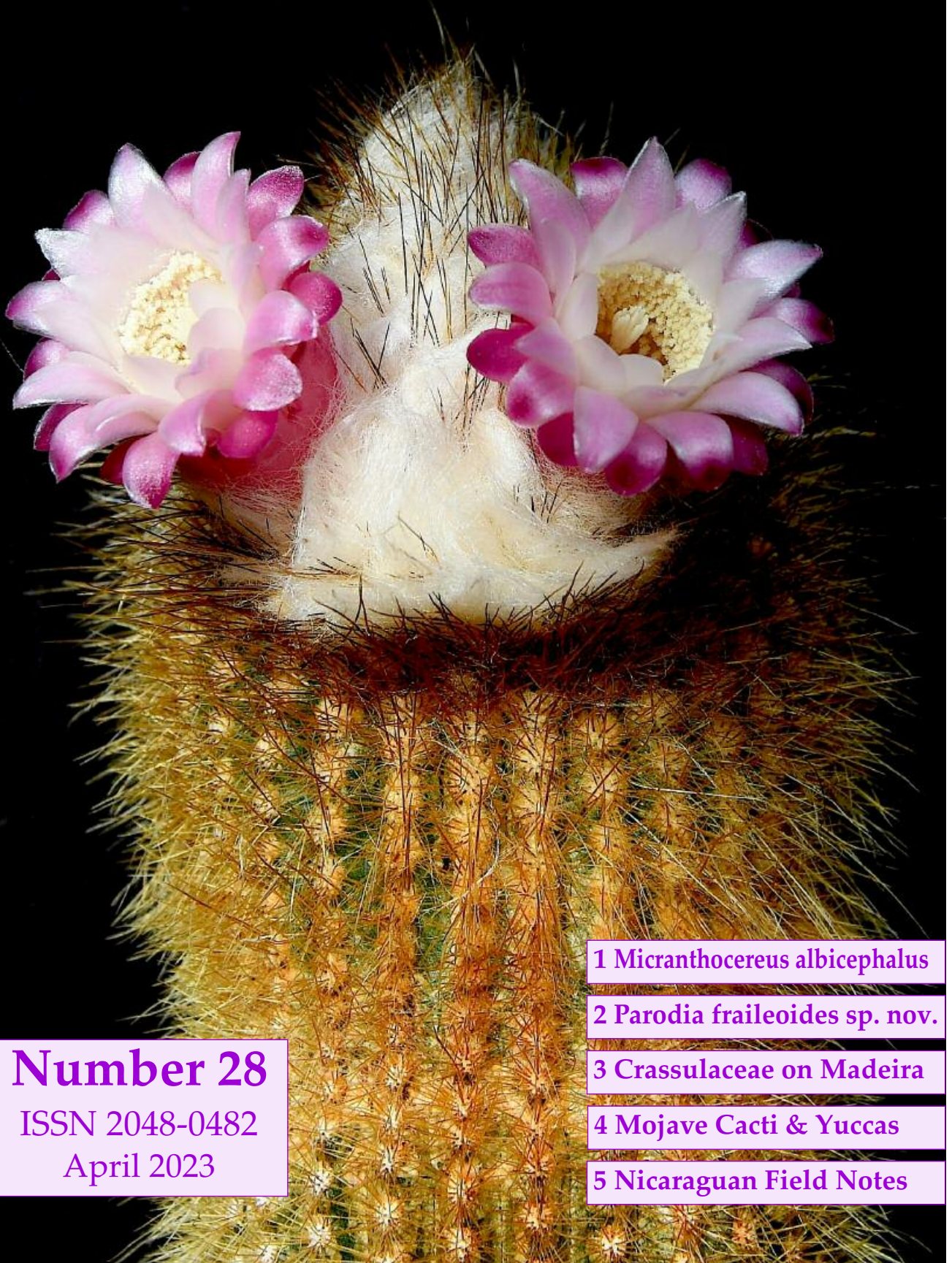


# The Cactus Explorer

The first free on-line Journal for Cactus and Succulent Enthusiasts



**Number 28**

ISSN 2048-0482

April 2023

1 *Micranthocereus albicephalus*

2 *Parodia fraileoides* sp. nov.

3 Crassulaceae on Madeira

4 Mojave Cacti & Yuccas

5 Nicaraguan Field Notes

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**Cover Picture:** *Micranthocereus albicephalus* flowering in cultivation.

Photograph: Kamiel Neirinck. [See page 10](#)

The No.1 source for on-line information about cacti and succulents is <http://www.cactus-mall.com>

The best on-line library of cactus and succulent literature can be found at:

<https://www.cactuspro.com/biblio/en:accueil>

## Invitation to Contributors

Please consider the Cactus Explorer as the place to publish your articles. We welcome contributions for any of the regular features or a longer article with pictures on any aspect of cacti and succulents. The editorial team is happy to help you with preparing your work. Please send your submissions as plain text in a 'Word' document together with jpeg or tiff images with the maximum resolution available.

A major advantage of this on-line format is the possibility of publishing contributions quickly and any issue is never full! We aim to publish your article quickly and the copy deadline is just a few days before the publication date. I will publish an issue when sufficient material is available. Please note that **advertising and links are free** and provided for the benefit of readers. Adverts are placed at the discretion of the editorial team, based on their relevance to the readership.

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This issue published on  
7th April 2023

Opinions expressed in the articles are those of the authors, and not necessarily those of the editorial team.

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# INTRODUCTION

## Spring is here!

It has been over a year since the last edition of the Cactus Explorer. I am sorry you have had to wait so long. I must admit that I have been working hard to finish my book about *Matucana*. After other demands on my time limited my progress, I felt that I had to prioritise my book if I was ever to publish it.

I have to say that I really missed visiting cacti in habitat during the pandemic so when travel became possible again, I took the opportunity to take up an invitation to visit Rio Grande do Sul, the most southern state of Brazil. It is the home of many wonderful plants of the genus *Parodia*, such as plants we know better as *Notocactus*, *Wigginsia*, *Eriocactus* and *Brasilicactus*. There are *Frailea* species as well as interesting gymnocalyciums.

After the restrictions imposed on us by the pandemic, it is wonderful to have a full calendar of events to look forward to. On pages 4 to 9 you can find a list of the major events of the year ahead. There are a number of Marts to visit and I guess that after the cold winter you may well have a few spaces to fill. I found out that some plants that had been in my unheated glasshouse for years were not as hardy as I thought!

It has been a noteworthy year for the British Cactus & Succulent Society, now managed by a largely new group of officials and trustees. The National Show, the first for six years, was a great success and I hope inspired growers to try even harder to grow wonderful plants.

Probably the most important step forward for the BCSS is its new website that can be found at <https://bcss.org.uk>. The new team is to be congratulated on producing such a functional site in such a short time. You can read about it in the latest *CactusWorld* 41(1) and I suggest you take a look and see all the useful information there.

Sadly, the last year has seen the passing of many influential people in the world of

succulents, including some I valued as friends. Some were well-known like Roy Mottram, nurseryman and bookseller, who had an extensive knowledge of the plants and was one of the few people I knew who had an understanding of the Botanical Code of Nomenclature.

I have recently heard of the death of Derek Castle, an old friend and mentor from whom I learnt so much in the early days of my hobby back in Birmingham. We visited nurseries in England and on the continent together in the 1970s and 80s.

I remain shocked and saddened at the loss of my close friend Chris Pugh who was a commercial cactus grower and had a great love of the plants. We visited South America together many times and shared unforgettable experiences. It's hard to believe that our adventures together have come to an end,

Good Growing!

*Graham Charles*

## A New Gymnocalycium

It was a few years ago that I first grew seeds from Volker Schädlich with his number VoS 1201. The seedlings soon flowered and, although they looked rather like *G. marsoneri megatae*, the green flowers reminded me of *G. mihanovichii*. I felt it was a new taxon that deserved a name.



In the latest issue of *Schütziana* it has been named as *G. arzbergeri* after the Paraguayan cactophile Alexander Arzberger. I offered many seedlings for sale so perhaps you have one!

G.C.

# NEWS AND EVENTS

## Cactus at the Castle 2023

Saturday 16th - Sunday 17th September  
11.00am–5.00pm



Lullingstone Castle  
Eynsford, Kent  
DA4 OJA

The largest Cactus Mart in the south-east  
with over 20 leading nurseries.  
The Mesemb Study Group Show  
The Mammillaria Society Open Show  
Talks and Plant Sales  
Guided tours of the World Garden with Tom  
Hart Dyke

Adults £12.50 Under 16s FREE  
Cactus & Succulent Review Readers £6  
Mammillaria Society Members £6 (Sunday only)  
Mesemb Study Group Members £6 (Saturday only)  
BCSS Members £10

Refreshments available

[Website](#)

## North West Cactus Mart

Saturday 20th May 2023

Parish Hall, St. Thomas More Church,  
Mainway, Alkington, Middleton,  
Manchester M24 1PP

10.15 – 14.00

Contact email: peter@bint.myzen.co.uk

## BCSS Showing & Judging Weekend

19 & 20th August 2023

Presentations by experts  
Fun interactive sessions  
Improve your showing and judging skills  
Take a test and qualify as a judge (optional!)  
Plant sales  
Plenty of time for meeting friends  
Full weekend or day delegate rates

Hilton Hotel (Next to the M1),  
Leicester

Bookings: Bill Darbon:  
[william.darbon77@btinternet.com](mailto:william.darbon77@btinternet.com)

## The 14th Spalding Cactus Mart

Saturday 22nd April 2022

10.00am–3.00pm



Holbeach Community Centre,  
Fishpond Lane,  
Holbeach, Lincs P12 7DE

14+ nurseries and growers in attendance

Ample free parking  
Free admission to the Mart  
Refreshments available all day

For further details please see the  
BCSS Spalding Branch website:  
[www.spalding.bcss.org.uk](http://www.spalding.bcss.org.uk)



# A BCSS Day at Wisley

13th May 2022

at the new Hilltop Centre, RHS Wisley Garden

Doors open at 10.00am

Displays, Plant Sales, Lectures.

Open to the public.

No additional charge, just garden admission.

Everyone enjoys a day out at the splendid garden that is Wisley. It will look wonderful in May and you can visit the remarkable new Hilltop Centre (pictured below) and enjoy cactus and succulent displays, talks and sales.

BCSS members can get a discount on entrance to Wisley on the day (present your membership card) and there is no further admission charge to the event.

Last year's event to celebrate Gordon Rowley (pictured below) was a great success with large numbers of visitors.



Picture provided by the RHS

## The Cactus Explorers Club 16th Meeting in 2023

August 4–6th 2023

The Leicester Hilton Hotel  
(next to M1 junction 21)



A weekend of good company with about 15 talks including overseas speakers. A good place to meet old friends and make new ones in a relaxed environment.

The talks are designed to give a more in-depth view of particular cacti or specific places. The informal atmosphere encourages discussion and there is ample opportunity to meet the speakers.

The price for the weekend is **£240** which includes two nights in en-suite hotel-quality single rooms, all meals, refreshments, and use of the large meeting room.

There will be sales of plants, literature and seeds, free for vendors.

Everyone is welcome and there are places available so please [email](#) me and I will send you an invitation.

*Graham Charles*

## BCSS Oxford Show & Haworthia Show

Saturday 1st July 2023

Old Mill Hall, School Lane,  
Grove, Wantage OX12 7LB



SHOW OPEN 10.00am – 3.30pm  
FREE ENTRY

Details/schedule from [Bill Darbon](#)

## Tephrocactus Study Group Meeting Sunday 21st May 2023

Coddington Village Hall, near Newark,  
Nottinghamshire NG24 2PN

*Everyone Welcome*

**11am start**

FREE admission and refreshments

Plants for sale

### Speakers

Norbert Sarnes: Chilean *Maihueniopsis*

Paul Hoxey: *Cumulopuntia sphaerica* group

John Betteley: Alan Hill Memorial Collection

Contact: John Betteley by [email](#)



## RHS Harlow Carr Autumn Cactus and Succulent Show

**Saturday 23rd September 2023**



RHS Garden Harlow Carr, Crag Lane,  
Harrogate, North Yorkshire, HG3 1QB

11.00 – 16.00 (gardens open 9.30 – 18.00)

FREE admission for BCSS Members!

For more information, to volunteer or to  
request a schedule when it becomes  
available, email the [Secretary](#).

## Cactus and Succulent Day 2023 with the Exeter Branch

**29th July 2023**

Exeter Branch are returning to the beautiful  
botanical gardens at Bicton for a third year  
(East Budleigh, Devon, EX9 7BJ) with a day  
of short talks, plant displays and plants for  
sale from a variety of local sellers  
starting at 10:00am.

Contact: [Eleanor Hurlock](#)

Normal garden entry fees apply and  
can be found on Bicton's website at  
[www.bictongardens.co.uk](http://www.bictongardens.co.uk)

## North East Cactus Mart

**This Event Cancelled**

**Saturday 29th July 2023**

Trinity Church Hall, Church Street,  
Rothwell, Leeds LS26 0QL

The second event at the new large venue  
Refreshments will be available.

Conveniently located near where the  
M1 and M62 cross.

More details from Peter Smith

[smipt6@aol.com](mailto:smipt6@aol.com)

## South West Succulent Plant Spring Fair

**Saturday 1st April 2023**

Portishead Youth Club,  
Harbour Road, Portishead BS20 7DD

9.30 – 13.30

Plant-care workshops

Plants for sale

Specialist pots and compost available

## The BCSS AGM

**29th April 2023**

Leicester East Forest Parish Hall,  
Kings Drive, Leicester Forest East, LE3 3JE

FREE entry

11.00 – 16.30

Plant Sales

**Talk 1.** Stonecrops: A Survey of the  
Crassulaceae, Dr Colin Walker

**Talk 2.** Caribbean Cacti Paul Hoxey

## Chelmsford Cactus Mart

**Saturday 22nd April 2023**

10.00 – 16.00

Rawreth New Village Hall, Church Street,  
Rawreth, Near Wickford, Essex, SS11 8SH

15 tables of sales plants from  
experienced local growers.

Admission: £3

Le Couleurs Cactus Club présente la 14<sup>ème</sup> édition de

# Couleurs Cactus

Le salon des cactus et plantes succulentes

9h - 18h



Plus d'infos : [www.couleurs-cactus.fr](http://www.couleurs-cactus.fr)

Vente - Expo - Conférences  
**27 - 28 mai 2023**  
Égliseneuve près Billom  
ENTRÉE GRATUITE



Hillebrandia par Hélène Sediri

Astrophytum myrtilloides par Brandon Blachère

Lobivia chimboraria par Michel Bassot

Le Cactus Francophone

Égliseneuve près Billom



[www.cactuspro.com](http://www.cactuspro.com)



Imprimé par nos soins. Ne pas jeter sur la voie publique





**8-9-10 sept. 2023**



**corsendonk-duinse polders  
blankenberge-belgium**

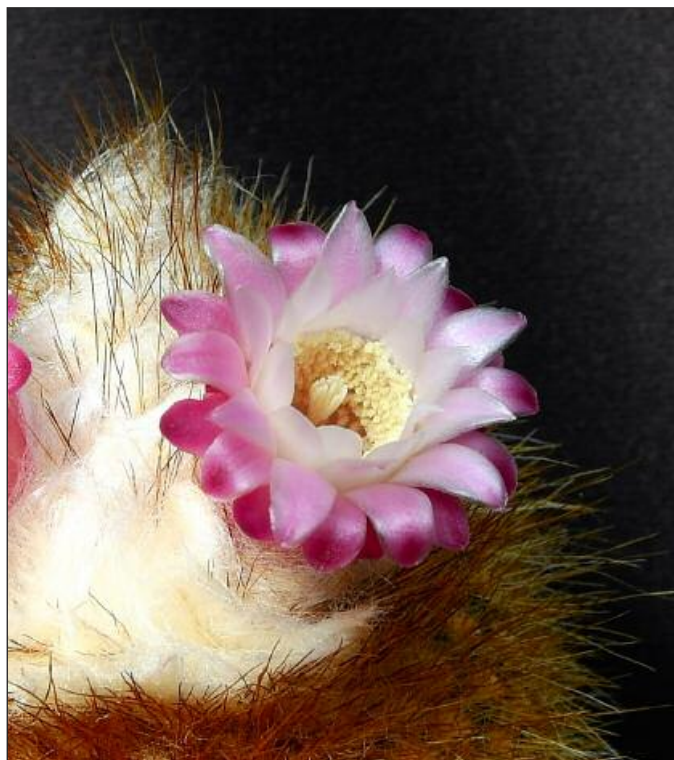


**info:  
[www.elkcactus.eu](http://www.elkcactus.eu)**

# IN THE GLASSHOUSE

Kamiel Neirinck, famous for his love of Brazilian cacti, tells us about flowering his *Micranthocereus albicephalus*, a rare event in European glasshouses.

Photographs: K. Neirinck except where shown.



**Figure 1.** A flower of *Micranthocereus albicephalus*.

*Austrocephalocereus albicephalus* Buining & Brederoo, *Kakt. and. Sukk.* **24**(4): 73–75 (1973).

*Micranthocereus albicephalus* (Buining & Brederoo) Ritter, *Kakteen in Südamerika* 1: 108 (1979).

## Synonyms

*Coleocephalocereus albicephalus* (Buining & Brederoo) Brandt 1981

*Micranthocereus aureispinus* Ritter 1979

*Micranthocereus monteazulensis* Ritter 1979

## Description

Columnar body, sprouting at the base, stems up to 2.5m high and 9cm thick. White woolly lateral cephalium, up to 9cm wide, with bristles up to 5cm long in the apex. Very densely spined, golden yellow to orange-brown colour, up to 15mm long. Nocturnal



**Figure 2.** *Micranthocereus albicephalus* in bud.





**Figure 3.** Flowers of *Micranthocereus albicephalus*.

flowers, up to 50mm long and 40mm wide. Red to brownish fruits. Seeds ovoid, dull black colour.

**Distribution**

Brazil, in northern Minas Gerais and southern Bahia, between Mato Verde and Jacaraci, on mountain slopes above 800m between rocks and in quartz sand; together with *Arrojadoa*, *Leocereus*, *Melocactus*, *Mirabella*, *Pilosocereus*, *Rhipsalis*, among others. Field numbers: HU348, Br86 and Br420.

