on dolerite outcrops and in these situations their root stems are well protected by surrounding rocks.

The higher elevations in the eastern Great Karoo are often covered with stretches of low-growing grassland, some of which may be extensive. These often border *M. camdeboensis* habitats which are separated spatially from the grasslands by their composition, consisting primarily of dolerite boulders and sheets of exposed rock with thin soil. The conditions here are unsuitable for the development of all but the sparsest scattering of grasses. After extensive rains annual herbs spring up as do tufts of ephemeral grass. These rapidly wilt once dry conditions resume and the veld is grazed by sheep.

The distribution range of *M. camdeboensis* ends rather abruptly as soon as the vegetation changes into largely uninterrupted grasslands. Two good examples of this are the Carlton Heights area north east of Middelburg and the farm Carnarvon Estates east of Molteno. These places are on the very fringes of grasslands prone to thorough burning in winter dry-season grass fires. The succulent *Monsonia* species are incompatible with true grassland biomes that characterise much of the South African interior. Their stems, impregnated with wax, blaze furiously when ignited and they can only survive in places where fires are virtually excluded from the microhabitat. This subject is discussed more fully in the chapter concerning the range of habitats occupied by these plants in southern Africa.

M. camdeboensis, although a species from the summer rainfall region, may receive some winter rain and quite often snow may fall in the coldest part of the winter from June to early August. Snowfalls usually melt quickly in the *Monsonia* habitat but may last longer on mountain tops such as the aptly named Sneeuberg that towers above the

Details of a *Monsonia camdeboensis* flower fully open under conditions of bright sunlight. Photograph. Cameron McMaster.

Monsonia camdeboensis is adept at growing in rock cracks, a typical feature found on the dolerite ridges of the eastern Great Karoo. The plants are irrigated by water funnelled off the rocks. Photograph. Connall Oosterbroek.

elevated *Monsonia* habitat near Murraysburg.

Indications are that *M. camdeboensis* may be very long-lived as evidenced by huge specimens at Matjieskloof near Middelburg and in the northern foothills of the Andriesberg. There are some subtle to very noticeable variations found in the terrain occupied by the plants and these are discussed with examples in the text below.

M. camdeboensis on the rocky northernmost section of the Andriesberg

The Andriesberg is an impressive mountain north of Queenstown and has a rich bulbous, caudiciform and succulent flora. *M. camdeboensis* here is at the extreme north-eastern end of its distribution range and seems to be restricted to two small populations associated with dolerite outcrops and sheets of exposed rock so commonly found all over the summit of the mountain. The Andriesberg lies at the western fringes of the north-eastern Cape grasslands and much of the surrounding area only a few kilometres to the north is subject to dry-season grass fires.

The greater portion of the Andriesberg falls within the farm boundaries of Carnarvon Estates, a large farm that has been owned by the Halse family for 5 generations. The estate has been carefully managed over many years with an emphasis on the preservation of its flora. Recently the farm has been sold to the South African government and is to be leased. Future changes to the established land use patterns practised by the Halse family may usher in several alterations to the composition of the flora. The small number of monsonias could increase if the habitat becomes drier as a result of new grazing practices on the property. The new dispensation is likely to provide valuable research opportunities on these plants and others in future.

Several surveys have been conducted by one of us (C.C.) across the summit of the mountain where there is a large amount of ideal habitat suitable for the Bushman Candles. None were found in the areas searched, consisting of a succession of sheets of exposed dolerite interspersed between rocky domes. The vastness of the habitat is scarcely credible and it was believed that somewhere here *M. camdeboensis* would be located. The two small colonies that are currently known are situated about a kilometre apart. One occurs on and near sheets of exposed dolerite with the roots of the plants wedged in cracks or spreading out under the rocks. The other is on a rocky slope just north of the Andriesberg covered in large boulders with crumbling weathered rocks.

The plants at the two sites are very different from one another. Those growing on the rock sheets and nearby are low-growing and spreading whilst at the other locality some of the largest *M. camdeboensis* ever recorded were observed. Some of these were more than 60 cm high and 90 cm wide, with numbers of densely spiny branches. The difference in habit between the two populations growing relatively close together is not clear. *M. camdeboensis* is not usually at all variable in a restricted area of habitat.

In both populations most of the plants were well established and mature with small numbers of seedlings. This is in keeping with the age grades of many *M. camdeboensis* populations scattered across the eastern Great Karoo.

The Bushman Candles here share their habitat with other Geraniaceae such as *Pelargonium abrotanifolium*, very common on the rocky slopes frequented by the largest plants of *M. camdeboensis*, *Pelargonium aridum* and *Pelargonium griseum*.

Monsonia camdeboensis in full leaf and active growth east of Steynsburg. This plant is typically growing in a deep pocket of dolerite-derived soil between large rocks. Photograph: Connall Oosterbroek.

An impressive old specimen of *Monsonia camdeboensis* near Steynsburg, with gracefully recurved branches.
Photograph Connall Oosterbroek

Distribution of *M. camdeboensis* on the Wapadsberg and around Matjieskloof

These two regions, which fall in the Middelburg and Graaff-Reinet districts respectively, are characterised by hilly and mountainous country so typical of the eastern Great Karoo The Wapadsberg Pass between Bethesdaweg and Cradock is situated at the extreme southern end of the Sneeuberge, a high range of mountains reaching over 2 000 metres in places. The countryside around the farm Matjieskloof north west of Middelburg consists of numerous dolerite outcrops capped with tumbled masses of large boulders. Both places have much ideal *M. camdeboensis* habitat and the land use pattern is predominantly sheep farming.

The monsonias that occur on the farm Matjieskloof and in the vicinity grow in cracks on sheets of exposed rock and, more commonly, in the thin soil that lies over these rock sheets. They are also found with their roots wedged under dolerite boulders – a very common habitat niche wherever this species grows on dolerite. Many of the places suitable for colonisation by these monsonias are already occupied by the plants. A good proportion of the rocky areas are partly shaded by boulders and shrubs and the flatter areas have deep soil that remains moist for long periods after rainfall. These places are avoided by the monsonias.

The plants flower throughout the summer, usually producing buds a few days after a shower of rain. They may also flower sporadically in the autumn and winter when in their leafless state. This habit is typical for the species across much of its distribution range.

Colossal numbers of *Pelargonium abrotanifolium* are found in the same habitat but these shrubs are concentrated in areas with dolerite boulders. This habitat is not favoured by the monsonias which require full, strong sunlight for the greater part of the day. Some very large specimens are found here which have survived many drought cycles in this harsh environment.

The summit of the Wapadskloof Pass has many grassy areas quite unsuitable for utilisation by the Bushman Candles. They occur, however, rather sparingly on thin soil that partially covers sheets of otherwise exposed rock. This habitat is not very common and also subject to sub-zero temperatures on many nights in the middle of the winter. Furthermore, snowfalls occur quite often on the higher peaks of the nearby Sneeuberg during the winter months. West of the pass in the arid exposed foothills of the mountain the monsonias are plentiful but rather small and stunted. This is related to the thin soil on rocky outcrops in which the majority of plants have taken root. Little else is able to grow here and the monsonias have virtually no competition. The plants are in blazing sunlight for most of the day and the rocks amongst which they grow remain hot well into the evening during the middle of the summer.

M. camdeboensis near Steynsburg

Steynsburg is a Karoo town with many dolerite outcrops close by and also to the north and east. The golf course immediately east of the town has a fairway bordered by low rocky hillocks where the monsonias are abundant They grow amongst boulders in hot places fully exposed to direct sunlight for the greater part of the day. They share their habitat with *Pelargonium griseum*.

These monsonias grow with their thick gnarled woody trunks protruding from shady south-facing rocky recesses. Their crowns of dense, tightly packed branches form mounds exposed to strong sunlight and the high daytime heat of the surrounding rocks. These Bushman Candles are much more plentiful than *P. griseum* as, unlike the pelargoniums, they do not need to grow with their trunks protected from harsh insolation.

There are usually some dead *M. camdeboensis* to be seen on the outcrops beside the Steynsburg golf course. These plants, drying out and gradually decomposing amongst the rocks, are typical of most populations of this species. Prolonged droughts and the associated heat on the exposed rocky habitat can cause even some larger plants to succumb.

The hills further east of the town are home to some large *Monsonia* populations At one place near Sewefontein there are some exceptionally large plants similar in size to those found just north of the Andriesberg. Seedlings are frequent in the habitat after good early summer rains in October and November. Many of these are however lost if a succession of dry years follows a period of abundant rainfall.

Drought and the rather limited amount of niches in the arid habitats occupied by this species appear to be the main factors which control population sizes.

Monsonia camdeboensis sometimes has difficulty in forcing its swollen roots into rock cracks and in such cases some of the lateral roots spread out exposed above the thin soil that covers dolerite boulders. The trunks of these plants are also damaged by falling rocks and their response is to develop a thick flattish trunk that lies prostrate against the rocks. This plant was seen at the northern end of the Andriesberg near Queenstown in the Eastern Cape. Photograph: Cameron McMaster.

The Steynsburg golf course is one of the few, if not the only, places where *Monsonia camdeboensis* grows on sheets of dolerite at the sides of the arid fairways. Photograph: Connall Oosterbroek

M. camdeboensis in the south-central, south-eastern, and southern parts of its distribution range

M. camdeboensis is probably best known from the plains of Camdeboo, an area of the eastern Karoo that lies roughly south and south east of the main road between Cradock and Pearston. Monsonias are common in this region, occurring on low rises of dolerite or shale but avoiding deeper clay-based loams of the lower areas. They are often very common on shale bands since there is little competition from other plants in these places.

Eve Palmer in her classic book "The Plains of Camdeboo" relates how dead *M. camdeboensis* were gathered from the veld and used very effectively as kindling for fires (Palmer 1986: 256). The plants are well represented on the farm Cranemere which is the main focus of her book. They are equally abundant on other farms such as Wheatlands to the west. Here they grow on low shale outcrops as well as dolerite ridges.

The *M. camdeboensis* that frequent "The Plains of Camdeboo" are generally smaller, lower-growing plants with flat crowns of branches, some barely raised above the surface of the ground. These contrast with the robust Bushman Candles of large size to the north in the Middelburg and Steynsburg areas.

A similar low-growing form of *M. camdeboensis* is widespread in the flat parts of the Karoo between Aberdeen and Beaufort West. The plants here are also associated with dolerite and shale.

The smallest *M. camdeboensis* recorded so far are from shale outcrops in the Steytlerville area. Here they occur in association with a particularly rich succulent flora but, as they often occupy the most arid ridges exposed to intense solar radiation for most of the day, they have little competition from other plants.

Conservation Status

M. camdeboensis does not appear to be threatened at present, as it appears to be adaptable to overgrazed terrain. Seed-set is abundant and many seedlings do survive. However, continuous over-stocking and concomitant soil erosion will also inevitably affect this resilient species.

Monsonia vanderietiae

Monsonia vanderietiae (L.Bolus) F.Albers,
S. Afr. J. Bot. 62(6): 345 (1996)

Synonym

Sarcocaulon vanderietiae L.Bolus, *S. Afr. Gdng Country Life*, 22: 10 (1932).

Description

The roots are wire-like (not thickened). The rather dark grey branches are no more than 10 mm thick. They are armed with short, straight spines, the hardened remnants of long petioles. The leaves, long- or short-stalked, are small, bright green, with indented margins. The flowers are large, measuring up to 35 mm across, with the bright yellow stamens contrasting attractively with the luminous pink to off-white corolla.

Monsonia vanderietiae grows in arid overgrazed areas in the Fish River basin north of Committees Drift, a few kilometres north of where the modern bridge crosses the Fish River. The top soil has been eroded away in most places but nevertheless forms a suitable habitat for these plants where they have little competition from other vegetation. Photograph: Connall Oosterbroek

Diagnostic features

Roots wire-like ***Branches*** spreading-erect, flexible, 4–10 mm thick, olive-green to dark grey ***Leaf blades*** not divided into segments, cordate or elliptic or obovate with indented margins, bright green; ***spines*** well developed, thin, 5–20 mm long, greyish. ***Petals*** whitish to rose-pink.

M. vanderietiae is usually much smaller than *M. camdeboensis* and less intricately branched In that species the roots are succulent, and the petals creamy yellow.

Geographical distribution and habitat preference

M. vanderietiae has a restricted distribution in the Eastern Cape province, growing mostly in the vicinity of the Fish River. The plants occur from just north of

Right: *Monsonia vanderietiae*. Painting. Ellaphie Ward-Hilhorst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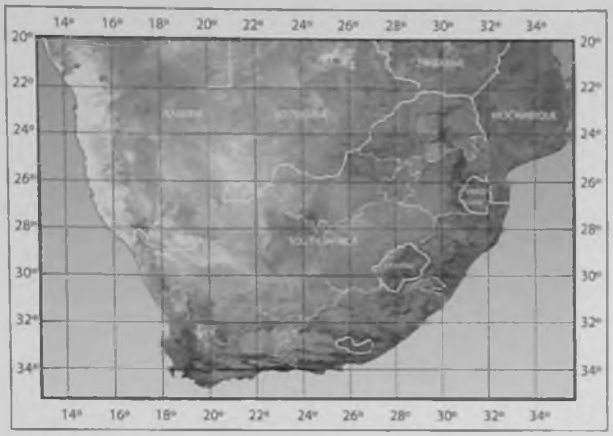


Distribution of *M. vanderietiae*.

Cookhouse in the west to Trompetter's Drift in the east. This is a predominantly summer rainfall region with peak precipitation period between October and early December. The average annual rainfall in the distribution range is around 250 mm, but the Fish River basin is subject to prolonged droughts.

The species favours thin soils associated with shale outcrops, but is also numerous on clay loams derived from shale, particularly in the Fort Brown area and just south of Bedford. In a few instances the plants grow well away from the Fish River, for example about 10 kilometres south-east of Bedford.

Temperatures may be very high in summer but may drop at night during the winter months to several degrees below freezing after the passage of cold fronts.

History

Although only recognised relatively late (1932) as specifically distinct by Louisa Bolus, this species has a pretty complex nomenclatural history. Ecklon was the first to collect plants of this it in 1830, but it was wrongly referred to *Sarcocaulon l'héritieri* from the Western Cape and Namaqualand. Harvey, in the *Flora Capensis*, assigned it to *S. patersonii* and it has since been variously misidentified as other species. The interested reader is referred to Moffet s excellent account for further details of the intricate taxonomic history of this rather attractive plant (Moffett, 1979).

Life history

Within a few days after good early summer rains the plants are covered in pink flowers. *M. vanderietiae* is able to reach flowering size from seed very rapidly, often within a year if there is sufficient moisture. They are also long-lived and able to produce vast amounts of seeds during their lifespan The seeds germinate quickly and seedlings take advantage of areas opened up by the death of other shrubs after prolonged droughts

The typical habitat of *Monsonia vanderietiae* north of Committees. The monsonias grow in open exposed shaly places where few other plants are able to take root. The monsonias are often much more common in very eroded overgrazed places closer to the Fish River. Photograph: Connall Oosterbroek.

A *Monsonia vanderietiae* seedling growing in a layer of thick shale gravel near Committees. The gravel beds, a direct result of soil erosion, help protect the young plants from the hooves of grazing goats. Photograph: Connall Oosterbroek.

Monsonia vanderietiae growing near Committees on eroded shaly slopes usually have much of their lower trunk and upper rooting areas exposed. Sheep and goats rarely permit many branches to grow as fresh growth is constantly nibbled down. Photograph: Connall Oosterbroek.

Autecology

The monsonias in the Fish River basin and vicinity

M. vanderietiae occurs in a region where the land is used for multiple types of stock farming. These include farming with Angora goats, ostriches, sheep and more recently game ranching. The former Ciskei, where the species is abundant, is heavily stocked with goats, donkeys, cattle and sheep. All these animals graze differently and affect the flora in various ways. Introduced grazers occur throughout the areas occupied by the *Monsonia* species discussed in this book. Nowhere, however, is the variety of these animals greater than in the Fish River basin of the Eastern Cape.

M. vanderietiae is also the only species that grows in an

Monsonia vanderietiae is constantly "pruned" by grazing goats near Committees on the Fish River. The plants nevertheless flower and fruit when there is good rainfall, as livestock finds more palatable grazing elsewhere. Photograph: Connall Oosterbroek.

A naturally occurring, goat-created *Monsonia vanderietiae* bonsai complete with exposed roots and pruned branches. These rather elegant plants grace the eroded shale gullies north of Committees in good numbers. Photograph: Connall Oosterbroek.

area where the predominant vegetation type is dense valley bushveld. The monsonias are able to exist in an almost symbiotic relationship with current land use patterns. The reasons are that the grazers keep the habitats open, which the monsonias require, they are not a preferred source of food and, furthermore, the plants produce colossal amounts of seed during the growing and flowering period. In addition *M. vanderietiae* is able to use virtually any niche in the environment as long as they do not need to compete with elements of the valley bushveld.

These hardy plants have been studied at several localities characterised by either abundant or more limited availability of suitable habitat.

M. vanderietiae near Cookhouse and Bedford

These Bushman Candles are abundant just north of Cookhouse and just west of the Fish River. They grow here in loamy soils, usually in association with rocky outcrops

Monsonia vanderietiae is able to colonise eroded overgrazed places and has extended its range in areas not subject to severe erosion near Committees north of the Fish River. Competing vegetation is unable to colonise the hot, barren arid habitats created by grazing livestock. Photograph: Connall Oosterbroek.

This handsome, rounded *Monsonia vanderietiae* shrub is typical of plants occurring near Bedford, in sheep farming country. Low stock numbers on the land ensure that the monsonias escape grazing. Photograph: Connall Oosterbroek

They are most plentiful in places where there is least competition from other karoid shrubs

The plants here are very low growing with dense flat crowns, which in most cases are elevated just above the surface of the soil. This area has extensive tracts of barren habitat suited to the growth of *M. vanderietiae*, which in consequence is quite abundant locally. In recent times ostrich farming has become a widespread practice and where large flocks of these birds are kept there are increasing signs of general habitat degradation. This seems to have had little effect on *M. vanderietiae* which is neither trampled nor grazed. It is likely that ostrich farming has helped maintain the open habitat so much favoured by this species.

Near Bedford the plants probably occur at their furthest from the Fish River. In this area they grow in clayey ground derived from shale as well as in thin, loamy soil on rocky outcrops. The plants are very numerous here, particularly in places with least competition from denser karoo shrubs which prefer areas with deep soil.

The colonies near Bedford consist of taller plants than those near Cookhouse but with similar compact crowns. They bloom in such profusion after early summer rains that their pink flowers are visible from afar amongst the otherwise sere vegetation.

The area around Bedford is used for sheep farming and the flocks keep the *Monsonia* habitats free from dense accumulations of grasses and herbs. As a general rule sheep do not graze the plants, which also grow away from places with the best grazing.

The isolated occurrence of *M. vanderietiae* near Bedford is not readily explained but the abundance of the plants may indicate that it is found in various places in this area but has been overlooked by amateur and professional botanists

Monsonia vanderietiae in full leaf and starting to flower following good summer rainfall. This photograph taken between Bedford and Adelaide in the Eastern Cape represents plants at the easternmost section of their distribution range. Photograph: Cameron McMaster.

Colonies near Committees Drift

Committees Drift and the surrounding area adjacent to the Fish River lie in the former Ciskei. This area is characterised by rural villages and associated communal grazing land nearby. The region is heavily stocked with cattle, donkeys, sheep and goats and heavy erosion is generally prevalent.

The shale ridges and rocky outcrops are in many cases badly eroded, part of the process of habitat degradation via erosion. The Bushman Candles have been able to thrive under changed circumstances. They cling tenaciously to the sides of eroded gullies with much of their root surfaces exposed. The plants are however more numerous in level or undulating areas covered in grey shale fragments where little else is able to survive owing to the trampling and over-grazing from livestock. These barren areas of shale chips have always been a feature of the area near Committees Drift but have expanded over the years, as rural settlements have increased in size with larger numbers of livestock

The former Ciskei is apparently the only part of the *Monsonia* distribution range where the plants are regularly grazed by goats, typically during droughts and when new shoots emerge after sparse summer rains. They have overall been able to take advantage of overgrazed conditions and are common everywhere except in places where there is severe gully erosion. The habitat, opened up by grazing and surface erosion, should theoretically have given rise to an increase in plants. In practice many young seedlings are trampled by livestock before they reach a size where they can resist this type of damage.

Colonies near Fort Brown

The area near Fort Brown, especially west of the Fish River, is characterised by some very dense expanses of valley bushveld and the amount of habitat available for the Bushman Candles is limited. The area is used primarily for ostrich and goat farming. In places where large numbers of the birds have been encamped in small areas, most of the vegetation has been destroyed through trampling and grazing. In the greater area however the birds range freely across the veld and little damage is done to the monsonias. Much of the habitat consists of open rocky areas surrounded by dense bush. The ground is densely cobbled with stones, and *Monsonia* seeds which germinate in these places are protected from trampling by the ostriches, in that they only emerge above the stones at a time when they are sufficiently robust to withstand moderate trampling.

Monsonia vanderietiae festooned with flat lichens growing in shaly, clayey soil just north of Committees. The compact habit is due to heavy grazing by livestock Photograph: Connall Oosterbroek.

The monsonias are able to thrive alongside various grazing animals since the plants have flexible branches, which are simply bent, rather than snapped, when animals walk on them, as is the case with rigid-stemmed species such as *M. crassicaulis* and *M. herrei*.

The countryside north of Fort Brown is covered in dense bush thickets which typify this part of the Fish River basin. Habitat for the Bushman Candles is limited and consists of stony patches of open ground unsuitable for colonisation by shrubs. *M. vanderietiae* may be very plentiful in these restricted areas and the biggest sizes reached by the species are recorded here, with crowns of up to 30 centimetres tall and in many cases even wider than this. The main stems and branches of the older monsonias are frequently speckled with conspicuous large, flat, green lichens looking like a miniature wood of bonsai trees.

The size of the monsonias north of Fort Brown and their height above the ground seem to be related to the rather deep soil in which they grow and the fact that they are only in direct sunlight for part of the day. The lack of day-long sunlight encourages the upward growth of the branches unlike the familiar flat-topped plants that are ubiquitous elsewhere.

Much of this thicket country is so dense that it is impossible to explore it thoroughly. The farmland beside the main road from Fort Brown to Fort Beaufort does, however, provide a useful cross section of the likely frequency of the type of habitat available for colonisation by *M. vanderietiae* in the district.

Conservation status

M. vanderietiae has a long history of living alongside the stock farming and game ranching activities of people and, although there is no historical data to show it, the plants have probably become more numerous as a result.

Cultivation

A rather small, yet showy plant, *M. vanderietiae* is one of the easier members of the group in cultivation, probably on account of its habitat lying in an area that, although it receives most rain in the warm summer months does, nevertheless, also enjoy some showers during the winter.

Monsonia vanderietiae growing in arid open countryside a few kilometres south-east of Bedford in the Eastern Cape. The large shrubs are evenly scattered about the veld typical for species in this area. Photograph: Connall Oosterbroek.

Monsonia crassicaulis

Monsonia crassicaulis (Rehm) F.Albers,
S. Afr. J. Bot. 62 (6): 596 (1996)

Synonym

Sarcocaulon crassicaule Rehm, *Bot. Jb.* 67: 271 (1935).

Vernacular names

Various vernacular names for *M. crassicaulis* are mentioned in the literature, such as Kaaingbos, Kaarsbos, Groot Kersbos and Boesmansdoring.

Description

M. crassicaulis, as the specific epithet indicates, has a very thick and rigid main stem and branches that can be up to 20 mm thick and, in some forms, may reach up to 40 cm in length It forms dense, very spiny shrublets, up to half a metre tall and at least as wide. The leaves, as in all other Bushman Candles, may have either long or short stalk and the long stalks harden into stout, sharp-pointed spines, as long as 50 mm, after the leaf-blade has dried. The leaf blades are green or grey-green, usually somewhat hairy, rounded with dentate margins, and measure no more than about 15 × 10 mm. They are soon-deciduous. The large, showy flowers can reach 60 mm across and come usually in various shades of yellow, while almost white-flowered individuals are not uncommon.

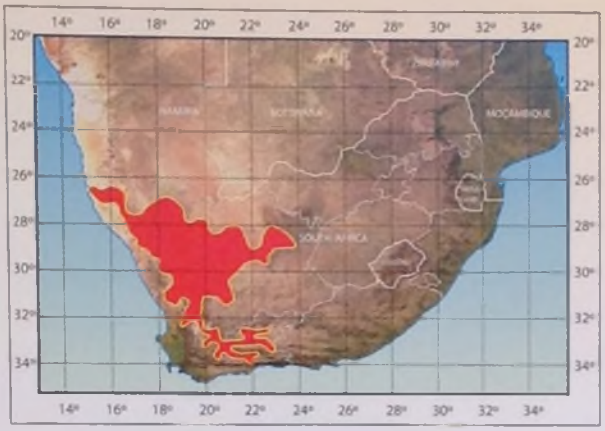
Diagnostic features

Roots wire-like ***Branches*** spreading or spreading-erect, very rigid, 10–20 mm thick, grey or greyed yellow. ***Leaf blade*** not divided into segments, obovate, irregularly pinnatilobate, margins crenate or dentate, green or grey-green; ***spines*** well-developed, stout, 20–50 mm long, grey. ***Petals*** yellow to sulphur-yellow or whitish

It resembles *M. ciliata* and *M. flavescens*, but in those species the branches are rather flexible and usually less than 10 mm thick, and the petals are bright primrose-yellow. Additionally, *M. ciliata* is distinguished by its apical petal margins being ciliate.

Typical habitat of *Monsonia crassicaulis* between Pella and Goodhouse in the Northern Cape. This harsh landscape comes to life with the monsonias in full flower after autumn and winter rains. Photograph: Connall Oosterbroek.

Right: *Monsonia crassicaulis*. Painting: Ellaphie Ward-Hilhorst.



Distribution of *M. crassicaulis*.

Variation

As might be expected of such a widespread species, *M. crassicaulis* exhibits a considerable degree of variability throughout its range, similar to that of the even more widespread *M. salmoniflora*. Worthy of note is the form that inhabits the western fringes of its distribution area and which can be seen at the Haalenberg, east of Lüderitz, or at various places along the road that runs along the Orange River from south of Rosh Pinah to Noordoewer. This form has long, almost simple branches that are armed with forward pointing spines. However, as Moffet pointed out, such differences are not sufficient for these plants to be considered a distinct variety or subspecies.

Geographical distribution and habitat preference

M. crassicaulis has been recorded from the fringes of the Namib sand sea, north-east of Luderitz and thence eastward through Aus, Goageb, Klein Karas and Grunau to the Warmbad area and Onseepkans on the Orange River. In South Africa it extends south-westward, north of the Cape folded ranges as far as Prince Albert and Laingsburg.

The species also occurs in the Little Karoo, between Calitzdorp and Oudtshoorn. There is an outlying population in the Montagu Karoo, while it is widespread in the Tanqua Karoo. It is present in the arid Knersvlakte to the west of Vanrhynsdorp and it has been recorded east of Nuwerus and Bitterfontein and from there, along the east side of the Kamiesberg and of Springbok, to near Sendelingsdrift on the Orange River, continuing northwards into Namibia. It is absent from the higher and very cold mountainous country around Sutherland, Fraserburg and the Nieuweveld plateau.

It has a very wide distribution in areas that receive their scanty and unreliable rainfall at almost any time of the year, but principally in the late summer and autumn. The western portions of its range are in part subject to cyclonic winter rainfall, associated with cold fronts that sweep in off the South Atlantic.

It is generally absent from the colder parts of the western interior, both in South Africa and in Namibia, and is rarely encountered from areas below the western escarpment that borders the southern African interior plateau.

Monsonia crassicaulis growing on a rocky outcrop near Brandrivier east of Barrydale in the Little Karoo. These plants are characterised by long petiolar spines. Photograph: Gerhard Marx.

Monsonia crassicaulis in full flower in the Ceres Karoo. The plants here respond to autumn and winter rainfall and are found in rocky areas or places with quartzite gravel. Photograph: Cameron McMaster.

History

For a detailed insight into the intricate taxonomic history of this ubiquitous species the reader is referred to the exhaustive works of Moffett (1979) and Albers (1995). It was first figured by Burman as far back as 1738 as "Geranium spinosum, nodosum, foliolis reflexis" It had been known in most herbaria as *Sarcocaulon burmanii* or *S. spinosum*, until Rehm described it as a new species, which has since been attributed to *Monsonia*

Life history

The species flowers by preference at the beginning of the rainy season and, as it is mostly found in areas that receive their rains in summer or autumn, flowering occurs principally at these times. At the western and southern extremities of its distribution, in the Tanqua Karoo, around Vanrhynsdorp, at Montagu and other parts of the Little Karoo, flowers are more frequent in May and June.

Autecology

M. crassicaulis colonies in southern Namibia and South Africa

This species is locally common in many arid parts of South Africa and southern Namibia. Throughout much of its wide distribution range it co-exists with various forms of pastoralism In the Richtersveld and parts of northern Namaqualand transhumance is practised and during the winter months the countryside is heavily stocked with sheep, donkeys and goats. In the rest of South Africa the monsonias grow mostly on sheep farms. These are often extensive and rarely over stocked. Stocking practices have an effect on the entire flora including *M. crassicaulis*.

The Namibian side of the Ais Ais Richtersveld Transfrontier Park is virtually devoid of livestock but frequented by herds of gemsbok (*Oryx gazella*) which may damage *M. crassicaulis* when other grazing is

scarce. Observations in this region provide valuable data concerning similarities to and differences from the grazing patterns of domestic livestock. The former tend to graze in open groups, while the latter in closed herds that, in addition to the grazing *per se*, disturb the soil rendering it apt to be blown by the high winds so frequent in the places inhabited by *M. crassicaulis*.

M. crassicaulis and *M. salmoniflora* are the two commonest Bushman Candle species in southern Africa and occupy a range of arid and semi-arid habitats, often sharing this with a varied bulbous, geophytic and succulent flora. A representative selection of these different habitats is discussed below with examples drawn from places in Namibia and South Africa.

Monsonia crassicaulis in the barren desert area of south-western Namibia, east of the confluence of the Fish and Orange Rivers. These plants rely on scanty, unreliable autumn and winter rains to come into leaf and flower. Photograph: Tim Harvey.

M. crassicaulis in the mountains along the Orange River in the south-western corner of Namibia

Particularly long-spined examples of *M. crassicaulis* are plentiful in the mountains north of the secondary road, the C13, which runs along the Orange River. There is ample habitat for these plants between the Dreigratberg in the west and the confluence of the Fish and Orange Rivers. One of the taller mountains in this region is the Sonnenberg, reaching a height of 994 metres. Valuable data may be obtained from places such as this about the distribution of the monsonias across mountain slopes, which span a considerable range in altitude. Altitude, aspect of the mountain slopes and different moisture regimes are particularly well demarcated on the Sonnenberg. The vastness of the mountain with its rugged and convoluted slopes is well captured in Bowen Boshier's pencil drawing on page 145.

M. crassicaulis is abundant on the arid lower reaches of the mountain, occurring in very dry, wel-drained habitats that hold few other plants. They are largely absent from the gravelly hillocks and drainage lines depicted in the foreground of Bowen's illustration. These areas contain large concentrations of scattered grass tufts and succulent shrubs. They provide a valuable grazing resource for gemsbok and other antelope species.

The lower third of the Sonnenberg contains numerous rocky foothills, most of which are exposed to direct sunlight all day long. *M. crassicaulis* is scattered across this rocky habitat but is not plentiful anywhere, particularly on steep slopes where there are regular slips of loose rock. Most plants are found on the crests of hills where the surface rocks are more stable. Only small numbers of young *Monsonia* are present, probably owing to the rugged terrain and aridity of these exposed sites. Some plants are found with their branches snapped off, scattered over the rocks and soil close by, while others are simply uprooted. This destruction appears to have been caused by indigenous antelope, probably gemsbok, as their fresh droppings are sometimes observed close by.

The distribution of the Bushman Candles ends rather abruptly towards the cliffs below the summit. In these areas there are large numbers of other xerophytic and succulent shrubs and also bulbs.

M. crassicaulis on the Haalenberg

The Haalenberg is a prominent mountain east of Luderitz. It rises abruptly from the windswept desert plains of the coastal Namib, a region where *M. patersonii* is common and conspicuous. Large *M. crassicaulis* are found here, similar to those on the arid lower foothills of the Sonnenberg. They also grow in the sunniest and most arid places but are absent from the southern slopes below the cliffs, near the summit of the mountain. These places are densely utilised by shade-loving succulent shrubs such as an arborescent *Othonna* species that inhabits the sides of ravines that retain moisture after rainfall.