**Culture**

Easily raised from seed. Do not overwinter below 10°C. Water generously in summer. Grow in a mineral-rich, well-drained substrate.

**Remarks**

My *Micranthocereus albicephalus* shown in the accompanying photographs flowered for the first time this year (2022). Already in spring, it was clear that the plant was developing a cephalium. At the end of July, one flower was produced. This is a grafted cultivated plant at least 20 years old. It is said to be exceptional for it to flower in Europe.

*Austrocephalocereus* is a subgenus of *Micranthocereus* with *Austrocephalocereus purpureus* and *A. albicephalus* as the sole representatives. *Austrocephalocereus dybowskii* was the only species assigned to the genus



**Figure 4.** *Micranthocereus albicephalus* GC1020.06 in habitat north of Licinio de Almeida, Brazil. Photograph: Graham Charles.

*Espostopsis*. In the 1980s, Werner Uebelmann imported top cuttings of this golden yellow cereus.

**Literature**

Braun, P. (1982). *Austrocephalocereus albicephalus* Buining et Brederoo - ein Schmuckstück der brasilianischen Kakteenflora. *Kakteen/Sukkulenten* 17(3): 45–50.

Braun, P. (1988). On the taxonomy of Brazilian Cereeae (Cactaceae). *Bradleya* 6: 75–99.

Braun, P. & Esteves Pereira, E. (1990). *Siccobaccatus* Braun et Esteves - Een nieuw cactusgeslacht uit Brazilië. *Succulenta* 69(I): 1–8

Braun, P. & Esteves Pereira, E. (1991). *Micranthocereus* Backeberg subgenus *Austrocephalocereus* (Backeberg) Braun et Esteves, Een nieuw ondergeslacht (Cactaceae) uit Brazilië, *Succulenta* 70(3): 62–67.

Heimen, G. (1977): *Austrocephalocereus albicephalus* Buining et Brederoo. *Kakt. and. Sukk.* 28(10): 225.

Taylor, N.P. & Zappi, D.C. (1989). An alternative view of generic delimitation and relationships in tribe Cereeae (Cactaceae). *Bradleya* 7: 13–40.

# ON-LINE JOURNALS

On-line Journals for you to download free

## Sansevieria Online



The online journal for the growing number of enthusiasts for this genus. A small group of *Sansevieria* enthusiasts publish the first *Sansevieria* online journal in German. They welcome contributions on systematics, morphology, physiology, evolution etc.

Issue 10(2) includes: Editorial; *Sansevieria mikephillipsii*, a new species from an old cultivar; The fruits of *Sansevieria* - an update; From historical redescrptions; Zimbabwe in Southern Africa and some *Sansevieria*; Some observations on *Sansevieria* in Zimbabwe; *Sansevieria* - Portraits.

Download the PDF from [www.sansevieria-online.de](http://www.sansevieria-online.de) where you can also find a special issue containing field number lists and the index to the journal.

## Schütziana

The latest issue of Schütziana, the specialist on-line journal for *Gymnocalycium* enthusiasts, 13(3) was published in December 2022 and features:

Schädlich, Volker: An Unexpected Discovery from Departamento Presidente Hayes in Paraguay – *Gymnocalycium arzbergeri* Schädlich spec. nov.

Papsch, Wolfgang: Remarks on the Type Localities of *Gymnocalycium glaucum* and *G. schmidianum*.

The text of this valuable publication is available in English, German, Russian and Japanese. You can download free all the issues from: [www.schuetziana.org](http://www.schuetziana.org)



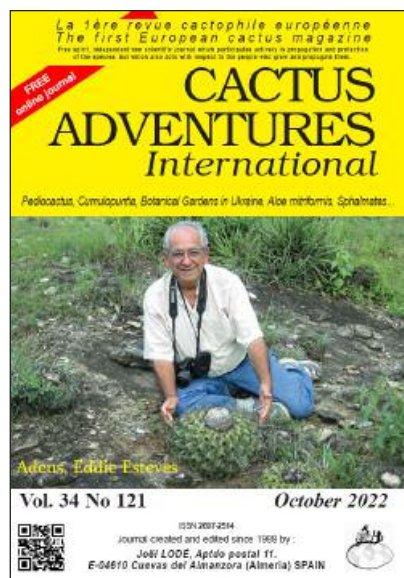
## Cactus Adventures International

Joel Lodé told us last year that his long-running journal would no longer be published in printed form. It is good to see the third on-line edition has appeared.

Vol.34 (121) contents: Comb. Nov. in Cactaceae; Comb. Nov. in Asparagaceae; Situation of Botanical Gardens in Ukraine; In praise of Ugliness; *Aloe mitriformis* Miller and its relatives; *Cumulopuntia sphaerica*; New Comb in Cactaceae; Damn Sphalmates; Le Specie Succulente del Genere *Polycarpaea* nelle isole Canarie; Eddie Esteves Pereira; A New Australian Adventure.

You can a free download at

[http://cactus-aventures.com/pageweb\\_ENG.html](http://cactus-aventures.com/pageweb_ENG.html)



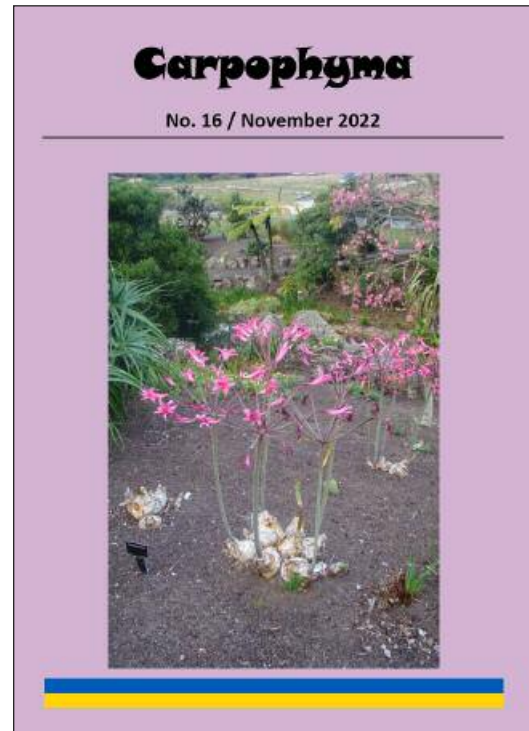


## Carpophyma

More new on-line publications have appeared this year. It is the brainchild of Eduart Zimer and contains a fascinating mix of subjects including cacti and succulent plants.

### Contents of No. 16

1. Eduart Zimer - Jacindamania, the Rise of Socialism in New Zealand (Part 3)
2. Eduart Zimer - Read My Lips: Without You!
3. Thoughts from the Past (Archives New Zealand) - Part 3
4. Timeless Music with Aldous Harding
5. Eduart Zimer - *Bowiea volubilis* Harv. ex Hook.f.
6. Elton Roberts - Mealybugs
7. Timeless Music with Elliott Murphy
8. Dag Panco & Valentin Posea - About the unexplainable dynamic of some cacti
9. Eduart Zimer - *Brunsvigia josephinae* (Redouté) Ker Gawl.
10. Eduart Zimer - From Long Bay to Devonport: 23 kilometres of coastal happiness



## Cactus & Succulent Review

The *Cactus & Succulent Review* is a high quality quarterly magazine featuring non-technical articles on all aspects of cacti and succulents.

**Issue 36**, published March 2023, features 58 pages of: Book reviews: The Genus *Aeonium*; 100 GM *Haworthia* hybrids; A Spendour of Succulents and Cacti; The genius of Georg Ehret; When is a flower not a flower?; *Quiabentia*; A quick look at seeds; *Stapelia hirsuta*; Red-flowered *Gymnocalycium*s; *Pachypodium namaquanum*; Gethyllis and their cultivation; Superlatives are compulsory today; The taxonomy of the Crassulaceae; The Desert Botanical Garden in Phoenix, Arizona; The Tatacoa Desert

You can subscribe to the mailing list to be notified by email when each issue is ready to download. Subscription is free. Further details and back issues are available to download from the website:

<https://www.cactusandsucculentreview.org.uk/>  
or email:

[contact@cactusandsucculentreview.org.uk](mailto:contact@cactusandsucculentreview.org.uk)



# THE LOVE OF BOOKS

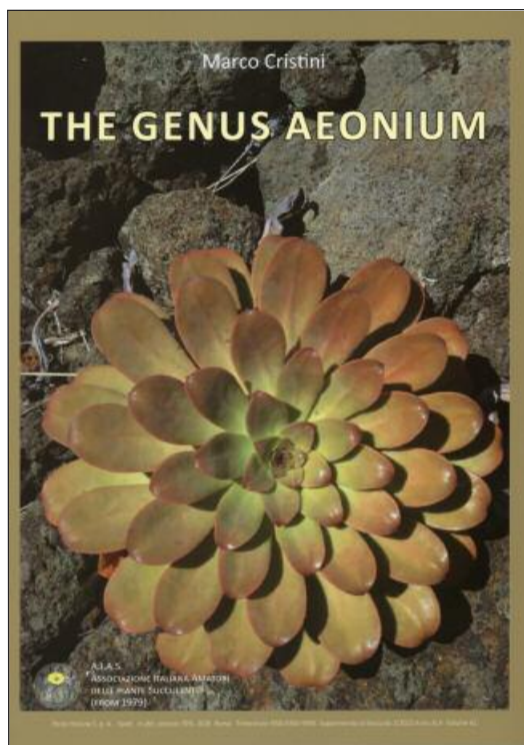
Here you will find information about new publications together with some that were published years ago and remain a valuable source of information.

## The genus Aeonium

Marco Cristini

## 100 cactus Argentinos

Roberto Kiesling & Pablo Demaio



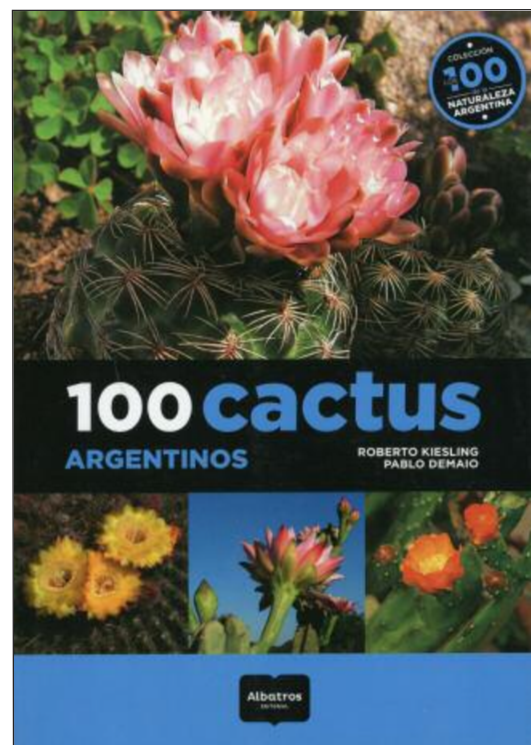
Here is a comprehensive account of this popular genus in habitat. The accepted taxa are organised by where they are found in nature rather than a taxonomic arrangement. 34 species and 9 subspecies are recognised, each being presented in detail with synonyms, etymology, description, flowering, distribution, natural hybrids, cultivation, notes and bibliography. All are illustrated with high-quality photographs, mainly taken in habitat.

Published by the Italian Succulent Society, AIAS. Softback, colour self cover, 225 pages 240 x 170mm with 268 colour pictures, 23 maps and figures, 3 tables. English language (Italian edition has also been published).

This is a good book, highly recommended!

Available from AIAS website for 50€ including postage and packing outside Italy:

[www.aias.info/the-genus-aeonium](http://www.aias.info/the-genus-aeonium)



Published in 2018, this well-illustrated book was written by two leading Argentinian cactus specialists to present the remarkable diversity of cacti in their country. With more than 250 species, second only to Mexico, Argentina is one of the world's paradises for cactus lovers.

For this book, which serves as an up-to-date guide for enthusiasts, the authors have chosen 100 species representative of the extraordinary diversity of the cacti, including all the country's environments and covering their field identification, abundance, biological importance, conservation and traditional uses.

Softback, colour self cover, 160 pages 240 x 170mm with 258 colour pictures. Spanish language. Many unusual plants are shown in flower.

Available from [Keith's Plant Books](http://www.keithsplantbooks.com) shipped from the UK: £20 + p.& p.

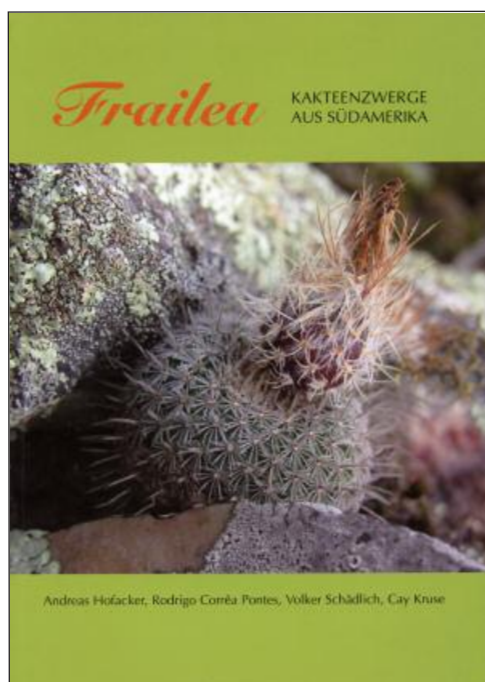


## Frailea

Dwarf Cacti from South America

Andreas Hofacker, Rodrigo Corrêa

Pontes, Volker Schädlich & Cay Kruse



The latest title in the impressive series of books published by the DKG and only available to buy if you are a member.

This is a welcome addition to the literature, following in the footsteps of the *Kaktusy Special* on the subject published in 2004 with either Czech or German text.

Fraileas are rarely seen in British collections but they are much more popular on the continent. This book illustrates that there is more diversity in the genus than you might have thought so hopefully it will make the plants more popular. You certainly don't need much space to house a good collection!

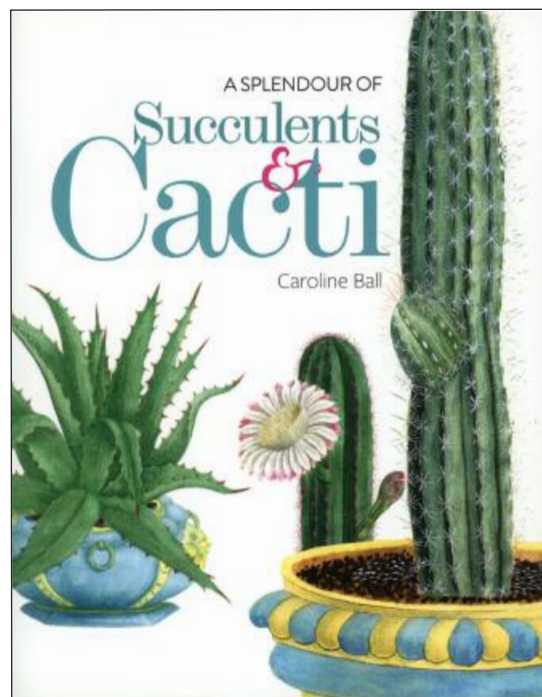
32 species are recognised including some recently described ones that you may not have seen before. As with other titles in this series, the quality of the production and the pictures is very good. Pictures include habitat localities and plants in cultivation.

Softback, colour self cover, 144 pages 170 x 240mm 165 colour pictures. German text. DKG members can buy the book for 17€ including postage outside Germany:

<https://www.dkg.eu/sonderpublikationen>

## A Splendour of Succulents & Cacti

Caroline Ball



This is an unusual book which is designed to appeal to those fascinated by succulents from a botanical standpoint as well as those with an interest in botanical art. The Bodleian has two copies of Weinmann's amazing book the *Phytanthoza Iconographia* published from 1737. It contained 1025 folio plates (325 x 210mm) depicting over 3,500 plants including many succulents, all reproduced in this book.

There are many interesting facts relating to the plants in the illustrations and the book is an easy and entertaining read. The text is written for those with an interest in succulents but not familiar with them. There is a chapter on where to see them in cultivation which feels somewhat out of place in this volume.

When I received this book, I was surprised by its small format. I feel the splendour of Weinmann's folio succulents is diminished by reproducing them so small (page size 150 x 190mm) even though the reproduction is high quality.

The book is available from the [Bodleian Library Bookshop](#). Price £16.99.

See **Cactus Explorer** 21 for more about Weinmann's amazing book the *Phytanthoza Iconographia*.

## SUCCULENTS ON A PLATE

Graham Charles looks back at a landmark book about cacti, the last volume of which was published 100 years ago. The first comprehensive account of the Cactaceae in English was written by Dr. Nathaniel Lord Britton and Dr. Joseph Nelson Rose, published by the Carnegie Institution of Washington and illustrated with colour chromolithographs by Mary Eaton.



Mary Emily Eaton (1873-1961) was an outstanding botanical illustrator and was the principal artist employed to illustrate Britton and Rose's *The Cactaceae* (1919-1923).

Born on 27 November 1873 in Coleford, Gloucestershire, England, she received formal training in art at the Taunton School of Art in Somerset, and also studied art at the Royal College of Art in South Kensington, and at Chelsea Polytechnic.

Miss Eaton was employed for a period as a painter for Worcester porcelain. In 1909, she went to Jamaica for two years, then to New York where she remained as an artist for the The New York Botanical Garden until January 1932 before returning to England.

At The New York Botanical Garden she was the principal illustrator for the Garden's illustrated journal *Addisonia* and she did the

vast majority of paintings and line drawings used to illustrate Britton and Rose's *The Cactaceae*.

Her artwork is now in the permanent collections of the National Geographic Society, The New York Botanical Garden, and the Smithsonian Institution (including most of the originals of Britton & Rose's *The Cactaceae*).

Mary Eaton died in Cossington, Somerset, England on 4 August 1961.

The colour illustrations in *The Cactaceae* are chromolithographs, the lithography done by A. Hoen & Co of Baltimore.

The first edition of *The Cactaceae* was published in 4 volumes from 1919 to 1923. It contained 107 colour plates and remains scarce today. The book was reprinted with corrections and a smaller page size by Scott E. Haselton of the Abbey San Encino Press, Los Angeles in 1937 with black and white versions of the colour plates. There is also an edition of 500 copies from the same time with pages the same size as the first edition. Most copies have just black and white plates but some copies contain a few of the original colour plates left over from the first edition production.