Young plants are observed scattered across the exposed slopes of the mountain, and particularly on the sun-drenched summit and the slopes immediately to the north and the west. Dead monsonias are quite often seen

with their long, slowly decomposing branches sprawled over the rocks. The very large dead specimens have probably reached the end of their life cycle, whereas the small ones appear to have succumbed to prolonged drought

Regeneration of this species is slow and sporadic both on the Haalenberg and the Sonnenberg, and related to the fact that conditions for the germination of seeds and development of young plants occur but irregularly. This is in contrast to arid areas with seasonally reliable rainfall such as the winter rainfall western Karoo in South Africa near Karoopoort and around Matjiesfontein (see below).

Nothing is currently known of the longevity of M crassicaulis on the Haalenberg and in the hills and mountains along the Namibian side of the Orange River. Individuals must however survive for many decades to be capable of maintaining viable populations.

M. crassicaulis in the Ceres Karoo and the western Karoo

The Ceres Karoo, east of Ceres in the winter rainfall Western Cape, is the furthest south-westerly occurrence of any succulent *Monsonia* species in South Africa This region lies in the rain shadow of the Swartrugberge and the Bontberg which is in effect an eastern extension of the Hex River Mountains.

M. crassicaulis is particularly abundant in the Ceres Karoo and shares its habitat with a rich diversity of bulbous, caudiciform and succulent plants. The region is well stocked with sheep and some goats, which do not seem to have an adverse effect on the Bushman Candles The most fragile plants grow within the shelter of karoid shrubs or else amongst rocks where they are best able to avoid trampling and grazing Others such as *M. crassicaulis* are well protected against grazing by virtue of their ferocious spines. The greatest concentrations of these plants nevertheless occur amongst rocks as in these situations the seedlings are best able to escape trampling.

Rainfall occurs in the autumn and winter months, mostly from May to early September There are also occasional thundershowers during February and March. The monsonias respond rapidly to this moisture by producing leaves and flower buds. These conditions are usually rather short-lived and the drought and heat of the late summer and autumn quickly resume. The winter rainfall provides ideal growing and flowering conditions. This precipitation is usually light and penetrating, falling at a time of year when evaporation is at its lowest In good seasons the Bushman Candles flower repeatedly and large amounts of seed are produced. In common with all other succulent stemmed monsonias the seeds will germinate immediately if liberated during moist conditions.

The low-lying areas of the Ceres Karoo experience ground frosts on clear nights from late May until early August. These are, however, of little significance to the Bushman Candles, which are confined to frost-free elevated rocky hills. The clayey soil in which the monsonias grow is water retentive for several days after winter rains, particularly soil pockets in the shadow cast by large rocks.

Pelargonium crithmifolium is regularly found growing together with *M. crassicaulis* in the Ceres Karoo, as is the

Monsonia crassicaulis growing in the arid south-western corner of the Ceres Karoo The plants flower mostly in the winter and spring months, the main time of the year in which rainfall can be expected. Photograph: Rod Saunders

Monsonia crassicaulis may reach very large sizes in the southern part of the Little Karoo. Charles Craib is seen here admiring a colossal plant a few kilometres north of Brandrivier. Photograph: Gerhard Marx.

much rarer, long stipuled form of *P. hystrix*. *P. nervifolium* is present at most localities where the Bushman Candles grow, either occurring together with them on exposed sunny ridges, or within the shelter of karoid shrubs.

The western Karoo north of Matjiesfontein is another arid region to the east of the Ceres Karoo. *M. crassicaulis* is common here, mostly on shale ridges with some quartzite. The distribution of the plants is restricted to the drier hills and stops abruptly where the altitude and the rainfall increase in the foothills of the Klein Roggeveldberge. This elevated area is also considerably colder in the winter months and snowfalls are quite often recorded during June and July.

North of Matjiesfontein *M. crassicaulis* is met with mainly on rocky hills and is particularly common on the farm Dwars-in-die-Weg and the surrounding farms. The habitat is well grazed by sheep throughout the year and much of the flora occurs under and beside shrubs forming part of the vegetation, as well as amongst rocks. In this way the plants escape the worst effects of trampling. The Bushman Candles require intense direct sunlight and, as in the Ceres Karoo, the seedlings are best protected from livestock trampling when they take root in rocky places.

M. crassicaulis occurs together with a fine-stipuled variant of *P. hystrix* north of Matjiesfontein. The monsonias are often damaged by grazing sheep when they grow in exposed situations since their rigid stems snap off when pressure is applied from above or sideways. In most instances the damage is accidental, occurring as the sheep move over the hillsides.

M. crassicaulis is generally absent from flat areas with their characteristic deep clayey soils. After rains these places are too moist for the monsonias which, throughout their distribution range, occur in very well drained situations. They also avoid barren outcrops covered in shale gravel.

Monsonia crassicaulis, like many other Bushman Candle species, is able to grow in rock fissures, its roots firmly wedged into crevices. Several plants were growing here, north of Brandrivier, on a rocky outcrop festooned with lichens. Photograph: Gerhard Marx

M. crassicaulis in the Little Karoo

M. crassicaulis is at the south-eastern corner of its distribution in the Little Karoo and occurs around Volmoed near Oudtshoorn and at various places around Brandrivier near Barrydale. The region is used primarily for ostrich farming but is also stocked with sheep and goats. Bushman Candles occur on the farm Kromkloof, a stone's throw from Brandrivier, where the hills are very rocky and covered with Karoo shrubs. The monsonias are confined to the rockiest and most arid places on the north-facing upper third of tall hills. In these situations the plants frequently reach large sizes with crowns of branches 50 centimetres or more wide. They receive little competition from other shrubs in these sunny dry places and would be much more common were the suitable habitat not so restricted.

The occurrence of the plants amongst rocks is once again related to the fact that seedlings are best protected from livestock trampling where they occur in rocky places. The *M. crassicaulis* at Kromkloof are nearly all large established plants, indicating that regeneration from seed is optimal only when there is extensive habitat.

M. crassicaulis is absent from the hills which carry concentrations of Renosterbos (*Elytropappus rhinocerotis*) and other shrubs growing close together. There is too much competition here from such shrubs because these hills, nearer to Brandrivier, are taller and capture more moisture during rainfall than the lower ridges nearby.

M. crassicaulis near Pofadder

Throughout the Pofadder district *M. crassicaulis* is usually associated with quartz outcrops exposed to direct sunlight all day long. The plants here are common, particularly where there are sandy pockets amongst stones. The region is used for sheep farming and seedlings are best able to establish themselves when they grow amongst stones, avoiding the worst effects of trampling.

The ridge immediately north of Pofadder is the eastern extension of the Groot Pellaberg. The habitat here is extremely rocky, cobbled everywhere with white quartz. The soils are thin and stony, often occurring over sheets of rock. *M. crassicaulis* is only sparsely and widely scattered in these situations as there are few sunny exposed places with any depth of soil for seedlings to establish themselves.

Conservation status

The species is widespread and not endangered although, in times of drought or in areas that have been overstocked, young growth is often eaten by goats and sheep. The sole factors that might affect it in places are human encroachment on its desert habitat, and soil erosion caused by the resultant overstocking and desertification.

Monsonia crassicaulis west of Keetmanshoop in May. At this time of the year plants are often damaged by various antelope species seeking grazing. Photograph: Dawie Human.

A moribund plant near Klein Pella in the Northern Cape. Many *Monsonia crassicaulis* die off in severe drought in the Pella area. The trunks and branches of dead plants blacken in the sun and the decomposition of the wax impregnated bark is a lengthy process. Photograph: Connall Oosterbroek.

Pelargonium xerophytum is commonly associated with *Monsonia crassicaulis* in the Pofadder, Pella, Klein Pella and Goodhouse areas of the Northern Cape. The pelargonium is however more adept at colonising partly shaded crevices on boulder outcrops. Photograph: Connall Oosterbroek.

Monsonia ciliata

Monsonia ciliata (Moffett) F.Albers,
S. Afr. J. Bot. 62(6): 346 (1996)

Synonym

Sarcocaulon ciliatum Moffett, *Bothalia*, 12(4): 599 (1979).

Description

M ciliata often occurs as rather small, compact shrublets with fairly thin brownish branches, armed with long, acute, chestnut-brown spines. It differs quite markedly by these characters from *M. flavescens* and inhabits rocky places or areas of red sand that have a less harsh climate and slightly higher rainfall that occurs almost entirely during the cool season, from April to October. Its long- and short-petioled leaves are bright green and usually puberulous, with wavy and indented margins. Its lovely, bright yellow flowers are about 35 mm wide. The apically obtuse and dentate petals are distinctly ciliate, justifying the choice of the name.

Diagnostic features

Roots wire-like. ***Branches*** obliquely ascending, flexible, usually less than 10 mm thick, chestnut- to grey-brown. ***Leaf blades*** not divided into segments, obovate to elliptic, irregularly pinnatifid, margins incised or indented at the apices, bright green; ***spines*** well-developed, thin, 15–25 mm long, chestnut-brown. ***Petals*** bright primrose-yellow with margins apically ciliate.

Monsonia ciliata growing on a stony ridge in the western foothills of the Kourkammaberg in central Namaqualand. The monsonias cluster thickly here and also on the dry, northern slope near the summit of the mountain. Photograph: Connall Oosterbroek.

Right: *Monsonia ciliata*. Painting: Ellaphie Ward-Hilhorst.

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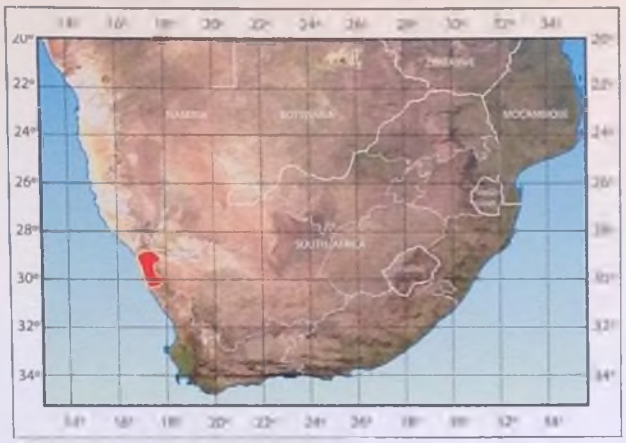


Distribution of *M. ciliata*

M. ciliata resembles *M. flavescens*; but in that species the leaves are dull green, the spines are grey-brown, and the petals are not ciliate. It also resembles *M. crassicaulis*; but that species has rigid branches 10–20 mm thick, and its petals are not ciliate.

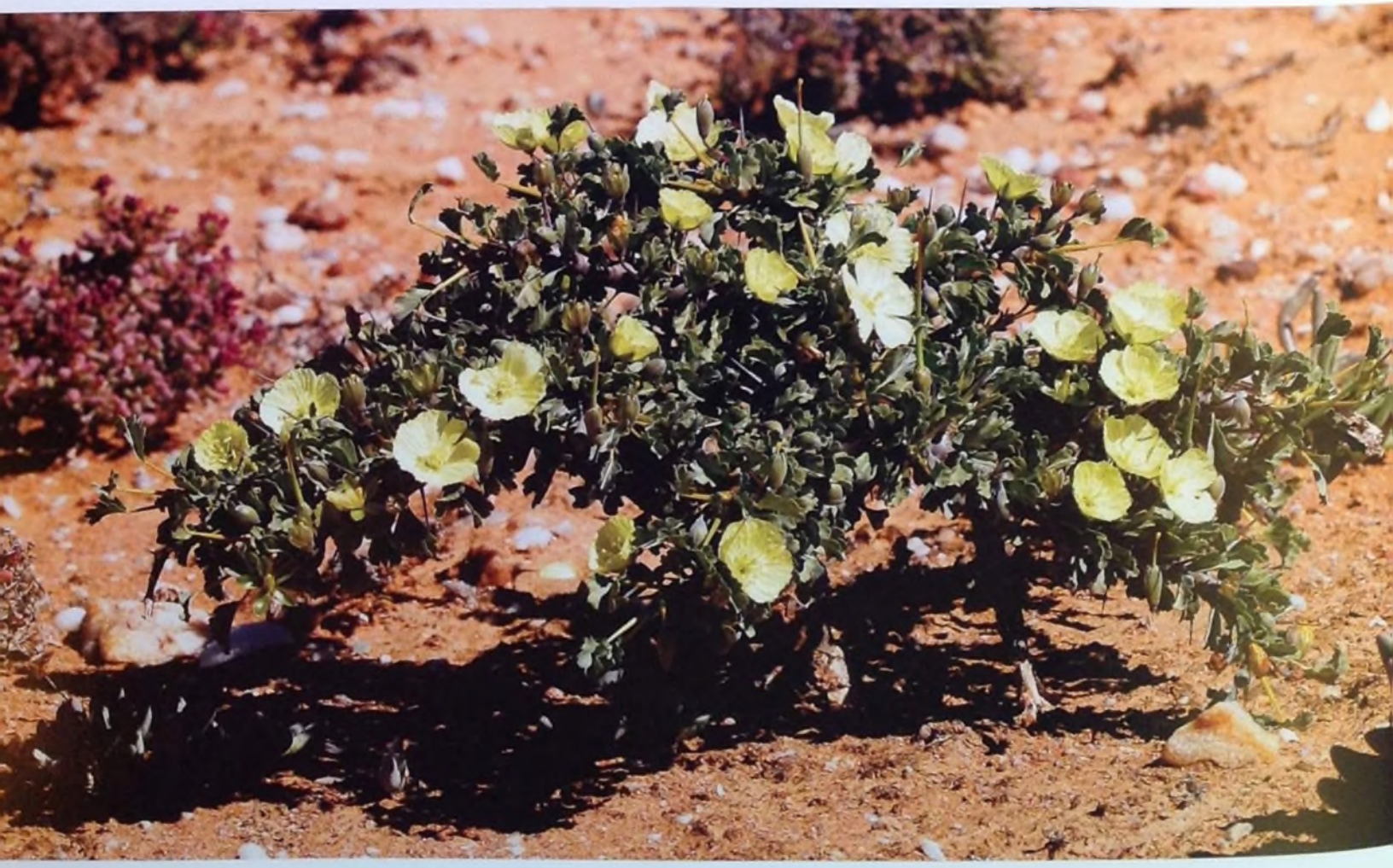
Geographical distribution and habitat preference

M. ciliata is fairly widespread in the north west of Namaqualand between the inland mountains and the Atlantic coast. Its distribution ranges from Soebatsfontein and Wallekraal in the south to the sandy flats just north of Lekkersing in the southern Richtersveld, and extends inland to the plains south of Eksteenfontein and from there along the foot of the Namaqualand escarpment to some way south of Komaggas. It is apparently absent from similar habitats in Namibia.

The annual rainfall in this area is of the order of 125 to 200 mm and falls almost exclusively in the winter season. Frosts occur only on rare occasions and, when they do, they are light.

M. ciliata is frequently encountered within its range, and is often a conspicuous component of the flora in sandy places on quartz ridges, for which it appears to have a particular predilection.

It is, nevertheless, met with, although in less abundance, in a variety of other habitats. *M. ciliata* has proved tolerant throughout its distribution range, to a countryside well grazed, particularly in the winter months, by donkeys, sheep and goats. The plants are widespread



The foothills of the Kourkammaberg are heavily grazed by donkeys, goats and sheep and rather barren in places as a result. *Monsonia ciliata* may become common in these arid areas since it has little competition from other xerophytic shrubs. Photograph: Connall Oosterbroek.

and derive benefit from the grazers which keep the general habitat clear from dense accumulations of shrubby perennial plants and seasonal grasses and herbs. They are at home on barren rocky outcrops where they are often found growing together with *Tylecodon pearsonii* and *T. reticulatus*. They are also found on rocky slopes well covered in succulent shrubs, particularly species in the genus *Euphorbia*. In these situations they often form large shrubs that spread out amongst boulders and also sprawl over them. This species is one of only two succulent-stemmed monsonias that occur in rocky places well-colonised by shrubby plants as well as geophytes of various genera, which make their appearance in the winter months. The other species is *M. spinosa* which quite often shares the same habitat as *M. ciliata*. This species is, like *M. ciliata*, also encountered in very dry, heavily grazed places.

History

This species was first recognised by Moffett in 1979 as an entity distinct from *M. flavescens*, although specimens already existed in South African herbaria where they were filed under various other species of *Sarcocaulon*, such as *S. burmanii*, and *S. vanderietiae*.

Life history

These monsonias produce leaves at any time during the autumn and winter months after rainfall or after dense Atlantic fogs. The main flowering season is the late winter and early spring months from July to October. They start to shed their leaves once Namaqualand starts to dry out in late October and early November. Flowers may at this time still be produced for several weeks or months once the leaves have been shed, in response to late rains, or unseasonal heavy fog in the case of plants occurring nearer the coast. Like most other succulent-stemmed monsonias from the winter rainfall region, *M. ciliata* may occasionally produce flowers in the hot dry summer when the plants are leafless.

Autecology

M. ciliata is well represented throughout its distribution range but rarely common in specific habitats. Its numbers are controlled by other competitive plants and grazing livestock. These factors operate either independently or concurrently and also vary from one year to the next. *M. ciliata* has been studied at several places in north-western Namaqualand and an account follows below of their distribution patterns in different environmental settings.

In years of good rainfall *Monsonia ciliata* is extremely floriferous. This photograph was taken on 14 August 2009 after regular winter rainfall and the plant is full of leaves, flowers and buds. Photograph: Connall Oosterbrock.

M. ciliata in the Komaggas Hills and Van Reenen se Water Mountains

The Komaggas hills and Van Reenen se Water mountains lie west and south-west of Springbok, close to the coastal plains of the Kleinsee diamond mining area. These hilly and mountainous areas support a very wide range of succulents and geophytes, all growing in distinct niches. The convolutions of the hills are either exposed to strong sunlight or are well shaded during the autumn and winter growing season. All the different niches are fully utilised by large numbers of different sun- or shade-frequenting plants. The region is, like so many other places in north-western Namaqualand, heavily grazed by donkeys, sheep and goats, mostly from the first rainfalls in May until well into the early summer when the vegetation reverts to its sere brown summer-dormant state.

M. ciliata here, as in the Aninaus Pass near Steinkopf, are amongst the largest recorded. These robust plants, with their branches spread out over the surrounding rocks, grow with their extensive root systems spread out in seasonally moist places well protected from desiccation. The rocks also help protect the plants from grazing goats. Competition for growing space is at a premium and this

Monsonia ciliata flowers are often visited by beetles, presumably to collect pollen. Photograph Connall Oosterbroek

Monsonia ciliata is common on the granite domes of Namaqualand such as those in the Aninaus Pass west of Steinkopf. The monsonias are commonly found growing amongst other succulent shrubs Photograph Connall Oosterbroek.

explains the relative scarcity of the plants. Seeds that germinate amongst shrubs in shaded rocky places succumb from lack of sunlight. The only really open places are paths made by grazing livestock and here any young plants that may take root are invariably trampled.

The west-facing slopes of the Van Reenen se Water mountains are sparsely colonised by *M. ciliata*. The plants are confined to rocky places where they keep company with *Pelargonium praemorsum* and *P. sericifolium* as well as shrubby euphorbias and other succulents. The Bushman Candles invariably grow on white quartz outcrops with fixed rocks.

The Komaggas hills are more heavily grazed than the Van Reenen se Water mountains and as a result *M. ciliata* is confined to outcrops of large rounded boulders. In these places the plants become very large with their crowns of branches spread out over bare rocks. *P. praemorsum* also grows on these hills, sheltered amongst shrubs and rock. Well grazed *P. sericifolium*, nibbled down by goats into rounded shrubs, are often seen.

The succulent and bulbous flora of the region is generally unpalatable to grazing in various ways and are, consequently, not heavily grazed.

M. ciliata colonies in the Aninaus Pass, on Farquharson se Kop and the Stony Hills near Vyftienmyl se Berg

The large granite hills in the Aninaus Pass such as the T'Ingberg support widely scattered groups of *M. ciliata*. The same is true of the hills lower down the pass that lie adjacent to the main road, the R382, or some distance from it.

Monsonia ciliata frequently produces close-growing clusters of petiolar spines affording the plants protection from grazing livestock. Photograph: Connall Oosterbroek

The stony outcrops of Namaqualand are often densely covered in succulent shrubs. *Monsonia ciliata* escapes competition from these plants by growing in rocky crevices where little else can take root. Photograph: Dawie Human

The T'Ingberg is characterised by large expanses of exposed rock, typical of the granite domes that abound throughout much of central Namaqualand. These places are very dry in summer and may be wet for weeks after winter rainfall. Seepage areas form in sandy patches on and at the edges of these domes, and the succulent and geophytic flora that occurs there is adapted to these conditions.

M. ciliata grows amongst stones and large rounded boulders at the edges of these domes but avoids the seepage areas, even if fully exposed to sunlight, because these become too wet in the winter. The plants are also found on the boulder-strewn rocky summit of the T'Ingberg, where they occur amongst rocks and may be large. Associated Geraniaceae are *Pelargonium praemorsum* and *P. sericifolium* which are commonly found elsewhere growing with the Bushman Candles.

The area is not heavily grazed since the lower lying places in the valley nearby, around Nonaams and Soebees, have more readily accessible grazing for the nomadic stock farmers. *M. ciliata* is better able to resist trampling by livestock than rigid-stemmed species such as *M. herrei* and *M. crassicaulis*. *M. ciliata* branches are flexible whereas the rigid branches of the other two species snap easily when trampled.

Farquharson se Kop is a prominent rocky peak west of the main road from Steinkopf to Port Nolloth. *M. ciliata* is widely scattered about the stony foothills on the lower sunny western and northern slopes. The countryside here is quite arid and the monsonias are small and readily grazed by livestock during the winter growing season.

The petals on the flowers of *Monsonia ciliata* start to fold inwards in the second half of the afternoon, much earlier than with other species where the flowers remain open until shortly before dusk. Photograph: Connall Oosterbroek.

The Vyftienmyl se Berg is a well known landmark inland from Port Nolloth. The foothills to the north of the mountain contain many quartz outcrops and in these places the Bushman Candles are widespread but, as elsewhere, not common at any specific place. They share their habitat with a rich succulent flora.

Monsonia ciliata is common in the slopes of north- and west-facing rocky hills at Gemsbokvlei in northern Namaqualand. The plants throng areas cobbled with rocks where little other vegetation is comfortable. Photograph: John Lavranos

M. ciliata in the southern part of its distribution range

The Kourkammaberg is a conspicuous quartzite mountain east of the coastal plains. The mountain slopes and the surrounding areas are heavily used by livestock, mostly during the rainy season in the autumn and winter months

The monsonias are once again found here on milky quartz outcrops at the foot of the mountain. They also occur up the south-western slopes but stop abruptly where these are in shadow for much of the day during the winter months. The north- and north-east-facing arid sunny upper crests of the Kourkammaberg hold some scattered colonies of *M. ciliata*. The plants are very large, in some cases similar to those found on the Komaggas hills. They grow amongst large quartzite rocks which help protect them from livestock.

Conservation status

Like many other plants within its area, *M. ciliata* is threatened by severe overstocking and consequent degradation of its biotope. This is particularly manifest in years of deficient rainfall when the absence of annuals renders the effect of soil erosion very obvious. At such times the tips of the branches are browsed by goats, particularly so if some light rain shower has encouraged new growth. Regeneration seems satisfactory, but seedlings, regrettably, seldom reach maturity.

Cultivation

M. ciliata is an attractive plant, relatively easy in cultivation, provided watering is confined to the winter months and is never excessive. It appears to be related, besides *M. flavescens*, to *M. crassicaulis* which is one of the most widespread species among the Bushman Candles

Othonna euphorbioides is commonly associated with *Monsonia ciliata* in the Steinkopf area of northern Namaqualand. The two species often grow together in cracks on sheets of exposed rock. Photograph: Connall Oosterbroek.

Monsonia flavescens

Monsonia flavescens (Rehm) F.Albers,
S. Afr. J. Bot. 62(6): 346 (1996)

Synonym

Sarcocaulon flavescens Rehm, *Bot. Jb.* 67: 264–274 (1935).

Description

Rather thin and flexible branches and silver-grey, usually pubescent leaves distinguish this species from *M. crassicaulis*, in which the branches are rigid and 10–20 mm thick, while it is relatively more robust and less branched than *M. salmoniflora*. Another apparent relative is *M. ciliata* from which *M. flavescens* differs by its habit, its more deeply lobed, usually dull-green leaves and the flowers, which in *M. ciliata* have apically ciliate petals. The bark of the rather thin branches of *M. ciliata* is brownish and the spines chestnut-brown. In both these latter species the flowers are wide open and primrose-yellow. Nowhere, throughout their respective distribution ranges, do these two species grow sympatrically.

Diagnostic features

Roots wire-like. ***Branches*** spreading, flexible, usually less than 10 mm thick, grey to greyish yellow. ***Leaf blades*** not divided into segments but irregularly pinnatilobate or dentate, broadly obovate or ovate or rotund, dull green (or silver-grey pubescent); ***spines*** well-developed, thin, grey-brown. ***Petals*** primrose-yellow.

Monsonia flavescens occurs in arid desert country north of Rosh Pinah in south-western Namibia. On the farm Spitskop, where this photograph was taken, *M. flavescens* grows on the driest ridges whereas *Monsonia inermis* is an inhabitant of the nearby better irrigated valley floor. Photograph: Connall Oosterbroek.

Right: *Monsonia flavescens*. Painting: Ellaphie Ward-Hilhorst


25/10/77.

Distribution of *M. flavescens*

Geographical distribution and habitat preference

M. flavescens is confined to the most inhospitable areas of south-western Namibia and the Northern Cape, where it grows by preference on shale outcrops in conditions of extreme aridity. Its habitat lies largely beyond the reach of the Atlantic fogs and receives its scanty rainfall by what the clouds, accompanying cold fronts with their south-westerly winds in winter, may still yield after shedding most of their moisture over the intervening hills. Its area is limited, in the east, by the north-west trending high mountain ranges of the Richtersveld and southern Namibia.

In places such as the higher ridges of the Namusberge or, at much lower altitudes, on the farms Witpütz, Zebrafontein and further south, *M. flavescens* seems confined to shales, phyllites and other similar rocks. There seems always to be an abrupt transition to populations of the magenta-flowered *M lavrani* where the habitat changes to loose, red sand or quartzite of a more acid nature.

History

We owe the discovery of this species, which is confined to within some 40 km of the two banks of the Orange River, some 60 km east of the Atlantic coast, to the elder Franz Erni, whose family has been farming since the beginning of the 20th century on the farms Plateau and Aar, a short distance east of Aus. Erni was Swiss and when he came to Namibia, then German South West Africa, was engaged in supplying the coastal diamond workings with water that was carried there by camels. He then bought the aforementioned farms and settled on them, raising Karakul sheep and cattle. He soon developed a lively interest in the indigenous flora, a fascination which he passed on to one of his two sons, Herbert. Between them they contributed a wealth of new taxa to science, witnessed by the recurrence of the family name in several botanical binomials (including

Monsonia flavescens, like so many other Bushman Candle species, grows amongst rocks, its roots penetrating deep into soil-filled cracks This plant, at Spitskop near Rosh Pinah, is in leaf and flower though this species often flowers in the leafless state
Photograph: Connall Oosterbroek.

Monsonia flavescens in full flower at Spitskop, north of Rosh Pinah, in early August after good rains a few weeks earlier. Photograph: Connall Oosterbroek.

Sarcocaulon ernii Dinter ex Range, possibly now *Monsonia peniculina*) and, even more so, in botanical literature.

M. flavescens was first described by Rehm in 1935, who cited a collection by the elder Erni from "near Witputz". The type material, deposited at Berlin, Munich and Gottingen, was destroyed in air raids during the last war and Moffett was led to designate an illustration in Rehm's revision as lectotype for the species.

Life history

M. flavescens grows in extremely arid, rocky terrain and for this reason its response to climatic conditions is more marked than in most other Bushman Candles. It is thus usually leafless, not only at the height of summer but also at most other times. It has been seen in flower, always intermittently, after rain or exceptionally heavy fogs, in February and March, from June to September and occasionally somewhat later.

Autecology

M. flavescens in the north-western Richtersveld of South Africa, and the south-western corner of Namibia

We have observed *M. flavescens* at several localities in the north-western Richtersveld and also in similar arid countryside to the north, across the Orange River in Namibia. Some representative examples of the occurrence of these plants in their habitats in both countries follow below.

In south-western Namibia the species is common in the eastern foothills of the Obib Mountains immediately west of Rosh Pinah and also northwards towards Witputs. It is most readily observed on the farm Spitskop, usually growing at the base of rocky arid hills beside the C13 road.

M. flavescens in the western Richtersveld

M. flavescens grows sparingly along the lower course of the Orange River over a distance of some 30 kilometres east from Sendelingsdrift. This is a very arid area that is subject to frequent wet fogs, in addition to a rainfall of perhaps 50 mm that occurs almost exclusively during the winter months, although heavy autumn thunderstorms are experienced every few years. Summers are generally rainless and temperatures at that time can range to well over 40°C.

The country here is hilly with metamorphic rocks making an ideal habitat for this species. Grazing pressures are intense, as they are throughout the Richtersveld, including the Richtersveld National Park and this has contributed to an appreciable thinning out of the vegetation cover during the 40 odd years during which we have observed conditions in the area Regeneration of virtually all plants growing here is consequently in jeopardy, although this seems to affect the very spiny individuals of *M. flavescens* less than it does other, softer species.

The area is rich in bulbs and is, moreover, characterised by the presence of monumental specimens of *Aloe pillansii* Sadly though, the numbers of these great plants have diminished greatly in recent years, owing probably to the prevalent desertification of the area. The only other species of *Monsonia* that frequents this inhospitable tract of country is the dainty *M. multifida*.

Monsonia flavescens bearing a few flowers in the leafless state. This plant was growing on a very arid rocky ridge on the farm Spitskop in south-western Namibia. Photograph: Connall Oosterbroek.

The eastern foothills of the Obib Mountains

The eastern foothills of the Obib Mountains are very rocky and arid with numerous convolutions that face most points of the compass. *M. flavescens* occurs here growing close to *M. multifida* but the latter prefers microhabitats featuring open areas littered with small stones, whereas *M. flavescens* is usually found on outcrops amongst either fixed or loose rocks. The other succulent *Monsonia* species which occurs in the area is *M. inermis*, which is abundant in flatter areas, usually the bottom of small valleys or the gently ascending slopes at their sides *M flavescens* is commonest however on elevated ridges, fully exposed to the sun and also to frequent winds which are not as prevalent in the more sheltered places colonised by *M. inermis*.

East of the Obib Mountains *M. flavescens* often grows as small compact shrublets. Young plants of various sizes, including seedlings, are usually plentiful. These juvenile plants are frequently of similar sizes, indicating that they originated from seeds that probably germinated at the same time, after good rainfall and an abundant seed set Seedlings and young plants are nearly always found in stony places. This seems to indicate that the seeds from which they originate lodge most readily between rocks and up against them. The only animals that could graze *M. flavescens* in the area are occasional herds of oryx. The distribution of plants is therefore related largely to the manner in which seeds are distributed by wind, rather than the trampling of young plants growing in open situations

M flavescens, like so many other Bushman Candles, avoids places which retain water after rainfall or are in shadow for some of the day. They are absent therefore from temporary seepage areas, which are so common in the convoluted eastern foothills of the Obib Mountains. The plants are particularly common in the rockiest, most arid parts of the habitat where they experience minimal competition from other succulent shrubs In addition, seeds are readily dispersed by wind into rocky niches, many of which remain sufficiently moist for long enough after rainfall to ensure successful germination

Near Rosh Pinah *M. flavescens* spends much of its life in the leafless state. After good rains, such as the exceptional conditions in the autumn of 2006, the plants flower prolifically and set abundant seed. The same is true of the other three succulent monsonias, *M. inermis*, *M. multifida* and *M. lavrani*, that occur in the same area. The seeds formed during these rare events contribute significantly to the seed bank in the local environment

M. flavescens around Spitskop, north of Rosh Pinah

The farm Spitskop and the adjacent one to the north, Zebrafontein, are very rich in bulbous, caudiciform and succulent plants despite heavy grazing by livestock in the past. The two farms are very hilly and even mountainous The different elevations and aspects of these hills and higher peaks determine the types of plants that are found there. *M. flavescens* occurs by preference in the lowest most arid places on east, north and west-facing hill slopes and rocky outcrops.

South of the Spitskop farmhouse are some sun-drenched hills, the foothills of the nearby Numaisspitze

Here *M. flavescens* occurs usually as large, sprawling, densely spinescent shrubs. The plants grow with their branches spreading out over rocks which absorb a great deal of heat during the day. These rocks are both loose and fixed, and there are frequent slips particularly when there is rainfall after a prolonged drought. *M. flavescens* is never abundant in this habitat and, unlike in the habitat near Rosh Pinah, few young plants or seedlings are encountered. There is moreover more competition for the suitable niches on the unstable slopes particularly from *Ceraria fruticulosa* and *Ceraria namaquensis*, two succulent shrubs which are common in these parts.

The floor of the small valley below the slopes is colonised by *M. inermis* and *M. lavrani*, but not by *M. flavescens*, which mirrors the situation in the foothills of the Obib Mountains. *M. flavescens* grows together with *Tylecodon hallii* and small numbers of *Pachypodium namaquanum*.

At a stone's throw from the Spitskop farmhouse *M. flavescens* grows close to *Pelargonium paniculatum* on rocky ridges, and also further northwards. These large succulents are generally found in places which retain moisture after rainfall and, where they grow together with *M. flavescens*, specimens of *P. paniculatum* are usually small and stunted owing to the aridity of the terrain. The succulent *Pelargonium* most commonly associated with *M. flavescens* in the south-western corner of Namibia is *P. klinghardtense*.

Conservation status

M. flavescens does not appear to be threatened in its arid habitat by factors other than human. Mining activities along the lower Orange River have obliterated several populations, as have similar developments in the Rosh Pinah area within its Namibian range. A further factor causing concern for this, as indeed for other species, is progressive desertification due to climatic change and also to abusive pastoral practises.

Monsonia flavescens often grows on the summit of stony hills near Rosh Pinah. In these excessively dry places the plants only produce leaves and flowers simultaneously after good rains. In cases where moisture is scant, the monsonias flower in the leafless state
Photograph: Tim Harvey.

Monsonia inermis

Monsonia inermis (Rehm) F.Albers,
S. Afr. J. Bot. 62(6): 346 (1996)

Synonym

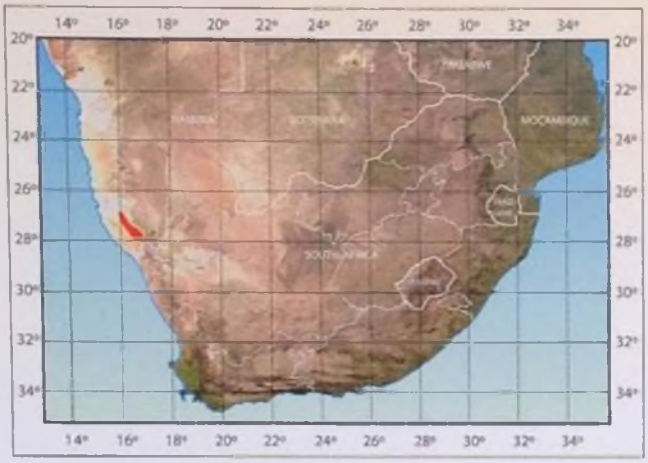
Sarcocaulon inerme Rehm, *Bot. Jb.* 67: 269 (1935).

Description

M. inermis certainly is one of the most interesting species of the genus, not only because of its narrow distribution but also on account of its habit and morphology. It forms low shrubs, reaching some 30 cm in height and 40 cm in diameter which, when fully grown, are rather intricately branched. The branches are finger-thick, with a leathery, grey or greyish brown epidermis which covers a hard, thick bark. There are four rows of leaves, which may have a long or short stalk that do not persist as long, hard spines but rather as short, blunt, woody prickles no more than 5 or 6 mm long. The leaf blades are very similar to those of certain herbaceous species of *Monsonia*. They are bright green or somewhat greyish in colour, smooth on the upper surface but shortly hairy below. They are egg-shaped, tapering towards the base (obovate) and their margins are undulate to bluntly toothed and shortly hairy. In dry weather they tend to close and present their hairy lower surfaces to the elements, thus reducing transpiration. Nevertheless, the leaves will wither rapidly and soon drop off if dry conditions persist. The petals are usually a clear rose-pink, although white-flowered specimens are occasionally seen

Monsonia inermis at the northern end of its distribution at Spitskop, north of Rosh Pinah in south western Namibia. The monsonias grow mostly on the valley floor where the ground is more water retentive after rainfall than the surrounding hills. Photograph: Connall Oosterbroek.

Right: *Monsonia inermis*. Painting: Ellaphie Ward-Hilhorst.



Distribution of *M. inermis*

Diagnostic features

Roots wire-like ***Branches*** spreading to ascending, rigid, 10–20 mm thick, greyish brown to greyish white ***Leaf blades*** not divided into segments, obovate, margins undulate to obtusely toothed, bright green to somewhat greyish; ***spines*** absent or reduced to vestiges ***Petals*** pinkish purple to purple, or occasionally white.

It resembles *M. marlothii* and *M. mossamedensis* by its undulate leaf margins, but both those species have well-developed spines.

Geographical distribution and habitat preference

This species is a narrow endemic, confined to the area immediately south-west and north of the little mining town of Rosh Pinah, in southernmost Namibia. It has not been found south of the Orange River. It seems to prefer gentle slopes covered with milky quartz pebbles in a silty soil derived from the underlying micaceous schists that are prevalent in its area of distribution and is usually present in scattered, mostly dense colonies. It is, however, absent from adjacent rocky slopes where *M. flavescens* abounds and from flat ground with deep, sandy soil, without rock fragments. A correlation seems to exist between the area of distribution of this species and the presence of the element zinc in the rock formations on which it grows, and Moffett has pointed out its apparent zinc-tolerance.

The rains, averaging about 50 mm per annum, fall mainly in the cool winter months, although thunderstorms

Monsonia inermis usually flowers at its best when in full leaf after rainfall, although plants may produce occasional flowers in the leafless state. These plants are at Spitskop, north of Rosh Pinah. Photograph: Connall Oosterbroek

do occur locally during the summer. Temperatures are usually not excessive and rarely exceed [illegible]°C, for the area lies on the seaward side of the main mountain ranges and is thus subject to the influence of the cold South Atlantic. Light ground frosts may occur in June and July, but they are infrequent. The vegetation is sparse, and arborescent forms generally absent. Succulents, however, are numerous, the Mesembryanthemaceae and Crassulaceae being best represented.

History

This species was apparently first collected by the famous German botanist von Wettstein in [illegible] and described by Rehm in [illegible]. It is surprising that the perspicacious Kurt Dinter does not appear to have taken notice of it on any of his earlier journeys through southern Namibia, although he did collect it later and proposed the name [illegible] [illegible].

Life history

The plants come into leaf within a few days of any significant shower of rain. This can happen several times in any one year but mainly in the cool season. The flowers are mainly produced between June and mid-September but may also appear, more sparingly, from February onwards. Plants may be leafless or in full leaf when they come into flower and, after exceptional rains, every plant in a population may be a mass of flowers, an unforgettable sight. These flowers are large and open wide when the sun is shining, but close in the late afternoon or in dull weather.

Autecology

M. inermis in the eastern foothills of the Obib Mountains near Rosh Pinah

The largest numbers of *M. inermis* are found in the foothills of the Obib Mountains. They occupy a very distinct habitat, growing on gentle rocky rises or low hills and in the bottom of small valleys in undulating terrain, more often than not strewn with fragments of milky quartz. They are never, it appears, found in the deep sands or adjacent to these, which mark temporary stream beds and drainage lines. Such places have an entirely different flora which is discussed below.

Typical *M. inermis* habitat south-west of Rosh Pinah is shown in the drawing by [illegible] on page [illegible]. The habitat niche commonly frequented by these plants consists of the lowest hills, visible in the drawing close to where the sand track [illegible] in the distance.

Spitskop is the first [illegible] north from Rosh Pinah on the [illegible] road that leads to Aus. Here *M. inermis* is found in [illegible] which it colonises in the foothills of the [illegible]. The monsonias grow in water-retaining [illegible] with rounded stones and milky quartz [illegible]. This is but a tiny fraction of [illegible] and [illegible] mirrors the type of terrain occupied by the plants near Rosh Pinah.

M. inermis grows in a very restricted [illegible]

Details of *Monsonia inermis* buds and flowers.
Photograph: [illegible]

Monsonia inermis full of leaves and in active growth a few weeks after a good winter rainfall at Spitskop in south-western Namibia.
Photograph: Connall Oosterbroek.

Monsonia inermis in leaf, flower and fruit after good rain had fallen in the late winter at Spitskop in south-western Namibia.
Photograph: Connall Oosterbroek.

usually the most abundant plant where it occurs. Large numbers of dead plants are often seen amongst the populations near Rosh Pinah. These are invariably the oldest well-branched specimens and they are most in evidence towards the end of prolonged droughts. It has been suggested that this may be explained by the combined circumstances of drought, grazing and erosion. Black resinous galls are also often found in large numbers on the branches of dead plants suggesting that these plants may have succumbed to disease.

Charles Craib crouching adjacent to a large specimen of *Monsonia inermis* at Spitskop. This photograph gives some idea of the size of large plants in relation to the size of a man.
Photograph: Connall Oosterbroek.

Monsonia inermis turns a characteristic black when plants die off after prolonged droughts or reach the end of their life cycle.
Photograph: Connall Oosterbroek.

For a succulent *Monsonia* this species exhibits rather high rates of regeneration from seed. It may also be that the high rates of mortality observed amongst larger plants is part of a natural process well established in *M. inermis*. At present no conclusion can be drawn concerning the reasons behind the seemingly high mortality within these populations. To establish these reasons with certainty, data would need to be collected for a period of about 50 years.

The highly dissected and lithologically diverse Obib Mountains contain a multitude of habitat niches and the terrain is very rocky. Sandy plains lie immediately east of the foothills. *M. inermis* grows mostly in places where it has little competition from other plants. These are rocky, gently ascending hill slopes with shallow soil, in direct sunlight for the greater part of the day.

The higher slopes and ridges have a more varied succulent flora which also grows much more densely. In these places two other succulent *Monsonia* species, *M. flavescens* and *M. multifida*, are usually abundant in the rockiest areas where they similarly experience the least competition from other components of the vegetation

M. inermis populations display a very wide range of sizes ranging from young seedlings or plants with only their unbranched initial stem, to large multi-branched specimens. The size of the monsonias is often uniform, particularly amongst smaller individuals, indicating successful mass germination under conditions of abundant moisture. The plants have rigid stems and would quickly be depleted in numbers by trampling, were livestock to be regularly grazed in the area. Occasional plants of *M. inermis* are, however, found damaged by the hooves of gemsbok which regularly pass through the habitat.

The greatest numbers of *M. inermis* are found on outcrops of milky quartz veins and in areas covered with milky quartz fragments of various sizes. Such localities retain moisture longer after rainfall, permitting a good crop of seedlings to develop since conditions are suitable for germination. The rocky terrain not only conserves moisture, but also provides shelter for young plants from exposure to desiccating insolation. As a result, the *M. inermis* populations contain large numbers of seedlings, small and medium sized plants, and only a few large ones. This is the reverse of the population dynamics we have encountered with all other succulent-stemmed *Monsonia* species.

The low, rocky foothills of the Obib Mountains give way to gritty sandy plains to the east which are mainly arid and sun-baked but springs to life shortly after good rains. Should the area receive autumn rainfall large umbels of pink *Crinum herrei* inflorescences make their appearance, scattered far and wide across the coarse reddish brown sand. These plains are not frequented by *M. inermis* and its distribution stops abruptly at the border between the sandy plains and the easternmost outliers of the hilly terrain.

M. inermis around Spitskop

The northern limit of the very restricted distribution of *M. inermis* lies on the farm Spitskop, north-north-west of Rosh Pinah on the tarred road that leads to Aus. Here several colonies are strung along the base of a tall, west-south-west facing range of hills, where milky quartz patches overlie

clayey, water retentive soil. This locality is only about 10 kilometres north-north-west of Rosh Pinah where various types of metasedimentary rocks, including carbonate types, are host to a flora that differs somewhat from that found in the foothills of the Obib range. In one restricted locality, comprising a small valley that rises gently from south to north, *M. inermis* is well represented. The plants grow in hard stony ground exposed to strong direct sunlight for much of the day. They share their habitat with *Tylecodon reticulatus* ssp. *phyllopodium*, which is also locally plentiful.

The soil in which the plants grow is similar in texture to that encountered near Rosh Pinah, drying out like hard grey window putty. Good regeneration is evident here too but the large numbers of dead plants so frequently met with in the foothills of the Obib Mountains are mostly absent here. The reason may be that the population is much smaller and dead individuals are not very numerous or conspicuous. The steeper slopes, facing east above the valley and exposed to strong morning sunlight, hold good numbers of *M. flavescens* as well as *Tylecodon hallii* growing in soil-filled pockets between steeply sloping rocks.

Conservation status

M. inermis does not seem threatened, except in the case of mining operations or in the rare instances where roads are widened or built. In some instances there is evidence of over grazing by sheep and goats. However, some major populations lie within the restricted diamond area, where no grazing by domestic stock is permitted and where access is strictly controlled. The large numbers of dead plants seen near the Rosh Pinah shooting range and elsewhere may be due to the effects of soil erosion, under conditions of prolonged drought combined with grazing pressure by domestic animals. Regeneration, in most populations examined, appeared to be satisfactory with a fair proportion of young plants of varying ages

This very large *Monsonia inermis* is covered in buds and flowers after good rains. At these times much seed is produced and liberated into the environment, often to lie dormant for several years in succession before there is enough moisture to trigger mass germination. Photograph: Connall Oosterbroek.

Monsonia marlothii

Monsonia marlothii (Engler) F.Albers,
S. Afr. J. Bot. 62(6): 346 (1995)

Synonym

Sarcocaulon marlothii Engler, *Bot. Jb.* 10: 31 (1889).

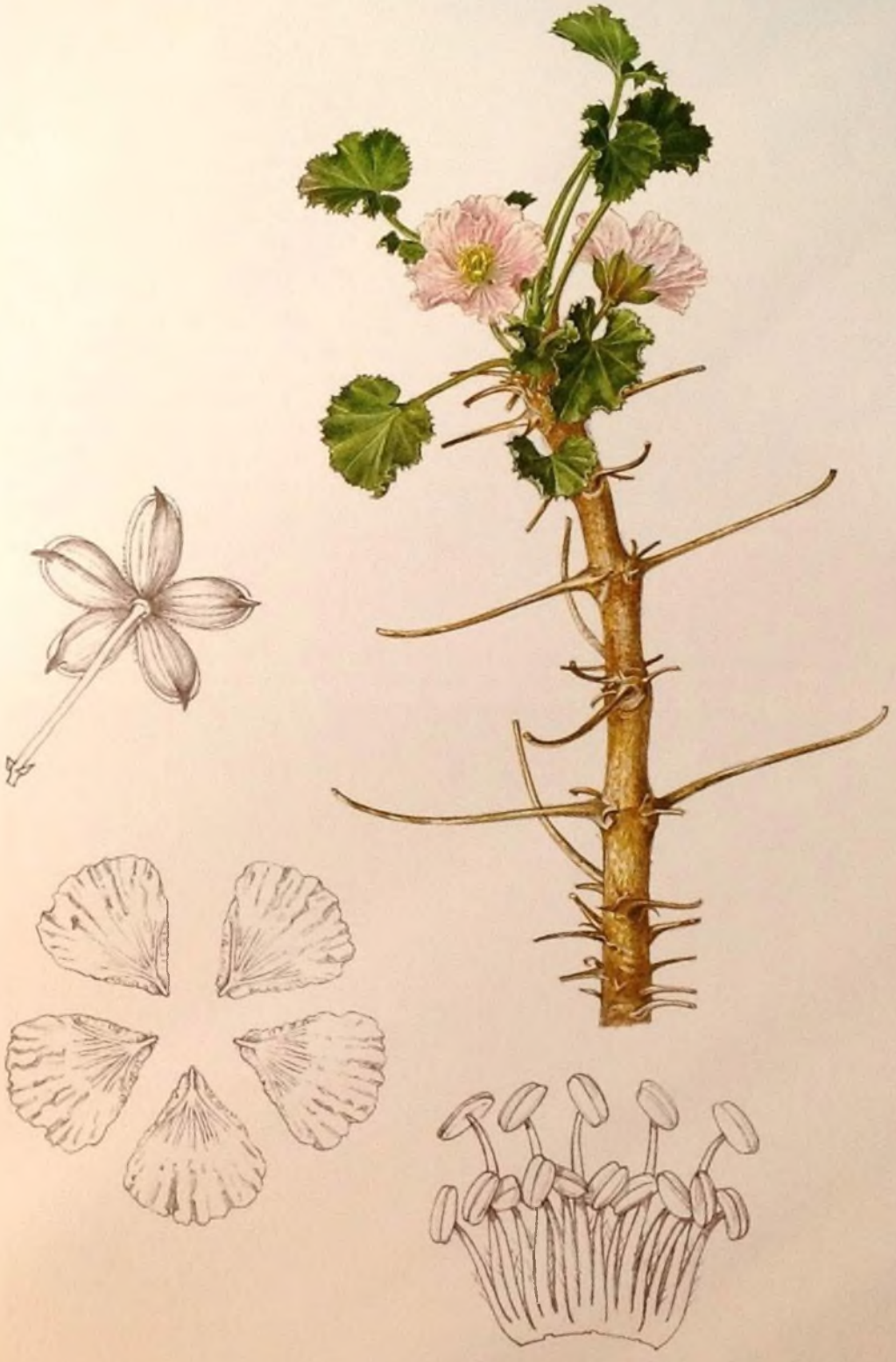
Description

There are manifest similarities between this and the following species, *M. mossamedensis*, described below. So much so that *M. marlothii* has been considered by certain authors to be but a more robust form of *M. mossamedensis* which, being the first to be named would, if such were the case, have precedence. There is no doubt that, in the only area where the two are said to share the same habitat – inland from Henties Bay in Namibia – there is a gradation in size and other characters from plants assigned to the one, to others considered to belong to the other.

We have studied what is believed to be *M. mossamedensis* at Cape Cross, in the Messum Crater and east of Henties Bay where it is said to grow socially with *M. marlothii*, which extends southward to north-west of Helmeringhausen. However, except for the gradual increase in size, development of an erect habit, and more intricate branching, we cannot see any significant differences between these two species, be it in the flowers or in the leaves. For the purposes of this book and for the reasons mentioned in the Introduction, we accept the taxonomy, at species level, of Moffett which has also been

The foothills of the Brandberg are home to *Monsonia marlothii*. These plants sometimes share their habitat with *Commiphora wildii* and *Welwitschia mirabilis*. Photograph: Rod Saunders.

Right. *Monsonia marlothii*. Painting: Ellaphie Ward-Hilhorst.



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Distribution of *M. marlothii*.

adopted by F. Albers and subsequent authors, including Touloumenidou *et al.* (2007) who have shown that the above two species, so similar in gross morphology of leaves and flowers, belong to different clades within *Monsonia*.

As accepted by Moffett and by Albers, *M. marlothii* ranges in size from low shrublets, 20 cm or so in height and up to 40 cm in diameter, to tall, profusely-branched shrubs to 150 cm tall with a main stem that can be as thick as 8 cm. The leaves in this species and in *M. mossamedensis* differ drastically from those of all the other Bushman Candles, in being bright green, glabrous, with orbicular blades some 30 mm across that have finely-toothed and often wavy margins. They exhibit rather distinct venation on the lower surfaces and are reminiscent of the leaves of many herbaceous species of *Monsonia*. The spines are 30–40 mm long, upcurved, with blunt apices that are often in the shape of a small knob. The plants appear to increase in size from the coast inland, while the largest specimens observed occur in the southern part of its range. The flowers of *M. marlothii* are showy and usually light to vivid pink in colour, while it has been found that paler forms occur in areas nearer the coast, where the white-flowered individuals have been observed. They are 30 mm across and are borne on pedicels 20–40 mm long.

Aloe claviflora is a dominant plant in much of the habitat frequented by *Monsonia marlothii* east of Swakopmund. The plants often form semi-circles as they grow outwards, offshoots from the original plant which has long since died back. Photograph: Connall Oosterbroek.

Diagnostic features

Roots wiry ***Branches*** usually ascending, rigid, up to 80 mm thick, greyish yellow to pale olive-green. ***Leaf blades*** not divided into segments, ovate to orbicular with margins finely toothed and shallowly undulate and bases cordate, bright green; ***spines*** well-developed, rigid, blunt, 30–40 mm long, brown or grey ***Peduncle*** usually shorter than 5 mm, ***petals*** uniformly rose-pink to purple or sometimes white.

It resembles both *M. inermis* and *M. mossamedensis* by its undulate leaf margins. However, in *M. mossamedensis* the leaf margins are markedly (rather than shallowly) undulate, the leaf bases are wedge-shaped, the peduncle is mostly longer than 5 mm, and the petals are rose-pink with white bases. *M. inermis* is readily distinguished by the absence of spines.

Geographical distribution and habitat preference

As accepted at present, it covers a wide area, from the banks of the Uniab River, off Terrace Bay on the Skeleton Coast, to south of Duwisib in the south, and extends inland onto the western fringes of the plateau where it has been

Details of *Monsonia marlothii* flowers fully open in bright sunlight Photograph: Rod Saunders.

Monsonia marlothii adds on a lot of fresh growth and leaves whenever there are good summer or autumn rains. These may, however, fail for some years in the Brandberg area of Namibia where this plant was seen. Photograph: Rod Saunders.

found at altitudes in excess of 1 500 metres.

Moffett stated that *M. marlothii* shows a preference for rocky habitats and limestone substrates. While this would hold true for those inland stations of this species that we have investigated, it does not so entirely for those at or nearer the coast. Here what has been attributed to *M. marlothii* is found on ridges of schistose rocks that belong to the Damara Sequence, often covered by varying depths of windblown sand, in the company of a few other plants, such as *Hoodia currori*, *H. pedicellata*, abundant individuals of *Monsonia salmoniflora*, *Suttera* sp. and a limited variety of woody composites, in a sub-desert environment, which survive only on account of the frequent fogs that roll in off the cold Benguela Current. The same observations hold good for the occurrences located in the Messum Crater, while at Cape Cross this species is found on windblown sand, among dark igneous rocks.

Further inland, notably some 60 km east of Henties Bay, shrubs of *M. marlothii* are found mostly in surface limestone terrain on dolerite ridges, accompanied by *Commiphora saxicola*, *C. virgata* and *Adenia pechuelii* as

Monsonia marlothii branches draped over a rusting Coca-Cola tin in the Namib desert inland from Swakopmund in Namibia. Photograph Connall Oosterbroek.

Monsonia marlothii west of Uis with the Brandberg in the distance, in the dry season when the plants are in a leafless state. Photograph: Tim Harvey.

widely scattered individuals. In places further south, as for instance in the lower reaches of the Remhoogte descent, huge specimens of *M. marlothii* occur in the company of *Cyphostemma seitzianum* (*C. currori* auctt.), *Acacia mellifera* and *Commiphora* spp. Here too the rocky terrain is covered with surface limestone, also known as "calcrete".

M. marlothii, like *M. mossamedensis*, is strictly confined to areas with a tropical sub-desert climate. Rainfall occurs almost exclusively in the hot summer months, while the cooler winter months are usually bone-dry. In the portion of its range that lies near the coast, the highly unreliable rainfall averages 15 mm per annum. However, frequent wet fogs supplement this and may indeed purvey the major portion of the plants' moisture requirements. Further inland the rainfall average increases to some 200 mm, but fog is absent.

It should be added here, that quite a few of the specimens in herbaria originating from the coastal regions of northern Namibia or simply sighted there and attributed to *M. marlothii* may, in point of fact, belong to *M. mossamedensis*.

Monsonia marlothii may produce the odd flower in the absence of moisture in parts of the west central Namib Desert. This plant was seen near Swakopmund in February 2010. Photograph: Connall Oosterbroek.

Monsonia marlothii west of Uis. These plants often become large scandent shrubs as seen in this picture. Photograph: Tim Harvey.

History

M marlothii was first collected by R. Marloth at "Haigamkab and Husab", in the present-day Namibia and described by Engler in 1889.

Life history

M. marlothii is widespread in Namibia, its area of distribution ranging from about Duwisib in the south, to the Uniab River It has a marked preference for limestone or similar soils. It has been recorded to flower from December to June, a span corresponding to the rainy season.

Autecology

Habitats of *M. marlothii*

We have chosen to dwell in some detail on the habitats of two populations of *M. marlothii* that are geographically widely separated and present important edaphic and climatic differences.

The first of these populations occurs some 60 km inland from Henties Bay, a short distance to the west of the Spitzkoppe group of inselbergs. Here a huge intrusion of diabase, also known in southern Africa as dolerite, forms a sinuous range of hills, which extends in a general north-north-east to south-south-west direction over a distance of many kilometres. This formation is conspicuous by its black colour which stands out in the otherwise brown-coloured landscape which, moreover, is devoid of trees and covered with only the sparsest of vegetation. As already mentioned, rainfall here occurs almost exclusively during the warm season with its maximum between February and April Although there are no rainfall statistics, the annual average would lie between 50 and 100 mm In contrast with other localities where this species is known ro grow, the area considered here also receives occasional fog.

Plants of *M. marlothii*, well-branched and some 50 cm high, are widely scattered among the dolerite boulders, as also are the few individuals of *Commiphora saxicola* and *C. virgata* that, with rare specimens of *Adenia pechuelii*, are the only other perennial plants that grow in these

Monsonia marlothii is the largest Bushman Candle species and sometimes develops into tall well branched shrubs. This plant was seen on a stony hillside north of Uis in west-central Namibia. Photograph: Tim Harvey.

An arborescent *Othonna* species is frequently encountered growing together with *Monsonia marlothii* on rocky ridges, slightly elevated above the desert plain, inland from Swakopmund. Photograph: Connall Oosterbroek.

Some months after death the branches of *Monsonia marlothii* collapse onto the desert floor. Here they wither and shrivel in the desert sun until they finally decompose. Photograph: Connall Oosterbroek.

desolate and often stiflingly hot hills. As might be expected, regeneration is sporadic and very slow. No damage to the vegetation by grazing wild animals could be detected.

There appears to be no obvious threat from human interference, but there is widespread evidence of degradation attributable to a slow decrease of the rainfall, both in its quantity as in its reliability.

An extensive and well-developed population of *M. marlothii* has been observed by us for a number of years near the base of the steep Remhoogte Pass that descends from the high plateau of the Khomas Hochland to the flats that separate it from the imposing Naukluft Mountains to the south. This population grows not far from the southern limit of the area covered by *M. marlothii*.

As at the previous locality, plants here are not common. They occur principally on the sides of gullies on stony ground with very little soil, and attain a very large size. Individuals 150 or even 175 cm tall are by no means infrequent. In some cases the main stem can measure 70 or 80 mm in diameter. Such tall and profusely branched plants are by far the largest in the genus *Monsonia* and can attain a great age.

Rainfall here too has its maximum in the autumn and may average some 200 mm. Fog is absent, as the locality is far inland and various intervening mountain ranges intercept what little moisture might be blown in from the distant cold Atlantic. Night temperatures can drop well below freezing on clear winter nights, while at the peak of summer they can range well beyond 40°C.

We have not noticed any significant degradation by human activities in this area over the past 30 years. Plants have remained healthy and the large ones, which by all tokens are very old, seem to be bearing their age in good health. Young plants, however, are few and far between although seed set has been found to be satisfactory.

In the Remhoogte *M. marlothii* often grows in *Acacia mellifera* thickets, associated with a considerable variety of plants, *Cyphostemma seitzianum* being perhaps the most noteworthy. Other associates belong to the Acanthaceae and the Asteraceae, while grasses are conspicuous by their scarcity, having probably been grazed out by domestic stock. In the conditions now prevailing *M. marlothii* does not seem to face any specific threat in this area.

Monsonia marlothii is often found growing with its trunk against large rocks. These places are the niches where seeds readily lodge after dispersal and they are also water-retentive places conducive to the germination of seeds. Photograph: Connall Oosterbroek

Conservation status

The survival of this species is hardly threatened by factors other than habitat degradation and desertification, which is conspicuous in places such as the dolerite ridges east of Henties Bay. Regeneration is sporadic throughout its inland range and absent in some of the populations examined. Nearer the coast conditions appear to be somewhat better in this respect.

Monsonia mossamedensis

Monsonia mossamedensis Welwitsch ex Oliver,
Fl. Trop. Afr. 1: 290 (1862)

Synonym

Sarcocaulon mossamedense (Welwitsch ex Oliver) Hiern,
Cat. Afr Pl. Welw. 1: 108 (1896)

Description

According to Moffett and to Albers who, beyond the data supplied by Oliver in his original description of *M. mossamedensis* and extant herbarium material of Angolan origin, based their observations almost exclusively on material from Namibia, from the Uniab River southward, the species is characterised by a semi-erect to prostrate dwarf habit, branches up to 25 mm thick, and spines curved upward and ending in blunt, swollen points. The bright green leaf blades are broadly ovate to elliptical with minutely denticulate, wavy margins, and are prominently veined below. The flowers are about 35 mm across, rose-pink with paler bases. We have seen almost white-flowered plants of what we suppose to be *M. mossamedensis* at stations a short distance from the coast in Namibia. All these characters seem to differ but very marginally from those of *M. marlothii*.

The Namib Desert, a short distance from Cape Cross, is a deserted place of extreme beauty. It is home to good numbers of *Monsonia mossamedensis* that grow on boulder outcrops or on stabilised ridges of coarse gravelly sand. Photograph: Connall Oosterbroek.

Right. *Monsonia mossamedensis*. Painting: Ellaphie Ward-Hilhorst

Distribution of *M. mossamedensis*.

Diagnostic features

Roots wiry. ***Branches*** horizontally spreading, rather rigid, rarely more than 25 mm thick, grey to greyish white. ***Leaf blades*** not divided into segments, ovate to elliptical or orbicular with margins minutely toothed and markedly undulate and bases wedge-shaped, bright green; ***spines*** well-developed, blunt and curved at apices, 15–20 mm long, greyish ***Peduncles*** mostly longer than 5 mm; ***petals*** rose-pink or occasionally white.

M. inermis is readily distinguished by the absence of spines. *M. mossamedensis* resembles both *M. marlothii* and *M. inermis* by its undulate leaf margins However, in *M. marlothii* the leaf margin is shallowly rather than markedly undulate, the leaf base is cordate, the peduncle is mostly shorter than 5 mm, and the petals are uniformly rose-pink to purple.

Monsonia mossamedensis is common and grows evenly spaced apart on the rocky plains 10 km north of Namibe in the coastal region of southern Angola. Photograph: Ernst van Jaarsveld.

Geographical distribution and habitat preference

Dr. Philip Downs, a well-known plant enthusiast who now lives near Auckland, New Zealand, visited Angola on several occasions in the late 1960's and early 1970's. On a journey, in 1969, to the Angolan Namib around Mossamedes (now Namibe), in the company of Ferdinand Pfister he observed large numbers of *M. mossamedensis* some distance from the coast, about 25 km north of Namibe, where it grew in sand overlying limestone, with *Tavaresia angolensis*. Further inland, at a distance of about 35 km, plants grew on and between low limestone ridges in extremely arid conditions in association with plants such as *Cyphostemma uter*, various species of *Euphorbia* and *Commiphora*, *Hoodia mossamedensis* and a dwarf *Aloe* reminiscent of the Namibian *A. sladeniana* and *A. dinteri*.

In habit, the plants formed low, almost prostrate shrublets, a few centimetres tall and up to 50 cm in diameter. They were leafless in August but bore quite a few flowers. These were white or pale pink along the coast but bright pink with a white base to each petal at the localities further inland. Dr Downs was good enough to copy for us two colour slides of *M. mossamedensis* habitat.

Monsonia mossamedensis flowers open out fully in bright sunlight and the petals also tend to reflex. Photograph: Ernst van Jaarsveld

Monsonia mossamedensis is frequently in full flower and leaf simultaneously. This is usually in the summer months in southern Angola when most of the rainfall can be expected. Photograph: Ernst van Jaarsveld.

Monsonia mossamedensis in its harsh desert habitat amongst black rocks south-east of Cape Cross along the central Namibia coastline. Photograph Connall Oosterbroek

These, until recently, constituted the sole photographic record of this species in the Angolan environment from where it was originally described.

There is only sparse information available on the habitat of this species around Mossâmedes (Namibe) from where it was originally described. The average annual rainfall at that port over a 21-year period to 1953 has been given as 55 mm but it may be somewhat higher towards the foot of the towering escarpment. The coastal strip and adjacent interior to the foot of the escarpment is subject to frequent dense and wet fog.

History

Monsonia mossamedensis was first described in 1868 by Oliver. The type specimen had been collected in 1859 by the noted German botanist and explorer Friedrich Welwitsch in the Serra de Montes Negros near Mossâmedes, now Namibe, near the southern coast of Angola. It was later placed by Hiern (1896) into *Sarcocaulon* and, according to him, differs from the closely related *M. marlothii* by the form of the sepals which are "obtuse" and not "apiculate". Indeed, much of the descriptions of these two species, as

Monsonia mossamedensis growing amongst the leaves of *Welwitschia mirabilis* in the vicinity of Lake Arko in southern Angola in January 2009. Photograph: Ernst van Jaarsveld.

well as observations in the live and dry state of material attributed to them, do not reveal any significant differences between them. The large size usually associated with *M marlothii* is rather illusory, as that species is known to grade from dwarf shrubs near the Namibian coast to impressive individuals inland.