The final edition, a reproduction of the 1937 version was published by Dover in 1963 with black and white plates, the four volumes bound in two. This edition is inexpensive to buy second hand.

You can download the first edition as PDFs from: [Au Cactus Francophone](#)  
GC



BRITTON AND ROSE, VOL. II

PLATE XXV



M. E. Eaton del.

1. Flowering branches of *Rathbunia alamosensis*.
  2. Flowering branches of *Rathbunia alamosensis*.
  3. Top of flowering branch of *Borzicactus acanthurus*.
  4. Top of stem of *Arrojadoa rhodantha*.
- (All natural size.)

# PARODIA FRAILEOIDES – A NEW OCCULT SPECIES FROM SOUTHERN BOLIVIA.

Martin Lowry<sup>1,3</sup> & John L. Arnold<sup>2</sup>

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3. IOS Executive board member.

Photographs: Martin Lowry except where shown.

## Dedication

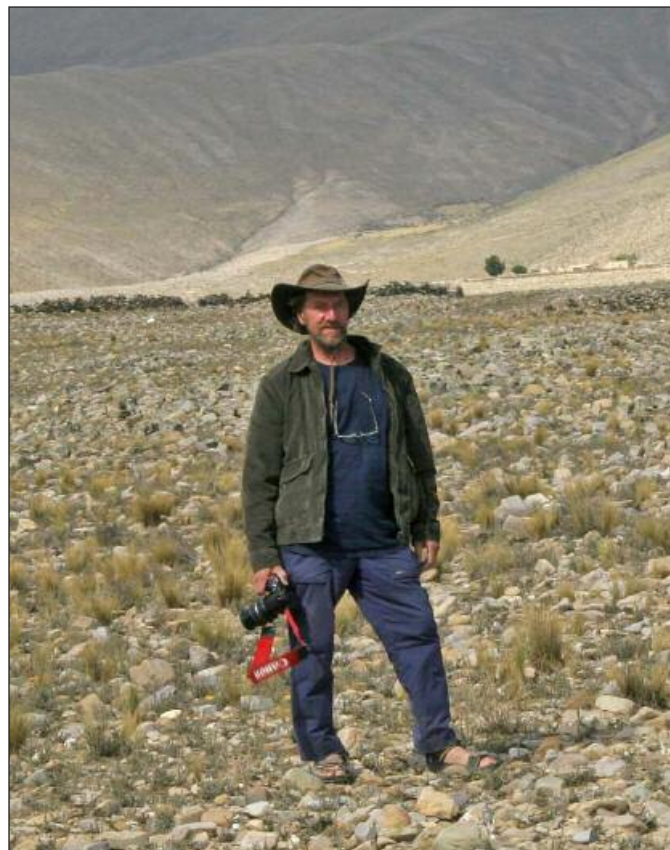
We dedicate this description to the memory of our dear friend Chris Pugh (Figure 1) who sadly passed away in November 2022 and was with us at the time of the discovery of this new species.

## Abstract

A new miniature geophytic *Parodia* from southern Bolivia is described. The species grows on almost barren high altitude plains in very stony ground. It appears to be a member of the *P. subterranea* group of species yet is much smaller, has shorter, finer spination and yellow-orange flowers. It has been found in only one small area of ~100m<sup>2</sup> and hence we consider its conservation status as critically endangered.

## Introduction

*Parodia*, although now much enlarged, has traditionally been conceived as a genus of small, mostly globular, hooked-spined, cacti from Argentina and Bolivia. During his travels throughout South America Friedrich Ritter discovered and subsequently described 43 new species of the genus, 29 of them between 1962 and 1964 (the remaining 14 were published in his magnum opus *Kakteen in Südamerika* in 1980). Among these was the horticulturally important species *P. subterranea* (Figs. 2 & 3), the first of a small group of geophytic species, which he discovered in the mountains around Salitre, Chuquisaca in 1958. This species has a large distribution centred around Culpina where it is a commonly seen and variable plant. In all its locations, however, it grows amongst



**Figure 1.** Chris Pugh near the type locality on the day we found the new *Parodia*.

Photograph: Graham Charles.

stones of shattered sandstone overlying vertical strata and rarely exceeds 8–10cm in height. It is prized in collections for its dark blue-green body with strongly hooked, black central spines and bright red flowers (although there are also yellow-flowered populations [Figs. 11 & 12]).

Five years later, whilst travelling in the remote north-western parts of Department Tarija, Ritter discovered another small geophytic *Parodia*. He eventually described this species in 1980 giving it the name *Parodia occulta* (Figs. 4 & 5) commenting that he had found it at only one location. Living up to its epithet it took many years for other travellers to Bolivia to rediscover the plant. The first author finally saw the species in habitat for the first time in 2018. It grows in very similar





**Figure 2.** *Parodia subterranea* LM0620.04 above Camargo.



**Figure 3.** *Parodia subterranea* LM0070.01 Mal Paso near Culpina, only a short distance (<5km) from the type locality of *P. laevis*.



**Figure 4.** *Parodia occulta* MU 548.1 Cana Cruz. Photograph: Andrzej Mushka



**Figure 5.** *Parodia occulta* FR1152. Abb 571 from Ritter's *Kakteen in Südamerika* 2.



**Figure 6.** *Parodia slabana* MU 048.2 Cieneguillas. Photograph: Andrzej Mushka



**Figure 7.** *Parodia slabana* LM0547.03 Obispo del Carmen.



**Figure 8.** *Parodia fraileoides* JLA0637.08 at the type locality. Photograph: John Arnold.



**Figure 9.** *Parodia fraileoides* LM0542.08.



conditions to *P. subterranea* but is considerably smaller, 2–6cm diameter, and in the dry season, not rising above the sandstone pebbles amongst which it grows. The ribs are more tuberculate than those of *P. subterranea* and it has finer, white rather than black central spines.

In the past 30 years there has been much confusion over the application of the name, particularly since a photograph of plants from near Culpina was published by Ken Preston-Mafham in his book *Cacti and Succulents in Habitat* in 1994 and labelled as *P. occulta*. Ken was travelling with Eddie Aguillar who was the source of the identification. The first author has visited the location illustrated on page 59 of Ken's book many times and was only able to find small plants of *P. subterranea*. Admittedly the plants from here do look a little different having much shorter spines than the plants on the surrounding hills and at the type locality near Salitre (see p 61 of Ken's book). The plant from Ken's location was published as *P. ladae* in 2000 by Halda & Horáček. Walter Rausch also collected a *Parodia* near here, calling it *P. subterranea* var. *occulta*, and giving it his

number WR634. Seedlings subsequently distributed under this number but labelled *P. ladae* (Fig 16) bear no resemblance to *P. occulta* and appear, as noted above, to be closer to *P. subterranea*.

The most recently discovered member of this group is *P. slabana* (Figs. 6 & 7) described in 2000 by Halda & Horáček. It also comes from north-western Department Tarija in a valley a little to the west of *P. occulta* but at a similar altitude. Again, the plant grows in shattered sandstone pebbles with little other vegetation and is very difficult to see unless in flower. In size it is intermediate between *P. subterranea* and *P. occulta* and has dark central spines. The most remarkable characteristic of this species is its large pale pink, even white, flowers which become darker on the second day of opening (Fig. 7).

In this article we describe a fourth member of this group. Whilst travelling in southern Bolivia in 2006 with our friends Graham Charles and Chris Pugh and accompanied by Moises Mendoza of the Noel Kempff Mercado Natural History Museum in Santa Cruz we stopped soon after crossing the Serrania de



**Figure 10.** The type location of *Parodia fraileoides*.

Photograph: Graham Charles





**Figure 11.** *Parodia subterranea* 'flaviflora' LM0562.09 South of Chinimaya.



**Figure 12.** *Parodia subterranea* 'flaviflora' LM0562.09.



**Figures 13.** Seeds of *Parodia fraileoides* LM 542.08 on a 1mm grid.



**Figures 14.** *Parodia fraileoides* LM 542.08 in bud.

Sama to view some plants of *Oreocereus trollii*. Wandering a little way off to an almost barren area (Fig. 10) the second author soon called us over to help identify what he had found. There, growing with its top level with the sandstone pebbles, was a tiny *Parodia* (Fig. 8). It was bluish-green, no more than 3cm in diameter, had tuberculate ribs and short pale spines. After several tens of minutes scouring the area we found perhaps 20 plants ranging in size from 1–3cm. At the time we thought perhaps we had rediscovered the long sought for *P. occulta*.

The first author subsequently visited the location on three more occasions. In 2009, with John Carr, the plants were extremely dehydrated and difficult to find. Better conditions prevailed in 2012 and, with Mats Winberg, more plants were found. Some of which were in bud at the time we visited (Fig. 14). Mats commented that the plants looked “like little Fraileas” thus appropriately coining a descriptive epithet for this diminutive plant.

On a further visit with Mats in 2018 specimens were collected for preparation of type material.

*Parodia fraileoides* M. Lowry & J.L. Arnold **sp. nov.** differs from *P. occulta* Ritter by its smaller size, straight (not hooked) central spines and small yellow-orange (not red) flowers.

**Type:** BOLIVIA. Dept. Tarija, Prov Mendez, 3360m, 19 November 2018, M. Lowry & M. Winberg s.n. (Holotype: USZ).

**Etymology:** The epithet alludes to the small size and appearance of the species, *i.e.* looking like a *Frailea*.

**Description:** *Roots:* fibrous. *Body:* solitary, appanate to spherical, 1–2cm tall x 2–3cm diameter, geophytic. *Epidermis:* glaucous. *Ribs:* 18–22, raised into tubercles 4.5–5.2mm diameter. *Areoles:* about 1.2mm diameter. *Radial spines:* 18–22, <1mm diameter, 1.5–2.5(3.0)mm long, white with a dark tip. *Central spines:* 2–4, similar to the radials in size. *Flowers:* arising apically from buds with dense brown hair (Figure 14), yellow-orange, 1.5–2cm





**Figure 15.** *Parodia fraileoides* LM0542.08 after 14 years in cultivation and still in a 7cm diameter pot.

diameter. *Outer tepals*: orange with red tips, bearing tiny scales with several short hairs. *Filaments and style*: translucent white. *Pollen*: yellow. *Stigma*: yellow with 8 lobes. *Fruit*: a thin walled capsule 5–6mm diameter deeply sunken in the apex. *Seeds*: helmet-shaped, shiny, dark brown/black, 1.1 x 0.8 x 0.7mm (Fig. 13).

### Conservation status

Although the species grows on an arid plain with few anthropogenic threats, excepting perhaps goat herding, it is currently known only from the type locality. With an area well less than 1km<sup>2</sup> and probably less than 1000 individuals we assess its IUCN status as Critically Endangered (CR: fulfilling criteria B1 & B2ac). For this reason we have refrained from revealing the exact location details.

As mentioned in the diagnosis the new species is perhaps closest to *P. occulta* Ritter primarily due to its small size and habitat preference. It is, however, easily distinguished by its straight central spines and flower colour. It is probably the smallest of all the *Parodias*.

In cultivation it grows well from seed (available from Succseed) reaching maturity within a few years and subsequently requires no special treatment. It will rarely require more than a 9cm diameter pot and can remain there for many years. The spines remain



**Figure 16.** *Parodia* WR634.

brown suggesting the white colour seen in habitat is due to bleaching. Unlike plants in habitat it will elongate in culture eventually reaching 7–8cm tall and produce copious white apical wool (Fig. 15). It flowers freely throughout the summer and, like all members of this group, the flowers produce a distinctly clinical aroma much like *TCP*.

Deciding to publish the description of this plant has been quite a difficult decision. On the one hand keeping quiet and doing nothing would likely protect it from unscrupulous poaching, as happened with *Yavia cryptocarpa*, however we recognise that it is impossible to apply legal protection to an undescribed taxon. Hopefully, those explorers who do find this amazing little plant will take away only photos and memories.

### Acknowledgements

The authors would like to thank †Andrzej Mushka and Graham Charles for the use of their pictures.

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# LOOKING FOR CRASSULACEAE ON MADEIRA

Marco Cristini has become well-known as an expert on Crassulaceae. Here, he tells us about his exploration of Madeira. Photographs by Marco Cristini

## Introduction

Madeira is an island situated in the Atlantic Ocean, 520km west of Morocco (Figure 1). Geographically, it belongs to Africa, but it was settled by the Portuguese in the fifteenth century and has been part of Portugal since then. Together with the Azores, the Canary islands and Cape Verde, Madeira forms the so-called Macaronesia, a bioregion rich in plant endemisms, many of which are relics of the flora that covered most of Northern Africa before the expansion of the Sahara desert and the disappearance of the laurisilva (laurel forest) from the shores of the Mediterranean. Madeira means “wood” in Portuguese, since the island was entirely covered by a subtropical rainforest when the first settlers arrived. In following decades, they set fire to many areas to clear the land for farming, but the northern slopes managed to escape the worst of the deforestation

process and are now a UNESCO World Heritage Site.

I visited Madeira for ten days in August 2022 to look for the endemic *Crassulaceae* species. The island is well connected to the main European airports, but is considerably less touristic than Tenerife or Gran Canaria, enabling visitors to catch a glimpse of a genuine Macaronesian environment. In the following pages, I will offer a brief overview of the most botanically interesting places I visited, with a few remarks on the plants I observed.

## The Funchal area

Several *Crassulaceae* species grow near Funchal, the main city of the island, from which one can easily reach the other towns by either bus or car, therefore I decided to stay in Funchal and start exploring Madeira from its surroundings. On the first day, I took the cable

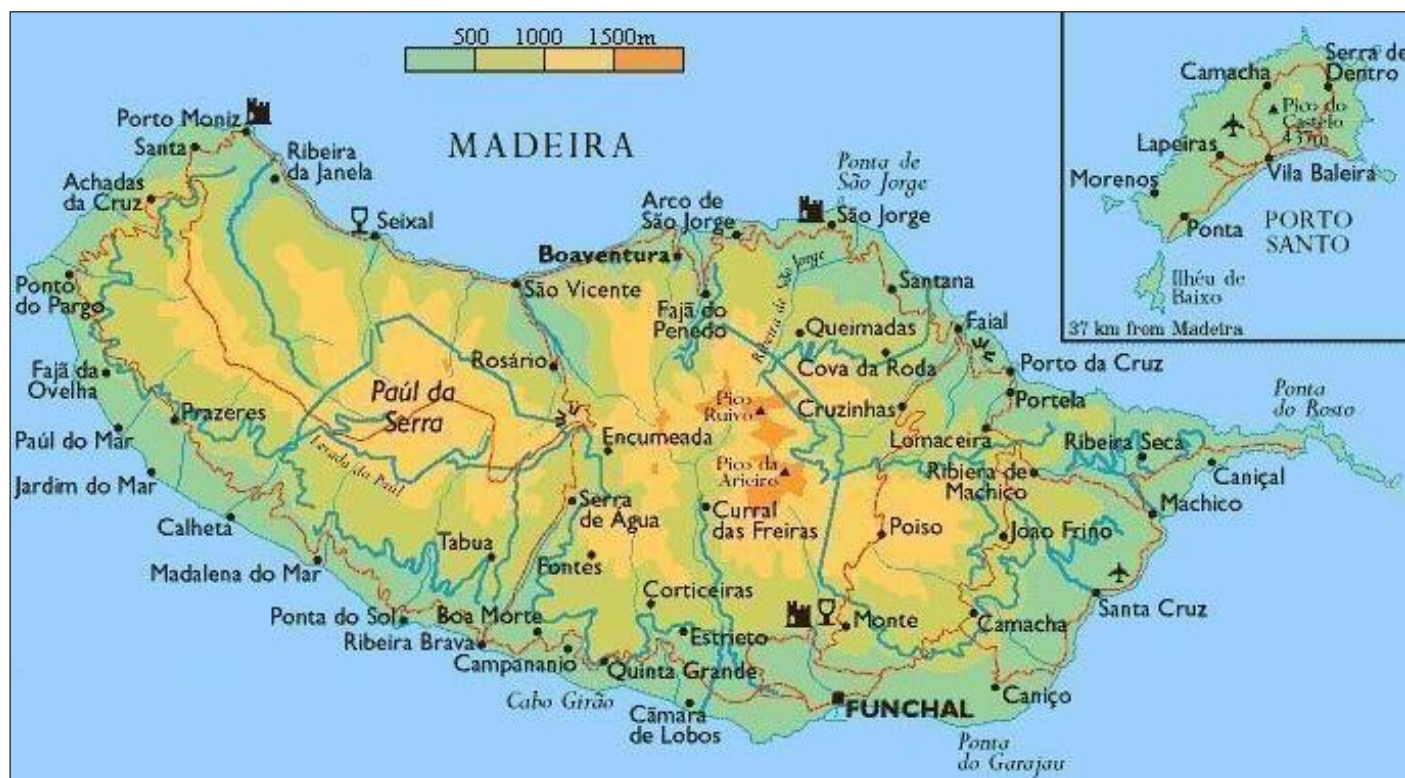


Figure 1. Map of Madeira (source: [www.madeira-reisetipps.com](http://www.madeira-reisetipps.com)).





Figure 2. The church of Nossa Senhora do Monte, north of Funchal.

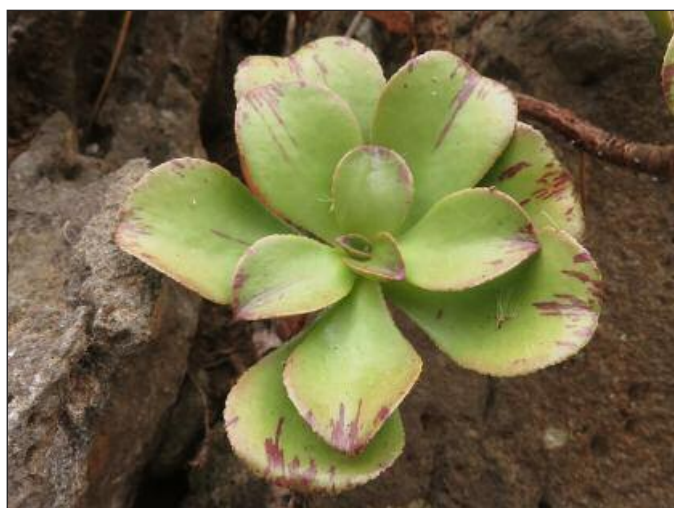


Figure 3 & 4. *Aeonium glutinosum* growing near Monte.



Figure 5. The stem of *Aeonium glutinosum* is quite sticky.



Figure 6. Flowers of *Aeonium glutinosum* on the upper levada of Ribeira do Curral das Freiras.





**Figure 7.** An almost stemless *Aeonium glutinosum* near Moledos.

railway to Monte, a village located north of Funchal (at an altitude of 550m) which is famous for the church of Nossa Senhora do Monte, where Charles I of Austria (1887–1922), the last Austro-Hungarian Emperor, is buried (Figure 2). Monte is the starting point of several paths crossing the surrounding mountains. I suggest to avoid that leading northwards to the chapel of Nossa Senhora da Paz, since it is uphill and remarkably free of *Crassulaceae* species apart from the omnipresent dry inflorescences of *Umbilicus rupestris*, which I observed throughout the island. According to Short (1994), both *Umbilicus rupestris* and *U. horizontalis* grow on the island, but the latter has been recorded infrequently and I suspect that some specimens of *U. rupestris* with flowers looking more horizontal than usual have been mistaken for *U. horizontalis*. Be that as it may, all inflorescences were spent at the time of my visit and I was unable to verify the presence of two different *Umbilicus* species on the island, although the dry specimens I saw looked quite similar to *U. rupestris*.

The path leading southwards from Monte to the Botanical Garden of Funchal is by far more rich in succulents. The first species that is likely to be spotted is *Aeonium glutinosum*, which is very common on Madeira (Figures 3&4). It is a shrub usually up to 60cm tall (but I saw specimens taller than 1m in shaded locations). Stems are ascending or decumbent, 7–20mm in diameter, sticky and therefore often covered with dust and debris, making them



**Figure 8.** A bushy *Aeonium glutinosum* on the old coastal road west of São Vicente.



**Figure 9.** *Aeonium glandulosum* near Monte.

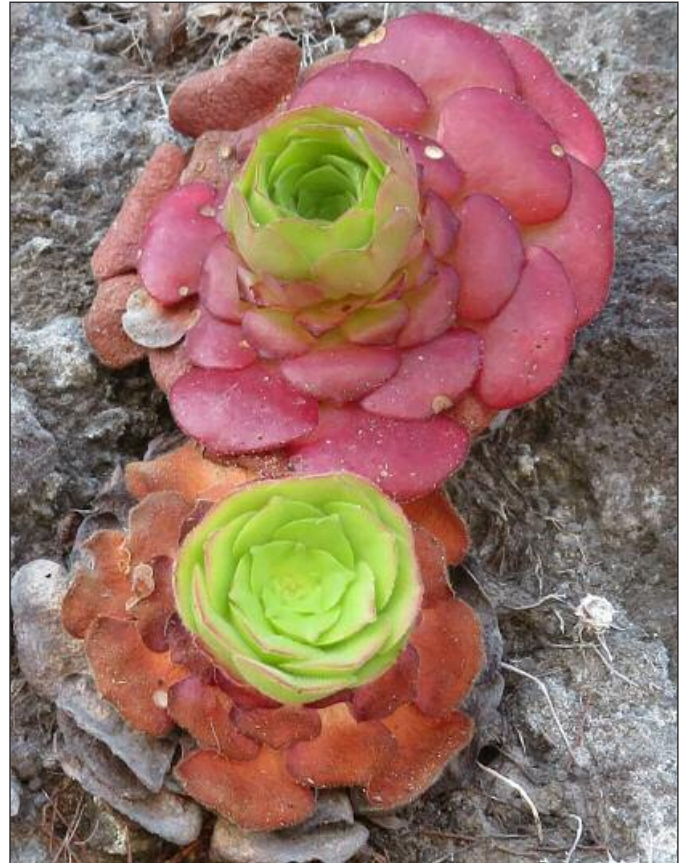
appear dark or even black (Figure 5). Rosettes are 12–22cm in diameter, with pale green to deep green leaves, 7–12cm long, 3–5.5cm broad, 2–4.5mm thick, obovate-spatulate, slightly wavy, acute on the apex, glabrous, sticky (especially in the first stages of growth), with darker stripes along the central axis and near the apex. Inflorescences are 15–60cm tall, with a sticky stem. Flowers have 8–11 yellow petals, with reddish veins on the lower surface. In mid-August, most inflorescences were spent, but I was able to see a few flowers still open (Figure 6).

*A. glutinosum* can take on different shapes: plants growing on cliffs are often almost stemless (Figure 7), whereas in flat locations the succulent may look similar to a small *A. arboreum* (Figure 8). This plant was once used by Madeiran fishermen to reinforce and waterproof fishing nets, which were rubbed with





**Figure 10.** A flat *Aeonium glandulosum* on the old coastal road west of São Vicente.



**Figure 11.** Two cup-shaped *Aeonium glandulosum* on the old coastal road west of São Vicente.



**Figure 12.** *Sedum fusiforme* on Pico do Rancho.

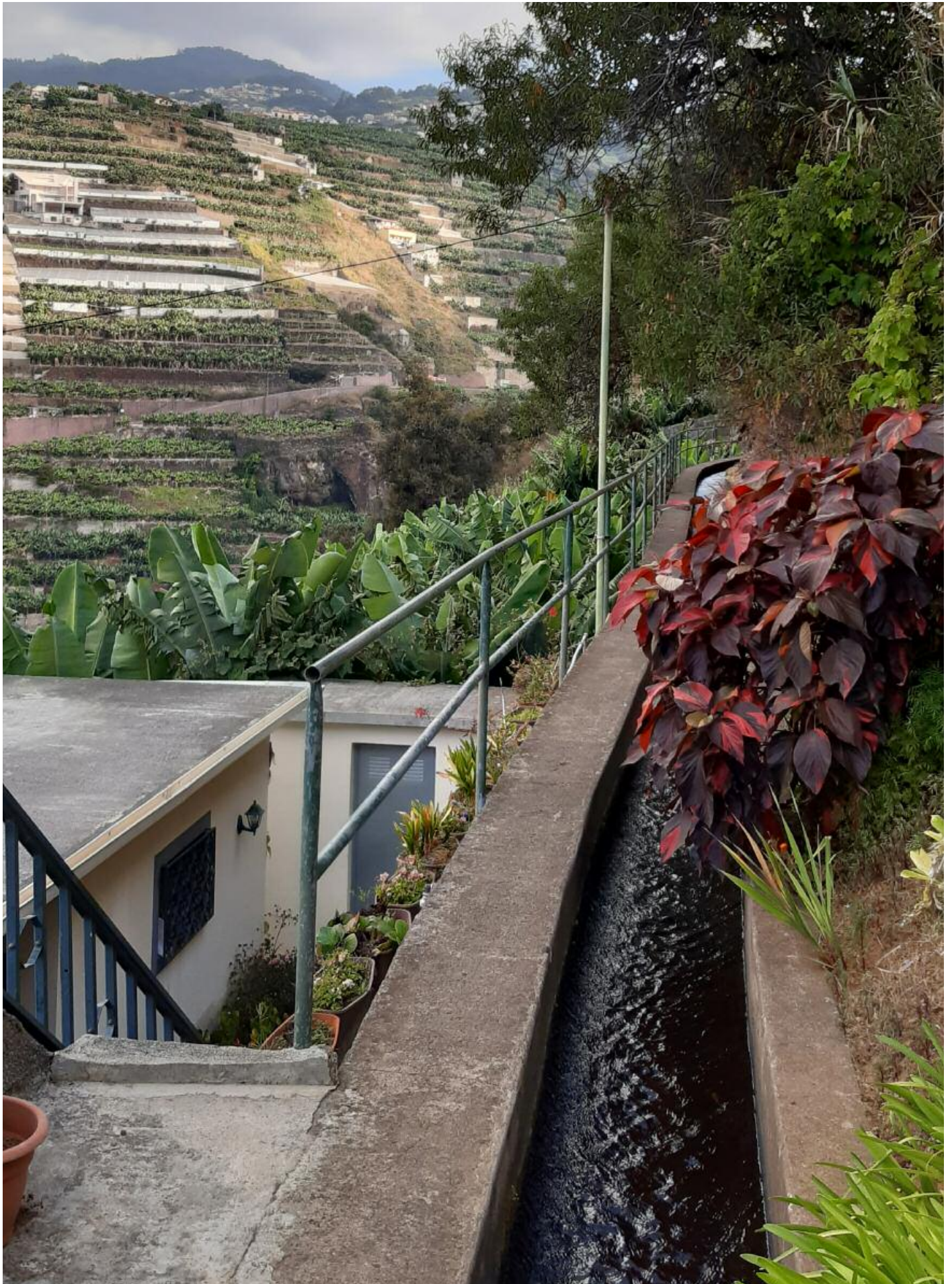


**Figure 13.** Flowers of *Sedum fusiforme* on Pico do Rancho.

fragments of the stem until they became dark and perfectly smooth, almost as if they had been covered with a layer of wax (Lowe 1868). A similar practice was also widespread on Lanzarote with *A. balsamiferum* and in Portugal with *A. arboreum* (Bolle 1892).

Climbing down towards Funchal, I saw several spent inflorescences of *Aichryson* and a small plant of *Aichryson divaricatum*, which is however more widespread in the upper laurisilva. Small specimens of *Aichryson villosum* were present as well. At an altitude of around 350m, I spotted the second endemic *Aeonium* of Madeira, namely *A. glandulosum* (Figure 9), which is said to grow mainly on cliffs along the northern coast, but I observed plenty of specimens in southern Madeira (one even near Ponta do Garajau, in the southernmost part of the island), in shady and sheltered places, where it is often only exposed to direct sunlight for a few hours a day. Unlike *A. glutinosum*, *A. glandulosum* is mostly a single plant, only occasionally with a few stolons. Stems are inconspicuous and very short, bearing rosettes





**Figure 14.** The lower *levada* in the Nuns' Valley.





**Figure 15.** *Sedum fusiforme* on the lower levada in the Nuns' Valley.

12–45cm in diameter, often cup-shaped. Leaves are light green when young, purple-red when more mature and exposed to the sun, 6–20cm long, 3–8cm wide, 3–5mm thick, imbricate, obovate or oblanceolate, finely pubescent, mucronate, with acute apex and margins adorned with cilia and small glands (hence the name), with a discernible smell of balsam. According to Praeger (1932), *A. glandulosum* grows in

summer, when the rosette becomes cup-shaped, while in winter it is flatter, unlike the Canary Island species, which mostly grow in winter, but I observed both cup-shaped and flat specimens in August 2022 (Figures 10 & 11). Inflorescences are 6–30cm tall and flowers have on average 8–13 yellow petals. The anthesis usually takes place between April and July. I was unable to spot an open flower and didn't see many recent inflorescences, thereby confirming what was already noted by Arnold (2005) and Schulz (2007), namely that there are massive flowerings in some years, whereas only a few specimens produce inflorescences in others.

Another good place to observe Madeiran succulents is the path between Cabo Girão and Pico do Rancho. Cabo Girão is a high cliff overlooking the ocean, on whose summit there is a *miradouro* (observation point) with a stunning view of the southern coast of Madeira. It can easily be reached by bus, and then it is possible to walk (downhill) to Funchal. The path crosses a mountain called Pico do Rancho, where I saw the rare *Sedum fusiforme*, a small



**Figure 16.** Ponta de São Lourenço.





**Figure 17.** *Sedum nudum* growing at Machico.

succulent up to 15–20cm tall, with several tortuous branches bearing alternate, sessile, elliptic to oblong, subterete leaves, 5–10mm long, which are often crowded at the stem tips (Figure 12). Leaves are usually glaucous and show a brownish red central stripe if exposed to the sun. Inflorescences are quite short (4–8cm) and with a few flowers bearing acuminate, yellow petals, 7–9mm long, sometimes mottled or spotted with red on the inside. I was fortunate enough to spot several inflorescences still in bloom (Figure 13). *S. fusiforme* grows on rocks and stone walls along the path and also on the cliffs overlooking the sea, which are its main habitat. On Pico do Facho, I also spotted the omnipresent *Aeonium glutinosum*, as well as a few small and reddish specimens of *Aeonium glandulosum*. When I reached the shore, 500m east of Camara de Lobos, I noted that *A. glutinosum* grows at an altitude of less than 10m, on some rocks in front of the sea, in a place which is possibly reached by some spray of sea water during storms.

A must-see for every tourist visiting Funchal are the so-called *levadas*, aqueducts bring-



**Figure 18.** Flowers of *Sedum nudum* at Machico.



**Figure 19.** *Aichryson villosum* near Santo António da Serra.



**Figure 20.** *Aeonium x meyerheimii* near Machico.

ing water from the mountains to the coast that have been carved into cliffs and rock faces. They are made up by the duct itself, which is mostly open, and a narrow footpath between the duct and the precipice, which is usually





**Figure 21.** São Vicente seen from the old coastal road.

(but not always!) provided with a handrail (Figure 14). On the eastern slope of the so-called Nuns' Valley (valley of Ribeira do Curral das Freiras in Portuguese), located between Camara de Lobos and Funchal, there are two *levadas* crossing a *Crassulaceae*-rich area. The lower *levada* is the most difficult of the two, and definitely not recommended for those suffering from vertigo, but you can find nice specimens of *Aeonium glandulosum* and plenty of *Sedum fusiforme* along it, at an altitude of around 200m (Figure 15), as well as *Aeonium glutinosum*, *Aichryson villosum* and the omnipresent *Umbilicus rupestris*. The upper *levada*, which can be reached from the neighbourhood of Santa Quitéria, is easier in the first part and allows you to observe *Aeonium glandulosum*, *A. glutinosum*, *Aichryson villosum* and possibly *A. divaricatum* as well (I spotted several glabrous, dry inflorescences that might well belong to this species). However, the *levada* becomes much trickier 2km north of Santa Quitéria, where I had to turn back, since it was interrupted by several waterfalls, which made the narrow footpath slippery, and was partially

obstructed by ferns and other plants.

Less interesting is the Levada dos Tornos, leading from Caniço to Curral dos Romeiros, along which I only observed *Aichryson divaricatum* and *Umbilicus rupestris*. Curral dos Romeiros is the starting point of another *levada*, namely Levada do Bom Sucesso, which is richer in succulents, since I found *Aeonium glandulosum* (only at an altitude of around 600m), *A. glutinosum*, *Aichryson villosum* and *Umbilicus rupestris*. However, the *levada* becomes increasingly tricky while leading northwards and must be abandoned at the end, since it disappears into a gallery. I suggest to turn back as soon as the first waterfalls cross the *levada*.

### Eastern Madeira

One of the most popular excursions on Madeira is the path crossing Ponta de São Lourenço, a narrow peninsula at the eastern tip of the island with impressive views of the ocean (Figure 16). I went there mainly because *Sedum nudum* had been spotted between Caniçal and Ponta de São Lourenço (Lowe





**Figure 22.** *Sedum brissemoretii* along the coastal road east of São Vicente.

1868; Stephenson 1998b), but I was unable to find any specimen apart from a single tuft growing right behind a small restaurant named Casa do Sardinha. I do not know for certain if *S. nudum* was brought there on purpose, but I suspect it, since nearby rocks and cliffs were entirely devoid of any *Crassulaceae* species. I only spotted a few, tiny and much stressed specimens of *A. glutinosum* near the narrowest point of the peninsula, on a south-facing slope. I walked on the coastal road until Caniçal and then along the path leading from this town to Pico do Facho, but was again unable to spot *Sedum nudum*, although 't Hart (1998) found it on this mountain. I only observed *Aeonium glutinosum* there.

After a few days, I returned to the eastern part of Madeira and decided to explore the area around Machico. This time, I had more luck. Just outside the town, I found plenty of *Sedum nudum* on a path named Caminho das Voltinhas, at an altitude of less than 50m, on rocks facing north-east. It is a nice, small and bushy succulent, with tortuous, brittle, much-branched stems up to 5–10cm tall (Figure 17).



**Figure 23.** A flower of *Sedum brissemoretii* east of São Vicente.



**Figure 24.** *Aeonium glandulosum* growing on rock cliffs over the old coastal road west of São Vicente.



**Figure 25.** *Sedum farinosum* near Pico do Jorge.

Leaves are linear to oblong, rounded, terete, green, often tinged with red, 3–6mm long. Inflorescences bear few tiny, 5-merous, yellow





**Figure 26.** *Aichryson divaricatum* near Boca das Torrinhas.

flowers, and were in full bloom during my visit (Figure 18). Together with *Sedum nudum*, I spotted several plants of *Aeonium glandulosum*, *A. glutinosum* and *Umbilicus rupestris*. Then, I again found *S. nudum* at an altitude of around 200m. As far as aichrysons are concerned, I only spotted *A. villosum* in a very shady and damp place near Santo António da Serra (at around 250m; Figure 19). The path between Machico and Santo António da Serra is botanically rewarding but tiring, since it is uphill and initially crosses a sunny slope with little shade or fresh air. The Levada do Caniçal, north of Machico, is easier and boasts the same species of the other path with the exception of *Sedum nudum*. Here, I also spotted a cross between *A. glandulosum* and *A. glutinosum*, namely *A. xmeyerheimii* (Figure 20). Its rosette is clearly intermediate between those of its parents.

### Northern Madeira

Turning now to northern Madeira, the village of São Vicente offers a good opportunity to spot several species of *Crassulaceae*. The cliffs on the coast, right behind the houses located in



**Figure 27.** A flower of *Sedum farinosum* near Boca da Encumeada.

front of the ocean (Figure 21), are covered with *Sedum brissemoretii*, a small succulent which is quite similar to *Sedum nudum*, but grows in entirely different habitats. In fact, *S. brissemoretii* can usually be found in full shade, whereas *S. nudum* prefers sunny places. Moreover, the latter is often tinged with red and has club-shaped leaves that are upturned at the ends. On the other hand, *S. brissemoretii* is almost never bronzed and its leaves show no tendency to turn up at the ends (Figure 22). Flowers differ as well, since they are tiny and with narrow petals in *S. nudum* (see Figure 18), much bigger and with wider, paler petals in *S. brissemoretii* (Stephenson 1998b; see Figure 23). *Sedum brissemoretii* is listed as vulnerable in the IUCN Red List, with allegedly 250–1000 mature individuals, but I observed hundreds of plants on the cliffs immediately behind São Vicente. The plant has been spotted on the northern coast of Madeira near Seixal and Porto Moniz as well (Hamet 1925; Stephenson 1998b; Capelo 2004), not to mention the populations seen around Calheta, Paul do Mar and Santana ('t Hart 1999; Brand 2016), therefore I believe that by far more than 1000 mature specimens survive in the wild. As stated by the Red List page on this succulent (Carvalho 2011), an updating of its status is needed.