At the time when Moffett (1979) published his revision of *Sarcocaulon*, there were only four collections of *M. mossamedensis* from Angola in existence. Further material, originating from northern Namibia, was assigned to this taxon, the distribution of which came to be regarded as extending as far south as the arid hills east of Henties Bay. Here, as at places elsewhere, the range of this species was said to be overlapping with that of *M. marlothii*. The relationships between these two species are discussed at some length in the treatment of *M. marlothii*.

Life history

E. van Jaarsveld, who visited the area around Namibe in 2009, reports that large numbers of *M. mossamedensis* can be found in the coastal Namib both north and south of that town, where they grow either on sand or on surface

Monsonia mossamedensis flowers sporadically in the absence of moisture. This plant was seen in the Namib Desert south of Cape Cross in February 2010. Photograph: Connall Oosterbroek.

Monsonia mossamedensis grows adjacent to the Atlantic Ocean in flat areas above limestone cliffs, 10 km north of Namibe in southern Angola. The shrubs in these places may become very large and spreading. Photograph: Ernst van Jaarsveld.

limestone (calcrete) in very arid conditions. These are, nevertheless, relieved by frequent coastal fogs, witness the usually dense growth of various lichens that festoon the branches of the monsonias and other desert vegetation.

Autecology

Monsonia mossamedensis in Angola and Namibia

Until quite recently little was known of the autecology of this species in south-western Angola, from where it was originally described. According to Dr. Philip Downs (pers comm.), who collected it in the area of its type locality in the early 1970's, plants were relatively abundant on low, sand covered limestone hills some 25 km north of Namibe, some distance from the coast. They were rather sparsely branched, with their branches hugging the ground, probably in response to the prevailing windy conditions. The species was also met with some 10 km further north on low limestone hills.

We owe detailed accounts of at least three Angolan localities of *M. mossamedensis* to Ernst van Jaarsveld who visited the desert coast around Namibe (Mossamedes) in January 2009. We thus are able to give detailed accounts of the occurrence of Bushman Candles in this most northerly and remote sector of their distribution.

Due to the prolonged civil war, the south-western corner of Angola is at present very thinly populated by humans and degradation due to their activities is limited to the immediate vicinity of Namibe. Wild herbivores are present in small numbers but no damage due to them was observed, as is so evident in certain areas south of the Kunene River. This, however, may be due to the fact that vegetation in this part of the Namib is considerably more lush than is the case south of the Kunene.

M. mossamedensis was observed along the coast north of Namibe, where it grows on surface limestone along the raised coastal terraces. Its area of distribution extends inland to about 35 km east of Namibe but here plants are rather uncommon and occur as single individuals or small groups on gravel plains. Here fogs seem to be less frequent, as witnessed by the relative paucity of lichen growth on plants and rocks.

Between these easternmost populations and the coast, the numbers of *M. mossamedensis* vary considerably. Thus, while in some places they can be dominant, at least

Gemsbok (oryx) frequently graze the branches of *Monsonia mossamedensis* in the desert near Cape Cross. They also partially uproot the plants whilst grazing. The net result is thick-stemmed stubby branched *Monsonias* scattered among the stones on the desert floor. Photograph: Connall Oosterbroek

in aspect, they may be almost absent in adjacent areas. The densest populations were observed on gravelly plains. The fact that many dead plants can be found seems to be a consequence of the virtual absence of a human presence from these arid expanses, since otherwise such dead plants would have been used as fuel. No observations have been made of seedling regeneration, but, as young plants are as common as adults, regeneration seems to be quite satisfactory.

M. mossamedensis does not exhibit any noticeable preference for specific types of soils and is equally at home on granite-derived terrain or on surface limestone. Its distribution range as well as the population density are apparently governed by the frequency and density of the coastal fogs, rather than by edaphic considerations.

M. mossamedensis on a granite hill 36 km east of Namibe

M. mossamedensis was first met with along the way to Iona, on gravelly plains interspersed with dome-shaped granite outcrops, strewn with large numbers of Middle Stone Age artefacts. The boulders were covered in part by large shrubs of *Sterculia africana, Boscia tomentosa,* sneezewood (*Ptaeroxylon inerme*), marula (*Sclerocarya birrea*), *Ficus ilicina, Euclea divinorum, Acacia mellifera,* and a few *Euphorbia eduardoi*. Low-growing *Commiphora* plants were common and included *C. africana, C. wildii, C. mossamedensis* and *C. virgata*. Succulent plants were prominent and included *Sansevieria pearsonii, Cissus cactiformis, Sarcostemma viminale, Kleinia longiflora, Adenia repanda,* a *Jatropha* which may be undescribed and a *Kalanchoe*. In general the vegetation was sparse and included various low perennials belonging to the family Acanthaceae (*Petalidium, Barleria*).

M. mossamedensis grows here scattered in open terrain in the company of an *Ipomoea* and *Hoodia mossamedensis*. Lichens were prominent on the branches of most plants, due to the proximity of the coast and the frequent fogs drifting in off the Benguela current. The Bushman Candles here had spreading branches and were covered with flowers ranging from white to pink.

M. mossamedensis about 10 km north of Namibe

Along the gravel track leading north along the coast, the terrain consists of rocky (surface limestone) desert with prominent *Euphorbia virosa* ssp *arenicola* forming part of a sparse, generally procumbent vegetation, suggesting strong coastal winds and including *Commiphora mossamedensis, C. angustifoliolata* and *C. saxicola, Terminalia prunoides* as also *Gossypium* and various grasses. Succulents are frequent and varied and include *Zygophyllum orbiculatum, Euphorbia mauritanica, Hoodia currori, H. pedicellata, Tavaresia angolensis, Aloe* cf. *A. kaokoensis, Psilocaulon* sp., *Adenolobus pechuelii,* and *Talinum* sp.. *M. mossamedensis* grows scattered on these coastal plains from the sea cliffs eastward The growth here is markedly procumbent and the plants were flowering white to light pink. The grass *Chloris flabellata* was common.

Monsonia mossamedensis is common in stony areas in the desert near Cape Cross. Seeds lodge readily in these places and this explains the preference the monsonias have for this type of habitat. Photograph: Connall Oosterbroek.

M. mossamedensis at Lake Arko, south-east of Namibe

The terrain here is hilly with sandy or gravel flats and sparse desert vegetation. *Welwitschia mirabilis* is dominant here and stretches as far as the eye can see. The cones were opening and seed scattered far and wide in huge numbers. Other larger plants include *Euphorbia virosa* ssp. *arenicola, Sesamothamnus benguellensis,* the "mustard tree" (*Salvadora persica*) and *Tamarix usneoides,* the last two confined to dry river beds.

Monsonia mossamedensis grows here in open terrain, sharing the habitat with *Welwitschia mirabilis* and various other plants such as *Zygophyllum orbiculatum, Commiphora saxicola, Adenolobus pechuelii* and the weird *Adenia pechuelii*. The grass *Chloris flabellata* occurs scattered over these flats Large ancient stone-age artifacts are conspicuous, indicating a long history of human presence. Bushman Candles, with flowers ranging in colour from white to pink occur on outcrops. Erosion gullies are quite conspicuous.

The presence in Namibia of *M. mossamedensis* is now generally accepted, although some doubt persists regarding the plants attributed to this species. Bushman Candles are absent from the desert coast north of the Ugab River mouth, from the sand sea fringing it to the east as far as some distance north of the Kunene River, and there

have been no reports of it having been seen in the hills and valleys fringing this area further inland. There thus appears to be a significant disjunction between the typical occurrence around Namibe in Angola and the assumed populations in Namibia. With this reservation, we shall here describe the conditions under which this species grows in the hills east of Cape Cross and a short distance away from the coast, it the western portion of the Messum Crater.

M. mossamedensis along the Namibian coast, east of Cape Cross

The range of hills directly inland from Cape Cross consists of dark, igneous rocks, covered by windblown sand. Large boulders afford shelter to a sparse vegetation of plants capable of growing in conditions of frequent drenching fogs. These include principally Chaenopodiaceae, Asteraceae and *M mossamedensis* Average rainfall at Swakopmund is of the order of 15 mm per annum and there is no reason to suppose that it amounts to more than this anywhere northwards along this desert coast.

M. mossamedensis plants grow here in small groups in the shelter of boulders, often in deep sand, and regeneration seems satisfactory No damage caused by grazing wild animals was observed here and the total absence of domestic stock has helped to maintain a healthy ecosystem

Conditions in the Messum Crater, at a slightly greater distance from the Atlantic coastline, are somewhat harsher, because the west wall of the crater intercepts some at least of the moisture carried by the prevailing westerly air currents. Nevertheless, heavy, drenching fogs are common and have allowed some extremely large and old individuals of *Welwitschia mirabilis* to survive, together with other much less conspicuous plants, among which widely scattered specimens of *M. mossamedensis*. Significantly, the latter are mostly found on the upper slopes of the crater wall, while those on its floor are fairly rare. Here too, the plants seem unmolested by grazing but, in latter years, frequent incursions into the crater by cross-country vehicles has been affecting their condition, as indeed that of the welwitschias, some of which must be 1 500 years old, if not older.

Conservation status

Its existence does not appear to be threatened by any factors other than overgrazing and desertification. Regeneration, where observed, appeared to be sporadic

Right: *Monsonia mossamedensis* at the height of summer in the coastal desert of southern Angola, quite some distance inland from the coast. Photograph: Ernst van Jaarsveld.

The Namib Desert near Cape Cross is a harsh wind blasted place subject to intense radiation all day. *Monsonia mossamedensis* is one of the few plants that are well-represented in this hostile environment. Photograph: Connall Oosterbroek.

Monsonia herrei

Monsonia herrei (L.Bolus) F.Albers,
S. Afr. J. Bot. 62(6): 346 (1996)

Synonym

Sarcocaulon herrei L.Bolus, *S. Afr. Gdng Country Life* 22 10 (1932).

Description

While all the species thus far dealt with here have leaves with simple leaf blades, there remain three taxa that are very distinct in this respect. These have leaves with blades that are multi-segmented or feathery (bi- to tripinnatisect) and densely covered with whitish, translucent hairs. In all other aspects they accord well with the morphology of the remaining species.

M. herrei is distinguished principally by the conspicuously stout spines into which the petioles of the long-stalked leaves harden when the blades drop off with the onset of drought. These spines can attain a length of 30 mm and be some 2 mm thick in the middle and sit on elliptic bases, up to 3 mm long. They are usually reddish-brown at first, turning grey with time.

The plants form compact, intricately branched shrubs, to 30 cm tall and up to 40 cm in diameter. The branches are very thick and stout and, after rains, are densely covered by the feathery, bright green leaves. These are soon deciduous, after which the plants assume the desolate aspect shared by so many other species in this harsh and arid environment.

Monsonia herrei is at the easternmost edge of its distribution in the Eenriet Mountains north of Steinkopf in northern Namaqualand. The plants are common in places and the new shoots often grazed by goats. Photograph: Connall Oosterbroek.

Right: *Monsonia herrei*. Painting Ellaphie Ward-Hilhorst

Distribution of *M. herrei*.

The pedicels average 20 mm in length. They and the sepals are shortly pubescent, while open flowers measure some 30 mm across. These are an attractive pale yellow and bear scattered hairs on the lower surface of the petals.

Diagnostic features

Roots wire-like. ***Branches*** sub-horizontal, rigid, usually more than 10 mm thick, greyish yellow. ***Leaf blade*** divided into segments (bi- to tripinnatisect), covered in fine hairs; ***spines*** well-developed, stout, 12–30 mm long, initially rust-brown and finely hairy but turning grey with age. ***Petals*** with scattered hairs on lower surface, pale yellow.

It resembles *M. multifida* and *M. peniculina* by the leaves being divided into segments; but in those species the spines are either absent or vestigial, and the petals are white or pale pink or magenta or salmon-red. *M. multifida* is the only known species with usually a basal blotch on each petal

Geographical distribution and habitat preference

M. herrei occupies a limited area in the inner, southern part of the Richtersveld. It is found on the plateau of Klipbokberg, south of Eksteenfontein and thence to Jenkinskop and the Rooiberg Mountains, which lie more or less north-east of that locality. These represent the northern and north-eastern limits of its distribution and from there it is found in scattered populations in a general south-easterly direction that extends as far as the conspicuous Eenriet Mountains, east and north-east of Steinkopf and the gravelly plains into which these descend. *M. herrei* favours quartzite ridges but can grow happily on crystalline schist outcrops, at altitudes 750 to 1 000 m. Its range seems to coincide with that area that lies between the strictly winter rainfall regimen of the Western Cape coast and the summer rainfall pattern that obtains further east. The annual averages would be in the region of 150 to 200 mm and rains fall principally as a result of infrequent cyclonic winter storms from May to September or as local but often violent thunderstorms in February to April. Frosts and even rare snow falls are known to occur throughout the higher parts of its range.


Monsonia herrei is invariably associated with white quartz fragments where it occurs north of Steinkopf. The petiolar spines may be curved and straight on the same plant. Photograph: Connall Oosterbroek

History

Moffett (1979) states that Bolus described this species from a plant growing in the Botanical Garden of the University of Stellenbosch, which Herre had collected in the Richtersveld.

Life history

The flowers appear shortly after the leaves in the cool season after the first abundant rains, and may continue to do so as late as December if conditions have been particularly propitious.

Autecology

M. herrei in the south-eastern Richtersveld and the Eenriet Mountains north-east of Steinkopf

The Richtersveld, a rugged mountainous region situated in the north-western corner of South Africa, has seen several changes to land use patterns over the last century or so. Initially a good amount of territory was prospected for minerals. It also attracted at least two waves of farmers who settled with their livestock, mostly sheep and goats. The current farming practice is communal grazing, moving livestock to pastures throughout the Richtersveld once the early winter rains fall and grazing conditions improve.

The flora of the Richtersveld has co-existed with pastoralism for a long time and has survived grazing by donkeys, sheep and goats. There is little doubt that the stony nature of the terrain has assisted the seedlings of many succulent species to survive until they are large enough to resist trampling. Prominent amongst these plants is *M. herrei*.

It is only in recent decades that the international significance of plant diversity in the region was recognised. Much of the region is formally preserved in the Richtersveld National Park and the adjoining Richtersveld Community Conservancy which is a world heritage site. Some large concentrations of *M. herrei* are conserved in these two reserves, including enormous and extensive populations on the Rooiberg east of Eksteenfontein. Transhumance as a way of life is now formally recognised in conservation plans for the two reserves.

Grazing by mixed livestock is part of a process with two distinct faces. One of them presents us with the destruction and grazing of seedling plants with limited possibilities for those that are the most palatable. The other shows the significance any grazing animals have in not only keeping the habitat clear from cluttering vegetation but also the very necessary function livestock plays in loosening stones and soil. It is in these situations that seeds of many bulbs, caudiciforms and succulents are able to lodge and germinate.

It is also important to note that grazing pressures vary from one season to the next on many of the stony hillsides in the Richtersveld. This is related to the size of the herds and the condition of the vegetation. In some of the newly conserved areas such as the Rooiberg there is currently an increase in the number of *M. herrei* seedlings. Preliminary indications are that livestock is grazed these days mostly in the sandy plains below the mountain and this has happened mostly since the formation of the community conservancy.

We have studied three colonies of *M. herrei* since the 1970's. One is situated on the Rooiberg in the Community Conservancy, the other scattered across the quartzite outcrops of the Wyepoort valley north-west of Steinkopf, and the third on the rocky northern slopes of the Eenriet Mountains to the north-east of Steinkopf. A discussion of these observations follows below.

Monsonia herrei flowers just before dusk on a warm early spring day. The flowers close completely in the early evening. Photograph: Connall Oosterbroek.

Monsonia herrei bears the majority of flower buds at, and towards the ends of, the youngest branches. The plants are often so covered with flowers that little else is visible when compact plants are in full flower. Photograph: Connall Oosterbroek.

M. herrei on the Rooiberg east of Eksteenfontein

One of the most impressive mountains in the south-central Richtersveld is the Rooiberg. Possibly the largest concentrations of *M. herrei* in the Richtersveld occur here, giving a good idea of how the plants grow under relatively undisturbed conditions. The Rooiberg is also an ideal locality for studying this species as it is cone-shaped with numerous rocky crests and gullies facing all points of the compass. It is easy therefore to survey the different slopes in order to find out which are most densely utilised by the Bushman Candles, as well as to identify places where the plants are absent altogether.

The summit of the Rooiberg lies at an altitude of 933 metres. The monsonias are abundant on the top of the mountain and on the north-east and west-facing slopes near the summit. They are particularly common on the north- and west-facing slopes right down to the foot of the mountain. They have even colonised parts of the foothills that were degraded and disturbed by earlier mineral prospecting activities.

Some of the largest *M. herrei* ever recorded occur on the summit of the Rooiberg. Their crowns of branches may be sixty centimetres across. Regeneration of the plants is very favourable all over the mountain. A notable exception is steep slopes with loose unstable rock that crushes seedlings and even mature plants when there are rock slides. The monsonias are best represented in places where rocks are fixed in the ground, or amongst boulders on the

Monsonia herrei in the last rays of the setting sun with the Eenriet Mountains in the distance. Much of the habitat at this locality is heavily grazed by sheep and goats, and the open barren areas are densely utilised by the monsonias. Photograph: Connall Oosterbroek.

numerous rocky ridges that are so plentiful all over the mountain.

Seedlings are very much in evidence after good rains. They establish themselves rapidly, particularly if they take root amongst rocks. In these places the young plants are well protected from the scorching rays of the afternoon sun. A few successive drought years reduce the number of young plants. These dry periods are the main factor that currently controls the recruitment of new individuals at this locality

The shady south- and south east-facing slopes of the Rooiberg, which are fairly extensive, hold no populations of *M. herrei*. It is interesting to see that the plants only occur immediately south of the trigonometric beacon on top of the mountain for a distance of some 40 metres. As soon as the slope becomes abruptly south-facing and shady the Bushman Candles are absent.

M. herrei is associated with an interesting bulbous, geophytic and succulent flora on the mountain. The iconic plant of the Richtersveld, *Pachypodium namaquanum*, is evident in many places on the sunny slopes and *Othonna armiana* is abundant on the south- and south-east facing slopes near the summit to within the vicinity of the trigonometric beacon. *Brunsvigia herrei* has an unusual habit on the Rooiberg, occurring on both the sunny and shady upper slopes.

M. herrei is readily observed on some of the rocky foothills close to the end of the mineral prospecting track about a kilometre from the guest-house. The countryside in the vicinity of the guest-house is well grazed by livestock, particularly sheep and goats. This open sunny area is rich in bulbous flora which marks its appearance after good rains. It is, however, not a place where any *M. herrei* are encountered.

M. herrei on quartz outcrops in the Wyepoort Valley

The Wyepoort Valley, also known as Umdaus, lies to the north-west of Steinkopf and is extensively used for seasonal grazing. It is very rich in succulent and bulbous plants, and has scattered colonies of *M. herrei*, which are invariably associated with prominent white quartz ridges.

The countryside is heavily stocked with sheep, goats and donkeys from May until September or early October. This is the period when the winter rains fall and grazing is at its best. Stock herders move to their winter camps when the first rains fall, usually in May. These places are then quickly refurbished for residence, most of them having been vacated for the duration of the hot dry summer.

Grazing is often at its heaviest in the general vicinity of the camps. The same places are used to set up temporary dwellings year after year and the surrounding has changed accordingly. Poisonous and unpalatable plants such as *Haemanthus namaquensis* and *H. unifoliatus* grow out in the open and amongst rocks and are avoided by livestock. Others escape heavy grazing by growing under thorny or dense shrubs, and by virtue of their location between sheltering stones on rocky outcrops. The rockiest places also have the least vegetation and are less attractive to livestock than the sandy areas with more plants.

M. herrei is regularly grazed at the beginning of the winter growing season since it is one of the first plants to sprout new growth after rains. The growing points of the branches are nibbled down, but the lower portions of the trunks, armed with heavy spines, generally remain intact. The plants quickly sprout new growth which may or may not be re-grazed, depending on the rainfall patterns during the winter. If the rains are good there is plenty else available for the livestock to graze. In drier seasons the Bushman Candles are repeatedly grazed because there is little else for the grazers to eat.

The stubby, thick-branched *M. herrei* so frequently seen at Umdaus are the hardy old survivors from grazing over the years. The main problems the monsonias encounter, however, are not so much grazing, but trampling of the seedlings. The young plants only escape when they grow in rocky niches on ridges or amongst large stones in places near the bottom of the valley.

At Umdaus they are confined to the rockiest places, unlike on the Rooiberg where they are ubiquitous.

It is surprising to notice that even under conditions of regular and heavy grazing, such as at Umdaus, they are plentiful in places where there are usually steep rocky slopes with little other vegetation to attract grazing livestock.

M. herrei on the northern slopes of the Eenriet Mountains north-east of Steinkopf

M. herrei is at the easternmost corner of its distribution range on the Eenriet Mountains. This is another area where regular seasonal grazing is practised by herders who take up temporary winter residence in the surrounding countryside. Herds of sheep, goats and donkeys graze the hillsides throughout the winter, and the effects on *M. herrei* parallel those at Umdaus. One significant difference is that there are large concentrations of *M. crassicaulis* occurring together with *M. herrei*. The *M. crassicaulis* are, however, much more numerous, particularly on the rockiest and most arid sections of the mountain.

M. crassicaulis is better adapted than *M. herrei* to survive heavy grazing. It has long, hard petiolar spines that often point forward in groups from just below the growing point of each branch. This armour makes the plants more difficult for livestock to approach and the animals choose other more readily accessible grazing.

Seedlings are also generally rather scarce on the Eenriet Mountains but are usually most evident in the rockiest places where they escape trampling. Mature *M. crassicaulis* and *M. herrei* are readily damaged by trampling. Their rigid branches break off rather easily when pressure is applied, particularly when the stems are turgid after rains, during the winter growing season.

Conservation status

M. herrei is threatened by intense overstocking in several parts of its range, and consequent habitat and soil degradation. Plants are often grazed to the bare ground and seedlings only survive when growing in the protection of woody shrubs or rocks. At sites known to us where the species was abundant in the 1960's and 1970's one would now struggle to find a single specimen.

Monsonia multifida

Monsonia multifida (E.Meyer *ex* R.Knuth) F.Albers, *S. Afr. J. Bot.* 62(6): 346 (1996)

Synonym

Sarcocaulon multifidum E. Meyer *ex* R. Knuth, *Pflanzenr.* 4. 129: 312 (1912).

Description

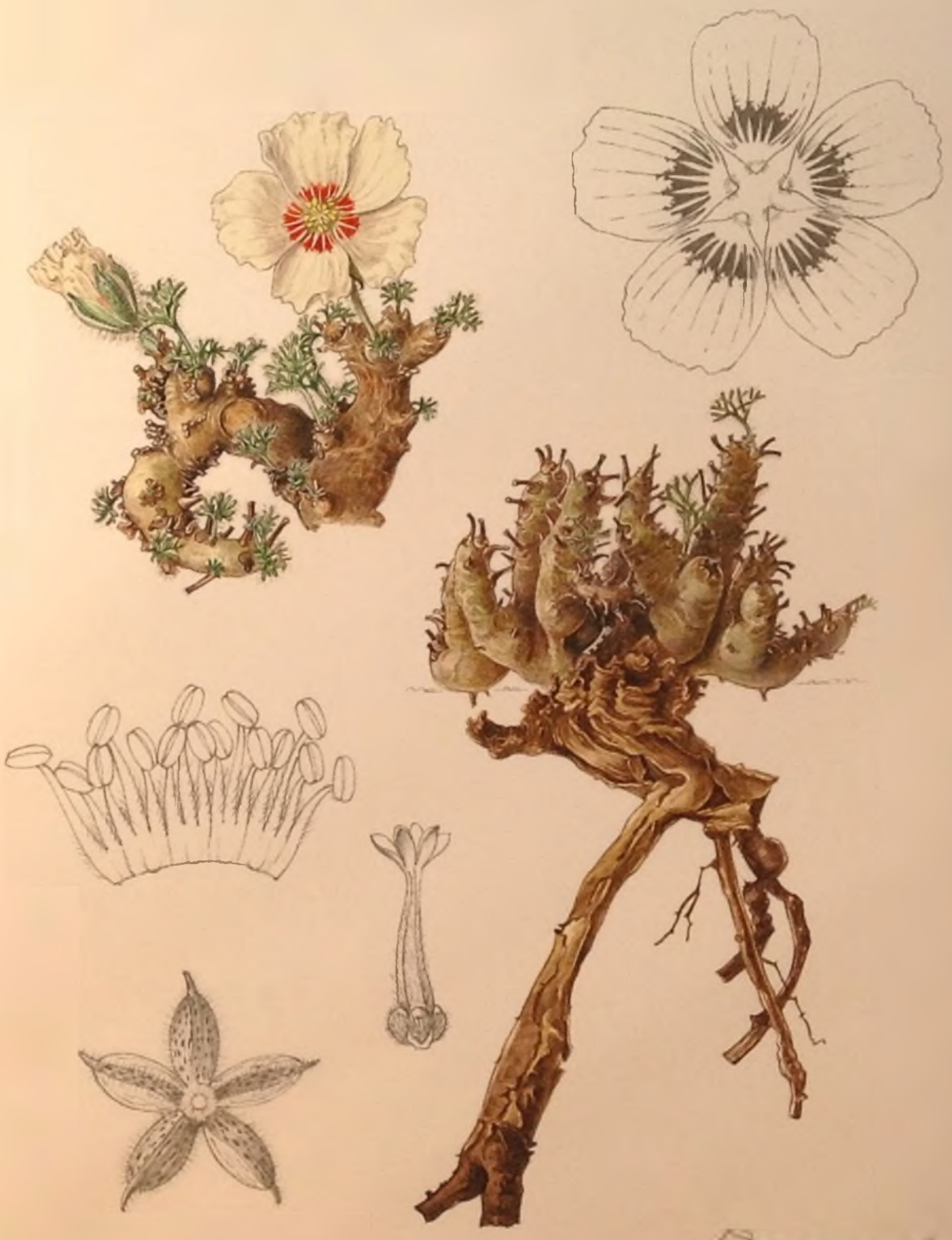
A most attractive dwarf species, *M. multifida* typically has few branches that usually hug the ground. They are characterised by thickened roots. They usually are about 5 cm tall, the greyish, horizontal branches most commonly having a spread of about 10 cm, although larger specimens, up to 15 cm tall and 25 cm in diameter, are occasionally met with in more sheltered positions. The branches are fairly thick (averaging about 12 mm) and are covered, after rains, by long- and short-petioled, feathery, hairy leaves of a silvery green colour. The species has no real spines, since the bases of the petioles dry with time as blunt, horn-like processes, 3–6 mm long. The flowers are particularly attractive, 30–35 mm in diameter and come in various luminous shades that range from pure white, through bright pink to magenta. South of the Orange River they bear a darker spot at the base of each petal but north of the river we have found this character to be far less frequent or entirely absent, irrespective of the base colour of the petals themselves.

Diagnostic features

Roots succulent ***Branches*** spreading horizontally, rigid, 10–20 mm thick, greyish brown to whitish grey. ***Leaf blades*** divided feather-like into segments, conspicuously hairy; silvery green; ***spines*** absent or reduced to vestiges ***Petals*** white, pink, or magenta, mostly with a basal crimson to maroon blotch on each.

Monsonia multifida grows mostly in the fog deserts adjacent to the Orange River in the Northern Cape and the adjacent parts of Namibia. This photograph shows the habitat east of Beauvallon in the Northern Cape looking across the river into equivalent habitat in the south-western corner of Namibia. Photograph: Tim Harvey.

Right White-flowered *Monsonia multifida*. Painting: Ellaphie Ward-Hilhorst.



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Distribution of *M. multifida*

It resembles both *M. herrei* and *M. peniculina* by its leaves being divided into segments; but differs from both by its succulent roots. *M herrei* is readily distinguished by its pale yellow petals and well-developed spines; while *M. peniculina* is characterised by it thicker stems (20–30 mm thick) and petals which are predominantly uniformly salmon-red, but can also be pink or white.

Geographical distribution and habitat preference

M. multifida has a much wider distribution range than *M. peniculina* and occurs in pure stands as one approaches the Orange River. It is confined to the semi desert on both banks of the lower Orange River, where it can be found from within 10 km of the Atlantic coast to places as far upcountry as Rosh Pinah in Namibia and at a relatively shorter distance in the south. The eastern limit of its distribution lies around Sendelingsdrift in the Richtersveld where we have photographed it on the vast fields of milky quartz gravel through which one descends to the river, coming from Alexander Bay. Generally speaking, *M multifida* favours extremely rocky habitats where it most often grows between the sheets of schistose strata. The rainfall in their habitat is of the order of 25 mm per annum and is associated with cold fronts that blow in from the South Atlantic. This is augmented by frequent dense fogs. *M. multifida* lives under conditions of almost constant winds, principally from the south-west, which very often reach gale force and are accompanied by severe sandstorms. These have a drying and abrasive effect on everything exposed to them.

Monsonia multifida growing in the arid mountainous desert south of Rosh Pinah in south-western Namibia, in full leaf after winter rainfall. Photograph: Tim Harvey.

Right Red-flowered *Monsonia multifida*. Painting: Ellaphie Ward-Hilhorst.

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Monsonia multifida growing in the desert east of Alexander Bay. A number of small unidentified wasps were present on the flower and were likely to have been gathering pollen. Photograph: Tim Harvey.

History

This little jewel of a plant was first pictured in an engraving (Fig. 34) of the second edition of Paterson's Travels (1790). This figure, like every other in Paterson's account, is extremely detailed and shows, among other features, the thickened, fleshy roots characteristic of *M. multifida*. There was no further record of this species until it was collected by Drege when he visited the mouth of the Orange River in 1830. Later, when Meyer (1843) catalogued Drege's collections, he named it *Monsonia multifida* but, as he did not provide a description it was not validly published. Knuth (1912) provided the type description under the binomial *Sarcocaulon multifidum*.

Life history

The leaves appear speedily, even after slight rain or an exceptionally heavy and wet fog and wilt as quickly as the soil dries out. *M. multifida* flowers mainly after dense fogs or rain and, as is the case with all other species in this arid region, it often does so in the leafless state. The optimum flowering periods last for several weeks after good rains have fallen. In South Africa this is usually in the winter and spring. However, in south-western Namibia, where the plants grow, rain may fall in March and April (the early autumn) or in the winter.

Monsonia multifida has flowers that may be pink, red or white. This white-flower plant was seen east of Beauvallon in the Northern Cape in the vicinity of the Orange River. Photograph: Tim Harvey

Autecology

M. multifida in north-western South Africa and south-western Namibia

The bulk of *M. multifida* habitat in southern Africa is close to the Orange River, the border between South Africa and Namibia. The plants frequent mostly the west-facing crests of windswept ridges. They are found more rarely on exposed schist outcrops that protrude from flat areas of stabilised pebbly sand. In these places they occur near populations of *M. patersonii*, which is always much more abundant, as it does not require rocky terrain in which to anchor its root system.

M. multifida grows in association with a rich succulent and bulbous flora including *Fenestraria aurantiaca*, *Pelargonium klinghardtense* and *Pelargonium mirabile*. Amongst the bulbs is an undescribed species of *Massonia* and, where *M. multifida* occurs nearer to the coast, *Strumaria bidentata*.

The Namibian distribution range extends much further inland. The plants are found on rocky east-facing foothills of the Obib Mountains immediately west of Rosh Pinah and east of the Dreigratberg, a stone's throw from the Orange River. This is an extremely arid area and receives much less coastal fog than other places adjacent to the Orange River, further downstream.

The Bushman Candles share their habitat in Namibia with an equally rich succulent and geophytic flora as they do in South Africa. In the foothills of the Obib Mountains *M. multifida* grows together with *M. flavescens* and *M. inermis*. The latter, however, is much more plentiful in the lower lying places whereas *M. multifida* only inhabits rocky hill crests. Hybrids between these species are conspicuous by their absence. Amongst the geophytes an *Eriospermum* species is common and so are several small *Albuca* species that may be undescribed. The bulbs and geophytes only make their appearance after good rains and otherwise the habitat is very arid and barren and the monsonias are leafless.

We have observed *M. multifida* for several decades at several places in Namibia and South Africa. A discussion of some representative habitats close to the Atlantic as well as much further inland follows below.

Monsonia multifida leaves are characterised by a fine dense pubescence. They appear to have some function in trapping fog when this is blown off the Atlantic, condensing it into droplets which irrigate the sand around the plants.
Photograph: Connall Oosterbroek.