Taking good pictures of *Sedum brissemoretii* in São Vicente can be difficult without an excellent telephoto lens. Fortunately, it grows abundantly along the coastal road east of the village, both on the rocks on which a chaplet has been built and on the cliffs next to the road





**Figure 28.** *Sedum farinosum* near Boca das Torrinhhas.

itself. However, the best place to see the *Crasulaceae* growing in this area is undoubtedly the old coastal road west of the village, which was abandoned after the construction of a new road with many galleries. The old road can easily be reached from São Vicente and the cliffs over it are covered with well-grown specimens of *Aeonium glandulosum* (Figures 24 & 33). I only spotted a few plants of *Sedum brissemoretii* here, together with *A. glutinosum* and several spent inflorescences of an aichryson species, possibly *A. villosum*. The first part of the old road is quite safe, although littered with fallen rocks and branches. However, it becomes more tricky after briefly rejoining the new road and is interrupted by a waterfall shortly afterwards. Going on should be possible, but I contented myself with the plants I had already seen and turned back, since the road surface was becoming too slippery.

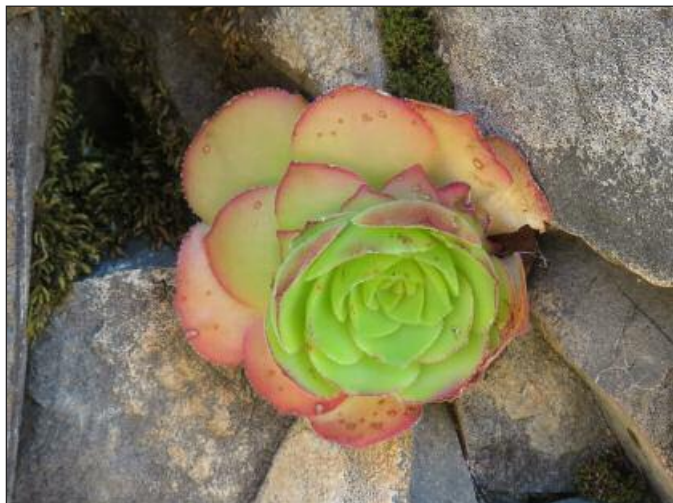
If the northern coast of Madeira is the habi-



**Figure 29.** *Aichryson villosum* near Boca das Torrinhhas.

tat of *Sedum brissemoretii*, the central part of the island hosts another endemic stonecrop, namely *Sedum farinosum* (Figure 25). This species has often been reported from the western slopes of Pico Ruivo (1862), but I found plenty east of it. Instead of taking the tradi-





**Figure 30.** *Aeonium* aff. *glandulosum* near Casado, at an altitude of around 1700m.



**Figure 32.** *Sedum nudum* growing at Moledos, in southwestern Madeira.

tional tour of the central mountains of Madeira (hence arriving at an altitude of 1600m by car and then proceeding on foot towards the top of the mountain), I climbed from Faja dos Cardos and reached Boca das Torrinhãs after a couple of hours. Around 1300m, I found plenty of *Aichryson divaricatum*, a nice bushy succulent up to 50–60cm tall, with glabrous, rhomboid-orbicular, obtuse, pea-green leaves and 6- or 7-merous yellow flowers (Figure 26). Several specimens were in full bloom and they were much bigger than those I observed in other parts of the islands.

Shortly afterwards, I found the first colonies of *Sedum farinosum*, an attractive, mat-forming succulent with stems 4–8cm tall. Its most remarkable feature are the highly pruinose, ovoid to oblong, obtuse, semiterete, 3–6mm long, whitish leaves. Flowers are 5-merous and



**Figure 31.** A few reddish *Aeonium glutinosum* growing at Moledos.

white. Most of the inflorescences I saw were already spent, but I was able to spot a few flowers that were still open (Figure 27). *S. farinosum* is generally considered as rare (Jardim & Francisco 2000; Stephenson 2020), but I found plenty of it from Boca das Torrinhãs (1300m) to Boca da Encumeada (1100m), happily growing not only on rocks and cliffs (Figure 28), but even on the path itself. I imagine that the plant is equally widespread on the mountains south and north of the path (as indicated by Capelo 2004), therefore it seems to be pretty common in the mountainous, central part of Madeira. I also spotted several nice specimens of *Aichryson villosum* between Boca das Torrinhãs and Pico do Jorge (Figure 29). This succulent is usually smaller than *A. divaricatum*, being 3–15cm tall, and densely pubescent (hence the name: *villosus* means “hairy” in Latin). Its leaves are 10–30mm long, 8–25mm wide (but much smaller, immature specimens can often be found), rhomboid-spathulate and obtuse; flowers are 6- to 9-merous and yellow. I was unable to see an open flower in August 2022.

Near Casado, at an altitude of around 1700m, I saw a puzzling aeonium growing on a stone wall (Figure 30). At first sight, it looked like a small *A. glandulosum*, but its leaves were less pubescent and much stiffer. It might well be a cross between *A. glandulosum* and *A. glutinosum* (i.e. *A. ×meyerheimii*). Still, its leaves were not sticky and the specimen of *A. ×meyerheimii* I observed on the Levada do Caniçal looked quite different. Possibly, it is a local, high-altitude form of *A. glandulosum*.



### Western Madeira

The only trip I made to western Madeira was to Arco da Calheta, in the hope of finding the extremely rare *Aichryson dumosum*, which reportedly grows in a single locality at around 300–400m. Although I think I managed to find the locality mentioned by Lowe (1868) and inspected “heaps or beds of bare loose rocky fragments” and stone walls (where the succulent is said to grow) for the best part of one day, I was unable to find it. While there, I took several pictures of an area covered with basaltic rocks with the telephoto lens of my camera and I possibly spotted a few dry, aichryson-like inflorescences upon re-examining the images, but this might well be wishful thinking... However, my trip was not entirely fruitless, since I saw several nice specimens of *Aeonium glutinosum* with reddish leaves (Figure 31) and a healthy population of *Sedum nudum*, growing at an altitude of around 300m (Figure 32).

As far as *Aichryson dumosum* is concerned, it should be a biennial plant with 20cm long stems, sometimes bushy in the upper quarter. Stephenson (1998a) reports that “in the wild only the top quarter or so of the plant is seen as the rest is hiding in a rock crack. Leaves are much longer and proportionately narrower in comparison to either of the two other endemic aichryson [...]. The whole plant is finely pubescent and terminates in simple, open inflorescences of 5-10-partite golden yellow flowers”. The succulent lives in an area of only 100 square metres and is considered as critically endangered. The good news is that it was seemingly spotted in July 2021, according to the iNaturalist website (<https://www.inaturalist.org/observations/86050474>), therefore it should still be present in the wild.

### Conclusion

Madeira hosts a rich succulent flora and most *Crassulaceae* species are easy to find, provided that one knows where to look for them. A good map is essential, but a valid alternative can be the Kompass app, which I found useful in countless occasions, since it not only shows you the same map whose unfolding can be hazardous when you are precariously bal-



**Figure 33.** *Aeonium glandulosum* on the old coastal road west of São Vicente, Madeira.

anced on a windy *levada*, but also your position and direction. As I already mentioned, Madeira is by far less touristic than the Canary Islands, a circumstance that has its obvious advantages, but also a few drawbacks, most notably the fact that paths are often not well-marked and sometimes disappear without any apparent reason before reaching their destination. Moreover, tracks are less in number than on the Canaries, therefore trekkers are often forced to walk on roads and pay close attention to cars, which can go remarkably fast even on minor streets. Finally, my 1:50,000 Kompass map proved to be quite obsolete on more than one occasion, since I found recent paths that were not recorded and several ones that had been engulfed by vegetation or were nowhere to be found, not to mention tracks that had become veritable roads in the meantime. In short, an updated map of the island (possibly 1:25,000; those issued by the Portuguese army are of little use as they do not indicate paths) and better marks on the tracks would be highly desirable.

This said, a trip to Madeira is undoubtedly rewarding for all people interested in succu-



lent plants. The endemic flora of the “island of wood”, its stunning landscapes, intriguing architecture and rich history will provide visitors with plenty of fond memories, enabling them to catch a glimpse of how Macaronesia looked like before the arrival of the first European settlers.

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### Appendix 1

#### Selected locations of *Crassulaceae* species growing on Madeira

In the following appendices, I indicate the position of most *Crassulaceae* species I observed on Madeira. Of course, I make no claim to completeness; these data refer exclusively to the parts of the island which I visited in 2022.

#### Funchal area

Cabo Girão – Pico do Rancho: *Aeonium glandulosum*, *A. glutinosum*, *Sedum fusiforme*.



Ribeira do Curral das Freiras: *Aeonium glandulosum*, *A. glutinosum*, *Aichryson villosum*, *Sedum fusiforme*, *Umbilicus rupestris*.

Funchal (Monte – Lomo do Monte): *Aeonium glandulosum*, *A. glutinosum*, *Aichryson divaricatum*, *A. villosum*, *Umbilicus rupestris*.

Levada dos Tornos: *Aichryson divaricatum*, *Umbilicus rupestris*.

Levada do Bom Sucesso: *Aeonium glandulosum* (abundant around 600 m), *A. glutinosum*, *Aichryson villosum*, *Umbilicus rupestris*.

Ponta do Garajau: *Aeonium glandulosum* (few plants near Estrada do Cristo Rei), *Aeonium glutinosum*.

### Eastern Madeira

Machico: *Aeonium glandulosum*, *A. glutinosum*, *A. ×meyerheimii* (Levada do Caniçal), *Aichryson villosum* (only at Santo António da Serra, around 250 m), *Sedum nudum*, *Umbilicus rupestris*.

Ponta de São Lourenço: *Aeonium glutinosum* (few small plants), *Sedum nudum* (only behind Casa do Sardinha).

### Central and Northern Madeira

Faja dos Cardos – Encumeada: *Aichryson divaricatum*, *Aichryson villosum*, *Sedum farinosum*, *Umbilicus rupestris*.

Serra de Agua: *Aeonium glandulosum*, *A. glutinosum* (both growing on rocks and stone walls along the roads ER 104 and ER 228).

São Vicente: *Aeonium glandulosum*, *A. glutinosum*, *Sedum brissemoretii*, *Aichryson sp.* (only dry inflorescences in August 2022).

### Western Madeira

Arco da Calheta (Moledos): *Aeonium glandulosum* (only a single plant), *A. glutinosum*, *Sedum nudum*, *Umbilicus rupestris*.

## Appendix 2

### *Crassulaceae* species growing on Madeira

*Aeonium glandulosum*: Pico do Rancho, Ribeira do Curral das Freiras, Funchal (Monte – Lomo do Monte), Levada do Bom Sucesso (abundant around 600m), Ponta do Garajau (few plants near Estrada do Cristo Rei), Machico, Serra de Agua, São Vicente, Arco da Calheta (Moledos).

*Aeonium glutinosum*: Cabo Girão, Pico do Rancho, Ribeira do Curral das Freiras, Funchal (Monte – Lomo do Monte), Levada do Bom Sucesso, Ponta do Garajau, Machico, Ponta de São Lourenço (few and small plants), Serra de Agua, São Vicente, Arco da Calheta (Moledos).

*Aichryson divaricatum*: Funchal (Monte – Lomo do Monte), Levada dos Tornos, between Boca das Torrinhãs and Boca da Encumeada.

*Aichryson villosum*: Ribeira do Curral das Freiras, Funchal (Monte – Lomo do Monte), Levada do Bom Sucesso, Santo António da Serra (around 250m), between Boca das Torrinhãs and Pico do Jorge.

*Sedum brissemoretii*: São Vicente.

*Sedum farinosum*: between Boca das Torrinhãs and Boca da Encumeada.

*Sedum fusiforme*: Pico do Rancho, Ribeira do Curral das Freiras.

*Sedum nudum*: Machico, Ponta de São Lourenço (only behind Casa do Sardinha), Arco da Calheta (Moledos).

*Umbilicus rupestris*: Ribeira do Curral das Freiras, Funchal (Monte – Lomo do Monte), Levada dos Tornos, Levada do Bom Sucesso, Machico, Faja dos Cardos, Arco da Calheta (Moledos).

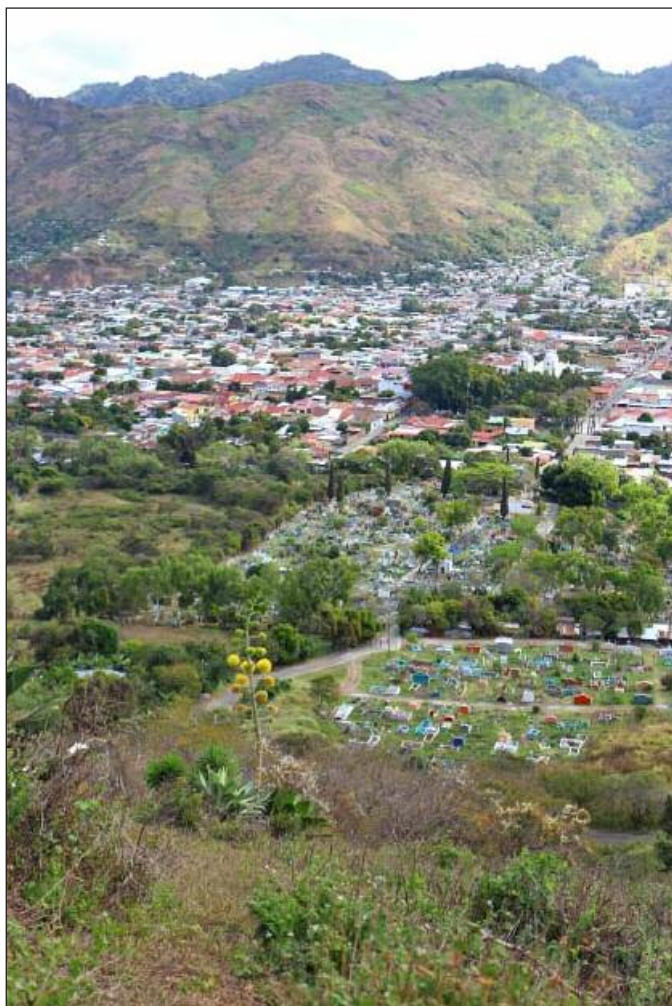


# NICARAGUAN FIELD NOTES 2022

## PEÑA DE LA CRUZ, JINOTEGA

Leland Smith tells us about a day out looking at plants in Nicaragua.

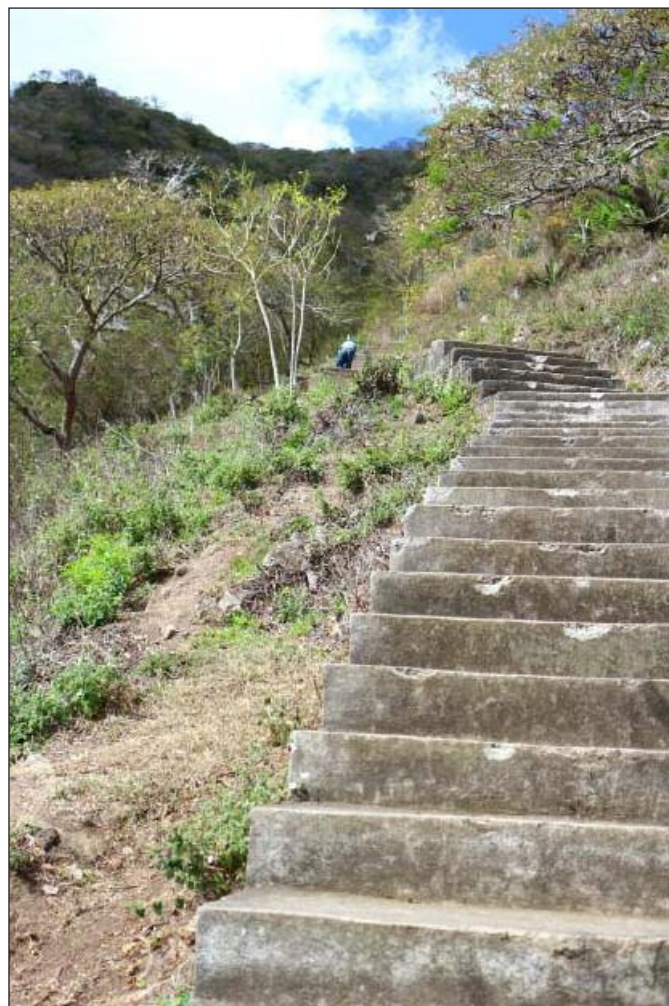
Photographs by the author



**Figure 1.** City of Jinotega, Nicaragua.

Peña de la Cruz, Rock of the Cross, is a prominent local landmark west of the City of Jinotega (Figure 1). It is the site of an annual religious pilgrimage and a year-round hiking area. It is a short but steep hike beginning at the town cemetery at 1100m elevation and ending at about 1300m. The authorities have kindly constructed approximately 800 concrete steps and a viewing platform at the top (Figure 2).

The lower level is drier with *Agave seemanniana*, Bromeliads, and *Furcraea cabuya*



**Figure 2.** The concrete steps leading to the viewing platform at the top.

being plants of interest (Figures 3 & 4). One of the agaves had a significantly different look to it and I hope to be able to follow its growth and see it in flower, fruit, seed, etc.

About half way up there is a transition to a lush ecosystem. Along the way I encountered some small specimens of *Epiphyllum* which are probably *E. costaricense* (Figure 5) which is hard to distinguish from *E. thomasianum* without seeing mature plants. Also in this area, was *Anthurium beltianum*, a Nicaraguan endemic (Figure 6) that was new





**Figure 3.** *Agave seemanniana*, Bromeliads, and *Furcraea cabuya* in the drier lower level.



**Figure 4.** *Agave seemanniana*.



**Figure 5.** *Epiphyllum costaricense*.



**Figure 6.** *Anthurium beltianum*, a Nicaraguan endemic

to me. Incidentally, the nickname for Jinotega is “City of Mists” for the frequent fog. These mists probably help some species to grow in partial sun on the hillside where they would be in shade elsewhere.

Further up were a few patches of *Selenicereus/Weberocereus glaber*, one plant having a flower bud (Figure 7) and hidden in the shelter of a rock was a healthy growth of *Rhipsalis baccifera* (Figure 8). In wetter locations I would expect the *Rhipsalis* to be freely hanging from tree branches, possibly in partial sun. Near the summit, *Deamia/Selenicereus testudo* was clinging on rocks (Figure 9).

The next hill to the west had a good stand of agaves in flower (Figure 10). I took this photo as representative of this section of Tropical Pre-Montane Forest which is an intermediate zone, wetter than Tropical Dry Forest but drier than Tropical Cloud Forest. In the rainy season



**Figure 7.** Flower bud of *Selenicereus/Weberocereus glaber*.





**Figure 8.** *Rhipsalis baccifera* hidden in the shelter of a rock.

it will have more greenery.

Overall, it was a productive outing. On a previous hike in the rainy season I did not see most of the cacti and succulents because of the cover of annual growth. I hope to get back soon with a better lens and binoculars to study “the orchid wall” and further investigate the native *Echeveria* species.



**Figure 9.** *Deamia/Selenicereus testudo* clinging on rocks.



**Figure 10.** The next hill to the west had a good stand of agaves in flower.



# CACTI AND YUCCAS OF THE MOJAVE RIVER WATERSHED, INCLUDING CIMA DOME

Root Gorelick presents a well-illustrated account with thoughtful observations of what he saw. An easily-accessed part of the world for us to enjoy.

Photographs by the author.

From 1994–2005, I lived in southern New Mexico and southern Arizona, which are in the northern parts of the Chihuahuan and Sonoran Deserts, respectively. But I never spent time in the Mojave Desert, other than brief stops between Phoenix and Los Angeles at Joshua Tree National Park and even briefer stops along Arizona Highway 93 between Phoenix and Las Vegas, actually, between Wickenburg and Hoover Dam. So, in February 2020, I endeavoured to see what I was missing in the Mojave Desert of California.

The Mojave is often characterized as the desert with Joshua trees, *Yucca brevifolia*, which means all the way from Interstate 5 in Gorman, California in the west to where the Santa Maria River crosses Arizona Highway 93 in the east. My synopsis here will not be comprehensive. I will show only a dozen species of cacti and three species of *Yucca*. I will not discuss parts of the Mojave Desert in states other than California, such as southern Nevada, northwestern Arizona, and southwestern Utah, and will skip low-desert parts of the Mojave around



**Figure 1.** *Yucca brevifolia* along Oak Creek at the southeastern edge of the Tehachapi Mountains, i.e. near the western edge of the range of this Mojave Desert species. This is along Oak Creek Road, just east of its terminus at Tehachapi Willow Springs Road.





**Figure 2.** *Cylindropuntia echinocarpa* along Oak Creek Road at the western edge of the Mojave town limit, amongst windmills. This plant looked clonal at this locale, with many nearby rooted and unrooted cladodes, some that lodged in my toes.



**Figure 3.** *Cylindropuntia ramosissima* between the Barstow-Daggett Airport and the Mojave River. This is a bleak floodplain with only a few successful plant species in this flat sandy area: *C. ramosissima*, *Larrea tridentata*, *Ephedra* sp. Same locale as the previous figure.



**Figure 4.** *Cylindropuntia echinocarpa* same locale as the two previous figures. This looks like a truly stressed plant and the only living plant of *C. echinocarpa* that I found at this locale between the Barstow-Daggett Airport and Mojave River. Many others specimens seemed to be recently deceased.



**Figure 5.** *Cylindropuntia echinocarpa* at higher elevation than the previous figure, well above the Mojave River floodplain, southwestern Barstow along Lenwood Road just east of I-15. While still a depauperate habitat, *C. echinocarpa* here looked greener and healthier than near the Barstow-Daggett Airport.

Death Valley and Joshua Tree National Park. Instead, I will focus on cacti and yuccas in the Mojave River watershed.

The Mojave River flows along current day Interstate 15 from the San Bernardino Mountains, starting near the town of Hesperia, flowing to the northeast, ending in Soda Lake next to the town of Baker. Occasionally, Soda Lake overflows into Silver Lake, which is just north of Baker. Silver Lake very rarely overflows northwards towards Death Valley, paralleling California Route 127. Cima Dome and Kelso are also parts of this watershed.

Kelso Wash flows from the Providence Mountains and Cima Dome into Soda Lake. Black Tank Wash flows from Cima Dome to Silver Lake. Kingston Wash flows from Cima Dome to Silver Lake. Therefore I consider Cima Dome and the western flank of the Providence Mountains to be part of the Mojave River watershed. I will also bend my rules and discuss plants from near Fenner, in the Watson Wash drainage, which flows south from the Mojave National Preserve, i.e. not into the Mojave River, Soda Lake, nor Silver Lake. I will also show one photo from Needles, California, 40km east of



Fenner, along the Colorado River. For a map of the Mojave National Preserve see <https://www.nps.gov/moja/planyourvisit/upload/MOJAmapWild.pdf>, and for a set of maps of the Mojave River watershed see <http://digital-desert.com/mojave-river/>.

### Mojave and Barstow

Start from the western end of the Mojave Desert, west of the town of Mojave. While driving California Highway 58, this is the land of windmills, with a ridiculous number of wind turbines, albeit not nearly as many as along Interstate 10 through Palm Springs. Halfway between the towns of Tehachapi and Mojave, Joshua trees, *Yucca brevifolia*, appear, and do so in high density along this western edge of the plant's range. I was hoping to find *Opuntia basilaris* var. *treleasei* at Oak Creek Pass in the Tehachapi Mountains, but had no luck. The entire pass has been bulldozed for wind power. Windmills, urban development around Bakersfield, sprawling agriculture, and petroleum extraction have obliterated much of the habitat of this spiny variety of *Opuntia basilaris*.

Giving up at Oak Creek Pass, I headed east towards the town of Mojave along Oak Creek Road and stopped to see the Joshua trees (Fig. 1), as well as silver cholla, *Cylindropuntia echinocarpa*, which had particularly long and dense spines (Fig. 2). This is at the western edge of the range of both *C. echinocarpa* and *Y. brevifolia* according to *Flora of North America* (Hess & Robbins 2002; Pinkava 2003; Benson 1982 and Ingram 2008). Joshua trees along Oak Creek were uniformly short plants, which is surprising given that *Y. brevifolia* is usually supposed to be tall in the south and west parts of its range (Ingram 2008). Oak Creek is far closer to the southwest than northwest part of the range of *Y. brevifolia*.

*Yucca brevifolia* dots much of the drive on California Highway 58 from Mojave to Barstow, although this species is never very dense on this stretch of highway and disappears for the final 10–20km west of Barstow. i.e. between Kramer Junction and Hinkley. The area between Mojave and Barstow is very flat – which is why the space shuttle originally landed just south of this route at Edwards Air Force Base – with an imperceptibly gradual descent driving east into the town of Barstow and the Mojave River. The area right around the Mojave River is probably too low an el-



**Figure 6.** *Cylindropuntia echinocarpa* at higher elevation than the previous figure, well above the Mojave River floodplain, southwestern Barstow along Lenwood Road just east of I-15. While still a depauperate habitat, *C. echinocarpa* here looked greener and healthier than near the Barstow-Daggett Airport.



**Figure 7.** *Echinocactus polycephalus* just north of I-40 at Hidden Springs Road, Daggett. Southern edge of Rodman Mountains. Note the numerous basaltic boulders about the same size as each barrel cactus shoot.

evation for *Y. brevifolia*. It is also a fairly harsh environment in which almost no cacti survive.

The Barstow area has at least four species of cacti: *Cylindropuntia echinocarpa*, *C. ramosissima*, *Echinocereus engelmannii*, and *Echinocactus polycephalus*. The two chollas grow all the way down to the river; the other two species are only found on basaltic hills in and overlooking Barstow. We did not travel upstream from Barstow, i.e. towards Hesperia, which is the type locality for *Opuntia mojaviensis*, but I have already written about that species (Gorelick 2020a), as well as about the diamond cholla, *C. ramosissima* in and around Barstow (Gorelick 2020b).





**Figure 8.** *Echinocactus polycephalus* just south of I-40 at Hidden Springs Road, Daggett.



**Figure 9.** *Echinocactus polycephalus* just north of I-40 at Hidden Springs Road, Daggett. Note copious wool and floral remains around the shoot apex.



**Figure 10.** *Yucca brevifolia* along I-15 at Hollaran Summit.





**Figure 11.** *Cylindropuntia ramosissima*, with *C. acanthocarpa*, *C. ramosissima*, and *Yucca schidigera* in the background; Boulders Viewpoint Area, south of Granite Pass, on Kelbaker Road, Mojave National Preserve. Backlit spine sheaths shimmer on these plants. Note the many spiny fruits on the *C. ramosissima* in the foreground. These plants looked far less stressed than the ones around Barstow.

We stayed at a strange but nice place between the Barstow-Daggett Airport and the Mojave River. There was a large hot tub in the garage. With the garage doors open, we could sit and watch jackrabbits racing through the desert, sometimes with our dog in pursuit. Walking the dog locally every morning and evening in the surrounding desert was a nice way to see the depauperate vegetation along the Mojave River. *Cylindropuntia ramosissima*, the diamond cholla, seemed to thrive in all settings around the Barstow-Daggett Airport (Figs. 3–4). *Cylindropuntia ramosissima* grows almost everywhere in the Mojave Desert until the elevation gets to 1100m, at which point it abruptly disappears. This indicates a distribution limited by cold temperatures, but I must add the caveat that *C. ramosissima* has survived winters outdoors in cultivation in Ontario, Canada, so cannot be quite as cold-limited as is often thought. By contrast with the ubiquitous *C. ramosissima* along the Mojave River, *C. echinocarpa* in the Mojave River flood plain near Barstow and Daggett were virtually all dead in February 2020 (Fig. 5). *Cylindropuntia echinocarpa* does far better with a slight amount of topography and looks far healthier on the small hills surrounding and in Barstow (Fig. 6).

*Echinocereus engelmannii* and *Echinocactus polycephalus* are also found on the volcanic hills, the Rodman Mountains, surrounding the towns of



**Figure 12.** A veritable sea of *Cylindropuntia acanthocarpa*, along with a few plants of *C. ramosissima* and *Yucca schidigera*. Boulders Viewpoint Area.



**Figure 13.** *Ferocactus acanthodes* at the Mountain Springs Road exit of I-40, which is a few kilometers east of Fenner and the Fenner Hills.

Barstow, Daggett, and Newberry Springs, never in the flood plain of the river (Figs. 7–9). Near these towns, *Echinocereus engelmannii* and *Echinocactus polycephalus* are extremely common along Interstate 40, where you can easily identify them while driving 75 mph (121 km/hr). Or just pull off the highway at any exit and look around, especially just to the south of I-40. From this odd base near the Barstow-Daggett Airport, we did day trips into the Mojave National Preserve, which was about an hour's drive to the east.

### Mojave National Preserve

The Mojave National Preserve is sandwiched within a triangle formed by I-40 to the south, I-15 to the northwest, and the Nevada border to the east. Recall that I-15 parallels the Mojave River from Hesperia to Barstow to Baker, so the plants are not





**Figure 14.** *Ferocactus acanthodes* at the Mountain Springs Road exit of I-40.

that impressive between Barstow and Baker. When we were there, Soda Lake on the south side of Baker had water, which is unusual, although I suspect it was fairly shallow and, given the name, fairly alkaline. From Baker, you can head southeast along Kelbaker Road, which is presumably short for Kelso-Baker Road, into the heart of the Mojave National Preserve, but it is also worthwhile continuing on I-15 towards Las Vegas, Nevada.

Heading northeast on I-15, once past Baker, the highway rapidly ascends to Halloran Pass at 1220m elevation, which is on the edge of Cima Dome. Halloran Pass is a great place to see big Joshua trees right alongside an interstate highway, although you have to ignore huge amounts of trash (Fig. 10). Northeast of Halloran Pass, I-15 descends slightly, with the roadside festooned with many large colourful red-spined specimens of *Ferocactus acanthodes*. You can then access the heart of the Mojave National Preserve by heading southeast at Cima Road towards Kelso Depot or heading east at Nipton Road towards Searchlight, Nevada, via a lovely pass separating the southern edge of the McCullough Range from the northern edge of the New York Mountains. This pass along Nipton Road is home to the putative natural hybrid between *Opuntia chlorotica* and *O. phaeacantha*, known as *Opun-*



**Figure 16.** *Echinocereus engelmannii* at the Mountain Springs Road exit of I-40.

*tia x curvispina*, as well as tall thin sparsely branched specimens of *Cylindropuntia acanthocarpa*. The drives along Cima Road and Nipton Road are both worthwhile.

The drive along I-40 from Barstow to Needles and the Colorado River, which closely parallels historic Route 66, provides decent places to stop and see cacti and yuccas. Just a few kilometers north of I-40 on Kelbaker Road is the Boulders Viewpoint area, which is just south of Granite Pass. To the west are the dramatic boulders of the Granite Mountains; to the east are the Providence Mountains. The Boulder Viewpoint area contains some of the densest and healthiest specimens I have seen of *Cylindropuntia ramosissima* (Fig. 11) and *C. acanthocarpa* (Fig. 12), as well as several plants of *Yucca shidigera*. The two chollas are spectacular when backlit, being both golden and silvery.

Deciduous spine sheaths are a peculiar feature of *Cylindropuntia*, as well as dog chollas in the genus *Corynopuntia*. The spine sheaths of *C. ramosissima* and *C. echinocarpa*, and to a lesser degree *C. acanthocarpa*, are a golden yellow. By contrast their mature spines are silver, grey, or white. This means that plants with new growth, i.e. before spine sheaths fall away, look more golden than older spines. Cactus spines are lignified leaves, but it is not obvious what, if any, functional significance there is to the epidermis of these highly modified leaves abscising. Given that deciduous spines (aka glochids) only occur in the subfamily Opuntioideae, it is not too surprising that deciduous spine sheaths also only occur amongst members of that subfamily. There are also nice clumps of the wide-ranging *Echinocereus engelmannii* at the Boulders Viewpoint. In general, *E. engelmannii* is typical of the





**Figure 15.** *Echinocereus engelmannii* at the Mountain Springs Road exit of I-40.



**Figure 17.** *Echinocereus engelmannii* at the Mountain Springs Road exit of I-40.

less cold-tolerant species in the genus insofar as the flower buds emerge directly from areoles. In the more cold hardy members of *Echinocereus*, including the other California Mojave Desert native *E. triglochidiatus* var. *mojavensis*, flowers erupt through the epidermis immediately above areoles.

Another nice stop along I-40 is at the intersection with Mountain Springs Road, just east of Fenner and the Fenner Hills. Right along I-40 at this exit, there are many densely spined specimens of *Ferocactus acanthodes* (Figs. 13–14), *Echinocereus*



**Figure 18.** *Cylindropuntia echinocarpa* at the Mountain Springs Road exit of I-40. Plants of *C. echinocarpa* at this locale all looked healthy, but were quite short, under 60 cm tall.

*engelmannii* (Figs. 15–17), and *Cylindropuntia echinocarpa* (Fig. 18). There are many plants of the other two common Mojave chollas here, *C. acanthocarpa* and *C. ramosissima*, several statuesque plants of *Yucca schidigera* (Fig. 19), and lots of *Opuntia basilaris* that were actively growing in early





**Figure 19.** *Yucca shidigera* at the Mountain Springs Road exit of I-40. This species is intermediate in height between that of *Y. brevifolia* and *Y. baccata*, which are the other two common *Yucca* species in California portions of the Mojave Desert.

February (Figs. 20–21). Living in Canada, seeing any plants growing in February seems miraculous. Depending on the species, my cold hardy cacti in Ontario do not start growing each season until May or June.

Within the Mojave National Preserve, there are many fascinating places to stop and explore, at both low and high elevations. Even just exploring along the side of roads can be amazing (Figs. 22–26). Don't miss the massive Kelso Dunes, despite that the shifting sands bury plant life (Figs. 27–28). In the near future, we will have to settle for such stops until one of the true gems of the Mojave National Preserve, Cima Dome, recovers from the Dome Fire. The remainder of this article will be something of a eulogy to the extraordinary hike along Teutonia Peak Trail on Cima Dome, which got hit hard by the fire.

### Teutonia Peak Trail

I was at Teutonia Peak Trail in February 2020, a half-year before the massive Dome Fire in August

2020. This fire burned 17,512 hectares (43,273 acres) of Cima Dome, killing many cacti and killing an estimated 1.3 million Joshua trees, *Yucca brevifolia* (<https://www.nps.gov/moja/learn/nature/dome-fire.htm>). While this ecosystem probably will return to its previous grandeur, if not invaded by weedy fast-burning annual grasses, recovery may take several decades or even centuries. The U.S. National Park Service transplanted many Joshua tree seedlings on Cima Dome during winter 2021–2022 to help spur regrowth of the dominant tree species there. Some Joshua trees here have started resprouting from surviving underground parts (Jim Boone, pers. comm.).

Teutonia Peak Trail is along Cima Road about 10km south of I-15. On the way to Teutonia Peak Trail, from either north or south, notice the gradual increase in elevation. Cima Dome is a very gently sloped dome that rises almost 1000m above the surroundings. Because of time constraints and because I took so many photos, we only walked half-way up the trail, from the trailhead at 1520m to around the





**Figure 20.** *Opuntia basilaris* already with new buds on 14 February, at the Mountain Springs Road exit of I-40.

sixth waypoint at 1640m elevation. Teutonia Peak Trail was too high of an elevation for *Cylindropuntia ramosissima*, *Echinocactus polycephalus*, *Ferocactus acanthodes*, and *Yucca shidigera*, but otherwise I saw virtually all other Mojave National Preserve cacti right along this trail. I highly recommend the following website about Teutonia Peak Trail, [https://birdandhike.com/Hike/MOJA/Teutonia\\_Pk/\\_Teutonia.htm](https://birdandhike.com/Hike/MOJA/Teutonia_Pk/_Teutonia.htm), by my colleague Jim Boone.