Monsonia multifida spends its first few years, after germination, as a swollen trunk. It later starts to branch.
Photograph: Connall Oosterbroek.

M. multifida east of Alexander Bay

M. multifida is plentiful on the north-west facing crests around Grootderm and Ysterkoppie, as well as on the desert hills south and south-west of Beauvallon. The plants are less frequent in the foothills of the Grootdermberg since much of this habitat consists of stabilised sand, a type of habitat generally avoided by *M. multifida*.

The stony low-lying areas of stabilised sand hold small groups of the monsonias in the occasional places where sheets of rock are exposed or where rocky ridges outcrop from more level ground. This habitat is regularly and richly bathed in fog at times during the autumn, winter and spring months. *M. patersonii* is very common in these sandy places that are littered with stones. Fog swept off the Atlantic is sometimes so dense that it falls as light penetrating rain. Once both *Monsonia* species have received this moisture, which often starts in early May, they flower in the leafless state. Leaves and more flowers appear if the mists continue for a few weeks. *M. multifida* is readily located at these times on account of the flowers and the dense conspicuous greyish green foliage.

During May *Strumaria bidentata* flowers around the sparse groups of *M. multifida* to be followed a little later in the winter by numerous *Pelargonium sibthorpiifolium*, should there have been rain. There is little doubt that

M. multifida would be much more plentiful in the general area, were there more rocky places to support it.

The situation changes completely further upriver to the east, particularly near Beauvallon where rocky crests reach well over 100 metres and capture heavy amounts of mist on their western slopes which face the distant Atlantic. Sometimes hundreds of *M. multifida* grow close together on the upper third of the hill crests. Here they are exposed to frequent strong winds which may reach gale force, but windy conditions are most frequent in the summer at a time when *M. multifida* is fully dormant so that little damage results.

During the period from June until August there is the greatest probability of rain from cold fronts. When the desert countryside does receive rain, masses of *M. multifida* come into leaf and flower. The flowering at these times may continue for several weeks and large amounts of seed are liberated into the habitat. These germinate quickly if there is follow-up moisture, and the seedlings develop rapidly allowing some of them to withstand the desiccating winds during much of the following summer.

Monsonia multifida flowers close at dusk. This flower, about half an hour before sunset, is host to a pollen seeking insect. Photograph: Connall Oosterbroek.

Monsonia multifida is at its most numerous on rocky ridges, east of Alexander Bay. The plants anchor their extensive root systems in rocky fissures. They are also found, but less frequently, in stabilised sand lower down. Photograph: Connall Oosterbroek.

M. multifida has little competition in its habitat on the rocky west-facing hilltops near Beauvallon. Other plants which are found here are small groups of *Pelargonium mirabile* and a most unusual *Massonia* species that appears to be undescribed.

The flora of these rocky crests is in various ways adapted to surviving strong winds. The swollen roots of *M. multifida* allow the plants to anchor themselves firmly amongst rocks. *Pelargonium mirabile* has very long rhizomatous roots that give rise to new plants at some distance from the original one as well as stems that extend well into the sand. The *Massonia* bulbs are encased in masses of tightly compacted papery tunics and they are frequently wedged into rocky fissures below the surface of the sand where moisture tends to linger.

In recent times mining has been started near Beauvallon below the largest concentrations of *M. multifida* so far recorded. Should mining or associated activities continue up the surrounding hills a large number of this interesting and significant species will be destroyed. Another recent occurrence is that of people who have moved into the area and built dwellings. Should livestock accompany settlement, *M. multifida* and other flora unprotected by spines may be grazed when most vulnerable during the leafing and flowering period.

M. multifida in the south-western corner of Namibia

M. multifida has an interesting distribution close to the mining town of Rosh Pinah. The plants occur immediately east and north of the Dreigratberg, which overlooks the Orange River. To the north they are replaced by *M. peniculina* for almost the entire length of the tall hills and peaks that lie west of the road leading to Rosh Pinah. They then reappear higher up in the rocky eastern foothills of the Obib Mountains.

Close to the Orange River the plants grow in a very hot and arid environment. Dense fog that periodically hangs over the river valley probably provides much of the moisture requirements for these plants. The Bushman Candles are scattered over low rocky crests, as they are

elsewhere in the distribution range, with their swollen roots frequently wedged into bands of schist that lie buried beneath the desert sands. After good rains, which are very infrequent in this arid area, the Bushman Candles are densely covered in leaves and flowers for a few weeks. At these times it is evident that they are plentiful in places, as the foliage and flowers are easy to spot in the otherwise drab habitat.

The monsonias are often larger with longer branches, unlike the more compact plants that occur on the wind blasted rocky hills further westwards, east of Alexander Bay in South Africa. Sporadic flowering in the leafless state is common, usually in response to a few successive fogs in the cooler autumn and winter months.

Immediately west of Rosh Pinah *M. multifida* occupies another distinct niche in the environment. Here plants occur on the rockiest parts of east-facing mountain foothills, again with their swollen roots wedged amongst rocks. The two other monsonia species that occur nearby, *M. flavescens* and *M. inermis*, are rather rare where *M. multifida* grows but much more common in the flatter, lower lying areas nearby.

The distribution of *M. multifida* ends abruptly in the hills just south of Rosh Pinah, the furthest known north-eastern locality. However, they are well represented here in the foothills of the Obib Mountains, an area very rich in succulent plants.

Conservation status

M. multifida seems to be well enough protected by the hostile environment in which it lives, as stock densities are low and the plants seem to be avoided by domestic animals. We did not encounter any plants injured by grazing, a cause of damage to most other species of Bushman Candle. Diamond mining activities along the course of the Orange River have, however, obliterated considerable populations of this species, as also of many other uncommon or rare plants.

A *Massonia* species grows together with *Monsonia multifida* at several localities east of Alexander Bay. The plants only emerge in years when there is heavy early winter fog or rainfall and may stay dormant for several years in succession during dry periods. Photograph: Connall Oosterbroek.

Pelargonium mirabile is commonly found growing together with *Monsonia multifida* east of Alexander Bay. The pelargoniums grow in leaf and flower in the winter from May to August, if there is enough moisture, at the same time as the massonias. Photograph: Connall Oosterbroek.

Monsonia peniculina

Monsonia peniculina (Moffett) F.Albers,
S. Afr. J. Bot. 62(6): 346 (1996)

Synonym

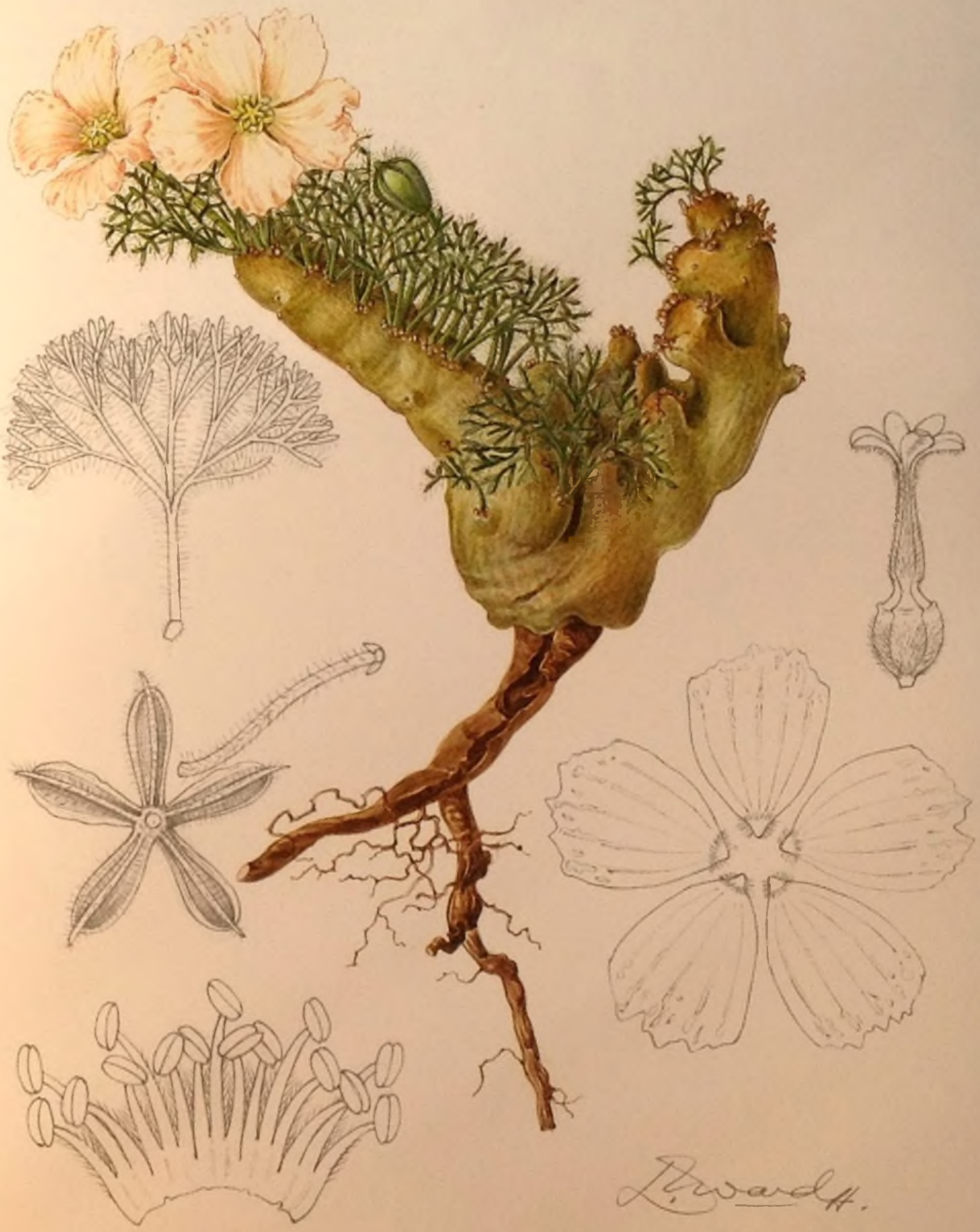
Sarcocaulon peniculinum Moffett, *Bothalia* 12(4): 610 (1979).

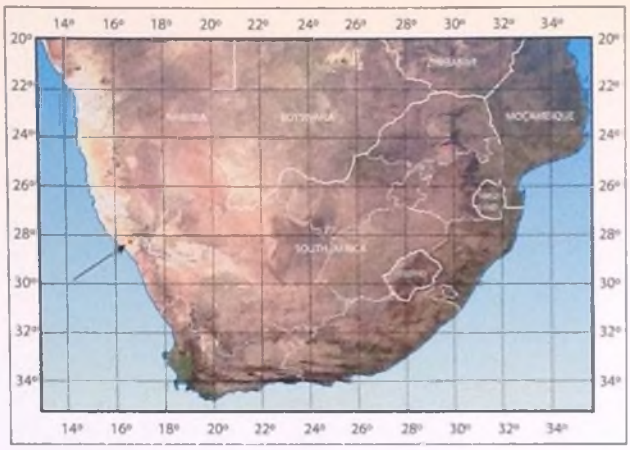
Description

M peniculina is, in our view, the most notable species among the Bushman Candles. Like *M. multifida*, with which it was confused until their differences were recognised by Moffett (1979), it is a low plant with few branches that are usually parallel to and often hugging the ground. The roots are wiry and thin, in contrast to the thickened, rather fleshy main roots of *M. multifida*. The branches, confined to two in young plants, arise dichotomously from a main stem. Occasionally older, more intricately-branched specimens may be encountered, which can attain a diameter of up to 15–20 cm and a height of about 15 cm. The branches are twice as thick as in its sister species and can exceed 20 mm in section, with rounded angles, and bear no spines but only short and blunt processes in lieu. The leaves are feathery and a rather vivid green, their segments densely covered with silvery hairs. The flowers range in colour from pure white to magenta but a lovely, vivid, salmon-red colouration is prevalent. Unlike most forms of *M. multifida*, the petals have no dark blotch at their bases.

The rocky desert mountains south of Rosh Pinah in the south-western corner of Namibia are home to *Monsonia peniculina*. This habitat is very hot and arid and the species is a very narrow endemic only known from this area. Photograph: Tim Harvey.

Right. *Monsonia peniculina*. Painting: Ellaphie Ward-Hilhorst.





Distribution of *M. peniculina*.

Diagnostic features

Roots wire-like. ***Branches*** spreading horizontally on the ground, rigid, 20–30 mm thick, whitish grey. ***Leaf blade*** feather-like divided into segments, vivid green but with silvery indumentum; ***spines*** absent or reduced to vestiges. ***Petals*** uniformly salmon-red, pink or rarely white.

Like *M. herrei* and *M. multifida*, *M. peniculina* is distinguished by leaves being divided into segments. *M. herrei* is distinguished by pale yellow petals and the absence of well-developed spines, while *M. multifida* has succulent roots, thinner branches (10–20 mm thick), and a basal blotch to each petal.

Geographical distribution and habitat preference

Confined to two parallel valleys running from north-north-west to south-south-east down to the Orange River in southern Namibia, some 8 km south-east of the mining town of Rosh Pinah, where it is found on steep, mainly east-facing slopes in conditions of extreme aridity. *M. peniculina* grows at altitudes of 150 to 300 m. At lower and higher elevations it is replaced entirely by *M. multifida*. The transition from one to the other is always abrupt, so much so that, while on a single slope separating torrent beds one observes the one species, and finds only the other on the opposite side.

Contrary to what had been reported previously, we have found that *M. peniculina* grows mainly on very steep slopes in wind-blown silt, underlying detritus of Precambrian metamorphic shales with numerous xenolithic inclusions that may well be of glacial origin, or else milky quartz rubble originating from quartz veins cutting through the metasedimentary strata. The slopes favoured are generally oriented east and cut by numerous steep-sided torrent beds. It is mainly on the south- or south-east-facing aspects of these slopes that the plants grow. They are entirely absent from the opposite, west-facing slopes of these valleys and accompanied by a very sparse, largely succulent, flora in which *Euphorbia gariepina*, *Juttadinteria* sp. and a number of Asteraceae dominate.

Monsonia peniculina is completely covered in leaves after sufficient coastal fog has condensed or rain has fallen. This plant is so leafy that none of its stubby branches are visible. Photograph: Tim Harvey.

History

M. peniculina was first observed by the elder Erni, of the farm Plateau, near Aus, in Namibia, who thought it to be new However, his collection, as also those of von Wettstein, Dinter and others, were invariably assigned to *M. multifida* until Moffett (1979) resolved their identity as a distinct and indeed remarkable species. Moffett (1979) lists a *Sarcocaulon ernii* Dinter ex Range among his Excluded Species. The plant in question was grown in the Berlin Botanic Garden and was stated to have been collected in the "Sudliches Namaland" which is Southern Namibia. No trace of this specimen, or corresponding herbarium material, could be found and may be presumed to have been destroyed during World War II. The late Herbert Erni considered this to correspond to what now is called *M. peniculina*.

Monsonia peniculina flowers are usually a uniform pale pink. Like most of the Bushman Candle species the plants flower at their best after sufficient moisture has brought them into leaf. Photograph: Jean-André Audissou.

Monsonia peniculina often grows with its branches wedged amongst rocks. Seeds also land in these places when blown about in the wind, and the shadows cast by the rocks preserve moisture, providing conditions conducive to germination. Photograph Tim Harvey

Life history

The leaves appear after even a few millimetres of rain have fallen, particularly in the cool season when the rain is most effective. It flowers mainly during the cool months but, after unseasonal rain showers, may do so at any time of the year even in the heat of summer when, however, the plants remain generally leafless.

Autecology

M. peniculina in the western section of its narrow distribution

The western section of the *M. peniculina* habitat is featured in the drawing by Bowen Boshier and appears on page xiv. The plants grow mostly on the east-facing slopes of the mountain for a distance of about five kilometres. The last prominent peak shown in the middle of the drawing slightly to the right is where the distribution of *M. peniculina* ends and that of *M. multifida* begins. The range slopes down towards the Orange River and in the far distance, across from the river, are the mountains of the Richtersveld in South Africa.

The drawing indicates how restricted the habitat is, since well over half of the known distribution range of the plants is illustrated here. The accompanying photographs, taken by Timothy Harvey, indicate the frequency of gullies, hilly convolutions and rocky slopes of various gradients that are occupied by the plants. Were it not for the extremely broken nature of the terrain, the niches available for colonisation by these plants would be much less plentiful.

The steepest slopes are mostly the highest and littered with rock rubble, much of which is very loose. The Bushman Candles that grow there often show signs of damage from rock slips when loose material has fallen down the scree. Rocks are also dislodged by herds of gemsbok which traverse these slopes. The most stable habitat, with fixed rocks, is usually around water-eroded gullies. The monsonias are often concentrated in these places. Another distinct niche frequented by the plants is on low hillocks littered with white quartz fragments. *M. peniculina* grows here in the same powdery textured soil found elsewhere on the mountain.

The various types of niches on the east-facing slopes face most points of the compass and the Bushman Candles

Monsonia peniculina is usually found on very steep slopes covered in both loose and fixed rocks. On occasions the plants grow in level areas, also littered with rocks, on valley floors. Photograph: Tim Harvey.

grow mostly in the shelter of gullies and generally avoid the most sunny, north-facing aspects. As the plants flower and seed throughout the year, whenever there has been rain, or dense fog blown in from the Atlantic, there is a continual window of opportunity for seeds to germinate.

Seeds germinate in as little as two days after receiving moisture, but the best chances for the seedlings to survive are in the autumn, winter and early spring when temperatures are lower and evaporation less. Groups of seedlings and young plants of equivalent ages are regularly observed. These plants have been recruited to the populations at times of abundant fog or good rainfall.

Seedlings grow very rapidly in habitat and have generally hardened off within a few months, to withstand extreme heat and drought. The young plants remain low and unbranched for a season or two, sometimes even more, until a good amount of moisture is available. At this time they usually produce two opposite thickened branches.

Monsonia peniculina generally starts its post seedling stage life with two branches. These either rebranch repeatedly or remain as just the two branches simply lengthening and expanding in girth. Photograph: Jean-Andre Audissou.

Typical rocky habitat occupied by *Monsonia peniculina* south of Rosh Pinah. The soil below these rocks is fine and soft, easily penetrated by the relatively thin insignificant root systems of these plants. Photograph: Tim Harvey.

Germination of seeds and development of young plants is always best in places which retain moisture. These situations are found on the sides of gullies, which are only in sunlight for part of the day, as well as on south-west facing scree which is also exposed to limited amounts of direct sunlight. Other seedlings take root in the shadows of sheltering rock fragments on the sunniest slopes. Young plants on hillocks with white quartz chips are found in similar places beside stones which afford protection from excessive insolation. Many seeds initially land in places unsuitable for germination, for example amongst exposed dark, heat absorbing rocks. A good proportion of seeds, however, are blown about in the wind and land in more suitable niches. No data are currently available but seedling mortality is probably very high.

During the last two decades many of these Bushman Candles have been infested with scale insects at various times, but usually during a succession of years when there is no rainfall and little fog. These infestations are normally shed when the plants are once again in active growth after autumn or winter rainfall. Some of the monsonias do succumb to scale insects but these appear to be in the minority. Heavy scale insect infestations may play a role in the population dynamics of *M. peniculina*. It would seem that scale insect attacks are nothing new, as plants with pock marked trunks are quite often met with, which would indicate earlier damage by these insects. Dead *M. peniculina* are sometimes found in groups and it is thought that this mortality is either a direct result of scale insect infestation, or of some scale insect borne disease.

M. peniculina in the eastern section of its distribution range

The second-largest concentration of *M. peniculina* occurs on the farm Namuskluft, situated south-east of the mining town of Rosh Pinah. The plants grow in the extremely arid valleys south-east of the farmhouse, at the foot of a tall,

A panorama of all the habitat niches occupied by *Monsonia peniculina* south of Rosh Pinah. The plants are most frequent on the steep mountain slopes in the middle and far distance and least so on the valley floor in the foreground. Photograph: Tim Harvey.

rocky, north-facing mountain as well as on its lower slopes which are covered by large rocks

The distribution of the species at Namuskluft is very similar to that further west, except that most of the plants are concentrated along the valley floor amongst large boulders. The conditions here are so harsh that in many places *M. peniculina* is the only plant that is able to survive. Fewer young plants are observed here and many years probably pass with no regeneration.

The mountain which rises above the northern end of the valley has much larger numbers of *M. peniculina*. This indicates that the peaks and slopes at a higher elevation attract more moisture during foggy weather and may also be better irrigated during rainfall. The plants are, on the whole much smaller than elsewhere. This is related to the thin soils and extremely rocky terrain

In mid-May 2004, after good rains had fallen on the farm, the plants were numerous on the lower northern slopes The monsonias are easily spotted after rainfall, when their distinctive tufts of greyish green leaves stand out amongst the rocks Good regeneration was evident with young plants scattered over a wide area. They were also sometimes found growing on sandy ledges high up on the north-facing peaks. A search was conducted on the south-facing peaks and areas below but no monsonias were found there A rich bulbous and succulent flora, partial to shady south facing slopes, was present such as a *Haemanthus* species, various pelargoniums including *P. grandicalcaratum* and *P. mirabile*, as well as a dwarf *Rhadamanthus*

Conservation status

M peniculina is a very local species and threatened only by the scale-infestation mentioned previously, habitat disturbance by grazing animals, climatic change and human activities. Much of its habitat is now included in the Ai-Ais/Richtersveld Transfrontier National Park and the latter threat must now be considered as drastically reduced. It has considerable horticultural potential as a bonsai plant and in specialised collections and no effort ought to be spared to reproduce it from seed.

Monsonia peniculina is frequently found with contorted or hooked branches. This habit is the result of rock falls from the steep slopes above. The fallen rocks break or damage branches, and new shoots which eventually form branches grow in response
Photograph: Tim Harvey.

In the post-seedling stage *Monsonia peniculina* begins its adult life as an irregular sphere The bulges at the edges are nascent branches awaiting the next period of moisture to grow out.
Photograph: Tim Harvey.

The leaves of *Monsonia peniculina* are virtually indistinguishable from those of *Monsonia multifida* The branches of M *peniculina* are, however, much thicker and more robust
Photograph: Tim Harvey.

SECTION II

BUSHMAN CANDLE ART

Botanical illustration is the flipside of the coin in the taxonomic descriptions of plants. In this instance the plant is isolated from its environment and accurate draftsmanship begins where words in taxonomic descriptions end. Ellaphie Ward-Hilhorst's paintings are in this sense classical botanical illustration and were an indispensable tool for Rodney Moffett's revision of the genus *Sarcocaulon*.

The scientist and the artist often develop a special working relationship. Moffett elicits and defines the substance of his work with Ward-Hilhorst. He also emphasises in his own special way the symbiosis that existed between botanist and plant illustrator. No two botanical artists are alike even though their function for the taxonomist may be the same. Ellaphie Ward-Hilhorst was one of the most accomplished and productive botanical illustrators. She not only developed special skills for illustrating the revisions of several plant genera, but also perfected the presentation of her subjects. Graham Duncan's account brings this topic to life, focusing too on how Ellaphie's work came to represent over time the acme of botanical illustration.

Very little research has so far been done on the autecology of South African plants. In this discipline the requirements for illustration of plants and their habitats are multi-faceted. Whilst the starting point may be classic botanical illustration, the discipline focuses on how the plants grow and where they live. Gerhard Marx has a unique way of representing plants in habitat with the medium of watercolour. He gives, in his own words, an account of how he paints his subjects. This style of illustration is really apposite for most of the significant themes discussed in this book.

Pencil drawings lend a unique dimension to books which have as one of their main themes, the autecology of plants. Pencil is a particularly expressive medium for conveying a feeling for the landscapes in which the plants grow. Bowen Boshier explains this further, through his lively discussion about the drawings he did for this book.

In much the same way as taxonomy goes hand in glove with conventional botanical art, photography is the same with books on autecology. Photographs record the macro and micro habitats as they are, without interpretation or simplification. There are many challenges which the plant photographer faces, particularly in the windy, dusty environments, with their harsh light, in which most of the Bushman Candle species grow. Connall Oosterbroek covers in his account, the difficulties of photographing Bushman Candles in the arid environments of south-western Namibia and the Northern Cape.

'Rooiberg at Dawn'
In the morning light the rough stones on the mountain mimic bushes. The river bed offers an easy invitation into the landscape. I constantly felt its pull while I was drawing, calling me to climb the slopes and wander amongst the thousands of *Monsonia herrei* on the sun-baked western slopes. Drawing. Bowen Boshier.

Reminiscences on *Sarcocaulon*

Rodney Moffett

More than thirty years later, I regard the 1979 publication of my monograph on *Sarcocaulon* in *Bothalia* as a particular highlight of my career, more especially because it emphasised the enormous role Ellaphie Ward-Hilhorst's superb illustrations played in making the genus better known. Although I had no way of knowing it when first starting the study in 1975, my involvement with this fascinating group of plants, growing in an equally fascinating and magnificent environment, together with the collaboration of such an outstanding artist, was to be a very great blessing.

How did this all start?

In 1970 I enrolled at Stellenbosch University for a degree in forestry. Finding the forestry course too commercial, I soon switched to majoring in botany and geology and managed to get my B.Sc. with distinction in 1972. Working as a technical officer, first in the Forestry Faculty and then in the Department of Botany at Stellenbosch, I continued my studies in Botany, getting my Honours degree in 1976. During our final year, we were required to do two major projects of our own choice. One of these had to be a taxonomic or morphological study of any plant – and that was my introduction to *Sarcocaulon*

Having completed his study of *Commiphora* (Burseraceae), Adri van der Walt, then Senior Lecturer in the Department, decided he would tackle the Geraniaceae as his next taxonomic project, beginning with *Pelargonium*. He expected that post-graduate students would help with this mammoth task, and I was one of the first. However, I did not work on *Pelargonium*, moving instead towards *Sarcocaulon*. The most recent taxonomic revision of *Sarcocaulon* at the time was that of Prof. Sigmund Rehm of Gottingen, who worked on the plants collected by von Wettstein and son in southern Africa in 1929. In the revision, published in *Botanische Jahrbücher* in 1935, Rehm recognized 17 taxa, including three new species and a number of infraspecific taxa. In their treatment of the genus for the *Prodromus einer Flora von Südwest Afrika*, Merxmüller and Schreiber only recognized seven species, and discarded all Rehm's infraspecific taxa. It was therefore obvious that more work needed to be done on *Sarcocaulon*.

I will never forget my first encounter with a Bushman Candle. Neither Adri nor I had ever seen one, apart from a picture or two, and returning from the Cango Valley, we detoured through the southern Great Karoo and stopped on 6 February 1975 between Leeu Gamka and Laingsburg I climbed through a barbed-wire fence and took a stroll in the late afternoon through the shaly karoid vegetation, coming across a small, leafless spiny shrublet. I called Adri and we both puzzled over it, wondering whether it was a *Sarcocaulon*, or perhaps a *Euphorbia*. For my work in the Cango valley, I had borrowed the Department's ancient camera, which worked with glass plates. I set this up on its tripod, draped a black hood over myself and it, and photographed Moffett 629 – what proved to be our first bushman candle (Fig. 15, *S. crassicaule* in my revision in *Bothalia*).

As a prelude to a later more detailed study of all the species, I decided to do an honours project on *Sarcocaulon herrei*. I can't remember why I chose *S. herrei*; perhaps it was because I was responsible for scientific input into the University's Botanic Garden, and thus felt an affinity for Hans Herre, its first curator. Or perhaps it was because part of my job was to guide visiting succulent specialists to places like the Richtersveld, where I collected Moffett 631, a specimen of *S. herrei*, in Kleinhelskloof. I see I wrote as my aim in that project "In this study, I tried to describe *Sarcocaulon herrei* L.Bolus as fully as possible – taxonomically, morphologically and anatomically – and in so doing, learnt what botany is all about."

On completing my honours degree, it seemed natural, given my interest in taxonomy, that I would attempt a revision of the genus *Sarcocaulon* for my M.Sc. degree.

Sarcocaulon patersonii in coarse sand at Rotkop, near Luderitz, Namibia, on 19 March 1977, shortly after a rain shower. The ability to flower and fruit in the leafless state ensures its survival. The loose pieces of stem and bark get blown about by the abrasive wind and form the flammable desert pearls.
Photograph: Rodney Moffett.

Right: The drawing in *Burman's Rariorum africanarum plantarum* of 1738, which served as the iconotype of the names *Sarcocaulon spinosum* and *S. burmanii*. Because it is a composite drawing of two different species, these names had to be discarded. The upper plant is probably *S. salmoniflorum* and the lower *S. crassicaule*

GERANIUM spinosum, & nodosum, foliolis reflexis.

The remains of a wall of one of the houses at Elizabethbucht in the diamond area south of Lüderitz, in 1976. The effect of the frequent sandstorms can clearly be seen, with the bricks having been completely removed, leaving only a latticework of mortar. Photograph: Rodney Moffett

Hamburg and Stellenbosch botanists' overnight camp at Buntfeldschuh in the diamond area while collecting succulent Geraniaceae and Mesembryanthemaceae in 1976. Pieter Drijfhout from the Stellenbosch University Botanic Garden, on the left, Wilfried Hartmann, husband of mesem specialist Heidi Hartmann from Hamburg, in the middle and Bettie Marais, Stellenbosch specialist on the section *Hoarea* of the genus *Pelargonium*. Photograph: Rodney Moffett.

In my favour, I had an enthusiastic project leader (Van der Walt), a sympathetic Head of Department (Prof. P. G. Jordaan), access to a botanic garden with excellent glasshouse facilities and staff, a good library (then housed in the Department) and the opportunity to go on collecting trips, both for the Botanic Garden and along with visiting succulent specialists. I was fortunate in being able to study all the species in their natural habitats, with field trips during February, March, April, June, September, November and December of 1975, June and October of 1976, and March and September of 1977. Some of these trips were possible only through the kind co-operation of the staff of Consolidated Diamond Mines of South West Africa (now Namibia), Octha Diamonds, and Imcor Zinc at Rosh Pinah, as the plants occurred in areas closed to the public. One of my strangest collections was of what turned out to be *S. camdeboense*. I was part of a kombi-load of students driving through the Karoo after a congress at Rhodes University. Somewhere near Steytlerville, long after sunset, I asked Adri, who was driving, to stop, as I just wanted to have a look in the veld next to the road. My fellow students couldn't believe it as I disappeared into the night with a torch. Much to everyone's astonishment, I returned with a Bushman Candle. On subsequent collecting trips, my daughters, then in primary school, would help me by pointing out what they called "Sarkie's friends" – changes in vegetation, with plants that usually grow alongside Bushman Candles. Most of the plants collected on these trips were grown in the Botanic Garden and provided leaves and flowering material for further study.

The importance of obtaining a thorough knowledge of the plants in the wild, and then marrying this to the type specimens, was highlighted by my discovery that the type

of *Sarcocaulon spinosum* and *S. burmanii*, a drawing in Burman's *Rariorum africanarum plantarum* (1738), was a composite drawing of two different species, one with entire leaves and the other with toothed leaves, thus rendering these names unusable (see illustration on page 129).

The subsequent revision was based on plants *in situ* in their natural habitats, living plants in the Botanic Garden, and specimens in all the major South African herbaria. I also studied photographs of type specimens in overseas herbaria. A very useful source of information was the private herbarium of Mr H. Erni, a sheep farmer from Aus, who had a particular interest in *Sarcocaulon*, and let me borrow his sheets of pressed flowers

In the course of his work on *Pelargonium*, Adri van der Walt had discovered that Ellaphie Ward-Hilhorst of Kenilworth, previously a commercial artist, had developed an interest in painting pelargoniums. When the time came for me to start writing up the dissertation, Adri asked Ellaphie if, besides drawing the *Pelargonium* species, she would like to illustrate the *Sarcocaulon* species. She agreed, and thus began a magical and absorbing process. I would take a flowering specimen in a pot to her flat in Kenilworth and discuss more or less what was required, or she would come to Stellenbosch and return to Kenilworth with a specimen I had provided. I think Adri provided her with a departmental microscope for the meticulous dissections she so ably did in pencil, but otherwise I left it up to her to depict the plant or parts of it as she saw fit. I sometimes provided a herbarium specimen and photos as well. However, herbarium specimens weren't much good to an artist, being in many cases leafless and flowerless. Before pressing them in the plant press, I used to flatten the more spiny specimens by placing them between two planks and standing on them, much to the astonishment of visiting botanists. The leaf stalks in *S. patersonii* become sharp, hard spines, known by farmers in southern Namibia as "heldoring", as they punctured their vehicles' tyres.