**Figure 21.** *Opuntia basilaris* and *Cylindropuntia echinocarpa*, Needles, California, both in full flower on 15 March 2020. This locale is low-elevation, close to the Colorado River, but I include it here to show the flowers. I took this photo at an informal trash dump behind a largely abandoned shopping mall, while driving from the Central Coast of California to Ontario, Canada at the start of the covid pandemic, racing back before the international border closed a few days later.



**Figure 22.** *Cylindropuntia acanthocarpa* along Kelso-Cima Road, just north of Gold Mine Road, Mojave National Preserve.





**Figure 23.** *Cylindropuntia ramosissima* along Kelso-Cima Road, just north of Gold Mine Road, Mojave National Preserve.



**Figure 24.** *Opuntia basilaris* along Kelso-Cima Road, just north of Gold Mine Road, Mojave National Preserve. Clumps of *O. basilaris* often grow larger, i.e. with more cladodes and larger cladodes, at lower elevation. Compare this medium-sized clump at medium elevation with the small clumps with small cladodes from higher elevation at Cima Dome (Fig 35) and the larger clumps with large cladodes at lower elevation near the Colorado River (Fig 21).



**Figure 25.** *Echinocereus engelmannii* and *Opuntia basilaris* along Kelso-Cima Road, just north of Gold Mine Road, Mojave National Preserve.

It was hard not being overwhelmed by the density of Joshua trees along Teutonia Peak Trail (Fig. 29). As Stephen Ingram (2008: 167) noted, “Joshua tree woodlands at Cima Dome are amongst the most extensive stands of this species.” They were so nice and impressive that, at first, I struggled to pay attention to the smaller plants. Yet right at the parking lot grew *Corynopuntia parishii*. While I saw *C. parishii* sporadically along the trail, at least to 1640m elevation (Fig. 30), it was easiest to spot right at the parking area (Figs. 31–33). The spines are so broad and dense, while the shoots are so thin, and the epidermis so dark-coloured, that these plants looked like the dead skeleton of spines of *Echinocereus englemannii*, until I spotted the orange fruits (Fig. 33). Like most dog chollas, this



**Figure 26.** *Ferocactus acanthodes* along Kelso-Cima Road, just north of Gold Mine Road, Mojave National Preserve, with *Cylindropuntia acanthocarpa* and *Opuntia basilaris* in the background.

species is clonal and a single plant can spread over a large area, with some older stems buried by blowing sand.

The other gem between the first and second way-points – i.e. between the parking lot and the one trail that crosses the main trail, which are ¾km apart – was *Coryphantha chlorantha*, sometimes known as *C. vivipara* var. *desertii* (Fig. 34). I only saw very small plants. Given that they were not in flower in February, I suppose these could have instead been *C. vivipara* var. *rosea*. However, only *C. chlorantha* has been documented at Cima Dome by





**Figure 27.** Kelso Dunes with *Cylindropuntia ramosissima* and *Larrea tridentata* (creosote).



**Figure 28.** *Cylindropuntia ramosissima* at the Kelso Dunes parking lot.

Allan Zimmerman (1985) and Stephen Ingram (2008). When not in flower or fruit, *C. chlorantha* and *C. vivipara* are indistinguishable. The flowers of *C. chlorantha* are much smaller and less vibrantly coloured than those of nearby *C. vivipara* (Zimmerman 1985; Zimmerman & Parfitt 2003). In fact, the flowers of *C. chlorantha* resemble those of *C. sneedii*, which does not grow anywhere close to Mojave National Preserve. Even *C. sneedii* var. *orcuttii* is over 800km away from Cima Dome as the crow flies. This provides circumstantial evidence that *C. sneedii* and maybe also *C. chlorantha* should be subsumed in *C. vivipara* (Gorelick 2020c).

I only saw three prickly pear species along Teutonia Peaks Trail, all worth seeing: *Opuntia basilaris*, *O. polyacantha* var. *erinacea*, and *O.*



**Figure 29.** *Yucca brevifolia* and *Cylindropuntia acanthocarpa*, which are the two ubiquitous species along Teutonia Peak Trail.

*chlorotica*. All three were trivial to identify which is unusual for prickly pears, which almost anywhere else confound me.

The beavertail prickly pear, *Opuntia basilaris* might be as good of an indicator of being in the Mojave Desert as *Yucca brevifolia*. *Opuntia basilaris* var. *basilaris* was easy to find along Teutonia Peak Trail, but was not exceptionally common (Fig. 35). I suppose that it would be much easier to find in late March and early April, when in full flower, with petals often in rich shades of magenta, albeit sometimes more pink (Fig. 15). *Opuntia basilaris* at Teutonia Peak Trail are small plants, with only a half-dozen to a dozen small pads per plant. At lower elevations the number and size of pads increases. At low elevations near the Colorado River, pads are up





**Figure 30.** *Corynopuntia parishii* at waypoint 6 along Teutonia Peak Trail (ca. 1640m elevation). At first, I thought this was a dead specimen of *Echinocereus engelmannii*, which does not grow at this high of an elevation, at least not at Cima



**Figure 31.** *Corynopuntia parishii* at the parking lot for Teutonia Peak Trail.



**Figure 32.** *Corynopuntia parishii* at the parking lot for Teutonia Peak Trail. Close-up of spines, some of which are flattened.

to 20cm across and a single plant can be over two meters in diameter with over a hundred pads. I suspect that *O. basilaris* does not simply carpet the ground at Teutonia Peak or anywhere because it does not appear to be clonal, but is probably mostly disseminated by seed. Lack of clonality seems to also be true of the two other prickly pears along Teutonia Peak Trail, *O. polyacantha* var. *erinacea* and *O. chlorotica*.

*Opuntia polyacantha* var. *erinacea* is a low-growing taxon with many extremely long flexible spines (Figs. 36–38). Actually, at first, its pads are upright and taller than wide, but after a few years of



**Figure 33.** *Corynopuntia parishii* at the parking lot for Teutonia Peak Trail, with orange fruits on 12 February 2020.

growth, possibly due to dehydration in winter, old pads become decumbent. As with all *Opuntia* species, their areoles have indeterminate growth, which means they can grow longer spines and more spines per areole as cladodes age. They can also grow more glochids, which are merely small deciduous spines. While spines of *O. polyacantha* var. *erinacea* on new growth are slightly rigid and colourful, spines on older pads are more flexible, much longer, and pure white (Fig. 38). Being a variety of *O. polyacantha*, their many closely-packed areoles per pad make older, longer spines look striking. *Opuntia polyacantha* var. *erinacea* very much resembles its more easterly relatives *O. diploursina*, *O. polyacantha* var. *hystericina*, and *O. polyacantha* var. *trichophora*, all of which can have





**Figure 34.** *Coryphantha chlorantha*, Teutonia Peak Trail, not far from trailhead, growing on a crumbling vertical face.



**Figure 35.** *Opuntia basilaris*, Teutonia Peak Trail. Along this trail, *O. basilaris* remains small, almost never consisting of more than a half-dozen small pads per plant. Most of the *O. basilaris* pads along Teutonia Peak Trail were quite wavy, more so than I have seen at other locales. What causes these wavy cladodes? If transplanted to a different environment, will new pads grow wavy or straight, as in my most other prickly pear species?



**Figure 36.** *Opuntia polyacantha* var. *erinacea*, Teutonia Peak Trail. Note the many dry fruits, which are characteristic of both *O. polyacantha* and *O. basilaris*. Notice how upright new or newish pads are.

long flexible white spines making the plants seem hairy or shaggy. I do not consider differences in ploidy to warrant classification as separate species (Rowley 2007). However, for those who consider different ploidies to constitute different species (e.g. Soltis *et al.* 2007; Breslin *et al.* 2015), *Opuntia diploursina* and *O. trichophora* are diploid; *Opuntia erinacea* and *O. hystricina* are tetraploid; and *O. nichollii* is hexaploid, which I think covers all of the prickly pears of the southwest U.S. that have long flexible spines.

Indeterminate growth of spines makes *Opuntia polyacantha* one of my favourite species in cultivation. While each long shoot (pad; cladode) of any *Opuntia* only grows for a few months over the lifetime of the plant, their areoles grow for decades, especially with *O. polyacantha* *sensu lato*. I have had



**Figure 37.** *Opuntia polyacantha* var. *erinacea*, Teutonia Peak Trail. Close-up of spines.





**Figure 38.** *Opuntia polyacantha* var. *erinacea*, Teutonia Peak Trail. All cladodes are from the same plant. Younger cladodes, which are on the left, are upright with spines that are white, red, and brown. Older cladodes, which are on the right, are decumbent with spines that are completely white and much longer. Because of indeterminate growth of areoles and spines, as cladodes age, they can grow more spines per areole and each spine can grow longer each year. It seems that spines turn white with age.



**Figure 40.** *Opuntia chlorotica*, Teutonia Peak Trail. Framed by arching branches of a Joshua tree.

pads of *O. polyacantha* that suffered a decade of abuse (poor drainage; excessive shade) followed by five years of better growing conditions. In those latter five years, the old truly ragged pads grew lots of new dense long spines. Another plant, also acquired 15 years ago, as *Opuntia rhodantha*, which is a synonym of *O. polyacantha* var. *polyacantha*, was virtually spineless for its decade of poor growing conditions. Once in decent growing conditions for the past five years, it started growing very stout spines on some very old pads and very long dense



**Figure 39.** *Opuntia chlorotica*, Teutonia Peak Trail. While known for its enormous circular cladodes, this species is named for its overall yellowish colour, i.e. appearing to be chlorotic, even though it isn't.

glochids on some other old pads. The real trick with any *Opuntia polyacantha* in cultivation is to be patient. Old pads can take years to grow a high density of long spines, which is also noticeable in habitat (Fig. 38). Any member of Opuntioideae can grow new and longer spines years after areoles were formed, but *Opuntia polyacantha* seems to do this as much as any other species I have grown.

Even less common along Teutonia Peak Trail, was the pancake cholla, *Opuntia chlorotica* (Figs. 39–40). Like its two congeners, *O. chlorotica* does not appear to be clonal. But unlike its two congeners *O. chlorotica* is a tall upright plant, sometimes to 2 meters tall, usually with huge circular pads. Growing right along Teutonia Peak Trail were specimens of *O. chlorotica* with many needle-like spines and few glochids, as well as specimens with no spines but plenty of long glochids. This is a wide-ranging species also found in southern Arizona and southwestern New Mexico, i.e. *O. chlorotica* inhabits the Mojave, Sonoran, and Chihuahuan Deserts.

I was a bit surprised to have not stumbled upon any plants that resembled *Opuntia phaeacantha* or *O. engelmannii* at Cima Dome nor at lower eleva-





**Figure 41.** It is worth saying again: *Cylindropuntia acanthocarpa* and *Yucca brevifolia* were ubiquitous along Teutonia Peak Trail.

tion sites in the Mojave National Preserve. I chalk that up to bad luck, as well as not specifically looking for these taxa.

Other than the dog cholla *Corynopuntia parishii*, there were only two cholla species at Teutonia Peak Trail: the tall loosely-branched *Cylindropuntia acanthocarpa* and the short densely-branched *C. echinocarpa*. *C. acanthocarpa* was the most common cactus along this trail (Figs. 41–47). When looking back through my Teutonia Peak photos, *C. acanthocarpa* appears in virtually every photo that was not a close-up. Their shoots are long and usually not very thin, at least along Teutonia Peak Trail. By contrast, farther north, on Nipton Road, at the pass between the McCullough Range and New York Mountains, which is a few kilometers east of both Nipton and the California-Nevada border, many specimens of *C. acanthocarpa* had very thin cladodes (under 1cm) with almost no branches, including none at the base. These thin specimens with almost no branches were the only specimens that I saw with what could be called a distinct trunk, albeit a very thin trunk. All other specimens tended to branch at or just above ground level. Spination of



**Figure 42.** *Cylindropuntia acanthocarpa* amongst *Juniperus californica* along Teutonia Peak Trail.





**Figure 43.** *Cylindropuntia acanthocarpa* and *Juniperus californica* near the ridgeline at waypoint 6 on Teutonia Peak Trail.



**Figure 44.** Even skeletons of *Cylindropuntia acanthocarpa* are elegant along Teutonia Peak Trail.

*C. acanthocarpa* was not nearly dense enough to obscure the green epidermis. Typically plants of *C. acanthocarpa* grow to about 1.5–2.0m tall and 1.0–1.5m across, with an overall conical shape, like an ice cream cone. A few of the *C. acanthocarpa* plants along Teutonia Peak Trail had fruits in mid-February, which were a rose-orange colour and not nearly as densely spined as fruits of *C. echinocarpa* and *C. ramosissima*. Plants of *C. acanthocarpa* in California, as well as near the Colorado River used

to be known as *C. acanthocarpa* var. *coloradensis*. But Baker, Pinkava, and Cloud-Hughes (2018) determined that var. *coloradensis* is not morphologically distinguishable from the type variety, a conclusion that is entirely consistent with my observations. At Teutonia Peak Trail, *C. acanthocarpa* was prevalent from the trailhead to at least 1680m, which is at waypoint 7, aka Cima Dome view. *Cylindropuntia acanthocarpa* is also common at lower elevations south of Cima Dome, such as on Cima Road, Kelso-Cima Road, and the parts of Kelbaker Road south of Kelso Depot (Figs. 12 & 22), all the way from Teutonia Peak Trail (and just east of Nipton) in the north to Interstate 40 at Kelbaker Road in the south. This is at about the western edge of the range of *C. acanthocarpa* according to *Flora of North America* (Pinkava 2003), Benson (1982), and Ingram (2008). *C. acanthocarpa* was, however, common to the east in the Lanfair Valley. When living in Tempe, Arizona, I used to delight in driving the Apache Trail in spring, seeing all the varied pastel colours that *C. acanthocarpa*'s flowers took. Their dark red filaments make the flowers look even more spectacular. For more on the range of *C. acanthocarpa* in the Mojave Desert, espe-





**Figure 45.** *Cylindropuntia acanthocarpa*, Teutonia Peak Trail, with silvery spines.



**Figure 46.** *Cylindropuntia acanthocarpa*, Teutonia Peak Trail, with golden spines.

cially its elevation range to at least 1900m, if not 2000m, see Gorelick and Boone (2021).

*Cylindropuntia acanthocarpa* does not appear to be a clonal species. You seldom (never?) see detached cladodes laying on the ground, let alone rooted detached cladodes. Instead, this cholla seems to be largely sexually reproducing, with cladodes that remain attached for decades or even centuries. Using repeat photography in the Grand Canyon, Bowers *et al.* (1995) reported individual specimens of *C. acanthocarpa* that were a century old, which would be impossible if these plants readily shed



**Figure 47.** *Cylindropuntia acanthocarpa*, Teutonia Peak Trail, with a fruit on 12 February 2020.



**Figure 48.** *Cylindropuntia echinocarpa*, Teutonia Peak Trail, with many fruits on 12 February 2020.



**Figure 49.** *Cylindropuntia echinocarpa*, Teutonia Peak Trail, with even more fruits on 12 February 2020.





**Figure 50.** *Echinocereus triglochidiatus* var. *mojavensis* at Teutonia Peak Trail, where this species usually grows in flat areas, forming large compact spherical or hemispherical clumps. Note the withered floral or fruit remains.



**Figure 52.** *Echinocereus triglochidiatus* var. *mojavensis* at Teutonia Peak Trail, with lots of withered floral remains. This clump is growing flatter than most here.

cladodes.

*Cylindropuntia echinocarpa* is more widespread than *C. acanthocarpa* in the Mojave Desert, but not in the Sonoran Desert. *C. echinocarpa* is a shorter and much denser plant, seldom more than 1.2m tall and across and usually with a definitive short trunk (Figs. 48–49). Areoles are denser and cladodes are shorter on *C. echinocarpa* than on *C. acanthocarpa*. Flower of *C. echinocarpa* never have fiery red filaments that are diagnostic of *C. acanthocarpa*. Branches of *C. echinocarpa* diverge from their parent branch at a much greater branching angle than that of *C. acanthocarpa*, which means the overall



**Figure 51.** *Echinocereus triglochidiatus* var. *mojavensis* at Teutonia Peak Trail, with *Juniperus californica* and *Cylindropuntia acanthocarpa* in the background.

plant of *C. echinocarpa* is wider spreading. *C. echinocarpa* appears to sometimes be naturally propagated clonally, with cladodes becoming dislodged and rooting. They also often have dense enough spines to look fuzzy from a distance, much like teddy bear cholla, *C. bigelovii*. There were plenty of specimens of *C. echinocarpa* at Teutonia Peaks Trail, many with a huge number of fruits (pericarpels).

*Echinocereus triglochidiatus* var. *mojavensis* (= *E. mojavensis*) dotted Teutonia Peaks Trail, with most clumps being fairly large with around a hundred shoots, always forming a tight spherical to hemispherical clump about 50–75cm in diameter (Figs. 50–53). It must be a joy seeing those in full flower. Vestiges of flowers and fruits are visible in several of the figures. But, in February, it was still nice seeing these dense clumps of stems, especially with their gently curved spines on all areoles in this population (Fig. 54). I did not see any small clumps nor solitary specimens of *E. triglochidiatus* var. *mojavensis* along Teutonia Peak Trail, which regrettably means that recruitment had been very low. With any luck, that changes after the Dome Fire.

All along Teutonia Peak Trail grew not just Joshua trees, *Yucca brevifolia*, but also the banana yucca, *Yucca baccata*. *Yucca baccata* is not as tall nor photogenic, but plants here formed clumps, with each shoot having a very short trunk containing many long stiff leaves (Figs. 53, 55–57). Often in this species, leaves are green, especially in Arizona, New Mexico, and Texas, but in the Mojave





**Figure 53.** *Echinocereus triglochidiatus* var. *mojavensis* at Teutonia Peak Trail, with *Yucca brevifolia*, *Y. baccata*, and *Cylindropuntia acanthocarpa*.

Desert of California its leaves are almost always ghostly greyish-glaucous. Many shoots contained last season's inflorescence, which are short in *Y. baccata*, usually not growing taller than the top of the leaves. The common name, banana yucca, is for the large fleshy fruits that superficially resemble fruits ('berries') of bananas, a name that could equally well apply to Joshua trees. Etymologically, the words *baccate* and *baguette* share a common ancestor. The flowers of *Y. baccata* are also very large for a yucca. *Yucca baccata* has a large and fairly continuous distribution across the Basin and Range province, from southeastern California and southern Utah, to most of Arizona, and much of New Mexico, all the way through Big Bend in west Texas. These are tough plants, whose seedlings and adult plants readily survive winters to  $-30^{\circ}\text{C}$ , as well as scorching hot summers.