One day Adri called me to his office, where I found Ellaphie with a completed drawing of *S. l'heritieri*, which I had collected at Bowesdorp, just north of Kamieskroon. Not knowing her work or anything about botanical illustration, I was amazed at the jewel-like quality of the work. Ellaphie numbered the drawing 141, 9/77. I am, however, slightly puzzled by her numbering of the *Sarcocaulon* drawings. *S. l'heritieri* was certainly the first one she showed us, but some of her other drawings had earlier numbers. I suspect that she was drawing them as they developed, perhaps adding flowers at a later stage. Ellaphie eventually drew all the species, and also redid some of them later for *Flowering Plants of Africa*.

Sarcocaulon is a prime example of a genus with a concentration of species in a centre of endemism. Ten of them are found in the Gariep centre, on either side of the Orange River near its mouth. As one moves away from the centre, the number of species decline until on the inland perimeter only one occurs per degree square block. The distribution of *S. salmoniflorum* has recently been extended much further inland, with a collection in 1993 by Prof. Johann du Preez of U.F.S., near Theunissen in the Free State. The intense speciation of *Sarcocaulon* and many other succulents in the Gariep centre is attributed to a long history of aridity (the Namib is regarded as one of the oldest deserts in the world) and deluges (such as caused the Fish River canyon), coupled with diverse geology and soils allied to one of the windiest places on earth, all exercising their effect on the plants.

Leafy branches and portion of stem of *Sarcocaulon crassicaule*. The translucent bark has been folded back to reveal the chlorophyll-rich cortex, a feature which enables the plant to photosynthesize, even when leafless. Photograph: Rodney Moffett.

Being perennial, *Sarcocaulon* has developed a particular survival strategy for its hostile environment. This includes a shallow widespread root system, which facilitates the uptake of the condensation of the coastal mists on the branches, an incredibly hard bark which becomes polished by the blowing sand; and the capacity

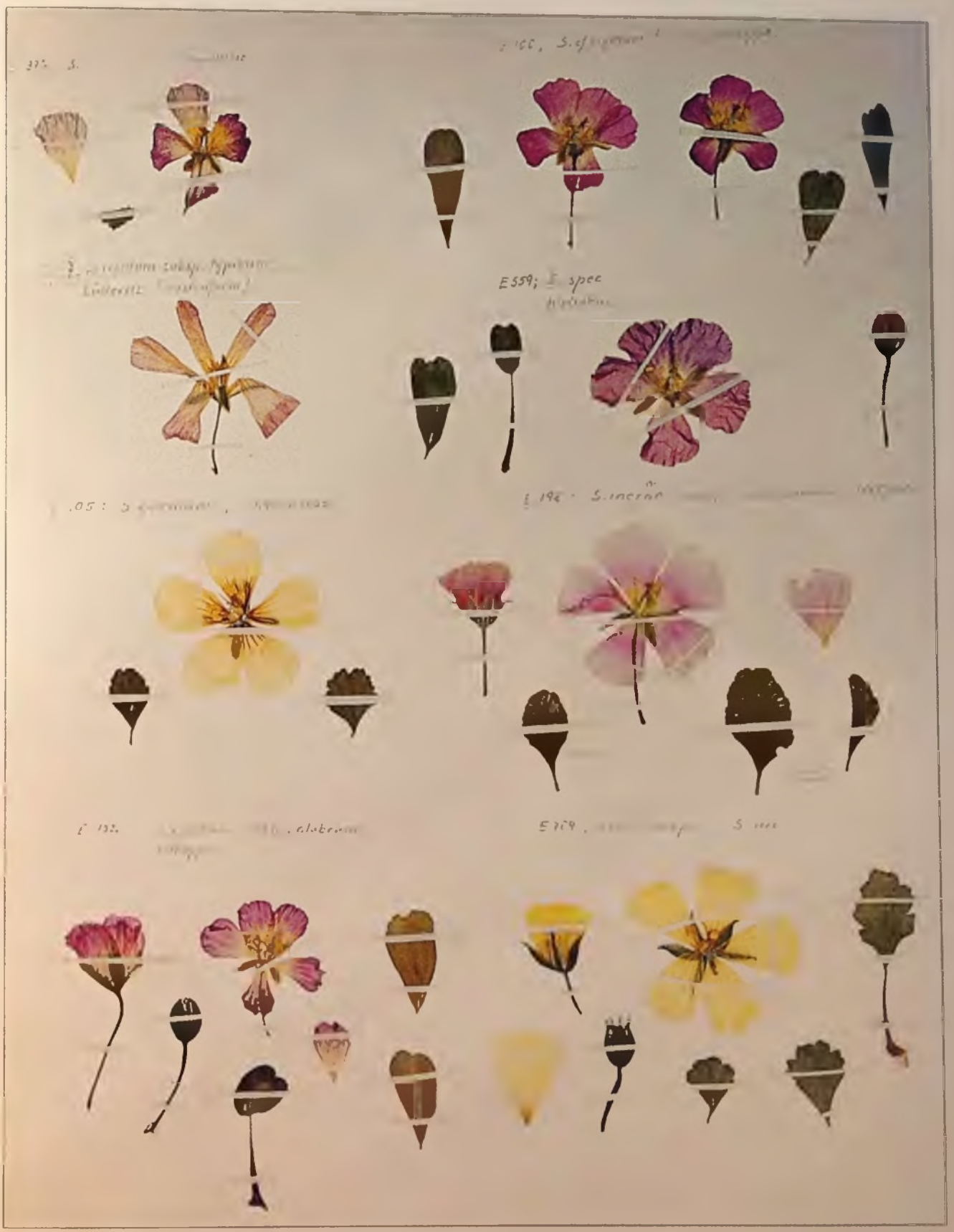
Sarcocaulon research collection in the Stellenbosch University Botanic Garden in 1976. Keeping the plants in imbedded pots enabled them to be lifted without disturbing the roots, for example when taking them in flower to the artist.
Photograph: Rodney Moffett.

for making immediate use of any rain by flowering and producing seed in a very short time. Seed germinates within as little as two days. Flowers often develop before leaves, and the plants survive due to the translucence of the bark, which allows enough light to reach the chlorophyll-rich cortex enabling photosynthesis to take place. The bark has a unique property in that it contains a flammable wax – even living plants of *S. patersonii* will burn if lit. This unique property was one of the main reasons that I and many others before me, including Knuth, who monographed the whole Geraniaceae family for *Das Pflanzenreich*, preferred to retain the species in the genus *Sarcocaulon*, rather than sinking them in *Monsonia*.

Unbeknown to me, my M.Sc. dissertation which I completed in 1978, was submitted to the South African Biological Society, which awarded it the Junior Capt. Scott Medal for the most outstanding masters thesis at any South African university of that year.

Ellaphie was as fascinated by these strange woody and succulent-like plants as I was, and that might be why her drawings of them proved to be some of her best work. Our collaboration did not end with *Sarcocaulon*, as she also did most of the line drawings and a few colour paintings for my revision of the southern African species of *Rhus* (now *Searsia*) (Anacardiaceae), published as part of the *Flora of southern Africa*, in 1993. She was without a doubt the most meticulous botanical artist I have encountered, her work a rare blend of beauty and scientific accuracy.

Monsonia (Sarcocaulon) crassicaulis. Painting: Gerhard Marx.



Sheet of pressed flowers and leaves of different *Sarcocaulon* species from the personal herbarium of Mr H. Erni, a sheep farmer of Aus, southern Namibia, who had an interest in the Bushman Candles growing in that area. Photograph: Rodney Moffett.

Ellaphie Ward-Hilhorst

Graham Duncan

Research into a taxonomic account of *Sarcocaulon*, by Rodney Moffett of the Botany Department at the University of Stellenbosch, served as catalyst for the commission of watercolour paintings that illustrate this book. Executed during the course of 1977 and 1978 from material sourced in habitat and cultivated at the University's *Hortus Botanicus*, they first appeared in print in the periodical *The Flowering Plants of Africa*, at irregular intervals from 1978 to 1995, and later collectively in the botanical journal *Bothalia*, illustrating Rodney Moffett's paper 'The genus *Sarcocaulon*', in 1979. Moffett's work formed part of a wider study of the family Geraniaceae at the University of Stellenbosch, initiated in the late 1970s by Prof. Adri van der Walt, that led to a proficient collaboration with Ellaphie Ward Hilhorst, widely regarded as one of South Africa's greatest botanical artists, whose talent was internationally acknowledged. The following synopsis of published biographies is augmented from material supplied by her daughter, Susan Goldswain, and my own thoughts.

Born in Pretoria on 10th July, 1920 to Cornelia Petronella Venter and Gerrit Adriaan Marie Hilhorst, the only sister to four brothers, she was christened Johanna Ellaphie but was known as Ellaphie (after two aunts, Sophie and Ella) from an early age. Following her matriculation from Pretoria High School for Girls in 1939, she began employment as a cartographer in the Survey Department of the Witwatersrand Gold Mines, from 1940 to 1946. Her father's passion for rose and pelargonium growing may have kindled her later interest in plants, but it was his elder brother, Gerhardus P. L. Hilhorst, who was to become her mentor and inspiration in art. As a teacher of natural history art, amongst other disciplines, Gerhardus Hilhorst had spent a number of years in Indonesia, during which he prolifically depicted aspects of Indonesian forest and animal life in pencil and silverpoint, wood-cuts and engravings: a folder of his surviving works remains in the possession of Susan Goldswain. Following his retirement in Indonesia, he returned to Zeist in The Netherlands and it was here in 1946 that Ellaphie, at age 27, visited 'Oom Hars' (Uncle Hars), as he was affectionately known, completing a year's study in watercolour drawing under his tutelage, followed by her return to South Africa. She had no formal training in botany and was self-taught as a botanical artist. Oom Hars died in 1957 and the following year she returned to The Netherlands for four months, a country she regarded as her 'spiritual home', with her daughter Susan. A poignant entry in her diary of this visit records her thinking while perusing her uncle's plethora of drawings, for which she had great admiration: 'I feel so tremendously humble and I also feel the urge to draw, if I had but the time, the peace and the freedom! I can almost hear him say "Go on, go on!" He is an inspiration and an example' In 1948 Ellaphie began a freelance career in commercial art in South Africa.

Ellaphie Ward-Hilhorst with her watercolour painting of the south-western Cape endemic species *Pelargonium cucullatum*, reproduced in the first volume of *Pelargoniums of southern Africa*, published in 1977 (Purnell). Photograph from volume one of her personal diaries, by kind permission of her daughter, Susan Goldswain.

She married Barry Baxter, who died in 1959, rendering her the sole breadwinner to her daughter Susan and stepson John from Barry's previous marriage. Despite hardship, she had a great sense of pride and determination to succeed in every aspect of her life, whether it be parenting, earning a living or painting.

She married John Ward in 1963 and relinquished commercial art in 1970, enabling her to change course to her real love of watercolour painting. The couple explored nature on the Cape Peninsula, frequently visiting Langebaan and Betty's Bay on the west and south coasts, and Chalumna in the Eastern Cape where her daughter Susan lived, and she began actively painting plants Ellaphie's interest in *Pelargonium* was earnestly aroused

Right: *Plectranthus saccatus* ssp. *saccatus* 'Gwaloweni' from Zululand (previously regarded as *Plectranthus saccatus* var *longitubus*), painted by Ellaphie Ward-Hilhorst in April 1979 and published in *Veld & Flora* in March 1981. By kind permission of the Botanical Society of South Africa.

PLECTRANTHUS SACCATUS
VAR. LONGITUBUS 764/77

GWALOWENI, ZULULAND

R. Vandell
4/79

Ellaphie Ward-Hilhorst and Prof. Adri van der Walt with the instantly acclaimed first volume of their collaborative work, *Pelargoniums of southern Africa*, published by Purnell (1977). Photograph from volume one of her personal diaries, by kind permission of her daughter, Susan Goldswain.

in 1972, finding them in her own words, 'so variable, surprising and always enchanting'. On her own, she resolved to paint all members of this speciose and beguiling genus that has the Western Cape as its centre of diversity At about the same time at the University of Stellenbosch, Prof. Adri van der Walt's interest in the family Geraniaceae, *Pelargonium* in particular, began to develop, resulting in a fortuitous collaboration with Ellaphie. The instantly acclaimed first volume of *Pelargoniums of southern Africa* appeared in 1977, followed by equally successful volumes two and three, with Dr Piet Vorster, published in 1981 and 1988 respectively.

From the early 1980s up until her death on 30th June 1994, at the age of 74, she was in constant demand and painted a steadily expanding array of genera that included *Aloe, Cyrtanthus, Diascia, Gasteria, Haemanthus, Hessea, Lachenalia, Plectranthus, Rhus* (now *Searsia*), *Serruria, Strumaria* and *Tylecodon* that featured in the publications of a growing number of authors, in numerous scientific and popular journals, several monographs and a number of miscellaneous publications.

Renowned for the remarkable life-like quality she imparted in all her works, she painted to scientific precision, yet her paintings were simultaneously outstanding artistically, their pleasing composition evidence of the careful planning that preceded her start to each plate For her watercolours she began by drawing the outlines lightly in pencil, then adding layer upon layer of paint until the desired colour was reached. She achieved remarkable depth in her subjects and was especially proficient in conveying a feeling of texture, seen for example in her rendition of the papery outer tunics of a *Cyrtanthus* bulb, the rough, bark-like exterior of a *Pelargonium* tuber, or the soft covering of hairs on a *Pelargonium* leaf. Her subjects had great movement, apparent in her depiction in the accompanying plate of *Crinum nerinoides* (now *Ammocharis nerinoides*), with its unusual arched inflorescence and tangle of narrow, spreading leaves (see page 139). She brought perfect balance to the various objects that constituted each plate and skilfully utilised the fall of light on leaves and tepals to accentuate surface sculpturing. Incorporating floral dissections, fruits and other plant parts wherever possible, her plates were full, yet never overcrowded. While most of the plants she painted were showy, she had the ability to portray even the most mundane subject in such a manner that its most interesting features were cast in the best possible way.

Ellaphie regarded herself as a botanical artist, not a flower painter, and was a perfectionist, on occasion destroying a work she was not completely happy with, and starting again. As her technique improved, she became discontented with the paintings she had done for the first volume of *Pelargoniums of southern Africa* and repainted all of them. The plants were sourced in habitat or obtained from material cultivated in the *Hortus Botanicus* at the University of Stellenbosch and the bulb and succulent nurseries at Kirstenbosch Botanical Garden

Susan Goldswain, daughter of the late Ellaphie Ward-Hilhorst admiring a portfolio of her mother's paintings. Photograph: Rob Pollock.

Right: Ellaphie Ward-Hilhorst donated a painting of *Pelargonium sericifolium* to the South African Pelargonium and Geranium Society. This floating trophy, known as the Ellaphie Ward-Hilhorst prize, was awarded at annual shows.

PELARGONIUM SERICIFOLIUM J.J.A. VAN DER WALT

Before collecting any wild material, she would spend time with her subject, studying it in its natural surroundings before capturing it on paper in her tiny studio above her apartment in Kenilworth, Cape Town. Considering the great detail she incorporated into her paintings, she was a fast worker. Most of her watercolour works and ink drawings produced after the publication of the first *Pelargonium* volume in 1977 had the date of completion added to the plate, underneath her signature or adjacent to her initials. Although watercolour was her favourite medium, she was an extremely versatile artist, equally adept at pencil habitat sketches and detailed ink studies.

Several awards were conferred upon her, The Botanical Society of South Africa's Cythna Letty Medal in 1988, a Gold Medal from the Royal Horticultural Society for an exhibition of her *Haemanthus* paintings in London in 1990, and the South African Association of Botanists' Certificate of Merit, awarded to her in 1993 for her contribution to systematic botany in South Africa. One of her greatest honours was her inclusion in William Stearn's second edition in 1994 of Wilfrid Blunt's classic work, *The Art of Botanical Illustration*. Within South Africa her works were exhibited at Kirstenbosch and Stellenbosch, the East London Museum, the Everard Read Gallery in Johannesburg, and in 1993 they formed part of a travelling exhibition to most major centres for the Standard Bank's Festival of the Arts, titled "Art Meets Science". A prolific artist, she completed a total of almost 800 plant studies over a period of about 24 years. Her collection of 314 *Pelargonium* watercolours (including the 50 plates she re-painted from the first volume of *Pelargoniums of southern Africa*) and 160 habitat sketches were acquired by the Brenthurst Library in Johannesburg in 1989. Other works are owned by a number of private collectors and institutions including the Shirley Sherwood collection housed at the Royal Botanic Gardens, Kew, and the Hunt Institute for Botanical Documentation in Pittsburgh, as well as the Missouri Botanical Garden and the South African National Biodiversity Institute, the latter the custodian of all her *Sarcocaulon* works. She is commemorated in *Gasteria ellaphieae*, *Pelargonium ellaphieae*, *Plectranthus fruticosus* 'Ellaphie' and *Tylecodon ellaphieae*.

Hers was botanical art at its best. The joyous endeavours of this remarkably talented, dignified and elegant, yet humble woman, live on.

For further reading about Ellaphie Ward-Hilhorst and her art, the following are recommended: Arnold (2001, 2006), Blunt & Stearn (1994); Gunn & Codd (1981), Rourke (1994); Sherwood (1996, 2005); Van Jaarsveld (1995) and Ward-Hilhorst (1983).

Ellaphie Ward-Hilhorst photographed sometime during the 1980's visiting the *Pelargonium* and *Sarcocaulon* collection in the Kirstenbosch Nursery, from which she obtained numerous cultivated specimens for illustration. Photograph: Michael Vassar, from *Geraniums around the World*, Vol 42.

Right: *Ammocharis nerinoides*, from seasonally inundated pans of northern and eastern Namibia, a beautifully balanced work by Ellaphie Ward-Hilhorst. Reproduced from the original watercolour in the private collection of Graham Duncan


L. Wardt.
8·10·1980

Homelands

Bowen Boshier

Charles Craib's invitation to portray some of the landscapes where these fascinating plants live presented me with an opportunity to head out on a journey to the Namib Desert. I began to hear the warm whispering of the far horizon, the quiet calling of plant creatures and desert stillness.

What I strive for in my work

The planet we live on is blessed with spectacular landscapes and exquisite life forms. Each of these holds an opportunity for us to understand the dynamics and complexities of existence. Through my works I intend to portray the beauty of our living system and the profoundness of its volume.

Africa is particularly blessed with its vast open spaces and secret places, dramatic seasons and variety of life forms. Africa combines harshness with delicate detail, danger with delight, sunlight with storm.

As evolving beings, we need to interact with nature, rather than just observe it. Through my drawings, I hope to inspire appreciation and a desire to explore the details and texture of life's fabric.

Medium

I find that pencil is well suited to capturing contrasts and textures. It holds the expectant silence that our African wilderness contains.

Pencil, with its large range of tones, like black and white photography, can carry the essence of a subject. It is slightly abstract in that it shows forms or landscapes that we are familiar with, but without their colour. Our imaginations are compelled to step in and become involved with the image and imbue the work with the colour of our own feelings and experiences.

How I do my drawings

I love to draw pristine wilderness; to lose myself in an unmarred landscape is to immerse myself in endless time. Through my travels, I discover and get to know places. I spend time on location, sometimes months in one place; walking and watching, sketching and sculpting. I am fascinated by detail so each drawing takes a long time to complete. Creatures get used to my presence and carry on their life around me. I watch birds build their nests, hear them court, witness the first flight of the fledglings.

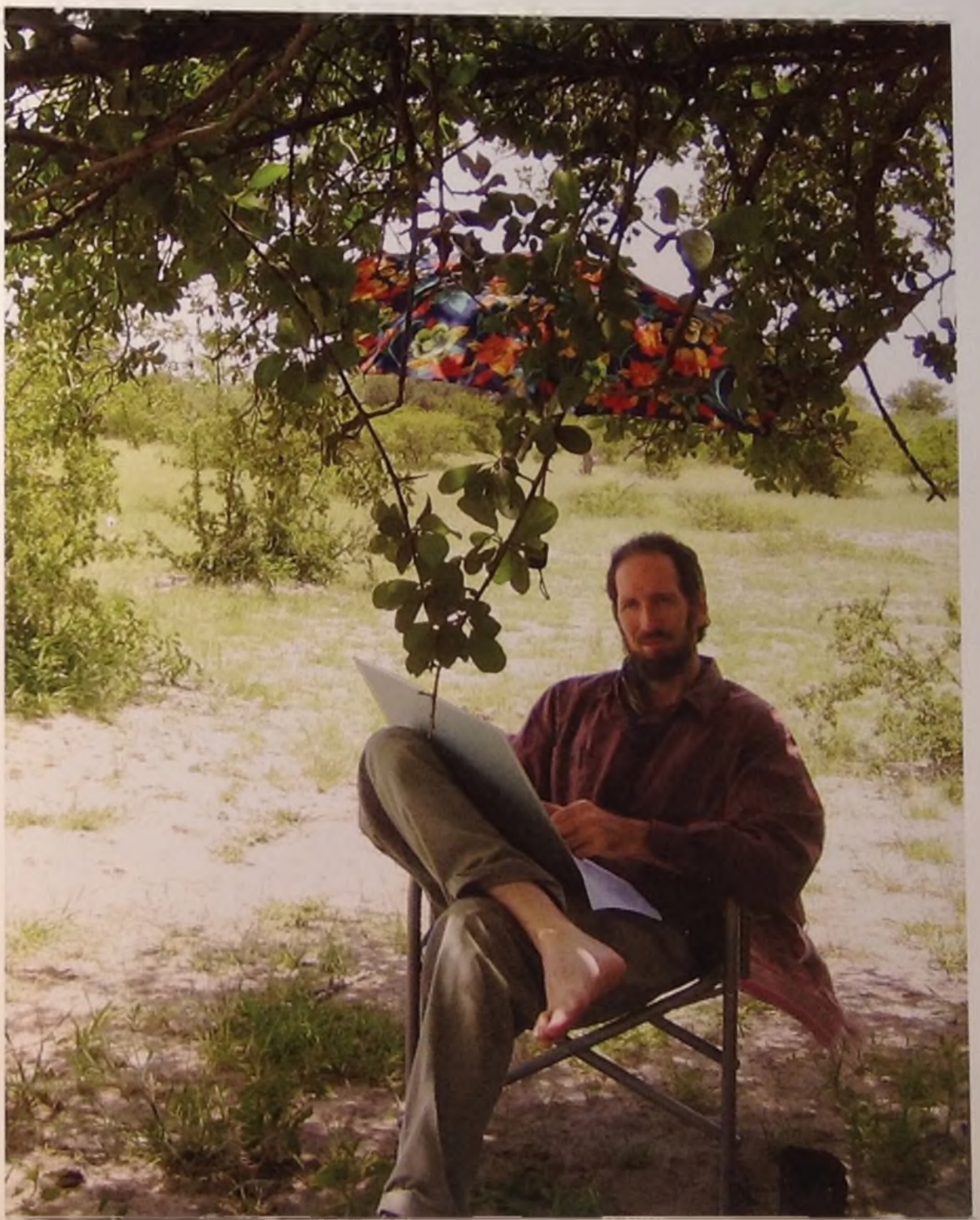
It is a challenge to isolate a subject or encapsulate a portion of a landscape. By confining it to the boundaries of the paper, it is separated off from its relationship to the rest of the world Now it has to hold the viewer's eye; it has to have its own life.

For the cropped-off window to resonate with the essence of the subject, it must also harmonise with the inner landscape of our minds.

I use nature to advise me on aesthetics and balance The piece must hold a moment in place, a mood or atmosphere that can sing out through time.

Each drawing feels like an expedition, with its preparation, endurance, lessons and satisfaction.

Following spread:
Across the Bay – Lüderitz'
The rocky peninsula on the left is balanced by the crags that screen the town with its steeple. I am held by the austerity of the cold ocean and wind-burnished rocks, and the wonder of the interesting plants and creatures that live here. In the hazy distance, the coast of Africa continues to the north



Bowen Boshier photographed near Ntwetwe Pan in Central Botswana. Photograph: Sally Andrew.

Journey

I pondered Charles' directions to the various sites where particular Bushman Candle plants live. I appreciate his aversion to things such as computers, mobile phones and GPS. The lack of detailed co-ordinates ensured that this was going to be a treasure hunt. If you have to look for something, you get to know it better than if it is just presented to you.

We were to head out along old paths now so well travelled that people hardly consider the wonder of what they are passing through. In the old days it would take explorers several months by wagon to do this same journey.

Preparing for an expedition always takes me much longer than I expect and, like my art, if I were realistic about how long it would take I probably wouldn't do it. It is difficult to foresee all eventualities; I have found that if, for example, I pack an excellent puncture repair kit, I don't get any punctures.

Plants are creatures that usually do not travel other than through their seed. The form of a plant, in a similar way to the particular physique of an animal, resonates with its lifestyle and particular circumstances. To meet with plants in their own homelands is different from marvelling at them in a botanical garden. I was going to be a guest in the homes of some interesting plant creatures.

'Rooiberg at Dawn' (page 126)

My partner, Sally Andrew, and I travelled through a desert wonderland towards the Richtersveld. The mountains were unashamedly naked, stripped of soil, and washed in splendid colours with highlights of gleaming quartz.

We arrived at the red mountain in the late afternoon. The setting sun turned the Rooiberg an even deeper crimson. It glowed warmly against the open sky and reminded me of Uluru (Ayers Rock).

The entrance area was devoid of humans, but the air was full of eerie fluted music. We followed the sound to some hollow fence posts, through which the searching wind sang. A well-worn track bypassed the entrance boom, so we joined it and headed towards the East. Charles had described the location of the *Monsonia herrei* as 'past the old mine and up a long spur on the western side'. I could see the spur but not the mine.

The terrain became more mountainous as we left the plains and entered the world of ridges and valleys. Each crest presented a different view. Which one to draw? Should I ascend by foot and view the magnificent Richtersveld massif in the distance with the monsonias in the foreground? I opted for a scene of the Rooiberg with an invitation to explore it via one of the sand riverbeds.

The evening breeze died down, making way for that silence that allows the roar of the brilliant stars to whisper down, like the sound from a distant shore. The mountain silhouette formed a giant stepping-stone to the Milky Way.

With sunrise, colour seeped out across the land. It warmed distant ranges to the north and brought the rocky ridges and valleys of the Rooiberg into stark contrast. I visualised Charles standing amongst his much-loved friends, high on this red mountain and gazing across the land. I sketched as fast as I could to capture the mountain's volume and texture in the morning light. The strong shadows clung to the night cool for as long as they could. All too soon pure sunlight lay upon us and with it another day in a long procession of time. This gleaming light had polished the plants, rocks and slopes of this mountain millions of times.

Wait a while

As is the wont in our civilisation, we could not resist the 'need for speed'. Deadlines loomed and time was becoming thin. I felt myself lament at the haste with which we skirted the Richtersveld and pushed onwards for the Orange River. Broad plains ended in sudden walls of textured mountain offering wonderful exercises in perspective. Stunning views passed by, each one calling out to be wondered at and somehow captured.

Our usually tireless engine suddenly faltered. There had been a disturbing little hiccup from the engine just as we left the town of Eksteenfontein. This seemed more serious. I could find nothing amiss under the bonnet Our Pajero contains a mass of confusing pipes and wires – where was my trusty old Landy, whose every little rattle I knew so well?

We started off again with trepidation. After a while all seemed fine and the landscape provided wonderful distraction. Then she stopped. We sat on a broad valley floor, next to a small hillock as the silence settled. Our dust plume quickly faded in the hot air. We needed to get off the road and set up camp. The road along here had been scraped so many times that it was a few feet below the plain. However the Spirits of Place had been kind to us and a rare side-track was close by. The vehicle was way too heavy to push up the slope. Luckily, one of the two cars per day that use the road pulled up alongside. It contained ten gay men from Alexander Bay. They laughed, clambered out, hitched up their dresses and pushed us down the side track.

I crawled under the car and stripped out what I could of the fuel system. Hours later I lay with my face pressed into the Earth, my body contorted and squeezed beneath the chassis, and looked at the wonderful array of succulents on the ground. I was exhausted and frustrated by failed technology, petrol fumes, oil and grit, while these beautiful fat little plants were living a pure and simple life.

We spent the next few days alternating between trying to solve the stubborn engine failure and exploring the area. We climbed slopes, examining the fascinating array of plants and creatures, and searched hollow boulders for bushman art. High up on a mountain, I found cell phone reception and called for assistance. We were retrieved by the 'other world' and carried to the friendly town of Springbok on the back of a truck, for hospitality, a hot bath and repair.

'Midday with Her Majesty'
The Sonnenberg lies some ten kilometres behind a throne of rough foothills. I enjoyed drawing the soft grass; it accentuated my sense of her velvet gown.

'Midday with Her Majesty' (page 145)

Rolling along on the journey again, we studied Charles' directions. He had described the locations as if travelling down from Luderitz, so we had to work out distances back to front. We entered the Richtersveld on the Namibian side of the Orange or Gariep River (old local name meaning 'The River'). This area is always exciting to me. It feels ancient, and must surely once have been home to powerful dragons. Eons of time and pressure have twisted the earth into wondrous contortions.

We aimed to find Charles' 'green mountain', Sonnenberg. With its peak at 994 metres, it should form a significant landmark in the area. I asked some diamond miners 'have you have seen a big green mountain?' None knew of it but they directed us to Nature Conservation offices – which turned out to be a deserted ruin. We kept on searching.

Suddenly we were amongst the foothills of Sonnenberg. I turned off the engine and everything became very quiet I set out in the thick heat; I had almost no shadow and could hear my heart beating. I stepped carefully amongst the myriad plants and felt I was treading on Sonnenberg's skirts, the train of an empress. I remembered Charles' excitement when he described how he'd climbed to the peak many years ago.

I ambled about for some time until I established the right view, where the rocky foothills, home to *Monsonia crassicaulis*, form a balanced and suitable plinth for Her Majesty. As with some of the other drawings, I have included the surrounding flatland as it contrasts nicely with the rocky crags. The desert silence and stillness is particularly strong in this area. The ground is textured with interesting stones and supports a marvellous diversity of plants.

'Portal' (page xiv)

Around eight kilometres south of the mining town Rosh Pinah, there is a sudden drop in the land. It invited me to open my arms and glide down the graceful slope on the bright air. This site can be seen as a gateway between the Richtersveld with its jagged mountains and the land of desert curves. At the end of the valley, around a few tight bends, lies the unexpected world of the Orange River.

I found some of the rare *Monsonia peniculina* plant creatures that occur here. The range of hills on the right of the drawing is where they live. They have stood guard for eons on the crest of the ridge, in this portal between lands. As I strolled around, I came upon contorted rocks whose textures and shapes complemented the plants. I was surprised to encounter three, large, fat-tailed scorpions – out hunting in the heat of the day!

'Deep Afternoon – Obib Mountains' (page 147)

To the west of Rosh Pinah lay the next wonderland. It must have been a weekend, as the mining club where I stopped to ask for directions was packed with people. The swimming pool was full of cavorting children, the pub with conversing adults. Charles had described the location being near the old shooting range. We headed into the late afternoon sun towards the Obib Mountains, home to *Monsonia inermis* This is an alluring place of untouched wilderness, which lies within a heavily restricted zone called the Sperrgebiet ('The Forbidden Region').

Through this piece I intend to draw the viewer into the landscape, to arouse a desire to enter and explore where few have gone before. A track like this could lead you back in time to a place where you can recreate your own beginnings. This landscape is complex and it changes constantly with the shifting light. The shadows feel ripe with the heat of the day; they swell and strengthen until all is saturated with their mood.

To the edge of the land

Other than finding a piece of smooth golden bark, we failed to locate the population of *Monsonia patersonii* that Charles had described on the broad and spectacular Kowisberg Plains some 30 km before the charming coastal town of Luderitz

The landscape here is tortured and demonic. Crazed rocks lie chaotically amongst smooth curves of dune and textured sand We entered the historic town and I looked for a viewpoint to locate the Peninsula. A large old house overlooking the harbour sported a small deck, high on its rooftop It belonged to the local doctor who was quite hospitable and immediately understood my quest. His wife knew and loved the golden *Monsonia* and explained that the population we had failed to locate on the Kowisberg plains had been threatened by a new railway line, but was now protected.

The doctor led me up a broad wooden stairway to his study where a shiny computer flung us high above, until we looked down on the Earth from space. He zoomed us in, and traced the landform on the glowing screen. The rocky peninsula is rather large and offers a sheltering weather lee to the town. We then ascended the high tower from the attic and had a splendid sunset view from the deck.

Morning found us heading for the next location: the Peninsula, south-west of the town. We rolled across tidal flats where gemsbok spoor mingled with flamingo feathers. I stopped at the foot of a miniature mountain that overlooks the rocky Peninsula. Ignoring the 'no entry – diamond area' sign, we started out on foot and soon came upon some of the charming *Monsonia patersonii*. They have waxy, golden trunks, and after dense fog, offer a mass of pink flowers to the sky. We were presented with one delicate pink flower.

The enticing landscape soon had us exploring further. We had to tread with great care for there were many fascinating plants amongst the sandy pockets and fragile stone ridges. I selected a view that included the sheltered bay, the stark peninsula on the left and the Lutheran church spire and endless coastline on the distant right. Then I started to draw while a flock of flamingos worked the shore.

'Deep Afternoon – Obib Mountains'
The tracks call you to follow in the footsteps of the old explorers, to seek out and experience your own adventures. Once the easy flatland has ended, the barrier of mountains rises as a challenge to enter the deepening shadows of the unknown.

My approach to botanical art

Gerhard Marx

I have never really thought of myself as a botanical artist in the strict sense of the word. The reason is that I have never been specifically trained in botanical painting and my art education has been of a general fine arts nature.

The general approach to botanical painting is to depict the plant taken out of context and presented as a suspended 'floating sculpture'. This method is very popular and effective because the plant image reads easily and becomes an attractive 'calligraphic' shape against the white paper background. This also makes it easier to depict a plant with a very complicated outline, like a succulent *Monsonia* for example, as there is no danger of the foreground subject being 'swallowed up' and visually disappearing into complicated background.

In contrast most of my plants are painted in habitat settings which are treated in almost the same detail as the subject itself. The main reason is that I paint mainly small succulent plants and most of them grow superbly camouflaged in the wild which adds to their unique charm. It is a challenge to paint the subject in such a way that it stands out enough without ignoring the matching colours and textures of the surroundings. To some extent the painting becomes an abstract arrangement of shapes, textures and colours but still appears realistically and logically to the eye. To obtain this result very subtle simplification needs to be made in order to achieve a balanced interpretation of the chaos of details that nature presents.

Gerhard in front of his acrylic painting depicting a 'Botterboom' (*Tylecondon paniculatus*) growing on the southern slopes of the Rondeberg, south of Laingsburg. Photograph: Ina Marx

Right *Monsonia peniculina*. Watercolour painting of a plant growing south of Rosh Pinah, Namibia.


GERHARD MARX
'05

Delta brainwaves interrupted. A quick smile for the camera while busy preparing the drawing for the *Monsonia crassicaulis* painting Photograph. Ina Marx

My interest in the plants extends beyond artistic appreciation and I am finding much pleasure in doing field research and publishing my observations in popular scientific journals. These regular field excursions offer the opportunity to become intimately familiar with the plants as they live and survive in the wild, and also generates a valuable data bank of conscious and subconscious impressions that influence my interpretations of the plants when painting them.

In our time of digital photography, computer graphics and associated technology, I have often asked myself what the point is of doing these painstaking renderings of succulent plants using the 'outdated' methods of making a pencil drawing filled in with watercolour. Each time I sit down to work I realise that there is always a considerable amount of interpretation, design and simplification that has to be made during the process of drawing and painting plants. Preparing an exact and fully detailed rendering is almost impossible and attempting to do so demands intense observation and concentration. In addition, the human eye is a rather lazy organ that needs some degree of simplification to enable appreciation of an object. For this reason a painting of a plant tends to please us more than a

Gerhard's small studio basking in the Little Karoo spring sunshine. In the far background a few peaks of the Outeniqua Mountains are visible. Photograph: Gerhard Marx.

Right. Watercolour rendering of *Haworthia agnis*, depicted as it grows in nature. The surrounding rocks, debris and other habitat details are correct as encountered in the wild.

Haworthia agnis L.BATTISTA
N/E VANRHYNSDORP

photograph; the information has been passed through the 'digestive' system of the human brain already and has been simplified and adapted to be easily understood.

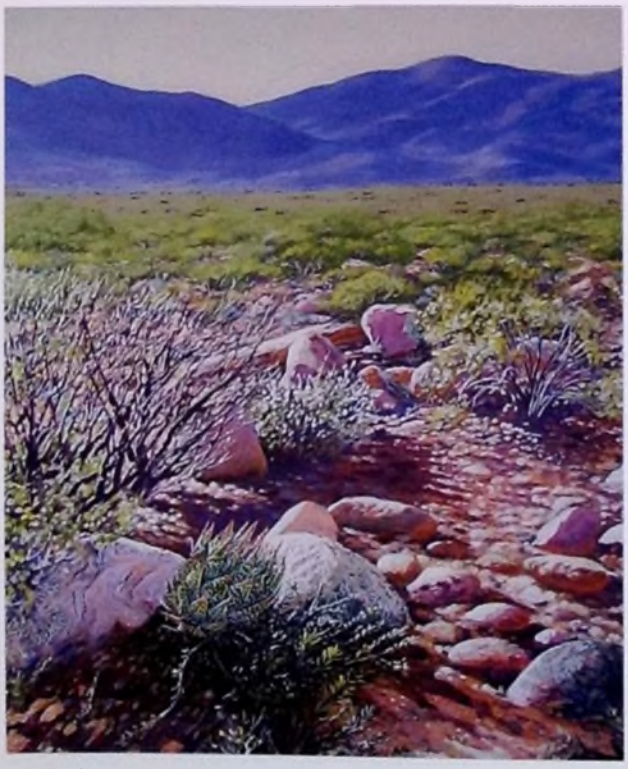
In order to do very detailed drawings of plants I make some use of photographs and have no hesitation to admit that I do. There however still seems to be a stigma attached to the use of photography in painting despite the fact that artists have now had a long time to get used to competition from this mechanical image maker. Photography is, I find, a wonderful additional tool that assists me in painting succulent plants.

Painting plants my way

I am often asked whether I work directly in the field when doing these detailed renderings of plants. The answer is no and the reasons are numerous. When one works outside in the field you are not only subjected to the irritating effects of wind and sun and insects, but there is also the big problem that the light changes as the sun moves, or contrasting shadows disappear as clouds move in. The best one can do in the field are a few very quick pencil drawings or rather rough 'Adolph Jensch-like' watercolour impressions. Such exercises are helpful in that they force one to do some preliminary memorising of the details of the subject but the drawings themselves contain rather little information that can be used during the execution of the final detailed painting in the studio. The main reference material for the latter would have to be either to remove the plant and take it to the studio or to take photographs. The ideal is of course to do both as the information in photographs is surprisingly insufficient; this is particularly so in the case of most of my paintings where I illustrate the plant as it grows in the wild surrounded by pebbles, rocks, leaf debris, moss, lichens and the like. The photographic reference material becomes very valuable in the studio as it is impossible to dig up a square metre of habitat and transport this intact to the studio. I work almost exclusively from photographs which I take myself and it is indeed ironical that the first such exception I ever had to make was during the production of the paintings for this book! Time and finances prevented me from visiting each of the localities where the plants I painted grew. In a few cases I had to make use of a combination of photographs taken by Jean-Andre Audissou and Tim Harvey. Making use of one's own photographs is preferable because while taking a photograph one already plans the composition of the painting. Often a beautiful plant will be growing amongst dull-coloured stones while a less attractive plant will sit in a neat 'nest' of attractive twigs and pebbles. In these cases I take several photos of both settings and in my drawing I recombine the images.

With several photographs and preferably a live plant available, a pencil drawing is then prepared in the studio on thin cartridge paper. Most plants growing in the wild have some dirt clinging to the leaves and are partially covered with some dead foliage, sticks and other debris. Frequently the stems and leaves have scars from animals trampling them or insects attempting to eat them. In my paintings, many of these imperfections and obstructions are removed by filling in the missing information via looking at the live plant. The result is that my paintings mostly show near perfect plants in a habitat setting not often seen in nature. I keep these interpretations however within realistic limits. This is also where knowledge of the appearance of the plants in habitat plays an important role.

Once the drawing on cartridge paper is completed, it is traced onto the watercolour paper. I use a hot-pressed, smooth, 100% cotton, 300 g/m² paper that is ideal for such fine-detailed watercolour painting. Before any paint is used, I make use of a masking fluid that is painted on the white and complicated overlapping shapes. This, for example, enables one to paint many fine white dots in the leaves of haworthias or even the dense and complicated spination of an *Euphorbia*, succulent *Monsonia* or cactus. One can then concentrate exclusively on adding the colours and textures of the areas behind the masked shapes and when dry, the masking fluid rubs off easily and can even be added again on the areas already painted, if needed. The use of masking fluid allows for the technique to remain pure transparent watercolour, as the use of opaque gouache paint on top of watercolour surfaces to add, for example, white dots or highlights, is undesirable. My kind of detailed watercolour painting also requires a 'dry' watercolour technique as opposed to the wet flowing of colours applied with a soaked brush on wet paper as used in general watercolour painting. In this case the paper remains dry and only small



An acrylic painting of *Haworthia pumila* in habitat as it occurs on the farm Keurfontein, south-west of Laingsburg. Unfortunately this painting never reached the art collector who had purchased it, because it was lost during international transit.

Right: Watercolour artwork of the form of *Monsonia multifida*, growing on rocky slopes of the Jakkalsberg, Richtersveld.


GERHARD MARX
'06

Palaeontological reconstruction. Panel in acrylic depicting a scene from the Upper Permian with the prehistoric reptile *Bradysaurus bainii* in the foreground and dinocephalian mammal-like reptiles *Struthiocephalus whaitsi* and *Tapinocephalus atherstonii* in the background. (Albany Museum Grahamstown.)

areas are painted at a time. The correct colours and textures are built up by overlaying very thin layers of colour. For example, when painting a green leaf I will first paint the appropriate areas with a very thin lime yellow and when dry, a thin transparent layer of cobalt blue will follow on top which results in a much livelier green than using an already mixed green. The ironical result is that despite the fact that I paint almost exclusively green plants, the green cubes in my watercolour set are always the least used ! Often a plant is painted that is generally perceived as green and during the process I do not use the green cubes of my set once. As can be gathered from above, I prefer dry watercolour cubes instead of watercolour in tubes. I find the mixing of colours far quicker and easier by dabbing a wet brush onto the colour cubes instead of having to unscrew tubes all the time.

The role of art in my life

Art has been a natural part of my life for as long as I can remember. From pre-school toddler onwards it was a natural activity like playing. My parents called it a 'gift' and that is how I viewed it; a toy to be enjoyed and to use as I wished. Mostly it was and still is a way of channelling my enthusiasm. As a schoolboy I painted rugby players, action heroes and racing cars and later on this turned to portraits of composers and writers and also landscapes and plants.

There was never a question as to what I would be doing with my life, and my parents had a full eighteen years to get used to the idea that I would study art at University. I completed BA Fine Arts at Pretoria University in 1979 and during these years at University I was taught to be a "philosopher with a brush" as it was frequently explained to the students. All advantages have disadvantages and the good part of this type of training, apart from being very enjoyable to experiment so freely, was to be stimulated to explore new visual ways of expression. It gave me a broad understanding of the visual arts and also taught me how restrictive total freedom can be.

The style of semi-abstract painting that I developed as an art student was also simply a synopsis of my passion for the South African veld. My relationship with the veld has always been an intimate one and quite literally so because the general panoramic landscape view is too remote and removed for me It is only when I adjust my eyes into macro lenses and enjoy the shapes and textures of the thorny scrub, gnarled tree roots, lichen-covered rocks and wealth of miniature plants that hide between these textures that I can feel that magical and healthy nourishment flowing through my eyes.

My abstract paintings mostly consisted of decorative 'emblems' depicting the essential textures, shapes and characters of these intimate landscape details I refer to this abstract art in the past tense because I seldom do such paintings any more. I gradually felt myself drawn more towards depicting close-up veld scenes as realistically as possible and focussing almost exclusively on succulent plants. Among the superb hidden gems of the South African landscape are the succulent plants, and the way that they are carefully hidden from careless eyes seems to emphasise their uniqueness. They are like refined abstract living sculptures and any attempt to reduce and transform them into arty designs that are dominated by raw human expression seems to me like sacrilege.

Another reason for my hesitance in the past for labelling myself as a 'botanical artist' is that my art production has not been restricted to botanical illustration alone. During my final two years as a fine arts student at the University of Pretoria I started doing freelance illustrations for children's books and continued doing that for three years after graduating. At first it was simply a way to earn pocket money as an art student, but it became an almost full-time occupation for a brief period after graduating. The number of children's books that I contributed some or all the illustrations towards is about 42 if my memory serves me correctly. I probably would have made illustrating children's books my career had it not been for the interruption of two years compulsory military service during 1983 and 1984. The latter half of my time in the military was also served in the capacity of artist and most of the work consisted of caricature artwork that formed part of lectures and films used for training purposes. The style of illustration that I developed in the children's books was very caricature-like and the move to adapt towards a more mature audience was easy. After completion of my military service I decided to apply for the position of exhibitions artist at the Albany Museum in Grahamstown and for the

next fifteen years this occupied the bulk of my productive time. During weekends I did some botanical painting or even the occasional abstract composition or landscape in oils or acrylic. During these years at the museum I was also frequently asked to produce caricature artwork for publications. During 1992 I did 52 caricatures illustrating lower Albany district country folk tales accompanied by humorous anecdotes that had been compiled by Brian Wilmot, director of the Albany Museum at the time. These were published in a booklet named 'L.A. Lore'.

The most rewarding work I did in my official capacity at the museum was the palaeontological artwork under scientific guidance of Dr Billy de Klerk. This consisted of several large-scale mural paintings featuring prehistoric fauna and flora as well as a few life-size three-dimensional reconstructions of dinosaurs and prehistoric mammal-like reptiles. Just like caricature illustration came easily to me in my life, the creation of three-dimensional sculptures was also something that I took to quickly and with much enjoyment and satisfaction. During the period of palaeontological art this became such a captivating experience that at times I even felt I could have been a full-time palaeontological artist!

Despite all these excursions into other forms of illustration, I never stopped my regular painting of succulent plants. The passion and interest in these plants was always there. During 1999 I resigned from the Museum and accepted an offer to work as succulent plant propagator and artist at a nursery in Tucson, Arizona. This was a wonderful adventure with many advantages but also some drawbacks. In practice the nursery work demanded almost all my time and there was little left for artwork. During the three years in the United States I did only one botanical painting, and two t-shirt designs for the nursery. In 2002 my wife and I decided to return to South Africa and since then I have been living in the Little Karoo and work as full-time botanical illustrator, apart from propagating rare succulents in a 6 × 30 metre greenhouse.

'Centripetal Trio'. An abstract painting in acrylic. Even Gerhard's older abstract artwork used natural shapes and textures as inspiration. He describes such paintings as "visual music with 'organic emblems' in rhythmical composition".

Photographing in habitat

Connall Oosterbroek

Early on the morning of 10 August 2009 we set off to photograph various Bushman Candle species and their habitats. The timing of the photographic expedition from 10 to 16 August fortuitously turned out to be ideally chosen. All the species we had earmarked for photography were in full growth and flower and the account which follows below concerns a discussion of the trip from a photographer's perspective.

Different lenses were required for different kinds of photography and one locality generally required a number of different kinds of photographs. I carry two camera bodies, a Nikon D200 and a D300. On one I keep a 70 200 mm f/2.8 and on the other I alternate between a wide angle and a 50 mm macro lens. There was ever present wind and dust which meant I had to decide which lens to use before leaving the sanctuary of our transport since swirling dust and the innards of a camera don't make for good companions. In some cases, where we had to walk a distance from the vehicle, I used a wide angle zoom (AF-S Nikkor 17-55 1:2.8) suitable for most of the photographs.

Chasing the light

The most important variable in the field is the light. The desert and semi-arid environments are characterised by very harsh bleached light conditions for much of the day. Generally I prefer to shoot landscapes in the two "golden hours" of the day – at sunrise and sunset. As circumstance would have it, on this trip the warm, gentle light at the end of the day was the time when most of the photographs were taken. We would ideally arrive on site at least two hours before sunset in order to choose the array of vistas that needed to be photographed. Then everything that had been earmarked for photographing took its turn for the camera in the rich, soft light Landscapes in these arid environments are a challenge to photograph. They are often vast and appear rather uniform in colour at most times of the day. Apart from shooting at the right time, a focal point in the photograph was also useful, leading the eye into the landscape. The most striking of these were roads that fade off into the distance over many kilometres,

The pont used on the Orange River at Sendelingsdrift on the way to photograph the Bushman Candles species in south-western Namibia. This expedition, in August 2009, proved to be ideal for photography as many of the Bushman Candle species were in leaf and flower.

particularly in south western Namibia. Mountains in the middle and far distance also gave effective perspectives to the composition of photographs.

Bushman Candle flowers open in strong light and this is usually between 11:00 and 15:00 each day. These conditions of harsh sunlight are anything but ideal though they are generally the only time the flowers can be photographed fully open. We were lucky on one occasion to be able to photograph *M. patersonii* in its southernmost habitat south of Alexander Bay when there was light cloud cover. The conditions were bright enough for the flowers to open, but the cloud cover removed a lot of the harshness. Circumstances such as this are rarely met with, particularly on a short trip.

Searching for suitable subjects

Perhaps one of the biggest challenges on a trip such as this one, covering many thousands of kilometres, is to set objectives for what needs to be achieved each day. Our *modus operandi* was to arrive at a site and to spend 10 to 20 minutes locating Bushman Candle specimens that lent themselves to photography. After this Charles Craib spent a good deal of time locating specimen plants in beautiful settings, as well as finding Bushman Candles that revealed aspects of the plants' lives. Throughout the trip I also photographed plants that either shared their habitat with Bushman Candles or grew close by.

Prior to taking detailed photographs such as this a decision has to be made as to which lens to take along. The day this photograph of a *Monsonia patersonii* flower was taken a howling wind was blowing on the Lüderitz peninsula with considerable amounts of dust and windblown grit in the air. Lenses could consequently only be changed in the vehicle.

The roof of a vehicle often provides enough height to stand on for taking landscape photographs over bushveld. Here I am photographing the Otjihaveraberg near Windhoek. Photograph: Dawie Human.

Monsonia patersonii at the southernmost locality where this species occurs south of Alexander Bay. The photograph was taken under ideal conditions on a cloudy day. The cloud filtered in soft light, there were no shadows and there was good colour on the subject as well as the surrounding desert.

We were fortunate in that wherever we travelled there were dirt roads or shepherd tracks across the countryside. Little time was consequently spent walking long distances in search of plants.

Photographing the different species

Each Bushman Candle species required attention to specific details in order to take characteristic photographs of the plant in its habitat.

Monsonia lavrani in its black limestone habitat in south-western Namibia

Just north of Witputz this species grows under very harsh conditions on an exposed scree slope covered in chunks of fixed and loose black limestone. The flowers and buds that were about to open were the rich magenta for which this plant is well known. The black rocks provided an ideal foil for the Bushman Candles even in the middle of the day.

The seemingly arid desert locality was very rich in plants that had sprung to life after recent rains. One of

Landscape photography is all about being aware of opportunities for artistic compositions. This photograph, taken on the summit of the far eastern section of the Pellaberg, shows the habitat of *Monsonia crassicaulis*. The track winds off over hillock after hillock and the rich colours of the grass come to life in the late afternoon sun.

them was *Strumaria hardyana*, which grows close to the *M. lavrani*, in seepage areas which remain moist for a few days after rain. These places are characterised by smooth sheets of weathered black limestone, and strumarias grow in the water retentive cracks and fissures which are commonly found on them. These plants with their ornamental fans of leaves lend themselves to photography.

Monsonia herrei north-east of Steinkopf

M. herrei and *M. crassicaulis* occur together at a locality consisting of low quartz foothills, just north of the Eenriet Mountains north-east of Steinkopf. The area is heavily grazed by donkeys, sheep and goats and the monsonias had been shaped like bonsais by the grazing animals, making for interesting photography. Because we had arrived a bit late, the flowers had by and large closed, but some of the *M. herrei* were covered in unopened buds. Using the rich orange tones of the late afternoon light these could be effectively photographed. The tall Eenriet Mountains, catching the last rays about 15 minutes before sunset, made for an interesting backdrop to the foreground that was already in shadow.

This photograph of *Monsonia inermis* was taken at Spitskop north of Rosh Pinah. In the early afternoon the valley where the monsonias grow was drenched in harsh sunlight so inimical to photography. Such conditions call for experimentation and plants were photographed with the strong light source from behind imparting a texture of rice paper to the fragile petals.

Sometimes landscape photographs have to be taken under conditions of poor light, usually whilst one is en route somewhere with no time to linger. This photograph of the Sonnenberg in south-western Namibia fortuitously turned out well. The mountain stretches upwards full of light and shadow as well as convolutions and textures

Monsonia multifida east of Alexander Bay

Inland from Alexander Bay *M. multifida* grow on the tops of rocky desert hills immediately south of the Orange River near Brandkaros. The crests of the hills where the plants occur are subject to strong winds blowing in from the nearby Atlantic, making photography difficult. We arrived on site late in the afternoon, just less than an hour before sunset. On this occasion I chose my 50 mm macro lens for close-up photography The flowers had nearly all closed, but some were still open as these desert hills face west and the last of sunlight lingers on them Even though the wind had died down, I felt that the air was still dusty and so I changed to a wide angle lens in the vehicle in order to shoot the habitat.

We were fortunate to find *Pelargonium sibthorpiifolium* in full leaf and flower on the hill crests, growing together with *M. multifida*. Fortunately the pelargonium flowers,

Photography in the harsh light of the Namib Desert as here on the Lüderitz peninsula has many attendant difficulties. Whilst photographing this wind blasted specimen of *Pelargonium crassicaulis* I used a shallow depth of field and sought as many contrasting shapes and colours as possible.

This photograph of a long-tongued bee visiting *Pelargonium sericifolium* flowers was taken near Komaggas Here a fast shutter speed was used to capture the fast moving insect

Small camouflaged plants such as this *Tylecodon shaeferianus* on the Luderitz peninsula require focusing the lens on small details, in this case the quartz pebbles and the markings on the leaves.

unlike those of the monsonia, do not close in the late afternoon light. We were also lucky to see and photograph an apparently undescribed *Massonia* with lime-green leaves that grows on the rocky crests together with *M. multifida*.

Monsonia patersonii on the Lüderitz peninsula and in the coastal desert

The Lüderitz Peninsula and desert inland from the town is home to large numbers of *M. patersonii*. Here we wanted to photograph plants that grow together with this *Monsonia* as well as the power and effects of constant winds on the stems and branches of the plants.

The wind was blowing very strongly on the peninsula when we arrived in the late morning. The light was extremely harsh and seemed to bleach out all the colour from the surroundings. Added to this, the air full of flying dust particles. We found a place amongst low hills on the eastern part of the peninsula somewhat protected from the strongest wind. Virtually all the plants that grow together with *M. patersonii* were here and full of leaves and flowers. I was able to obtain many good close up photographs of the different plants by lying on my stomach with the camera lens pointing away from the wind. Some interesting shots were taken of *Pelargonium ceratophyllum* and *P. crassicaule* which were in full leaf and flower. These plants are particularly photogenic and the dark stems of *P. crassicaule* contrasted nicely with the wind-blasted desert environment. This was one locality where it was imperative to change lenses in the vehicle.

In the early afternoon we travelled to the rugged coastline. Charles knew of a place called Eberlanzhohle, a gully adjacent to the Atlantic. The desert here consists of steep rocky slopes and small cliffs rich in succulent plants. *M. patersonii* grows here together with *Othonna littoralis* and *Pelargonium cortusifolium*. Many of the monsonias are festooned in pendant as well as flat lichens and these bright colours provided for photographs with bold highlights, drawing the eye deeper into the photographic image.

It was surprising to find that although strong winds were blowing all over the peninsula and in the town of Lüderitz, the steep slopes adjacent to the sea at Eberlanzhohle were almost wind free. This certainly made photography easier than on our first stop, but camera lenses still had to be changed in the vehicle as the air was once again full of fine dust and wind-blown moisture from the adjacent Atlantic.

We left the Lüderitz Peninsula in the late afternoon and even at this time the surroundings were too bleached and the light too harsh for good landscape photography. With a way still to go for some habitat photography south of the Kowisberg, we found ourselves once more chasing the light!

It is always an advantage to photograph unusual small plants in pairs or tiny groups. This pair of *Gethyllis setosa* photographed west of Bulletrap in northern Namaqualand makes for an interesting point of focus.

The photography of plants in their natural habitats provides a variety of interesting opportunities. Photographing this *Euphorbia hamata* near Bulletrap involved looking for patterns in the flowers and isolating them. The developing seeds made for an interesting aggregation of forms and shapes.

SECTION III

BUSHMAN CANDLE CULTURE

Horticulture is an indispensable tool for the study of plants. In this sense living collections of species in various plant genera provide a resource that epitomises the natural growing conditions and growth habits of different plants.

The section focuses on methods for cultivating and propagating Bushman Candle species and it goes further than that. The plants are in themselves objects of beauty and they lend themselves to ornamental horticulture, particularly planting them in specially made terracotta vessels. At this point there is a transition from horticulture to art which takes place in a unique way. This is discussed in the text which follows.

People interested in growing plants, when circumstances allow, visit natural populations of their favourite plants. Displays of Bushman Candle species in flower are unparalleled. They provide an inspiration not only for improvements in horticultural techniques but also for various innovative and artistic ways of presenting the plants in cultivation.

Many landowners in the arid parts of central and southern Namibia and South Africa have opened up their farms to ecotourism. Though ecotourism is often centred on reintroduced game that used to occur in the region, this land use practice also encompasses hiking trails for visitors to enjoy the splendour of the natural scenery. A number of farms have substantial numbers of Bushman Candles of different species growing on them. These are covered in flowers at certain times of the year and could be included as special items to see on hiking trails or local tours familiarising guests with the flora.

There are spectacular and almost uninterrupted displays of *M. vanderietiae* on the game farms in the Fish River basin north, north-east and north-west of Grahamstown in the Eastern Cape. These could become valuable attractions for tourists who at present mainly visit the farms to see the game.

Several of the farms north of Rosh Pinah in south-western Namibia have large numbers of *M. lavrani* and *M. flavescens*. These are further examples of unrealised potential that could be utilised under the banner of ecotourism.

In a number of instances the places in which Bushman Candle species occur already form part of established private conservancies. The emphasis is already on preservation of habitats and the flora in them. An emphasis on spectacular plants such as the Bushman Candles provides further interest for ecotourists and photographers alike who visit these farms.

'To the North'

allow vast distances to enter the eye. This view captures the enormous space open to the explorer. It is the home to *Monsonia marlothii* as well as grass, shrubs and trees that have adapted to this harsh environment. Drawing by Bowen Boshier.

Bushman Candles in habitat

All the Bushman Candles species, except for some populations of *Monsonia camdeboensis* and *M. salmoniflora*, occur in places with an erratic and unpredictable rainfall. They have evolved to flower in the leafless state after receiving minimal moisture, by way of fog or rainfall. This habit ensures a regular production of flowers and seeds, even during a succession of dry years, and has a number of far reaching advantages for the plants There are always seeds present in the environment, to make use of favourable conditions for germination at the beginning of a rainy cycle. Those produced after the rains are often prolific and restore the number of ungerminated seeds to their former balance.

Bushman Candle species produce flowers in response to rains that fall at any time of the year, irrespective of whether they are from summer or winter rainfall regions. *M. camdeboensis*, a plant from summer rainfall habitat, may flower in the middle of winter in response to rain or snow received via well-developed cold fronts that occasionally sweep into the eastern Great Karoo from the south The same is also true of *M. salmoniflora* in its habitat near Theunissen in the Free State Should winter rains fall here, in this technically summer rainfall region, the largest shrubs sprout buds and flowers even though temperatures may be below freezing point at night

Bushman Candle species occur across a wide range of desert and semi-arid habitats and also grow sparingly at the edges of, and within, a grassland biome The specific habitat details applicable to each are discussed in the text about the different species. The themes which occur regularly in different habitats are elicited here for the purposes of more general discussion

The C13 between Rosh Pinah and Aus in south-western Namibia near Witputz. The calcrete plains on either side of the road and the black limestone hills in the distance are home to large colonies of *Monsonia lavrani*. Photograph: Connall Oosterbroek.

Monsonia inermis is a narrow endemic confined to the foothills of the Obib Mountains near Rosh Pinah and thence some 20 kilometres north to the farm Spitskop. The plants grow mostly in valley floors and on low ridges immediately above them. These are places that retain moisture longest after rainfall. Photograph: Connall Oosterbroek.

Species which grow in the Atlantic fog desert

Three species are found in coastal desert, namely *M. mossamedensis*, *M. multifida* and *M. patersonii*. These occur from the general vicinity of the Atlantic to some distance inland, all within reach of regular coastal fog, except for *M. multifida* which can grow well beyond the fog belt.

All plants growing in the Atlantic fog desert receive greater amounts of water from fog than they do from rain, but flower in response to any moisture they may receive. *M. mossamedensis* and *M. patersonii* are often large robust shrubs and may be festooned with lichens, which thrive in the fog belt. These lichens cause some plants to succumb, in the case of *M. patersonii* and possibly in the case of *M. mossamedensis*, though there is presently no data to confirm this in the last mentioned species.

Ernst van Jaarsveld (pers. com.) observed *M. mossamedensis* at several localities in Angola in January 2009. These were in the coastal desert near Namibe and around Lake Arko to the southeast. He noted that the distribution of the plants followed the fog belt along the coast, up to about 36 kilometres inland. All of them had growths of lichens which acted as moisture traps for the plants. There is undoubtedly a symbiotic relationship between the two robust Bushman Candle species (*M. mossamedensis* and *M. patersonii*) frequenting fog deserts and the lichens. It may be that in the case of *M. patersonii* only the largest plants, growing in sheltered positions, succumb when they are entirely covered in lichens. These plants are probably in any case near the end of their lives.

Van Jaarsveld also confirmed that *M. mossamedensis* makes use of fog as well as rain to grow and flower. Many plants were in leaf and flower in January 2009 after summer rains earlier in the season. South-western Angola lies in a summer rainfall region and there were also annuals in leaf around the monsonias, an indication of earlier rains.

M. multifida is the only species in the fog belt that does not support colonies of lichens. The reasons are to be found in the preferred habitat occupied by these plants. They usually occur on the tops of ridges directly facing the prevailing winds which may be very strong at times. In addition, the small stature of the plants makes them unattractive to colonies of lichens.

The *M. patersonii* which occur on the desert plains of the Namib, inland from Luderitz, are subject to winds of

Strumaria hardyana commonly grows near large groups of *Monsonia lavrani* in south-western Namibia, often in soil filled rocky crevices which are watered by runoff from the surrounding rock sheets after rainfall. Photograph: Connall Oosterbroek.

The dead trunk and lower branches of *Monsonia lavrani* in the final stages of decomposition. The petiolar spines have disintegrated and the bark has become brittle prior to complete decomposition. Photograph: Connall Oosterbroek.

such force that their trunks are burnished a rich golden yellow from windblown grit. The often extensive colonies of this species are devoid of lichens, which are unable to withstand the winds. Their smooth trunks, however, are most effective for condensing fog and in this respect play a role similar to that of the lichens growing on the stems of coastal plants.

Bushman Candles in south-western Namibia and Namaqualand

The species found in south-western Namibia and Namaqualand occupy a range of habitats exposed to direct sunlight for the greater part of the day. They occur on sandy plains, rocky outcrops, ridges and stony hills as well as on the slopes of mountains and their summits. They rarely if ever occur on southern slopes which carry a completely different set of plants adapted to more shady conditions.

The predilection for growing in arid sunny habitats means that the various Bushman Candle species have less competition from other plants. Other genera are more abundant in places with deeper soil that are better irrigated after rainfall. The habit of growing in open exposed places does however render plants more susceptible to grazing and trampling by livestock. Stock farming occurs throughout much of south-western Namibia and Namaqualand and different pastoral practices have affected the Bushman Candle species in various ways. The specific details are discussed in the species accounts and are also referred to below.

The current stock farming practices in south-western Namibia have little impact on the different Bushman Candle species that occur there. Stock levels are kept within the carrying capacity of the land and the majority of grazing takes place away from the arid and often stony, places inhabited by these plants. In Namaqualand the situation is very different. Here the seedlings and young

Diamond mining is commonplace in the vicinity of the Orange River east of Alexander Bay in the Northern Cape. Many colonies of *Monsonia multifida* and *Monsonia patersonii* have been destroyed via mines but overall this has as yet made little difference since both species enjoy a wide distribution on both sides of the Orange River near the Atlantic Ocean. Photograph: Connall Oosterbroek

The habitat of *Monsonia peniculina* south of Rush Pinah. The endless convolutions of these mountains with their slopes, ravines and valleys provide a vast amount of habitat for the Monsonias in a relatively small area. Photograph: Connall Oosterbroek

plants are often trampled by livestock, with the result that several species are usually restricted to protecting rocky niches where they escape the worst effects of trampling.

Most of the Bushman Candle species in Namaqualand are nonetheless widespread and occur across regions with variable numbers of livestock in any given season. These variations and the fact that most species set abundant seed ensure their survival in over-grazed landscapes.

Plants growing in the semi-arid regions of western southern Africa have lived with grazing animals for many thousands of years. In general, however, pastoralism exerts greater pressures on the landscape and the flexibility of plants has limitations.