Many authors, but not me, consider there to be two varieties of *Yucca brevifolia* – var. *brevifolia* and var. *jaegeriana*. Plants at Teutonia Peak Trail, all of Cima Dome, and the rest of the north and east



**Figure 54.** *Echinocereus triglochidiatus* var. *mojavensis* at Teutonia Peak Trail, with typical gently curving spines.





**Figure 55.** *Yucca baccata* at Teutonia Peak Trail, with omnipresent *Y. brevifolia* and *Cylindropuntia acanthocarpa*.



**Figure 56.** *Yucca baccata* at Teutonia Peak Trail, with *Juniperus californica* and *Ephedra* sp. Notice how greyish-glaucous the yucca leaves are, especially in the bottom right corner.





**Figure 57.** *Yucca brevifolia* at the ridgeline near waypoint 6 on Teutonia Peak Trail, with *Y. baccata* and *Juniperus californica*. Note the greyish-glaucous leaf colour of *Y. baccata*.



**Figure 58.** A particularly tall specimen of *Yucca brevifolia* along Teutonia Peak Trail, with *Cylindropuntia acanthocarpa*.





**Figure 59.** *Yucca brevifolia* at the ridgeline near waypoint 6 on Teutonia Peak Trail. The branching pattern of this specimen very vaguely reminds me of some specimens of the totally unrelated and almost antipodal *Pachypodium namaquanum*.

portions of its range are considered to be *Y. brevifolia* var. *jaegeriana*, commonly known as the dwarf or miniature Joshua tree (Figs. 58–64). On average, plants along Teutonia Peaks Trail and Cima Dome were shorter than those farther south in Joshua Tree National Park. But those are just averages, with tall specimens at nearby Hollaran Summit along I-15 (Fig. 10) and a few tall specimens along Teutonia Peaks Trail (Fig. 58). By contrast and antithetically, plants along Oak Creek west of Mojave were generally quite short, despite being at the western edge of the species range (Fig. 1). There are also questions about whether flowering is required or not for dichotomous branching and whether this might help distinguish these two putative varieties (Ingram 2008). I will plead ignorance on this question, except to provide a pair of observations. First, repeated symmetrical branching (“isotomous”, in which *iso-* means *equal* and *-tomous* means *branch-*



**Figure 60.** *Yucca brevifolia* along Teutonia Peak Trail. Close-up of its short stout leaves.

*ing*]) that is dichotomous in trees is usually associated with woody monocots, including tree aloes in *Aloidendron* and *Kumara*, grass trees in *Xanthorrhoea*, arborescent dracaenas in *Dracaena* and *Cordyline*, and branching palms in *Hyphanae* and *Nypa*, as well as all or almost all arborescent yuccas (Fig. 61). Second, branching of *Y. brevifolia* at Teutonia Peak Trail was not always dichotomous. Sometimes branching was trichotomous, but still with equal sized branches, i.e. isotomous (Fig. 62). Rarely, branching appeared to be axillary branching, as in many eudicots and conifers (Fig. 63).

Recent large-scale genetic analysis (Smith *et al.* 2021) indicates that Joshua trees in the Mojave National Preserve, as well as in southern Nevada and northwestern Arizona, should be segregated as a separate species, *Yucca jageriana*. See Smith *et al.*'s (2021) Figure 1 for a range map along with graphical summaries of their genetic data. However, these authors also estimated that *Y. jageriana* only diverged from *Y. brevifolia* between 100,000 – 200,000 years ago, plus they provided evidence for continuing gene flow from *Y. jageriana* to *Y. brevifolia*. So you will have to call me curmudgeonly for continuing to call plants at Teutonia Peak *Y. brevifolia*. Smith *et al.* (2021) still consider Joshua trees in Joshua Tree National Park, as well as those between Tehachapi and Barstow, to be *Y. brevifolia*.

Teutonia Peak Trail is supposedly part of a Joshua tree forest, although there were almost as many plants of California juniper, *Juniperus californica* as there were Joshua trees, with the junipers usually being larger than the Joshua trees. One caveat: the plants along Teutonia Peak Trail may





**Figure 61.** *Yucca brevifolia* along Teutonia Peak Trail, with isotomous dichotomous branching; showing bark formation.



**Figure 62.** *Yucca brevifolia* along Teutonia Peak Trail, with isotomous trichotomous branching. I have no idea what caused the drooping shoots.



**Figure 63.** *Yucca brevifolia* along Teutonia Peak Trail, showing large baccate fruits. The branch on the lower right contains a pair of what look to be small axillary branches.



**Figure 64.** *Yucca brevifolia* along Teutonia Peak Trail, with annual rings and medullary rays. This plant was growing alongside the trail not too far from the trailhead, so I assume that park rangers created this cut with a chainsaw.

possibly have been Utah juniper, *J. osteosperma*. I was a bad botanist and neglected to figure out which juniper species was there.

Naively and incorrectly, I used to think that a forest of monocot trees, such as yuccas, was weird because monocots could not grow increasingly wide trunks over time, as compared to most eudicot and coniferous trees. There are some differences between how these three disparate plant groups (eudicot, monocot, conifer) grow wide trunks, but I now realize that those differences are nuanced. Like all seed plants, Joshua trees at first grow from a shoot apical meristem, which is a hemispherical mass of dividing cells at the growing point (there are exceptions, such as cristate growth in any seed plant

and/or growth of thalloid vegetative tissues in the aquatic eudicot family Podostemaceae). Later, seed plants with secondary growth, including Joshua trees, grow wider via a cylinder of dividing cells called a lateral meristem or vascular cambium. Yes, Joshua trees and all *Yuccas* produce annual rings or at least seasonal rings when in semi-tropical environs (Fig. 64). As with eudicots and coniferous trees, tree yuccas have a lateral meristem that produces new cells – including xylem, phloem, and less specialized thin-walled cells – to both the inside and outside of the cylinder. In eudicots and conifers, usually xylem and less specialized thin-walled cells are produced to the inside of the cylinder, while phloem and less specialized cells are



produced to the outside of the cylinder. In tree yuccas and their relatives, trunks get wider by a cylindrical lateral meristem producing xylem, phloem and less specialized thin-walled cells to the inside of the cylinder, while only less specialized thin-walled cells are produced to the outside of the cylinder. To the outside of lateral meristems, yuccas produce additional water storage tissue called secondary cortex (primary cortex is produced by the shoot apical meristem). See Tomescu & Groover (2019), who discuss *Cordyline*, but sections of *Yucca* look virtually identical, which is not surprising given that both genera are now considered to be in the same family, Asparagaceae/Ruscaceae according to APG IV. To the inside of the lateral meristem, yuccas produce discrete bundles of xylem and phloem arranged as radial spokes, with the area between the spokes comprised of less specialized thin-walled cells, which are effectively medullary rays, although often not called this. When most trees die, these less specialized thin-walled cells disintegrate, which allows you to easily split a cut log with an axe. The figure showing annual rings in a Joshua tree also shows these medullary rays between the spokes of xylem and phloem (Fig. 64). Like eudicot and coniferous trees, tree yuccas also produce distinctive bark, with different bark patterns produced by differential growth of one or more concentric cylindrical cork cambia (Fig. 62). So maybe a forest of Joshua trees isn't that weird. But still, I lament the demise of the Joshua tree forest and all the other amazing plants on Cima Dome, which will take a long time to recover from the Dome Fire of 2020.

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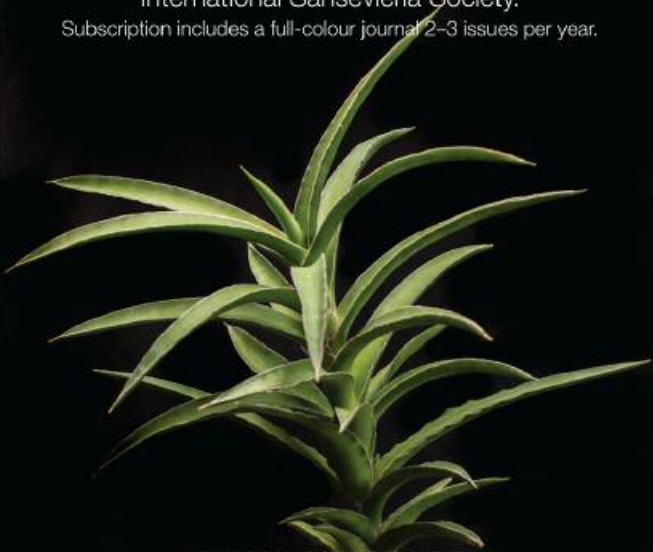
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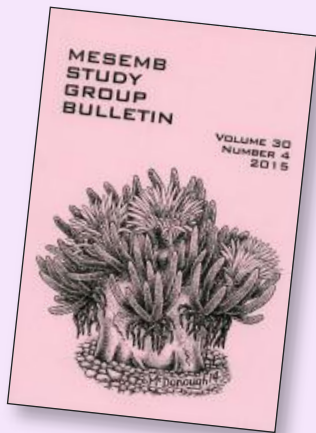
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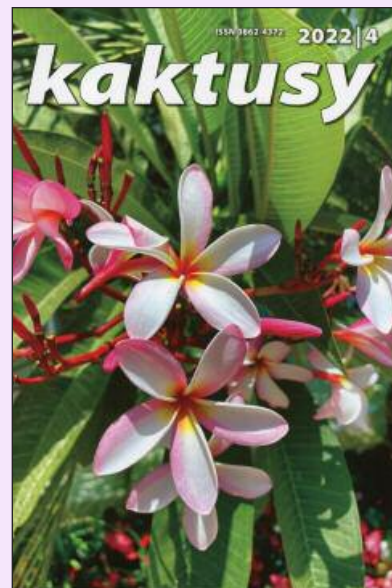


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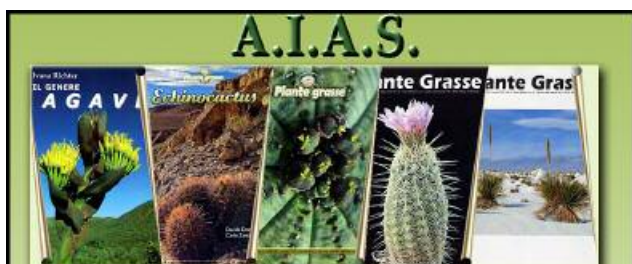


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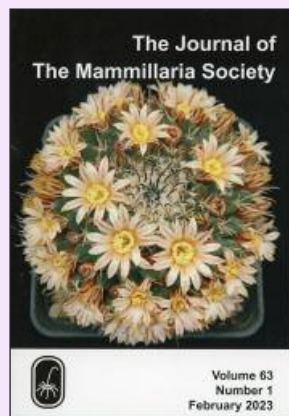
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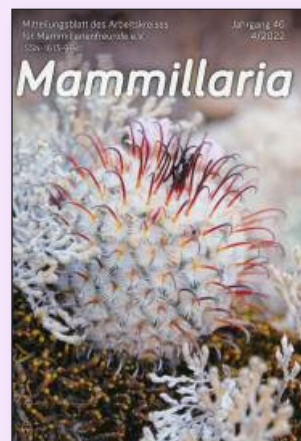
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Cactus Shop (formerly Westfield Cacti) have been growing and trading in cacti & other succulents since 1979 and guarantee speedy delivery of top class plants

All plants have been grown from seed or cuttings in cultivation. Winkleigh, EX19 8DW Devon  
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Large list of Cactus and Succulent seeds, particularly strong on Mexican and U.S.

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*Note the new email address*

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Cacti and Succulents for sale and exchange

<https://www.rrm.me.uk/Cacti/forsale.php>

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We specialise in Cacti and Succulents for the beginner and collector, grown by us in our nursery.

Visitors are welcome by appointment.

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## Ian and Sarda Woolnough

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 Norfolk  
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Tel +44 (0)1553 617132

Visitors welcome by appointment only.

Please email for our Cactus seed list.

[ianneilwoolnough@gmail.com](mailto:ianneilwoolnough@gmail.com)







**It's time to buy seeds!**

**Seeds from Aymeric de Barmon** (The picture above is his glasshouse)

The list of species available is extensive and many seeds have data about their origin.

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volker@gymnos.de



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Mondocactus is the virtual store of De Rerum Natura Nursery, for the sale of rare and not so rare succulent plants since 2013 in San Lazzaro di Savena (Bologna, Italy). See the website, also in English:

<http://www.mondocactus.com>



Online shop for Cacti, Succulents and other Exotic plants. We offer a good range of plants, seeds and accessories.

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The Genus – Culture – Habitat – Field Numbers –  
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Supplementary information

Echinocereus pectinatus [www.pectinatus.de](http://www.pectinatus.de)  
Flower galleries of *Echinocereus pectinatus*



visit our webpage:  
[www.epiphyllum.online](http://www.epiphyllum.online)

**Pavel Pavlicek**

New seed list for 2022/23

<http://www.cact.cz/semena-seeds-prodej-a15>

Plants offer: <http://www.cact.cz/nabidka-ros-tlin-jaro-2014-a16>



## Piccolo Plants



Piccolo Plants Nursery is a specialist succulent nursery located in the village of Branscombe, in South East Devon (UK). The nursery offers a wide variety of indoor and outdoor succulents for sale. Open during the week and mail order via our website.

[www.piccoloplantsnursery.co.uk](http://www.piccoloplantsnursery.co.uk)

## Ottershaw Cacti

UK nursery specialising in succulents such as Echeveria, Aeonium, Crassula and Sedum as well as cacti.



78 Bousley Rise, Ottershaw, Surrey, KT16 0LB

[hello@ottershawcacti.com](mailto:hello@ottershawcacti.com)

Tel: 01932 872667

Website: <https://ottershawcacti.com>

## Seeds from Ralf Hillmann



New seed list available in December.

All seeds are from habitat source or pollinated in my own collection.

Specialising in *Aylostera*, *Mediolobivia*, *Rebutia*, *Sulcorebutia*, *Lobivia*, *Echinopsis*, *Gymnocalycium*, *Notocactus*, *Cereoids*, *Opuntiae*, *Mesembs*, *Puya*, *Crassulaceae* etc.

For more information please contact [sulcohilli@gmx.ch](mailto:sulcohilli@gmx.ch)

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Large selection of reliable seeds; specialising in South American cacti. We offer over 450 *Rebutia*, 350 *Lobivia*, over 200 *Eriosyce*, many *Gymnocalycium*, *Copiapoa* & *Echinopsis* plus many others.

Visit our webshop at [www.succseed.com](http://www.succseed.com)

If you have not already told me and would like to be advised when each issue of the **Cactus Explorer** is available for download, please send [me](#) your E-mail address and I will add you to the distribution list.



# Southfield Nurseries - Cactusland

Bourne Road, Morton, Bourne, Lincolnshire, PE10 0RH U.K.

Tel: +44 (0)1778 570168



×Chamaelobivia 'Lincoln Gem'



Echinopsis 'Bourne Razzle Dazzle'



×Chamaelobivia 'Lincoln Firecracker'



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Southfield Nurseries, the home of 'Cactusland' – the largest cactus nursery in the United Kingdom. All of our plants are propagated here in our own nursery and we have many thousands of cacti ready potted for sale; over 750 varieties including many hybrids unique to Cactusland that we have developed ourselves.

**Mail order service.**

Visitors welcome (please check opening hours)

Enquiries: [customer.services@cactusland.co.uk](mailto:customer.services@cactusland.co.uk)

Website: <http://www.cactusland.co.uk>


## Corona Cactus Nursery



- Specializing in collector cacti and succulents
- Mail Order - We ship to most countries, please inquire
- The majority of our plants are seed grown
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photo galleries and more ....

<http://www.coronacactus.com>



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## J & J Cactus and Succulents



Joyce Hochtritt  
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 City, OK 73130, USA  
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Visits By Appointment Only

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## Brookside Nursery

Contact address: via della Campana 7, 00048 Nettuno (RM), Italy  
Website: [www.brookside-nursery.com](http://www.brookside-nursery.com)  
E-mail: [alan-brook-side@hotmail.com](mailto:alan-brook-side@hotmail.com)  
Tel: 00-39-335-6159058

We are open to visitors but strictly by prior appointment.

Visit our web site at [www.brookside-nursery.com](http://www.brookside-nursery.com) for more information and our plant list. We offer an efficient mail order service and probably the most comprehensive list of Sansevierias, and Aloaceae in Europe. We also stock a wide range of other succulents, especially asclepiads, euphorbias and caudex plants.



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Stuart & Jane Riley

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FAX +44(0)1323 724973

email: [mailto:plantlifenuresery@fsmail.net](mailto:mailto:plantlifenuresery@fsmail.net)

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# Milenaudio

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- Seed grown plants
- Mail order service



Via Casalgrasso 1/a, 10022 Carmagnola (To) Italy

Web: <http://www.milenaudio.it>

Email: [info@milenaudio.it](mailto:info@milenaudio.it)

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Succulents, caudiciform plants and bulbs.

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email: [info@lifestyleseeds.co.za](mailto:info@lifestyleseeds.co.za)

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Cacti, Succulents and Seeds

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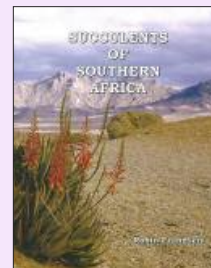
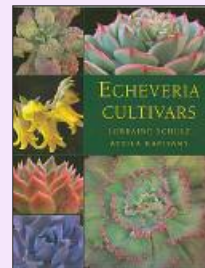
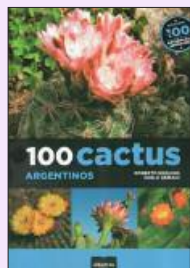
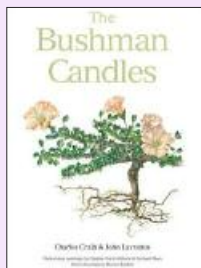
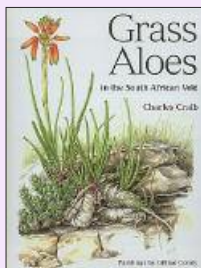
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Copies of my book are still available from dealers around the world or from me.

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