Species in the Northern Cape, western Karoo and the Eastern Cape

The Northern Cape east of Namaqualand is a vast area where stock farming is commonplace. The two widespread species that occur in this region, namely *M. crassicaulis* and *M. salmoniflora*, are generally common. Prolonged droughts cause reductions in the numbers of plants but they soon build up again when favourable conditions return.

The same two species also occur in the western Karoo, a region extensively used for sheep farming. *M. crassicaulis*, the more abundant and widespread species, is very common in certain parts of the Ceres Karoo and also north of Matjiesfontein. The reason is that the dry ridges frequented by the monsonias are the least attractive areas for grazing sheep.

The two Eastern Cape species, *M. camdeboensis* and *M. vanderietiae*, also occur in countryside where stock farming is practised. Once again the plants grow in places that are arid and shaly or rocky, ensuring that they are rarely trampled or grazed. A change in stock farming practices or the expansion of traditional pastoralism in conjunction with rising human numbers could reverse these circumstances.

Growth cycles and regeneration

All the Bushman Candle species are in active growth at the time of the year when most of the rainfall can be expected. In south-western Namibia and Namaqualand this is usually the autumn and winter months. Some species such as *M. crassicaulis* habitually flower and seed throughout the rainy season whereas others flower and seed primarily at the end of winter and in the spring. Nevertheless all the

The Ceres Karoo east of Karoopoort is an area characterised by many rock ridges. *Monsonia crassicaulis* grows gregariously in these places, sometimes alongside scattered colonies of *Pelargonium hystrix*. Photograph: Connall Oosterbroek

Monsonia vanderietiae is one of the Bushman Candle species that survives in eroded over-grazed places such as the countryside just north of Committees on the Fish River
Photograph. Connall Oosterbroek

species may flower and seed in their leafless state either in response to unseasonal rains or limited precipitation received during droughts.

M. camdeboensis and *M. vanderietiae* grow mostly in the first half of summer if there is good rainfall. A spurt of fresh growth is always accompanied by mass flowering The populations of *M. salmoniflora* in the summer rainfall interior of South Africa share the same cycle of active growth.

Regeneration from seed is tenuous in all the species, as they are confined to arid places fully exposed to the sun. The seeds require sufficient moisture to germinate and then develop an initially thin stem, capable of resisting drought. This happens within a few weeks and seedlings which derive some shade during the day from surrounding rocks are best able to survive The whole process is assisted by the way in which seeds are dispersed by wind, many of them lodging amongst rocks The seeds themselves are sharply pointed and their attached tails uncoil after receiving moisture. This is a singular adaptation for drilling seeds into the soil during damp conditions.

Observers are often struck by the numbers of dead Bushman Candles that are so frequently found amongst the living plants in arid areas This phenomenon is not fully understood but appears to be related to a number

The hills west of Bulletrap in northern Namaqualand support a very rich bulbous geophytic and succulent flora. The quartzite outcrops in the middle distance contain large numbers of *Monsonia ciliata* Photograph: Connall Oosterbroek.

The hills and ridges north of the Eenriet Mountains near Steinkopf contain large concentrations of *Monsonia crassicaulis* and *Monsonia herrei*. The area is heavily grazed by sheep and goats in the winter and *M. crassicaulis* is pruned down via grazing. Photograph: Connall Oosterbroek.

The desert plains inland from Luderitz contain enormous scattered colonies of *Monsonia patersonii*. It is remarkable that any plants grow in this wind blasted environment, let alone thrive. Photograph: Connall Oosterbroek.

of factors that operate simultaneously or independently. Dead Bushman Candles take a long time to decompose, particularly species with a dense wax-impregnated bark. The process is slowed down even further in deserts or semi-arid regions. The greatest numbers of dead plants are usually found in places where there are no or few people. The dry waxy stems are ideal for igniting fires and many of the dead plants are gathered up for this purpose in populated rural places. Conditions for the germination of large numbers of seeds are generally very restricted. Many dead plants that appear to be of equivalent ages are likely to have reached the ends of their lives at about the same age, creating the impression of large numbers of plants dying simultaneously.

Bushman Candle seeds are produced prolifically over several weeks or months during the growing season and also at many other times after sporadic flowering. Many of the seeds are, however, eaten by a variety of insects whilst they are still ripening on the plants. Those that ripen successfully and are liberated into the environment are often eaten by other insects. The destruction of seeds and the limited chances seedlings have of surviving drought at the beginning of their lives, help maintain stable populations for most species.

The grassy sandy plains at the fringes of the Namib Desert, west of the Huib Hochplateau in south-western Namibia. *Monsonia salmoniflora* is commonly found on these plains as well as on the rocky summit of the limestone plateau. Photograph: Connall Oosterbroek.

Growing Bushman Candles

Propagation from seed

All Bushman Candle species are readily grown from seeds. Seeds may be sown as soon as they have been set and may also be stored as they usually remain viable for many months or even years. A good sowing mixture consists of equal parts of silt, river sand and sandy soil to which a small amount of very well rotted sieved compost has been added. In addition a small amount (about a teaspoon) of bone meal should also be very well mixed in. A tiny quantity of hoof and horn meal is also ideal and this may be added together with the bone meal.

Large deep seed trays or plastic pots are the best for sowing purposes. If seed trays are used, the seedlings of the majority of species need to be transplanted to deeper pots at the end of their second growing season, in order to accommodate the extensive root development that takes place in the case of most species. Seedlings in large deep

In Namibia *Monsonia marlothii* is used as a plant in landscapes often featured with other indigenous succulents such as aloes and euphorbias. These plants have been used to good effect in the gardens around the hotel at Solitaire. Photograph: Dawie Human

Right: *Monsonia peniculina* is a particularly attractive cultivation subject when grown in terracotta pots with a rough earthy textured finish. Photograph: Connall Oosterbroek

pots can be left for much longer, several years if necessary, but far fewer seeds can be sown in a large pot than a tray.

Seeds should be individually sown 2 to 3 cm apart with the sharp end of the seed pressed into the sowing medium until the blunt end is just covered. Once the seeds have been sown they should be watered about once every two days for the first 4 to 6 weeks and then less frequently as in the case of adult plants. Seeds sown in spring or summer should be watered in the late afternoon or early evening. This is a natural way of controlling "damp off" fungi to which seedlings become exposed if they are watered during the heat of the day. Seeds sown in autumn or the winter are best watered in the early afternoon. "Damp off" fungi are rarely a problem during cool weather.

Development of seedlings

In most species the seedlings develop very quickly for the first few months. There is a huge advantage to this growth habit which must have evolved as a survival mechanism for all the Bushman Candle species. They generally grow in the most arid parts of dry environments and thus have to establish themselves as quickly as possible in order to survive

Monsonia multifida, like its counterparts in nature, often flowers in the leafless state in response to its first watering. Photograph: Connall Oosterbroek.

Monsonia multifida is a relatively easy Bushman Candle species to cultivate. It needs to be grown in gravelly sand and frugally watered in late autumn and winter. The plants are in active growth at this time. Photograph: Connall Oosterbroek.

In the multi-branched Bushman Candles there is considerable variation in the length of time particular species take to produce a crown of branches. A multi-branched species such as *M. spinosa* for example, may take 2 to 3 years before branching properly, whereas in *M. vanderietiae* a crown of branches is often developed in the first year, when these plants are grown from seed. The majority of seedlings flower once they have branched and the slowest species to flower, when grown from seed, is generally *M. spinosa* as it takes the longest to branch.

The development of Bushman Candle seedlings in cultivation is similar to that in the wild, except that few if any plants should succumb to drought. The most dangerous period for seedling plants from strictly winter rainfall regions is the summer. They need to be kept dry whilst dormant but at the same time their trunks do not always withstand continual drought. Young plants of *M. spinosa* are very susceptible to drying out during dormancy.

Propagation from cuttings

Thinner stemmed Bushman Candle species can be grown from cuttings struck in barely moist sand. These should be at least 6 to 7 cm long and taken with a sharp knife or pair of secateurs. They should be allowed to dry and heal thoroughly before being placed in a rooting medium.

Thick stem species such as *M. multifida* or *M. peniculina* are particularly difficult to grow from cuttings. The site of the cut needs to heal for several months before attempts can be made to strike such a cutting. Mostly such attempts fail as the stem segment rots or fails to produce roots even when it is well healed over.

The commonest Bushman Candle species such as *M. camdeboensis* and *M. vanderietiae* are usually the easiest to grow from cuttings. This hardly seems necessary however as both these and other multi branched species are so readily grown from seeds.

Cultivation

Bushman Candle species are best cultivated in a well-drained gravelly or sandy mixture consisting of a third coarse sand or fine gravel, a third ordinary soil and a third silt. They are always grown best in positions which receive long periods of strong sunlight. They should be watered about once every 6 to 10 days during the period when they are in active growth and producing leaves. As soon as the foliage starts to show signs of yellowing or withering, water should be withheld. The leaves start to die back in spring in the case of autumn and winter growing species, as temperatures warm up and day length increases. The reverse is true of the two strictly summer growing plants, *M. camdeboensis* and *M. vanderietiae*. These two species respond to increases in temperature and usually sprout leaves and flower buds a few days after they have been watered in the spring and early summer months.

Species from very arid regions where rain is erratic are often best watered during the autumn and early part of the winter. The two most notable examples here are *M. mossamedensis* and *M. peniculina*. In cultivation the latter may flower even in response to moisture in the air in summer rainfall regions. A little water may also be given occasionally under cool cloudy conditions to encourage further buds to develop.

Monsonia vanderietiae is the easiest Bushman Candle species in cultivation and also the most rewarding. It flowers throughout the summer and is an ideal specimen plant for sunny rockeries in summer rainfall regions. Photograph: Connall Oosterbroek.

Monsonia vanderietiae seeds lodge readily between the joins in brick paving. Once the seeds have germinated their roots quickly find their way below the pavers. Photograph: Connall Oosterbroek

It is important that there is plenty of free air circulation around cultivated plants and also that they are not over-watered. Too much water and lack of circulating air predisposes all the species with thickened stems to fungal attack and rot.

The best results with cultivated plants are nearly always from those that have been grown from seed. The seedlings adapt to the climate where they are grown and develop a vigorous root system. Transplanted plants usually require the trimming of their extensive root systems in order to fit into the containers in which they are cultivated. In many

Monsonia vanderietiae usually looks at its best in cultivation in the spring and early summer months. This is a time of fresh green stem growth and masses of new leaves as well as buds and flowers. Photograph: Connall Oosterbroek.

Monsonia peniculina often flowers in a nearly leafless state when cultivated under greenhouse conditions. This often seems to be in response to moisture during rainy summer weather as the plants are not watered at this time. Photograph: Connall Oosterbroek.

cases these plants do not readily develop any new roots and for many years put on nothing more than a few leaves during the growing season.

In a greenhouse it is often impossible to grow Bushman Candles under the conditions of intense direct sunlight which they enjoy in nature. Stems and trunks of greenhouse-grown plants become etiolated but they nevertheless do well, producing leaves and flowers.

The growth cycle in cultivation

Bushman Candles are opportunistic growers and only a few are strictly winter or summer growing. Many of them will flower in the leafless state. If the weather is cool and cloudy and the plants have produced flower buds or leaves, they will benefit from a little water given at intervals. The plants have to be carefully observed and water withheld as soon as the leaves start to wither or buds stop appearing and developing.

Transplanted Bushman Candles generally behave rather erratically whereas those grown from seed usually settle into predictable rhythms of growth and flowering.

In cultivation *Monsonia peniculina* flowers with or without leaves as it does in its natural habitat. Photograph: Connall Oosterbroek.

Monsonia peniculina is readily grown from seed in cultivation. It is important, however, to ensure that the plants are grown under conditions of intense day-long sunlight in order to preserve their compact habit. Photograph: Connall Oosterbroek.

Seed sources and seed production

Bushman Candle seeds rarely feature on commercial seed lists and, when they do, it is often the species that produce good quantities of seed in cultivation that are listed, such as *M. vanderietiae*. There is little doubt that this situation is a major drawback for increasing the popularity of these plants amongst enthusiasts, particularly growers who concentrate on the Geraniaceae.

Most Bushman Candle species readily produce seeds in cultivation if hand pollinated. This is easily achieved using cotton buds on which pollen is gathered up on the bud and swept across the ripe stigmas of different flowers. The most successful method, in practice, is to gather up pollen from several flowers on one cotton bud and then manually pollinate flowers on different plants. Pollination is most easily achieved when the flowers are fully open between 11:00 and 15:00 and it is best to repeat-pollinate flowers at intervals on the same day and also on successive days until the flower withers.

Seeds develop rapidly and often spring off the plant as soon as they are ripe. Ripening seeds have to be watched carefully to ensure that they are captured before they are blown away. Another easier method is to cover the seed producing plant with a net made from fly screen. Ripe seeds are retained in the net and can be harvested when desired.

Horticultural uses

Bushman Candles have several uses in horticulture. Some of them, particularly *M. vanderietiae*, are very well suited to ornamental container planting and this is the subject of the following chapter.

In most instances however the plants require specialised care throughout the year, which eliminates them at once from popular horticulture. The bulk of the species are likely only to feature in specialised collections maintained either by botanical organisations or private specialist collectors.

M. vanderietiae is probably the most versatile species for use in general horticulture. It is easily propagated from seeds, the seedlings mature rapidly and it is long-lived, flowering well for many years. The plants thrive in summer rainfall areas under cultivated conditions and can be grown in containers or beds. They require practically no maintenance and produce buds and flowers after each good shower of rain. They grow in hot places under conditions of intense sunlight, where few other flowering plants would be able to survive.

Preliminary indications are that *M. vanderietiae* can be cross bred and selected for flower colours, compact or spreading growth habits and size. This plant has much potential for the landscaping industry in South Africa, and probably elsewhere in the world.

M. marlothii has been used to good effect for landscaping around the hotel in Solitaire in west central Namibia. The large shrubs are covered in leaves and flowers for much of the year, even well into the autumn. When the hotel grounds were visited in mid-May 2009 (early winter) the Monsonias were still covered in leaves and flowers. These shrubs were producing large amounts of fertile seeds which could easily be used for propagation purposes.

Monsonia marlothii in the natural landscape around the hotel at Solitaire are in flower and leaf for lengthy periods in response to artificial watering. This plant was photographed in mid-May 2009. Photograph: Dawie Human.

Bushman Candles as container plants

Ornamental container planting is an unusual art, combining the attributes of specially hand crafted containers with those of plants. It is also known by some people as living art. A number of combined skills are needed to develop and establish this genre of artistic expression. A detailed knowledge of ceramics is a pre-requisite linked closely to a flair for exploring and creating different surfaces, shapes and textures. In addition, thorough experience is required for growing a wide variety of plants within the confines of a container and presenting them cleverly in the chosen vessel. It is rare for anyone to have all these skills and a symbiosis between the potter and the planter usually achieves the best results. The potter needs to develop different concepts of how particular vessels display living subjects and to realise these through the shapes, textures and colours in which the containers appear in their completed state. Apart from a sound knowledge of how plants thrive in confined spaces, the planter should approach the subject with a latitude of imagination. This is usually inspired by natural surfaces and textures, such as the rocks amongst which plants grow in their habitats. This chapter provides an excursion into the

Charles Craib and Chris Patton discussing a batch of containers that have recently been fired. The vessel Charles is holding was inspired by the angled winged sides of a combretum seed. Photograph: Connall Oosterbroek.

Right: This ornamental container planting, using *Monsonia vanderietiae*, is a study in elevations, shapes and textures. The shape of the plant perfectly suits the curve of the vessel. The spiny branches radiating outwards work well against the soft flowing lines on the lip of the container. Photograph: Elsa Young.

art form as well as a discussion of *Monsonia vanderietiae*, as an eminently suitable subject for certain types of ornamental container planting.

The niche market for sculptural and ornamental containers, specially planted up and presented as a form of art, is very restricted in South Africa. It owes its existence entirely to commissions and a handful of collectors. This market is virtually excluded from general commercial horticulture, firstly by virtue of the expense and secondly as a result of the focus of pottery in general horticulture. The last mentioned is based on the common denominator of public tastes and the commercial responses to these which favour containers that are inexpensive and functional. Creative ceramic art, when it is presented in general horticulture, usually takes the form of vessels into which the common plastic flower pot is placed with whatever horticultural item it may contain.

There are also other factors which keep ornamental containers separate from mainstream horticulture. These sculptured vessels remain scarce as they are specially designed and hand thrown. In addition they take up kiln space which is usually required for general commercial products, restricting their availability even more The potter needs an aesthetic interest in making specially crafted containers that are marginally viable commercially, adding another set of limitations. Finally, horticulturists interested in ornamental container planting are often more attracted to well-established conventional art forms with plants, such as bonsai.

Chris Patton creates his special containers for Charles Craib via a process which includes the exchange of ideas. These take on their form and expression via pencil sketches culminating in the production of individual and unique pieces.
Photograph: Connall Oosterbroek.

Chris Patton, his pottery and using the vessels he makes

Chris Patton is a ceramic designer who immigrated to South Africa from Northern Ireland in 1982. He makes small runs of production pottery at his studio near Muldersdrift north of Johannesburg and also creates individual pieces, which are generally commissioned.

I (Charles Craib) was fortunate to have met Chris Patton some decades ago through a rather unusual set of circumstances. Some vessels were displayed at an indigenous plant nursery, handmade with rough uneven finishes resembling cavities on sheets of exposed rock. The nursery owner referred me to Chris and I went to visit him soon afterwards at his studio. We quickly realised that we shared similar views with respect to the vessels required for presenting indigenous plants and Chris produced the first batch of ornamental containers for me shortly afterwards. In subsequent years he has made successive batches of pots that have suited my requirements perfectly. These containers have evolved and changed through time in tandem with the growth and development of my own concepts.

It is difficult to explain why Chris's pots work so well for ornamental container planting. Perhaps one of the keys to the success of the vessels and my subsequent plantings in them lies in our initial conceptual discussions. Chris articulates his ideas of sizes, shapes, forms and textures with reference to sketches he draws on large sheets of paper, whilst we are talking. These guide the process until the pots are fired. Afterwards, when I call to take delivery of the vessels, I see in my mind's eye numerous ways in which they can be planted. The latitude within which the containers are designed allows for truly creative expression with different types of plants.

Natural and contrived surfaces, textures, shapes and colours

Landscape artists isolate aspects of continuous features in nature for the purpose of portraying them in pencil or colour. This choice is the first step towards planning a

drawing or painting. The artist busy with an ornamental container planting however strives to re-create personal perceptions of the manner in which plants grow naturally. Alternatively, there is plenty of room for the exploration of colours, shapes and textures which are not modelled on themes regularly encountered in nature. Essentially an ornamental container planting can only be connected to nature via interpretation and recreation. It is therefore an abstraction, removed from the initial subject matter that served as a catalyst for inspiration.

The surface of the container in which the planting is presented for viewing is in reality a small restricted area, typically under 15 × 15 cm. In view of these limitations a number of factors must be combined to produce a successful result. The vessel itself needs to draw the viewer towards the living subject. This is achieved via uneven rims around the edge of the pot, sloping upwards or downwards. Chris Patton, a master potter, in many cases goes one step further, broadening the rims of the vessels he creates by extending them for some 5 to 9 cm. The functional area for planting is in these instances to all intents and purposes like a cavity on a sheet of rock. The use of earthy ochre-coloured clays in creating a vessel and also the light browns so prevalent in sere Highveld winter grasslands inspires specific kinds of planting. Dark brown or grey shales around the chosen plants focus the viewer's attention. If the living subjects are cryptic, an added dimension extends the viewer's visual pleasure even further.

An interesting recent development in Chris's repertoire of containers is some modelled on the shapes of seeds particularly those typical of various combretums, *Holubia saccata* and *Pterodiscus ngamicus*. These plants all produce winged seeds and their shapes inspire a unique genre of planting. Some of these vessels are tall and the ascent of their clay wings draws the eye upwards. Commiphoras planted amongst tall fragments of dark grey limestone continue this line of ascent, so strongly embedded in the aesthetics of the vessel. Shorter, somewhat squat containers emphasise the intricacies of the winged shapes and these are ideal for planting *Monsonia vanderietiae* which is described in some detail below.

Charles Craib has used *Haworthia limifolia* when planting up this trio of pots. Symmetry is achieved within each planted vessel and across the three vessels via descending lines, angles, shapes and textures. Photograph: Connall Oosterbroek.

Chris Patton at work in his studio near Muldersdrift north of Johannesburg. The idea of a vessel based on a Combretum seed begins to take via kneading and teasing out the moist clay. Photograph: Connall Oosterbroek.

Using pebbles, rocks and shales for ornamental container planting

Yellows, ochres, browns and greys are the typical colours found amongst pebbles, rocks, gravels and shales. The endless range of these hues and their subtleties on individual rock surfaces are to the planter the same as colours for the artist.

Chris Patton's containers quite often lead the way for the selection of rocks or shales used in some plantings. Uneven cobbled surfaces on the broad rim of a pot suggest pebbles or oblong stones. Dark lines converging vertically towards the vessel's rim point out clearly the aesthetic advantages gained by using thin strips of shale. These lead up towards the plants which appear framed by a continuity of lines shared between the vessel and the narrow strips of shale

Several rounded separated holes made at different levels in one container imply that a different plant should appear in each. Thick cylindrical succulent trunks are ideal here and a good candidate for planting is *Cyphostemma juttae*. There is a balance between the shapes of the holes in the pot and the rounded appearance of the Cyphostemma trunks.

Some of the most readily sourced materials in South Africa are shales exposed via road works as well as waste granite, sandstone and quartzite found around quarries Rock fragments exposed during construction of road cut tings are also useful, displaying a range of surfaces and colours. Many of these freshly exposed rocks have colours that are harsh and raw. The material weathers quickly however when exposed to strong sunlight and rain. Rough-textured rocks, such as sandstone, develop greyish and ochre streaks within as little as a year after exposure to the elements. The imaginative mind quickly realises the potential of different types and colours of rocks when opportunities to collect them present themselves.

Perhaps one of the most versatile substrates is limestone. Its surface may be rough like coarse sandpaper, full of concave indentations or miniature convex bumps. It also occurs in a vast range of light and dark greys and its plenti ful cavities and fissures are very useful for exposing and concealing roots.

Light and shadow, and creating an illusion of depth and height

Perhaps the dullest features of conventional container planting are a monotonous replication of level surfaces in which the plants are presented Ornamental container

This plant is an exploration of rounded shapes both of the vessel and the *Monsonia vanderietiae* planted in it. During its photography Elsa Young noted that the simplicity of the plant and container called for an elevated camera position where both forms are visually equal – the elevation of the plant matching the proportion of the container. Photograph. Elsa Young.

Trunks and exposed roots connive to form the essence of this planting spread across two containers. The multi-coloured clay used in each vessel creates a sense of ascending movement. In her photography Elsa Young explored the relationship between the roots and rocks as well as the pottery and its colours. Photograph: Elsa Young.

planting seeks to dispense with this and brings about changes in various ways. It is true to say that the confined spaces for planting imply that limited possibilities have to be used to their fullest. Certain effects lie tantalisingly beyond reach and this "beyondness of things" stretches the planter's imagination to its limits. Small surface areas for planting, which are sometimes only about 12 × 12 cm, need to be carefully planned; the use of small dark stones surrounded by some larger, paler-coloured ones, creates a sense of depth. This too re-creates natural rocky surfaces which are rarely level. The plants themselves seldom have very dark trunks or leaves which cause them to stand out in relief against the darker rocks.

The chosen plants, particularly those with thick trunks or an intricate branching system cast an array of shadows at different times of the day. These add a good deal of interest to the container and its plants, accentuating the visual attributes of light- and dark-coloured rocks. *Commiphora* species and *M. vanderietiae* are particularly useful for showcasing the effects of light and shadow. Smaller plants with interesting foliage, such as *Haworthia limifolia*, may also be used to achieve similar results but in a more subtle way.

Bushman Candle species for ornamental container planting

The most useful species and also the most versatile for ornamental container planting, is probably *M. vanderietiae*. It is readily propagated from seed, quickly reaches flowering size and has an intricate branching system. It is in leaf and flower for a good deal of the year and individual plants vary from one another with respect to their size, thickness and orientation of their trunks and branches as well as their flowers. Several specimens can be planted together in a large container, and those with full spreading crowns of branches can be attractively presented on their own in a smaller vessel.

M. vanderietiae may be used effectively in vessels with a variety of colours, textures, shapes and sizes. Their tightly packed masses of branches sometimes have equivalent shapes to the containers in which they are planted, particularly those with broad rims. The range of visual possibilities that this species provides is presented in good measure by the photographs which accompany the text in this chapter. The captions below each photograph explore the effects created via the use of different types of vessels and also the methods for displaying the plants growing in them.

Elsa Young's own words describing how she took this photograph capture perfectly the objectives Charles Craib had when planting up this container. " ...the small opening of this container gives a sense of the plants bursting out of it, almost like vegetation growing from between rocks on a koppie. It has a sense of tightness but the expanding fleshy shrublets balance the earthy quality of the container ..." Photograph Elsa Young.

Monsonia vanderietiae lends itself to showing off the symmetry of its branches shared with the irregular panel-like edges of the containers. Elsa Young found the two vessels perfect to photograph as a pair, reminding her of a rocky outcrop! She has shown, via her unique photographic technique, how the stone placements in the vessels enhance the texture of both the plants and the container. Photograph: Elsa Young.

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Glossary

Androecium – the assemblage of male organs of a plant.

Apiculate – with a short, sharp point.

Arborescent – tree-shaped.

Armed – with spines or thorns.

Ascending – growing upwards.

Autecology – branch of ecology that deals with the biological relationship between an individual organism or an individual species and its environment.

Biotope – an area of uniform environmental conditions providing a living place for a specific assemblage of plants and animals. Biotope is almost synonymous with the term habitat, but while the subject of a habitat is a species or a population, the subject of a biotope is a biological community.

Bi-pinnatisect – twice Pinnatisect. See also **Pinnatisect, Tri-pinnatisect**.

Boesmanskers or **Boesmans Kers** – Afrikaans word for Bushman's Candle.

Caudiciform – with a markedly thickened, often succulent stem.

Centre of endemism – in a biological context, an organism restricted to a localised area is referred to as an endemic. If this localised area has a high occurrence of endemics it is generally referred to as a "centre of endemism".

Ciliate – having eyelash-like hairs along the margin.

Composites – plants of the family Asteraceae (daisies).

Congeneric nature – belonging to the same genus.

Cordate – heart-shaped in outline

Corolla – the inner whorl of the flower perianth, comprising the petals.

Crenate – with convex teeth. See also **Crenulate**

Crenulate – with minute convex teeth. See also **Crenate**.

Cytological – referring to the cell-structure and in particular to the chromosomes.

Deciduous – shedding all the leaves at certain times.

Dentate – with teeth-like structures, usually on leaf margins. See also **Denticulate**

Denticulate – with very small teeth-like structures, usually on leaf margins. See also **Dentate**

Diabase – an **Igneous rock** type. Similar to **Dolerite**

Dichotomously – branched into two equal branches.

Dolerite – an **Igneous rock** type. Similar to **Diabase**

Elliptic/elliptical – in outline like a flattened circle, tapering towards opposite ends.

Entire – un-indented or incised **Leaf blade**.

Epidermis – the outer cell layer of every plant organ.

Floral morphology – the detailed composition of a flower.

Fog desert – a coastal desert having a cold-water marine current just off-shore of a warm continental land mass – the coolness and moist air produce fog but little precipitation, just enough to sustain animal and plant life.

Folded coastal ranges – mountains created by compression and folding, e.g the mountains of the Cape.

Generic level – the taxonomic level above that of species, e g. Pelargonium.

Geophyte – a plant with underground storage structures.

Geophytic flora – an assembly of **Geophytes**.

Glabrous – without hairs

Gneiss – metamorphic rock with a swirling banded texture, consisting mainly of **Quartz**, feldspar, and mica.

Granite – a coarse-grained, generally light-coloured intrusive igneous rock type consisting of **Quartz**, feldspar, and some dark minerals.

Identification key – a literary structure, usually based on artificial criteria, whereby biological entities can be recognised by way of a given set of characters.

Igneous rock – formed from molten material. See also **Sedimentary rock**

Indumentum – a covering of fine hairs or bristles (rarely scales). See also **Pubescence**.

Inflorescence – an assemblage of flowers.

Intra specific – between species.

Karyological – refers to properties of the cell nucleus, notably the chromosomes.

Leaf blade – the flattened part of a leaf. See also **Petiole**

Less advanced features of (the) genus – characters perceived as derived from others, more primitive.

Metasedimentary – metamorphosed **Sedimentary rock**

Midrib – the principal vein on a leaf, a continuation of the **Petiole** into the **Leaf blade**

Molecular – in biological science this term usually refers to nucleic acids (such as DNA) and proteins, and especially with their role in cell replication and the transmission of genetic information.

Monsonia – genus of plants belonging to the geranium family and named for a British aristocrat, Lady Anne Monson (née Vane) (1726–1776), great-granddaughter of Charles II. She explored South Africa with her second husband, Col. George Monson.

Obovate – like a bird's egg in outline, with the narrowest part at the end of attachment. See also **Ovate**

Ontogeny – history of development and growth of an individual or of an organ.

Orbicular – almost perfectly circular in outline.

Ornamental Container Planting – form of art combining attributes of plants, the natural settings in which they occur and related features of specially crafted hand thrown pottery

Ovate – Like a bird's egg in outline, with the widest part at the end of attachment. See also **Obovate**.

Palynological – relating to the study of pollen and spores.

Pedicel – the stalk bearing a flower. See also **Peduncle, Petiole**

Peduncle – the stalk bearing an **Inflorescence**. See also **Pedicel, Petiole**

Petiole – the leaf stalk See also **Pedicel, Peduncle**

Petioled – leaf with a discernable **Petiole**

Phyllitic – metamorphic rock with mica-like minerals forming parallel to the foliation, but not so strongly as in **Schist**.

Phylogenetic – refers to the lines of descent or evolutionary development of any plant or animal species.

Phytochemical – pertaining to chemical properties of a plant.

Pinnatilobate – leaf lobed along its longitudinal axis with the indentations extending between half and two-thirds of the way towards the **Midrib**

Pinnatisect – leaf incised along its longitudinal axis, with the incisions extending almost to the **Midrib** See also **Bi-pinnatisect, Tri-pinnatisect**

Puberulous – minutely downy or **Pubescent**

Pubescence – a coat of hairs. See also **Indumentum**

Pubescent – downy, covered with very short and soft hairs. See also **Puberulous**

Quartz – commonest form of silica, one of the most abundant minerals in the earth's crust.

Quartzite – metamorphosed sandstone consisting of sedimentary **Quartz** grains recrystallised into larger interlocking crystals.

Revision – critical account of what is known about the subject, with suggestions for adopting differing views.

Roots succulent – roots can function as water storing organs in certain plants. This appears to be the case in only two species of Bushman Candles. The remainder all have wiry roots.

Sarcocaulon – name derived from two Greek roots: *sarkos*, meaning flesh, or fleshy and *caulon*, meaning a stem

Scandent – climbing.

Schist – metamorphic rock consisting of mostly flattened, flaky minerals like micas, chlorite, and talc, formed by directional stress during folding.

Scree – debris from rock falls

Sedimentary rock – formed by deposition of mineral grains. See also **Igneous rock**

Segmented – with the **Leaf blade** divided in various ways.

SEM studies – studies by means of the Scanning Electron Microscope.

Shale – fine-grained, layered, **Sedimentary rock** originating from deposits of clay or mud.

Shallowly undulate – wavy but without deep indentations.

Silt – unconsolidated deposit of very fine water-borne mineral particles, not as fine as clay.

Spines – modified leaves. In *Monsonia* all spines are petiolar spines, spines that are the modified **Petiole** that remains after the **Leaf blades** are shed.

Spinescent – ending in a **Spine** or sharp point.

Sympatrically – two species occurring together.

Synonymous (synonymy) – representing taxonomically the same entity, though under a different name.

Taxonomic treatment – study of the relationships of a biological entity and its position in relation to other similar units.

Taxonomic value – a feature capable of helping to define the identity of a plant or animal.

Transhumance – the seasonal movement of people with their livestock over relatively short distances, typically to higher pastures in summer and to lower valleys in winter. Herders have a permanent home, typically in valleys. Only the herds travel, with the people necessary to tend them.

Transpiration – the loss of water vapour through the stomata

Tri-pinnatisect – three times **Pinnatisect**. See also **Pinnatisect, Bi-pinnatisect**

Unarmed – without any spines or thorns

Undulate – margin uneven, alternately convex and concave.

Venation – the veins of a leaf

Vestige(s) – remains of a structure, or a greatly reduced structure.

Vestigial spines – Spines that either do not persist or do so only occasionally.

Xenolithic – foreign rock fragments contained within a host rock.

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